D2.1
Demo Implementation Roadmap

MOUNT RESILIENCE

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1. Introduction

The Deliverable 2.1 Demo implementation roadmap is one of the 55 deliverables that will be produced throughout the MountResilience project's lifetime. The six regional demonstrators, the targeted partners group, will be empowered by an innovative and collaborative workspace, designed to tackle both climate and social challenges using a quadruple-helix approach. This workspace fosters strong collaboration between academia, industry, government, and community, ensuring that all key stakeholders contribute to the development and especially the improvement of climate-resilient solutions. By integrating innovation, technology, and community engagement, this workspace aims to enhance the climate resilience of each region, promoting cooperation, trust, and shared knowledge among partners. Finally, an implementation roadmap (D2.1) will be created based on the solutions identified in T1.3. It will detail the suggested pilot implementation stages, timelines, required resources, regional management frameworks, partner responsibilities, and data collection guidelines for impact assessment (T1.5). This phase will also identify common elements across demonstrators, such as reusable templates and technologies.

In order to better understand the process that will lead to the implementation roadmap production of this deliverable, it is essential to begin with the **project's context and the partners involved** in this specific phase of the roadmap creation.

The overall project in brief:

As stated in the official project documents (Grant Agreement and Consortium Agreement), **MountResilience** is a project funded by the **Horizon Europe Program**. Over the course of 54 months, it brings together a diverse partnership of more than 45 organizations from various sectors, including governance bodies, research institutes, universities, irrigation consortia, and tourism boards, among others. A key feature of this project is its implementation in a wide-ranging context, where each area involved has its own distinct characteristics, yet all share **one universal trait**: they are **mountainous regions/communities**. This choice highlights the significance of **mountain areas** and acknowledges their **crucial role for the countries involved, as well as for all the communities within them**. **Mountains play a vital role** in our lives, supplying essential resources to a large part of the global population, including those far from mountainous areas (Drexler et al. 2016). They provide 60-80% of the world's freshwater, often called the "world's water towers," regulating water flow and supplying nutrients to lowland crops. Mountains also host rich biodiversity, with nearly two-thirds of continental plant species found there and are key sources of forest and agricultural products like wood, livestock pastures, dairy, fruits, and medicinal plants. Moreover, as popular tourist destinations, mountains attract millions annually for activities such as health, sports, gastronomy, and cultural tourism: therefor sustainable tourism is a vital income source for mountain communities, helping preserve local traditions and food systems (EC, 2021). Mountains face significant challenges from Climate Change (CC), but unlike other areas, they are **particularly vulnerable**. As Manfred Kauffmann of the Swiss Agency for Development and Cooperation highlights, "Global warming is more pronounced in mountain areas than in lowlands". Since the industrial revolution, temperatures in the Alps and Himalayas have risen at double the global average. Mountain water supplies rely heavily on glaciers and snowmelt, and with many glaciers predicted to disappear by the century's end, these vital water sources may vanish. Some of the most visible signs of CC, such as rapid glacier melting, species extinction, extreme weather events, shifting rainfall, floods, and heatwaves, are already affecting mountains. These changes impact key community systems—agriculture, biodiversity, energy, tourism, and water resources—making mountain regions particularly vulnerable (IPCC, 2018). The effects also extend to lower regions, affecting water supply, agriculture, tourism, and health. Mountains' complex terrain creates diverse climates over short distances, increasing the impact of CC. Given the global dependence on mountain resources, urgent climate adaptation measures are needed. Innovative solutions must help communities adjust to the irreversible effects of CC while harnessing new opportunities. Despite differences across European mountain regions, they share common challenges, such as

climate risks, depopulation, poor connectivity, and limited access to services, all exacerbated by COVID-19. Systemic climate adaptation solutions are necessary, adaptable to each region's specific needs. However, recent World Bank data reveals that research on adaptation has stagnated, leaving many EU mountain areas in need of innovative solutions. Mountains face significant adaptation deficits (McDowell et al., 2021) due to several gaps, including limited climate change adaptation (CCA) options, low uptake of existing solutions, and a lack of coherence in response strategies. **MountResilience aims to address these issues by strengthening the adaptation capacity of European mountain regions and closing the adaptation gap.**

MR partners involved in D2.1:

The project brings together partners across **Europe** to drive climate-resilient transformation in **10 key mountain regions across 9 countries**. Six regions**—Tirol (Austria), Gabrovo (Bulgaria), Râu Sadului (Romania), Valais (Switzerland), Lapland (Finland), and Piemonte (Italy)—**will serve as "**regional demonstrators**", also called **pilots or Pilot Areas**, where transformative CCA solutions will be tested. These solutions will include both technological and social innovations, with a focus on nature-based solutions (NbS). They will address policy, governance, societal needs, and financing targets, tackling climate challenges typical of the Alpine biogeographical region (EEA, 2012). The demo regions will rely on regional quadruple-helix partnerships and collaborative decision-making processes to engage stakeholders and local communities. The remaining four regions—**Catalonia (Spain), Primorje-Gorski Kotar (Croatia), Friuli Venezia Giulia (Italy), and Subcarpathian (Poland)**— the **Regional Replicators**, will act as "replicator" regions, focusing on increasing their adaptive capacity by applying lessons learned from the demo regions. In addition to solution development, knowledge exchange, and cross-fertilization between regions, the project will also ensure sustainability by promoting CCA scale-up and access to funding through public, private, and PPP instruments at both EU and global levels.

Figure 1. Project regions (UMIL, 2024)

The six Regional Demonstrators, or pilots, are the key players involved in achieving the objectives of this deliverable, alongside the stakeholders associated with each of them. Depending on the project objectives of each Regional Demonstrator within MR, that will be discussed in detail in the following sections of the text, the setup and deployment of the regional pilots will be carefully coordinated with the regional demo's leaders, following a standardized and shared methodology. Carefully considering the specificities of each pilot, in terms of context, challenges, resources, and objectives, this unified approach will ensure consistency across all regions while allowing for flexibility to address specific local needs. **The implementation roadmap** (D2.1 Demo Implementation Roadmap), main outcome of the deliverable, **will provide a detailed plan, including the necessary steps, timelines, required resources, and the allocation of responsibilities among partners.** The roadmap will also feature instructions for data collection, which will be essential for evaluating the impact of the pilots (T1.5 Methodology for the Impact Assessment of the regional demonstrators). Additionally, the process will identify common aspects across the different demonstrators, such as templates, technologies, and best practices that can be shared and reused. This ensures a streamlined approach, maximizing efficiency and fostering innovation that can be scaled or adapted to other regions.

D2.1 starting point:

It is essential to highlight some basic background concepts and deliverables strictly linked to the present Deliverable 2.1. To achieves the final aim the MR project uses a **Conceptual Framework** based on **Nature-Based Solutions (NbS)** developed in **D1.1 "MountResilience Conceptual Model for Climate Resilient Transformation"** to guide the development of transformative climate adaptation initiatives. D1.1 report is composed by four key elements:

1. ***Socio-Technical-Ecological Systems (STES)****:* this approach views regions as complex systems where social, technical, and ecological elements are interconnected. Any innovation introduced affects these dimensions through feedback loops. The STES concept helps to analyze regional systems and integrate project innovations within these dimensions.

2. ***Three Spheres of Transformation****:* this theory focuses on achieving transformative outcomes through localized actions and innovations. It emphasizes the need for a project to engage the following three areas:
    a. **Practical sphere** (specific interventions),
    b. **Political sphere** (regulatory and institutional support),
    c. **Personal sphere** (values and beliefs).

    True transformation requires changes across all three spheres.

3. **Transformative Adaptation**: this refers to **systemic regional changes** that address the root causes of climate vulnerability while ensuring system resilience, reducing climate risks, and promoting social equity.

4. **Nature-Based Solutions (NbS)**: The project's activities focus on NbS, which involve managing and restoring ecosystems to address societal challenges, benefiting both human well-being and biodiversity. A key for the NbS success is the correct stakeholder engagement, needed to implement correctly these solutions.

