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Policy Study

N. 37

FOSTERING REGIONAL COOPERATION ON NATURAL DISASTERS AND CRISIS MANAGEMENT IN THE MEDITERRANEAN

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Coordinators

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The aim of the IEMed, in accordance with the principles of the Euro-Mediterranean Partnership (EMP), the European Neighbourhood Policy (ENP) and the Union for the Mediterranean (UfM), is to stimulate reflection and action that contribute to mutual understanding, exchange and cooperation between the different Mediterranean countries, societies and cultures, and to promote the progressive construction of a space of peace and stability, shared prosperity and dialogue between cultures and civilisations in the Mediterranean.

The IEMed is a consortium comprising the Catalan Government, the Spanish Ministry of Foreign Affairs, European Union and Cooperation, the European Union and Barcelona City Council. It also incorporates civil society through its Board of Trustees and its Advisory Council.

Content

Executive Summary

The Mediterranean region is at a critical juncture, facing escalating threats from natural disasters and climate change that exacerbate existing vulnerabilities and challenge the resilience of communities and infrastructure. This policy study provides a comprehensive analysis of the current state of disaster risk management in the region and offers strategic recommendations for enhancing regional cooperation, integrating innovative technologies, and promoting inclusive approaches to build resilience.

Regional vulnerabilities and challenges

The Mediterranean is one of the most climate-vulnerable regions in the world. Climate-related hazards such as floods, droughts, wildfires, and extreme weather events pose significant threats to human security, economic stability, and environmental sustainability. These hazards are compounded by underlying socioeconomic and political challenges, including water scarcity, rapid urbanisation, and conflict. The region's unique vulnerabilities require a coordinated approach to disaster management that addresses the interconnected risks faced by countries such as Jordan, Syria, Iraq, Egypt and Lebanon.

The first chapter highlights the diverse and interconnected risks in the Mediterranean, with each country facing specific climate challenges and implementing diverse disaster risk reduction (DRR) strategies. For example, Jordan faces severe water shortages and droughts, while Syria's climate challenges are exacerbated by an overly long conflict and weakened governance. Egypt faces acute water stress and coastal flooding risks, while Lebanon faces extreme weather event, coastal erosion or (Natural-hazard triggered technological accident) threats. These country profiles highlight the need for tailored and collaborative solutions to strengthen regional resilience.

The role of the Union Civil Protection Mechanism (UCPM)

The Union Civil Protection Mechanism (UCPM) plays a pivotal role in fostering regional cooperation and providing support (before and) during crises. Established in 2001 and strengthened by successive reforms, the second chapter highlights how the UCPM has become a solid framework for coordinating disaster response and civil protection activities within and beyond EU borders. The mechanism's architecture, legal foundations, and operational framework enable it to mobilise resources and coordinate responses across borders, with more or less successes, as demonstrated in case studies such as the 2023 Turkey-Syria earthquakes and the 2021 wildfires in Algeria.

For example, during the 2023 Turkey-Syria earthquakes, the UCPM facilitated one of the largest deployments in its history, with 21 EU member states and three participating countries deploying 38 search and rescue (SAR) and medical teams, totalling nearly 2,000 responders and 111 trained dogs. The EU's Emergency Response Coordination Centre (ERCC) coordinated logistics, and Copernicus satellite mapping was activated to support damage assessment. This key example of large-scale activation should not obscure the considerable challenges facing the UCPM in the Mediterranean, as the Mechanism explores potential reforms in a context of heightened climate exposure and fragile governance in the region. The chapter also highlights efforts to align current deployments and cooperation mechanisms with evolving priorities of mutual resilience and a "partnership of equals" with Southern Mediterranean countries.

Technological integration for enhanced resilience

The strategic integration of technology is crucial for enhancing resilience to natural disasters and climate change. The third chapter explores the potential of early warning systems, decision support systems, and innovative tools like artificial intelligence (AI) and geographic information systems (GIS) to improve disaster preparedness and response. Successful initiatives, such as the GOBEYOND (2024) and MedEWSa projects, demonstrate the potential of technology-driven approaches to enhance regional resilience.

Early warning systems are essential for providing timely and accurate information to enable effective disaster response. The European Flood Awareness System (EFAS) and Global Flood Awareness System (GLOFAS), for example, provide overview of ongoing and possible future flooding up to 10 days into the future, supporting preparatory measures for flood events. Similarly, the European Forest Fire Information System (EFFIS) and Global Wildfire Information System (GWIS) forecast dangerous weather conditions up to 10 days ahead and provide near-real-time information on active fires and burnt areas. These systems are part of the EU's Copernicus programme and are available for Southern Mediterranean Countries (SMCs), contributing to enhanced disaster preparedness and response in the region. Innovative technologies, such as AI-driven risk assessment and early warning systems, also play a critical role in enhancing resilience. AI can analyse complex hydrological data to simulate flood scenarios, predict water flow, and estimate the extent and depth of potential flooding. This information can be used to improve flood forecasting, optimise infrastructure design, support land-use planning, enhance emergency response, and create dynamic risk maps. The GO-BEYOND project (2024), for example, develops a multi-risk impact-based early warning system (MR-IEWS) by combining advanced algorithms for geohazards and weather/climate events. The system utilises high-resolution vulnerability,

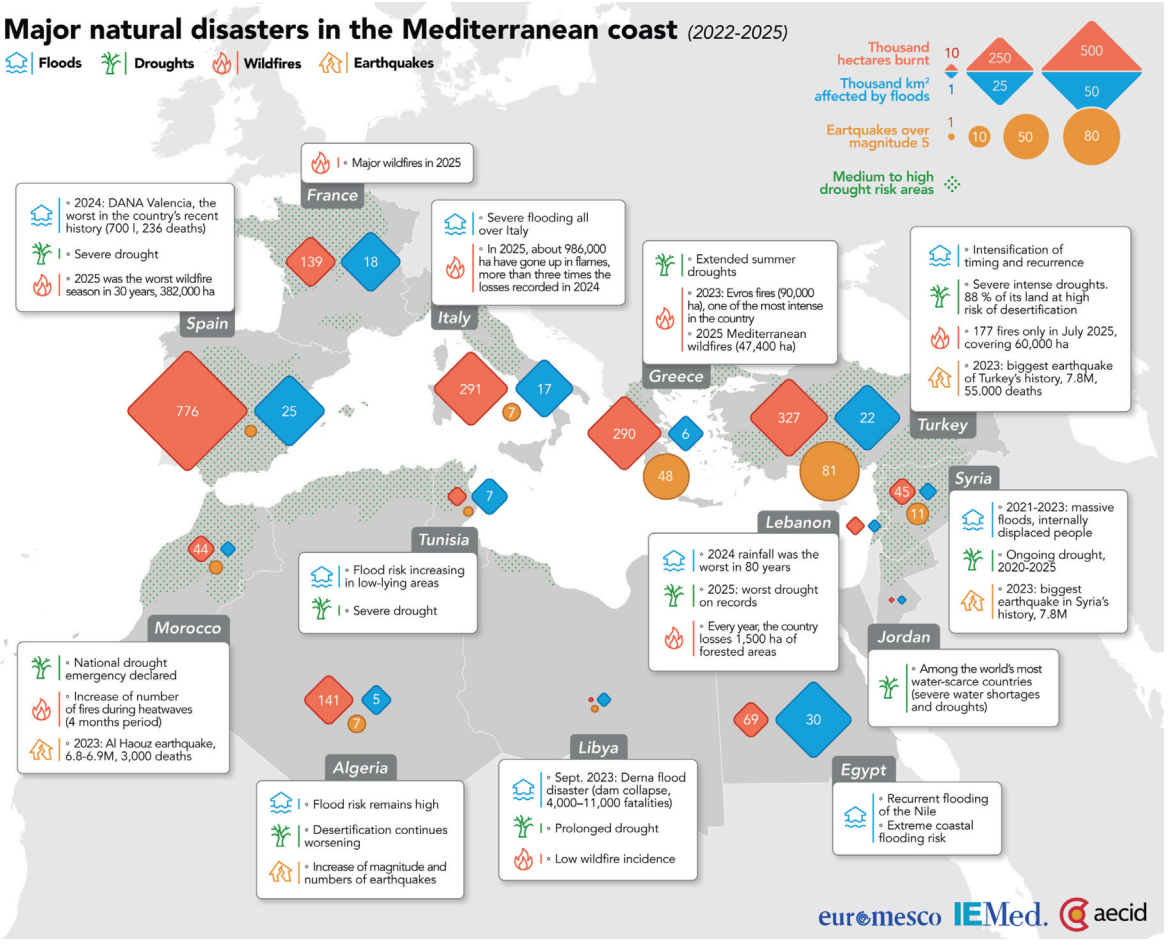
exposure, and risk data to provide real-time decision support systems (DSSs) that predict socioeconomic impacts. This initiative demonstrates the potential of technology-driven approaches to enhance regional resilience.

Inclusive strategies for disaster risk management

Inclusive disaster risk management requires addressing the specific needs of marginalised groups, refugees, and displaced populations through community engagement, local leadership, and regional cooperation. The fourth chapter highlights how active participation, equitable access to resources, and tailored strategies are essential, going beyond simple consultation, and are the cornerstones of inclusive disaster risk management and recovery. Community engagement and local leadership provide valuable local knowledge, fostering trust, and ensuring appropriate policies, particularly in informal settlements and underserved urban areas. Institutional support for participation, as emphasised by ISO 22395:2018, is essential. This is an international standard that provides guidelines for organisations to support vulnerable people during emergencies. It focuses on how organisations can identify, involve, communicate with, and support individuals who are most at risk during both natural and human-induced emergencies.

To address the increased vulnerability of refugees and displaced people living in precarious conditions, it is necessary to recognise their specific risks and actively involve them in preparedness, planning, and recovery processes. Strengthening social inclusion through the development of universally-designed infrastructure is essential to building resilience. The exclusion of persons with disabilities from planning and public spaces exacerbates inequalities during disasters. Refugees, asylum seekers, and other displaced persons are often more vulnerable to disaster risks. Inclusive DRR frameworks must ensure that displaced persons are not only protected during emergencies but also actively involved in preparedness, planning, and recovery processes. This includes the provision of culturally appropriate shelter, multilingual risk communication, legal assistance, and non-discriminatory access to services. Close collaboration between national governments, humanitarian agencies, and local authorities is essential to achieve inclusion.

Regional cooperation is increasingly crucial as disasters transcend political boundaries, such as sharing technical knowledge, standardising risk assessments, and mutual assistance in emergencies, facilitated by mechanisms such as the EU Civil Protection Mechanism, which was created in October 2001. The Mechanism aims to strengthen civil protection cooperation and offer instruments of prevention, preparedness and response. Any country hit by a disaster, in Europe and beyond, can request emergency assistance through the Mechanism and the Union for the Mediterranean (UfM), an initiative that aims to coordinate cross-border assistance in the event of disasters, an association of both northern and southern Euro-Mediterranean countries, and a true territorial and institutional extension of the EU Civil Protection Mechanism.


Major natural disasters in the Mediterranean coast (2022-2025)
Floods
Droughts
Wildfires
Earthquakes
Thousand hectares burnt
Thousand km² affected by floods
Eartquakes over magnitude 5
Medium to high drought risk areas
10
250
500
1
25
50
1
10
50
80
France
Major wildfires in 2025
139
18
Spain
2024: DANA Valencia, the worst in the country's recent history (700 l, 236 deaths)
Severe drought
2025 was the worst wildfire season in 30 years, 382,000 ha
776
25
Italy
Severe flooding all over Italy
In 2025, about 986,000 ha have gone up in flames, more than three times the losses recorded in 2024
291
17
7
Greece
Extended summer droughts
2023: Evros fires (90,000 ha), one of the most intense in the country
2025 Mediterranean wildfires (47,400 ha)
290
6
48
327
22
81
Turkey
Intensification of timing and recurrence
Severe intense droughts. 88 % of its land at high risk of desertification
177 fires only in July 2025, covering 60,000 ha
2023: biggest earthquake of Turkey's history, 7.8M, 55.000 deaths
Syria
2021-2023: massive floods, internally displaced people
Ongoing drought, 2020-2025
2023: biggest earthquake in Syria's history, 7.8M
45
11
Lebanon
2024 rainfall was the worst in 80 years
2025: worst drought on records
Every year, the country losses 1,500 ha of forested areas
Jordan
Among the world's most water-scarce countries (severe water shortages and droughts)
69
30
Egypt
Recurrent flooding of the Nile
Extreme coastal flooding risk
Tunisia
Flood risk increasing in low-lying areas
Severe drought
7
44
Morocco
National drought emergency declared
Increase of number of fires during heatwaves (4 months period)
2023: Al Haouz earthquake, 6.8-6.9M, 3,000 deaths
141
5
7
Algeria
Flood risk remains high
Desertification continues worsening
Increase of magnitude and numbers of earthquakes
Libya
Sept. 2023: Derna flood disaster (dam collapse, 4,000–11,000 fatalities)
Prolonged drought
Low wildfire incidence
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List of Acronyms and Abbreviations

ABPRS	Address-Based Population Registration System
ACMDRR	Arab Coordination Mechanism for Disaster Risk Reduction
AI	Artificial Intelligence
ARISTOTLE	enhanced European Natural Hazard Scientific Partnership
CCR	Coastal Community Resilience
CNRS	National Council for Scientific Research
CREWS	Climate Risk Early Warnings Systems
DANA	Depresión Aislada en Niveles Altos (Isolated Depression at High Levels)
DG ECHO	Directorate-General for European Civil Protection and Humanitarian Aid Operations
DGMM	Directorate General of Migration Management (Turkey)
DRG	Disaster Resilience Goals
DRM	Disaster Risk Management
DRMU	National Disaster Risk Management Unit
DRR	Disaster Risk Reduction
DSS	Decision Support Systems
EC	European Commission
EDL	Electricité du Liban
EDO	European Drought Observatory
EEA	European Environment Agency
eENHSP	enhanced European Natural Hazard Scientific Partnership
EFAS	European Flood Awareness System
EFFIS	European Forest Fire Information System
ERCC	Emergency Response Coordination Centre
ESFD	Economic and Social Fund for Development
EU	European Union
EUCRA	European Climate Risk Assessment
EUMS	European Union Military Staff
EWS	Early Warning Systems
GCF	Green Climate Fund
GDACS	Global Disaster Alert and Coordination System
GDO	Global Drought Observatory
GFDRR	Global Facility for Disaster Reduction and Recovery
GIS	Geographic Information System
GLOFAS	Global Flood Awareness System
GWIS	Global Wildfire Information System
ICZM	Integrated Coastal Zone Management
IFRC	International Federation of Red Cross and Red Crescent Societies
IOM	International Organization for Migration
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
ITU	International Telecommunication Union
IUCN	International Union for the Conservation of Nature
KI	Key Informant
LARI	Lebanese Agricultural Research Institute
LGBTQ+	Lesbian, Gay, Bisexual, Transgender, Queer (or Questioning)
LRC	Lebanese Red Cross

LRC DRR	Disaster Risk Reduction unit of the Lebanese Red Cross
LRC	Lebanese Red Cross
LRCP	Lebanon Response Crisis Plan
MedECC	Mediterranean Experts on Climate and Environmental Change
MENA	Middle East and North Africa
MHEWS	Multi-Hazard Early Warning Systems
MPA	Marine Protected Areas
MPA-ADAPT	Mediterranean Marine Protected Areas - Adaptation to Climate Change Project
NATECH	Natural-hazard triggered technological accident
NATO	North Atlantic Treaty Organization
NDC	Nationally Determined Contribution
OEA	Order of Engineers and Architects
OECD	Organisation for Economic Co-operation and Development
PPRD	Prevention, Preparedness, Response to natural & man-made Disasters in the Southern & Eastern Mediterranean
ROAS	Regional Office for Arab States
SMC	Southern Mediterranean Countries
UCPM	Union Civil Protection Mechanism
UfM	Union for the Mediterranean
UHC	Universal Health Coverage
UNDP	United Nations Development Program
UNDRR	United Nations Office for Disaster Risk Reduction
UNEP	United Nation Environment Programme
UNHCR	United Nations High Commissioner for Refugees
UoB	Balamand University
WHO	World Health Organization
WMO	World Meteorological Organization

Introduction

The Mediterranean region, a historic crossroads of civilisations and a hub of cultural, economic, and environmental diversity, is increasingly facing the combined challenges of natural disasters and climate change. From devastating floods and fires to severe droughts and earthquakes, these events not only test the resilience of nations but also underscore the urgency of collective action. Extreme weather events further exacerbate these challenges, impacting diverse sectors and the well-being of populations. Projections indicate an increase in the frequency and severity of these events, requiring enhanced regional cooperation. These disasters not only cause environmental damage but also trigger humanitarian crises and exacerbate existing socioeconomic disparities, disproportionately affecting vulnerable populations. These interconnected threats weaken human societies, ecosystems, infrastructure, and economic stability, impacting regional trade and tourism. Reducing greenhouse gas emissions is crucial to mitigating these risks and preserving the fragile balance of the Mediterranean.

The transboundary nature of many of these risks requires a regional approach to disaster risk reduction and management that transcends national borders and must foster collaboration among Mediterranean countries. In a time of unprecedented complexity and cascading crises, global collaboration in crisis management has never been more urgent.

The Mediterranean basin is characterised by unique geographic and climatic conditions that make it particularly vulnerable to a wide range of natural disasters. Climate change exacerbates these risks: rising temperatures, changing precipitation patterns, and sea level rise pose significant threats to coastal communities, agriculture, and water resources. These environmental challenges are further compounded by socioeconomic factors such as rapid urbanisation, population growth, and political instability, which amplify the vulnerability of communities in the region. In this context, effective disaster risk reduction and management require not only robust national strategies but also a coordinated regional approach leveraging shared resources, knowledge, and capacities. Risk assessments must consider simultaneous events and cascading effects, and AI-based technologies can enhance these assessments. Despite shared aspirations for peace and stability, unequal geographic and social exposure to risks complicates the building of resilient societies. Inclusive strategies that address the needs of vulnerable populations are essential for disaster risk reduction, response, and recovery planning. Effective communication and feedback mechanisms are critical for building trust and promoting preparedness within diverse Mediterranean communities. This study aims to provide an analysis and assessment of the current situation in the Mediterranean, highlighting gaps and opportunities for strengthening regional cooperation. It examines the role of key institutions, such as the UCPM, the United Nations Office for Disaster Risk Reduction (UNDRR), and the Union for the Mediterranean (UfM), in facilitating cross-border cooperation and providing crisis preparedness support.

The intensifying climate crisis places unprecedented strain on crisis management frameworks, particularly as the frequency of compounded extreme events rises, requiring a reassessment of risks, national and regional cooperation mechanisms, including policy frameworks and agreements. This endeavour will involve a meticulous examination of existing regional frameworks, identifying gaps and opportunities for improvement. We will explore innovative solutions, drawing upon the expertise and best practices of countries across the Mediterranean basin. The study strives to draw a portrait of a disaster-ready Mediterranean region, one that can effectively mitigate the impacts of

natural and human-induced hazards and safeguard the well-being of its people for generations to come.

The Mediterranean basin is evolving amidst a variety of crises, from East to West and from North to South. Key regional actors are becoming increasingly active and working to unify their efforts in order to address and mitigate the consequences and impacts of both foreseeable and unforeseen events. Notable examples include regional UNDRR offices (Europe and Central Asia - Arab States) and the Sendai Framework, as well as initiatives like EW4all.[1] The UfM, which will celebrate its 30th anniversary in November, is seeking to reform itself in support of the creation of a new Directorate-General for the Middle East, North Africa and the Gulf (DG MENA)[2] and a roadmap known as the "Mediterranean Pact"[3]. Meanwhile, the UCPM could evolve into a new "civil defence" dimension to adapt and address systemic risks.

This research will contribute to a forward-looking framework for tackling current and emerging risks in the Mediterranean region. By focusing on three key pillars: (i) the scale and impact of natural disasters whose analysis of recent events will provide crucial insights into the evolving nature of disasters in the region; (ii) adapting the EU Civil Protection Mechanism (UCPM): evaluating the strengths and weaknesses of the Mechanism in responding to these events will inform recommendations for its adaptation to better serve the needs of the Mediterranean, including a "Best Available Technologies" (BATs) approach; (iii) inclusive strategies for vulnerable populations in disaster risk reduction and response efforts, ensuring that no one is left behind.

