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# Shaping New Rural and Mountain Narratives: Priorities for Challenges and Opportunities in Mountain Research

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## Abstract

In recent decades, analyses on spatial change have addressed mountains as specific and crucial places for resilience and global sustainable development pathways. Comprehensive studies have recognized the complexity of "mountain" research issues at local to global levels. This article takes stock of the emerging shift in priorities across European research towards analyzing interactions in social-ecological systems of mountain areas. The analysis builds on long-term engagement in mountain research networks, the elaboration of a European mountain research strategy, and expert interviews on key requirements for research on mountain opportunities and challenges. In order to understand the complex interrelations of mountain social-ecological systems, it is crucial to apply inter- and transdisciplinary methods enabling the elaboration of new narratives on mountain research that address pressing societal challenges.

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## Keywords

Mountain development · Spatial differentiation · Research strategy · Social-ecological systems · Inter- and transdisciplinary research

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## 1 Introduction

In recent decades, the need to find sustainable pathways for spatial development has intensified in all geographic areas. This sharpened focus has also extended to the mountain context, which has received increased attention in analyzing place-based conditions of the human-nature relationship and policy responses to emerging challenges.

The need for mountain research has been increasingly recognized as climate change aspects became visible and understood as triggers for global change in mountain areas (Price 1999). The linkage of mountain research considerations with global change discourses reflects its crucial role in recognizing the increasing tensions of human-nature interaction in mountain areas since the 1980s. With the inclusion of the concept of Sustainable Mountain Development in the Agenda 21 at the Earth Summit 1992 in Rio de Janeiro (United Nations Conference on Environment and Development, UNCED 1992), the related research issues received widespread attention and global interest. Since this summit, the research remit has been extended, respective institutional settings have been elaborated, and there have been calls for cooperation through inter- and transdisciplinary research approaches at various levels. The commitment to intensify research on the challenges of mountain regions has been strengthened in particular by the realization that climate change is impacting mountains much faster than other areas. They are often considered "sentinels" of global change. The rising notion has found expression in an emerging research commitment that addresses mountain issues and appreciates their role and impact on environmental performance based on the human-nature linkages of "mountain social-ecological systems" (MtSES) that are "vital to humanity, providing ecosystem services to over half the planet's human population" (Klein et al. 2019, p. 547).

This article briefly reviews how the research community has learned to appreciate mountain areas as "social-ecological systems" (SES) that require in-depth study of the multitude of interactions. In addition, a reorientation of research priorities is discussed, with a particular focus on translating research findings into policy conclusions and implementation. First, the evolving scientific discourse of mountain development research over the past decades is presented. The following subsections discuss the limited implications for policy solutions, and highlight the increasing need for a shift toward a knowledge "transfer", which is complemented by an analysis of substantive barriers to policy change. Both aspects, limited practical effectiveness and slow policy adaptation, are presented as critical to providing relevant responses to current mountain challenges. Finally, the assessment leads to a set of key issues for future mountain research

frameworks. Ongoing strategic discussions and investigations within the research community are used to outline recommendations for mountain research activities to enhance sustainable development pathways, and to reformulate "narratives" for mountain development.

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## 2 Mountain Research: An Evolving Scientific Field

Recognizing the need for a globally coordinated framework to address the intensive reliance of human population on natural processes and the implications of human activities in mountain areas contributed to the establishment of UNESCO's Man and Biosphere Program (MAB) in 1971. Since then, this program has provided an important impetus to researchers and practitioners in many countries, resulting in the World Network of Biosphere Reserves (BR) that currently counts 714 biosphere reserves in 129 countries around the world (UNESCO 2021), including four in Austria in 2019 (UNESCO 2019)<sup>1</sup>. The aims of these protected areas are to "foster the harmonious integration of people and nature for sustainable development through participatory dialogue; knowledge sharing; poverty reduction and human well-being improvements; respect for cultural values and society's ability to cope with change – thus contributing to the 2030 Agenda and the Sustainable Development Goals (SDGs)" (UNESCO 2021). BR's commitment expresses an early reflection of assessing ecological performance and regional action to develop and implement sustainable development approaches, with particular relevance and application in mountain contexts (Reed and Price 2019).

