CASE STUDY CATALOGUE OF MARGINALISED MOUNTAIN AREAS IN EUROPE



September 2026

Andrej Ficko · Maruša Čotar · Ana Laura López Carlassare · Simo Sarkki (*Editors*)

MARGISTAR COST ACTION CA21125 A European forum for revitalisation of marginalised mountain areas

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Ljubljana, 2026

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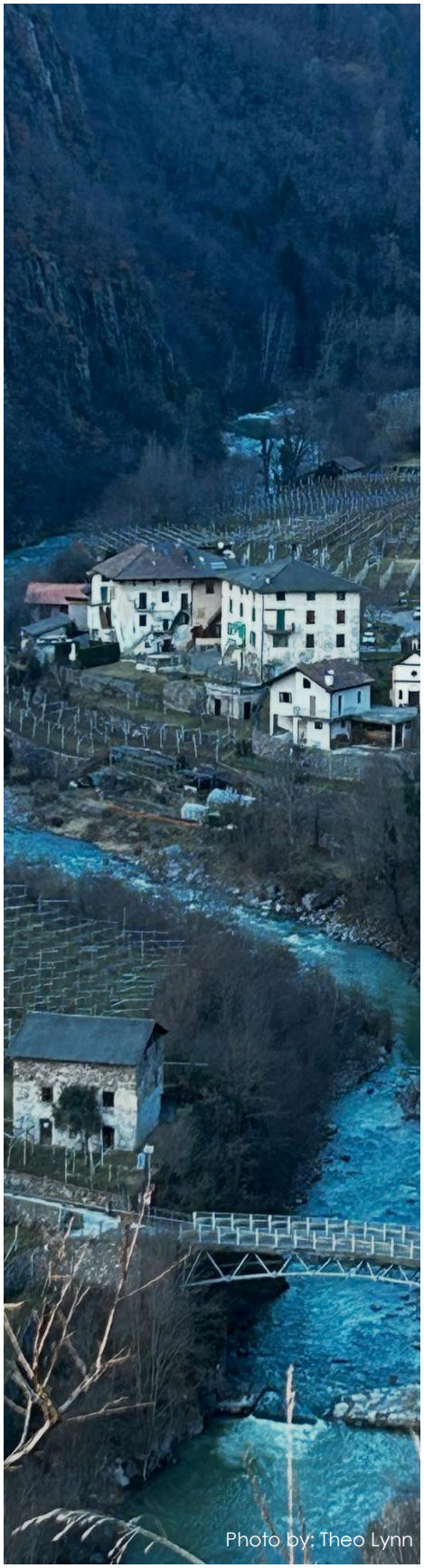
PREFACE

The Case study catalogue on marginalised mountain areas in Europe presents local examples of the developmental challenges faced by Europe's remote rural and mountain regions, complementing the regional- and continental-level analyses undertaken within COST Action MARGISTAR CA21125 (A European forum for revitalisation of marginalised mountain areas). It presents a collection of 25 case studies that explore socio-economic, environmental, and governance challenges and opportunities faced by mountain communities across the continent. The authors delve into topics such as depopulation, agricultural decline, climate change, digital connectivity, sustainable resource management, and legal frameworks. The studies span a wide geographical range, from the Lapland to the Mediterranean, the Carpathians to the Iberian Peninsula, providing a comparative perspective on how different mountain areas navigate modernization, conservation, and resilience-building. By examining these cases, the catalogue offers insights into positive and negative impacts of marginalization on actors, and critical factors for development. The catalogue summarizes visions and main strategies and policies that can help revitalise and sustain these areas.

Dr. Andrej Ficko
Maruša Čotar
Dr. Ana Laura López Carlassare
Dr. Simo Sarkki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OVERVIEW OF THE CASE STUDIES

Andrej Ficko[a]

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In the first case study, **Ingrid Machold** and **Somaye Latifi** from the Federal Institute of Agricultural Economics, Rural and Mountain Research (BAB) in Vienna, Austria examine immigration as both an opportunity and a challenge in mountainous communities in the Vorarlberg region. The study explores how immigration can counteract depopulation and balance ageing demographics, while also highlighting the difficulties of integrating forced migrants such as asylum seekers and refugees. Key challenges identified include geographical isolation, cultural differences, and language barriers, which complicate the social integration process in rural areas. The role of "gatekeepers" – local individuals who help migrants establish social connections – is emphasized as crucial in facilitating access to employment, housing, and social inclusion. These social connections not only improve migrants' integration but also have broader benefits for local communities by addressing labour market needs and fostering economic resilience. The study also underscores the importance of regional coordinators in proactively connecting local stakeholders to support migrants. Ultimately, the extent to which immigration is viewed as an opportunity or a threat in these areas depends on how well communities manage integration and leverage the benefits while addressing the accompanying challenges. The case study provides insights into how rural communities can navigate the complexities of migration to achieve sustainable local development and avoid periphery traps like depopulation and social isolation.

Violeta Santrač from Veterinary Institute "Dr. Vaso Butozan" in Banja Luka, Republic of Srpska, Bosnia and Herzegovina, examines Risovac, a marginalised community in the Grmeč region, focusing on the challenges of demographic decline and economic stagnation. As a Doctor of Veterinary Medicine with a passion for beekeeping, Santrač highlights the community's decreasing population and its effects on local development efforts. Key challenges include a lack of accurate census data, which is essential for effective planning, and the need for sustainable resource management despite the area's rich natural resources, such as wood and water. The study emphasizes the importance of revitalizing the local economy and engaging residents in community projects to ensure long-term sustainability. Solutions include promoting local food chains, advocating for natural beekeeping, and developing initiatives that foster resilience in marginalised areas. The case study suggests that overcoming "periphery traps" like isolation and limited opportunities requires strategic investments in infrastructure, digital technologies, and heritage preservation, while also boosting

tourism and media engagement. Overall, Santrač's work underscores that a combination of visible actions and community involvement is key to unlocking the economic potential of Bosnia's rural areas, transforming them into sustainable and thriving communities.

Anita Bušljeta Tonković from Ivo Pilar Institute of Social Sciences, Zagreb, Croatia and the colleagues from the University of Zagreb, Department of Geography explore the stagnation of modernization, transition, and post-transition processes in the Croatian mountain region of Lika. Over the past two centuries, rural Lika has remained underdeveloped due to various social, political, cultural, and economic factors. This lack of development has led to demographic abandonment, particularly through the emigration of young people seeking better educational and employment opportunities abroad. While this has caused economic precarity, it has also preserved the natural environment, offering potential for sustainable and neo-endogenous development. The study identifies challenges such as unplanned tourism, governmental unresponsiveness, and passivity in local communities, often rooted in the legacy of the Homeland War and historical rigid governance. These issues have created a "learned helplessness," where local communities rely on the state rather than driving change. The study suggests that overcoming these periphery traps requires fostering sustainable development through a balance of ecological, socio-cultural, political, and economic dimensions, supported by both bottom-up and top-down approaches. A key takeaway is that immigration policies should be designed to revitalize the region and bring about desired social and economic changes, making Lika a sustainable and thriving area for future generations.

Pavel Cudlín and **Marcela Prokopová** from Czechia addresses the challenges of land degradation in the Novohradské mountains, with a focus on the impacts of unsustainable agricultural and forestry practices. The study examines how intensive farming methods, including the use of heavy machinery and chemical inputs, have led to a decline in biodiversity, soil degradation, and vulnerability to climate change. In less favourable areas for agriculture, land abandonment has further contributed to ecological issues, such as reduced plant diversity and landscape homogeneity. The forests, dominated by spruce and pine monocultures, are particularly susceptible to droughts, bark beetle infestations, and storm damage, posing a significant risk to ecological stability. To counter these challenges, the study emphasizes ecological forestry, land use diversification and precise farming techniques. It also explores the potential of social agriculture, which supports non-productive farm functions and post-farming processes, aiming to increase the resilience of both farming and forestry sectors. Although the case study is still ongoing, it seeks to identify sustainable practices that can mitigate the effects of climate change, improve land productivity, and enhance the long-term prosperity of farmers in the region.

Juha Hiedanpää from LUKE, Finland examines the profound social, cultural, economic, and ecological transformations affecting the Deatnu/Teno River region in northern Finland and Norway, where the collapse of native Atlantic salmon and the rapid spread of invasive pink salmon have fundamentally altered the river ecosystem and Sámi ways of life. The closure of salmon fishing in 2021, introduced in response to the collapse of Atlantic salmon stocks, has had severe consequences for local livelihoods, well-being, and the transmission of Sámi fishing culture between generations. A commissioned assessment found substantial impacts on health and well-being, as well as an estimated annual economic loss of €4.5 million on the Finnish side. The case illustrates how ecological crises can become intertwined with cultural identity, Indigenous rights, livelihoods, and contested governance. The situation has been further complicated by differing responses to the invasive pink salmon, including large-scale removal programmes and barriers introduced on the Norwegian side, which may themselves affect fish migration and fishing opportunities. While Sámi communities and administrations in both countries recognize the severity of the salmon crisis, the formulation and implementation of salmon policies remain contested. The case highlights the challenges of reconciling ecological conservation with Indigenous cultural rights, local livelihoods, and legitimate forms of knowledge in cross-border mountain and remote rural governance.

Simo Sarkki's study delves into the complex polycrisis faced by reindeer herders in northern Finland. Reindeer herding, a vital nature-based livelihood, is increasingly threatened by intertwined crises, including climate change, rising fuel and feed costs due to the war in Ukraine, predator abundance, and land use pressures from green transition projects like wind power and mining. These factors, compounded by a long history of land encroachment, are eroding the stability of the herding lifestyle. Herders report feeling that after navigating one crisis, another follows. Sarkki's research highlights that herders must not simply adapt to each crisis in isolation, but rather embrace "revitalizing adaptation," which focuses on strengthening the core values and practices of reindeer herding itself. This approach moves away from reactive adaptation to each specific issue, as that strategy risks creating new vulnerabilities in the future. Instead, the paper argues that increasing the influence of herders in land-use governance and decision-making is key to sustaining their livelihood. Such empowerment, however, requires dialogue with government actors and other stakeholders, as enhanced herder rights may come at the cost of limiting other land uses. This holistic, forward-thinking approach is vital for the future resilience of reindeer herding.

Theo Lynn et al. examine how a rural Irish community overcame the digital divide through a community-led broadband initiative. Faced with poor digital infrastructure and exclusion from the government's National Broadband Plan, the towns of Piltown and Fiddown launched "Broadband for Our Community" (B4OC), Ireland's first

community-owned and operated Fibre-to-the-Premises (FTTP) network. The project, driven by local volunteers, including four trained fibre-optic technicians, focused on providing high-speed, low-cost internet to improve the area's attractiveness for both residents and businesses. Key challenges included securing land access, managing community expectations, and sustaining long-term involvement. While technical problems were surmountable, people-related issues were the greatest hurdle. Successful delivery relied on leveraging industry contacts and building local support. To mitigate future issues, the project emphasized better communication with residents, both in person and via social media, and helped with network setup to ensure a positive user experience. Additionally, the project highlighted the need for continuous recruitment to maintain operational strength. The B4OC initiative demonstrates how community-led efforts can address critical infrastructure gaps, offering a blueprint for other rural areas facing similar digital challenges.