Furthermore, the project's primary goal is to enhance **adaptive capacity**, leveraging local competences, skills, and assets to tackle climate change issues. **Ecosystem services**, such as food, water, and recreation, are central to the well-being of both people and the environment. A **monitoring framework** will be developed to track progress, drawing from the STES concept to ensure alignment with the project's social, ecological, and technological objectives. Starting from **D1.1 Conceptual model for climate resilient transformation** work whose four main elements have just been presented, **Task 1.2** – "**Regional diagnosis and baseline for climate adaptation" focuses on assessing the current state of climate change adaptation (CCA) in each demo and replicator region,** ensuring that solutions are well-integrated into regional structures and processes while leveraging existing capacities and networks. Based on this close collaboration, therefore **D1.2 "Regional diagnosis and baseline for climate adaptation"** aimed to create a **comprehensive understanding of adaptation needs, opportunities, and solutions** with some key points:

1. **Information collection framework:**

- Region-specific climate challenges.

- Existing CCA strategies, projects, and policies.

- Key regional actors involved in CCA.

- Gaps in knowledge, tools, and methodologies for transformational *adaptation*.

2. Regional diagnosis reports and factsheets: these documents summarized the status of CCA efforts, transformative capabilities, and barriers to achieving adaptation goals in each region.

3. Methodology: the task involved desk research, document analysis, interviews with key actors, and regional validation workshops to gather insights.

4. Integration with other tasks: the results fed into **T1.3 – "Climate resilient transformation strategies for project regions"**, and feed regional demonstrators of Work Package (WP) 2 Regional Demonstrators, Regional Replicators of **Task 3.2 – "Replication Lab for transferring knowledge and solutions to replicator regions"** in WP3, and the exploitation plan of **Task 5.2 – "Support to the scale-up process"** of WP5, and will be published in **D1.2. – "Regional diagnosis and baseline for climate adaptation".** They will also provide the baseline for the impact assessment in **T1.5 – "Methodology for the Impact Assessment of the regional demonstrators".**

Finally, the **D1.3 – "Climate resilient transformation strategies for project regions"** report outlines the **regional transformation strategies** needed for climate-resilient action. The process began by defining the boundaries of regional challenges, using insights from **D1.1 – "Conceptual model for climate resilient transformation"** and **D2.2 – "Capacity-building for regions for increased climate resilience",** and involving stakeholders through a co-creation approach. This included expert input and a validation process with Local Councils better explained next (**Task 2.1 – "Implementation Roadmap"**). Using frameworks like STES and SRA, stakeholders identified adaptation pathways. A bibliographic search on Nature-Based Solutions (NbS) and related adaptation strategies led to the creation of a catalogue of options and factsheets. These resources provide a foundation for the **implementation roadmap (D2.1)** and future decision-making (**D2.2 – "Capacity-building for regions for increased climate resilience"**). All information will be made available in an open-source tool on the project site, allowing regions to implement strategies and assess their own climate adaptation actions (**D2.3 – "Testing and demonstrating transformative solutions on climate resilience in Lapland" and D2.8 – "New global interaction & co-creation system for faster adaptation to climate change in Valais").**

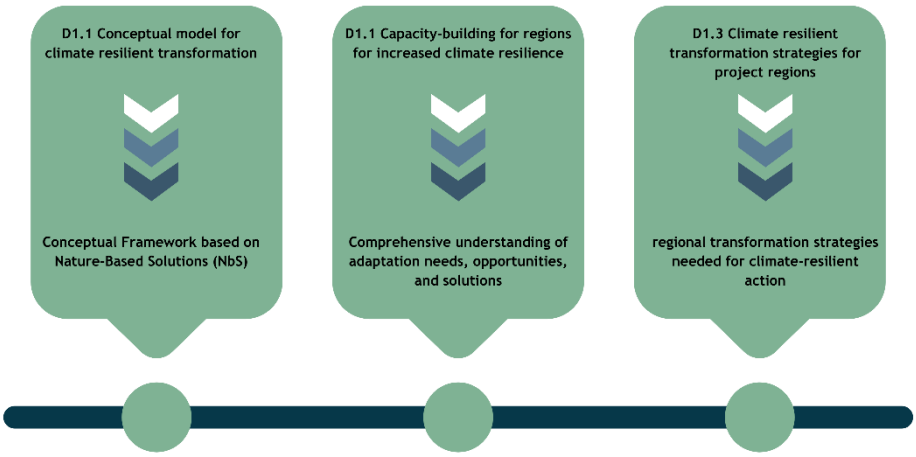

Figure 2. D2.1 starting point snapshot (UMIL, 2024)