

Brussels, 12 May 2023

COST 072/23

DECISION

Subject: Memorandum of Understanding for the implementation of the COST Action “FutureMed: A TRANSDISCIPLINARY NETWORK TO BRIDGE CLIMATE SCIENCE AND IMPACTS ON SOCIETY” (FutureMed) CA22162

The COST Member Countries will find attached the Memorandum of Understanding for the COST Action FutureMed: A TRANSDISCIPLINARY NETWORK TO BRIDGE CLIMATE SCIENCE AND IMPACTS ON SOCIETY approved by the Committee of Senior Officials through written procedure on 12 May 2023.

MEMORANDUM OF UNDERSTANDING

For the implementation of a COST Action designated as

COST Action CA22162
**FUTUREMED: A TRANSDISCIPLINARY NETWORK TO BRIDGE CLIMATE SCIENCE AND IMPACTS
ON SOCIETY (FutureMed)**

The COST Members through the present Memorandum of Understanding (MoU) wish to undertake joint activities of mutual interest and declare their common intention to participate in the COST Action, referred to above and described in the Technical Annex of this MoU.

The Action will be carried out in accordance with the set of COST Implementation Rules approved by the Committee of Senior Officials (CSO), or any document amending or replacing them.

The main aim and objective of the Action is to create a coordinated network that serves as a platform to explore multidisciplinary approaches, methods, and tools to go beyond the evolution of hazards only and consider impacts in an integrated way. This will be achieved through the specific objectives detailed in the Technical Annex.

The present MoU enters into force on the date of the approval of the COST Action by the CSO.

OVERVIEW

Summary

The Mediterranean is a climate change hotspot suffering severe consequences of global warming. Several types of risks are currently affecting the region, from frequent extreme weather events to coastal erosion from rising sea levels or increased pollution. In addition, climate change impacts also propagate as “cascades” across socio-economic sectors. In urban areas, such sequential or concurrent compounding hazards are more disastrous than single events. The impacts affect ecosystems, economic activities, and human health.

Despite the ubiquity of these connections, scientists and decision makers are typically working addressing isolated risks, advancing in parallel and missing added value from cooperative efforts. It is thus necessary to move beyond siloed approaches towards integrated efforts that promote effective science-based and agent-based decision-making. It is necessary to establish unprecedented networks of transdisciplinary partnerships, including scientific, human health, social approaches, to governance, and risk management. Such networks facilitate stakeholders and researchers to reach more accurate recommendations, strategies and policies addressing climate change impacts and risk management.

FutureMed will foster new climate change-related science and synergies serving as a transdisciplinary and integrative platform effectively connecting scientific knowledge on high-impact weather (HIW) events and climate change impacts with stakeholders from priority socio-economic sectors such as energy supply and demand, agriculture, health and migration. For the first time, an Action coordinates a platform where scientific communities, key stakeholders and citizens can interact for the ends of promoting climate change impacts awareness, establishing future research priorities, and building capacities based on knowledge exchange in a living lab.

<p>Areas of Expertise Relevant for the Action</p> <ul style="list-style-type: none"> • Earth and related Environmental sciences: Climatology and climate change 	<p>Keywords</p> <ul style="list-style-type: none"> • Mediterranean Climate Change • High-Impact Weather • Impacts • Stakeholders • Social learning
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Specific Objectives

To achieve the main objective described in this MoU, the following specific objectives shall be accomplished:

Research Coordination

- Coordination of transdisciplinary panels of experts and stakeholders to foster exchanges of scientific knowledge, and narratives from stakeholders and citizens about climate change impacts.
- Identification of mutual benefits and shared knowledge from “societal challenges” eliciting areas of common interest to integrate stakeholders’ perspectives and citizens’ experiences of climate change risks, to foster inter-communication among groups and a multi-way interaction between policy-makers, researchers, and stakeholders/end-users
- Overcoming “climatic multilingualism” and “grey zones” through coordinated responses to translate the needs and results of the diverse climate change-related expert communities, breaking down or bridging silo

structures.

- Bridge knowledge, practices, and communication gaps between Mediterranean regions fostering the exchange of information and experiences, especially between northern and southern Mediterranean countries.
- Co-definition of new climate change approaches and testing of relevant tools to increase the adaptive capacity of stakeholders and citizens, by checking the predefined knowledge and discussing the suitability of a novel definition aligned with transdisciplinary research.
- Fostering dialogue with stakeholders and decision-makers through well-established partnerships in the region strengthen in time as part of a living lab.
- Contribute to improving stakeholders' and public understanding of climate change risks by promoting a triple-loop approach to awareness, perceived impacts, and adaptation measures and barriers to identify the weaknesses of the Mediterranean's resilience to the impacts of climate change.

Capacity Building

- To establish a living lab to ensure partnership with stakeholders
- To foster the exchange of knowledge between different disciplines
- To enhance communication among Mediterranean regions, institutions, and international organizations
- To discuss the basis for new research lines by training early career researchers on the possibility of new multi-disciplinary fields of research

TECHNICAL ANNEX

1. S&T EXCELLENCE

1.1. SOUNDNESS OF THE CHALLENGE

1.1.1. DESCRIPTION OF THE STATE OF THE ART

High-impact weather (HIW) events and climate change impacts in the Mediterranean - The Mediterranean region, encompassing southern Europe, northern Africa, and the Middle East, is recognized as a climate change hotspot, warming 20 % faster than the rest of the world (MEDECC, 2020), highly exposed to natural hazards, and characterized by profound environmental heterogeneities, cultural and socio-economic complexity, and inequalities. Expected changes in temperature and precipitation extremes will have profound and far-reaching implications for the predicted 529 million inhabitants by 2025. Ground-breaking findings of the first-ever scientific report on climate and environmental change in the Mediterranean area (MedECC, 2020) and the recent Sixth IPCC Assessment Report (2021) show the exacerbation of existing environmental problems in the Mediterranean basin. These problems emerge from the combination of changes in land and sea use, increasing pollution, intrusion of non-indigenous species, and declining biodiversity due to accelerated climate change. Past climate trends and future scenarios consistently point to significantly increasing risks during the coming decades in most impact domains (such as water, ecosystems, food, health, and human security). Being already affected by HIW events, including extreme precipitation, floods, heatwaves, and droughts among others, record-shattering weather events are taking place every year, shaking the concept of a “new normal” in the coming years.

Extreme heat waves, increased number of fires, sea-level rise, floods, droughts, desertification, increased pollution and disease patterns, water rationing, food shortage, and massive migrations, will undeniably affect communities around the Mediterranean. With current policies, temperatures are expected to increase by 2.2°C by 2040. Sea-level rise may exceed 1m by 2100, affecting 1/3 of the coastal population. In addition, freshwater availability will decrease by 15 % within the next 20 years turning 250 million people to be considered “water-poor” whereas massive deaths of marine species are projected due to water acidification. Economic prosperity, conflicts, and human health are a few of the socio-economic aspects to be affected by climate change. Indeed, recent epidemiological assessments found that the Mediterranean region is a hot spot of vulnerability to heat (Zhao et al. 2021), wildfires (Chen et al. 2021a), and poor air quality (Meng et al. 2021). For the sustainable development of Mediterranean countries, decision-makers need to adopt policies that enhance the mitigation of these impacts and consider adaptation options that take into consideration the complexity and diversity of the region's social inequalities. This is a difficult task, particularly for the most vulnerable southern Mediterranean societies, where fewer systematic observation schemes and impact models are based. The Mediterranean can be considered as a warning sentinel for climate change, both from the physical and socio-economic point of view, as well as a global laboratory to experience the effects of climate change in a great variety of socio-economic environments. Therefore, detailed knowledge of Mediterranean climate change impacts is necessary to ameliorate expected consequences.