Pilot actions in many BR regions and close practice-science cooperation within that program provided a strong impetus to raise awareness and shape future mountain research. The program can be seen as a forerunner to mountain recognition at the UNCED in 1992 and thereafter. These global high-level events have emphasized the urgency for sustainable mountain development and called for conclusions on research priorities (Drexler et al. 2016).

In view of the rising pressure from climate change implications (Thornton et al. 2021), mountains areas are affected by large-scale environmental and socioeconomic changes earlier and to a greater extent than other geographic regions. It was recognized early on, that classical distinctions and/or separate

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<sup>1</sup>Four other Austrian biosphere reserves were designated as early as 1977, but were withdrawn in 2014 and 2016 (two in each year).

research programs for natural, social and human sciences can hardly meet the rising challenges. In the upcoming discourse on "fragile ecosystems" of mountains and global integration processes of the 1990s, research priorities were explored in several fields (Price 1999). In retrospect, we can observe that the evolution of research was based on inherent cultural views of human-nature relationships in different regions/countries and diverse scientific fields. Nevertheless, we can discern the following six overarching strands of research evolution:

- In the initial phase, the *thematic focus* was on mountains, inspiring numerous country- and region-specific activities as well as thematic analyses and events on mountain development. Considerations were driven by productivity, compensation, and spatial concerns, emphasizing cohesion aspects as a guiding concept (Dax 2008) as well as functional approaches, and highlighting interrelations of areas (Price 2010). Thematic foci were the crucial role in ecosystem service provision (Robinson 2009) and place-sensitive aspects of natural resource use associated with SES (Ostrom and Cox 2010). Despite the broad range of topics, which in part also included socioeconomic aspects, the natural science perspective dominated. There was a strong orientation towards biodiversity aspects, biophysical processes, nature conservation, and support for protected areas, strengthening the narrative of mountains as resource-poor and "disadvantaged" areas.
- The *geographic specificity* of mountain areas (Gløersen et al. 2012) has gained attention with rising efforts to link research with onsite implementation. The belief that spatial problems do not stop at borders led to increasing trans-regional cooperation. In addition to analyzing the challenges and opportunities of mountain regions in Europe (Dax 2020; Gløersen et al. 2016; Nordregio 2004; Price 2010), transborder issues have been intensively explored, among others, in Interreg programs for the Alpine region (Bausch et al. 2005), the Pyrenees, through the creation of the Carpathian Convention, and emerging transregional cooperation in the Balkans. The orientation of those studies seemed very ambitious and focused on institutional and program development as well as policy recommendations aiming at "territorial cohesion" and giving mountain areas a prominent role in this process (Dax 2008). It is important that findings are not applied to policy as a panacea (Ostrom and Cox 2010), but largely reflect the specifics of local and regional contexts and the particularities of human-nature relationships, and respond to challenges that vary widely at small scales (Bruley et al. 2021).
- In addition to this spatial focus, it was realized that scale is decisive to gain an insightful understanding of *MtSES*. In particular, micro-level analysis

and integration of local views through participatory approaches have been promoted. Mountains are increasingly referred to as areas "under pressure" from a bundle of ecologic, economic, and sociocultural forces (Klein et al. 2019), about which research should gain insights to stimulate appropriate policy design and implementation.

