EUROPEAN MOUNTAINS

TEST-BEDS FOR EUROPE TO FACE GLOBAL CHANGES

NETWORK FOR EUROPEAN MOUNTAIN RESEARCH

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THE VISION

In a relatively short period at the late 20th century and the early 21st, mountain areas had to ***face many rapid challenges****: people were leaving, internet connectivity was low, high-quality jobs were lacking, and the natural environment was threatened by climate change (glaciers were melting, many species were in danger, etc).*

In response, recurrent warnings about continued demographic decline, land abandonment, future droughts and conflicts for resources triggered a ***paradigmatic change of mountain perspectives*** *and activities.*

Focused high-quality research, innovation programmes, and adapted governance systems at all policy levels allowed these challenges to be effectively addressed. ***"Disruption" was turned into "Creation"****, and essential processes towards long-term economic and cultural revitalization and social progress were initiated.*

Now in 2030, mountain innovation and technology have been adapted and applied, and ***"Smart Mountains" are in dialogue with "Smart Cities"****.*

YEAR 2015, A SUMMIT TO TRANSFORM OUR WORLD

In 2015, the 193 UN Member States adopted the UN 2030 Agenda for Sustainable Development. With this important step they committed to achieving **sustainable development in three dimensions:** economic, social and environmental. The 17 Sustainable Development Goals (SDGs), with their 169 targets, triggered and gauged the process of global sustainable development.

From that time on, the European Union committed itself to devote efforts and investments in Research and Innovation to achieve efficiently and rapidly these goals. **Mountain regions** started to play an important roles in reaching pivotal aspects of these goals, and **become important driving forces for research and innovation**. Actions supporting sustainable development in mountain regions led to enhanced awareness of mutual supportive relationships for the improved wellbeing of both mountain and lowland communities, with an increased flow of materials, people, goods, services, and ideas.

YEAR 2030, ON SOME EUROPEAN MOUNTAINS...

Now in 2030, mountains are finally on the path to be embedded in a **wider social, economic and natural context** that enables place-based challenges to be solved. Mountain specificities and benefits are now recognized and their governance is based on them. Contrary to the many conflicts over resources that were foreseen in the 2010's, resource flows - connecting mountain areas and their surroundings - are now fully balanced.

Mountains have experienced an **environmental progress** that has transcended their borders. Resources (energy, food products, minerals, water) and ecosystem services, the cultural heritage of the mountains and in the mountains (retreat, places for escape, recreation and tourism), are used in sustainable ways and are shared with the lowlands, creating common values and richness. Lowlands and cities offer the markets that mountain businesses need. Previously overlooked mountain ecosystem services, such as biodiversity protection, climate, and water regulation, are incorporated in national accounting systems, and specific policies for mountains have been developed and are implemented. Socio-economic and cultural innovation strategies developed in mountain regions over the last decade have promoted the creation of new and qualified job opportunities. The new approaches have also vitalized and empowered communities and engaged local people in research and policy, by asking them to address their problems, supporting them to define challenges and opportunities, and discuss options in a collaborative manner. Mountains are now places where people wish to live and many are returning.

Mountains are now also **sites for replication and transfer when adopting a circular economy approach for sustainable development**. The network of green valleys based on the green economy concept (few successful examples existed in 2018) now inspire additional regions to become green economy hotspots. These vibrant societies have led to the creation of new integration models that are now used in the lowlands. New in-migrants have contributed positively to face the depopulation experienced in mountain regions during the early 21st century.

These extraordinary changes were made possible **through investments in research and innovation in the three dimensions of the SDGs (economic, social and environmental).** Such investments came at many levels, but most importantly were driven by joint considerations and efforts at the all-European level. Mountains, amongst the first European regions affected by global warming, were also the first test-beds where adaptive policies were carried out. Research and the inclusion of all stakeholders in policy and decision-making were fundamental to achieve the leading role of mountains for Europe and the rest of the world.

THE ROAD

*The members of the **Network for European Mountain Research** (NEMOR) believe that the vision mentioned above, a desired scenario, is achievable and can be reached thanks to the new European Research and Innovation program (FP9).*

*This document suggests the main topics that we believe that should be urgently addressed in the coming years framed in the **three dimensions of the SDGs**: environmental, social and economic.*

*It also proposes the creation of a global partnerships between scientists and stakeholders to trigger projects with a **holistic view of mountain** development and adaptation to global change.*

ENvISAGE, A GLOBAL PARTNERSHIP FOR EUROPE

A first important step is the creation of an **«European Convention on Integrated Sustainable Governance of Mountains (ENvISAGE)»**. Given the increase of research groups and stakeholder partnerships at national and transnational levels that are currently active and/or appearing in Europe, we think that this is a good moment to facilitate such initiative, because it would provide a **shared framework at the European scale**, that would also take into account **each singularity**.