There is a strong need to go beyond the evolution of hazards only and consider the impacts in an integrated way. It is therefore mandatory to shift climate knowledge towards what the weather will do rather than what the weather will be. This paradigm shift is the main goal of this Action.

Socio-economic risks - It is common knowledge that under climate change higher temperatures lead to increased morbidity and mortality rates, reduced productivity, damage to infrastructures, and multiple impacts on plant and animal species, as well as ecosystems. Together with the decline of precipitation, higher temperatures increase the risk for severe droughts to further affect European regions, with implications on agriculture, forestry, air quality, water, and biodiversity, among others. More frequent and severe droughts are predicted in future scenarios. This increases the length and severity of the wildfire seasons in the Mediterranean area, and also in regions not currently considered to be threatened by climate change. The availability of freshwater and a decrease in water quality, the changes in the composition of the atmosphere, as well as the “urban heat island effect” impacting human health, are also consequences of the above-mentioned changes in temperature and precipitation. Heavy rainfall is projected to become more frequent and more intense in the near future, inflicting consequent flash floods across Europe. Alongside, the sea level rise is expected to further reduce the amount of available freshwater, affecting agriculture and the supply of drinking water. This increases the risk of flooding and erosion around the coasts, posing multiple cascading threats to local populations, infrastructures, and ecosystems additionally removing the natural protection of some areas against storm surges. Our growing capability to project the impacts and economic effects of climate change across multiple sectors shows complex patterns of projected changes with damages estimated to reach hundreds of billion at the end of the century (Martinich and Crimmins, 2019).

Several challenges have been recently highlighted, for example by the latest MedECC report, challenges that require integrated studies to adapt to climate change impacts. For instance, what could be the impact on human activities of floods and droughts that may increase in frequency and magnitude under climate change? The impacts on forest fires on both ecosystem functioning and agricultural productions, as well as on air quality? The impacts of heat on human health and how future societal development (i.e., socio-economic and demographic) will alter the impacts in the coming decades? The impact of increasing water requirements for food and energy production as well as for conservation of endemic coastal/aquatic ecosystems? The impacts of the Mediterranean Sea warming and acidification on fisheries, aquaculture, or on jellyfish blooms and then on tourism? The potential impacts of climate change (through its effects of agriculture and economic activities, notably) on migration? The impacts of the increasing energy demand for cooling (in addition to heating) in urban areas on indoor air quality, and finally on human health? The change of paradigm considering not only hazards, but also impacts will support decision makers to adapt socio-economic systems to these evolving risks.

Problematic - Climate sciences have experienced great progress in the last decades to understand underlying processes through more skillful modelling of the earth system in more detailed high-resolution future projections. Also, the relevance of establishing a close relationship between researchers and stakeholders has been recognized; however, this is still an aspect that requires greater efforts.

Effective strategies to respond to climate change require the application of transdisciplinary and cross-sectional approaches. This Action has the ambition of functioning as a paradigm of shift where coordinated efforts will lean towards impact studies, will encompass multi-sectoral effects, and will assess the plausible consequences of climate change on human activities. This will be achieved through a coordinated network that serves as a platform for researchers to explore new multidisciplinary approaches, methods, and tools based on a direct and ongoing collaboration with stakeholders and citizens.

Furthermore, little attention has been given to the social aspects of climate change impacts, with only a partial and not interconnected focus on risk perception and management from stakeholders and individuals. Working in parallel monologues, the scientific community tended to address such knowledge gaps in a compartmentalized way.

Consequently, we are at a time in which all communities agree on the need to achieve progress beyond the state-of-the-art by overcoming the silos between disciplines. However, scientific communities with specific expertise perceive isolated risks and/or solutions on their own spatial, temporal, and sectoral scales, which could be an underlying reason for these communities “looking past each other”.

1.1.2. DESCRIPTION OF THE CHALLENGE (MAIN AIM)

Challenges addressed by the Action - Observed climate change has already led to a wide range of impacts on environmental systems and society, and further climate change impacts are projected for the future. The contribution of climate change to the damage costs, including economic and personal losses, from natural disasters is expected to increase in the future due to the projected increase in the intensity and frequency of extreme weather events in many regions. The damage costs from climate impacts can be reduced significantly by prevention, adaptation, and mitigation actions. However, successful actions and implementation require detailed understanding, effective dialogue, and planning among the different affected communities across the multiple spatial scales involved in this problem. The problems faced by society are complex and require knowledge, approaches, and solutions that push the boundaries of individual disciplines demanding novel integrative and collaborative research models. Unfortunately, to date communities with diverse expertise perceive and evaluate isolated risks/solutions, which could be an underlying reason for “climate action failure” and the perpetuation of the classical adaptation-mitigation dichotomy. **Partnerships based on transdisciplinary, cross-sectional collaborations between research groups with different expertise, active engagement with stakeholders, and feedback from citizen science are needed with the purpose of (i) “Understanding of needs and perspectives”, translating “multilingualism” to common ground to understand each other necessities, (ii) “Identification of grey zones”, community gaps, and citizen risk perceptions (iii) “Co-definition for a better future”, respectful, creative and collaborative work for the definition of methodologies, tools and data sources, including cooperation at all scales enhanced through integrated responses to societal interests and objectives towards climate change neutrality, to enhance resilient communities.** This approach will result in higher efficiency research by enabling better definition and representation of complex challenges additionally fostering critical dialogue between scientists, stakeholders, and society, and creative planning to challenge assumptions that arise within a single sector or discipline.

The overarching aim of FutureMed is to collect and provide knowledge about what the weather will DO beyond the classical approach of what the weather will BE. Thus, improve understanding about the complex process chain of climate change effects in the Mediterranean, by considering individuals and stakeholders’ awareness, perceived impacts, and adaptive capacity (including adaptation measures and barriers). This will be achieved through the provision, for the first time, of a platform for transdisciplinary communities to meet, shear and foster new and ongoing science to achieve progress beyond the state-of-the-art. At the same time, helping to reduce inequalities between Mediterranean regions through the exchange of data, know-how and methodological approaches.

The transdisciplinary FutureMed network will shear learnings, resources, data sources, methodologies, and tools to advance in a coordinated manner in this research field recognizing that science-based solutions are beyond the scope and resources of any single discipline and/or community and must be addressed collectively in benefit of more resilient societies. Therefore, this Action tackles the overall challenges of (1) problem framing and team building, (2) co-definition of solution-adaptation-oriented transferable bottom-up and multifocal knowledge, (3)

increase public awareness of Mediterranean climate change impacts and risks, and (4) dissemination and efficient communication of results for future (re)integration of created learning rendering it accessible to policymakers, key stakeholders, and citizens.