Alberto Doretto's case study focuses on Ostana, a small village in the Italian Cottian Alps. Since 2019, Ostana has hosted the Alpine Stream Research Center (ALPSTREAM), an interdisciplinary hub for water management, biodiversity conservation, education, and ecotourism. ALPSTREAM brings students, scientists, and scholars to the village through lessons, fieldwork, and international summer schools, aiming to revitalize Ostana. Key challenges include sustainable mobility, decreasing financial resources, and a lack of affordable housing and cultural services. To address these, the municipality is investing in electric mobility, carpooling, and partnerships with stakeholders to boost social infrastructure and attract residents and entrepreneurs. The case emphasizes the importance of cultural and social services in fostering a cohesive community, blending tradition with innovation. Ostana's success lies in its strong heritage, ongoing innovation, and collaboration with research institutions, offering training and education opportunities. Additionally, building networks with local and external partners is crucial for the village's revitalisation and future development. This combination of tradition, innovation, and networking showcases how rural communities can thrive by connecting local assets with modern solutions.

Dimitris Manoukas presents a case study from Val Venosta (Vinschgau) in Italy. The BASIS project undertaken in this area highlights a transformative initiative that repurposes a former military barracks into a social activation hub aimed at fostering innovation, community engagement, and sustainable practices. BASIS focuses on creating a "third place," which acts as a shared space beyond home and work where people can collaborate on new initiatives, build community projects, and drive local development. This approach integrates social activation, economic growth, and cultural enrichment. The project leverages the unique cultural and historical assets of Val Venosta, integrating traditional industries with innovative business models to stimulate economic diversification and resilience. Coworking spaces are a key element, serving as socio-material infrastructures that bridge creative workers and

institutions, fostering interaction and collaboration. These spaces act as "relational milieus" that mediate between grassroots efforts and institutional support. The project's success demonstrates that by combining social, economic, and cultural strategies, marginalised regions can be revitalized into dynamic and inclusive hubs of innovation. The BASIS project offers a model for turning peripheral areas into pioneers of sustainable development, emphasizing the need for inclusive and adaptive approaches to regional growth that leverage local assets and community involvement for long-term success.

In another case study from Italy**, Matteo Vizzarri et al.** present VALC project which focuses on the sustainability of coupled human and natural systems in Valle Camonica. The project addresses challenges such as depopulation, ageing, land abandonment, and climate change impacts on the local economy. The project's activities aim to enhance resilience through sustainable land use practices, boost the viability of local agriculture and forestry, and engage stakeholders through participatory governance. Key obstacles include limited forest accessibility, economic inefficiencies, weak land stewardship, and pressures from tourism. Vizzarri's work highlights several important lessons: adopting a holistic approach that integrates job creation, community empowerment, and natural resource management is vital for sustainable development. Community engagement in decision-making fosters ownership of initiatives, while economic diversification through small-scale entrepreneurship and eco-friendly tourism strengthens resilience against external pressures. Additionally, coherent policy frameworks that integrate social, economic, and environmental objectives are essential for addressing periphery traps. By applying these principles, regions like VALC can overcome marginalization and achieve long-term sustainability, equity, and environmental stewardship.

Ivan Laković from University of Montenegro, Historical institute, presents a case study of the Kuči Mountains in eastern Montenegro and examines the decline of transhumant pastoralism in the region, traditionally used by the Kuči tribe. The area once thrived with around 200 katuns (seasonal mountain settlements), but more than 150 are now abandoned due to rapid depopulation and societal changes. After WWII, Montenegro's shift towards urbanization and industrialization led to a decrease in rural populations, which significantly affected mountain communities. The younger generation has shown little interest in maintaining traditional pastoral lifestyles, leaving the active pastoral households to older populations. Additionally, tourism and recreational activities have transformed remaining katuns, compromising their authenticity. Laković emphasizes the lack of dedicated governmental policies addressing these challenges, noting that without intervention, the traditional landscapes and cultural heritage of the region will continue to be eroded. He argues that the marginalization of rural life stems from a failure to align policy with the unique needs of these areas. To reverse this decline, Laković advocates for comprehensive

strategies that promote the revitalisation of villages, which in turn would restore life to the seasonal mountain settlements. Without such efforts, the Kuči Mountains risk becoming purely tourist zones, losing their cultural and historical significance.

Catarina Esgalhado et al. present a case study on the evolution of shepherding practices in Serra da Estrela, Portugal. The case study highlights the significant shifts in social and economic dynamics that have led to a decline in traditional grazing methods among shepherds. This change has resulted in shrub encroachment on commons and previously grazed areas, notably following pastoral abandonment. The increased landscape continuity and biomass availability became apparent during the devastating wildfires of 2017 and 2022, underscoring the urgent need for strategies to mitigate fragmentation in these ecosystems, particularly in light of climate change. Historically, shepherding of autochthonous breeds supported local livelihoods, maintaining a landscape characterized by a mosaic of large forest patches and open pastures. However, as grazing pressure diminishes, shrubs threaten to overtake these areas, exacerbating fire risks. The case study stresses the necessity of a cohesive territorial strategy that fosters dialogue among stakeholders, enhances training in agriculture and local administration, and educates consumers about the value of products like Serra da Estrela PDO cheese. By establishing a communication platform and aligning efforts among various actors, the region can better navigate its challenges and work toward a resilient future for its pastoral landscapes.

Vlad Crisan's case study on the abandoned gold mines in the Romanian Western Carpathians explores the profound socio-economic impacts following the cessation of mining activities in 1995. Once a thriving hub since Roman times, the closure of the mines led to a dramatic loss of jobs and population decline as residents sought employment in urban centres across Romania and the EU. The local economy, which depended heavily on mining and associated activities such as machinery repair and ore processing, has drastically diminished, resulting in a significant void in economic activity. A key challenge for the region is retaining its remaining population amidst this economic downturn. To revitalize the area, the development of alternative economic activities focused on ecological tourism and natural forest products is crucial. Crisan emphasizes the importance of collaboration among local stakeholders, suggesting that partnerships with central authorities, such as the national forest authority and the national railway company, could facilitate the necessary support and resources for revitalisation efforts. By fostering cooperation and developing new economic opportunities, the region can work towards a sustainable future, reversing the trend of depopulation and promoting community resilience.

Stanislava Brnkalakova et al. present the Tatra Mountains, the highest peaks of the Carpathian range, situated along the borders of Slovakia and Poland. The study aims to analyse the policies related to national park governance, identifying synergies and

trade-offs among different interests concerning biodiversity conservation, climate change impacts, and wildlife-urban interactions. Key challenges include addressing natural disturbances such as wind and bark beetle calamities in spruce stands, as well as managing diverse perceptions of wilderness among stakeholders. The research also highlights the low level of public education regarding natural processes and the importance of biodiversity for human well-being, alongside inadequate communication of conservation efforts. Additionally, the study examines the wide spectrum of actor interests, social and demographic structures, and the complexities of spatial planning and administrative changes. By investigating these elements, Brnkalakova aims to provide insights into effective management strategies for the Tatra National Park, with results anticipated in the coming years as the research progresses.

Luka Jemec et al. from Slovenia examine the interplay between agricultural abandonment and nature conservation in shaping land-use patterns in and around Triglav National Park. This region is characterized by its diverse landscapes, ranging from mountainous terrain to valleys and settlements, each facing distinct challenges. While touristy areas have developed infrastructure and cultural vibrancy, they struggle with environmental pressures from tourism and the decline of traditional agriculture. In contrast, other areas face depopulation, land abandonment, and a lack of essential services. Governance issues arise from the absence of a regional government, leading to fragmented spatial management that complicates cooperation among municipalities. The area is also subject to strict regulations due to its designation as a protected natural area, limiting agricultural, transport, and tourism activities. This has resulted in declining cultural landscapes and increased overgrowth of high mountain grasslands, impacting internationally important habitats and exacerbating wildlife conflicts, particularly with large carnivores. The study highlights that outdated regulations fail to address rapid changes in the region, emphasizing the need for updated conservation strategies that include local community input. Additionally, it underscores the Slovenian government's constitutional responsibility to support the economic, cultural, and social development of populations in mountainous areas.

Artemi Cerdà from Department of Geography at University of Valencia explores the Macizo del Caroig, a limestone platform in Eastern Spain spanning 2,500 km², which experienced significant population decline and abandonment since the 1960s. This depopulation has led to a series of ecological changes, including the recovery of forests, increased fauna, and a rise in forest fires due to a lack of human management. The region faces several challenges, including land degradation, soil erosion, and the loss of soil biodiversity, which threaten the delicate balance of the ecosystem. However, the ongoing recovery of wildlife and plant life presents opportunities for economic development rooted in local traditions and heritage. Cerdà's research positions the Macizo del Caroig as a pertinent case study for other Mediterranean

regions experiencing similar challenges. The area highlights the intricate relationship between human activity and environmental health, demonstrating how abandonment can lead to both ecological restoration and new risks, such as increased fire hazards. The study suggests that understanding these dynamics is crucial for developing sustainable land management strategies that can revitalize abandoned areas while preserving their natural and cultural heritage.

In another case study from the Mediterranean **Elena Górriz** addresses the critical issue of rural depopulation in Teruel, Spain, the most depopulated province in the country. This region is characterized by small municipalities with a strong agricultural base, particularly in black truffle production, alongside emerging rural tourism, albeit not among the top destinations in Spain. The progressive abandonment of farmlands has led to spontaneous afforestation, creating a paradoxical situation: after five years of non-irrigation, these lands risk losing their irrigation rights, which would reallocate water resources to urban areas downstream. This loss not only restricts potential bioeconomy development opportunities but also diminishes the commons dynamics essential for managing these rights. The erosion of historical irrigation practices signifies a broader cultural loss in the management of water resources, which is integral to the region's agricultural identity and productivity. Furthermore, the diminishing social capital associated with traditional commons management hampers the community's ability to self-organize and advocate for the preservation of their irrigation rights. Górriz's analysis underscores the interlinked challenges of rural depopulation and the need for sustainable agricultural practices that safeguard both the environment and the cultural heritage of Teruel.

José Jesús Delgado Peña highlights the pressing challenge of depopulation in the River Genal Valley in Málaga, Spain. This region suffers from a shortage of sustainable job opportunities, isolation, and a lack of entrepreneurial training, hindering its economic development despite its rich ecological and cultural heritage. The valley's stunning landscapes and cultural assets, including historical heritage, festivals, and gastronomy, present significant potential for development. To address these challenges, it is essential to create strategies that leverage local heritage and resources while empowering and training the local population. Key initiatives could include compiling an inventory of heritage resources, promoting local festivals and traditional food production, and supporting the revival of autochthonous breeds like the golden blonde pig and traditional crops such as cherry trees. Notably, the rise of rural tourism and local food products, particularly those related to chestnuts and Iberian pork, could serve as the foundation for a robust socio-economic development plan. The recent slaughter festival organized by Farajan's municipal government exemplifies this potential, drawing regional and national interest. Delgado Peña emphasizes that addressing depopulation through sustainable practices rooted in local traditions can

combat the socio-economic and ecological challenges facing rural areas, ensuring their viability and preserving their heritage for future generations.