The completed policy study will be delivered as a comprehensive report, structured with an introduction, an executive summary, and four thematic chapters: (i) the Mediterranean: A Region Under Threat; (ii) strengthening Cooperation through the EU Civil Protection [Defence] Mechanism; (iii) leveraging technology for resilience; (iv) building a new space of stability for all, and a concluding section. The methodology will be based on a combination of case study analysis, lessons learned reviews, desk research, literature reviews, expert interviews, and comparative studies.

1 The Early Warnings for All initiative aims to ensure universal protection from hazardous hydrometeorological, climatological and related environmental events through life-saving multi-hazard early warning systems, anticipatory action and resilience efforts by the end of 2027, as called for by the United Nations Secretary-General António Guterres in 2022.

With human-induced climate change leading to more extreme weather and climate conditions, the need for effective multi-hazard early warning systems is more crucial than ever. Systems that warn people of impending storms, floods or droughts, and support action are not a luxury but cost-effective tools that save lives, reduce economic losses, and provide a nearly tenfold return on investment. Early warning systems have already helped decrease the number of deaths and have reduced losses and damages resulting from hazardous weather, water or climate events. But major gaps still exist, especially in small island developing states and least-developed countries: (i) 50% of countries worldwide report having adequate multi-hazard early warning systems; (2) climate, weather and water-related extremes have led to 15 times more deadly hazards in Africa, South Asia, South and Central America, and small island states; (3) 70% of all deaths from climate-related disasters have occurred in the 46 poorest countries over the past 50 years.

2 "The Mediterranean has always been a cultural bridge and strategic route where common histories and traditions have shaped our European identity. The creation of the new MENA Directorate-General marks a pivotal moment, which brings renewed relevance and innovation to the EU policy towards the Mediterranean and the Gulf. This new Commission's department will be fully dedicated to address the unique opportunities and challenges of the region - bringing together the different shores of our Mare Nostrum and beyond. In an evolving geopolitical landscape, the EU is acting as a strategic, coherent, and credible partner for a stable and prosperous future rooted in mutual respect, growth, and stronger connections." Dubravka Šuica, Commissioner for the Mediterranean.

3 The policy study does not include the Pact for the Mediterranean which was unpublished at the time of writing.

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The Mediterranean: A Region under Threat

The Case of Lebanese Coastal Cities

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Introduction

Global climate change will impact the physical and biogeochemical characteristics of oceans and coasts, affecting the ecosystem services and functions that they provide. Sea level rise, sea-surface temperatures, sea-ice cover, salinity, alkalinity, and ocean circulation are expected to change on a large scale, as well as sea acidification, which will affect and alter the equilibrium of coastal marine ecosystem (IUCN, 2021; Wong et al., 2014). Coastal zones are situated at the most dynamic interfaces on the planet, putting them in a unique position to support and utilise diverse and productive ecosystems, from natural habitats to major urban and economic centres (Wong et al., 2014). However, this increases the challenges and impacts of global environmental changes in these productive zones. According to the Intergovernmental Panel on Climate Change's (IPCC) Sixth Assessment Report, sea levels and surface temperatures are projected, with high confidence, to rise in most coastal cities and settlements. This would have downstream effects when combined with projected increases in storm surges and extreme rainfall events, leading to a high chance of increase in the probability of pluvial flooding (IPCC, 2022).

Continued urbanisation and urban sprawl will likely have knock-on effects on air and surface temperatures, amplifying projected increases regardless of background climate characteristics (IPCC, 2022).

Cities are considered contributors to climate change while also being hotspots for its related risks and vulnerabilities. Anthropogenic climate change puts cities at significant risk beyond those resulting from natural variations in climate and seasonal weather patterns (Rosenzweig, Solecki, Hammer, & Mehrotra, 2012). Cities are already witnessing several impacts on the natural physical environment, including droughts, floods, sea level extremes and coastal high water, several waves and coastal hazards like erosion and inundation, and sand and dust storms.

Furthermore, climate hazards like extreme weather events, storms, heatwaves, floods, droughts, and wildfires, significantly increase deaths, diseases, and health emergencies. Climate hazards also weaken the health workforce and limit universal health coverage (UHC) by degrading essential environmental and social conditions like clean air, water, food security, and livelihoods (WHO, 2023).

Climate models in the Mediterranean clearly indicate a decrease in rainfall in the coming decades. This decline in precipitation, combined with rising temperatures, is creating drier conditions throughout the region. Since 1950, the frequency and intensity of droughts have increased significantly. For example, between 2008 and 2011, the Middle East faced a period of severe drought driven by low rainfall; additionally, the region noticed a 1°C temperature rise from 1931 to 2008, and growing water demand due to rapid population growth (UNEP, 2019).

Countries along the Southern and Eastern Mediterranean, where semi-arid climates are common, are particularly vulnerable to water shortages and irregular water availability. Even if global warming is limited to 2°C, people living in river basins across the Middle East will likely face more severe chronic water scarcity (UNEP, 2019).

These climate hazards pose a serious threat to human health, impacting the environment, social systems, and health infrastructure. They act as a threat multiplier, worsening health challenges and potentially

reversing decades of public health progress (WHO, 2023).

Furthermore, human health in the Mediterranean is also shaped by societal trends and political conditions. In some regions, particularly those affected by conflict in the Middle East and North Africa (MENA), poor sanitation increases the risk of consuming contaminated food or water. Urbanisation and rising population density in coastal areas worsen air pollution and heighten the spread of contagious diseases. Additionally, social instability and political conflicts drive human migration, increasing the risk of disease proliferation across the region due to overcrowding, poor sanitation, limited healthcare access, and the movement of potentially infected individuals across regions (UNEP, 2019).

Without urgent action, climate change will increase health risks, undermine health systems, and threaten the human right to health, especially for vulnerable populations (WHO, 2023).

The following are examples of country profiles from the Southern Mediterranean region, including a general overview of the climate profile of Jordan, Syria, and Egypt, with a special focus on Lebanon. These profiles aim to highlight the key characteristics and climate-related features of each country, with Lebanon serving as a detailed case study as the majority of its population is living in urban areas along the coast and is facing several climate hazards like floods and extreme weather events.

Jordan climate profile

Jordan faces significant challenges due to climate change, which exacerbate existing environmental vulnerabilities and threaten critical sectors. The country's climate varies from arid desert to Mediterranean, with hot, dry summers and cool, wet winters. Average annual temperatures range between 16-24°C, while precipitation is unevenly distributed, ranging from less than 50mm in the southern Badia to 600mm in the upper northern highlands. Climate change has led to a rise in mean annual temperatures by approximately 0.3°C per decade between 1961 and 2015 (Gutiérrez et al., 2021), along with increasing heatwave intensity and a reduction in cold days (Dunn et al., 2020). Projections indicate that by 2050, Jordan could experience temperature increases of 3-4°C under high-emission scenarios (SSP5-8.5) and temperature increases of at least 2°C under low-emission scenarios (SSP2-4.5) (Gutiérrez et al., 2021), with more frequent and intense heatwaves (Kirkpatrick-Perkins, 2020). Precipitation is expected to decline by 5-15%, leading to more severe droughts and, paradoxically, more intense rainstorms during the wet season (Gutiérrez et al., 2021).

Water scarcity is among Jordan's most critical challenges, driven by rising temperatures and decreasing precipitation (WHO &UNFCCC, 2015; USAID, 2017). These climatic changes significantly threaten public health, increasing the risk of vector-borne diseases and exposing more people, especially in urban areas, to extreme heat events (Abdulla & Alwadi, 2022).

Flooding events, such as the devastating 2018 flash floods, pose significant threats to both urban and rural populations (The Guardian, 2018). Refugees in Jordan, particularly those in the Azraq and Za'atari camps, are especially vulnerable. The refugee population, primarily from Syria, places additional pressure on already scarce water resources, and climate-induced displacement is expected to grow (Arsenault, 2017).

In response, Jordan has implemented various disaster risk reduction (DRR) strategies through centralised bodies like the Higher Council of Civil Defense (HCCD)

Coastal zones are situated at the most dynamic interfaces on the planet, putting them in a unique position to support and utilise diverse and productive ecosystems, from natural habitats to major urban and economic centres.

and aims to establish a National Center for Security and Crisis Management (NCSM). The National Climate Change Policy (2013-2020) and the updated Nationally Determined Contribution (NDC) outline key areas of focus, including water resource management, health, agriculture, and urban resilience. Jordan's revised NDC commits to reducing greenhouse gas emissions by 31% by 2030. The country also seeks to integrate climate adaptation strategies with disaster management through early warning systems and community resilience programmes. Climate finance initiatives, including projects funded by the Green Climate Fund (GCF), support adaptation measures such as protecting vulnerable ecosystems. Despite these efforts, addressing the complex interplay of environmental hazards, social vulnerabilities, and climate-induced migration remains a significant challenge for Jordan's future sustainability (RCCC, 2024a).

Syria climate profile

Syria's climate challenges are deeply intertwined with its prolonged conflict, which has severely weakened environmental governance, infrastructure, and public services. The country's climate is predominantly arid and semi-arid, with more rainfall and cooler temperatures in the coastal and mountainous west compared to the hot, dry eastern and interior regions. In Syria, average temperatures have been rising, and the country is now approximately 0.8°C hotter than it was 100 years ago (World Bank Group, 2014). Projections suggest an increase of a minimum of 2°C in average temperatures by 2050, and, in the next three decades, precipitation is expected to decline by 11%, with the most significant reductions occurring in winter, spring and autumn (USAID, 2017).

Water scarcity is among Syria's most pressing climate risks. The country's water infrastructure has been heavily damaged by conflict, and years of below-average rainfall have strained surface and groundwater supplies. Agriculture, which once employed nearly a quarter of the population and was a cornerstone of the Syrian economy, has been devastated by both climate variability and war. Sea level rise is a major threat, heightening the risk of saltwater intrusion and further endangering coastal communities and infrastructure along Syria's coastline. Although Syria's coastal zone covers only 2% of the country's land area, it is home to over 11% of the population and plays a vital role in the national economy (USAID, 2017). Coastal cities have remained relatively stable despite the conflict. However, rising sea levels pose significant risks, including coastal erosion, saltwater intrusion, and groundwater contamination, threatening both infrastructure and agricultural productivity in the region (Faour & Fayad, 2008).

Climate change has significant implications for health in Syria. Heatwaves, dust storms, and deteriorating water quality have led to rising rates of respiratory infections, diarrheal diseases, and vector-borne illnesses (World Bank, 2019). Climate-induced displacement is expected to rise, especially in areas where water and food scarcity overlap with insecurity and limited humanitarian access.

Despite these severe challenges, Syria has outlined adaptation goals in its NDC focused on water management, DRR, biodiversity, and agriculture. However, implementation remains extremely limited due to institutional fragmentation, insecurity, and lack of access to international climate finance. To address the growing risks, support is urgently needed to restore critical water and health infrastructure, build local adaptation capacity, and strengthen early warning systems. Prioritising climate resilience in humanitarian and recovery strategies is essential for

reducing long-term vulnerability (RCCC, 2024b).

Egypt climate profile

Egypt faces acute challenges due to climate change, which amplify existing environmental pressures, particularly in water-stressed and densely populated areas. The country's climate ranges from arid desert to Mediterranean along the northern coast, with extremely hot summers and mild winters. Average annual temperatures can exceed 40°C in the south during summer, while coastal areas remain cooler due to prevailing winds. Rainfall is scarce and uneven, with the majority falling along the northern coast and minimal precipitation inland. Climate change has already led to increased average temperatures and a rise in the frequency and severity of heatwaves. Projections suggest temperature increases of at least 2°C by 2050 along with more prolonged and extreme heat events and a 5-10% decline in annual precipitation (World Bank, 2021), increasing the risk of flash floods and coastal inundation.

Several projections estimate that a sea level rise of 0.5 metres by 2050 could displace between 2 to 4 million people from Egypt's coastal zones to other areas of the country (TNC, 2016). Alexandria, the country's second-largest city, is located on the Nile Delta and is among the world's most vulnerable cities to sea level rise (MMC, 2023). The densely populated Lower Nile Delta is particularly at risk, with rising seas expected to trigger large-scale migration and cause severe impacts such as coastal erosion, flooding, salinisation, and pollution.

Climate change further impacts health through heat-related illnesses, respiratory conditions from dust storms, and increased transmission of vector-borne and waterborne diseases. Egypt already has the highest number of heat-related deaths in the MENA region (Hajat et al.,2023), and this figure is expected to rise.

To address these challenges, Egypt has developed several strategies, including the National Climate Change Strategy 2050 and the National Strategy for Disaster Risk Reduction 2030. The updated NDC outlines adaptation priorities in water, agriculture, health, and coastal zones, though it lacks a clear emission reduction target. Egypt aims to generate 42% of its electricity from renewables by 2035 and is pursuing climate finance through the GCF. However, implementation gaps and limited awareness at the community level hinder progress. Strengthening institutional capacity, investing in early warning systems, and improving infrastructure resilience are essential for safeguarding Egypt's future sustainability (RCCC, 2024d).

Lebanese coastal zone and climate profile

The Lebanese coastline stretches over 240 kilometres in length, from the southern to the northern border. The coastal area, within a 500-metre-wide corridor along the coastline, is very narrow, constituting 8% of the total Lebanese surface area (or 840 km2) (MoE, gef, & UNDP, 2011). This coastal corridor comprises 40% urban areas, 41% agricultural areas, and 19% natural areas (CDR & DGU, 2005). No specific definition of a coastal zone has been set in Lebanon and, depending on political and administrative considerations, the delineation of its boundaries differs from one specific zoning area to another (IOE-UoB, 2012).

Sea level rise poses an additional threat, with the Mediterranean Sea rising approximately 20mm annually since 1960.

In general, coastal zones are defined by several institutions and papers as "interface between the land and sea" (Cao & Wong, 2007; EEA, 2020).

The Lebanese coastal zone is densely populated, with an estimated 594 inhabitants/km2 in 2000 (MoE et al., 2011). It comprises a great concentration of Lebanon's main economic sectors including commercial and financial activities, large industrial zones, important agricultural lands, fishing, and tourism. These activities provide more than 74% of Lebanon's GDP. Along the coast, there are four major commercial ports in Beirut, Tripoli, Saida, and Tyre along with several small ones used mainly for fishing and leisure activities. Several types of urban developments are situated along the coast, including beach resorts and marinas, archaeological sites, natural landscapes (e.g., Ras Chaqaa, Enfeh, Pigeon Rock) and nature reserves (Palm Islands, Tyre Coastal Nature Reserve) (MoE et al., 2011).

Lebanon's coastal cities are experiencing contrasting and notable climatic changes, whereby the average temperature has gradually increased, and torrential rains are more frequent (Verdeil, Faour, & Hamze, 2019).

Climate change also poses significant health risks, including increased cases of heat-related illnesses, waterborne diseases, and respiratory issues due to worsening air pollution

Lebanon, located on the eastern shore of the Mediterranean Sea, experiences a diverse climate due to its complex topography. The coastal region has a hot-summer Mediterranean climate with temperatures ranging from 4-5°C in winter to 35°C in summer. Lebanon has experienced significant climate change impacts, with an annual mean temperature increase of 0.3°C per decade since 1970, exceeding the global average. Precipitation patterns have also shifted, with a decrease of 11mm per decade since 1950, resulting in increased drought events, as well as more severe one-day rainfall events that heighten flood risks. Future projections indicate a 4-11% reduction in rainfall by 2100 (MoE et al., 2016), which will disrupt groundwater recharge, decrease annual water availability by 29% by 2080, and increase the risk of winter floods by 30% (MoE, 2016).

Sea level rise poses an additional threat, with the Mediterranean Sea rising approximately 20mm annually since 1960. This has led to salination of key coastal aquifers, particularly in the Greater Beirut area (El Moujabber & Bou Samra, 2002). Projections estimate a rise of 30-60cm by 2050 under a "business as usual" scenario, increasing the risk of coastal flooding and further saltwater intrusion (USAID, 2016). These climate-induced changes threaten critical sectors such as the tourism sector, which employs 38% of the workforce, and is vulnerable to increased temperatures and coastal erosion (Netherlands Ministry of Foreign Affairs, 2019).

The humanitarian implications of climate change in Lebanon are profound. Floods and droughts have intensified, affecting agricultural production, infrastructure, and vulnerable communities. Wildfires and extreme winter storms are becoming more frequent, threatening public safety and access to remote areas. Climate change also poses significant health risks, including increased cases of heat-related illnesses, waterborne diseases, and respiratory issues due to worsening air pollution (WHO & UNFCCC, 2022). Vulnerable populations, including the elderly and those in informal settlements, face the greatest risks. Lebanon hosts approximately 1.5 million Syrian refugees, making it the country with the highest per capita refugee population. Climate-induced water shortages and poor sani-

tation conditions heighten their vulnerability, particularly in informal settlements, where 28% of refugees lack access to clean water (World Vision International, 2020).

In response, Lebanon has integrated DRR strategies into its climate policy framework. The updated NDC outlines a conditional greenhouse gas emission reduction target of 31% by 2030, focusing on energy, food and water security, infrastructure, and public health. The Lebanese Red Cross (LRC) is implementing climate adaptation projects such as Forecast-based Financing, collaborating with national and scientific institutions to develop multi-hazard early warning systems. However, challenges remain regarding the implementation of these policies. Climate finance initiatives, including the GCF and Lebanon Green Investment Facility (LGIF), aim to support climate-smart projects and encourage private sector involvement. Despite these efforts, Lebanon's healthcare system remains fragile due to ongoing socioeconomic crises, the Beirut port explosion, the war and political instability. The cumulative impacts of climate change, coupled with these existing vulnerabilities, require a comprehensive and sustained approach to climate resilience and disaster preparedness (RCCC, 2024e).

Chosen methodology for the Lebanese case study

Several studies have explored urban resilience and developed different frameworks to measure it. These frameworks help in understanding the complexities of cities and the factors that influence their ability to withstand and recover from challenges. Examining the key drivers of resilience makes it easier to assess a city's resilience, identify areas of weakness, and suggest programmes or measures to improve it. Among the frameworks reviewed like the Disaster Resilience Scorecard for Cities (UNDRR, 2017) and the Local Government Powers for Disaster Risk Reduction: A Study of Local Level-Authority and Capacity for Resilience (UNISDR, 2017) that were very similar in targeting disaster reduction for resilience, the Coastal Community Resilience (CCR) guide appears to be the most suitable for Mediterranean coastal cities, especially in Lebanon. Created in 2007, the guide is based on lessons learned from managing coastal hazards and reducing risks for vulnerable communities. Its goal is to strengthen coastal communities' ability to cope with and recover from hazards (USAID, 2007). The guide also encourages a broader planning approach across different sectors to create a more comprehensive and effective framework for enhancing community resilience.

The features considered for mapping resilience components are:

1. **Governance and policy** – Focus on governmental offices; critical facilities like schools and hospitals; basic services like potable water, electrical supply, harbours and ports, bridges and roads.

2. **Economy and society** – Focus on livelihood resources like cold storage and fishing grounds; commercial centres like supply centres, and markets; cultural resources like historical landmarks and shrines; religious institutions like temples, mosques or churches.

3. **Management of coastal resources** – Focus on protective resources like mangroves and sand dunes; resources of special concern like spawning ground and endangered species, critical habitat like wetlands and coral reefs; management areas; conservation zones; protected areas.

4. **Land use and infrastructure** – Focus on existing and planned land uses in terms of conservation, industrial, residential, and agricultural.

5. **Risk knowledge** – Focus on hazard zones like erosion areas, landslide areas, flooding areas, and tsunami areas, communities with special needs, and populations at risk.

6. **Early evacuation and warning** – Focus on safe zones, evacuation shelters, towers, routes and areas, warning centres, flags and towers.

7. **Emergency response capacity** – Focus on community centres; police stations; emergency centres.

8. **Disaster recovery and adaptation** – Focus on coastal setbacks; redevelopment zones; emergency supplies.

Summary of findings for the Coastal Community Resilience (CCR) guide assessment in Lebanon

The CCR Guide was designed to address coastal hazards, enhance community resilience, and reduce risks to vulnerable populations. It connects disaster management, coastal management, and community development through eight key resilience factors, each assessed using benchmarks across four areas: policy and planning, physical and natural resources, social and cultural, and technical and financial support (USAID, 2007).

To adapt the Coastal Community Resilience (CCR) Guide to Lebanon, indicators were developed in the form of questions and completed through an extensive literature review and some key informant (KI) interviews when needed. This assessment highlighted strengths, identified weaknesses, and provided actionable recommendations to enhance national and local preparedness and response to climate hazards.