Euromontana, CIMO, RIIM, MRI, NEMOR, OPCC, ISCAR, EURAC, SEEMore, the Norwegian Mountain Research Network, or UNIMONT, are only some of the partnerships that should participate in the creation of ENvISAGE, in collaboration with the European Parliament and the European Commission.

The main aim of ENvISAGE should be to trigger projects with a holistic view of mountain development and adaptation to global change.

Solutions should not only be limited to policies, infrastructures and other means, but should also include a redefinition, communication, and an acceptance of a new vision of mountains, based on specificities, richness and uniqueness. While the natural and social sciences facilitate research on mountain observations and responses to changing socio-ecological conditions, the **inclusion of the human dimension** would help conceive and communicate the 'new' mountain space and the **dependencies and interactions with the lowland space**. Thus, transdisciplinary research will ascertain what limits to adaptation in the mountain space society can 'accept', e.g. in order to facilitate **resilient thinking**. We suggest that **the arts and humanities** are indispensable in helping to share (and reshape) human values.

Globally, research projects must include defining, adapting, and developing governance systems for co-creative, sustainable, resilient, and integrated socio-ecological mountain systems, using **modeling approaches, scenario analyses** and, in some cases, developing applied outcomes with a stricter **problem-oriented approach**; all should address mountain issues while also considering the lowlands and adjacent urban areas.

To be durable and effective, programmes and projects **must involve young people and students,** because the shared work and the exchange of experience and culture can promote and identify common goals.

THE THREE DIMENSIONS OF THE NEW MOUNTAIN RESEARCH

ENVIRONMENTAL DIMENSION

"European R&I can facilitate and enhance an environmental progress in mountains"

The mountain natural environment is among the first in Europe to be impacted by global change. Increases in the temperature and decreases (in many places) of precipitation already have many effects, from changes in water availability and quality, to potential conflicts for resources and territory between the mountain areas and the lowlands. Research and Innovation will find solutions for these conflicts by giving respective weights in favour of "basic needs". The main research lines to be addressed are:

Climate Change

The main abiotic driver in mountain regions, with important effects on many components. Research topics within this line should cover protection and adaptation strategies, risks and vulnerability measurement, and resilience development.

Suggested specific questions to address are:

- Identification, modelling and projected drivers of change and their dynamics in mountain areas.
- Identification of sustainable ecosystem and landscape management needs and strategies for mountain areas, with an emphasis on
  - » strategies to reduce or eliminate conflicts for resources;
  - » increasing the quality of the ecosystem services that mountains provide to the lowlands (forests, water, biodiversity, cultural heritage, tourism, etc); and
  - » combining use and conservation of resources (e.g. mineral resources).

Forests

Europe is experiencing a steady increase of forested land. Fire risk is increasing in some areas or becoming a new threat in others, due to global warming and more frequent and prolonged drought episodes. Fire risk management in mountains is challenging, since the topography and transport infrastructure in mountains require alternative approaches. The increase of forests has consequences, such as the loss of biodiversity linked to the loss of environmental heterogeneity, or the increase of populations of large mammals. But the increase of forests is also an opportunity for energy policies and bioeconomy, providing more raw material, forest products, and other ecosystem services, including storing more carbon. We suggest the following research lines:

- The study of forest dynamics in mountain areas over the last 18,000 years, considering forest dynamics in conjunction with the evolution of the climate and its cycles and with the effects of human pressur.
- Fire ecology in mountain areas, identifying how changes in drivers influence fire regimes; modeling and estimating impacts of changes in fire regimes on the supply of ecosystem services; looking for an optimization of the ecosystem and landscape structure and configuration to minimize fire hazards.

Water

Mountains are commonly defined as water towers. This key role is being influenced by increases in forested area, receding glaciers and multiyear ice mass, warmer temperatures, extreme meteorological and hydrological events concentrated in space and time, an adaptation of hydrological patterns to new climate conditions, contrasting changes of precipitation, and increased water demand. These are only some of the many factors that demand urgent new policies and clear governance structures for water management, to avoid conflicts between uses and users. We suggest the following research lines:

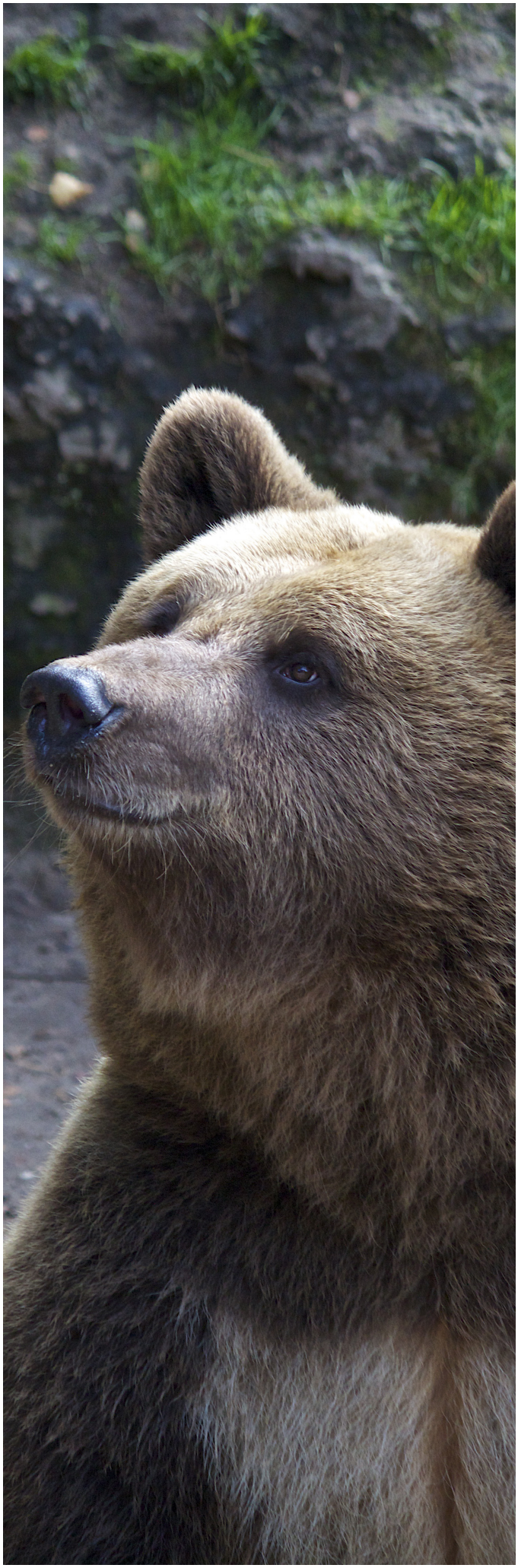
- To study, protect and manage watercourses and tributaries with reference to watercourse ecology and hydrology (including the ability to store and retain water, thus moderating flooding).
- To define a social, economic, and technical strategy to ensure balance between the requirements of mountain and lowland people (the latter are generally more effective in protecting their needs).
- To define a new perspective in approaching the transition in the high mountain area from a typical glacial and periglacial environment into the emerging paraglacial (highly influenced by gravitational processes and running water).

Biodiversity

Biodiversity is threatened in most mountain ranges, full of endemic species, due to the environmental changes that are becoming more extreme and intense than in the lowlands. The increase of large mammals, the increasing presence of exotic species, and also increased demands from society to visit «wild» areas, require new management policies to balance conservation with societal demands.

The following research lines will help develop and apply innovative strategies for biodiversity conservation:

- Research on innovative processes to sustainably exploit biodiversity resources, including those of agronomic and productive interest (landraces).
- Finding a balance between agriculture or forestry and "wild" biodiversity. " How can biodiversity be preserved, including the maintenance of pastoralism?" or "How to develop a coexistence between large carnivores and pastoralism activities? ?" are among the urgent questions to answer.
- Defining sustainable trade-offs between biodiversity conservation and economic development, particularly through embedding conservation in the wider context through mechanisms, such as biosphere reserves and regional parks.



Clean Energy

In 2030, mountains - with the oceans - can be the «stars» of clean energy. Hydroelectric, solar, and wind energy, and wood pellets are all available, but both the technology and the infrastructure to use them efficiently is not well-developed yet.

FP9 can trigger and facilitate the development of efficient clean energy production, distribution and use, also putting in practice a circular economy structure for energy use.

SOCIAL DIMENSION

"Innovation strategies will transform mountains in prosperous regions with more and better jobs and where people will wish to live"

The inclusion of the society is key to future Europe. In agreement with the ENvISAGE vision, all societal stakeholders should take active part and leading roles in specific areas. Understanding and addressing the social changes is a prerequisite for some research, but it must also be a direct objective of research programs:

Health and quality of live

At the European scale, many of the most remote places are in mountain areas, where most services are absent. The Europe of the 21st century cannot accept, for example, that access to medical services is extremely difficult for a society with a growing proportion of elderly people.

Yet, **technological advances** from major advances in paramedics and telemedicine (e.g., diagnostic sensors in clothes) are appearing and offer promising improvements and alternatives to the classical ways that citizens use the health services.

eHealth technologies have the potential to be rapidly accepted and used by mountain people.

The most important consequence will be a notably higher well-being of this society, transforming mountains from remote areas to places where people will wish to live.

Research programs must also analyze mountains as places providing enhanced quality of life and health (including specific advantages of remote places).