Therese Bjärstig and **Annelie Sjölander Lindqvist** address the complexities of making waterways sustainable through regional collaboration in hydroelectricity production, specifically in the Swedish river basins of Ångermanälven and Vojmån. The project aims to design a framework that allows for sustainable and legitimate management of these vital waterways while fostering public participation to develop a knowledge base essential for effective evaluation processes. By employing a context-sensitive approach, the initiative seeks to create a model for fair and efficient regional collaboration ahead of the retrial of environmental conditions for hydropower. The research identifies factors and trade-offs that facilitate or hinder coordination among stakeholders, exploring how power dynamics shift from central governments to local actors within the political-administrative framework. Bjärstig's work highlights the potential challenges arising from conflicting interests among collaborative governance actors, which may impact administrative and legal boundaries, potentially constraining desired outcomes. This ongoing research will provide valuable insights into the implementation of collaborative governance regimes, contributing to the transition toward a fossil-free society while safeguarding river basin ecosystems. Although the research is still in progress, it holds promise for advancing sustainable practices in hydropower management.

Five case studies from Turkiye present methodological, biological, legal, planning and natural resource governance issues in selected marginalised mountain areas. The first study by **Ahmet Kurnaz** examines Adatepe Village, nestled on the southern slope of Mount Ida, a rural settlement that requires protection due to its historical significance. The study identifies both positive attributes and negative impacts resulting from uncontrolled tourism activities in the area. To assess conservation needs, a SWOT analysis was conducted, gathering insights from various stakeholders, including tourists, residents, and public officials. This approach enables a comprehensive understanding of the challenges facing Adatepe. Following the SWOT analysis, the study applied the Analytic Hierarchy Process (AHP) method, engaging interdisciplinary experts to develop actionable recommendations aimed at mitigating the identified weaknesses and threats, thereby revitalizing the village. Kurnaz's research aspires to enhance conservation practices in Adatepe, offering theoretical and practical contributions that could serve as a model for similar mountain slope villages. By advocating for the protection of cultural heritage and fostering sustainable tourism practices, the study underscores the importance of collaborative stakeholder engagement in shaping effective conservation strategies.

In another case study from Turkiye, **Tugrul Yakupoglu** investigates the challenges faced by agricultural soils on Mount Erciyes due to climate change and tourism pressure. The

study highlights that climate change is altering management practices in agricultural systems, particularly affecting vegetable cultivation in mountainous regions above 1200 meters. Faulty agricultural practices lead to increased soil erosion sensitivity and deteriorating soil quality, diminishing the value of agricultural lands and threatening the livelihoods of local communities. As agricultural soils become unproductive, the allure of tourism contributes to further abandonment of farming, prompting migration as residents seek better opportunities. Yakupoglu terms the combined effects of climate change and tourism pressure as "periphery traps," reshaping the agricultural landscape. The study reveals that declining farming viability exacerbates rural exodus, disrupting local economies and community structures. It emphasizes the urgent need for sustainable agricultural practices to mitigate soil degradation and enhance resilience against climate change. By addressing these intertwined challenges, the research aims to inform strategies that can stabilize agricultural livelihoods, ultimately contributing to the long-term sustainability of the region's agricultural systems.

Hakan Yasin Özdemir examines the management of plateau areas within state forests in Düzce Province, Turkey, focusing on the newly established legal framework aimed at addressing practical issues. The study identifies key challenges, including ambiguous plateau borders, illegal constructions, and inadequate oversight, which hinder effective management. Proposed solutions include clarifying legal boundaries, enhancing inspections, and streamlining pasture management under a unified regulatory framework. The current legal discrepancies between forested and non-forested plateaus lead to inconsistencies in property rights, resulting in uneven rent obligations among users. Moreover, the study highlights the need for state support for transhumance, a traditional pastoral practice, which remains largely unrecognized in current regulations. Özdemir advocates for a holistic evaluation of plateaus, emphasizing stakeholder involvement in developing management plans that identify suitable uses for these areas. By increasing state incentives and improving legal clarity, the study aims to revitalize plateau areas, mitigate rural depopulation, and preserve the cultural heritage of transhumance. The findings provide a roadmap for enhancing legal and practical frameworks, ensuring sustainable management of these vital ecosystems in Turkey.

In the fourth study from Turkiye, **Turgay Dindaroglu** addresses the increasing vulnerability of Mediterranean Karst Mountain ecosystems to desertification, exacerbated by climate change and inappropriate land use. Field studies reveal significant deterioration in soil, plant, and water relationships, particularly impacting the physical and chemical properties of the soil in fragmented mountain ecosystems. To promote vegetation continuity, the study establishes guiding criteria for creating and rehabilitating ecological corridors. The limited agricultural land in karst areas, primarily located in depressions with better soil depth, intensifies human pressure on these fragile ecosystems. Dindaroglu highlights the challenges of managing

agriculture, pastures, and forests due to the region's geomorphological limitations and a lack of technical expertise. Public awareness regarding climate change solutions is notably insufficient, prompting calls for enhanced education and infrastructure development, such as irrigation dams and canals. Farmers express a commitment to maintaining agricultural focus but highlight the need for improved irrigation and labour. The potential for sustainable agriculture remains constrained by the unique characteristics of karst ecosystems, with a preference for low-water crops like olives and oats. Challenges such as pests, fires, and climate change further threaten these ecosystems, necessitating comprehensive strategies for resilience and sustainability.

Yaşar Selman Gültekin et al. focus on the sustainable management of Karduz Upland (Turkiye), emphasizing the importance of multiple stakeholders, including forest villagers, the General Directorate of Forest, and the Ministry of Culture and Tourism. The study aims to analyse these stakeholders through the lenses of legislation, sustainable forest management, and ecotourism. Karduz Upland is characterized by its mountainous terrain, which supports pastoralism, winter tourism, and forestry activities managed by the public sector. However, the region faces various conflicts that impact social, economic, and environmental aspects. By utilizing stakeholder analysis and typology, the study seeks to identify and propose effective solutions to the conflicts present in the area. This approach will enhance the understanding of peripheral traps and facilitate the exploration of potential solutions, guiding the stakeholders toward desirable futures. The overarching goal is to develop a framework that balances the diverse interests of the stakeholders while promoting sustainable practices in this ecologically sensitive upland region.

Oksana Pelyukh focuses on the Skolivski Beskydy mountain range in western Ukraine, part of the Eastern Beskids within the Outer Eastern Carpathians. This region is significant for tourism and recreation, supported by developed infrastructure in nearby cities. However, it faces several challenges, including high unemployment, low wages, and significant labour migration. Traditional sectors such as sheep and dairy farming have nearly vanished, alongside a decline in local crafts. Educational institutions struggle with low enrolment and inadequate transportation for students. Key issues identified include underdeveloped transport infrastructure, weak medical facilities, and ecological concerns like the drying of spruce forests and illegal logging. The study underscores the need for integrated approaches and coordinated cross-sectoral policies to tackle demographic, economic, and ecological challenges in mountainous areas. A specialized program is essential to create frameworks that enable regional and national initiatives to address these challenges and foster cooperation among various mountain programs. Such collaborative efforts can be implemented through "place-based policy" strategies to effectively overcome periphery traps and promote sustainable futures in mountainous regions.

METHODOLOGY

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1. The case study approach and theoretical framework

As this book is a collection of case studies, representativeness in the statistical sense is not the primary objective. Rather, the geographical breadth provides a basis for storytelling, contextual understanding and the identification of commonalities and contrasts across diverse social-ecological systems. By bringing together local experiences from different countries and mountain ranges, the collection illustrates how certain challenges – such as depopulation, economic marginalisation, changing land use, governance difficulties, climate change and infrastructure deficits – emerge in different forms and under different historical and geographical conditions.

The theoretical framework draws on the concept of centre–periphery relations, which highlights unequal access to resources, services, decision-making and opportunities between central and peripheral areas, and on the periphery trap, referring to processes through which such disadvantages may become self-reinforcing. The case studies therefore provide context-specific insights while enabling the identification of recurring challenges, drivers and potential pathways towards desirable futures.

The purpose of this catalogue is not to synthesise or generalise the experiences presented across the individual cases, but primarily to document and preserve the local experiences, observations and analyses prepared by the case study authors. The catalogue therefore presents the cases largely in the form in which they were developed by their contributors. Some cross-case analytical work based on this material has already been undertaken by Poprženović (2025) and by Sarkki et al. (2026) who use the case material to develop a cross-case conceptual interpretation of rural shrinkage and polytrap dynamics.

2. Geographical scope and representation

The case studies cover a broad geographical range of European mountain areas, extending from the Iberian Peninsula and the western Mediterranean to the Nordic Arctic and from Ireland and the Alps to the Balkans, Carpathians and Turkey (Fig. 1). The 25 cases represented in the collection are distributed across a diverse set of mountain ranges and landscapes, including the Alps, Carpathians, Tatra, Eastern Beskids, Dinaric and Balkan Mountains, Scandinavian mountain areas, the Iberian ranges, and several

mountain and upland areas of Turkey. The cases also span a wide latitudinal gradient, from approximately 36.6° N in southern Spain to 69.9° N in northern Finland, illustrating the markedly different environmental, demographic and socio-economic contexts in which marginalisation occurs. The geographical distribution is intentionally heterogeneous, with several cases from some countries and mountain systems and single cases from others.



Fig. 1 Geographical distribution of the 25 case studies

3. Data collection

The information from the case studies were collected through a structured online survey. developed within the MARGISTAR COST Action and introduced to the Management Committee during the first MARGISTAR Management Committee meeting in Utsjoki, Finland. Case studies were collected through an open invitation to members of the MARGISTAR network. The network brings together over 200 researchers and practitioners from more than 30 European countries, representing a broad range of disciplines, including governance and political science, environmental sciences, geography, regional planning, economics and business. Interested contributors were provided with an online template and approximately six months to document their selected mountain-area cases. Following this process, 26 case studies were submitted. One case study was excluded following the withdrawal of the case study provider and because the survey

had not been sufficiently completed. Thus, 25 case studies remained, which were subsequently reviewed, updated and finalised for inclusion in the catalogue.

The questionnaire was organised into several thematic sections. In total, the survey contained up to 44 questions (of which some were conditional on previous answers), of which most were open- ended. The question concerning the duration of the problems additionally recorded the number of years for which the principal challenge had been acute. The initial questions collected metadata and contextual information, including the case-study title, authors and affiliations, precise geographical location, country, and a short description of the study area. Subsequent sections addressed the nature and duration of the challenges, including the key problems addressed, relevant challenge categories, the length of time for which the problems had been acute, and the groups negatively or positively affected. Particular attention was given to centre–periphery relations and the concept of the periphery trap, including questions concerning whether the case was linked to unbalanced centre–periphery relations, how these relationships were manifested, and how the periphery trap could be understood in the local context.

