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Mid-mountain adaptation to climate change

Management Strategies for Southern European Mid-Mountain Landscapes to enhance climate resilience

Implementing and testing landscape management measures in Spain's marginal mid-mountain areas to address today's climate change-related challenges and improve their socio-economic development.

Key Learnings

- **Large-scale implementation**: A more heterogeneous landscape with a mix of crops, forests and grazing areas increases ecosystem resilience. Enabling better climate change adaptation of communities in Mediterranean mountain areas.
- **Ecological benefits**: Adequate land management such as pasture recovery and appropriate livestock management, results in key ecological benefits. It improves soil quality, increases water runoff, controls soil erosion, supports biodiversity, and provides a buffer against extreme weather.
- **Stakeholder engagement**: This is key to achieving good governance, meaning more inclusive decision-making, better transparency and improved accountability in landscape management, as well as assuring more successful implementation.

About the region

The Mediterranean regions La Rioja, Aragon and Catalonia, encompass various bioclimatic conditions, ranging from the sub-humid Mediterranean of the Pyrenees to the Mediterranean mid-mountains of the Iberian System. The adaptation measures in the three pilot areas address a diversity of environmental and socio-economic characteristics.

Climate Hazards

Droughts, Extreme Temperatures, Flooding, Water Scarcity

Sector

Agriculture, Forestry

Key system

Ecosystems and Nature Based Solutions
Land use and Food Systems
Local Economic System

Climate Threats

The Mediterranean Mountain areas are highly sensitive to climate change. Reduced water availability, longer and more severe droughts, as well as more forest fires, are threatening Mediterranean mountain communities. In recent decades, rural abandonment and declining economic activities have led to the loss of the region’s characteristic landscape mosaic, causing previously diverse mountain slopes to become more uniform. This change has reduced essential ecosystem services, such as water supply to lower basin areas and soil carbon storage, threatening local agriculture and forestry's sustainability and economic viability.

Agro-silvo-pastoral landscape mosaics as a key to climate change adaptation

It is important to promote the recovery of diversified landscapes to tackle climate impacts and reduce their socio-economic consequences. Agro-silvo-pastoral landscape mosaics integrate agricultural, forestry and livestock activities, enabling multiple economic activities in small spatial units. The diversified landscapes contribute to climate resilience by reducing soil erosion and increasing water retention. Additionally, the combination of grazing, crops and trees supports biodiversity. In order to promote those activities at a large scale, one must evaluate their ecological and socio-economic impact. Recovering pastures by clearing shrubland and practising extensive livestock grazing serve as an initial step in improving landscape mosaics and reducing forest fire risk.

Regenerative livestock management is a farming approach that uses grazing techniques to restore soil health, improve biodiversity, and enhance ecosystem resilience, ultimately making land more resilient and productive over time. Monitoring and control plots enable the effective evaluation of the measures.

Figure 1: Experimental plots for scrubland clearing and regenerative livestock management in Ajamil de Cameros, La Rioja, Spain. Image Credit: LIFE MIDMACC project.

The monitoring results show that:

- At **landscape level**: Smaller patches improve landscape heterogeneity, increasing land use diversity and biodiversity. This also improves landscape aesthetics, making the landscape more attractive for touristic use. An increasing number of grazing areas also leads to increasing livestock. Moreover, clearing activities reduce forest fires and burnt-down areas.
- At **plot level**: Combining shrubland clearing with extensive livestock farming positively affects soil quality, increasing soil nitrogen and carbon stored in organic matter. It also creates diverse and productive meadows with a high nutritional content. Plant cover and livestock grazing frequency, influencing grazing pressure leads to considerable variability in soil moisture. High livestock grazing frequency increases water runoff without a clear increase in soil erosion. Grazed areas have a greater coverage of herbaceous plants and legumes but fewer grasses, making it difficult to determine the ideal grazing frequency to ensure the highest plant diversity.

> *"The recovery of pastures through scrubland clearing together with regenerative livestock management has a direct positive impact on soil quality and pasture diversity and quality, without implying higher erosion rates."*
>
> *Eduard Pla, CREAF and LIFE MIDMACC project coordinator.*

Engaging local and regional stakeholders

A robust participatory approach involving identifying and actively engaging all relevant local community stakeholders was central to integrating diverse perspectives into the adaptive management process. This approach is vital for achieving good governance, fostering inclusive decision-making, enhancing

transparency, and improving accountability in landscape management. By incorporating stakeholder views, the process also ensured more effective and sustainable implementation of initiatives.

Four participatory bodies were created, including three regional committees and the supra-regional working group, involving 202 stakeholders based on an actor map. The stakeholders represented the different territories, socio-economic sectors, affiliations, scopes of action and genders:

- **Regional committees**: The creation of the three regional actor committees with one per region was significant in successfully implementing climate change adaptation measures. It made it possible to involve key representatives of the agriculture, livestock farming and forestry sectors, local and regional administrations, research, environmental associations and civil society. During fifteen meetings, the committees designed, developed and evaluated various priority adaptation measures. The meetings also enabled maintaining a continuous and up-to-date information channel and dialogue on the progress of the activities.