1. Governance and policy

Governance is a key part of resilience, involving rules, leadership, and community roles. In Lebanon, the assessment looked at government offices, services like ports and roads, and important places like schools and hospitals. Questions were adapted to each part of governance, showing both strengths and gaps in planning, physical, social, and technical areas, as shown in Table 1.

Table 1. Governance identified strengths and gaps

Governance and policy	Lebanon	
Are there visible coastal protection regulations (e.g., building codes, coastal zone policies)?	Strengths	Lebanon is actively assessing and addressing hazard risks, especially along its coast through the National Council for Scientific Research (CNRS)'s monitoring and early warning systems (CNRS, 2020; 2021). Coastal hazards and associated risks are routinely evaluated and assessed by the CNRS National Center for Marine Sciences through a national monthly monitoring framework that monitors the entire coastal area

Is there evidence of integrated planning for coastal hazard management?

(CNRS, 2021). The Sunar Platform, the early warning system of CNRS, supports the assessment by monitoring existing and historical hazards, as well as potential future coastal risks. It also captures episodic and chronic threats, including daily natural hazards and the likelihood of forest fires (CNRS, 2020).

Disaster risk reduction (DRR) is increasingly integrated into development plans, with community-based interventions focusing on resilience, green infrastructure, and livelihoods (UNDP & LG, 2015; UN & LG, 2021). According to the dashboard that was developed by the LRC there are 274 registered non-governmental organizations (NGOs) in Lebanon targeting weaker segments of society (LRC, 2020c). There are community goals for hazard resilience, natural resources and livelihoods. The National Disaster Risk Management Unit (DRMU) is focusing on strengthening community and local capacity for DRR are and minimise losses to property and life (UNDP & LG, 2017). The LRC DRR programme mostly addresses disaster preparedness, prevention, community resilience, and mitigation. The LRC tries to improve capacity in every community and continue to create local emergency response teams to empower communities. Because, for a community to be resilient, it has to be aware and risk informed (LRC, 2019).

Climate risk, livelihood, and environmentally-friendly strategies are integrated into community development plans. The DRMU considers disaster risk reduction in economic and social planning (UNDP & LG, 2015). The 2021 Lebanese Response Crisis Plan (LRCP) promotes livelihood interventions in villages and municipalities through small to medium infrastructure projects, such as road rehabilitation, DRR, and environmental works, aligned with Lebanese laws. These projects, implemented by municipalities, NGOs, or private contractors, include green zone planting, contour walls, reforestation, and river or canal improvements to reduce flood risks (UN & LG, 2021).

-Programmes by DRMU, LRC, and Economic and Social Fund for development (ESFD) promote local capacity-building and participation (LRC, 2019; ESFD, 2012), and should be aligned with the 2030 agenda on climate change, disaster risk management, and resilience (AUB-IFI, 2019).

-Coastal resource management also considers cultural heritage and community needs (CNRS et al., 2016c; Interview with UoB). There is a procedure to revise strategies based on community feedback and coastal resource matters within the Coastal Zone Management (CZM) draft law and the associated CZM Strategy, both currently at the MOE.

	Disaster management programmes take into account community natural and cultural resource components and targets. For example, archaeological sites are considered in the CZM draft. Furthermore, the risk assessment conducted by the CNRS and DRMU showed that over 1857 worship sites in Lebanon, 829 are located in Mount-Lebanon; and over 282 historical sites in Lebanon, 138 are situated in Mount-Lebanon. The assessment also revealed to what extent these sites are impacted by hazard event (CNRS et al., 2016c).
Gaps	-Power infrastructure remains vulnerable, but coordination among stakeholders and reliance on international funding offer opportunities for improvement (CNRS et al., 2016a; UNDP & LG, 2017). -In Lebanon, efforts toward DRR face several challenges. The Ministry of Energy and Water lacks contingency plans, trained teams, and backup systems, though a community-level plan is being developed (CNRS et al., 2016a; Interviews with LRC, and DRMU). -Risk reduction is not yet integrated into the service delivery of Water Establishments and Electricité du Liban (EDL), and related infrastructure is often underfunded, despite some support from donors for Water, Sanitation and Hygiene (WASH) and electricity projects (CNRS et al., 2016a). -While hazard risks are not fully considered in socioeconomic programmes, they are reflected in the LRCP 2023's livelihood section (UN & LG, 2023). -Community participation in planning remains limited due to logistical and governance challenges, despite some promising initiatives (DRI, 2017; Interviews with LRC, CNRS, DRMU). -Additionally, coastal planning does not yet fully reflect community needs, and local budgets often lack dedicated risk mitigation priorities (Interviews with KIIs from UoB). Risk assessment results are shared by CNRS, primarily with DRMU and its partners.

2. Society and economy

Society and economy are a key part of resilience, focusing on sustainable, hazard-resistant livelihoods. In Lebanon, the assessment included resources like fishing grounds, cultural sites, religious institutions, and markets. Questions were tailored to each part, showing strengths in planning, financial and technical areas, as shown in Table 2.

Table 2. Society and economy identified strengths and gaps

Society and economy	Lebanon	
-Are there public awareness campaigns (signs, public information) about coastal risks? **-Is there visible support infrastructure for vulnerable groups (e.g., shelters, health services)?**	Strengths	-The ESFD's Community Development Unit has identified economically and socially marginalised groups in Lebanon and supports them through loans, technical assistance, and startup grants (ESFD, 2012). -Its services target both registered and unregistered small businesses, particularly in underserved and rural areas, to promote sustainable livelihoods. Micro-financing initiatives further assist communities in developing alternative and resilient income sources (ESFD, 2012).
	Gaps	-Despite some initiatives, small business loan programmes do not offer additional financial support for disaster recovery (ESFD, 2012).

Note: ESFD: In November 2000, the Economic and Social Fund for Development (ESFD), a governmental institution, was created in Lebanon through the collaboration of the Lebanese Government (LG) and the European Union (EU). The ESFD aims to reduce poverty in the country by improving the conditions of living of the marginalised and deprived populations (ESFD, 2012). Table adapted and compiled by the author.

3. Coastal resource management

Coastal resource management is a key part of resilience, focusing on managing coastal resources to reduce hazard risks and support livelihoods. In Lebanon, the assessment included features like mangroves, sand dunes, endangered species, conservation zones, and protected areas. Questions were adapted for each part, showing strengths in planning, natural, and social capacities, and weaknesses across all areas, including financial and technical as shown in Table 3.

Table 3. Coastal resource management identified strengths and gaps

Coastal resource management	Lebanon	
-Are coastal ecosystems (e.g., wetlands, natural reserves, dunes) protected or degraded? **-Are there signs of sustainable coastal development (e.g., limits on coastal construction)?**	Strengths	-According to interviews with KIs from UoB and CNRS, coastal hazard assessments inform coastal resource management (CRM) plans, which are adequately scaled for government and community use. The CZM draft law and strategy, currently with the Ministry of Environment, include hazard mitigation, biodiversity protection, feedback mechanisms, and mapped sensitive habitats (Interview with KIs from UoB; IUCN & MoE, 2012). -Management tools like fisheries regulations and marine protected areas, such as Palm Islands and Tyre Coast Reserves,

	have been established (FAO, 2019). Long-term monitoring and baseline assessments are in place, with restoration opportunities identified, and community groups actively engaged in CZM planning.
Gaps	-According to the interview with KIs from UoB, the CZM plan has not yet been implemented, and no official policies have been endorsed by national or local authorities beyond existing laws. Although a long-term monitoring programme exists, it is not currently operational. Local communities and authorities are not actively involved in or investing in CZM implementation, and political support for these management plans remains lacking.

4. Land use and infrastructure

Structural design and land use is a key part of resilience, focusing on safe land use and building design that reduce hazard risks and support community, economic, and environmental goals. In Lebanon, the assessment looked at planned and actual land uses, such as residential, industrial, and agricultural areas. Questions were tailored to each part, showing strengths in social, financial, and technical capacities, and weaknesses across planning, natural, social, and technical areas as shown in Table 4.

Table 4. Land use and infrastructure identified strengths and gaps

Structural design and land use	**Lebanon**	
-Do communities and developers integrate risk reduction within the design and location of structures. **-Are drainage systems visible and maintained to prevent flooding?**	Strengths	-Structural engineers in Lebanon consider risk factors, including earthquake resistance, in infrastructure design, as required by the Lebanese Building Code. Permits follow a two-phase process: approval and execution. However, due to weak oversight, many constructions deviate from approved earthquake-resistant designs. While certification programmes like LEED and BREEAM promote hazard mitigation and sustainable building, their adoption remains limited (based on interviews from KIs from the Order of Engineers and Architects of Beirut [OEA]).
	Gaps	-Lebanon has laws for hazard risk reduction, such as the Public Safety Decree 2005 and Law 646/2004, which regulate building safety (UNDP & LG, 2010). However, critical infrastructure remains vulnerable to hazards like earthquakes and landslides. -Risk assessments show that many buildings, including Civil Defence and health facilities, are exposed but not designed to resist hazards (CNRS et al., 2016c).

	-While land-use plans offer hazard maps, they do not guide the sitting of critical infrastructure (UNDP & LG, 2010). Enforcement of regulations is challenging, as seen in unlicensed coastal developments and building violations like the Lancaster Eden Bay Hotel (Hamdan, 2018). There is limited training for engineers, and hazard mitigation is not integrated into education, though future plans, like those under the LRCP 2023, aim to address these gaps (UN & LG, 2021).

5. Risk knowledge

Risk knowledge is a key part of resilience, focusing on using risk information for decision-making and ensuring communities and leaders understand local hazards. In Lebanon, the assessment looked at hazard zones (like floods and landslides), people with special needs, and at-risk populations. Questions were adapted for each part, showing strengths in social, financial, and technical capacities, and weaknesses in natural, social, and technical areas as shown in Table 5.

Table 5. Risk knowledge identified strengths and gaps

Risk knowledge	Lebanon	
-Are hazard maps or public disaster preparedness materials available online or in local offices? **-Are hazard-prone zones clearly marked (e.g., tsunami evacuation signs)?**	Strengths	-Risk information is shared by the DRMU, LRC, Civil Defence, the army, and NGOs to inform policies and actions (CNRS, 2021). -The United Nations Development Program (UNDP) DMRU follows the Sendai Framework, focusing on risk understanding, governance, and preparedness (UNDP, 2015). -DMRU strengthens national emergency response and DRR across sectors (UNDP, 2015). -CNRS periodically assesses risks with monthly coastal monitoring (CNRS, 2021).
	Gaps	-According to the interview with the DRMU, since Lebanon still lacks a disaster recovery framework and, due to the current economic crisis, the assessment of cultural and social vulnerability that must determine areas where individual resources are minimal for disaster recovery and preparation has not been conducted yet. -Community involvement in risk assessment is minimal, though some projects integrate it (CNRS, 2018). -Risk information is not widely accessible, and awareness campaigns are insufficient (CNRS, 2016, 2017).

-Coastal management decisions do not consider hazard risks (KIs from UoB).

6. Early warning and evacuation

Early warning and evacuation is a key part of resilience, focusing on how communities receive alerts and respond to coastal hazards. In Lebanon, the assessment included features like safe zones, evacuation shelters, warning towers, routes, and flags. Questions were tailored to each part, showing strengths and gaps across all areas: planning, natural, social, financial and technical capacities, as shown in Table 6.

Table 6. Early warning and evacuation identified strengths and gaps

Early warning and evacuation	**Lebanon**	
-Are there visible early warning systems (sirens, public alerts) for coastal hazards? **-Are evacuation routes clearly marked and accessible?**	Strengths	-Evacuation procedures and early warning systems are regularly tested and improved by organisations like the LRC, DRMU, and CNRS, including flood simulations and forest fire drills. -The LRC's DRR programme provides training, and outreach, and develops local emergency response teams to improve community response times (LRC, 2019). -The DRMU organises workshops and media campaigns to raise awareness, including gender-focused DRR training (UNDP & LG, 2017). While there is not a unified national evacuation plan, the LRC updates its own evacuation plans periodically. DRR strategies ensure that all residents, including migrants and tourists, are included (LRC, 2019). -The DRR unit benefits from partnerships with international organisations like the UNDP for technical support and funding (UNDP & LG, 2015).
	Gaps	-In Lebanon, there is a lack of effective emergency information sharing due to limited weather data and no unified evacuation framework. The economic crisis has worsened resource shortages, hindering disaster response (CNRS et al., 2016c). -Disaster risk management education is absent in schools, though the LRCP 2023 aimed to address this (UN & LG, 2023). -Limited government funding affects the maintenance of warning systems and evacuation procedures (UNDP & LG, 2015).

7. Emergency response capacity
Emergency response is a key part of resilience, focusing on systems in place to meet community needs and respond quickly to coastal disasters. In Lebanon, the assessment looked at emergency centres, community centres, and police stations. Questions were adapted for each part, showing strengths and gaps across all areas: planning, natural, social, financial, and technical capacities, as shown in Table 7.

Table 7. Emergency response capacity identified strengths and gaps

Emergency response capacity	Lebanon	
-Are emergency services (e.g., fire, medical) easily accessible along the coast? **-Is there evidence of emergency supply storage or disaster response facilities?**	Strengths	-Disaster response plans have been developed for the LRC, 8 governorates, and ministries (UNDP & LG, 2017). -Local emergency teams are linked to the LRC hotline for faster response (ESRI, 2019). -LRC and DRMU conduct regular training and drills to improve disaster preparedness (CNRS et al., 2016b). -Vital facilities for emergency response are identified, though capacity assessments are limited (LRC, 2021). -Emergency plans are updated every 3-5 years based on lessons learned from exercises (LRC DRR program). -LRC has 12,000 trained volunteers ready for disaster response.
	Gaps	-The LRC is prepared for various disaster scenarios with supplies for short-term management, though community preparedness varies by municipality, such as Jounieh, which has better funding (LRC DRR programme, DRMU). -The LRC maintains multiple warehouses and agreements for emergency supplies, but there are gaps in government preparedness (LRC DRR program, DRMU). -While vital facilities are assessed for operational readiness, no national measures are in place (LRC DRR programme, DRMU). Over 47 NGOs provide food services (LRC, 2021), and LRC offers mental health services and trains responders in Psychological First Aid (LRC, 2020a, 2020b), though no national psychological support structure exists. -Emergency response education is lacking but could be addressed in the LRCP 2023 (UN & LG, 2023).

	-Community resources are limited due to the economic crisis and local political turnover (LRC DRR programme, DRMU), and mechanisms for maintaining resources exist but are not widespread (LRC DRR programme, DRMU).

8. Disaster recovery and adaptation

Disaster recovery is a key part of resilience, focusing on plans that engage the community in recovery and minimize the negative impacts of disasters. In Lebanon, the assessment considered redevelopment zones, coastal setbacks, and emergency supplies. Questions were tailored to each part, showing strengths in planning, social, financial and technical capacities, and weaknesses in natural, social and technical areas, as shown in Table 8.

Table 8. Disaster recovery and adaptation identified strengths and gaps

Disaster recovery & adaptation	**Lebanon**	
-Are there visible reconstruction efforts addressing previous coastal damage? **-Are climate adaptation projects (e.g., seawalls, elevated structures) implemented?**	Strengths	-Lebanon has policies and procedures guiding redevelopment away from sensitive areas, such as the Protected Areas Law No. 130 of 2019, which safeguards natural areas (MoE & SOER, 2010), and Law 92 of 2010, which preserves burnt green spaces and mandates reforestation after arson. Hazard and risk assessments, such as those conducted by the CNRS for Mount Lebanon and South Lebanon, help estimate financial losses and damages (CNRS, UNDP, & LG, 2016d). -The LRC coordinates donor support nationally, notably through a tool developed after the Beirut Blast (LRC DRR programme). -The CNRS and LARI engage in extensive data exchange (CNRS, 2020), and both the LRC DRR programme and DRMU provide technical support to municipalities in need of assistance after a disaster.
	Gaps	-Lebanon lacks a national disaster recovery framework (LRC DRR programme, DRMU). The LRCP 2023 aimed for long-term development but is not yet implemented (UN & LG, 2023). -Plans like the Lebanon National Forest Programme focus on resource management. The LRC struggles to share information with communities due to limited communication resources and funding. Post-disaster assessments occur, but there is a shortage of human resources. There are no national recovery incentives or mechanisms to solicit external funds, though the High Relief Committee handles compensation (LRC DRR programme, DRMU).

Tables elaborated by the author.

Conclusions and policy recommendations

Based on the assessment of the identified benchmarks — Governance; Economy and Society; Management of Coastal Resources; Structural Design and Land Use; Risk Knowledge; Warning and Evacuation; Emergency Response; and Disaster Recovery — several recommendations have been developed and are proposed hereafter to enhance and promote coastal resilience.

1. Governance and policy recommendations

Based on the governance benchmark assessment, the following recommendations are proposed to strengthen coastal resilience:

- **Develop a unified national database** that is interactive, automated and updated in real time. It should be accessible to all stakeholders to improve risk evaluation and coordination.
- **Enhance participatory governance** by encouraging community involvement in planning and decision-making, while strengthening data management capacities of local authorities.
- **Integrate risk reduction (DRR) into basic services** in the water and energy sectors. Water establishments and EDL should embed DRR in their core strategies. Critical infrastructure should be maintained and backed by secondary systems to ensure continuity during disasters.
- **Strengthen disaster preparedness** within the Ministry of Energy and Water through trained emergency teams and functional backup systems. Finalise and implement the national contingency plan.
- **Ensure Coastal Zone Management (CZM) plans** reflect community needs and priorities.
- **Promote the ecological and economic value** of coastal ecosystems to increase awareness and protection.
- **Mainstream hazard considerations into development planning,** prioritise DRR in local budgets, and empower municipalities to access concessional funding (e.g., Green Climate Fund). Local environmental taxes and charges should be increased to support resilience efforts.

2. Society and economy recommendations

Based on the assessment findings, the following actions are recommended to strengthen coastal resilience:

- **Integrate risk management** into community development planning. Although current efforts address education, agriculture and the environment, they overlook the impact of climate-related hazards on key sectors like tourism, fisheries and infrastructure.
- **Enhance municipal capacity.** Most municipalities face administrative, financial, and human resource limitations, and are constrained by central government dependencies. Local strategies, data systems, and planning tools are lacking.
- **Increase municipal autonomy and resources** to enable independent DRR planning and implementation. Their financial and administrative frameworks should be reinforced.
- **Empower local authorities to:**
  - Engage communities in DRR efforts and integrate their needs into planning.
  - Develop and apply tailored DRR tools.
  - Establish multi-stakeholder platforms for hazard-specific resilience planning.
- **Prioritise proactive risk planning** to strengthen the ability of local authorities to respond effectively to disasters.

3. Management of coastal resources recommendations

To address weaknesses identified in the coastal resource management framework and promote resilience, the following recommendations are proposed:

- **Enforce and implement the CZM draft law and strategy** and ensure endorsement of CZM policies by both national and local authorities.
- **Operationalize and invest in coastal resource monitoring programmes** to improve management practices and protect Lebanon's coastal biodiversity.
- **Adopt a participatory approach** to raise awareness and strengthen local community preparedness and involvement in coastal resource preservation.
- **Support the implementation of coastal management plans and policies** at all governance levels to enhance adaptive capacity and resilience.

4. Land use and infrastructure recommendations

To address identified weaknesses and enhance coastal resilience, the following recommendations are proposed:

- **Enforce Decree 14293 on Public Safety** and ensure its application to both new and existing buildings.
- **Apply Environmental Impact Assessments (EIA)** rigorously for all new constructions in line with the Environmental Protection Law.
- **Update and enforce the building code** to align with current and future safety standards, ensuring all structures meet compliance requirements.
- **Implement land-use regulations** based on NPMPLT recommendations to prevent construction of critical facilities in hazard-prone areas.
- **Promote risk-based land-use planning** at the municipal level. Encourage the development of new master plans that consider hazard zones, particularly at the union-of-municipalities level for greater efficiency and collaboration.
- **Introduce hazard awareness and mitigation** topics into school and university curricula.
- **Provide specialised training** for architects and builders on climate hazards and resilient construction practices.

5. Risk knowledge recommendations

To strengthen coastal resilience, the following actions are recommended:

- **Raise public awareness** on coastal hazard impacts through targeted campaigns to highlight their effects on livelihoods and the economy.
- **Integrate risk education** into school curricula to build long-term community understanding.
- **Establish a national risk database** to ensure information is accessible and shared with all stakeholders.
- **Prioritize DRR in decision-making,** ensuring hazard risks are factored into coastal management and development planning at both local and national levels.