- The systemic approach is closely linked to the shift in societal concern and the need for a transformation towards *sustainable development* pathways. This orientation was prepared by the MAB programs and has been globally approved in the UNCED since 1992. The global remit of mountain research expressed there has been taken up in international scientific fora, mountain development conferences, and regional policy programs leading to the approval of the United Nations International Year of Mountains (IYM) in 2002. It also resulted in the establishment of the global Mountain Partnership to secure a powerful platform for knowledge exchange, thematic discourse, and policy implementation in the long run. In this context, integrated approaches have been claimed as crucial to address the respective sociopolitical and economic frameworks linked to adverse climate and harsh natural conditions of mountain environments (Price 2007). However, the picture of mountain research is not as bleak as it seems, as there are numerous scientific studies and discourses at regional, national, and European levels aiming to integrate socioeconomic challenges and increasingly addressing the pressures on mountain regions. Surveys on mountain research practice highlight that Alpine countries, particularly Switzerland and Austria (Körner 2009), have increasingly focused their research priorities on mountains for several decades. However, a global view on mountain challenges underscored the quest to tackle the diverse contexts and pressing needs of the world's non-industrialized mountain regions (Payne et al. 2020) through increased research commitment and global priorities; a concern that was taken up by the Mountain Research Initiative (MRI), the Mountain Partnership, and other global network associations. The policy relevance of mountain research has been gradually acknowledged in various European and national programs. In the discussion on research priorities, it was recognized that *inter- and transdisciplinarity* are central to understanding complex systems and addressing current challenges (Otero et al. 2020). Recent economic, ecological, and health crises underscored the interlinkages of social and ecological systems and the need for research frameworks that take hold of interactions among various systems. At the same time, this calls for an integration of diverse knowledge domains, the support by intermediaries to enhance trustful linkages, and the inclusion of non-academic stakeholders and actors to adapt methods in geographic and institutional contexts.

While these components of research perspectives were developed simultaneously, a more synthetic view has emerged since the discourse intensified in the context of IYM 2002. In this vein, global conferences to assess the status of mountain research and shape future research commitment were organized at five-years intervals in 2005, 2010, and 2015 by the Centre for Mountain Studies in Perth, Scotland (UK), followed in 2019 by the International Mountain Conference in Innsbruck, Austria, hosted by the mountain-related research institutes of the University of Innsbruck<sup>2</sup>. In each of these conferences, an extensive inter- and transdisciplinary discussion on mountain research took place involving more than 500 researchers, and helping to provide an overview of the state of priorities and gaps in research activity (Björnsen Gurung et al. 2012; Gleeson et al. 2016). These discourses, in addition to national research commitment for mountain issues, paved the way for the MRI, a global network agency to monitor and facilitate worldwide research cooperation. As part of the joint efforts of European researchers to address research gaps and propose a Strategic Research Agenda for European mountains (see below), research collaboration and thematic networking activities have been intensified. This European cooperative view was subsumed in a group of European research institutions, the Network for European Mountain Research (NEMOR), established as a "hub" to enhance information about cooperation on relevant research issues in Europe. Its initial activities and involvement in discussions with Horizon 2020, the EU Framework Program for Research and Innovation (EU FP8, 2014–2020), demonstrate the shift toward interdisciplinary and outcome-based approaches to research planning (NEMOR 2018).

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### **3 Strategy Building and Orientation of Mountain Research**

This subsection highlights the extent to which the expanded scope of mountain research issues has been adopted in the research organization. Did the intensification of mountain research activities and scope actually lead to respective priorities in national and European research programs? And, which common threads in research focus and design became visible? The "Mountain Agenda" (2002), a background document to the UN World Summit on Sustainable Development in 2002 prepared by a group of experts on sustainable

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<sup>2</sup>A follow-up conference in Innsbruck is planned for September 2022.

mountain development, presented a global assessment to tackle pressing societal challenges. The thrust of this document fostered the recognition of key principles by research and policy actors and the inclusion of social, economic, spatial, and cultural dimensions in strategy building to enhance policy implementation.

