

**COMPRENDRE**



# CLIMATE CHANGE IN MOUNTAIN AREAS:

## MEETING THE CHALLENGE OF ADAPTING WATER MANAGEMENT AND TOURISM

Diverse perspectives on practices and policies in Europe



**Summary**

This publication presents the main findings of the study "Diverse perspectives on member states' policies in response to climate change in mountain areas".

The study was sponsored by the ANCT and funded by France's National Rural Network. It was conducted in 2023 by a group comprising Eurêka21, Euromontana and ADT Consult. The study was coordinated by Patricia Andriot (ANCT), Marie Laurent (ANCT) and Marie-Luce Ghib (ANCT).

This study was co-funded by the European agricultural fund for rural development (EAFRD). The European Commission's support in the production of this publication by no means constitutes approval of its content, which reflects the authors' viewpoints only. The Commission shall not be held responsible for any use made of the information contained in this publication.

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**Date of legal deposit:** January 2024    **ISBN:** 978-2-492484-62-9

The European Structural Funds are important for regional cohesion in France. The National Agency for Territorial Cohesion coordinates ERDF<sup>1</sup> and ESF<sup>2</sup> funding, and also works with the EAFRD<sup>3</sup> as co-director of the National Rural Network alongside the Ministry of Agriculture and Food Sovereignty and the Regions of France. In addition, since 2017, the French government has developed a proactive policy for rural areas with a rural agenda, followed by a new programme launched in 2023: Rural France.

Understanding how these funds interact and the roles that they play, particularly that of the EAFRD, in national rural development issues, and observing other countries' practices in policies for rural and mountainous areas are therefore, naturally, some of our primary concerns.

With the help of the National Rural Network, the agency has therefore decided to conduct research in order to:

- assess and demonstrate how European funds contribute to rural and mountainous areas. In particular, we seek to highlight the EAFRD's support of measures that contribute to advancing the Rural Agenda,
- identify how French and European public policies address issues relating to development in rural and mountainous areas.

The results of these studies are published in three reports<sup>4</sup> and confirm the structuring, and in some cases determining, nature of European funds in France, as well as in the other countries studied, in terms of rural development.

Beyond the different histories and trajectories of each of the countries studied, this research highlights common issues: a widely observed feeling that rural areas have been neglected, public policies that are being developed to support rural and mountainous areas as they face climate change, a shared resurgence of initiatives that begin in these regions, as well as the role of engineering.

These 3 reports on how the EAFRD is used to facilitate rural development and what kind of support is provided for adapting to climate change in the countries studied all highlight the key role of engineering in meeting these new challenges. These studies confirm how important the agency, its programmes and adaptive engineering are, as well as the role of engineering in better use of European funds.

Stanislas Bourron  
Director general of  
the national agency for territorial cohesion

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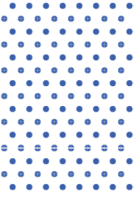
<sup>1</sup> European Regional Development Fund

<sup>2</sup> European Social Fund

<sup>3</sup> European Agricultural Fund for Rural Development

<sup>4</sup>This report, *Climate Change in Mountain Areas: Meeting the Challenge of Adapting Water Management and Tourism*, as well as *Rural Areas and Rural Policy in Europe (Comparative Approach to Five Countries)* and *A Study of Comparative Views of European Funds and the French Rural Agenda*.

(available on the ANCT website <https://agence-cohesion-territoires.gouv.fr/ressources-16>)



# MOUNTAINS: SENTINELS OF THE CLIMATE AND TERRITORIES THAT ARE MORE AFFECTED BY THE EFFECTS OF CLIMATE CHANGE

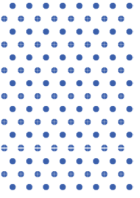
The Intergovernmental Panel on Climate Change estimates a rise in global temperature of between 1.5 and 2°C by the end of the 21<sup>st</sup> century compared to pre-industrial levels. Mountain zones are among the first to be affected by climate change. The scale and speed of climate change therefore calls for an acceleration of adaptive measures in order to limit environmental, social and economic impacts.