6. Early warning and evacuation recommendations

To improve Lebanon's capacity to respond to coastal hazards, the following measures are recommended:

- **Expand weather station coverage** to ensure timely and accurate climate data for national and local decision-making.
- **Create a centralised hazard monitoring database** and link municipalities to nearby monitoring stations equipped with early warning systems. Ensure data is accessible to communities.
- **Prioritise early warning systems** in national budgets, including their development, activation, and maintenance — especially in high-risk zones. Allocate specific funding to local authorities for DRR.
- **Integrate evacuation and emergency preparedness** into school curricula

and promote academic support for hazard education.
- **Conduct awareness campaigns and training** to help communities interpret and respond to early warnings. Legislation should mandate data-driven decision-making in emergencies.
- **Develop and activate a national evacuation plan,** particularly for vulnerable slum areas. Communities must be well trained on evacuation procedures.
- **Establish an emergency communication strategy,** including the designation of an information officer, use of alarms, loudspeakers, and digital platforms to ensure effective information flow between authorities and communities.

7. Emergency response capacity recommendations

To enhance coastal resilience and preparedness in Lebanon, the following actions are proposed:
- **Equip local authorities** with emergency supplies and resources, stored safely outside hazard-prone areas.
- **Establish a national coordination mechanism,** linking the DRMU with municipalities to manage and maintain emergency resources effectively.
- **Collaborate with NGOs** to create a national emergency food supply to support communities during disasters.
- **Ensure vital facilities** are assessed and remain functional during emergency events.
- **Develop a national volunteer framework** for hazard communication, aid distribution, and damage reporting. A designated coordinator should oversee volunteer efforts and ensure community engagement.
- **Provide psychological and social support services** through a dedicated national structure activated during disaster events.
- **Raise community awareness** through education and public campaigns about the importance of emergency response.
- **Empower local authorities** with the tools and autonomy to design and implement localised emergency management programmes, recognising their crucial role as first responders.

8. Disaster recovery and adaptation recommendations

To strengthen coastal resilience and improve disaster recovery efforts in Lebanon, the following recommendations are proposed:
- **Develop and activate a national disaster recovery framework** to guide coordinated recovery processes.
- **Establish a communication mechanism** between the DRMU, LRC, ministries, relevant organisations, and communities to facilitate information and data sharing during recovery.
- **Implement and enhance the information technology access law** at national and local levels to improve access to information, and support the development of DRR tools such as multi-hazard early warning systems.
- **Operationalise the priorities identified in the LRCP 2023**, focusing on long-term community development goals and resilience-building.
- **Strengthen laws and policies** to prioritise the sustainable use, conservation, and restoration of natural resources during the recovery phase.
- **Create dedicated recovery funding programs,** with mechanisms to receive and manage community recovery funds. Donor support should be encouraged to finance local recovery initiatives, media engagement, and coordination with governmental institutions.

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Strengthening Cooperation through a Renewed EU Civil Protection Mechanism

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Introduction

As the Mediterranean region faces intensifying environmental, socio-political and climatic risks, there is growing urgency to assess and strengthen transboundary civil protection efforts. The Union Civil Protection Mechanism (UCPM) is the EU's flagship mechanism for disaster response and risk management, established in 2001 and "upgraded" in 2019 and 2021 through the creation of rescEU and the European Civil Protection Pool (European Commission, 2024). At its basics, any country hit by a disaster, in Europe and beyond, can request emergency assistance through the Mechanism, which is then "activated" to provide human and material resources. With only a budget of €3.6 billion for 7 years, the UCPM functions with just about 0.17 % of the overall EU budget of €2.018 trillion (2021-2027). Despite this limited funding, the UCPM has still achieved 775 activations to date. In 2024 alone, the Mechanism was activated by national authorities 58 times, evacuating EU citizens (almost 1,400) by providing supplies (e.g., medicines, shelter items), specialised teams (e.g., Search & Rescue teams, firefighters) and experts (e.g., coordination) to respond to conflict, floods, wildfires and the tropical cyclone Chido in Mayotte, a French island in the Indian ocean (European Commission, 2025b; 2025c). Given that two-thirds of those activations are outside EU territory, the UCPM is increasingly positioned as a key instrument of European solidarity and crisis response both internally and externally (European Commission & ICF, 2024, p. 448).

This second chapter explores the potential for adaptation and reform of the UCPM in light of the evolving risk landscape in the Southern Mediterranean. Drawing on the United Nations (UN) Office for Disaster Risk Reduction (UNIDSR) understanding of disasters,[4] the analysis centres on how the UCPM operates beyond Europe's borders, especially in the EU's neighbourhood, focusing on countries subject to heightened exposure and vulnerability due to climate change and fragile governance (UNDRR, 2017). Disasters such as the 2023 earthquakes in Turkey, Syria (OCHA, 2023) and Morocco (The New Arab, 2023; El Atti, B., 2025), the 2021 devastating wildfires, respectively in Algeria (France 24, 2021) and Turkey (with almost 2800 wildfires reported in 2021 alone) (Daily Sabah, 2021), and the catastrophic floods in Libya caused by Medicane Daniel (Climate Center, 2023), have starkly demonstrated the links between regional interconnections, institutional fragility and climate change. These disasters are illustrative of combined challenges and opportunities faced by the EU in extending solidarity with non-EU countries, whether or not they are participating states in the UCPM, and especially in strengthening cooperation with Southern Neighbourhood Countries (SNCs) through civil protection frameworks.

This chapter examines current deployments and cooperation mechanisms under the UCPM and their alignment with the evolving priorities of mutual resilience and "a partnership of equals" with Southern Mediterranean countries. These themes have been promoted not only in the European Commission President's political orientations but also through the establishment of the new Directorate-General for the Middle East, North Africa and the Gulf (DG MENA), led by Commissioner for

[4] The UNIDSR defines disaster as "a serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts" United Nations Office for Disaster Risk Reduction (UNDRR, 2017).

the Mediterranean Dubravka Šuica (European Commission, 2024a; European Commission, 2024b). Furthermore, the analysis draws on the Sauli Niinistö report, commissioned by the European Commission, which identifies mutual resilience as a cornerstone of the EU's future external action. The Niinistö report advocates for whole-of-government and whole-of-society approaches, and for strengthened cooperation with neighbouring countries on hybrid threats, climate adaptation and disaster preparedness (Niinistö, 2024, pp. 8-17). This strategic reframing is particularly timely in view of three key developments: the forthcoming revision of the UCPM under the EU Preparedness Union Strategy in 2025 (European Commission, 2025), the drafting of the New Pact for the Mediterranean expected in June of the same year, and the current negotiations shaping the next seven-year EU budget cycle (European Union, 2025).

Within this context, it is critical to consider whether the UCPM can be reimagined not only as a mechanism for emergency response but also as an instrument of anticipatory governance and all-encompassing crisis prevention. Cooperation with SNCs has already taken several forms under the UCPM, including joint training exercises, regional dialogue platforms, peer-review missions, and targeted capacity-building initiatives. This second chapter assesses both the institutional capacity and political will underpinning the UCPM's grounding in the EU's Southern and Southeastern regions by drawing from secondary literature (Niinistö report, DG ECHO peer-review reports), two case studies showcasing nationwide governance evolutions following a peer-review report produced by the European Commission (in Algeria) and a large-scale cross-border UCPM mobilisation (2023 Turkey-Syria doublet earthquakes), and expert interviews. As such, it will highlight lessons learned from cooperation, barriers to implementation, and levers for enhancing operational cooperation with participating countries of the EU's Southern and Eastern Neighbourhood. In doing so, it aims to offer evidence-based and forward-looking recommendations to support the role of the UCPM in addressing emerging compound risks and promoting a safer and more prepared Mediterranean.

Understanding the UCPM in 2025

The UCPM architecture

The UCPM is the EU's primary instrument for coordinating disaster response and civil protection activities both within and beyond EU borders. It can be activated in response to any type of natural or human-induced disaster, such as earthquakes, floods, cyclones, tsunamis, forest fires, volcanic eruptions, pandemics, industrial or chemical, biological, radiological and nuclear (CBRN) accidents and marine pollution accidents. Established in 2001 and subsequently strengthened through successive legal and institutional reforms, the UCPM has evolved into a structured, multi-actor system organised around three pillars: (i) prevention (Article 5ff), (ii) preparedness (Article 7ff) and (iii) response (Article 14ff), although not all pillars weigh the same both in number and diversity (European Commission, 2013). Operated by the European Commission's Directorate-General for European Civil Protection and Humanitarian Aid Operations (DG ECHO), it is designed to promote cooperation among participating states, pool resources, and enhance the predictability and effectiveness of EU emergency action. It is both a solidarity mechanism and a tool of European visibility in crisis situations (European Commission & ICF, 2024, p. 447).

It is critical to consider whether the UCPM can be reimagined not only as a mechanism for emergency response but also as an instrument of anticipatory governance and all-encompassing crisis prevention.

The UCPM is currently composed of 27 EU member states and 10 additional participating countries who joined their national civil protection capacities (including four joining between 2022 and 2024).[5] In addition, the Commission has signed eight more bilateral agreements to "improve cooperation and facilitate preparedness in emergency situations."[6] The Emergency Response Coordination Centre (ERCC), hosted by DG ECHO in Brussels, Belgium, ensures 24/7, 365 days a year, the monitoring of emergencies globally, and rapid deployment of emergency support through a direct link with national civil protection authorities. The mechanism is "activated" upon request from any member state, a third country, the UN and its agencies or any relevant international organisation through the UCPM. The ERCC not only ensures the coordination and monitoring of international response operations, but it has progressively become the EU's primary crisis coordination hub, bridging preparedness and response activities and supporting both member states and participating countries, with operational, analytical and information management capabilities (European Commission & ICF, 2024, p. 448). In addition, from a technical perspective, the UCPM is assisted by a number of technical groups and committees. A key one, is the Civil Protection Committee (CPC) (Article 33 of Decision 1313/2013), the comitology committee where representatives of both member states and participating states sit to assist the European Commission in the "implementation of civil protection legislation". (ERCC, 2025)

Table 1. Simplified table of the UCPM's principal structure at different stages

UCPM main elements	Type	Prevention	Preparedness	Response
Copernicus Emergency Management Service (2012)	Risk and Recovery Mapping component (on-demand Mapping and Early Warning and Monitoring systems on floods, forest fires and droughts) – free of charge	✓	✓	✓
Emergency Response Coordination Centre (2013)	Coordination centre, hosted by DG ECHO	✓	✓	✓
European Civil Protection Pool (2013)	Resources-pooling of teams and assets (e.g., European Medical Corps, Mobile biosafety laboratories)			✓
RescEU reserve (2019) then rescEU capacities (2021)	Resources polling (e.g., energy and shelter stockpiles across the EU and participating countries, firefighting planes and			✓

	helicopters) primarily within the EU		
EU Civil Protection Knowledge Network (2021)	Knowledge and innovation	✓	✓

Notes:

5 This list (27 + 10) includes: all EU member states and 10 participating countries (Albania, Bosnia and Herzegovina, Iceland, Moldova, Montenegro, North Macedonia, Norway, Serbia, Turkey and Ukraine). Albania, Bosnia and Herzegovina, Moldova, and Ukraine were the last additions between 2022 and 2024.

6 This list includes eight additional bilateral partners: Algeria, Australia, Georgia, Switzerland, Tunisia, Ukraine, the United States and Moldova.

Table adapted and compiled by the author

Legal and operational foundations

Legally, the UCPM is governed by Decision No. 1313/2013/EU, amended in 2019 and 2021, which provides the framework for its operations and funding (European Commission & ICF, 2024, p. 451).[7] These reforms led to the creation of the abovementioned rescEU reserve in 2019, which was reshaped under "rescEU" during the COVID-19 pandemic; in other words, a dedicated reserve of EU-owned assets and materials fully financed by the EU (e.g., financing of a stand-by firefighting fleet, medical evacuation planes, stockpiles of shelters, transport and logistics assets, and energy supply items). As of 2024, the EU and its member states have taken the initiative to form a "permanent rescEU fleet" through the acquisition of 12 new firefighting planes and three helicopters (hosted across six EU member states) to be delivered in 2026 and 2027 (DG ECHO, 2024a). This legal framework embeds the UCPM in the logic of subsidiarity and solidarity, with EU member states and participating countries retaining primary responsibility for civil protection, but with the EU offering support when national capacities are overwhelmed as well as through the co-financing of transport and operational costs of the assistance through the Mechanism. Notably, the Mechanism complements rather than replaces bilateral cooperation, and is comparable in ambition, though not in scope or governance models, to other region-wide systems such as ASEAN's Coordinating Centre for Humanitarian Assistance (AHA Centre) or the UN's International Search and Rescue Advisory Group (INSARAG). It can also be seen as a civilian counterpart to certain aspects of NATO's disaster relief coordination (The Euro-Atlantic Disaster Response Coordination Centre), though with a distinct emphasis on pooling EU resources together for greater coordination and more effective interventions.

A wide range of actors contributes to the functioning of the UCPM. At its centre is DG ECHO, responsible for coordinating operations, managing funding instruments, and supporting capacity

[7] The 2024 evaluation of the UCPM, and more specifically its Annex III, offers a comprehensive overview of the UCPM's evolving legal basis, thus highlighting its increasing integration into EU crisis response frameworks and external action instruments (European Commission & ICF, 2024, p. 451).

development. The ERCC operates with the support of national contact points across member states and participating countries, while operational assets are provided through the European Civil Protection Pool (ECPP), a voluntary reserve composed of national teams and specialised capacities. These include 18 certified modules such as urban search and rescue (SAR), aerial firefighting, medical response and mobile laboratories, alongside 21 categories of other deployable resources (European Commission, 2025). Complementing these capabilities, the abovementioned rescEU capacities provide centrally managed, EU-owned strategic assets that are primarily available for deployment within the EU and in third countries in exceptional cases (e.g., if the emergency significantly affects one or several member states and their citizens).

Furthermore, the Union Civil Protection Knowledge Network (UCPKN), launched in 2021, plays a central role in promoting interoperability, including EU-supported civil protection exercises, training, exchange of experts, and capacity-building initiatives. The UCPM also relies on the Copernicus Emergency Management Service (CEMS), which uses satellite imagery and other geospatial data to provide free of charge mapping service globally. This includes an extensive and time-consuming peer-review programme coordinated by DG ECHO in collaboration with the Euro-Mediterranean Centre for Climate Change (CMCC), which provides a structured framework for institutional learning and continuous improvement. Such peer review is open to all countries participating in UCPM, as well as EU candidate countries and neighbouring countries. While countries may request such reviews through an application letter, in view of a growing number of applications for the peer-review programme and a limited number of "spots" (due to DG ECHO's limited capacities), some countries may be routinely refused. The Knowledge Network is increasingly linked to other EU initiatives such as the Disaster Risk Management Knowledge Centre (DRMKC) and contributes to the development of disaster resilience goals and scenario-building exercises (European Commission & ICF, 2024, pp. 447-448).

The UCPM in action – Lessons from the EU Neighbourhood

Regional cooperation in the Southern Neighbourhood

The UCPM's role in fostering regional cooperation with the Southern Neighbourhood has gained increasing visibility, particularly through operational cooperation, capacity-building and structured knowledge exchange on forest fires, floods, earthquakes and other climate-induced hazards.

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The UCPM's role in fostering regional cooperation with the Southern Neighbourhood has gained increasing visibility, particularly through operational cooperation, capacity-building and structured knowledge exchange on forest fires, floods, earthquakes and other climate-induced hazards. Although primarily designed as an intra-EU mechanism, the UCPM has extended its reach to third countries through the tools available under the mechanism umbrella (e.g., peer reviews, expert exchanges, joint training exercises, and project funding), and **cooperation between the UCPM and third countries is expected to increase in the coming years.** As the Commission noted, in 2024, approximately 2/3 of UCPM activations originate from non-EU countries (European Commission & ICF, 2024, p. 448). According to the Commission, the "focus remains on strengthening the cooperation with the immediate neighbourhood, notably with the EU candidate countries or potential candidate countries as well as the Southern and Eastern Neighbour-

hoods" in matters of the external dimension of prevention and preparedness activities (European Commission & ICF, 2024, p. 447).

Southern and Southeastern Neighbourhood countries have actively participated in these initiatives, with feedback suggesting that such exchanges significantly improved preparedness and operational coordination at national level (European Commission & ICF, 2024, p. 323). While operational cooperation (i.e., ad hoc cooperation when the need arises) with third countries strengthened, particularly in response to emergencies and logistics financing, progress on long-term diplomatic cooperation (i.e., long-term strategic and formalised cooperation) remained limited. Only one new administrative agreement (with Georgia) was signed between 2017 and 2022, and the expansion of structured partnerships was not considered a priority and remained constrained by DG ECHO's limited human resources for the UCPM (European Commission & ICF, 2024, pp. 119-120). Even though time and resource constraints remain a key barrier and may grow thinner, particularly as interest in UCPM cooperation grows among third-countries, these developments reflect the broader ambition to align Mediterranean disaster governance more closely with EU norms and standards.

This engagement has been facilitated by external cooperation tools aligned with UCPM objectives, notably the Preparedness and Response to Natural and Man-made Disasters (PPRD) South (I, II and III), now renamed PPRD Med. While not part of the UCPM's mandates, projects the PPRD South I, II and III have been closely aligned with it and functioned as external cooperation tools that support the UCPM's objectives in the EU's Southern Neighbourhood since 2009. Its most recent iteration, PPRD South III (from 2018 to 2021), was designed to strengthen disaster risk management capacities in all European Neighbourhood countries or eight Mediterranean partner countries: Algeria, Egypt, Israel, Jordan, Lebanon, Morocco, Palestine and Tunisia, under the coordination of Expertise France (PPRD Mediterranean, 2025). Through a peer-to-peer approach (between EU member states and SNC), the project supported national, cross-border and regional cooperation in disaster risk reduction (DRR), thus contributing to the gradual integration of Southern Neighbourhood countries into the EU's civil protection framework (EU Neighbours South, 2020). This engagement promoted the creation of a Euro-Mediterranean cooperation mechanism that mirrors the structure and principles of the UCPM in order to reinforce regional resilience and reduce the social, environmental and economic costs of disasters in the ENP South region. Soon enough, under the leadership the International Science & Technology Center (ISTC) and the European Space Agency (ESA), the PPRD Mediterranean project (PPRD Med) was launched (2023-2026) with a vision: to strengthen collective resilience in the Mediterranean by aligning DG ECHO, the Union for the Mediterranean (UfM), and southern partner countries through cooperation under the UCPM.[8] Based on feedback from third-country participants, PPRD Med has evolved toward a more participatory, bottom-up model, strengthening ownership and alignment with national priorities. Alongside these efforts, UCPM prevention and preparedness grants have enabled the development of cross-border risk assessments and joint responses to shared risks such as floods, forest fires, and marine pollution (European Commission and ICF, 2024:

[8] This time, focusing on 10 countries: Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Mauritania, Morocco, Palestine, Tunisia. (PPRD Mediterranean, 2025) https://www.pprdmed.eu/vision

447). Strengthening knowledge-sharing platforms has emerged as a critical lever for reinforcing regional disaster governance. Initiatives such as PPRD Med demonstrate the value of peer-to-peer exchanges and the importance of moving beyond traditional EU-to-partner models. Building structured spaces for South-South and triangular cooperation (between the EU and southern partners with complementary levels of experience), particularly through the UCPKN, could consolidate regional expertise and better support locally driven resilience efforts. These insights inform the first set of recommendations.

The UCPM also contributes to broader EU objectives under the European Neighbourhood Policy (ENP) and the Neighbourhood, Development and International Cooperation Instrument – Global Europe (NDICI–GE), where DRR is increasingly recognised as a significant objective (see section 3.4 on CAP-Med). The UCPM also supports prevention and preparedness activities in third countries with a cross-border dimension, often using regional EU instruments such as the Instrument for Pre-Accession Assistance (IPA) and the European Neighbourhood Instrument (ENI). These activities have fostered technical cooperation, capacity-building, and the development of operational networks among civil protection actors across the Mediterranean and beyond (European Commission & ICF, 2024, p. 447). Implementation gaps, however, still persist, especially in terms of timely access to funding, dissemination of training opportunities, and technical interoperability across national systems. To that end, the role of civil society and regional organisations on civil protection is also increasingly recognised. For instance, the UfM has, since 2022, hosted a Regional Dialogue Platform on Civil Protection, intended to foster coordination among Mediterranean actors, share best practices, and the implementation of a regional strategy to 2030 (the Action Plan 2030 for Civil Protection).