The elaboration of a mountain-oriented "research strategy" was then facilitated by the Global Land Project of the GLOCHAMORE project, and later by the synthesis of the Perth conferences. In 2015 and 2016, a strategic research agenda for Europe's mountains was developed by a multinational and interdisciplinary team, coordinated by the Swiss-Austrian Alliance (CH-AT Alliance 2013), a research group to foster transnational research cooperation. This activity was built on repeated discussions about mountain research organizations and the widely shared realization that "transforming research into practice (and) ... strong regional imbalance in research projects funded by the EU in mountain areas" as well as the "recognition that ... there has been little specific emphasis in Horizon 2020 calls for research proposals on mountains" (Price 2016, p. 377). The analysis was structured along the priority areas of *Horizon 2020* and was based in particular on past and existing research activities suggesting that these aspects include mission statements for future European research. Both the resulting research agenda (Drexler et al. 2016) and the Perth III conference structure refer to the concept of the research program Future Earth and the three components of its research agenda (Future Earth 2014), which call for research on a "Dynamic Planet", for "Global Sustainable Development" and for enhancing "Transformations towards Sustainable Development".

The research gap analysis underlined the need to fill geographic gaps in mountain research, which means in particular "to overcome the geographic under-representation of African, Latin American, and South and Southeast Asian mountain research" (Gleeson et al. 2016, p. 543). It also advocates to draw on existing efforts to intensify long-term capacity-building for respective researchers and to stabilize research communities through long-term projects in these contexts. The research orientation intends to overcome an imbalanced focus on "observation and explanatory" research versus low engagement in holistic approaches addressing sustainable development in the context of global change. In particular, it embraces a shift towards "transformation research" demanding the following structural adaptations (Gleeson et al. 2016, pp. 545):

- To raise "understanding how transformation occurs" and enhance "effective communication and utilization",

- To realize a "new emphasis on transformative research as an alternative for standard" views on current valuation frameworks and a lock-in of prevailing policy trade-offs (Gorddard et al. 2016),
- To strengthen community capacity/capacities through collaboration of scientists and stakeholders at different scales to promote shared visions for knowledge production,
- To increase the "awareness and recognition of upland-lowland interrelations" to better grasp the "meaning" of mountain development processes, and
- To "create institutions with a long-term commitment to ... mountain region(s)" to support long-term appreciation of change efforts toward intergenerational justice (Krzrnaric 2020) and relevant governance timescales, beyond typical three to five year project cycles.

To instigate European research, the aforementioned mountain research strategy (Drexler et al. 2016) revealed that activities in all strands of the EU Framework Program for Research and Innovation might be inductive for raising transformation aspects. It therefore explored topics and priorities for all Societal Challenges of the program, which form the basis for the research organization of *Horizon Europe* (EU FP9, 2021–2027). It is apparent that involvement is often closely tied to disciplines and existing networks, and that mission-oriented research requires greater inter- and transdisciplinary engagement. These epistemological shortcomings are often superseded by a lack of data, resources, institutional access, and appreciation of research concepts at fine geographic scales that prevent differentiated analyses of mountain and non-mountain developments. As Gløersen et al. (2016) analyzed that such differentiation is crucial for cohesion considerations and policy implementation. Future research priorities therefore also depend on knowledge development at the local level, including data curation at fine geographic scales, assessment of spatial differentiation, research community networks, and an enhanced understanding of value changes and transformation needs.

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#### **4 Obstacles to Success and “Blind Spots” in Research Strategy Elaboration**

While the interest in research activities addressing additional and more in-depth dimensions of mountain development has increased in many countries across Europe and in mountain regions around the world, policy implementation lags behind scholarly expertise. This deficit has been reflected by research



communities and has become a major concern in calling for a shift toward “transformation research” (Mountain.TRIP 2009). However, such far-reaching changes in the nature of research organization, strategic directions, and science-policy-practice relationships require substantial adaptations in institutional frameworks, decision-making processes, participation, and understanding of these interactions. The holistic nature of such frameworks was captured in activities involving the extension of spheres and dimensions to be covered by elaboration processes, advocating multilevel and multidimensional management. These included discussions of inter- and transdisciplinary frameworks arguing that knowledge production and use should be framed not only by integrating research, industry, and government (triple helix), but also by adding the helix of a “media-based and culture-based public” (quadruple helix), and in the final stage, the sphere of “natural environments” (quintuple helix; Carayannis and Campbell 2012).