Relevance and timeliness - Presently it is widely recognized that climate change is a complex problem requiring traditional disciplines to work together for an integrated response to its impacts. **Transdisciplinary research approaches have been also recognized for being well-placed to aid responses to complex problems such as climate change. Despite this knowledge, diverse scientific communities, stakeholders, and citizens rarely undergo coordinated collaborative efforts due to the existing barriers and limitations and the lack of a favourable environment to do so.** Several coordinated international programs, many endorsed by the World Meteorological

Organization (WMO), successfully gathers researchers from diverse disciplines to investigate climate change in the Mediterranean and its impacts. Examples of this mainly in the field of meteorology and climatology are ALPEX, MAP, MEDEX, CIRCE or HyMeX, part of the MISTRALS program over the past decade. These programs were very successful in creating networks of scientists in the Mediterranean with similar interests. However, mostly they lacked transdisciplinarity. Through numerous small studies, monothematic national-level projects and several large collaborative projects (MISTRALS, MedCLIVAR, or Med-Cordex) substantial scientific knowledge on climate and environmental change in the Mediterranean has been achieved. But it has been widely recognized that the results of this research

At present, no scientific coordinated international umbrella exists interconnecting research activities from different disciplines in the field of Mediterranean climate change impacts, beyond that working with and for stakeholders and citizens. FutureMed will fill this gap building a transdisciplinary network to bridge climate science and impacts on society complementing activities and goals of presently well-established organizations with whom close ties will be established.

remain often not easily accessible to policymakers and citizens, and rarely these communities were considered in the dynamics of these collaborative efforts. Beyond that, existing organizations and institutions such as MEDECC, the Union for the Mediterranean or IEMed were conceived with the objective to consolidate the existing knowledge by a panel of experts and render it available to policymakers and citizens or are intergovernmental institutions to promote dialogue and cooperation.

Society has benefited from the enormous advances achieved in the last decade in the above-mentioned programs in relation to climate change impacts knowledge in the Mediterranean. However, it is particularly relevant and timeless to create and offer a platform for researchers and stakeholders to gather and in a coordinated manner jointly plan and exploit research progress achieved in different disciplines in the past towards improved knowledge of complex challenges in the present and future Mediterranean. This COST Action

network proposal is built upon past research projects on climate change and its impacts on the Mediterranean, such as the CIRCE project, the MISTRALS program, and the HyMeX program. It also follows the publication of the MedECC initiative report, which shed light on the main challenges facing the Mediterranean in the context of climate change. It associates different interconnected initiatives, such as the network of experts on the Mediterranean climate MedCLIVAR or boundary organizations in charge of bridging the gap between the scientific community and decision-makers such as MedECC or Plan Bleu.

1.2. PROGRESS BEYOND THE STATE-OF-THE-ART

1.2.1. APPROACH TO THE CHALLENGE AND PROGRESS BEYOND THE STATE OF THE ART

Significant efforts will be made on the continuous expansion of the network, in particular, mapping and engagement of stakeholders will be a key aspect considered in this Action as well as the novel definition of co-defined effective communication pathways between the academic and non-academic communities. The continuous exchange of expertise, tools, and information and the cross-sectional

FutureMed will serve as a common umbrella and collaborative platform (1) bringing together transdisciplinary panels of experts to bridge climate science and impacts on society, (2) as a novel approach the overarching goal of the Action goes beyond knowledge of HIW and aims at gathering information on resulting hazards, such as sea level rise, floods, storm surges, droughts, lightning, windstorms and impacts, i.e., fatalities and economic damages, (3) co-defining and effectively communicating solution-oriented knowledge in the form of climate change adaptation strategies and decision tools, and (4) render all this information freely available to potential users on the FutureMed website.

collaborations will foster **critical dialogue between researchers, stakeholders, governance, and end users** favouring progress beyond state-of-the-art impact studies. Strong ties will be established between intra-Mediterranean countries and institutions, also with outside Mediterranean countries, institutions, and international organizations, to build international cooperation for the benefit of societies. **Through international cooperation, potential inequalities between countries will diminish.** Focus will be on assisting and building strong ties with southern Mediterranean countries using the different

tools provided during COST actions; workshops, short-term scientific missions (STSMs), training schools, and conference grants. Furthermore, through exchanges of personnel and training schools, international cooperations will be sustained over time and **a new generation of researchers will be formed in new multidisciplinary cross-sectional disciplines that move away from the old monothematic research standards and are more in line with future needs.** In particular, the research currently carried out on HIW concerns more about the evolution of hazards than changes in the vulnerability of populations. **The research initiated in this COST network will operate a paradigm shift towards the estimation of issues and vulnerabilities as the starting point for these impact studies.** For this shift, it is not only required to look at, for example, hydrometeorological processes, but also consider a wide spectrum of activities such as agricultural production, city planning and land management, societal perception, and responses to catastrophic events, among others. Given the complexity of the problems facing society in the Mediterranean because of HIW events magnification under climate change, a sectoral approach is used as a platform for integration. This will allow the Action to coordinate research activities already being carried out. Priority sectors considered are Energy supply and demand including mobility, Agricultural production, Human Health including pollution, and Migration, including cascading impacts mediated through economic effects. Nevertheless, as the network expands throughout the period of the Action additional sectors of interest are expected to be considered, such as infrastructures, fishery, or tourism among others. Therefore, expected contributions to progress beyond state-of-the-art (PBS) brought by this Action are as follows:

PBS1 - FutureMed will constitute a **paradigm shift towards impact studies** encompassing multi-sectoral effects, to assess the plausible consequences of climate change on human activities in a more integrated way. As climate change does not impact everywhere and everyone in the same way, testing multiple case studies around the Mediterranean region can reveal links between attributes of resilience and the capacity of complex systems to absorb disturbances while still being able to maintain a certain level of functioning. Consequently, there is a need to focus more on local realities facing climate change impacts to identify best practices and replicable strategies.

PBS2 - The **transdisciplinary approach** of the Action will contribute to advance knowledge beyond the state-of-the-art given the need to transcend disciplines and tackle complex challenges facing society using learning from different perspectives including stakeholders and citizens overcoming the silo approach, breaking down or bridging silo structures resulting in barriers to communication and information flow. Given the transdisciplinary nature of this COST action, this focus on the interactions between natural and social systems would be a contribution to the emerging field of sustainability citizen science.

PBS3 - Data Sharing from multiple disciplines will be done at the European Open Science Cloud ([EOSC Portal](#)) to support collaborations among climate-related communities, affected sectors, and stakeholders, and to build our **legacy towards an inclusive, transdisciplinary, and open science model** facilitating networking and transfer of knowledge across scales and communities. By combining qualitative information and quantitative metrics, data-sharing robustness will be strengthened, contributing to more valuable agent-based decision-making processes between scientists, stakeholders, and the public.

PBS4 - Co-definition of **novel research orientations** providing the right context for transdisciplinary priority research lines to be defined and corresponding networks to form. Unlike the common way of organizing events (workshops, conferences...), this Action will organize them by shaping events addressing major societal concerns, favouring further team building and transdisciplinary cooperation. **A living lab** is proposed as a user-centred, open discussion and innovation ecosystem based on a systematic co-creation approach, integrating research and social-learning in real-life communities and settings regarding climate change risk. The lab can operate as an intermediate among citizens, stakeholders, researchers, and policymakers for joint local knowledge value co-creation as the basis for improving risk management.

PBS5 - Co-definition of **more effective communication pathways**, particularly between **scientists and stakeholders**, tackling one of the most important and under-addressed challenges to ensure the most relevant and efficient information use. However, **valuable information from individuals** should be considered to test their climate change awareness, main perceived impacts, and those measures for adaptation and barriers hindering a more resilient society. Consequently, checking different communication ways at different levels, through complementary channels (e.g., institutional advertisements, community disaster response, social networks), and considering the different phases of disaster, can reduce social vulnerability and promote faster and more efficient responses before,

during, and after the disaster occurs. An effort will be put into **bridging the knowledge and communication gap and strengthening existing collaborations between Mediterranean regions** already on board in this initiative. In this regard, particularly focusing on southern Mediterranean regions.