The questionnaire also explored the level of conflict, previous attempts to address the identified challenges, and the perceived success of these interventions. Case-study providers were asked to identify potential research-related contributions and proposals, as well as desirable futures and the visions of relevant actors. The final sections focused on lessons that could be learned from the case study, its relevance to the UN Sustainable Development Goals (SDGs), supporting references and photographic documentation.

4. DEMATEL analysis

After the case study data submission process ended, we launched the DEMATEL (Decision-Making Trial and Evaluation Laboratory) analysis to quantitatively explore the relationships among the main challenges and drivers identified in the case studies. In particular, the DEMATEL method was used to distinguish factors that primarily drive change from those that are more strongly influenced by other factors. Rather than considering each challenge independently, DEMATEL examines the extent to which one factor influences another. The method therefore helps identify factors that have a strong role in shaping the system, as well as factors that are mainly consequences of other conditions. The results can be presented graphically as a cause-and-effect diagram (impact relation map). This provides a way of looking beyond a simple list of challenges and helps reveal how different economic, social, demographic, environmental, political and resource-related factors interact with each other.

Based on the case study descriptions, a common set of 10 groups of challenges was developed, with particular reference to the responses to Question 3.4: "What are the fundamental causes and drivers for the challenges experienced in your case study?" The groups comprised (1) Economic Challenges, (2) Infrastructure and Service Gaps, (3)

Geographical and Demographic Isolation, (4) Cultural and Social Integration Issues, (5) Historical and Political Legacies, (6) Environmental and Climate Drivers, (7) Policy and Governance Issues, (8) Technological Gaps, (9) Tourism and Land Use Conflicts, and (10) Resource Management Challenges. Each group contained a number of more specific factors derived from the case studies (Table 1).

Table 1 Groups of challenges and specific factors used in DEMATEL

No.	Challenge group	Specific factors
1	Economic Challenges	• Lack of economic opportunities• Limited resources• High outmigration• Small-scale agriculture• Economic disparities• Privatisation malversations• European economic crisis (2008–2016)• Low revenue in shepherding• Competing uses of river water• Abandonment due to economic changes• Brain drain• NEET levels (not in education, employment or training)
2	Infrastructure and Service Gaps	• Inadequate infrastructure• Limited access to essential services• Inadequate broadband infrastructure• Delayed broadband implementation• Scarcity of communication infrastructure• Polarisation of services towards urban centres• Low territorial maintenance• Lack of infrastructure in remote areas
3	Geographical and Demographic Isolation	• Peripheral and mountain location• Geographical isolation• Low population density• Weak demographic growth• Population ageing• Depopulation of villages• Historical abandonment of villages• Geographical handicaps
4	Cultural and Social Integration Issues	• Different cultural backgrounds• Language differences• Strong social networks in mountain communities• Limited exposure to diverse cultures• Social and ethnic tensions• Difficulty integrating into local communities• Loss of traditional agriculture and practices
5	Historical and Political Legacies	• Historical legacy of the Austro-Hungarian military frontier• Socialist legacy• Expulsion of German inhabitants• Farm fragmentation• Flawed ideology for mountainous area development• Legacy of agricultural overpopulation
6	Environmental and Climate Drivers	• Climate change• GHG emissions• Land-use abandonment (agriculture, forestry)• Rewilding phenomena• Accelerating climate change in the Arctic• Natural disasters (windstorms, droughts)• Wildfires
7	Policy and Governance Issues	• Lack of cohesive territorial strategy• Misuse of funds• Insufficient allocation of funds• Institutional/administrative changes• Zonation and governance issues (e.g. land-use conflicts)• Incoherent policies (e.g. pastoralism vs. carnivore protection)
8	Technological Gaps	• Digital divide (urban–rural)• Delayed broadband infrastructure investment• Outdated internet and technology standards (NGA threshold changes)
9	Tourism and Land-Use Conflicts	• Uncontrolled tourism• Conflicts due to tourism (e.g. traffic jams, mass tourism)• Loss of cultural landscapes due to tourism• Land-use conflicts• Pressure on natural resources from tourism
10	Resource Management Challenges	• Ownership fragmentation (land, forest)• Reduced interest in agriculture and forestry• Scarcity of water and soil fertility• Lack of interest in managing natural resources• Environmental degradation (e.g. hydropower effects)

The DEMATEL method consisted of several steps. First, case-study providers were asked to select the factors that were relevant to their particular case. To facilitate this process, a

dedicated Excel-based DEMATEL template was developed (Fig. 2). The case-study providers first selected the relevant factors by ticking the corresponding tick boxes. Based on these selections, the Excel file automatically generated a dynamic comparison table (influence matrix) containing only the factors relevant to the particular case study.
Second, the selected factors were compared pairwise in terms of their direct influence on one another. A five-point scale was used: 0 = no influence, 1 = low influence, 2 = moderate influence, 3 = high influence, and 4 = very high influence. Thus, the assessment did not ask whether a factor was simply present, but whether and to what extent one selected factor directly influenced another. This approach reduced unnecessary comparisons between factors that were not considered relevant to a particular case and allowed the analysis to be adapted to the specific circumstances of each case study.

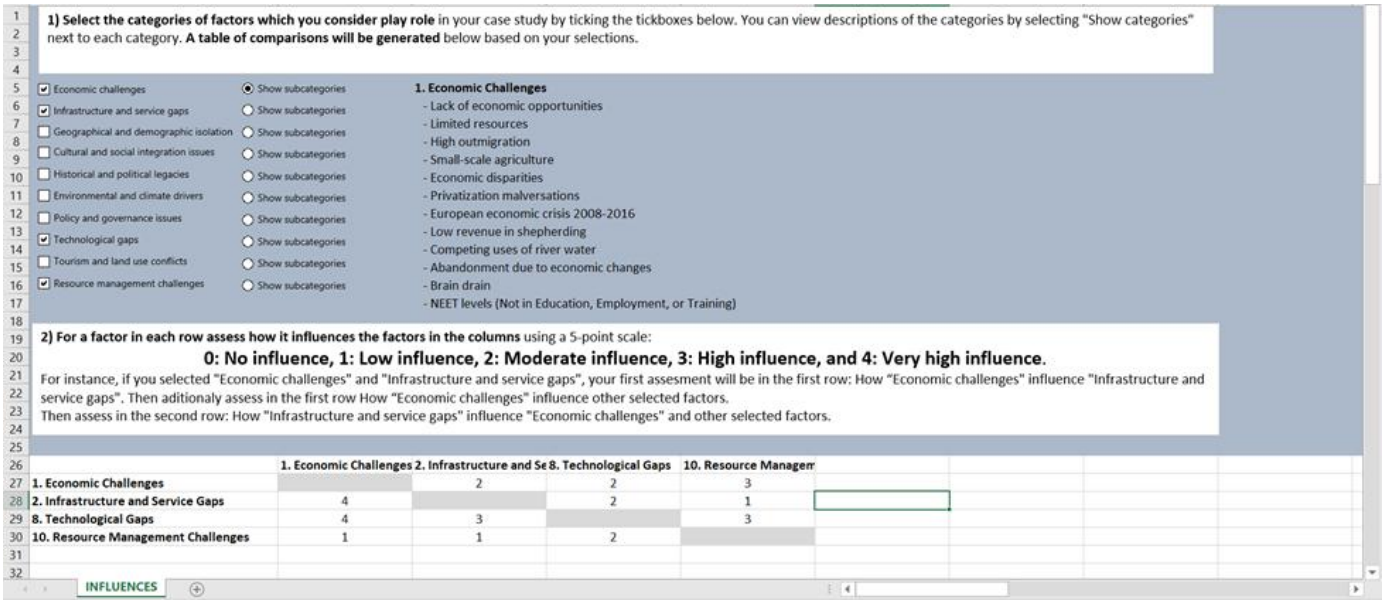

Fig. 2 Excel-based DEMATEL template used to evaluate the impact and prominence of 10 groups of factors

The resulting direct-influence matrix was then normalised to make the influence scores comparable within the matrix. The analysis subsequently incorporated both direct and indirect relationships between factors to produce a total-influence matrix.

The final stage involved determining the prominence and net influence of each factor following the DEMATEL procedure (Gabus and Fontela 1972; Si et al. 2018, Šmidovnik and Grošelj, 2023). Prominence represents the total influence associated with a factor, including both the influence it exerts on other factors and the influence it receives from them. A high prominence value indicates that a factor plays an important role in the overall system, regardless of whether it primarily acts as a cause or an effect. Net influence is calculated as the difference between the influence a factor exerts and the influence it receives. Factors with a positive net influence are therefore interpreted as

causal factors or drivers, whereas factors with a negative net influence are interpreted as effects, meaning that they are more strongly influenced by other factors.

The results can subsequently be visualised in an impact relation map, in which the factors are positioned according to their prominence and net influence. Such a map provides a concise overview of the structure of challenges within a case study and helps identify the factors that may have a particularly important role in driving other challenges. DEMATEL therefore complements the descriptive case-study information by providing a structured way to examine the interdependencies among the challenges identified by the case-study providers.

Not all case study providers conducted the analysis. Moreover, in case of only two factors with equal impact on each other, the DEMATEL analysis could not be conducted and the functional analysis was only descriptive.

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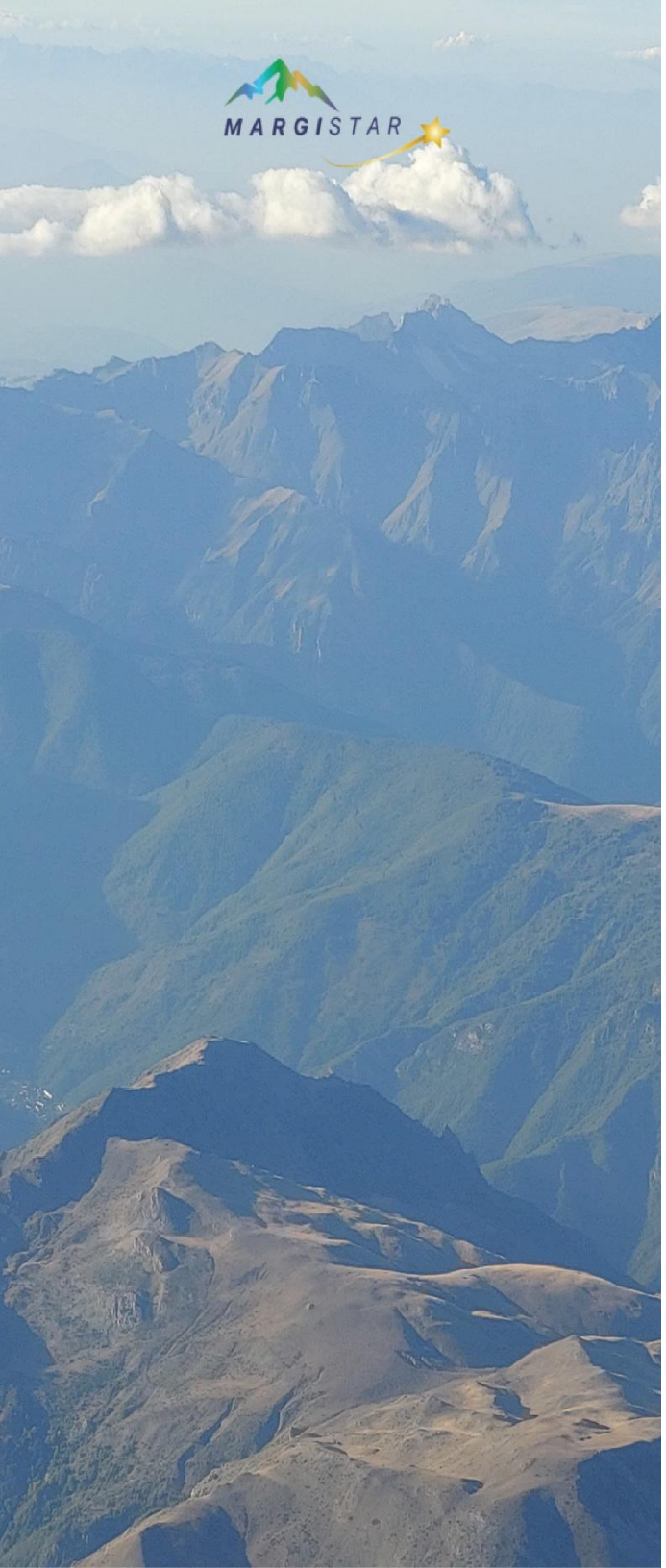
THE CATALOGUE