The aforementioned strategy processes explored the scope of issues, obstacles, and shortcomings of existing research. Table 1 draws on a survey of selected “mountain research” experts, supplemented by a small group of regional development experts for comparability (Dax 2017). The synthesis of their statements is presented using core dimensions of research analysis: thematic scope, epistemological changes through collaboration and stakeholder involvement, spatial differentiation and cohesion, interaction and research transformation, and relevance to “spatial justice” objectives.

Although expert assessments are inherently subjective, a wider scope of views is presented as a conceptual background. In many respects, the organization of research programs is far from “ideal”. An intense discussion on the design of mountain research has therefore been used to highlight the respective obstacles to achieving an improved and more comprehensive research framework, and the shortcomings of existing research practice (see Table 1). For this purpose, recent articles summarizing commitment in mountain research with different but high-level thematic foci have been used to underscore such limitations and call for an enhanced strategic and practical realization of the research remit in these contexts.

The articles refer to surveys of numerous research studies, the analysis of Perth III conference contributions (Gleeson et al. 2016), the challenges of ‘mountain paradoxes’ to achieve desired transformations through the Mountain Sentinels Network (Klein et al. 2019), the progress of participatory approaches in MtSES (Thorn et al. 2020), or a survey realizing mountain research on climate change adaptation (Vij et al. 2021).

Observations from global network institutions and specific studies underline the major challenges of inter- and transdisciplinary research emanating from

**Table 1** Synthesis of mountain research strategies. Based on Dax (2017, pp. 42); Gleeson et al. (2016)

Issues	Synthesis of assessment	Obstacles	Shortcomings
Lack in thematic focus	Integrated & systemic approach (more on social & spatial interaction); many themes, incl. cooperation, globalization, well-being & foresight	Disciplinary separation, local role & data; short-term focus	Explanatory “power” restricted & limited to case study regions & analyzed themes
Local & regional development	Local conditions crucial, focus on rural dimension, pressures on “marginal” areas, environmental sensitivity, increasing societal demand & new valuation	Path dependency, policy trade-offs & actor conflicts; reluctance to embrace ‘change’, power & scale	Limited reliance on local agency; only partial assessment of social-ecological systems; spatial interrelations
Participation of local actors	Selective participation & bias, absence of sufficient human capital & social innovation processes; yet, also increasing collective action, “social learning” & interest in transferability	Local actors seen as “information” resource; paternalistic view on stakeholders still prevailing	Pitfalls against “rhetoric” for sustainability; lack of new research styles; convincing pathways
Service provision	Ecosystem services, natural & cultural diversity, landscape, water & soil quality & risk prevention; linkages to economic & social activities, quality of life, food security, biodiversity, etc.	“Cost” of services vs. interrelation & long-term effects; lack of systemic view & place-sensitivity	Potentially missing appreciation of external (large-scale) drivers

(continued)

**Table 1** (continued)

Issues	Synthesis of assessment	Obstacles	Shortcomings
Territorial cohesion & social justice	Strong reference to current EU policy framework; depletion of natural resources, with socially adverse effects	“Compensating” view still prevailing, technological & short-term solutions preferred	Path dependency; technological change overrated, “social innovation” & new narratives underrated
Grand societal challenges	High interest in sustainable mountain development, human-nature interaction; incl. issues of mobility, tourism, demography & technology; institutions, cooperation, spatial justice & future adaptation	Mountain challenges as ‘paradoxes’; opportunities & climate change impacts neglected	Systemic inter-relations hardly covered sufficiently; mainstream focus on centers
Enhance transformation & knowledge transfer	Focus on transformation projects & activities, local action, networking & good practice	Adaptation to spatial context, links to external areas (non-mountain contexts) neglected	Often limitation to one area of investigation; novel methodological issues
Inter- & trans-disciplinarity	Methodological requirements; spatial & social dimensions; human-nature interrelations; integration of diverse perspectives	Disciplinary boundaries, diverse scientific schools; neglect of spatial differentiation & practice knowledge	No explicit focus on territorial approach or social dimension