This report analyses the specific challenges relating to climate change in mountain areas, comparing adaptation responses in the fields of tourism and water resource management in five European countries. The report examines the cases of Italy, Spain, Slovenia, Austria and Romania in comparison with that of France. Its conclusions are based on documentary analysis; on interviews carried out among a range of players, such as academics and public officials, in each country studied; and on the contributions of those who attended a seminar for players involved in European mountain environments.<sup>5</sup>

| Austria  | Spain  | France   |
|--|--|--|
| <ul style="list-style-type: none"> <li>- Mountains cover more than 60% of Austria</li> <li>- Temperature increase of 1.8°C since 1950</li> </ul>   | <ul style="list-style-type: none"> <li>- High mountain ranges cover almost half of Spain</li> <li>- Regular temperature increase in the Pyrenees over the last thirty years</li> </ul> | <ul style="list-style-type: none"> <li>- Mountains cover 25% of metropolitan France</li> <li>- Temperature increase of between 1.8 and 2.1°C since 1950</li> </ul>         |
| Italy  | Romania  | Slovenia   |
| <ul style="list-style-type: none"> <li>- The Italian Alps cover 17.4% of the country</li> <li>- Average temperature increase of 1.1C° over the last thirty years (2020 – WMO)</li> </ul> | <ul style="list-style-type: none"> <li>- Mountains cover 31% of the country</li> <li>- Average temperature increase of between 0.7 and 1.1C°</li> </ul>                                | <ul style="list-style-type: none"> <li>- The Slovenian Alps cover 34% of the country</li> <li>- Average temperature increase of 1.7°C over the last fifty years</li> </ul> |

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<sup>5</sup> Seminar held in Brussels on 12 September 2023 as part of this research



# MOVING TOWARD A SHIFT IN THE TOURISM MODEL

- Growing awareness around the carbon footprint of mountain tourism, as well as a desire to reduce it
- Support for tourism professionals to adopt more ecological practices
- A more timid tourism adaptation strategy:
  - diversification and promotion of “two- and four-season tourism”, which must be balanced to ensure the protection of ecosystems and control visitor flows
  - progressive phase-out of skiing for some resorts, which is difficult to assimilate and anticipate due to economic and social reasons

## AN EMERGING PROCESS TO DECARBONISE TOURISM

All the countries studied and the territories therein are committed to transforming their tourism policy, with their priority often being decarbonisation objectives. Particular emphasis is placed on mobility issues (accessibility of mountain areas and outdoor activity sites etc.) and the use of more resource-efficient infrastructure. This aim also involves encouraging and supporting professionals in their sectors, including hospitality, catering, creation of new destinations etc. In this regard, several countries have introduced labels or certifications as part of a continuous improvement process for the practices of those in the tourism sector. Slovenia, for example, has introduced a green scheme for its tourism sector entitled “Slovenian Green”, which aims to offer tourism professionals tools to assess and improve their actions toward the environment.

## A BALANCING ACT BETWEEN NATURE CONSERVATION AND THE DEVELOPMENT OF FOUR-SEASON TOURISM

Climate change and rising temperatures directly affect winter and summer tourism. Mountain areas have the appeal of being cooler places to spend the summer, which in turn results in lower visitors on average to ski resorts and a shorter ski season. One of the main priorities shown among the countries studied is the diversification of tourism, and the development of four-season tourism or “mountain resorts” as opposed to ski resorts. While the development of four-season tourism offers opportunities to mountain territories, it also brings with it certain negative externalities, including the development of outdoor activities in protected spaces or areas that were previously untouched for six months of the year, and massive traffic flows to natural zones.

### *Creating itineraries around mountain foothills for better distribution of tourist flows with the “EMbleMatiC” project*

With the involvement of nine Mediterranean mountains (Canigó and Sainte-Victoire in France, Olympus and Ida in Greece, Pedraforca and Serra de Tramuntana in Spain, Etna and Gran Sasso in Italy, and Cika in Albania), the INTERREG MED “EMbleMatiC” project aims to rebalance tourist flows by directing visitors from popular coastal zones and peaks toward the foothills of these mountains, to boost local economies by involving local residents and players, and to extend seasonality. This cooperative project has helped co-build a new tourism offer in mountain foothills by creating nine eco-itineraries based on the iconic features of each territory and on ecological transition criteria (such as mobility, short circuits etc.).



**Italy - Piani di Artavaggio: a new approach to winter tourism that generates jobs and activities throughout the year**

In this part of the valley of Valsassina, mountain tourism has changed radically over the last two decades. In 2007, the municipality of Moggio acquired ownership of ski lifts that had been abandoned in the 2000s due to lack of snowfall. The town reactivated the cable car service, but also dismantled the ski lifts at higher altitudes. This type of operation was unusual at the time. The area has since seen an influx of cross-country skiers, snowshoers and hikers. Then in the summer, Mountain bikers, e-bike users and hikers find the environment to be better protected. Today, there are some thirty people working at the site's five refuges, as well as four cable car operators, four seasonal workers for the carpet lifts in winter, and three ski instructors.