Strengthening knowledge-sharing platforms has emerged as a critical lever for reinforcing regional disaster governance.

Lastly, the Climate Action Package for the Southern Neighbourhood (CAP-Med), as a climate-focused regional programme under the EU's NDICI-GE, offers complementary support for climate adaptation and resilience-building in the Mediterranean region. While not tied to UCPM, in a cross-border manner, CAP-Med includes DRR as a strategic component under its broader climate adaptation objectives and intends to contribute to DRR through policy support, the development of national and local climate risk assessments in partner countries, and multi-hazard early warning systems. Among others, it promotes the integration of climate and disaster risk into urban planning, infrastructure investment, and national adaptation strategies.

Reforming risk governance in Algeria's shifting landscape

Algeria, the largest country in both Africa and the Mediterranean region, is a complex and relevant case of disaster risk governance and cooperation with the UCPM. According to national data, the country has spent, on average, more than $225 million per year over the past 15 years to repair damages caused by natural catastrophes, particularly floods (70 % of repairs), earthquakes, and forest fires (Algeria Press Service, 2025). These figures reflect not only the growing frequency of climate-related hazards but also the importance of transitioning from reactive spending to investment in prevention and preparedness. Its diverse geography and climatic zones make it highly exposed to a wide range of natural hazards, including seismic activity, floods and extreme weather events, while being described as "the main fire hotspot" in SNC (Soualah et al., 2024; Curt et al., 2020). Major disasters such as the 1980 El Asnam earthquake and the

2003 Boumerdes earthquake triggered significant legislative and institutional reforms. In response to these events, Algeria adopted the Major Risk Prevention and Disaster Management Law (Law 04-20) in 2004 and launched the National Spatial Planning Scheme (*Schéma National d'Aménagement du Territoire* – SNAT), revised in 2010, to mainstream risk prevention into territorial development (DG ECHO, 2019, p. 20; Benouar, D. and Benmokhtar, A., 2025, p. 5). These instruments established a multi-level governance framework, coordinated by the Ministry of the Interior, with implementation shared among national ministries, 58 *wilayas* (provinces), and 1,541 municipalities.

Furthermore, Algeria was the first SNC to formalise bilateral cooperation with the UCPM through an administrative arrangement signed in 2016 with DG ECHO (DG ECHO & the People's Democratic Republic of Algeria, 2016). This agreement enabled a structured exchange on crisis preparedness and response and provided the basis for Algeria's participation in the 2019 Peer Review to assess the country's disaster response and preparedness, conducted by a team of four experts from France, Italy and Spain who visited Algeria in the middle of the *Hirak* ("the Movement") in opposition to Algerian President Abdelaziz Bouteflika's fifth term. The peer review lauded Algeria's legal and institutional infrastructure, the coordination role of the DG of Civil Protection (*Direction Générale de la Protection Civile* – DGPC), and the strategic use of seismic risk mapping and urban microzonation across 50 municipalities (DG ECHO, 2019, pp. 38-39). The review also noted Algeria's efforts to integrate DRR and climate adaptation objectives, as reflected in the National Climate Plan (2020-2030) and the establishment of the National Agency for Climate Change (*Agence Nationale de Changements Climatiques* – ANCC). It also highlighted persistent challenges, particularly around a disparity of implementation at the local level, limited civil society engagement, and the absence of dedicated budgets and access to interoperable data systems (DG ECHO, 2019, pp. 22-24).

These gaps became visible during the wildfires of August 2021, which affected the north-east region of Kabylia (including northern *wilayas* of Tizi Ouzou, Béjaïa, and El Tarf), which resulted in more than 90 people killed,[9] over 2,000 displaced and widespread destruction (approx. 82,000 ha of forests) for 10 days. Between 10 and 11 August, in the Tizi Ouzou *wilaya* alone, 90 wildfires broke out across 3,000 kilometres – the driving distance between London and Istanbul (Eberle, C. and Higuera Roa, O., 2022). In response to a request for international assistance submitted to the UCPM on 11 August 2021, France dispatched two Canadair aircrafts and a command plane, with transport costs co-financed by the EU (at 75 %) to support Algerian firefighting operations (European Commission, 2021), rapidly complemented by two more Canadairs, sent by Spain (Ismail, M., 2021). Such limited mobilisation is to be understood in relation to the broader "2021 Mediterranean Wildfires Crisis",[10] which ultimately strained the resources of the UCPM and EU member states (Copernicus,

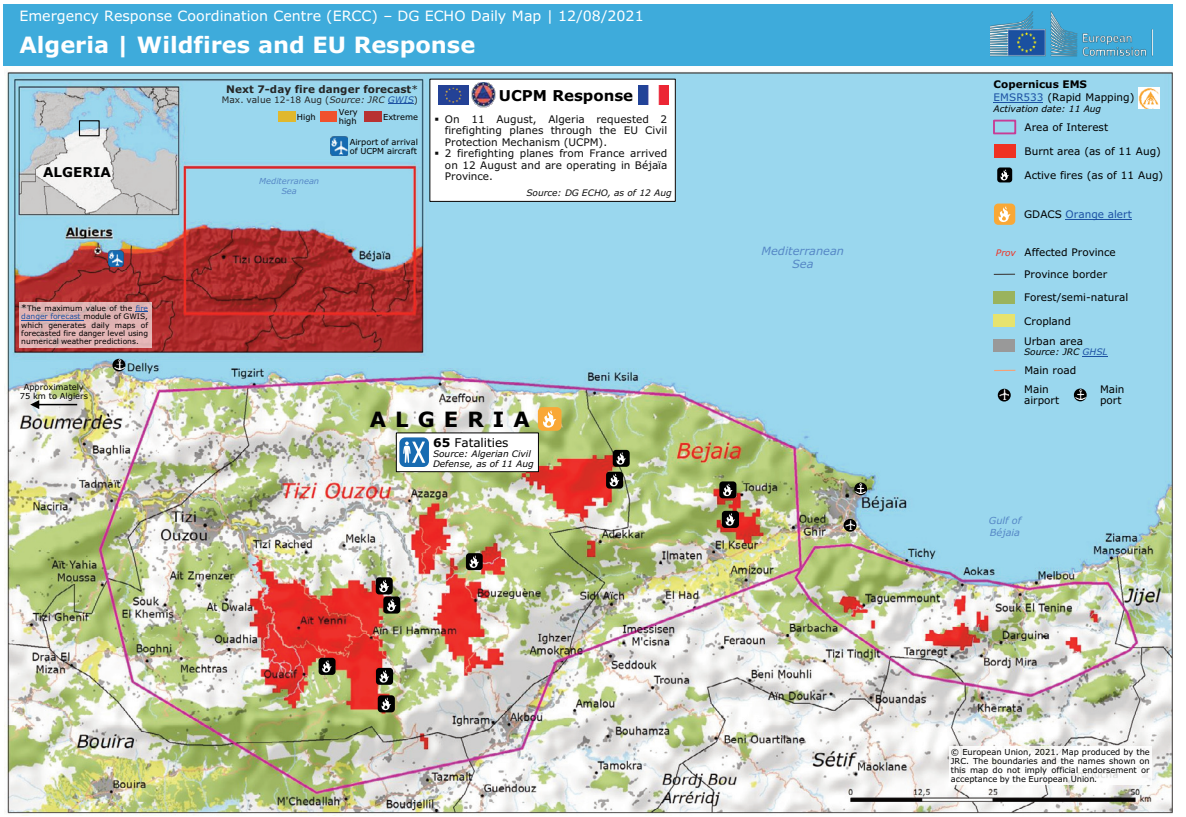
[9] One should consider this number carefully, given that there are only far and few reports addressing the death toll past August 2021.

[10] The term is borrowed from Copernicus, the Earth observation component of the EU's Space programme, to describe the "multiple forest fires that ravaged several countries of the Mediterranean basin for over a month" across Greece, Spain, Italy, France, Cyprus, Turkey, Portugal, Albania and North Macedonia.

2021; (Eberle & Higuera Roa, 2022). The fires once again exposed fragilities in Algeria's emergency management system in two interlinked ways. Due to its insufficient aerial firefighting and limited trained personnel, fire spread rapidly, and the government sent untrained and unequipped soldiers to stop the blaze (Bouandel, Y., 2021). This led to growing issues in public trust and risk communication at a critical time. Misinformation circulating on social media accused the DGPC of mismanagement, and public reactions revealed a lack of confidence in official disaster response mechanisms (Majhoul, T., 2023; Allouche, Y., 2021; Bouandel, Y., 2021; Mezahi, M., 2021). These episodes reinforced the peer review's findings on the need to improve disaster governance's legitimacy, visibility and inclusiveness.

The Algerian government has since

Figure 1. Algeria Wildfires and EU Response, DG ECHO Daily Map 12/08/2021



Note. Figure sourced from ERCC (2021).

undertaken further reforms (Benouar, D. and Benmokhtar, A., 2025; Gherabi, 2024). In February 2024, the adoption of Law 24-04 modernised the 2004 legal framework by integrating principles of sustainable development, climate resilience and multisectoral coordination. A new national disaster risk management strategy is also under development, aimed at reinforcing institutional pre-

paredness and multisectoral coordination mechanisms (Algérie Presse Service, 2024). Early warning systems for floods, fires and seismic risks are now coordinated by a network of national bodies. Between 2014 and 2017, the Ministry of Water Resources identified 689 flood-prone areas and developed a National Strategy for Flood Risk Prevention through to 2030 (DG ECHO, 2019, p. 43). However, contingency planning through ORSEC (*Organisation de la Réponse de Sécurité Civile*) plans remains uneven across *wilayas*, with technical and financial resources still insufficient at the local level.

Algeria also plays an active role in strengthening regional cooperation on civil protection and DRR beyond the EU, particularly in Arab and Mediterranean frameworks, to advance the Sendai Framework (UNDRR, 2023). It proposed and now hosts in Algiers the Arab Centre for the Prevention of Earthquake and Natural Disaster Hazards (*Centre Arabe de Prévention des Risques Sismiques et des Autres Catastrophes Naturelles*), an initiative of the Arab League funded by all Arab countries. The Centre could contribute to creating an Arab mechanism for rapid response to assist disaster-stricken countries, and coordinate, under the League umbrella, among agencies and specialised centres in Arab countries. The country is further involved in regional scientific and policy cooperation on seismic risk through initiatives such as PAMERAR (*Programme d'Appui à la Prévention du Risque Sismique dans la Région Méditerranéenne*) and ITERATE (*Improved Tools for Early Warning and Risk Assessment for Transboundary Effects of Earthquakes*), as well as bilateral partnerships with UN agencies and the EU. An example of this is the EU- and UNDP-funded CapDel programme (2017-2020), which piloted decentralised approaches to risk management in 10 municipalities, linking disaster preparedness with participatory development planning and citizen engagement (DG ECHO, 2019, p. 31). Additionally, city-level resilience efforts in Algiers and Constantine have been supported by seismic scenario exercises and technical partnerships with the Research Centre in Astronomy, Astrophysics and Geophysics (*Centre de Recherche en Astronomie, Astrophysique et Géophysique* – CRAAG) and the National Earthquake Engineering Research Centre (Centre National de Recherche Appliquée en Génie Parasismique – CGS).

Coordinating a transboundary emergency with Turkey-Syria earthquakes

Another example of UCPM intervention in third countries, this time with a cross-border dimension, can be captured in the following example.

On 6 February 2023, two powerful earthquakes struck southeastern Turkey near the Syrian border, with epicentres in the Pazarcık and Elbistan districts of Kahramanmaraş. The first occurred at 04:17 a.m. with a magnitude of 7.7, followed approximately nine hours later by a second earthquake measuring 7.6. Together, they affected an area of over 110,000 square kilometres and directly impacted approximately 13.5 million people in Turkey and 8.8 million in Syria (Avar, 2024, p. 1560; Daher, 2023, p. 6). Turkish provinces most affected included Şanlıurfa, Gaziantep, Hatay, Adıyaman, and Malatya, while, in Syria, major damage occurred in Idlib, Aleppo, Latakia and Hama. The earthquakes led to over 53,000 deaths, 107,000 injuries, and the displacement of more than three million people in Turkey, as well as over 6,200 reported

deaths and 14,700 injuries in Syria. Many of the fatalities occurred in opposition-held areas of north-west Syria, already weakened by over a decade of armed conflict, disease outbreaks and insufficient infrastructure (Erva Nur, C. et al., 2023, p. 1; Kaloti et al., 2024).

The UCPM was activated on Turkey's request for international assistance. The EU mobilised funding from its Emergency toolbox by activating the Acute Large Emergency Response Tool (ALERT) (European Commission, 2025d),[11] prompting what became one of the largest deployments in UCPM history. In total, the Commission provided €78.2 million through its civil protection and humanitarian operations, but a further breakdown is not publicly accessible (Council of the European Union, 2023). Twenty-one EU member states and three UCPM participating countries deployed 38 USAR and medical teams, totalling nearly 2,000 responders and 111 trained dogs (Avar, 2024, p. 1564). Urban search and rescue teams were dispatched from France, Germany, Greece, Hungary, Italy and Poland. The EU's ERCC coordinated logistics, and Copernicus satellite mapping was activated to support damage assessment. Emergency relief supplies such as winter tents, food, hygiene kits, and medical equipment were mobilised both to Turkey and across the border into Syria, marking a rare instance of UCPM-facilitated transboundary assistance (European Commission, 2023; Avar, 2024: 1564).

Turkey became a UCPM participating state in 2016, after having previously undergone a peer review under the UCPM framework in 2015 at the peak of Europe's "refugee crisis" and a few months before the body of two-year old Alan Kurdi was found on Bodrum's beach, in Turkey. The report praised the institutional role of Turkey's Disaster and Emergency Management Authority (AFAD), the development of earthquake risk mapping tools, and initiatives such as the national information platform AYDES and the national disaster response plan Turkey Afet Müdahale Planı – TAMP (DG ECHO, 2015, pp. 13-36). AFAD's coordination capabilities were evident during the 2023 response, although challenges remained, especially in terms of information management, emergency shelter and addressing the basic needs of vulnerable groups, including Syrians under temporary protection (Kaloti et al., 2024). In addition, strong criticisms of weak building code enforcement, corruption and regulatory failures resurfaced after the earthquakes, which highlighted persistent vulnerabilities despite prior institutional progress (Avar, 2024, p. 1558; Earthquake Engineering Field Investigation Team, 2024).

In Syria, the earthquakes intensified an already extreme and protracted humanitarian crisis since the start of the civil war in 2011. For the first week after the disaster, emergency assistance could only be delivered through a single border crossing, Bab al-Hawa, due to the access being constrained by the Assad regime and sanctions. Two additional crossings, Bab al-Salamah and al-Rai, were only opened on 13 February 2023 following diplomatic pressure and only for a limited period of three months (Erva Nur, C. et al., 2023, p. 1; Daher, 2023, p. 6). Aid convoys from non-regime areas faced delays or were intercepted by Syrian government forces. To face those, the EU adopted a temporary humanitarian exemption on 23 February 2023 that allowed transfers

[11] ALERT aims to "allocate funds within 24-48 hours of an emergency's onset, emphasising on the swiftness of the decision-making process". https://civil-protection-humanitarian-aid.ec.europa.eu/emergency-toolbox_en

to sanctioned entities for disaster relief purposes, but this came too late to meet urgent needs within the critical first 72 hours of an earthquake. The waiver also excluded dual-use items such as medical devices, generators and water infrastructure, which limited the scope of response (Moret, 2023, p. 3, p. 15). Humanitarian agencies highlighted that legal uncertainty and donor-imposed compliance restrictions continued to hinder access to non-regime areas, especially where needs were greatest (Kanfash, 2025, p. 6).

The Turkey-Syria doublet earthquake response further illustrated that resilience cannot be secured by national authorities alone. Local and subnational actors, including civil society organization (CSO)s and civilians, have played a decisive role in crisis preparedness and response, particularly in fragile governance contexts where central coordination may be limited

or obstructed. In Turkey alone, the Local Humanitarian Forum, mapped 73 local CSOs in four Turkish provinces (Adıyaman, Hatay, Kahramanmaraş and Malatya) involved in early recovery and medium-term support, with a focus on protection, psychosocial support, shelter rehabilitation, education continuity, and community mobilisation.[12] In Syria, the White Helmets, vilified by the Assad regime but well-known for their rapid response after bombings during the war, mobilised all their volunteers to search for those disappeared under the rubbles (The White Helmets, 2023).

The difficulties in ensuring timely humanitarian access in Syria and the operational pressures faced by Turkey's local disaster management structures demonstrated the urgent need to build capacity, interoperability and inclusiveness at multiple levels of governance. These experiences reinforce the importance of strengthening decentralised risk governance frameworks across the Mediterranean, which could benefit from UCPM already established resources and structures.

The UCPM's potential for adaptation

Mutual resilience and civil-military cooperation: two strategic shifts in EU civil protection

Within the EU, civil protection and the UCPM at large have been called upon to build a more disaster-resilient Union, as last year's 8th European Civil Protection Forum highlighted (European Union, 2024). There, Sauli Niinistö, Special Adviser to the President of the European Commission and former President of Finland, highlighted, as he was still writing a key report on how to enhance the EU's civilian and defence preparedness and readiness in crisis situations: "the mindset of civil protection, with preparedness at its centre, needs to be exported to the entire EU" (DG ECHO, 2024b). In practice, what does it mean for regional cooperation in the Mediterranean, and more particularly, with Southern Mediterranean countries?

Looking ahead, the UCPM is expected to further strengthen its external dimension, especially as the European Commission frames disaster risk management and climate adaptation under the shared

Looking ahead, the UCPM is expected to further strengthen its external dimension, especially as the European Commission frames disaster risk management and climate adaptation under the shared banner of mutual resilience.

[12] For further information see: Local Humanitarian Forum, Report: Mapping Local Civil Society Networks in Earthquake, October 2023 https://www.supporttolife.org/announcements/report-mapping-local-civil-society-networks-in-earthquake-2/

banner of mutual resilience. Commissioned by the European Commission, the Niinistö report underlines the need for scenario-based planning, integrated risk assessments, and the embedding of resilience into all external actions, including civil protection (Niinistö, 2024c, p. 17). As climate impacts accelerate, the UCPM is likely to play an even more visible role in the EU's southern engagement, particularly if its tools are aligned with new financing and policy frameworks such as the Pact for the Mediterranean (2025) and the upcoming European Climate Adaptation Plan (2026). At the same time, DG ECHO continues to expand its early warning and Geographic Information System (GIS) capabilities, leveraging Copernicus services for emergency management, security and climate-related risks across the Union and its neighbourhood (see next Chapter) (European Commission & ICF, 2024, p. 448).

While the Niinistö report lays out an agenda for strengthening Europe's civilian and military preparedness, it appears ultimately as an ambitious proposal with limited applications as of date. The author calls for a reactive crisis response to anticipatory governance, where a central tenet of this approach is the move from siloed crisis management to a whole-of-society model, cutting across policy areas, institutions and territorial boundaries. In this new approach, the UCPM is a foundational instrument upon which this broader preparedness architecture can be expanded – integrating tools and actors from across civilian protection, defence, diplomacy and civil society to reinforce the EU's ability to anticipate, prevent, withstand and respond to multidimensional risks (European Commission & ICF, 2024, pp. 13-15). Another key tenet is his insistence on greater civil-military cooperation, with the development of dual-use infrastructures, such as shared transport corridors, interoperable communications systems and joint stockpiling (Niinistö, 2024c, p. 119; see also Niinistö, 2024b). The ERCC, thanks to its operational coordination capacity, is identified as a potential central hub, beyond the abovementioned civil protection mandate, for cross-sectoral coordination during complex crises, including civil defence scenarios. In a nutshell, the report supports proposals for a future European Civil Defence Mechanism, but this enhanced civil-military cooperation is far from being achieved, given the boundaries (legal, operational and normative) between civilian and military mandates. At the time of writing, member states hold divergent positions (for example, Central and Eastern vs Southern European member states) about this hybrid governance model, inherited from different legacies with centralised governance models, conflicts in their territory and the role of the military.