interrelations of physical and socioeconomic trends. Moreover, aspects of global change require a strong observational network and sound monitoring systems to provide substantive results and verification of large-scale and long-term processes (Shahgedanova et al. 2021). For many (small-scale) mountain regions, the empirical thresholds seem particularly high and constitute extremely adverse obstacles. The threat of partial analysis, short-term adaptation, and exaggerated expectations of “policy transfer” from seemingly successful examples is

enticing. However, such shortcuts might leave significant “blind spots” in development aspirations and place-sensitive policies. It seems crucial to pay particular attention to characteristics of places, socioeconomic and institutional organization, and cultural legacy (Kulonen et al. 2019). As the manifold research documents for integrative approaches underpin, such an orientation requires long-term commitment to mountain research and careful strategic planning to unveil neglected actor groups, unaddressed issues, underestimated drivers, “hidden” cause-effect relationships, explanatory frameworks, and an enhanced understanding of interactions. Albeit discourse on a systemic perception of influencing aspects is increasing, “transferring” these views into policy-practice frameworks remains a major task.

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## 5 Focal Points of Strengthening Mountain Research

The increased commitment to mountain research and policy in recent decades underlines the crucial role of respective scientific approaches in sustainable development. The high priority on the agenda for future research implies a comprehensive perspective in developing mountain research strategies. As shown by numerous studies and widely recognized in the research community, policy concepts and adoption into good practice as well as current prevailing narratives based on passive attitudes of deprivation and inaction are hardly helpful. A meaningful research orientation would need to frame mountains as also having place-based opportunities, based on local knowledge and a rich cultural heritage.

Based on expert analyses and discussions about the research framework, there is a strong need to communicate a new kind of theoretical and practical explanation of mountain-lowland linkages and conceptual explanations which can be summarized as “new narratives”. These might focus on the potential of mountains to provide “viable, vibrant places to live and work” (Drexler et al. 2016, p. 12) and their far-reaching and lasting benefits to other places. Crucially, such an approach will have to overcome the flaws of current mainstream economic thinking and respond adequately to the high demand for nature services for all humans (Dasgupta 2021) provided by mountain communities.

As recent decades have triggered rapid changes in nearly all spheres of our communities, economic relations, and natural resource use, “recurrent warnings about continued demographic decline, land abandonment, future droughts and conflicts for resources triggered a paradigmatic change of mountain perspectives and activities” (NEMOR 2018, p. 3). An assessment of current research discourses and orientation indicates that enhanced commitment to mountain research

is related to the inherent need for profound change, particularly as mountain landscapes and the people, who depend on them, face intense pressure to adapt resource use (Dax 2017). Such an interpretation of the pressing research issues at stake in mountain regions points to a positive answer to the question, “Should mountains (really) matter in science and policy?” (Balsiger and Debarbieux 2015). Hence, the main objectives for a new framework for mountain research are seen as: i) aspects of regional environmental governance considering spatial differentiation, stakeholder engagement, and policy integration, ii) policies capturing regional knowledge and large-scale impacts of respective research themes, and place-based policies, and iii) effective pathways for policy diffusion. The perception of mountain research remit underscores the need to elaborate and shape forcible narratives for mountain region development pathways. These need to transcend short-term limitations of mountain contexts and incite creative processes for transformational research and science-policy exchange, putting interactions of MtSES at the center of activities.

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