## IS A GREEN TRANSITION IN SKIING POSSIBLE WITHOUT A CHANGE OF MODEL?

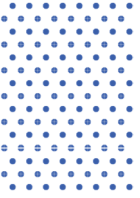
| Austria   | Spain  | France   |
|---|--|--|
| - 70% of slopes in Austria depend on artificial snow <sup>6</sup> | - 50% of slopes in Spain are covered with artificial snow <sup>7</sup>           | - 39% of slopes in France are covered with artificial snow (Union of French Ski Areas, 2022) |
| Italy   | Romania  | Slovenia   |
| - 90% of slopes in Italy depend on artificial snow <sup>8</sup>   | - 70% of ski slopes are equipped with artificial snowmaking systems <sup>3</sup> | - 40% of slopes in Slovenia depend on artificial snow (2021 - Statista)                      |

If they did not rely on snowmaking and if there were a temperature increase of 2°C, 53% of the 2,234 ski resorts in Europe would be exposed to serious risks to their operation. This figure would rise to 98% if the temperature were to increase by 4°C.<sup>9</sup> These changes are taking place within the context of a ski market dominated by European countries, which currently host almost 60% of skiers worldwide each year<sup>35</sup>. Resorts located in high mountain areas are opting for this model due to the prospect of maintaining precipitation at high altitude. At medium altitude (up to 1,500 m), there is a desire to maintain certain Alpine skiing facilities for as long as is feasible with the technical methods available (e.g. infrastructure, snowmaking, and reliance on snow farming<sup>10</sup>). However, snow production has repercussions on landscapes and requires the use of polluting, energy-consuming mechanical methods. Artificial snowmaking, for its part, leads to a rise in electricity consumption. It is estimated that this consumption would increase by 18% in the case of a

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<sup>6</sup> Article, "Winter tourism in the climate crisis", CIPRA, 2023  
<sup>7</sup> International Report on Snow & Mountain Tourism, Laurent Vanat, 2020  
<sup>8</sup> Nevediversa 2023: Winter tourism in the era of climate crisis, 2023  
<sup>9</sup> Study, "Climate change exacerbates snow-water-energy challenges for European ski tourism", Nature Climate Change, 2023  
<sup>10</sup> Snow farming (or "snow banking") is a technique whereby snow is piled up during the winter close to the slopes and then covered with sawdust or wood shavings, to an average height of around 50 cm, until the start of the next season.





temperature rise of 2°C, and 24% in the case of a rise of 4°C<sup>11</sup>. Snowmaking is also more water-intensive and leads to conflicts over water<sup>12</sup> use in certain mountain regions.

Maintaining skiing activity therefore entails significant investments in terms of cost, energy and water, the results of which will last only for a limited time period regardless of whether the temperature rises by 2 or 4°C.

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<sup>11</sup> Article, "Climate change exacerbates snow-water-energy challenges for European ski tourism", *Nature Climate Change*, 2023

<sup>12</sup> According to a report by the International Commission for the Protection of the Alps (CIPRA), almost 1,000 litres of water are required to produce around 2.5 cubic metres of artificial snow, or around one million litres of water for one hectare of piste: *Rapport de synthèse, L'enneigement artificiel dans l'arc Alpin*, Felix Hahn, CIPRA-International (2004)



# CHALLENGES FOR MOUNTAIN AREAS IN TERMS OF WATER RESOURCES

- ➔ Increase in water consumption alongside a reduction in the quantity available
- ➔ Repercussions on winter tourism and potential conflicts between different players
- ➔ Varying degree of attention given to water resources in national or regional strategies
- ➔ A need to improve knowledge around water resources (in terms of consumption,

Mountain areas are subject to growing tensions around water resource management, resulting in conflicts over use. The annual demand for water is increasing due to the effects of climate change, all while water resources are diminishing. In mountain areas, studies indicate a decrease in precipitation in summer and an increased risk of drought; steady precipitation in winter, but which falls as rain below 2,000 m; and widespread glacier melt.

## TOURISM, AGRICULTURE AND HYDROELECTRICITY: POTENTIAL CONFLICTS OVER USE

Water and snow are essential resources for winter tourism. Below 2,000 m, the reliance on artificial snow is putting pressure on water resources. Given the development of summer tourism in mountain areas around water sports such as kayaking, rafting and canyoning, these areas may be severely impacted by a reduction in water resources in summer. Mountain areas may also attract more visitor numbers in summer due to the effect of rising temperatures in cities and valleys. The management of these visitor flows and resource availability constitutes an additional challenge that has not yet been thoroughly addressed by territorial strategies. Climate change and water resource availability also significantly impact both mountain and lowland agriculture. 68% of lowland farmland depends on a supply of mountain run-off for its irrigation.<sup>13</sup> Drought periods have already led to a need for arbitration to divide water resources between hydroelectric power stations and downstream agricultural activities. The Mountain Law introduced in **Romania**, for instance, regulates the use of water in the country’s mountain zones, and prohibits its use by hydroelectric power stations unless the water needs of domestic and wild animals have been met.