Immigration as an opportunity or a threat in mountainous communities

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1 Case study location

47° 13' 5.16"N, 9° 53' 2.51"E



2 Country

Austria

3 For how long has the challenge been acute?

10 years

4 Challenge categories

Socio-cultural challenges: Demography, migration (out/in) and/or social and ethnic tensions.

5 Relevant UN Sustainable development goals

SDG8: Decent work and economic growth.
SDG10: Reduced inequalities.
SDG15: Life on land.

6 Short description of the case study location

Vorarlberg is a mountainous province in western Austria, covering 2,601 square kilometres and sharing borders with Switzerland, Liechtenstein, and Germany. It is divided into two NUTS-3 regions, Bludenz-Bregenzerwald and Rheintal-Bodenseegebiet. In both regions, more than 50% of the surface area is covered by mountain areas, and more than half of their populations reside in these areas. The regional GDP of both regions is well above the Austrian average. In terms of economic sectors, the primary sector contributes minimally (1% or less) to overall value added and employment, while the secondary sector accounts for well above-average shares of gross value added and employment (Machold and Bauchinger, 2020).

Vorarlberg is one of the regions in Austria that has experienced strong immigration flows. The main waves of immigration occurred from the late 19th century onwards (Häfele, 2016), with a particularly significant influx of third-country nationals (TCNs) from countries affected by war in 2015 and 2016 (Machold et al., 2021). Since the Second World War, immigration has been an important component of the overall positive demographic development in Vorarlberg, and the population is younger than the national average (Machold and Bauchinger, 2020).

The case study focuses on three municipalities – Frastanz, Schruns, and Innerbraz – all located in the south of Vorarlberg, which together constitute a more rural and mountainous part of the province. Schruns and Innerbraz rely on tourism as a main source of income, while Frastanz is more industrialised and densely populated and therefore has a long history of labour migration. Between 2010 and 2020, the total number of third-country nationals (TCNs) rose consistently across all three municipalities. The peak influx of TCNs occurred in 2016 and 2017 in Innerbraz and Frastanz, while in Schruns, it peaked in 2019 (Machold et al., 2021).



Fig. 1 Municipality of Schruns

Photo: Ingrid Machold

7 Key challenges in the case study

Depopulation is a common phenomenon in many mountainous regions of Austria and can lead to an imbalanced demographic structure. In particular, younger people and women tend to move to central areas, resulting in a declining and ageing population and a reduction in the number of working-age individuals, which negatively affects local economies and services. Immigration can serve as a potential response to this depopulation trend. For years, migrants have played a crucial role in Vorarlberg's workforce (Gruber et al., 2021). However, immigration to the mountainous areas of Vorarlberg faces multiple challenges, not only because of the complex processes of integration and inclusion but also due to geographical isolation (Machold et al., 2023). Integrating forced migrants into host communities can be challenging because of cultural differences and language barriers. In addition, limited social networks and support structures in mountainous areas can make

it difficult for forced migrants to establish connections and feel included. Hence, this study primarily focuses on identifying and analysing local structures that could facilitate and support social integration in three rural and mountainous communities with distinct socioeconomic characteristics. It also aims to identify specific challenges and needs in rural areas and explore opportunities for strengthening social integration processes (Machold et al., 2022a).

8 A brief summary: What is this case study about?

Immigration can be viewed as both an opportunity and a challenge for mountainous communities. It can counteract depopulation and potentially contribute to more balanced age structures, but it may also create challenges related to social integration, pressure on local resources, and potential conflicts. Given its long history of international labour migration, Vorarlberg provides an ideal setting for studying the implications of immigration in mountain areas. The main aim of the case study was to analyse the processes and patterns of social integration among asylum seekers, refugees, and local inhabitants in rural and mountainous communities. This short report provides a summary of the MATILDE[1] research project.

9 The fundamental causes and drivers for the challenges

Different causes and drivers contribute to the socio-cultural challenges associated with immigration in mountain communities. Immigrants often bring diverse cultural backgrounds, practices, and traditions that differ from established norms in the mountainous areas of Vorarlberg. This can lead to misunderstandings, tensions, or difficulties with integration. Communication and exchange are fundamental aspects of integration, but language differences can hinder effective interaction, access to services, and the ability to form relationships within the community.

At the same time, remote mountain communities often have strong social bonds and well-established networks. Newcomers may find it challenging to gain access to these close-knit social networks, potentially leading to feelings of isolation and exclusion. However, where local structures facilitate interaction between local residents and newcomers, opportunities for inclusion are strengthened. In particular, relationships with local gatekeepers can provide an entry point into local networks

[1]The research project MATILDE (Migration ImpAct assessment To Enhance Integration and Local Development in European rural and mountain regions) has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 870831.

and facilitate participation in social activities, as well as support in finding employment and accommodation. Mountain communities have a homogeneous population with less exposure to diverse cultures. This lack of exposure might make it harder for immigrants to feel accepted. Sometimes, limited resources, both in terms of jobs and community support, hinder the ability of these areas to provide adequate assistance or opportunities for newcomers.

9a A cause-and effect diagram identifying key drivers and their interrelationships

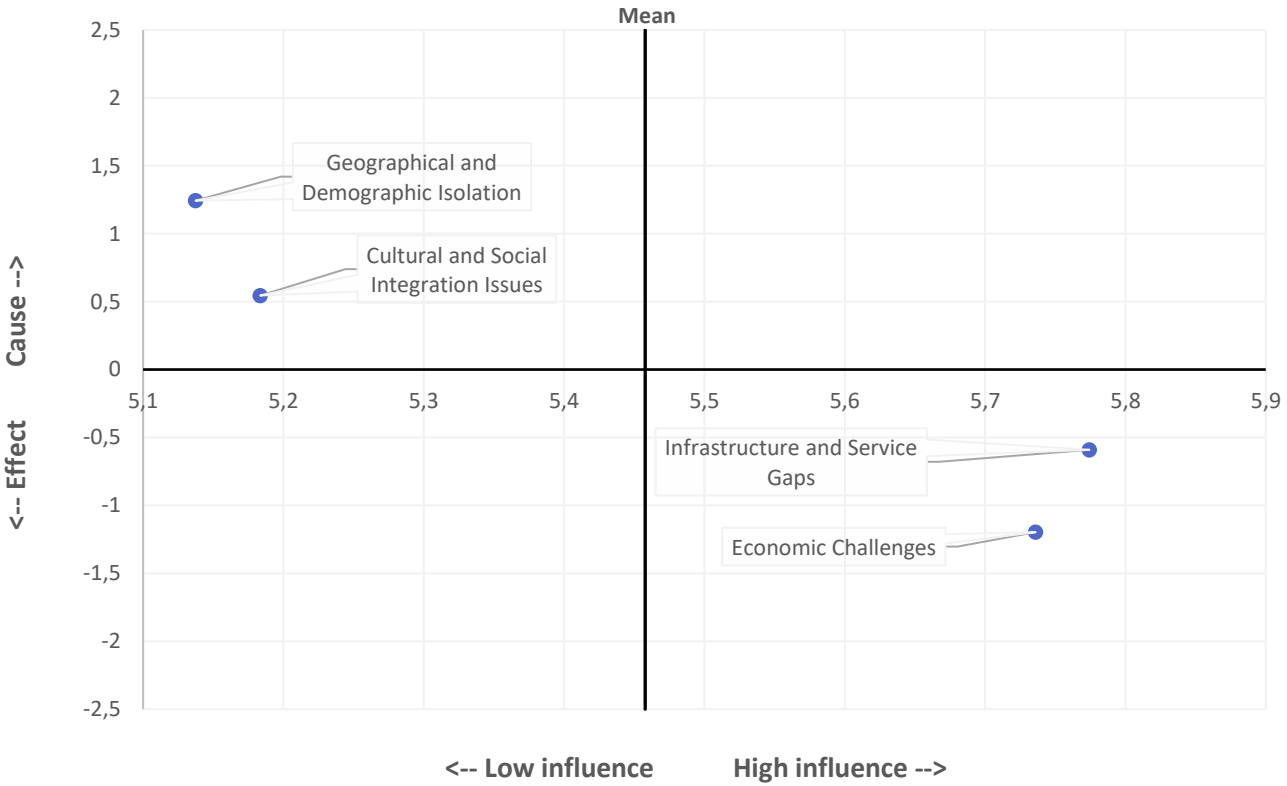

Fig. 2 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

The results indicate that Geographical and Demographic Isolation and Cultural and Social Integration Issues are causal factors with relatively low prominence, suggesting that they act as underlying drivers of the system. In contrast, Economic Challenges and Infrastructure and Service Gaps are identified as effect factors with high prominence, indicating that they are highly interconnected within the system but are mainly influenced by other dimensions. The findings suggest that geographical isolation and social integration constitute the principal driving forces, whereas economic and infrastructure-related challenges represent the main outcomes of these underlying causal relationships.

10 Who is negatively impacted by the challenge, and how?

The case study region of Vorarlberg in Austria is an area that has been characterized by diverse immigration experiences in the last century. The rising influx of migrants from diverse cultural and geographic backgrounds has accentuated challenges experienced by the local population and policymakers. This recognition of increasing migrant numbers and diversity, along with a political commitment to address the complexities affecting community life, has elevated immigration as a pivotal issue for regional decision-makers (Machold et al., 2023). Immigration poses challenges related to integration, cultural differences, strain on infrastructure, competition for resources, and social tensions. The challenge of integrating migrants into host communities primarily affects both the existing local population and the newcomers themselves. Locals might feel a sense of cultural change or perceive a loss of tradition as new practices and perspectives are introduced. As well as there are concerns about the strain on resources or services due to an increased population. On the other hand, newcomers face difficulties in being accepted or integrating into the established community, which can lead to feelings of isolation, exclusion, or challenges in finding employment and accessing social support networks and in migrating to more central and densely populated areas.