From a Southern Neighbourhood or Mediterranean perspective, the Niinistö report is particularly relevant in its emphasis on mutual resilience with partner countries "based on shared interests and in line with our principles and values" and an "assertive EU diplomacy" (Niinistö, 2024: Chapter 8 of the report, p. 138), yet little is known about what boundaries those shared interests and principles may concretely hold. The region is envisaged as a space where the EU must prioritise diplomacy and resilience-building to mitigate cross-border risks and prevent destabilisation. Recognising that many threats, such as climate-driven disasters, health emergencies and supply chain disruptions, originate or cascade beyond EU borders, the report positions

civil protection as a key pillar of the EU's external action. It recommends embedding mutual resilience as a guiding principle in all regional initiatives, particularly in fragile environments (Niinistö, 2024a, p. 3). This aligns with ongoing efforts to deepen civil protection cooperation with SNCs through instruments and initiatives such as the UCPM, CAP-Med (see below) and the UfM's Regional Dialogue Platform on Civil Protection. In this regard, strengthening joint risk assessments, conducting scenario-based exercises and formalising peer-learning mechanisms are all encouraged as ways to move from ad hoc to structured regional engagement. By linking disaster response with anticipatory planning and external action, the report reinforces the idea that managing disasters is not simply a matter of emergency logistics, but a test of "systemic" coordination, institutional agility and regional solidarity. In view of these considerations, an increasing number of the UCPM's participating states have expressed their interest in joining this political discussion (with little success) and weighing on the new framing of UPCM as a "defence mechanism".

Greening the Mechanism, including third-countries

In addition to these considerations, efforts to green the UCPM have gained visibility as part of the EU's broader ambitions under the European Green Deal and REPowerEU, although Russia's war of aggression on Ukraine (2022) reduced this momentum. In line with EU commitments to achieve climate neutrality by 2050, the European Commission has increasingly framed civil protection as a sector that must contribute to climate and environmental goals without compromising operational effectiveness; however, questions remain about how Niinistö's ambitions may reconcile with the following. Greening in this context is defined as the adoption of feasible solutions, investments and behaviours that reduce the environmental footprint of prevention, preparedness and response activities. The 2023 study commissioned by DG ECHO outlines five priority domains: (i) improving data collection and conceptual clarity; (ii) adapting Disaster Resilience Grants to support environmental performance; (iii) enhancing feedback loops to embed environmental lessons from crisis response, (iv) integrating circular economy and waste management practices, and (v) reducing greenhouse gas emissions through mitigation actions, particularly in transport (European Commission & COWI, 2023, pp. 5-35)

However, significant challenges persist, particularly due to the limited data to measure the environmental impact of civil protection activities (e.g., data and SMART indicators on emissions, lifecycle impacts, and waste). Moreover, the integration of greening principles across member states and participating states is uneven. Some of the barriers to these principles include fragmented procurement rules, limited access to green technologies, cost concerns, and the absence of shared environmental standards. In addition, institutional inertia, legacy infrastructure, and varying levels of awareness among operational actors further constrain progress.

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Institutionally, DG ECHO has several levers to support greening across the UCPM. These include funding tools such as the abovementioned Adaptation Grants and Disaster Resilience Grants, the UCPKN, and regulatory influence over rescEU procurement. For instance, in the preparedness phase, greening

can be advanced by introducing low-packaging procurement, selecting greener venues for training or deploying more hybrid training formats. While DG ECHO is well positioned to lead on strategic coordination, the success of greening the UCPM ultimately hinges on multi-level buy-in, including from EU member states, participating countries and countries under a signed agreement (such as Algeria and Tunisia), investment in environmental expertise, and the formalisation of environmental criteria across funding, training and deployment frameworks.

Conclusions and policy recommendations

As the Mediterranean region confronts intensifying compound risks, the UCPM has become a central instrument in the EU's efforts to foster mutual resilience with neighbouring countries. This chapter has demonstrated that although operational cooperation through the UCPM with SNCs has expanded, key challenges – institutional, operational and political – persist in realising the full potential of the Mechanism. These challenges are further heightened by new international, regional and EU priorities, which, within the EU, increasingly point towards the development of a future European Civil Defence Mechanism.

Examples such as the PPRD Med project, Algeria's disaster risk governance reforms, and the largest UCPM deployment during the 2023 Turkey-Syria doublet earthquake illustrate the tangible benefits of building shared capacities and promoting structured regional cooperation. Nevertheless, the constraints encountered during the earthquakes, notably the impact of sanctions on delaying humanitarian access in Syria (both in regime- and non-regime-held areas), have highlighted the urgent need to align civil protection operations with broader diplomatic and legal frameworks, including EU sanctions regimes within the EU's Common Foreign and Security Policy.

In addition, the 2024 Niinistö report underlines the necessity of embedding mutual resilience and anticipatory governance across all aspects of the EU's external action to reinforce the strategic relevance of forging deeper partnerships with SNCs. As this chapter has shown, the success of UCPM cooperation depends not only on operational capabilities but also on the sustained political will within the EU to expand external cooperation, invest in joint operations, and support Southern Neighbourhood participation in order to fully realise the ambitions of the UCPM. At the same time, the EU's ambition to green the UCPM is crucial for future cooperation. Yet persistent challenges – from limited data to fragmented standards – risk undermining this goal, particularly in partnerships with SNCs. Overcoming these barriers across all phases of DRR is key to aligning civil protection with broader climate and environmental objectives and to strengthen a more resilient and sustainable Mediterranean.

In light of these, the following recommendations should be considered moving forward:

1. **Invest further in multi-level resilience building by strengthening capacity development at national and subnational levels,** enhancing technical interoperability, and promoting the inclusive engagement of CSOs and local actors in disaster risk governance across the Mediterranean region, particularly in fragile

governance contexts. Lessons from this chapter highlight that resilience must be rooted simultaneously at the local and national levels, with decentralised risk governance essential to enabling more effective civil protection efforts. Through its established structures, the UCPM, through its activities and partnerships, could be a central mechanism in enabling further multi-level resilience and promoting further anticipatory and inclusive approaches across diverse and fragile contexts.

2. **Expand inclusive knowledge-sharing under the UCPKN, promoting South-South and triangular cooperation (between the EU and southern partners with complementary levels of experience) to support locally-led resilience initiatives in SNCs.** Strengthening knowledge-sharing mechanisms would build on the lessons identified in this chapter, where examples have shown the importance of peer learning, regional expertise and ownership in enhancing preparedness and response capacities. Fostering horizontal exchanges among southern partners, rather than relying exclusively on EU-to-partner models, would help embed the principles of mutual resilience, anticipatory governance and structured regional cooperation that are essential for the future evolution of the UCPM's external dimension. To be effective, these knowledge exchanges must be matched by dedicated funding streams that enable southern partners to set priorities and sustain collaborative efforts beyond short-term project cycles.

3. **Accelerate the greening of the UCPM by supporting the integration of environmental sustainability principles and actions** across prevention, preparedness and response activities in close collaboration with EU member states, participating countries and local partners. Priority should be given to overcoming concrete obstacles such as fragmented procurement rules, limited access to green technologies, lack of common environmental standards and insufficient data to measure the environmental impacts of operations, and securing strong multi-level buy-in from EU member states, participating states and external partners to ensure coherent and lasting integration.

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Leveraging Technology for Resilience

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Introduction

This chapter explores the strategic integration of technology to enhance resilience against natural disasters and crises in the Mediterranean. It emphasises the need for a collaborative, technology-driven approach to address the unique vulnerabilities of the region. Over the past two decades, there has been a dramatic increase in major natural disasters, particularly floods and storms. Other hazards, including droughts, wildfires, extreme temperatures, earthquakes, and tsunamis, have also risen, with geophysical events causing the highest number of fatalities (The human cost of disasters: an overview of the last 20 years -2000-2019, CRED, UNDRR). Flooding in the Mediterranean presents a [major] severe threat. Water management is becoming increasingly challenging due to the region's susceptibility to flooding, which poses a significant threat to infrastructure, communities, and local economies. While rainfall is generally scarce, the rainy season can bring sudden, heavy downpours that necessitate rapid and efficient responses to prevent devastating flash floods. The combination of rapid surface runoff and inadequate urban drainage infrastructure further complicates the situation, leading to widespread damage. The Climate Resilience Alliance's report (Double Jeopardy: Addressing compound flood and heatwave events, 2025) explores the compound events: heatwaves followed by floods, floods followed by heatwaves, and simultaneous occurrences of both. We can delve deeper into the analysis of complex events related to climate change with a definition proposed by the OECD for Emerging Critical Risks (Framework on Management of Emerging Critical Risks, 2023): "Either new risks or familiar risks that evolved due to new or unfamiliar conditions or changes in the threat or vulnerability environment. These risks lack historical precedent and can be a specific threat or a condition ripe for exploitation." We are compelled by this new multifactorial paradigm to reassess our diverse defence strategies for anticipation, prevention, mitigation, and the reduction of risk vulnerabilities, alongside management and coordination. The spatiotemporal aspects dictate the evaluation of potential scenarios for the Mediterranean.

Understanding the complex nexus of development, disasters, and vulnerability requires a holistic analysis that integrates contextual factors across all levels, historical influences, and the nuanced dynamics of social structures into disaster preparedness and response strategies. The reality is that climate change is seriously affecting the region in the form of a now too well-known scenario with prolonged heatwaves, and more frequent occurrences of extreme weather events such as torrential rains and floods. "Flood losses are a growing concern, driven by the combined effects of natural occurrences and human-induced factors that intensify flood risks and their impact" (From deluge to disaster: The Human Factor in Flood Losses, Europe diplomatic, 2025).

"The disasters are collaborating better than we are" (UNDRR, 2025). Integrated risk and crisis management (A crisis is a period during which control over events and their effects diminishes. - A crisis is characterised by a sense of urgency, which often produces stress and anxiety. - A crisis is a period during which available information is particularly inadequate – (Lagadec, 1991) must go beyond simply sizing the coverage of hypothetical risks. The picture of our risks and vulnerabilities demands much more, "given the scales to consider, given the com-

plexity of the situations, given the depth of the shocks, given the difficulties of strategic steering in a situation of the unknown, given the level of complexity and unknown to face, and finally, given, once again, the overwhelming scale of the situations" (Lagadec & Alfonso, 2021). In this respect, the latest, and 6th Intergovernmental Panel on Climate Change (IPCC) report reminds us of the planetary dimension (and its Mediterranean subset) of the interactions and butterfly effects that will collectively affect us (IPCC, 2023).

The frequency and intensity of meteorological phenomena require us to engage in multidisciplinary consultation and coordination to join our efforts in preserving lives, property and our environment. There are two criteria that are major obstacles to our understanding of what affects us. The first is 'complexity.' The French philosopher Edgar Morin ('Introduction to Complex Thinking', 2014) defines it as follows: "Complexity is the fabric of events, actions, interactions, feedback loops, determinations, and random occurrences that constitute our phenomenal world." The second criterion is predictability. Christian Oestreicher (2007) provides a definition that links it to the quest for solutions or palliatives that converge toward Cartesianism and the universalism of science. "Predictability refers to the degree to which a correct forecast of a system's state or behaviour can be made, either qualitatively or quantitatively. It implies a level of certainty or confidence in the outcome of future events based on current knowledge and understanding."

"Science must help to develop a complex way of thinking, capable of connecting knowledge and understanding the interactions between different systems." When this stage of predictability, leading to anticipation, is overcome, it opens up opportunities to consider protecting, preparing, and responding, without however being able to claim to control and master the impacts and consequences of the phenomena that climate change will impose on us.

Echoing chapter one, the kinetics of these phenomena is a key factor, while extremely high temperatures, limited groundwater and rainfall are already experienced in the Middle East and North Africa (MENA) region. "There has been a substantial escalation in the number of meteorological, climatological, and hydrological disasters in last two decades. Poverty, rapid urbanisation, state fragility, internal displacement, and conflict in some countries in the region have compounded the increased vulnerability and exposure of populations to the impacts of climate hazards" (Dr Martina Egedusevic, University of Exeter). The Mediterranean is already one of the most water-stressed regions in the world, and changes to the climate will exacerbate this further. Water scarcity is compounded by the underlying geopolitical struggles around access to this vital resource, with relevant impacts on agriculture/food security, health, energy, conflict, and migration within and between countries (MET Office and Red Cross Climate Center, 2022).

The European Commission's approach, as implemented by DG ECHO (Directorate-General for European Civil Protection and Humanitarian Aid Operations) and within the evolving Union Civil Protection Mechanism (UCPM) framework, serves as a model that should be adapted and applied throughout the Mediterranean basin. DG ECHO launched, in 2021, the member states, the scenario-building initiative under the revised UCPM legislation (i.e., under Article 10.1 of the Decision No 1313/2013/EU on the UCPM), based on an overview of the natural and man-made disaster risks that the EU may face report (European Commission, 2021), prepared under EU legislation on civil protection, with the aim to (i) capture the trends in the

Climate change is seriously affecting the region in the form of a now too well-known scenario with prolonged heatwaves, and more frequent occurrences of extreme weather events such as torrential rains and floods.

ever-evolving disaster risk landscape, discuss the major drivers shaping it, take a closer look at 12 selected disaster risks of particular relevance for Europe and to assess the implications of developments in disaster risks for risk management; (ii) drive policy actions that will further improve the UCPM; (iii) lay a more systematic foundation for evidence-based decision-making for the UCPM, in the areas of disaster prevention, preparedness and response, by creating a portfolio of union-wide, cross-sectoral and multi-country transboundary scenarios.

A risk assessment from EUMS (European Union Military Staff) identified 16 hazards upon which the disaster scenarios will be developed (earthquake, floods, heatwave/cold wave, major storm, health threat including pandemics, tsunami, volcanic eruption, wildfire, blackout and energy disruption, effects of an armed conflict, effects of a cybersecurity incident, effects of a terrorist attack, industrial emergencies, marine pollution, nuclear emergencies, and population displacement in emergencies). Ten scenarios have been selected (severe nuclear accident, extreme winter weather with a cyber component, extreme heatwave, energy crisis within the Union, severe pandemic, armed conflict, terrorist attack, earthquake induced tsunami, inland water and coastal pollution, and volcanic eruption) and resulted in two types of documents: (i) main body, with a target audience of decision and policy-makers (as short as possible) ; (ii) appendices, with a target of experts (justification for the main body/technically sound).

The frequency and intensity of meteorological phenomena require us to engage in multidisciplinary consultation and coordination to join our efforts in preserving lives, property and our environment.

This initiative, which admittedly remains very academic, has the merit of pooling the risk identification, assessment, and analysis at an extra-national territorial scale that takes into account risk basins. But, however good the practice may be, we quickly realise the difficulty of implementing harmonised and effective measures in peace and emergency times. Extra-territorial (regional) tools can help to "smooth out" the deficiencies of some to the benefit of others. In this respect, a human-technology continuum and urgent science based on data-driven and time-critical scientific workflows can leverage timely distributed data sources to facilitate important decision-making. The following sub-chapters explore how technologies can support and cover the anticipation/preparedness and response stages in emergency management, from [Multi Hazards] Early Warning Systems (EWS) to Decision Support Systems (DSS), and cutting-edge innovations for practitioners.

Review of existing solutions and roadmaps

As a preamble, Mediterranean countries can rely on four framework and interest pillars in terms of regional cooperation. These are the UCPM and the Disaster Resilience Goals initiative (DG ECHO), EW4All, Early Warning for All (UNDRR, WMO, ITU, IFRC), the Arab Regional Platform (UNDRR ROAS, 2025), and the Union for the Mediterranean (UfM) regional platform – PPRD Med. These four actions are accompanied by concurrent and complementary roadmaps.

European disaster resilience goals

The growing intensification and severity of extreme weather events in recent years underscores the importance of robust EU-wide policies and capabilities around disaster risk management. As a result, the UCPM is increasingly incorporating climate risks and scenario analysis into its work. In 2023, the European Commission adopted the Disaster Resilience Goals (DRGs) to better prepare the EU, member states and UCPM participating states for different types of disasters.

All the goals have some bearing on climate adaptation, directly or indirectly. DRG 1 (Anticipate) has a particularly important role in enhancing the EU's capacity to anticipate and withstand the effects of future natural hazard-related disasters accelerated by climate change: it is focused on improving risk assessment, anticipation, and disaster risk management planning. DRG 2 (Prepare) is aimed at increasing the disaster risk awareness of the population and thus enabling people to be better prepared. DRG 3 (Alert) is focused on improving early warning systems. DRG 4 (Respond) is aimed at strengthening the response capacities for disaster events, which will be particularly important for climate-related hazards. DRG 5 (Secure) is concerned with the overall strengthening and future-proofing of civil protection systems. Designated flagship initiatives were announced to deliver against each of the five goals (EEA, EUCRA, 2024). As a flagship for DRG 3, the aim is to enhance early warning. This ensures that warning messages across the national, regional and local levels reach the right people on time. The EU supports the early warning and information systems of member states (and Southern Mediterranean Countries (SMCs) in their assessment of hazards by contributing to early analysis and action in real time. Disaster alerts allow the Emergency Response Coordination Centre (ERCC) to provide a comprehensive early assessment of the event. They also enable early action within the framework of EU civil protection both within the EU and worldwide. At this stage, the UfM "Mediterranean Framework on Civil Protection" roadmap, is aligned, and integrated the DRGs in its regional platform and 2030 Action Plan.

Close cooperation with multiple research institutes furthers the development of disaster forecasting and disaster management tools for both natural and human-induced hazards:

Table 1. Disaster forecasting and management tools

The **European Forest Fire Information System** (**EFFIS**- https://forestfire.emergency.copernicus.eu/) and **Global Wildfire Information System** (https://gwis.jrc.ec.europa.eu/) forecast dangerous weather conditions up to 10 days ahead and provide near-real-time information on active fires and burnt areas. These systems analyse the severity and risk that each forest fire poses for the local population and the environment.		The **European** (EDO- https://drought.emergency.copernicus.eu/) and **Global Drought Observatories** (GDO-https://drought.emergency.copernicus.eu/ tumbo/gdo/map/) give information on potential and ongoing droughts, including meteorological indicators, soil moisture anomalies, vegetation stress, and river low flows.
	MeteoAlarm (https://www.meteoalarm.org/en/live/) is an Early Warning Dissemination System that visualises, aggregates, and accessibly provides early warnings from 38 European National Meteorological and Hydrological Services (only Israel as an SMC is involved). MeteoAlarm has been developed for EUMETNET (European Network of National Meteorological Services).	
The **Global Disaster Alert and Coordination System** (GDACS- https://gdacs.org/) provides alerts and estimates impacts of earthquakes, tsunamis, tropical cyclones, floods, volcanos, and droughts worldwide.		The **European Flood Awareness System** (EFAS-IS - https://european-flood.emergency.copernicus.eu/efas_frontend/#/home) and **Global Flood Awareness System** (GLOFAS- https://global-flood.emergency.copernicus.eu/) develop an overview of ongoing and possible future flooding up to 10 days into the future to support preparatory measures for flood events, particularly in large transnational river basins.

Table adapted and compiled by the author

These early warning and information systems are part of the EU's Copernicus programme and are available for SMCs. In line with the monitoring and evaluation logic of the ERCC coordination centre, and the various tools at its disposal, the latter benefits from support and early assessment of any event that could trigger the activation of the UCPM. In addition, an expert group is acting under ARISTOTLE-eENHSP (enhanced European Natural Hazard Scientific Partnership). It is an interdisciplinary Multi-Hazard Partnership consisting of world-leading scientific centres in the areas of earth and climate sciences to ensure: (i) the provision of 24/7 operational multi-hazard scientific advice at global level to the ERCC for earthquakes, tsunamis, volcanoes, severe weather, flooding, and forest fires; (ii) the establishment of a truly Pan-European eNHSP based on developmental pillars that sustain a flexible and adaptable system and allow introducing new hazards and new partners into operations.

Early Warnings for all

Launched in 2022, EW4all is a groundbreaking initiative "to ensure that everyone on Earth is protected from hazardous weather, water, or climate events through life-saving early warning systems" by the end of 2027. Compared to countries with "substantial" to "comprehensive" Multi-Hazard Early Warning Systems (MHEWS), countries with "limited" to "moderate" MHEWS comprehensiveness have: (i) a disaster-related mortality ratio that is nearly six times higher (similar to last year); (ii) nearly three and a half times more disaster-affected people per capita than countries with substantial to comprehensive coverage (lower than last year, which was five times). There is a growing recognition of the need for MHEWS that can address a range of threats, including heatwaves, floods, wildfires, and tsunamis. While progress has been made, gaps remain in ensuring comprehensive and effective early warning coverage across all areas. Factors like varying national capacities, geopolitical complexities, and the need for cross-border cooperation present challenges, in parallel to a complex relationship between development, disasters, and vulnerability (Development and Disasters: Natural hazards and vulnerability reduction 2nd edition, 2025).