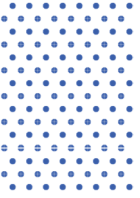
## VARYING DEGREE OF AWARENESS AROUND WATER AVAILABILITY

The issue of water resources is a factor generally taken into account in climate change adaptation strategies, especially through the prism of agriculture and groundwater management. The level of awareness around this factor is more variable in mountain areas. There are contrasting situations between high-altitude areas, which continue to benefit from enough precipitation and snowfall to maintain sporting activities, and mid- or low-altitude areas, which face multiple conflicts over water use and issues relating to infrastructure (hill dams and reservoirs). There are still relatively few

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<sup>13</sup> IPCC report, “Climate Change and Land”, 2020





specific approaches for water management in mid-altitude areas. Those concerned—elected officials, professionals and residents alike—are still largely unaware of the changes currently taking place, while regions lack the precise information and engineering required to implement effective adaptation strategies.

***Characterising the water cycle in the Pyrenees against the backdrop of climate change***

The partners involved the [\*PIRAGUA\*](#)<sup>14</sup> project carried out nine studies and drew up a strategy to assess future water resources (by 2030 and 2050) in the Pyrenees based on climate change projections and future water use, to measure the impact of the Pyrenean region’s main economic activities on water resources, and to explore adaptation strategies.

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<sup>14</sup>*PIRAGUA* was 65% co-financed by the European Regional Development Fund (ERDF) as part of the Interreg V-A Spain-France-Andorra Programme (POCTEFA 2014-2020).



# METHODS FOR IMPLEMENTING ADAPTATION STRATEGIES IN MOUNTAIN AREAS

## LOCAL, MULTI-LEVEL GOVERNANCE DEDICATED TO MOUNTAIN AREAS

Climate change adaptation in mountain zones covers a large number of sectors (water management, regional and urban planning, renewable energy, agriculture and tourism) and involves different ministries (economy, tourism, environment and climate, and agriculture). In decentralised countries, there are also additional sectoral policies from regional and local authorities. Lastly comes cooperation involving mountain areas—particularly the Alpine Convention, the European Union Strategy for the Alpine Region and the Working Community of the Pyrenees—which helps coordinate policies for all aspects of the mountain, find synergies and build shared projects.

## INVOLVEMENT OF ALL STAKEHOLDERS TO FACILITATE THE ADOPTION OF THESE TRANSITIONS

In order to implement successful transitions—rather than imposed ones—in mountain areas, it is essential to inform and involve citizens. There were various mechanisms studied in the five countries that could prove worthwhile in this process, such as the “mountain communities” in **Italy**, the participatory management of national parks in **Romania**, and the involvement of young people in formulating strategies that was tested as part of the Pyrenean Climate Change Strategy.<sup>15</sup>




## VARIETY OF FUNDING SOURCES USED

Mountain areas use a combination of funding sources coming from different regional levels. FEADER, FEDER and Next Generation EU are usually part of the pool of funding available for climate change mitigation and adaptation in mountain regions through investment-based support. Projects financed as part of programmes such as LIFE, Horizon Europe, ERASMUS+ or Interreg are often sources of innovation that encourage cross-border or transnational action, which is especially beneficial to mountain regions. They present an opportunity to test out schemes and solutions. Nonetheless, these experiments too often remain limited, meaning that their scope is uncertain. National programmes round off this pool of funding available for mountain areas, such as in the case in **Austria** with its KLAR! and KEM schemes, and Climate and Energy Fund; or in France with its Avenir Montagnes plan. These programmes offer funding for investment over several years in climate change adaptation, as well as in engineering.

### Notes .....

<sup>15</sup>The *Trans-Pyrenean Youth Forum* was held in El Pueyo de Jaca (Huesca, Aragon) as part of the Pyrenean Youth project (co-funded by the Erasmus+ programme): <https://ctp.org/fr/projets/forum-transpyreneen-de-la-jeunesse/>

# RECOMMENDATIONS

Some of the following recommendations are intended for European institutions , while others are for different EU countries with mountain regions (including France)  or for France specifically. 