11 Who is positively impacted by the challenge, and how?

Over the last two decades, positive net international migration has contributed to a balanced and, in some cases, even increasing population in Austria, including in many rural and mountainous regions. Despite immigrants' preference for larger

cities, almost all rural and mountainous areas have experienced a positive net balance of international migration, which in many regions has been sufficient to compensate for population losses resulting from natural decrease and a negative internal migration balance (Machold & Dax, 2019). In the case study region, immigration has contributed to vibrant and dynamic communities, a more balanced age structure, an increased share of working-age residents, and population growth. New residents have stimulated economic activity by establishing businesses and working in existing local industries, particularly in-service sectors. They have also contributed to social activities aimed at supporting (forced) migrants and revitalising exchange and interaction between local residents and migrants.

Immigration to mountain communities has also had positive effects for forced migrants themselves. It has provided opportunities to start afresh, build a new life, and potentially access better living conditions, education, and healthcare for themselves and their families. These opportunities have been particularly significant for those who have been able to establish connections with local social networks.

12 Does the case study link to unbalanced centre-periphery relations?

No.

13 In what ways are the centre-periphery relations unbalanced?

N/A.

14 The definition of the periphery trap in this case

Immigrants, especially those with low skill sets or language barriers, are facing challenges in integrating into communities and finding suitable employment. As a result, they become dependent on regional financial support rather than actively contributing to regional growth. Furthermore, inadequate support services like language classes, cultural integration programs, or social support networks, hinder immigrants' ability to integrate. This is even reinforced by poor public transportation facilities. These challenges perpetuate a cycle where immigrants struggle to integrate, find suitable

employment, or access essential services, thereby becoming trapped in a socioeconomic periphery that may cause them to relocate toward urban areas.



Fig. 3 Social mapping with two refugees

Photo: Rudi Summer

15 The level of conflict

Challenges faced by forced migrants have the potential to increase the level of conflict in the case study region.

16 Description of the level of conflict related to the case study

Immigration can have significant economic effects on mountain regions, but it also has important implications for societal change, as the increasing social diversity of people with different origins and cultural and linguistic backgrounds affects host communities (Machold and Dax, 2017). Local populations may perceive immigrants as a threat to their identity, culture, or

economic stability, potentially leading to heightened tensions and conflicts. At the same time, when people from different geographical and cultural backgrounds come together, differences in traditions, beliefs, values, and cultural practices can result in misunderstandings or tensions within and between communities. Limited resources, such as employment opportunities and access to services, may also create competition between immigrants and local residents, further contributing to social tensions and conflicts.

17 Efforts to solve the challenge(s)

In some mountainous municipalities, local volunteers have engaged in various activities with forced migrants, including language courses, sporting activities, and opportunities for socialising. Other initiatives have had a more institutional background, such as "Neighbourhood Aid" and "Naflahus–Third Space". These initiatives highlight the importance of community-based action in facilitating the integration of migrants.

The "Neighbourhood Aid" project, led by the non-governmental organisation Caritas Vorarlberg from 1993 to 2016 and subsequently continued as "Integration Activities" from 2017 onwards, aimed to support asylum seekers by providing employment opportunities and modest remuneration while they waited for recognition interviews. Caritas matched asylum seekers with local residents in need of household or gardening assistance, providing hourly remuneration. The initiative facilitated cultural exchange, challenged stereotypes, and fostered friendships between asylum seekers and local residents, which subsequently helped asylum seekers find employment and housing. Despite its success, the initiative faced legal constraints in 2016 due to violations of Austrian legislation, leading to modifications. Under the "Integration Activities" programme, asylum seekers can still undertake small jobs for federal, state, and local government institutions, as well as for private individuals with social needs (Bauchinger and Machold, 2022).

The "Naflahus–Third Space" initiative, launched by the local authority and volunteers in 2016 and continuing to the present, aims to foster social cohesion by providing a welcoming space for refugees, immigrants, and the local community. The initiative offers a low-threshold meeting place that facilitates various activities and language learning, as well as assistance with challenges such as finding employment and housing. Initially attracting short-term residents, it now predominantly engages unemployed refugee women aged 40–50. Through volunteer-led activities, the initiative has established social connections and provided a regular structure, particularly benefiting unemployed women. Despite its innovative and

inclusive approach, greater awareness and sustained funding are needed to ensure its long-term effectiveness and the sustainability of volunteer engagement (Bauchinger and Machold, 2022).



Fig. 4 Soccer club

Photo: Ingrid Machold

18 Research-related proposals for potentially solving these challenges

Research could focus on various aspects of immigration to address the challenges faced by mountainous regions. Collaborative research involving key stakeholders, including immigrant communities, local authorities, and academic institutions, could contribute to comprehensive solutions that promote the harmonious coexistence of diverse populations. Identifying effective strategies for integrating newcomers into these communities, while considering cultural differences, language barriers, and existing social networks, is critical. Case studies and surveys could help identify successful integration

models, while research into interventions addressing social isolation and mental health challenges could support a stronger sense of belonging among both immigrants and local populations.

Research on ways to stimulate economic development and create employment opportunities that match migrants' skills could benefit both newcomers and local residents by reducing competition for jobs and fostering cooperation. In addition, assessing existing policies and developing adaptive policy frameworks that reflect the specific challenges of mountainous regions could provide evidence-based guidance for policymakers and contribute to creating more inclusive and supportive environments for migrants in these settings.

19 Visions of desirable futures of the involved actors and the source of information

During the MATILDE project, two roundtable discussions were held. The first involved four stakeholders from public administration, asylum and refugee care, and a former mayor, together with the case study team. The second was attended by 23 participants, including regional decision-makers, mayors, public administration officials, asylum and refugee care personnel, volunteers, forced migrants, and an interpreter.

The discussions focused on how to harness the potential for social integration in rural municipalities. Participants strongly supported establishing a contact person for integration issues in each municipality. They emphasised that social integration should remain an important issue for municipalities and that personal and reliable links between different actors, stakeholders, and initiatives are crucial. Such links can help ensure that those involved understand local circumstances and institutional frameworks. Participants also highlighted the importance of the newly established regional coordinators for refugee care in Vorarlberg, which are particularly important in building up awareness, know-how, knowledge exchange, networking, and support as well as accompaniment, particularly for the smaller municipalities in mountain areas.

Creating inclusive spaces for social interaction between migrants and local residents was also highlighted as crucial for fostering a sense of belonging and well-being. Such efforts are important for local development and may influence migrants' decisions to remain in or leave rural areas after acquiring residence rights. The discussions emphasised the potential benefits of retaining refugees within local communities for both municipalities and refugees. For municipalities, these include population growth, stronger connections between newcomers and local residents, and greater diversity in local businesses.

For refugees, remaining in local communities can contribute to improved well-being through better living conditions, access to quality education, and a healthier environment (Machold and Bauchinger, 2022).

20 Lessons-learned from the case study

In rural and mountainous areas with declining and ageing populations, immigration can provide a means of counteracting negative trends associated with outmigration and an opportunity for local development. As the case study results showed, immigration has had a positive impact on meeting labour market needs in Vorarlberg, particularly in the technical sector. However, harnessing the potential of forced migrants in rural and mountainous areas requires strengthening their integration into local communities.

The case study highlighted the important role of social relationships between forced migrants and the local population in processes of social integration, as well as the role of local structures in fostering such connections. "Gatekeepers" can help forced migrants establish connections with local communities by facilitating access to relevant positions and networks within the receiving society. These relationships have numerous practical benefits, such as facilitating access to employment and housing, but they also have fundamental value in their own right. By creating social bridges, these connections can also support language acquisition and migrants' efforts to find employment and housing. In some cases, social connections may even contribute to securing migrants' continued residence in Austria. Thus, diverse social contacts with local and regional gatekeepers, volunteers, neighbours, friends, and others can serve as an "anchor" for the permanent settlement of forced migrants in rural and mountainous municipalities (Machold et al., 2022b).

The case study also highlighted the crucial role of regional coordinators in supporting refugees. Regional authorities need to take a more proactive approach to connecting local and regional stakeholders and perspectives (Machold et al., 2023).

Overall, whether immigration is perceived as an opportunity or a threat depends on how effectively communities manage the associated challenges and harness its potential benefits.

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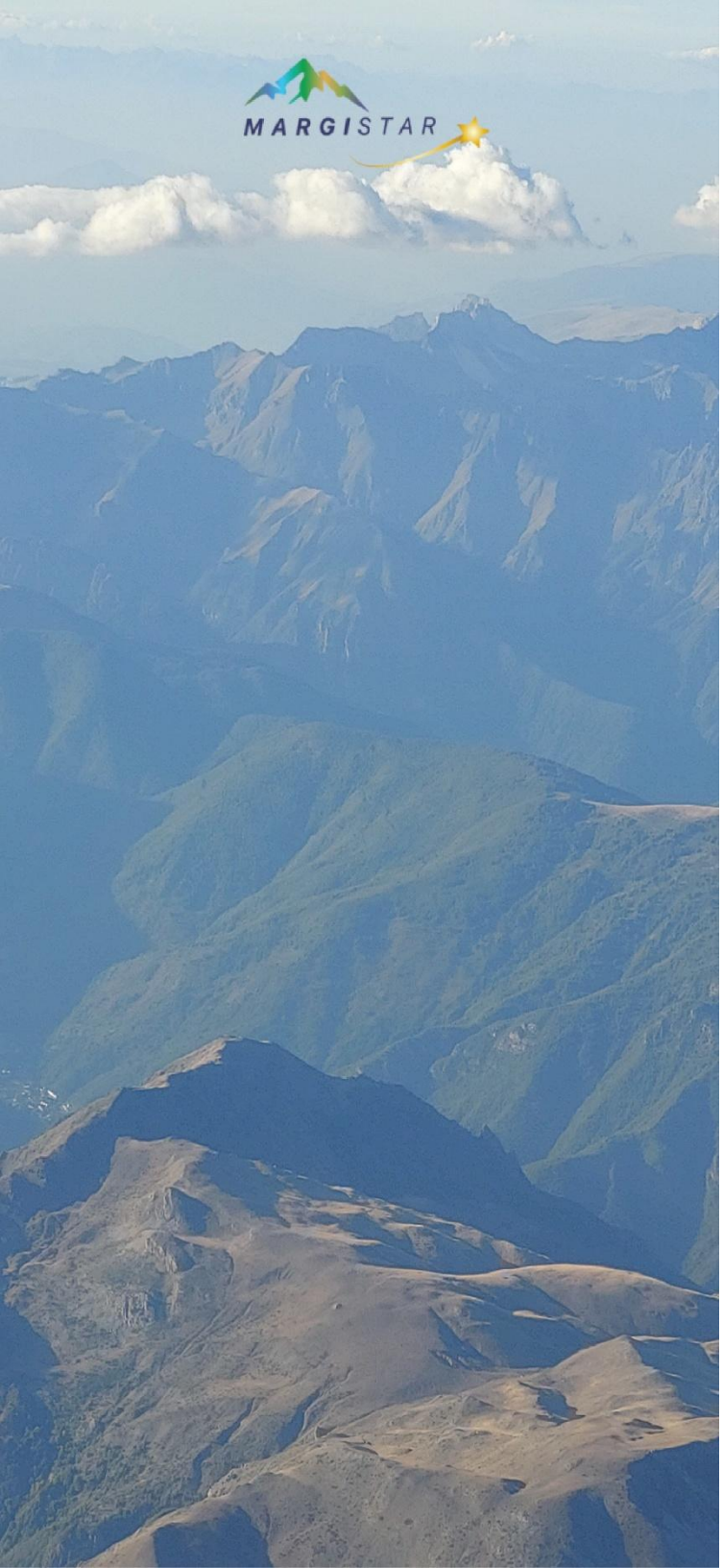