PBS6 - Contribution to **overcoming regional inequalities regarding climate change adaptive capacity**, particularly between northern and southern Mediterranean regions. Particular focus has been set on recruitment from an early stage of the southern Mediterranean regions for the benefit of the whole consortium. Active cooperation with Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine, and Tunisia will be a priority of the Action with the purpose of sharing knowledge, tools, and data.

1.2.2. OBJECTIVES

1.2.2.1. *Research Coordination Objectives*

The following Research Coordination Objectives (RCO) are defined with the purpose of adequately tackling the main objectives of this Action.

RCO1 - **Coordination of transdisciplinary panels of experts and stakeholders** to update and consolidate the best scientific knowledge about climate change impacts, narratives from stakeholders and citizens, and implications for managers and policy-makers in the Mediterranean region, considering affected sectors as well as compound and cascading effects.

RCO2 - **Identification of mutual benefits and shared knowledge from “societal challenges”** eliciting areas of common interest to integrate stakeholders’ perspectives and citizens’ experiences of climate change risks, to foster inter-communication among groups and a multi-way interaction between policy-makers, researchers, and stakeholders/end-users.

RCO3 – **Overcoming “climatic multilingualism” and “grey zones”** through coordinated responses to translate needs and results of the diverse climate change-related expert communities, breaking down or bridging silo structures resulting in barriers to communication and information flow.

RCO4 - **Bridge knowledge, practices, and communication gaps between Mediterranean regions** fostering the exchange of information and experiences, especially between northern and southern Mediterranean countries.

RCO5 - **Co-definition of new climate change approaches and testing of relevant tools to increase the adaptive capacity of stakeholders and citizens**, by checking the predefined knowledge and discussing the suitability of a novel definition aligned with transdisciplinary research.

RCO6 - **Fostering dialogue with stakeholders and decision-makers** through well-established partnerships in the region, not just to deliver progress and to render it accessible to policymakers, key stakeholders, and citizens, but to strengthen them in time as part of a living lab and according to climate change risks evolution and patterns.

RCO7 - **Contribute to improving stakeholders and public understanding of climate change risks** by promoting a triple-loop approach to awareness, perceived impacts, and adaptation measures and barriers to identify the weaknesses of the Mediterranean’s resilience to the impacts of climate change.

1.2.2.2. *Capacity-building Objectives*

The main objective of the capacity building and training activities in this Action is to create, enhance and develop constituents to foster new science practices for the benefit of social protection against climate change impacts and risks. To this end, this Action aims:

CBO1 - To establish **a living lab to ensure partnership with stakeholders** from the start of the Action to promote and manage co-designed and co-generated learnings, improved methodologies, tailored decision support tools, and more effective and efficient communication channels (organizational capacity)

CBO2 - To foster the **exchange of knowledge between different disciplines** based on expertise from atmospheric physics, climatology, hydrologists, environmentalists, geographers, risk managers, urban

planners, among others... to advance climate change related science beyond present knowledge in an integrated way and benefiting of mutual understandings among different angles of the climate sciences (systemic capacity)

CBO3 - To enhance **communication among Mediterranean regions**, institutions, and international organizations as well as other European countries, hiring collaboration and **knowledge and data exchange with North African and Middle East partners**, some of whom are already secondary proposers in this Action to reinforce their relevance in policy-making (organizational capacity)

CBO4 - To introduce and discuss the basis for new research lines focused on mentoring climate change response through a triple-loop approach to climate change risks (awareness, perceived impacts, and adaptation measures and barriers), by **training early career researchers on the possibility to work in new multi-disciplinary fields** of research (individual capacity).

2. NETWORKING EXCELLENCE

2.1. ADDED VALUE OF NETWORKING IN S&T EXCELLENCE

2.1.1. ADDED VALUE IN RELATION TO EXISTING EFFORTS AT EUROPEAN AND/OR INTERNATIONAL LEVEL

On the scientific side, major advances have been achieved in recent decades through structured international initiatives such as the MISTRALS program, the Mediterranean component of the CORDEX program (MedCORDEX), and the MedCLIVAR program. This better understanding of the physical processes linked to climate change makes it possible to envisage work that is much more integrated between different disciplines. Well-established networks in Mediterranean studies have been active in the past.

Presently no coordination platform exists to foster active scientific collaboration between multidisciplinary research communities and stakeholders in the Mediterranean. More than that, weather-related impacts in a changing climate are currently addressed implicitly, mostly in terms of extreme events. This approach lacks to include non-extreme high-impact weather events and their compound effect. This Action will bring added value to climate communities by working at the interface between weather and climate scales and thus by introducing event-based socio-economic impacts in climatological scales. This will set exemplary cases of socio-economic impacts and will facilitate interaction between stakeholders, weather, and climate communities. This Action will build upon existing contacts between multidisciplinary researchers and stakeholders already involved in the preparation of this Action and their respective networks in addition to already well-established networks on climate and socio-economic impacts.

To achieve this objective, different organizations working on the dissemination of research results to stakeholders and

decision-makers such as MedECC, Plan Bleu, Union for the Mediterranean, IEMed will be mobilized. This action also aims to involve partner countries from the southern Mediterranean, via networks supported by the Institute of Research for Development (GDRI RHYMA and ARID) and the UNESCO water center in Montpellier (ICIREWARD). Thus, FutureMed will participate, and complement current initiatives and forums focusing on the Mediterranean, such as EGU Plinius Conference on Mediterranean Risks, the MetMed Conference or the WMO World Weather Research Programme (WWRP) High Impact Weather (HIWeather) and the Global Energy and Water Exchanges (GEWEX) project, Hydroclimatology Panel (GHP), as part of the World Climate Research Programme (WCRP) .

2.2. ADDED VALUE OF NETWORKING IN IMPACT

2.2.1. SECURING THE CRITICAL MASS, EXPERTISE AND GEOGRAPHICAL BALANCE WITHIN THE COST MEMBERS AND BEYOND

Given the multidisciplinary nature of the Action, the number of international researchers already involved in the discussions about this proposal, and the interest it is arising among the Mediterranean research communities and stakeholders in the region, the critical mass and expertise being ensured. Every

potential participants with different scientific backgrounds and expertise will contribute to the Action with their own international network of collaborators. **Workshops, training schools, and STSMs will be a fundamental goal of this Action ensuring the exchange of knowledge. Part of the budget devoted to these activities will be dedicated to north-African partners.** Moreover, we have made a particular effort to already involve north-African partners, whose participation in past international programs in the Mediterranean was limited. Furthermore, **several of the proposers of this Action are already involved in international research programs with global coverage. They will assist us in a more effective enrollment of these countries.** The network is built to additionally integrate stakeholders and international organizations to ensure effective communication, co-planning, and transfer of knowledge. Critical mass and expertise are initially demonstrated through secondary proposers from the Mediterranean, including southern and northern countries, and central and northern European countries. Researchers from universities and research institutions are included as well as stakeholders from public and private entities at different scales, from European to regional and local. The network will be naturally enlarged after the beginning of the project since a call will be issued to Mediterranean research communities and related stakeholders by the Steering Committee of the Action, working group leaders, and secondary proposers already involved in the Action.