Mountains as tourist destinations

Tourism has become a dominant force in mountain areas since the 19th century, and during the late 20th and early 21st centuries in particular, with a huge diversity of activities. Yet global warming and increasing demands from lowland people force the establishment of new models for touristic activities, while keeping the attractiveness of the «wild» parts of the mountains as intact as possible. The challenges are enormous, but an efficient R&I programme can enable a sustainable pathway for both mountain economies and environments:

- Particularly in mountain areas where the tourism model has been based on snow activities, the model has to be redesigned and re-oriented towards a more sustainable tourism, with a more diversified range of activities over four seasons.

  Research will help:
  - » Raise the attractiveness of mountain regions by identifying innovative and sustainable touristic offers, including agritourism, cultural heritage, education opportunities, archaeology and ecology.
  - » Adapting and broadening scientific tourism, e.g. quality of sky (Starlight tourist destinations), ornithology, wildlife viewing tours, or volunteering.
- Rigorous case studies to evaluate how a transition towards a more sustainable tourism can take place and how such transitions can be fostered are also recommended. Mountain areas may be seen as prototypes (of adaptive/resilient areas) for territories "in transition", a transition in which other territories will also have to get involved in the future.

A social model

In the 2020's, young people are typically leaving the mountain areas to go to urban regions where they perceive most offers and opportunities. But mountains need the people. Mountain regions can provide most services, but the social model that currently dominates in Europe must be revised. Mountains have to potential to become test beds for innovative social models, more cooperative, transversal, horizontal, and circular. This is only possible with significant investment at the European level, with specific programmes, such as:

- Research projects with communities on mountains. Engage local people in research and decision making: ask them to describe the problems, support them to define research questions, work on the collection of data, experiments and writing results together - a combination of citizen science with science communication and dissemination projects.

  Communities in mountains can serve as a test-bed. It is probably easier to gather locals in a "town hall" and to establish an incubator there, than in a city. Communicate how the research is done and how the community can benefit from it to solve problems, improve quality of life.
- Research on how to avoid losing mountain populations by **increasing current levels of low-capital-intensive food production and increasing housing capacity** is also fundamental. Mountain regions and their communities should maintain societal structures that create high resilience: loosely coupled and low complexity societies, allowing for high levels of cross-sectorisation, cross disciplinarity and business diversification. Research to make this possible is also key. Particularly in mountain areas where the tourism model has been based on snow activities, the model has to be redesigned and re-oriented towards a more sustainable tourism, with a more diversified range of activities over four seasons.

ECONOMIC DIMENSION

"A better connection within mountain and lowland communities will allow creating a network of green valleys based on the green economy"

An increased awareness in both mountain and lowland communities of their interdependence, with **projects based on the circular economy and a long-term vision of resource use** will lead to **shifts in economic objectives and perspectives** - mostly thanks to research framed in mountain regions - that may be subsequently adapted to the lowlands. Europe can become a world leader of this new economic development model thanks to an investment in R&I in the FP9 program in mountains:

- Agriculture, forestry, & Open source tools. Empower communities to develop or use existing open source tools for agriculture and forestry, i.e. work on open source technologies in these sectors. Develop high-quality products (novel or traditional) to be marketed.
- Define circular economy systems, identifying opportunities for industry and services, from local biodiversity and natural resources.
- Food and Biodiversity: local and quality agri-food products (high ecological value activities utilising pastures and agricultural fields) vs Agroindustry and new tendencies in Mediterranean agriculture (wine and factory farms).
- Communication and services: ICTs and transfer of innovation, promoting specialization and competitiveness in the rural world with the use of ICT and high speed broadband.

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THE CONTRIBUTION OF MOUNTAINS TO GLOBAL SOCIETAL PROBLEMS

The world is experiencing significant social, economic and environmental changes. Questions such "What roles can mountains play to overcome the future problems/ challenges of humanity?" or "Which answers can research in mountains offer?" are at the basis of NEMOR interests, and set our long-term goals. NEMOR is a network **able to mobilise and link needed mountain research competences and capacities Europe-wide**, formed by researchers who want to promote research in, and for the sustainable development of, mountain areas. We believe that Europe has the potential to play a world-leading role addressing the most urgent global needs, and we advocate to address them in mountains: their specificities, singularities and necessities provide an excellent research framework. Research in mountains has the potential of impacting in the following topics:

- **Climate change consequences.** As highly affected by climate change, research carried out in mountain areas can be applied in other contexts, e.g. developing countries.
- **Globalization**. Mountains worldwide are biodiversity hotspots and ecosystem services providers, so new governance models can also be applied elsewhere.
- **Demographic change**. Mountains are excellent test-beds to address and counterbalance land abandonment, as well as increased touristic pressure: both trends are found throughout the world.
- **Digitalization, labour market, quality of life & added value creation**. Being remote areas, research focused on new jobs related to mountain development and new technologies is also of global interest.