The Global Status of Multi-Hazard Early Warning Systems report uses the Sendai Framework indicators G2-G5, mapping to the four elements/pillars of MHEWS and the EW4All initiative. These pillars are: Disaster Risk Knowledge (Indicator G-5); Detection, observations, monitoring and forecasting (Indicator G-2); Warning dissemination and communication (Indicator G-3); Preparedness to respond (Indicator G-4). Both the Arab States and the Europe and Central Asia regions have around 60% coverage. However, the Arab States have the lowest proportion of "comprehensive" MHEWS (5%) and a large proportion of "limited" MHEWS (23%). Disaster risk knowledge remains a challenge for Arab States. Unfortunately, the CREWS (Climate Risk Early Warnings Systems), a funding initiative supporting direct early warning action, as an extension and implementation of EW4all, does not cover the Mediterranean (CREWS, 2025).

UNDRR ROAS

The Kuwait Declaration on Disaster Risk Reduction, adopted on February 12, 2025, at the Sixth Session of the Arab Regional Platform for Disaster Risk Reduction, outlines the commitment of Arab States to strengthen disaster risk reduction (DRR) efforts ; calls for increasing the use of science, technology, and innovation to improve risk assessment, early warning systems (in this regard, the Arab Science and Technology Advisory Group [ASTAG] plays a key role) for DRR, and disaster preparedness; stresses the im-

portance of strengthening coordination between Arab countries through the Arab Coordination Mechanism for Disaster Risk Reduction (ACMDRR) and involving various stakeholders, including governments, civil society, academia, youth, vulnerable groups, the private sector, and the media (UNDRR, 2025).

UfM – PPRD Med

The UfM, through its regional platform on civil protection, has included the strengthening of an Early Warning System (EWS) in its prevention working group, and as priority 2 of its 2030 Action Plan (Enhance Euro-Mediterranean preparedness through capacity development). The PPRD Med implemented a federated web platform designed to provide Mediterranean countries with disaster risk information and access to crisis management tools (PPRD, 2025).

Innovative technologies for disaster preparedness and response

Technology as a catalyst for resilience

To ensure a robust civil protection system, resilience-building tools exist, but they must be integrated into efficient governance and decision-making processes (Aunger, R., 2010). There are many exploratory solutions, and integrated tools are sought, covering the spectrum of national, sub-national, local, and regional needs. The challenge lies in the willingness and ability to pool, share, and make data and information interoperable through harmonisation or, failing that, through bridges and links. Beyond the complexity of risks, in their emerging and systemic dimensions, it appears necessary to work on multi-risk solutions to better measure interactions, consequences, and impacts.

AI-Driven risk assessment and early warning

As example, artificial intelligence (AI) is driving important advancements in flood risk management. One promising application involves leveraging historical flood data, including rainfall patterns, river levels, terrain data, and infrastructure information, to project flood behaviour and generate detailed inundation maps. This enables the identification of areas most prone to flood inundation and impact, allowing for more precise risk assessments and targeted mitigation strategies. AI algorithms can analyse complex hydrological data to simulate flood scenarios, predict water flow, and estimate the extent and depth of potential flooding. This information can be used to: improve flood forecasting, enhancing the accuracy and lead time of flood warnings; optimize infrastructure design, informing the design and placement of flood defences, drainage systems, and other infrastructure; support land-use planning: guiding urban development and land-use decisions to minimize flood risk; enhance emergency response: facilitating more efficient evacuation planning and resource allocation during flood events; create dynamic risk maps: allowing for real-time updates, as new data comes in. By leveraging AI, flood risk management can become more proactive, data-driven, and effective in protecting communities and infrastructure.

Today, decision-makers and operational staff must converge, each within their prerogatives and procedures, in a constrained space-time continuum, and AI has this capability in developing dynamic early warning systems and real-time risk monitoring, with challenges in data accessibility, interoperability, and ethical considerations. Interfaces

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must combine Digital Platforms for Crisis Communication and Coordination, disseminating information, coordinating response efforts, and facilitating communication among stakeholders, bridge with mobile applications and social media for citizen engagement and situational awareness, with Data Analytics and Decision Support System modules for analysing disaster impacts, relying on Geographic Information Systems (GIS), remote sensing for hazard mapping and risk assessment, and to effectively incorporate a wide array of data. The Disaster Risk Management Knowledge Centre (DRMKC) of the European Commission Joint Research Centre is developing within the Risk INFORM platform, a new INFORM Warning tool that will present reliable, quantified, multi-hazard information, and warns about risk trends, forecasts, scenarios and events that could lead to crisis impacts in the next 12 months and can be easily used to support decisions on preparedness and anticipatory action.

Success story: EU Project GOBEYOND (GeO and weather multi-risk impact Based Early warning and response systems supporting rapid deploYment of first respONders in EU and beyond) and MedEWSa (MEDiterranean and pan-European forecast and Early Warning System Against natural hazards)

GOBEYOND (2024) is the continuation of the previous ANYWHERE project (2019), and will develop a multi-risk impact-based early warning system (MR-IEWS) by combining advanced algorithms for geohazards and weather/climate events. The system will utilise high-resolution vulnerability, exposure, and risk data to provide real-time decision support systems (DSSs) that predict socioeconomic impacts. The MR-IEWS will be co-designed with stakeholders through a participatory framework, ensuring user buy-in. Six operational demonstrations, including regional and municipal trials, will test the system's performance and advanced communication capabilities, such as site-specific warnings and AI-driven features. These demonstrations will run for 24 months, achieving Technology Readiness Levels 7 and 8. The Jordan Civil Defense, the Tunisian and the Moroccan Risk Prevention Departments are involved in the Community of Practice as end user (first workshop was held in Seville, Spain, 18-19 March 2025). In parallel, the MedEWSa project (2023/2026) is developing a complementary tool based on the development of a Decision Support and Dissemination System (DSDS). The infrastructure will provide first responders, planners and policy-makers with a range of innovative services to improve their knowledge and optimise their response actions, promoting rapid and effective deployment in vulnerable areas through highly accurate, real-time decision support. It will provide new knowledge about the vulnerability of sites, communities and assets, constantly updated impact forecasts, and other cascading effects. The added value is also based on the involvement of local communities, public-private cooperation, and a Europe-Mediterranean-Africa continuum.

Case study: floods in the Valencia region (Spain), October 2024

On 29 October 2024 at 14:30 UTC, an extraordinary rainfall event affected the Valencia region in Spain, caused by a DANA (Isolated Depression at High Levels, a meteorological phenomenon that occurs when a mass of cold air becomes isolated in the upper layers of the atmosphere, generating conditions of extreme instability). This situation, when interacting with warm and humid air on the surface, causes heavy rainfall, thunderstorms, and, in extreme cases, severe flooding, with more than 300 millimetres of rainfall in parts of the

province, as reported by Spain's meteorological agency, AEMET. In the town of Chiva, nearly 500 millimetres fell in 8 hours. The resulting floods left 233 dead (with 12 different nationalities), nearly half of whom were over 70 years old, while thousands more were displaced, and affected 78 municipalities (850,000 persons, on 562 km^2).

This area in Spain, on the Mediterranean coast, is accustomed to extreme meteorological episodes, in a context of exacerbated climate change. However, as with every catastrophic event, a succession of factors led to this human and material toll, which we will emphasise through a case study based on damage assessment and a citizen initiative. At the beginning, as an accumulation of facts, we can cite an equivocal governance between the state and the autonomous region, a late alert in view of the available meteorological information, an urbanisation favouring runoff, and inappropriate human behaviours. Over and above the catastrophic scale of this event, it was the spontaneous commitment of the citizens that made a particularly strong impression. In this respect, an initiative by the Colegio Territorial de Arquitectos de Valencia (CTAV) mobilised almost 150 architects in the 11 municipalities affected. Volunteer architects carried out 6,000 excavations in buildings in the 11 municipalities worst affected by the DANA (Hernández Torrecilla, P., 2024). Specifically, they used a mobile application to gather visual information on the condition of the buildings. This tool, developed on the basis of advanced technology (advanced geospatial mapping, AI-enhanced decision support), produces data in real time and with traceability (Hernández Torrecilla, P., 2024).

Conclusions and policy recommendations

Technology plays a critical role in all the aforementioned proposed solutions, mainly by improving preparedness, response, recovery, and resilience. "Due to the availability of vast amounts of data coming from various sources, a combination of technologies related to Earth Observation, Global Navigation Satellite System (GNSS), satellite communications (GOVSATCOM), Geographic Information Systems (GIS), Internet of Things (IoT) sensors, etc., are necessary to provide critical information to first responders, decisionmakers and policy makers to take informed and timely decisions" (Marios Tzouvaras, Eratosthene Centre of Excellence). Sharing data, aligning strategies, ensuring harmonisation and interoperability of standards, and consolidating funding to cascade down to the ultimate goal of preserving lives must be underpinned by:

- Strengthening the regional cooperation and information-sharing through platforms like the EU Civil Protection Mechanism, United Nations and UfM frameworks.
- Expanding early warning systems and disaster risk education using public-private partnership, bridging authorities and citizens.
- Boosting financial resources for DRM and risk reduction measures.
- Developing leverage effects by transferring knowledge and skills in new technologies in a regional dimension, such as: Earth Observation/Satellite Remote Sensing, Unmanned Aerial Vehicles (UAV) and robotics, IoT, Geographic Information Systems (GIS), Mobile and cloud-based platforms (ARISTOTLE and MedEWSa), AI, Virtual, Augmented and Extended Reality, Digital Twins, High-Performance Computing (HPC).

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Inclusive Pathways to Disaster Resilience in the Mediterranean: Toward a New Space of Stability for All

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Introduction

The impacts of natural hazards and climate change are not experienced equally. They are shaped by the social, economic, political, and environmental conditions in which people live. Across the Mediterranean, climate change is increasingly undermining human security, particularly in regions already marked by social and infrastructural vulnerabilities. Coastal zones are among the most exposed, with nearly 150 million people living in areas at risk from sea-level rise, coastal erosion, and saltwater intrusion, which threaten homes, agricultural land, and freshwater supplies. In North Africa, a sea-level rise of just one metre could affect over 40,000 square kilometres of land and displace millions of people. At the same time, inland regions face growing hazards such as wildfires, floods, and droughts, often made worse by land degradation, weak infrastructure, and poor land-use planning (MedECC, 2019).

However, these environmental hazards do not operate in isolation — their impacts are mediated and magnified by existing social inequalities. Marginalised groups, including those living in informal housing, migrants, the unemployed, women, people with disabilities, and stateless persons, often inhabit high-risk areas with limited access to early warning systems, public services, and legal protection. Displacement driven by conflict, environmental degradation, and economic hardship has placed countries such as Lebanon, Turkey, Greece, Tunisia, and Italy at the intersection of humanitarian response and disaster risk governance. Refugees and asylum seekers, many of whom live outside formal support structures, are disproportionately exposed to climate hazards and systematically excluded from disaster risk reduction (DRR) frameworks (Council of Europe and IOM, 2017; Abou Dagher, M. et al., 2023). These vulnerabilities are further compounded by broader structural challenges: youth unemployment, political instability, gender inequality, and under-resourced governance systems (Wisner, B. et al., 2003; Iskandar, I. et al., 2024). In peri-urban and coastal areas in particular, overlapping risks converge in ways that strain institutional capacity and expose persistent gaps in protection and inclusion. In this context, it is increasingly clear that effective and equitable disaster risk reduction requires more than technical fixes or infrastructural interventions. It demands a fundamental shift toward inclusive, participatory, and context-sensitive approaches that account for the complexity of people's lived experiences. However, participation alone cannot reduce systemic vulnerability. Inclusive disaster risk governance must also be accompanied by redistributive policies and expanded social protection mechanisms (such as access to affordable healthcare, housing, education, and income support) that directly address the structural drivers of inequality and insecurity. Vulnerability must be understood not only in terms of exposure but as a product of social positioning, shaped by intersecting characteristics and reinforced by uneven access to state support.

This chapter explores how disasters and climate-related hazards interact with social and economic inequalities across the Mediterranean region. It begins by examining the concept of vulnerability, highlighting how exposure to hazards is shaped not only by geography or infrastructure but also by social characteristics. These intersecting conditions mean that certain groups, especially marginalised communities, face greater risks and have fewer resources to re-

cover. Building on this understanding, the chapter then turns to inclusive strategies for disaster risk management and recovery. It focuses on four key areas of action:

a. The importance of community engagement and local leadership, supported by strong civil and social security institutions;
b. Addressing the specific needs of refugees and displaced populations who are often excluded from formal disaster planning and lack access to basic services;
c. The role of equitable economic and infrastructure development in promoting social inclusion;
d. The value of regional cooperation in addressing shared risks, given the transboundary nature of Mediterranean risks.

Drawing on case studies from across the Mediterranean, the chapter highlights how more inclusive, participatory, and equitable approaches to disaster planning and response can help build long-term resilience and ensure that no one is left behind in efforts to create safer, more stable societies.

Understanding vulnerability in the context of disaster risks

Vulnerability is a critical and multifaceted concept, generally referring to the limited capacity of individuals, communities, or systems to anticipate, cope with, and recover from hazardous events. This limitation increases the likelihood that such events will escalate into disasters (Gabel, F. et al., 2022). Importantly, vulnerability is not determined solely by physical exposure or geographic location alone; rather, it is shaped by a complex interplay of social, economic, political, and environmental factors that determine the extent to which populations are affected, and how effectively they can respond and rebuild. Each of these dimensions provides a unique lens through which susceptibility to disaster impacts can be understood. These dimensions, however, do not operate independently. Instead, they interact in complex and context-specific ways, shaping risk outcomes across populations and over time.

In many contexts, vulnerability is intensified by compound and overlapping exposures, for example, to both climate-related hazards and socio-political stressors such as conflict, displacement, economic precarity, or weak governance. These forms of double or triple exposure (Leichenko and O'Brien, 2008) can significantly amplify risk by weakening coping capacities, particularly where institutional support and civil security mechanisms are fragile or under-resourced. In such settings, vulnerability becomes not only a matter of physical exposure but a reflection of deeper social and institutional fragilities (Zografos, C. et al., 2014).

The distribution of vulnerabilities is rarely uniform as it differs not only between countries and communities but also within them, influenced by dynamic social structures and unequal access to power and resources (IPCC, 2023). Recognising this complexity is essential for designing DRR strategies that are equitable, targeted, and effective.

Physical vulnerability relates to tangible, spatial aspects such as the quality of infrastructure, settlement patterns, and environmental conditions that influence direct exposure to hazards (Cutter, S. L. et al., 2003). These material conditions often determine the likelihood of buildings withstanding earthquakes, floods, or fires, and can either mitigate or amplify risk. Economic vulnerability reflects livelihood stability, income levels, and the capacity of individuals,

It is increasingly clear that effective and equitable disaster risk reduction requires more than technical fixes or infrastructural interventions. It demands a fundamental shift toward inclusive, participatory, and context-sensitive approaches that account for the complexity of people's lived experiences.

households, or broader economic systems to absorb and recover from financial shocks (Prohaska, A., 2020). Financial insecurity can limit evacuation options, restrict access to insurance, and prolong recovery periods following disasters. Environmental vulnerability, on the other hand, stems from the degradation or loss of ecosystem services that support human well-being and adaptive capacity in the face of climate and environmental stressors (Birkmann, J., 2013). Deforestation, soil erosion, and loss of wetlands, for example, can increase the severity of flooding and drought events. Equally important is institutional or political vulnerability, which refers to the effectiveness, accountability, and inclusiveness of governance systems and disaster risk management institutions. Governance structures play a key role in mediating access to resources, information, and protection, and often influence the degree to which other vulnerabilities are either mitigated or exacerbated (Birkmann, J., 2013).

Among the most widely discussed forms is social vulnerability, which encompasses both structural inequalities and individual characteristics that shape people's resilience. Factors such as health, education, housing security, and the ability to access or mobilise community resources are central (Cutter & Morath, 2013; Kuran et al., 2020). Social vulnerability is often conceptualised through two broad categories: internal factors, which include characteristics like age, gender, disability, race, and health status; and external factors, such as socioeconomic position, access to services, housing conditions, political marginalisation, and geographic isolation (Otto, I. M. et al., 2017; MSB, 2021). For example, women in some rural areas may face mobility restrictions or lack decision-making power, making it harder to evacuate or access relief. Language barriers, discrimination, and lack of documentation similarly inhibit migrants' and minorities' access to vital services (Council of Europe and IOM, 2017).

Importantly, vulnerability within a society or population group is rarely evenly distributed, with factors such as socioeconomic status, ethnicity, age, and gender often influencing the likelihood of individuals being more severely affected by disasters. Moreover, disasters exacerbate existing inequalities and create conditions that compound vulnerability over time, making vulnerable populations, such as the elderly, people with disabilities, children, and those economically disadvantaged, even more susceptible to future disaster impacts. The heightened risk faced by certain groups stems not only from physical vulnerabilities but also from reduced access to resources necessary for preparedness and recovery. Such groups often lack sufficient coping resources during times of disaster, which underscores the need for tailored emergency preparedness plans that consider diverse capabilities and needs (Benevolenza, M. A., and DeRigne, L., 2019). For example, poverty increases the risk and impact of adverse events by restricting individuals' and communities' access to financial means and by hindering their ability to adapt (IPCC, 2023).

Intersectionality offers a valuable framework for understanding how multiple forms of social difference interact to shape individuals' experiences, capacities, and vulnerabilities. Rather than treating marginalised groups as homogeneous, intersectional approaches recognise that people's ability to prepare for, cope with, and recover from the impacts of both natural and human-caused hazards (including climate-related events, industrial accidents, conflict, and technological disasters) is shaped by the unique interplay of their social identities and structural conditions (O'Brien, K. et al., 2011; UNDESA, 2016). By considering the complex ways in which social identities intersect, inter-

sectionality helps to clarify the specific needs and strengths of different groups, offering more nuanced and equitable pathways for resilience-building (Chaplin, D. et al., 2019). These intersecting factors can produce compound vulnerabilities — for instance, a refugee who is also part of a gender or sexual minority may face compounded barriers: limited access to services due to language or legal status, alongside discrimination from emergency providers based on sexual or gender identity. This can result in people avoiding shelters or aid altogether for fear of harassment or rejection. Likewise, women with disability from minority communities often confront multiple forms of structural disadvantage that leave them unrepresented in emergency planning and physically or socially excluded from shelters and warning systems. These examples highlight how traditional disaster risk management approaches often fail to account for people experiencing several layers of marginalisation, ultimately deepening existing inequalities and exposing them to greater harm. Intersectionality, therefore, not only improves our understanding of vulnerability but also points to the need for tailored, inclusive, and justice-oriented disaster responses. There is a growing demand for concrete, context-sensitive tools to integrate intersectional analysis into disaster risk and climate adaptation policies, ensuring that no one is left behind in times of crisis (Blanchard, J. L., and Novaglio, C., 2024).

Characteristics (determinants) likely to affect a person's situation and that might have repercussions on increased vulnerability to disaster risk

Axis of inequality	Vulnerability to disaster risks
Gender	Women often experience increased disaster vulnerability due to gendered caregiving roles, lower economic security, social norms limiting mobility, and exclusion from decision-making. Single mothers and elderly women may face heightened risks during evacuation and recovery, with limited access to tailored aid and protection from gender-based violence.
Ethnicity and race	Ethnic minorities often live in socioeconomically marginalised areas that are more hazard-prone and lack adequate infrastructure. They may experience systemic discrimination in emergency response, face barriers to accessing services, and suffer from reduced political visibility in recovery efforts.
Migrant status	Migrants often face compounded risks due to legal uncertainty, lack of language skills, absence from official population registers, and fear of authorities. These factors lead to exclusion from early warning systems, shelter access, healthcare, and aid, significantly increasing exposure and delaying recovery.
Disability	People with disabilities face physical, sensory, and communication barriers during disasters. Emergency services often lack accessible infrastructure and information, and

	evacuation plans frequently overlook mobility, cognitive, and sensory needs. Disasters exacerbate pre-existing isolation and barriers to services.
Age	Both children and the elderly have unique physiological and psychological vulnerabilities. Children are highly dependent on caregivers and structured support, while older adults may face mobility challenges, health conditions, and social isolation, making it harder to evacuate or access relief.
Socioeconomic status	Lower-income individuals typically live in high-risk areas, in poorly constructed housing, lack insurance coverage, and have minimal savings or access to credit. They are less able to evacuate, adapt, or recover post-disaster, deepening cycles of poverty and vulnerability.
Geographical location (urban/rural)	Remote and rural communities frequently have fewer emergency services, weaker infrastructure (e.g., roads, communications), and longer response times. Isolation may also reduce access to preparedness programmes, risk awareness campaigns, and recovery support after disasters.
LGBTQ+ identity	LGBTQ+ individuals may face discrimination when accessing shelters, health services, or humanitarian aid. Emergency services may lack protocols for inclusive support, and fear of harassment can prevent seeking help. Lack of legal recognition of partnerships also complicates relocation, housing, and recovery.