2.2.2. INVOLVEMENT OF STAKEHOLDERS

The involvement of stakeholders is a key aspect of this Action. The contribution of the latter is fundamental to efficiently co-define research avenues and adaptation decision support tools and jointly explore and propose new, more effective communication pathways. To this end, their enrollment is foreseen from the beginning of the Action which is a novel approach of this proposal. Furthermore, **a whole WG will be devoted to mapping, engagement, and transfer to this community with the purpose of enlarging the participation and contribution of stakeholders for the duration of the Action to the benefit of the whole consortium.** Thus, stakeholders will benefit from the outcomes of this Action, but they will also actively contribute to the correct development of its objectives. Utilizing the knowledge and experience of a wide range of stakeholders in developing research outputs will bridge existing knowledge gaps across disciplines and sectors. In this Action, we envision the cross-scale involvement of stakeholders, from European - to national - to local groups. Engaging stakeholders across scales will increase the visibility of the Action and convey its utility. Some of the most relevant international organizations in relation to Mediterranean activities are already involved in this Action and included as secondary proposers. **Furthermore, this Action will actively pursue the engagement of all potential stakeholder-relevant climate change impacts. This entails local authorities, reinsurance companies, risk analysts, and more public or private legal entities with a strong interest in climate change impacts, adaptation and mitigation measures, policymakers, and the impacted groups across sectors, such as energy supply and demand, agricultural production, human health, civil protection.** Stakeholder discovery, mapping, and analysis will ensure the inclusion of all relevant parties. Engaging these stakeholders will be a cross-cutting activity, closely aligned with the other WGs. A dedicated project partner dialogue event at the kick-off meeting will be held to (i) undertake preliminary stakeholder mapping, establishing categories, criteria, and boundaries of the mapping; (ii) train partners in stakeholders mapping and analysis and in identifying stakeholder forum participants; (iii) co-develop a dynamic Stakeholder Engagement plan with partners. Engagement of more stakeholders will be pursued through direct invitations to organized workshops, dedicated sessions, and round tables, also through dedicated STSMs. Moreover, presentations of the Action outcomes and expectations at already established networks, and international organizations such as the WMO GLASS and GHP panels, HIWeather and HWRP programs and MedECC, Med-Clivar will further allow the inclusion of stakeholders. Furthermore, we are also aware of how opening science to society is essential to enrich research and reinforce society's trust in science and innovation in the battle against climate change. Citizen science can be described as public participation (individuals, teams, or networks of volunteers) in scientific research to bring advancements in scientific research outputs and impacts as well as increase the public's understanding of science. As climate change tends to be perceived as an abstract risk, it is essential to ensure not only stakeholders' engagement but individuals' participation, providing a framework to share their experiences and narratives on climate change impacts and measures for increasing their resilience. Under the Science with and for Society (SwafS) part of Horizon 2020, the Action considers citizen science in research methodologies, working with samples, in which citizens can provide matchless social learning on how climate change impacts are exemplified at the local scale, how communities are responding in extreme events situation, or which barriers must be solved to ensure more resilient attitudes regarding climate change.

3. IMPACT

3.1. IMPACT TO SCIENCE, SOCIETY AND COMPETITIVENESS, AND POTENTIAL FOR INNOVATION/BREAK-THROUGHS

3.1.1. SCIENTIFIC, TECHNOLOGICAL, AND/OR SOCIOECONOMIC IMPACTS (INCLUDING POTENTIAL INNOVATIONS AND/OR BREAKTHROUGHS)

Scientific impacts - This Action is proposing integrated solutions to respond to challenges and impacts relevant to climate change. For this reason, its members will develop beyond state-of-the-art transdisciplinary research schemes and will invest time and effort into collaborative research topics. This will break the silos effect and will contribute to European competitiveness in one of the most pressing topics nowadays: climate change and its impacts on society. On a regional level, the Mediterranean research community will greatly benefit from the transdisciplinary nature of the Action. It will be able to recalibrate its research lines/areas, as well as to co-define priorities into a solution-oriented culture. This promotes adaptation strategies and fosters more efficient communication pathways between researchers and stakeholders. The transdisciplinary-integrated perspective in this Action will reduce the abstract nature of climate change perception and will effectively combine physical data (climate modeling) and detailed social data (behaviour modelling). Early career scientists will be introduced in this new hybrid theme, rendering this knowledge accessible opening new opportunities to collaborate with stakeholders and decision-makers. **Socioeconomic impacts** - This Action results' will directly benefit governments, businesses, and society through the potential of improving understanding, predictability, and adaptation to HIW events. The beyond-state-of-the-art understanding of present climate change socio-economic impacts in terms of compound and cascading effects will assist civil protection agencies and decision-makers to better trace new adaptation and mitigation strategies. The co-definition with stakeholders of adaptation support tools and communication pathways will tackle one of the most under-addressed challenges: ensure the use of the most relevant and efficient information for decision-making. Indirectly, a more integrated response to the imposed climate change challenges will favour more climate-conscious and resilient societies through intensive dissemination and science-based recommendations. **Long-lasting synergies and collaborations** will be established through this Action among diverse scientific disciplines and stakeholders. This favours a novel integrated approach to climate change impacts on society, further promoted by rapid dissemination in the context of a rich and diverse network.

3.2. MEASURES TO MAXIMISE IMPACT

3.2.1. KNOWLEDGE CREATION, TRANSFER OF KNOWLEDGE AND CAREER DEVELOPMENT

Knowledge co-creation- FutureMed will create climate change-related knowledge beyond state-of-the-art by fostering the definition of transdisciplinary research benefiting from the numerous advances in the last decade in all disciplines. The continuous exchange and transfer of knowledge, methodologies, tools, and data between researchers from multiple disciplines and stakeholders, from the Mediterranean region and abroad and between eastern, western, southern and northern Mediterranean regions will enable considerable advancements in understanding present knowledge, identifying needs and gaps and co-defining potential research directions to forge a better future for society. Furthermore, through effective communication of relevant information to the general public knowledge and awareness of climate change impacts will increase contributing to create more resilient communities.

Knowledge Transfer- The Action will foster knowledge exchange and transfer as a necessary requirement for the successful development of the Action. The exchange of information and knowledge will occur at several levels, (i) within the network and among different disciplines and Mediterranean regions, with a particular focus on the exchange between northern and southern Mediterranean countries, through in-person and virtual meetings, workshops, training events, and STSMs, (ii) within the network and with external stakeholders, their mapping and engagement will be the goal of WG3 during the whole Action favouring also through the organization of dedicated workshops the continuous and effective communication with stakeholders, combined with citizen science background in which the public's experiences on climate change risks will be part of the strategy to recap social-learning at the local scale, (iii) dissemination activities in each one of the WGs will ensure the transfer of knowledge to the wider community through publicly available reports, scientific publications, policy briefs, and open-access data sets.

Career development- The Action will positively impact the careers of all members. The transdisciplinary approach of the Action and the rich and diverse network will boost research and knowledge creation much faster than individual efforts. Particularly through exchanging knowledge, sharing data and discussing research ideas, and improvement of communication channels with stakeholders, high-quality research will be fostered raising the profile of all network members. Early career scientists will be particularly supported in this Action to develop the next generation of scientific leaders with transdisciplinary backgrounds. The STSMs and training schools will favour this aspect supporting the exchange of information, knowledge, and methods through mobility and collaboration across Europe.