Risovac: marginalised location in the heart of Grmeč, Bosnia and Herzegovina

Violeta Santrač[a]

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1 Case study location

44° 43' 48.29"N, 16° 13' 5.05"E



2 Country

Bosnia and Herzegovina

3 For how long has the challenge been acute?

50 years

4 Challenge categories

Socio-cultural challenges: Demography, migration (out/in) and/or social and ethnic tensions. Economic challenges: Economic problems, poverty, and lack of employment and education opportunities. Governance challenges: e.g., policies made at national and/or EU levels, top-down decision-making, lack of local participation in decision-making. Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods. Service-related challenges: Poor cultural, social and/or commercial services. Environmental challenges: Climate change, biodiversity loss, and/or ecological destruction.

5 Relevant UN Sustainable development goals

SDG3: Good health and well-being, SDG4: Quality Education, SDG9: Industry, innovation, and infrastructure, SDG12: Responsible consumption and production, SDG15: Life on land, SDG16: Peace, justice, and strong institutions, SDG17: Partnership for the goals.

6 Short description of the case study location

Nestled beneath the imposing stone formation of Risovačka greda, a branch of the Grmeč Mountains, are two notable caves. One, located in the Vodice area at an altitude of 600 metres, was once a sinkhole of the river in Risovac. Its formation resembles that of a sinkhole, although its position suggests a more straightforward cave structure. The other cave serves as a perennial sinkhole, continuously receiving water even during the driest periods. Local history highlights the importance of collecting atmospheric water during periods of snowfall and rainfall for household use. This water was stored in structures called "čatrnja", which are similar to concrete cisterns.

Despite its natural riches, Risovac faces significant demographic challenges. According to the 2013 census, the community had only 57 residents, a stark contrast to its more prosperous past, when it had 649 inhabitants in 1971. Depopulation is a growing concern, with local representatives stressing the need for an accurate population count ahead of the next census and estimating that only around 33 inhabitants currently remain.

In light of these challenges, there is a pressing need for sustainable development initiatives aimed at revitalising Risovac. Preserving its natural resources while addressing demographic decline requires strategic planning and community engagement. Harnessing the potential of Risovac's abundant water resources and fostering economic opportunities could contribute to its long-term viability. Strengthening residents' sense of ownership and pride in the area could further support efforts to address demographic decline and promote the community's future development.

7 Key challenges in the case study

Demographic decline: Risovac has experienced a significant decline in population over the years, posing challenges to sustaining community initiatives and local development efforts.

Depopulation: The dwindling population directly affects the community's economic and social dynamics, creating a need for strategies to reverse this trend and attract new residents.

Need for accurate census data: Accurate population data are essential for planning and implementing effective development projects. Establishing the actual number of residents before the next census would provide a more reliable basis for planning.

Sustainable resource management: Despite its abundant natural resources, including forests and water, Risovac needs sustainable management practices to ensure their long-term availability and ecological preservation.
Economic revitalisation: Addressing demographic decline requires initiatives to revitalise the local economy and create opportunities for residents, thereby contributing to a more sustainable future for Risovac.
Community engagement: Engaging the local community in project planning and implementation is essential for the success and sustainability of development initiatives. Building a sense of ownership and pride among residents can foster cooperation and support for ongoing efforts.

8 A brief summary: What is this case study about?

As a Doctor of Veterinary Medicine with a background in science, I faced the challenge of understanding and contributing to the development of respect for life and social communication in a remote and isolated location. While I have expertise in livestock production, my particular interest lies in exploring how beekeeping can be promoted and sustained in remote and marginalised areas. I am motivated to support the promotion of natural beekeeping practices and the development of local food chains.

9 The fundamental causes and drivers for the challenges

Fundamental causes include outmigration, lack of economic opportunities, inadequate infrastructure, and limited access to essential services in Risovac.

9a A cause-and effect diagram identifying key drivers and their interrelationships

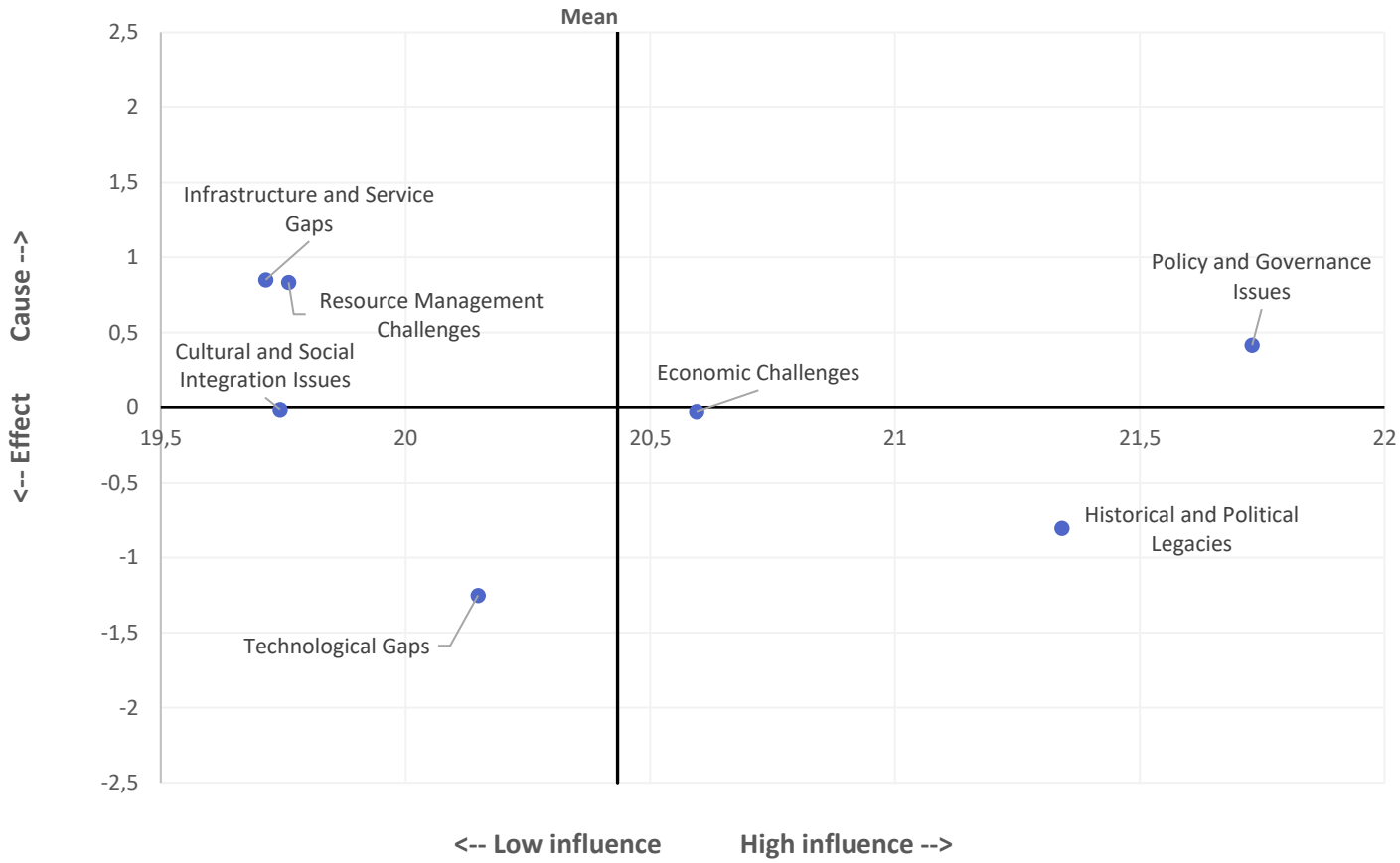

Fig. 1 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

The results indicate that Infrastructure and Service Gaps, Resource Management Challenges, and Policy and Governance Issues are causal factors, suggesting that they act as the main driving forces within the system. While Infrastructure and Service

Gaps and Resource Management Challenges exhibit relatively low prominence, Policy and Governance Issues shows high prominence, indicating that it is both a key driver and a highly interconnected factor. In contrast, Historical and Political Legacies, Technological Gaps, and Economic Challenges are identified as effect factors, reflecting dimensions that are primarily influenced by other factors. Among these, Historical and Political Legacies and Economic Challenges display high prominence, whereas Technological Gaps has relatively low prominence. Overall, the findings suggest that governance, infrastructure, and resource management constitute the principal driving forces, while historical, technological, and economic challenges represent the main outcomes of the system's causal relationships.



Fig. 2 Entrance to Risovac

Photo: Violeta Santrač



Fig. 3 Villagers in Risovac

Photo: Violeta Santrač

10 Who is negatively impacted by the challenge, and how?

Residents: The declining population directly affects the quality of community life and access to essential services.
Local economy: Depopulation reduces economic activity and limits opportunities for growth and investment.
Community services: With fewer residents, maintaining essential services such as schools and healthcare facilities becomes increasingly challenging.
Social cohesion: A shrinking population can reduce community engagement and weaken social cohesion.
Development projects: Accurate census data are crucial for securing funding and planning sustainable development initiatives.

11 Who is positively impacted by the challenge, and how?

Remaining residents: With fewer people, those who remain may experience less competition for resources and potentially stronger community cohesion.
Environmental preservation: Sustainable resource management practices can help preserve Risovac's natural environment, benefiting both current and future generations.
Economic development initiatives: Addressing demographic decline can create opportunities for economic revitalisation, potentially increasing employment and supporting business growth.
Community services efficiency: A smaller population may allow for more efficient delivery of community services and ensure that available resources are allocated effectively.
Long-term sustainability: By addressing demographic challenges, Risovac can work towards a more sustainable future and ensure the long-term viability of the community.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

We need more official data to examine this question in greater detail.



Fig. 4 Traditional beekeeping in Risovac

Photo: Violeta Santrač

14 The definition of the periphery trap in this case

The "periphery trap" in Risovac refers to its isolation, limited access to resources, and dependency on external support for development.