## 1/ MOVE TOWARD A MORE RESILIENT TOURISM MODEL

This comparative analysis highlights a need to observe and encourage the support for mountain areas in a more resilient development model:

- Continue developing the cultural tourism offer in areas that are committed to transitioning toward “two- and four-season tourism”
- Anticipate visitor flows to avoid mass tourism to protected spaces in summer
- Anticipate changes in water resources and demand, and work with different stakeholders to prepare strategies focused on a reasonable use of this scarce resource
- Reflect on how to diversify mountain economies beyond the tourism sector in order to reduce dependence on activities with a high environmental impact and/or those most strongly impacted by climate change
- For ski resorts in particular: provide adapted, means-tested support for resorts according to their specific characteristics (altitude, snowfall, economic scope etc.)

## 2/ PROMOTE PUBLIC POLICY THAT IS SPECIFICALLY TARGETED TOWARD MOUNTAIN ZONES

Climate change affects all areas, but mountain zones are feeling its effects at a faster and often more extreme rate. There is a need for policies at the European, national or more local level that consider the specific characteristics of mountain zones. This involves:

- ⇒ Increasing awareness of issues faced by mountain areas in discussions for the future Cohesion Policy in accordance with Article 174 of the TFEU: earmarking funds to be given to mountain zones or Community-Led Local Development for Mountains (DLAL Montagnes) via the objective of bringing “Europe closer to citizens”
- ⇒ Implementing national or regional public policies specifically aimed at mountain areas

## 3/ FACILITATE ACCESS TO KNOWLEDGE AND INCREASE ACCEPTANCE REGARDING THE TRANSITIONS OF MOUNTAIN AREAS

Mountain areas can only carry out successful transitions once all players (decision-makers, economic players, residents, young people, seasonal workers, associations etc.) become committed, convinced stakeholders in this transformation. This involves:

- ⇒ Improving regional knowledge around the impact of climate change on all players (by facilitating access to territorial data, cooperating with the research community etc.)

- ⇒ Raising awareness and providing training to enable a transformation that is desirable to everyone (by enlisting the help of social science experts, setting up training programmes for all players involved in the mountain area etc.)
- ⇒ Developing actions to mobilise and involve all players in advance of implementing local strategies and projects (by introducing “mountain” governance in countries where this does not yet exist, mobilising young people and professionals, changing the culture of dealing with funding bodies, etc.)

## 4/ ENSURE THAT MOUNTAIN AREAS ARE ABLE TO IMPLEMENT TRANSITIONS SUCCESSFULLY

The analysis has shown that the countries studied had defined national and/or regional strategies for climate change adaptation, but there are several conditions involved in implementing these effectively in order to:

- ⇒ Support the development of skills and engineering in mountain areas:
  - Combine forms of local, multi-level governance
  - Favour a regional approach as opposed to opportunistic investments (through calls for projects relating to photovoltaic energy, calls for projects relating to ski lifts etc.)
  - Support the development of engineering in mountain areas over the long term (more than three years)
  - Encourage engineering exchanges between mountain areas (through exchange programmes at the national or European level)
  - Foster cooperation with neighbouring mountain areas
- ⇒ Explore the possibility of broadening the scope of the French Avenir Montagnes network across all topics related to the ecological transition (beyond the realm of tourism)



- ⇒ Combine funding sources: support for Community-Led Local Development for Mountains (DLAL Montagnes), development of financial engineering in mountain areas to diversify funding, and funding for infrastructures and engineering.

## 5/ MEASURE AND MONITOR IN ORDER TO ADJUST ADAPTATION POLICIES AGAINST A CONTEXT OF UNCERTAINTY

- ⇒ Turn previous experiments into successes by capitalising on the network of mountain areas at the level of the areas themselves, as well as at the member state and European level
- ⇒ Set up the right conditions for continuous monitoring and adaptation











# COMPRENDRE

## CLIMATE CHANGE IN THE MOUNTAINS: MEETING THE CHALLENGES OF ADAPTING TO CLIMATE CHANGE IN WATER AND TOURISM MANAGEMENT



In the context of global warming, which is accelerating in mountain areas, and after two years of implementing the programme «Avenir montagnes ingénierie» in France, the National Agency for Territorial Cohesion (ANCT) intended to measure the level of awareness on these topics through a European benchmarking study. To this end, the ANCT commissioned a study from a consortium consisting of Eurêka 21, Euromontana and ADT consult.

In order to identify how French and European public policies are addressing topics relating to the development of mountain areas, and in particular water management and the development of tourism, the study brought together technicians and researchers from five European countries. Eurêka 21, Euromontana and ADT consult also drew on a body of scientific knowledge that enabled them to formulate concrete and substantiated recommendations.



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