3.2.2. PLAN FOR DISSEMINATION AND/OR EXPLOITATION AND DIALOGUE WITH THE GENERAL PUBLIC OR POLICY

The **Action Management Committee (MC)** will appoint two members from each of the WGs and two from the MC as the **Communication Team** to coordinate the dissemination of results, internal and external communication, and the coordination of the website and social media. These communication channels will be continuously updated including all outcomes and activities from the Action adapted to the needs of each one of the WGs' needs. Focused and **effective dissemination, exploitation, and communication (DEC)** activities will support FutureMed through novel formats that address multiple target audiences including the general public, journalists, the scientific community including IPCC, stakeholders, and the impacted groups in energy supply and demand, agricultural production, human health, and migration. The communication strategy and activities to maximize the project impact will be outlined in the DEC Plan, developed during the first six months of the project. Key **Performance Indicators** to monitor and assess the activities will be defined in order to maximize the project's impact. This will be reflected in the DEC Plan updates, while a final **Exploitation Plan for the project legacy strategy** will also be provided at the end of the project. The DEC Plan will include the visual identity of the project (logo and guidelines) as well as the strategy, objectives, targets, and channels to promote the project and its planned activities. Multiple formats for communication will be embraced including the project website, social media including Twitter and LinkedIn as well as video tutorials. Combined in a synergistic manner, these channels will represent the project's gateway to identify key actors in the online community. The DEC Plan will be a living document that will be revised and updated twice during the lifetime of the project, making required adjustments to maximize the visibility and impact of the project. The DEC Plan will also include the development and maintenance of the project website, organizing press releases to be shared with national and international media contacts, and managing the project's social media accounts (Twitter and LinkedIn in particular will be used to promote the project and further engage stakeholders and citizens - closely aligned with activities of WG3). The primary purpose of the Action's dissemination activities is to raise visibility, deliver relevant and tailored information on the outcomes, promote the uptake of these outcomes, and thereby amplify the overall impact of the Action among the key target groups listed below. The expected impact through the targeted dissemination activities is to engage and stimulate action. The selection of communication and dissemination tools and channels will rely on the targeted audience: (a) **Scientific Community** (including the IPCC and MedECC). Sharing knowledge and expertise across disciplines, promoting future research, and informing on climate change impacts and project research/outcomes; (b) **Media Professionals** including journalists, editors, and producers. Increasing the visibility and distribution of reliable and clear information on Action objectives and outcomes, ensuring maximum reach and impact; (c) **Citizens**. Special emphasis will be placed on particularly impacted groups in energy supply and demand, agricultural production, human health, and migration - to raise awareness about climate change impact, inform about their benefits and value, and promote their uptake by society; to provide credible information and encourage a dialogue between science and society; (d) **Academic Sector and Industry**. Important multipliers include not only educators and their students but also corporate decision makers in impacted sectors such as energy, health, or agriculture; (e) **Action partners, consortia of other research projects**, to ensure effective communication of the project outcomes. Particularly, close ties will be established with ongoing COST Actions such as MEDCYCLONES CA19019; (f) **Relevant stakeholders**. Promoting evidence-based policies that reflect the latest insights of climate science, including both European as well as international organizations. Regarding the dissemination and impact assessment, deliverables and other material produced during the Action will be curated and delivered in multiple editorial formats to maximize the reach among different target audiences - including blog entries, Website, infographics, press releases, social media posts, webinar recordings, and video tutorials. Dissemination activities include participation in relevant events and peer-reviewed publications in prestigious scientific outlets (climate science as well as related disciplines combining transdisciplinary approaches), identifying and leveraging synergies with other projects and initiatives under development. FutureMed will help multiple communities, from decision-takers to the general public, to better understand climate change and its impacts across spatio-temporal scales, particularly at highly vulnerable, but also diverse climate change-affected regions. Benchmarking and exchanging best practices among regions will help replicate results, also provide

important input for the exploitation planning process to ensure the sustainability of the project and uptake of results during and after the project's lifetime. Exploitable results and initial routes to exploitation will be included in the DEC Plan and updated throughout the project, with the final strategies reported in the Final Exploitation Plan.

4. IMPLEMENTATION

4.1. COHERENCE AND EFFECTIVENESS OF THE WORK PLAN

4.1.1. DESCRIPTION OF WORKING GROUPS, TASKS AND ACTIVITIES

The FutureMed Action will be coordinated by the Action Management Committee (MC) in accordance with the COST Action "Rules for Participation and Implementation of Cost Activities". The MC will meet virtually every 4 months, and in person once per year in the annual FutureMed workshops held in different Mediterranean countries if no restrictions are issued. The COST Action will address the RC and CB challenges (section 1.2.2) of the action through 4 WGs. All WGs will work in a coordinated manner, continuously sharing knowledge and advances through planned **coordinated activities between WGs. Each WG will have a multidisciplinary coordination team**, e.g., researchers with different expertise and stakeholders, to ensure the multidisciplinary in each and the critical mass and expertise. **The groups will be flexible**, and possible topics to be investigated among groups are expected to arise during the Action. Within each WG several relevant initiatives will be suggested, it is the goal of the Action to foster numerous initiatives in parallel. **A regional and seamless approach will be applied**. Each topic will be investigated for the whole Mediterranean pointing out regional-to-local similarities and differences, hotspots etc. This will allow an exchange of knowledge, tools, and expertise across the Mediterranean regions. **The time scale investigated will be adjusted to the needs of the investigation issue**. Annual meetings will help the community to shear progress towards the Action goals and foster an effective communication flow with the purpose of network consolidation. In the following, a detailed description of the WGs is given,

WG1: Hazards and socio-economic impacts in weather and climate scales - *The overarching goal of WG1 is to effectively bridge weather and climate modelling with actual socio-economic impacts. For this reason, members of WG1 will collect and analyse the atmospheric and oceanic variables that deliver socio-economic impacts, namely wind speed, temperature, precipitation, sea-level, and significant sea wave height. These fields will be acquired by climate simulations, freely available through international repositories (e.g. Climate Change Copernicus), and by daily weather forecasts, performed by participant organisations to the Action and the ones being freely available (e.g. NCEP, DWD etc.). In addition to collecting these variables, WG1 members will gather information on actual socio-economic impacts using reports and relevant catastrophe modelling. The effective cross-assessment of socio-economic impacts and weather events will be done through the refinement of prediction datasets using specific diagnostics. These will allow the members to identify specific conditions that depict cyclones, heat-waves, storm surges, climate extremes, etc.*

Tasks (T) - T1.1: Inventory of simulations. A list of repositories and the origin of experiments will be gathered for climate prediction simulations, while a dedicated website will collect and visualize all possible weather forecasts. List will include the atmospheric and oceanic variables related to impacts. **T1.2: Inventory of impacts.** Members will continuously collect reports and any other source of information regarding socio-economic impacts. Brainstorming is a key element for T1.2, aiming to build a first-of-its-kind comprehensive open-accessed inventory of impacts. **T1.3: Employment of diagnostics.** It is important in the context of WG1 to translate atmospheric and oceanic variables into hazard weather types and actual impacts. For this reason, diagnostics will be gathered and applied to the datasets identified in T1.1. **T1.4: Case study analyses.** The members of WG1 will collectively work on specific, renowned case studies where they will build a common culture in understanding weather events' relationship to impacts. Case studies will comprise an ensemble of representative hazards such as heat-waves, cyclones, air pollution events, cold spells etc.