Table adapted and compiled by the author, based on Blanchard, J.L. and Novaglio, C. (2024), Council of Europe and IOM (2017), UNHCR (2015), Dominey-Howes, D. et al. (2015).

Intersectional Approach to Emergency Relief in Lebanon

In the aftermath of the Beirut Port explosion in August 2020, several Lebanese LGBT+ organisations demonstrated how intersectional approaches can enhance disaster response and recovery. Recognising that marginalised groups, particularly women in all their diversity and gender minorities within refugee and host communities face compounded vulnerabilities in crises, these organisations swiftly shifted from their usual advocacy work to delivering emergency support. They established safe shelters and psychosocial services for individuals at risk of gender-based violence or discrimination, especially those excluded from mainstream humanitarian response. By partnering with humanitarian actors and adapting their networks to deliver targeted aid, they helped fill critical gaps in disaster assistance. This response illustrates how intersectionality can guide more equitable and effective disaster risk reduction, especially in contexts marked by inequality and displacement.

Table adapted and compiled by the author, based on Ghanem, D. (2024). A Beirut blast: how inclusive disaster management for refugees and gender minorities strengthens resilience. Gender & Development. https://doi.org/10.1080/13552074.2024.2424631

Inclusive strategies for disaster risk management and recovery

Disaster risk management and recovery efforts are most effective when they are designed to be inclusive from the outset, recognising the diverse needs, capacities, and experiences of affected populations. An inclusive approach involves more than consultation, and it requires active participation, equitable access to resources, and tailored strategies that account for different vulnerabilities.

a. The role of community engagement and local leadership

Community engagement and local leadership are cornerstones of inclusive disaster risk management and recovery. According to Grabmaier, I. et al. (2025), inclusive disaster risk management depends on the early, meaningful, and continuous participation of local communities throughout all stages of disaster planning. Community members bring valuable local knowledge about vulnerabilities, needs, and capacities that often go unrecognised in top-down systems. Their engagement fosters trust, enhances the legitimacy of interventions, and ensures that policies and measures are responsive to the specific risks faced by different groups, particularly those in informal settlements or underserved peri-urban areas. The importance of institutional support for participation is also underscored in ISO 22395:2018, which provides guidance on how authorities can identify, engage with, and support vulnerable individuals and groups during emergencies. The standard recommends mechanisms such as neighbourhood advisory groups, community focal points, and participatory risk mapping as tools to embed inclusion at the local level (ISO, 2018). Such mechanisms not only strengthen preparedness but also foster shared responsibility and collective ownership of resilience.

However, inclusive participation is often challenged by structural inequalities. Language barriers, political exclusion, gender norms, and lack of access to information or resources can prevent meaningful involvement of the very groups most at risk. This is especially evident among migrants and displaced persons, whose ability to participate is frequently limited by legal status, mobility, or social discrimination (Council of Europe and IOM, 2017).

b. Addressing the needs of refugees and displaced populations

Refugees, asylum seekers, and other displaced persons often experience heightened vulnerability in the face of disaster risks; despite being among the most affected, displaced populations are frequently excluded from national and local disaster risk reduction systems, either due to legal status, lack of information, or systemic discrimination (Council of Europe and IOM, 2017). Displacement often results in precarious living conditions, with many refugees and migrants residing in informal settlements, temporary shelters, or overcrowded urban districts. These environments tend to lack adequate infrastructure, early warning systems, and access to emergency services. Migrants with irregular or temporary status may avoid contact with authorities, even in crisis situations, for fear of detention or deportation (Ionesco, D. et al., 2016). Such dynamics create significant barriers to inclusion, and compound the impact of disasters on these already vulnerable populations. Inclusive DRR must begin with recognising the specific risks and protection needs of displaced commu-

nities. According to UNHCR (2015), DRR frameworks must ensure that displaced persons are not only protected in emergencies but also actively involved in preparedness, planning, and recovery processes. This includes providing culturally appropriate shelters, multilingual risk communication, legal aid, and non-discriminatory access to services. Equally important is training emergency personnel to understand and accommodate the diverse needs of migrant and refugee populations. As the Council of Europe and the International Organization for Migration (IOM) (2017) highlight, strong collaboration between national governments, humanitarian agencies, and local authorities is key to operationalising inclusion. This requires mainstreaming the needs of migrants into national DRR strategies, ensuring they are represented in local emergency planning, and building trust between displaced communities and public institutions. Community engagement is critical, not just for improving outcomes, but also for empowering refugees and migrants as active agents of resilience.

Including Refugee Populations in Earthquake Risk Modelling – South-Eastern Turkey

Accurate risk assessments are essential for DRR, informing both pre-disaster planning and the allocation of humanitarian aid in the aftermath of the events. However, conventional models often rely on long-term census data and static population assumptions that fail to reflect dynamic demographic shifts. This gap is particularly evident in southeastern Turkey, where the arrival of nearly 2.8 million Syrian refugees since 2011 has dramatically altered the social landscape and increased exposure to earthquake risk.

Unlike many neighbouring countries, the vast majority of Syrian refugees in Turkey (around 90%) live outside formal camps. Instead, they are integrated into towns, cities, and rural communities, frequently settling in areas already characterised by high seismic vulnerability and inadequate housing stock. These realities challenge traditional risk modelling approaches that fail to account for rapid, large-scale population movements. To address this, researchers conducted a comparative earthquake risk analysis using two population models: the official Address-Based Population Registration System (ABPRS) and a modified version incorporating refugee data from the Directorate-General of Migration Management (DGMM). Simulating 15 earthquake scenarios of varying magnitudes across multiple fault zones, the study found that including refugee populations significantly increased projected casualty figures, ranging from minor additions to more than 1,500 extra deaths. These adjustments represented a 1% to 26% rise in estimated casualties compared to baseline models. The effects were most pronounced in provinces like Hatay, where population centres overlap with major fault lines. In such areas, neglecting the presence of large refugee populations can lead to substantial underestimations in projected casualties, undermining emergency preparedness and response planning. Even in provinces with fewer refugees, the increase in estimated casualties ranged from 7% to 9%, amounting to dozens or even hundreds of additional lives at risk.

Beyond numbers, the study exposes deeper challenges in disaster modelling. Many refugees reside in unsafe or informal housing, with limited data available on building conditions, occupancy rates, or levels of structural resilience. According to national assessments, as many as one in four refugees live in makeshift shelters or substandard housing, significantly increasing their risk of injury or death in the event of a building collapse. Compounding these challenges is the issue of freedom of movement. Under Turkey's Temporary Protection Regulation, refugees are generally required to remain in assigned provinces, yet enforcement varies, and accurate tracking remains difficult.

As a result, even official figures may underrepresent actual refugee distributions, adding another layer of uncertainty to risk models. This case study highlights the importance of integrating refugee populations into DRR frameworks, not only for the sake of accuracy but also to uphold the principles of equity and inclusion. By failing to reflect current population realities, traditional earthquake models risk leaving vulnerable groups uncounted and unprotected. For governments and humanitarian actors alike, the findings serve as a compelling reminder that population models must evolve in parallel with displacement trends if disaster planning is to be both effective and just.

Table adapted and compiled by the author, based on Council of Europe and International Organisation for Migration. (2017). Migrants in Disaster Risk Reduction: Practices for Inclusion. Geneva: IOM. https://publications.iom.int/system/files/pdf/migrants_in _drr.pdf

c. Strengthening social inclusion through infrastructure development

Infrastructure development is often viewed as a cornerstone of disaster resilience. Investments in roads, schools, hospitals, shelters, water and sanitation systems, and communication networks all play a crucial role in reducing exposure to hazards, enabling emergency response, and supporting post-disaster recovery. Yet, the benefits of infrastructure are not experienced equally - many communities remain excluded from critical systems due to poor spatial planning, lack of accessibility, and weak integration with social services. As climate risks accelerate, simply building more infrastructure is no longer enough. The real challenge lies in ensuring that infrastructure is designed and governed in ways that actively reduce exclusion and inequality (UN DESA, 2016a; Hallegatte, S. et al., 2016). However, it is important to mention that infrastructure alone cannot address the root causes of vulnerability. If it is not designed to be inclusive and supported by strong systems of social protection, it can deepen inequality and fail to protect those most at risk. Social resilience depends equally, if not more, on strong, well-functioning welfare systems that reduce chronic poverty, enhance coping capacity, and buffer communities against economic and environmental shocks. Without them, even the most advanced infrastructure remains insufficient to address social vulnerability (UN DESA, 2016b; OECD, 2020). Investing in inclusive infrastructure is therefore not just a matter of constructing physical assets; it requires strengthening the social and institutional foundations that determine who can access and benefit from those assets, and under what conditions. It is this intersection between physical development and social inclusion that will define the success of disaster resilience efforts in an increasingly risk-prone world.

Infrastructure must therefore be both physically safe and socially inclusive, designed to respond to diverse needs. For persons with disabilities, who make up over one billion people worldwide, exclusion from

planning and public spaces is still a daily reality. These inequalities are magnified during and after disasters, when inaccessible infrastructure and services create life-threatening barriers to safety, mobility, and recovery (GFDRR, 2020). Similar vulnerabilities also affect the elderly, migrants, low-income households, and informal workers, groups that often lack access to essential welfare services and social protection. To address structural inequalities, disaster risk management must go beyond physical safety and prioritise universal design principles in infrastructure and public services. This means ensuring that schools, hospitals, transportation systems, and emergency shelters are accessible to all, regardless of physical or cognitive ability. It also involves inclusive urban planning processes that incorporate feedback from vulnerable groups (e.g., persons with disabilities and their representative organisations) at every stage, from needs assessment to reconstruction (GFDRR, 2020).

Importantly, authorities must also invest in the institutional capacity to deliver both inclusive infrastructure and reliable social services — institutional capacity-building, including training for planners and emergency responders on inclusion, is a key step toward transforming policies into practice (World Bank, 2022). Data also plays a central role, as without disaggregated information on disability, age and access to services, it is difficult to measure the reach or impact of DRR programmes. Governments and humanitarian actors must improve data collection on disability status, living conditions, and accessibility challenges in both urban and rural contexts (GFDRR, 2020; World Bank, 2022).

d. Regional cooperation for resilience

Disasters do not recognise political borders — wildfires, floods, earthquakes, and extreme weather events often strike with little regard for national boundaries, yet their impacts are frequently amplified or mitigated by how well neighbouring countries collaborate. In the Mediterranean, where countries share similar climatic risks and socio-environmental vulnerabilities, effective disaster risk management increasingly depends on coordinated regional approaches rather than isolated national responses (European Commission, 2024). Mediterranean states, from Southern Europe to North Africa and the Eastern Mediterranean, face converging challenges: urbanisation in hazard-prone coastal areas, ageing or informal infrastructure, migration-linked pressures, and the growing effects of climate change. While contexts vary, the risks are shared. For example, rising sea levels threaten both Italian and Tunisian coastlines, earthquakes affect both Greece and Turkey, and prolonged droughts impact agriculture in Spain and Morocco alike. This overlapping exposure makes regional cooperation not just beneficial but essential.

Joint action enables countries to share technical knowledge, standardise risk assessments, and support each other in emergencies. The EU's Civil Protection Mechanism and the UfM's platforms for civil protection and environmental cooperation are key vehicles for such collaboration. These initiatives have supported joint disaster simulations, capacity-building workshops, and real-time mobilisation of aid between countries (European Commission, 2024). Aligning resilience efforts across the region through integrated territorial strategies is of utmost importance – and should include shared climate adaptation frameworks, interoperable early warning systems, and common standards for resilience in infrastructure projects (European Commission, 2024). Coordinated investments, particularly in cross-border ecosystems and watersheds, can also multiply the effectiveness of national and/or local projects.

Guiding Mediterranean Marine Protected Areas (MPAs) through the climate change era — building resilience and adaptation

In response to the emerging challenges, the Interreg Med-funded project MPA-ADAPT was launched to help Mediterranean MPAs adapt to climate change and integrate climate resilience into their management frameworks. The project brought together a diverse consortium of institutions and pilot sites from four Mediterranean countries: France, Italy, Spain, and Croatia. These countries were selected for their ecological diversity and institutional experience in managing marine areas under pressure from both anthropogenic and climatic threats. Pilot sites included the Parc national de Port-Cros and the Office de l'environnement de la Corse (OEC) in France; the MPA of the Pelagie Islands and MPA of Portofino in Italy; the Brijuni National Park in Croatia; and organisations such as the Spanish National Research Council (CSIC) and IUCN Med Office in Spain. The stakeholders collaborated to assess vulnerabilities, develop monitoring tools, and design adaptive strategies tailored to local conditions.

The project adopted a participatory and science-based approach. Vulnerability assessments were conducted to identify ecological and socioeconomic risks within each MPA. These findings were then used to develop climate adaptation plans that incorporated ecosystem-based approaches, risk management strategies, and stakeholder engagement mechanisms. Emphasis was placed on strengthening local capacities by involving MPA managers, scientists, policy-makers, and local communities in every phase of planning and implementation.

MPA-ADAPT also fostered cross-border cooperation by facilitating knowledge exchange and the co-development of methodologies for climate monitoring, policy integration, and institutional learning. One of its major achievements was the development of a set of practical tools and guidelines for integrating climate change into marine conservation policy and practice, resources that are now being used beyond the initial project sites.

Table adapted and compiled by the author, based on Mediterranean MPAs through the climate change era: Building resilience and adaptation. Interreg Med MPA-ADAPT project.

Conclusions and policy recommendations

The Mediterranean region stands at a critical crossroads where climate change, environmental hazards, and social inequalities converge to produce complex and uneven vulnerabilities. As demonstrated throughout this chapter, disaster risks are not simply the result of exposure to natural events, but are shaped by a web of political, economic, and social factors that determine how different populations experience, withstand, and recover from crises. It is increasingly evident that top-down solutions alone cannot deliver equitable resilience; instead, effective DRM must be deeply rooted in inclusion, participation, and justice. This requires acknowledging and addressing intersecting forms of disadvantage through tailored, community-led strategies that empower at-risk populations as active agents of change. Moreover, the shared nature of environmental risks across the Mediterranean calls for enhanced regional cooperation, knowledge exchange, and harmonised policy responses. Ultimately,

leaving no one behind in disaster preparedness and climate adaptation is not merely an ethical imperative, it is a practical necessity.

Recommendations

- Inclusive DRR must be embedded across all levels of policy and practice. Governments and regional bodies should integrate considerations of gender, disability, legal status, and socioeconomic vulnerability into DRR strategies and climate adaptation plans. Robust, disaggregated data is crucial for identifying and responding to vulnerability. Governments should collect and analyse data by gender, age, disability, legal status, and socioeconomic background to design targeted interventions and measure impact. Particular attention should be given to informal or underserved areas where data gaps are most acute.

- Given the transboundary nature of many climate-related and environmental hazards, regional cooperation is essential. Mediterranean countries should strengthen collaboration on shared risk assessments, climate adaptation strategies, and emergency responses. Platforms such as the EU Civil Protection Mechanism and the UfM can support this by facilitating joint exercises, capacity-building initiatives, and knowledge exchange. Harmonising standards and aligning regional resilience efforts will lead to more coordinated and efficient responses.

- Local communities, especially those in informal settlements and high-risk areas, possess essential knowledge about their specific vulnerabilities and capacities. Their early and continuous involvement in DRR planning enhances the legitimacy, relevance, and sustainability of interventions. Policy-makers should invest in participatory mechanisms such as community advisory groups and neighbourhood mapping initiatives, while supporting grassroots organisations with financial and technical resources to enable meaningful leadership.

- Physical infrastructure is a critical foundation for disaster preparedness and response, providing the essential assets needed to reduce hazard exposure and facilitate recovery. However, its effectiveness depends on strengthening the social and institutional foundations that determine who can access and benefit from these assets, and under what conditions. Without inclusive governance and strong welfare systems, infrastructure alone cannot address the social vulnerabilities that disasters expose and exacerbate. Authorities must therefore ensure that infrastructure investments are coupled with universal access to essential services such as healthcare and adequate housing. It is at the intersection of physical development and social inclusion that true disaster resilience is built, enabling communities to absorb shocks and recover more quickly in an increasingly risk-prone world.

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Conclusions and policy recommendations

The Mediterranean region is facing increasingly complex natural disasters and climate risks, compounded by socioeconomic weaknesses and governance issues. This study underscores the urgent requirement for stronger regional collaboration, cutting-edge technological solutions, and inclusive disaster risk management to foster resilience and safeguard communities. Despite the diverse geographical characteristics, risk exposure, vulnerabilities, organisational structures, and governance across Mediterranean countries, shared gaps and needs form a common foundation for overarching recommendations.

Strengthening regional cooperation remains crucial in the face of increasingly frequent and cross-border events. Domino or cumulative effects are indicative of the need for emergency coordination centres, integrated crisis management frameworks and bilateral/multilateral arrangements for a harmonised response to crises. The development of platforms such as the EU's Civil Protection Mechanism (UCPM) and the Union for the Mediterranean (UfM) contribute to sharing best practices and implementing concerted regional strategies, roadmaps and action plans.

By expanding the role of the UCPM, its operational capacity and political support for the participation of countries in the Southern Neighbourhood can be increased, promoting mutual resilience and proactive governance in EU external actions, as recommended in the Niinistö report. To this end, the involvement of the countries of the Southern Neighbourhood in political discussions and strategic planning can be achieved through the creation of a UCPM-associated country status, based on the UfM's Mediterranean framework for civil protection. New technologies remain a factor in reducing inequalities between countries and require structural and sustainable investments (beyond the accumulation and superimposition of projects), as well as an increase in the competence of actors to improve risk forecasting, emergency response, and decision-making through AI-based analytics, real-time data integration and digital monitoring systems. Developing and implementing multi-hazard early warning systems (MHEWS) and decision support systems (DSS) is vital to anticipate and manage the major risks of floods, forest fires and earthquakes. To develop inclusive strategies for disaster risk management, the system must be based on community engagement and local leadership to encourage active participation, equitable access to resources, and an appropriate strategy for marginalised groups, refugees and displaced populations, building confidence and ensuring appropriate policies, particularly in informal settlements and underserved urban areas.

Refugees remain a vulnerable population group, and the specific risks of these refugees and displaced persons should be properly recognised by involving them in preparation, planning and recovery processes, providing them with culturally appropriate shelter, multilingual risk communication, legal assistance and non-discriminatory access to services. Finally, strengthening social inclusion must prioritise universal design principles in public infrastructure and services to ensure accessibility for all.

In a more general context, the strengthening emergency response capacity can rely on:

- Equip local authorities: provide local authorities with emergency supplies and resources, safely stored outside of risk areas. Establish a national coordination mechanism linking the Disaster Risk Management Unit (DRMU) to municipalities.

- Develop national frameworks for volunteers: create a national framework for hazard communication, aid distribution and damage reporting. Provide psychological and social support services through a dedicated structure activated during disasters.

- Promote public awareness and education: through targeted campaigns and integrating risk education into school curricula to establish a long-term understanding of communities.

Beyond the urgency of addressing disaster response and risk reduction must be based on long-term resilience strategies that address climate risks, ensure sustainable infrastructure and proactive adaptation and mitigation policies. The countdown to 2030 has begun, which will see the completion of the Sendai Framework and numerous multi-annual funding/work programme strategies and plans. DG MENA, in co-production with DG ECHO, UNDRR, and the UfM around the Pact for the Mediterranean, will have a determining role in integrating all the challenges of the Mediterranean. As we already look towards the next stage of 2050, the acceleration of changes and the adaptation needs of systems and societies compel us to intensify the activation of diplomatic, governance, environmental, financial, economic, and educational levers geared towards collective resilience.

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