- **Supra-Regional Working Group**: The main objective of this working group was to involve the governments of La Rioja, Aragon and Catalonia and to jointly elaborate a coordinated policy framework. The LIFE MIDMACC project team selected those regions because they are neighbouring regions and due to common challenges and threats. Representatives from each regional committee ensured the inclusion of key sectors like vineyards, forests, and livestock, as well as public administration, research, and industry. During four meetings with 37 participants, they prioritised the 16 most important barriers the regional committees had identified and proposed 37 solutions. The group also prioritised the adaptation measures the regional committees had identified to improve adaptation actions in public policies.

Figure 2: Meetings of the Regional Committee and the Supra-Regional Working Group. Image Credit: LIFE MIDMACC project.

Recommendations for adaptive management of Mediterranean mid-mountain areas

The results of the five-year project enable the following main recommendations to achieve successful climate change adaptation through adaptive management:

Pasture recovery

- **Secure annual funding** through public policies for targeted scrub clearing, as this practice delivers proven environmental, landscape, and socio-economic benefits, making it highly cost-effective in selected areas.
- Pasture appropriate **livestock densities** that align with each area's grazing capacity and adapt them annually or biennially to suit current climatic conditions.
- Adopt **regenerative grazing practices**, such as rotational or holistic management, which use high livestock densities for short periods followed by extended recovery periods. This approach supports productivity, enhances soil quality, and promotes animal welfare.
- Graze **different livestock species**.
- Distribute cleared areas strategically across managed spaces to **expand grazing routes**, enabling livestock to access diverse pastoral resources throughout the territory. Incentives for fencing, salt stations, and water troughs, to help guide grazing paths effectively should support this activity.

Extensive livestock farming

- Provide training for shepherds in regenerative and silvo-pastoral livestock farming techniques to support sustainable and effective land management.
- Enhance farm profitability by increasing product value, particularly for meat, through strategies such as promoting direct-to-consumer sales, offering tax benefits for livestock farmers, establishing a quality brand for regenerative extensive livestock, and implementing mobile slaughterhouses.
- Maintain and enhance essential public subsidies to support livestock farmers' incomes. Recommendations for increasing aid include:
    - Establish legal mechanisms, ensuring that the value generated by the ecosystem of the mountains, such as water, hydroelectricity, carbon sequestration, biodiversity, and recreational opportunities, benefits the local population.
    - Adapt the Coefficient of Pasture Eligibility to include forest grazing within the Common Agricultural Policy.
    - Incorporate all environmental, landscape and climate change-related benefits into subsidies from the Common Agricultural Policy.
- Support livestock farmers by facilitating digital grazing with GPS monitoring of livestock movements, improving network coverage, and upgrading pathways.

Summary

The mountain areas of southern Europe are highly sensitive to climate change impacts, such as droughts and forest fires. During recent decades rural abandonment and the reduction of socio-economic activity have also caused the progressive loss of the characteristic landscape mosaic and led to a unification of the mountain slopes. These processes have reduced the Ecosystem Services the mountain areas provide, which is why it is important to promote the recovery of the agro-silvo-pastoral mosaic. This landscape management type contributes to reversing land abandonment and adapting the Mediterranean mid-mountain areas to climate change. Stakeholder involvement allowed prioritising tailormade adaptation actions and including them in public policies.

Further information

The work presented in this adaptation story is part of the LIFE MIDMACC project.

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- Layman's report: https://life-midmacc.eu/wp-content/uploads/2024/07/LaymanReport_MIDMACC_EN_v3.pdf
- Adaptation measures for climate change in Mediterranean mid-mountains: a practical guide https://life-midmacc.eu/wp-content/uploads/2024/07/MIDMACC_2024_ENG_red.pdf
- Handbook of Lessons learned and replication protocols https://life-midmacc.eu/wp-content/uploads/2024/07/DL24_Lessons-learned-manual_v3.pdf
- Report with the final monitoring results of the pasture recovery (action C1) https://life-midmacc.eu/wp-content/uploads/2024/06/DL30_FinalMonitoringC1_v2.pdf
- Report with the final monitoring results of the adaptive forest management (action C2) https://life-midmacc.eu/wp-content/uploads/2024/06/DL31_FinalMonitoringC2_v3.pdf
- Report with the final monitoring results of the vineyards pilots (action C3) https://life-midmacc.eu/wp-content/uploads/2024/06/DL32_FinalReportC3.pdf
- Joint position paper "A step forward common policies for Southern European Mountain's pastoral systems". This position paper was created to ensure that the project outputs and recommendations impact the design of new European environmental policies, in collaboration with other several LIFE projects.

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