Milestone (M1.1): Completion of T1.1. **M1.2:** Gathering enough information in T1.2 to allow the beginning of case studies.

WG2: Climate adaptation decision and support tools - *The overarching goal of WG2 is (i) to develop a joint research agenda together with stakeholders on methods and tools for adaptation to climate change in the Mediterranean, and (ii) to achieve an overview of existing decision-supporting tools for adaptation to climate change impacts and explore their usability, transferability, and cross-scale character.*

Task: T2.1: Overview of existing agent-based and decision-supporting tools. Existing tools aimed at modelling decisions have different national origins and target different scales, sectors, and user groups. For instance, tools might be of different "nature" when applied for the purposes of policy-makers in the international/national/regional or local level, and of different "nature" when applied for the purposes of business-oriented legal entities (e.g., reinsurance companies). Likewise, behaviour modelling based on agents' attitudes and perceptions regarding climate change is an innovative framework, asking for, among others, a discussion on how to reinforce their robustness by considering both qualitative (from narratives and social learning) and quantitative data (from meteorological information and scenarios). Understanding these differences and highlighting their advantages and disadvantages is a scientific challenge that demands cross/multi/interdisciplinary cooperation. The Action will gather existing information on the various types of climate adaptation support tools and organize the key attributes to each tool. Attributes (e.g., key sector, temporal scales, type of users) will be defined in collaboration with WG1 and WG3 and will synthesize an inventory of climate adaptation support tools. **T2.2 Definition and synthesis of a typology framework.** Aggregate and systematically organize the information of the climate adaptation and decision-support tools inventory by developing a coherent typology framework that will standardize the analysis for the development of a common theoretical and methodological framework, which can be used as a template for future characterization of climate adaptation tools in a range of case studies. Tools transdisciplinary from physics and social sciences are key to considering different characterization factors, such as sectors, impacts, regions, purposes, time horizons, data sources, level of processing of climate data, degree of stakeholder co-development, background knowledge, type of users, making analysis results comparable. **T2.3: Case studies and best practices.** Case studies are excellent opportunities for international cooperation and the extraction of useful results when comparing different decision-supporting tools. FutureMed will bring existing case studies with different particularities on sectors, impacts, geographical, and sociocultural contexts found among its members. This will provide a warm start to the network while case studies and associated stakeholders and citizens survey samples will act as a showcase for the capacities offered by the different decision-supporting tools and will facilitate the identification of best practices and FutureMed success stories in which the adoption of support tools has improved mitigation of impacts. Through the case studies and best practices gathered from the Action Network, Nexus knowledge will be enriched, and the typology framework will be tested and validated. **T2.4: Opportunities for the development of multisectoral support tools.** Explore common aspects and opportunities for the development of multidisciplinary (multisectoral) support tools (on the contrary of tailored user-specific applications). Identification of interactions, interdependencies, and interlinkages between the different FutureMed sectors. Stakeholders and researchers will carry out common discussions that aim to acquire insights into the applicability and usefulness of tools that will help to cover methodological gaps by exploiting existing capabilities of tools from different sectors and explore the transferability and cross-scale character of tools. Proposals on state-of-the-art approaches that could be adopted.

M2.1: Relevant decision-supporting tool identified

M2.2: FutureMed case studies identified

WG3: Stakeholder and citizens' engagement for inclusive climate adaptation - *The overall aim of WG3 is to ensure strong cross-sectoral engagement from policy-makers, decision-makers, companies, citizens and researchers and between different Mediterranean countries in co-defining outputs and tools for climate change adaptation. Engaging individuals and stakeholders will be a cross-cutting activity, closely aligned with the other WGs with the purpose of enlarging stakeholders' participation and citizens' contribution.*

T3.1: Stakeholder mapping. Stakeholder mapping will be achieved through a number of sector-specific dialogue events at different levels as listed above to: i) undertake preliminary stakeholder mapping, establishing categories, criteria and boundaries of the mapping; including cross-sector, and ii) identify key stakeholder communities to engage with during the Action. Established methods will be used for capturing and mapping the influence and level of interests to identify types (roles and responsibilities) and relationships, and consider representation, influence, democracy, capacity, and legitimacy of stakeholders (for example gender issues). The most relevant stakeholders will include: (a) Supranational level stakeholders, including EU and/or EEA as well as WMO, IPCC, IPBES, FAO, UNESCO and iNGOs, UNEP/MAP, (b) National government policy-makers and decision-makers, responsible for making policies to adapt to climate change in the Mediterranean, (c) Local authorities and decision-makers (e.g. municipal, provincial) who are responsible for implementing (implementation officers) the national action plans and specifically planning climate change adaptation in the Mediterranean that need a cross-sectoral overview, (d) Private commercial companies for

example in the energy, agri-food and insurance sectors, (e) NGOs addressing societal issues (health, energy, environment, food) advocating for example, climate justice, net zero agricultural transformations, green energy transitions, (f) Citizens knowledge and information to understand climate change impacts and adaptation. The engagement of stakeholders will be a crosscutting activity during the Action time pursued through direct invitations to organized workshops, dedicated sessions, and round tables. **T3.2: Interview and surveys to delve into risk awareness, perceived impacts, and adaptation measures and barriers (triple-loop approach) of Mediterranean communities.** Information and experiences from stakeholders and citizens will be collected through semi-structured interviews and individual surveys to recap social knowledge on how climate change risk is perceived, which impacts have been experienced at the local and the regional scale, which measures and barriers for adaptation can be highlighted, or which policies should be tested to increase individuals and communities' resilience to climate change. This information will be then used to identify stakeholders' risk perception levels and discuss concepts such as 'risk aversion', and how it determines adaptive capacity in decision-making processes at the individual and community levels. **T3.3: Workshops to identify stakeholder needs and priorities and facilitate vertical integration.** Two workshops (SM(stakeholder dedicated meeting)⁶, SM12) will be run focused on particular case studies to develop a nuanced understanding of stakeholder needs and priorities. They will be facilitated through the use of interactive sessions, such as the development of narrative scenarios and policy simulations to represent an imagined future for decision-makers, including the effects of potentially cascading events. Workshops will also use tools, such as the C40 Vertical Integrated Action tool to undertake a stepwise analysis for climate action planning from strategic to sector and action levels. The workshop will integrate: (a) High-level policymakers to ensure engagement with those interested in climate change adaptation at supranational e.g. European level, including from the European Commission, Parliament as well as NGOs and private sector, (b) National Mediterranean level stakeholders (national and regional governments, supra-municipal administrations, think-tanks), (3) Local-level stakeholders (municipalities, associations). Workshops can be planned to coincide with other relevant Mediterranean level/network events, such as national EIT Climate-KIC events. **T3.4: Workshop to co-define tailored integrated datasets and information.** Two workshops (SM24, SM36) will be run with stakeholders to focus on particular case studies to co-define ways of producing tailored integrated datasets and information. Workshops will integrate the same stakeholders as T3.3.

M3.1: Stakeholder initial recruitment plan completed. **M3.2:** Workshops to identify stakeholder needs and priorities and facilitate vertical integration completed. **M3.3:** Workshop to co-define datasets and information completed.

WG4: Capacity building and Dissemination - *The main goal of this WG is to support the network activities effectively delivering the results of the Action.*

T4.1: Monitor progress and the growing network. Action progress and outcomes within and outside the network will be disseminated through the web portal, reports, meetings, conferences, social media (Twitter, LinkedIn, ...). New Action members will be identified and recruited during the duration of the Action through dissemination channels and international and national conferences, to reinforce the consortium background and be sure that on-time advances in climate change risk analysis in the Mediterranean region are integrated into the Action. A major contribution in the context of T4.1 will be the setting up of the Action website. It will be constantly enriched with information while deliverables of tasks from all WGs are produced in the course of the Action. **T4.2: Communication, dissemination, and public engagement.** Progress on dissemination and outreach activities will be done twice per year to allow adjustments if necessary. In parallel to social media and web-portal dissemination activities (including newsletters and policy-briefs), editorials submitted to scientific journals summarising findings and recommendations, interviews of key network members, scientific conferences and workshops will contribute to the successful dissemination of Action activities and public engagement (to be assigned to the Science Communication Coordinator). **T4.3 Training and measures to maximise impact.** Through the organization of training schools, workshops, STSMs, and virtual and in-person conferences the impact of the Actions' activities is maximized, (i) Through STSMs, the exchange of experiences between the different regions of the project, e.g. north-south, is ensured. Furthermore, visits of FutureMed researchers (and stakeholders) to learn about best practices and success stories in which the adoption of support tools have improved mitigation against climate change impacts, (b) Summer schools with a cross-disciplinary objective, to gather and promote common scientific backgrounds about climate change impacts to students, young researchers and scientists, (c) Capacity building events for stakeholders to improve future engagement activities with scientists making more effective and efficient communication channels (in cooperation with WG3 and also including citizen science' feedback), (d) Training schools will be developed and implemented on (1) Transdisciplinary approach to climate change impacts in the

Mediterranean region, and (2) Stakeholder engagement on climate adaptation.

M4.1: DEC plan prepared. **M4.2:** Exploitation Plan for the project legacy strategy. **M4.3:** Training school on “Transdisciplinary approach to climate change impacts in the Mediterranean region”. **M4.4:** Training school on “Stakeholder engagement on climate adaptation”.

4.1.2. DESCRIPTION OF DELIVERABLES AND TIMEFRAME

WG1: Hazards and socio-economic impacts in weather and climate scales - Deliverable (D1.1):

List of datasets to be commonly used by all participants of WG1. We will define a reference dataset for the present climate and model simulations to be used for addressing HIW in climate change. This list will be the product of collaborative work and will be highly prioritized to assure harmonized efforts in WG1. The deliverable will be later enriched with recommendations and best practices in conjunction with D1.3. **D1.2:** Inventory of impacts similar to the international disaster database of EM-DAT. This will be a “rolling” effort where any participant will be able to enrich the database with new entries of events all along the four-year period of this Action. D1.2 will be provided as an open-access database through the website of the Action. **D1.3:** Different weather-related diagnostics will be applied to the datasets listed in D1.1. These diagnostics will be enriched during the Action and results will be provided and communicated among the Action participants. **D1.4:** At least two exemplary case studies will be analysed in a community effort and will be communicated in the form of peer-reviewed scientific articles. At the end of the Action, a review paper will be written, aiming to summarise results and efforts in WG1 by providing a comprehensive view of HIW and relevant socio-economic impacts in a climatological context.

WG2: Climate adaptation decision and support tools - D2.1: Report on the inventory of existing climate adaptation decision and support tools (Y2/Q1). **D2.2:** Scientific peer-review overview article on the typology of existing climate adaptation decisions and support tools (Y2/Q3). **D2.3:** Special issue on the synthesis of case studies and best practices on climate adaptation support tools (Y3/Q3). **D2.4:** Report on the opportunities for the development of multisectoral support tools (Y4/Q3). **D2.5:** Yearly internal report (Y1,2,3,4/Q4)

WG3: Stakeholder and citizens’ engagement for inclusive climate adaptation - D3.1: Report addressed to Action members and stakeholders including mapping criteria and identified key stakeholder communities (Y2/Q2). **D3.2:** Report synthesizing stakeholders’ and citizens’ perceptions regarding climate change risks (Y2/Q3). **D3.3:** Recommendations for policymakers in the Mediterranean region to foster integrated decision-making for climate change adaptation (Y3/Q2). **D3.4:** Yearly internal report (Y1,2,3,4/Q4)

WG4: Capacity building and Dissemination - D4.1: Yearly internal report (Y1,2,3,4/Q4) **D4.2:** Yearly internal report addressed to Action members on dissemination strategies (see section 2.2.2, Y2/Q1). **D4.3:** Website creation (Y1/Q2).

4.1.3. RISK ANALYSIS AND CONTINGENCY PLANS

The FutureMed Action addresses the ambitious challenge of serving as a platform to enhance communication among diverse scientific disciplines and stakeholders to foster new science contributing to improved knowledge on climate change and its impact in the Med region. Potential risks associated to this Action and specific contingency plans are in the following: - Lack of interest or difficulties from North African and/or eastern European countries to participate in the action. A cross-cutting activity will establish new connections -and strengthen the ones already existing- with researchers and institutions of these regions through previous Mediterranean networks such as HyMeX, or ongoing projects such as COST Action Medcyclones. - Failure to gather a large enough and diverse network membership including stakeholders. A transdisciplinary network of experts is already in place. Through their networks already critical mass is reached. Nevertheless, the recruitment of new members and stakeholders, which is a major goal of WG3, will be a focus of the Action during its all duration to ensure diversity. - Force majeure. In case of a new pandemic, the only implementation aspect that could be affected is in-person meetings. All of them could eventually take place remotely. The considered budget will be then transferred to communication activities. - Workload and/or time schedule is underestimated. Periodic consortium meetings will monitor the progress of milestones and deliverables to ensure that all tasks are delivered on time. In the case of a heavy workload, the timing of certain milestones may be shifted to allow for their appropriate completion. - Failure to agree on a general framework for case study selection, for best practice, for guidelines in terms of methodologies and tools etc ..Involved

WGs will in parallel and jointly work to reach a consensus offering enough flexibility with more than one option to accommodate different needs. The multidisciplinary coordination panels for the WGs together with the MC will in any case reach a consensus.- *Failure for successful information or data exchange.* From the earliest stages of the project communication between all relevant experts will be set up in order to jointly design a data exchange protocol.

4.1.4. GANTT DIAGRAM

Quarter:		Year 1				Year 2				Year 3				Year 4			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
M	KO	SM	WG	MC SM		WG		MCM	WG			MCWGSM			WG	MCF	
WG1: Hazards and socio-economic impacts in weather and climate scales																	
T1.1				D1.1		M1.1											
T1.2						M1.2			D1.2								
T1.3														D1.3			
T1.4																D1.4	
WG2: Climate adaptation decision and support tools																	
T2.1		M2.1			D2.1												
T2.2							D2.2										
T2.3			M2.2								D2.3						
T2.4															D2.4		
				D2.5				D2.5				D2.5				D2.5	
WG3: Stakeholder and citizens' engagement for inclusive climate adaptation																	
T3.1			M3.1			D3.1											
T3.2				M3.2			D3.2										
T3.3										D3.3		M3.3					
T3.4																	
				D3.4				D3.4				D3.4				D3.4	
WG4: Capacity building and Dissemination																	
T4.1		D4.3 M4.1		D4.1				D4.1				D4.1				D4.1	
T4.2					D4.2										M4.2		
T4.3								M4.3		M4.4							

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