15 The level of conflict

In Risovac, conflicts arise from socio-economic factors like population decline, resource scarcity, and limited opportunities. Post-war disruptions, slow development, insufficient funding, brain drain, and global migration contribute to insecurity amid ongoing political tensions.

16 Description of the level of conflict related to the case study

Bosnia and Herzegovina, a less developed non-EU country in Europe, faces persistent socio-economic challenges stemming from political instability, the legacy of war, and regional economic disparities. These challenges are compounded by limited access to international funding and the ongoing outmigration of highly educated and skilled people. As a non-EU member, Bosnia and Herzegovina also has more limited access to some funding mechanisms, resources, and opportunities available to EU Member States, which can further constrain its development prospects. A useful source for information on development in Bosnia and Herzegovina can provide further insights into these challenges and the country's development prospects.

17 Efforts to solve the challenge(s)

The government of Bosnia and Herzegovina has implemented development programmes aimed at fostering economic growth and improving infrastructure in rural areas. These initiatives include investments in education, healthcare, infrastructure, and employment creation. However, their scale and implementation remain insufficient to address the challenges faced by rural communities. Progress is often slow, and projects may remain incomplete or fail to generate lasting impacts.

International aid and development assistance provide additional support, but such interventions are often short-term and project-based, limiting their potential to generate sustained, long-term impacts.

Local community engagement: Local community organisations and structures appear to be limited, which may constrain the capacity of residents to collectively participate in local development initiatives and advocate for their needs.



Fig. 5 Villagers in Risovac

Photo: Violeta Santrač

18 Research-related proposals for potentially solving these challenges

There is reason for optimism that natural resources can be managed responsibly rather than exploited. Moreover, successful case studies may demonstrate the potential for positive change and encourage individuals and organisations with a vested interest to use their influence to promote more substantial action.

19 Visions of desirable futures of the involved actors and the source of information

Conversations with local residents indicate that many are sceptical about the prospects for rapid revitalisation of the marginalised area. Over the years, they have gradually lost confidence in the potential for the area to be developed for the common good.

Realising the area's potential requires a well-prepared and strategically planned approach extending over at least a ten-year period.
Both academia and industry could recognise a shared interest in supporting marginalised areas such as Risovac by building on their natural, social, and development potential.
At present, I am unable to provide any relevant supporting documents. However, a more precise understanding of the situation would require further engagement with regional stakeholders to assess their willingness to participate in open science initiatives and broader social engagement.

20 Lessons-learned from the case study

The case study shows that periphery traps in locations such as Risovac arise from isolation, limited resources, and demographic decline. Potential solutions include strategic investment, community engagement, and sustainable development initiatives to strengthen resilience and unlock economic opportunities.
To strengthen local optimism, visible action in areas such as legislation, infrastructure, digital technologies, networking, media engagement, social science, heritage preservation, sport, and tourism is vital to enhance the attractiveness of Bosnia and Herzegovina's exceptional natural areas. Local beekeeping certainly has great potential and should be further promoted and supported.

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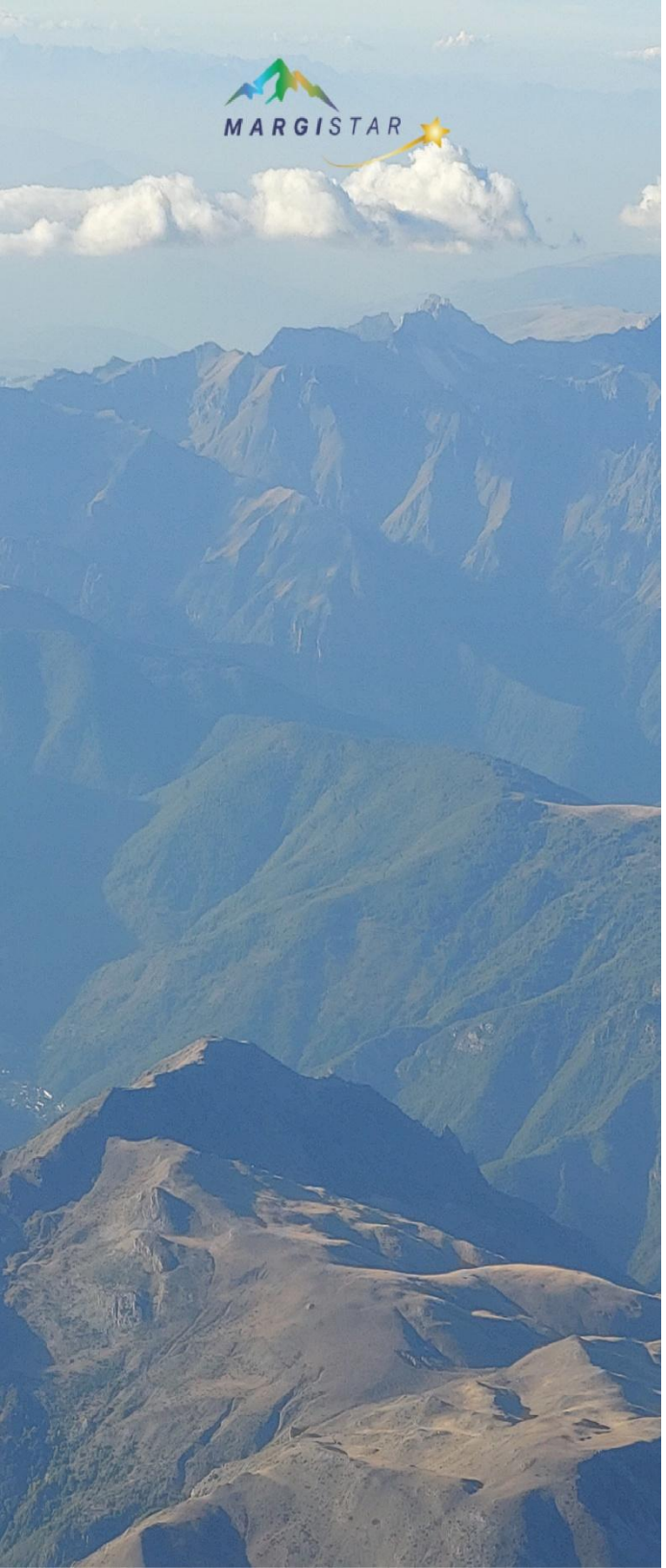

The (skipped) processes of modernisation, transition and post-transition in the Croatian mountain region of Lika

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1 Case study location

44° 32' 46.46"N, 15° 22' 31.22"E

2 Country

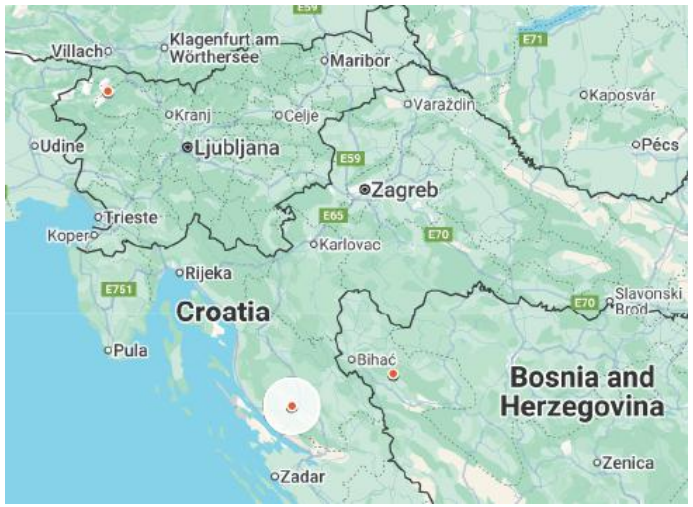
Croatia

3 For how long has the challenge been acute?

50 years

4 Challenge categories

Socio-cultural challenges: Demography, migration (out/in) and/or social and ethnic tensions.
Economic challenges: Economic problems, poverty, and lack of employment and education opportunities.
Governance challenges: e.g., policies made at national and/or EU levels, top-down decision-making, lack of local participation in decision-making etc.
Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Service-related challenges: Poor cultural, social and/or commercial services.
Geographical challenges: Geographical handicaps (including long distances, lack of connectivity, difficult terrains etc.) and/or natural handicaps (e.g., soil productivity, growing season).



5 Relevant UN Sustainable development goals

SDG1: No poverty.
SDG3: Good health and well-being.
SDG4: Quality Education.
SDG5: Gender equality.
SDG7: Affordable and clean energy.
SDG8: Decent work and economic growth.
SDG9: Industry, innovation, and infrastructure.
SDG10: Reduced inequalities.
SDG11: Sustainable cities and economies.
SDG12: Responsible consumption and production.
SDG16: Peace, justice and strong institutions.
SDG17: Partnership for the goals.

6 Short description of the case study location

Lika is a rural-peripheral area, although it represents a kind of link between the north and south of Croatia, i.e. between the NUTS regions of the Continental and the Coastal Region of Croatia. Furthermore, Lika (together with the wider area of the Croatian Highlands) is the link between the developed part of Central Europe and the underdeveloped area of Southeast Europe (potential EU Member States). The region is rural and has 35,451 inhabitants (2021), who live in two small towns (up to 12,000 inhabitants) and seven rural municipalities (up to 4,000 inhabitants). It is the most sparsely populated region in Croatia: 6.3 inhabitants/km² (a consequence of its mountainous character and long-term depopulation). Even the most populated units have a very low density – the town of Otočac (17.3 inhabitants/km²) and the town of Gospić (13.2 inhabitants/km²). Lika in 2021 had an extremely aging population, i.e. the age index of the population of Lika (197.8) was extremely high. The region is characterized by small local communities, concentrated in city and municipal centres. The population is mostly employed in the public sector and commutes on a daily basis. According to the criteria of the owners' age, family farms are old, and the owners often work part-time in the public sector and in agriculture. Due to the closure of the socialist planned industry, the environment has been preserved; land ownership is private, with an emphasis on small and fragmented plots, which is the legacy of family cooperatives. The state owns large plots of land, which is a legacy of the socialist period. The main stakeholders in the region are the state and the region, i.e. the local public sector institutions and the institutions responsible for the protection of the natural environment, while the entrepreneurial sector is mainly linked to the tertiary and service sectors.



Fig. 1 A panoramic view of the town and the surrounding rural landscape along the Novčica river

Photo: Josip Durdov

7 Key challenges in the case study

The emigration of young people, i.e. their staying in the cities where they attended school or studied, which is directly related to the lack of educational opportunities.

Precarious work, which is directly related to the migration of the younger population abroad for better working conditions.

Unplanned development of tourism (a balance between over-tourism and under-tourism in certain places), which is currently jeopardizing the ecological systems of specific places.

Local government that is not responsive to either bottom-up/top-down approaches or the community-based approach, resulting in the apolitical nature of young people.
The passivity of local communities themselves, linked to the legacy of the Homeland War and the legacy of the Military Frontier – the local community living on the "frontier of Europe". Therefore, the region also has a problem with migrants passing through its territory.

8 A brief summary: What is this case study about?

Rural Lika has remained undeveloped due to social, cultural, political and economic circumstances over the past two centuries. A negative consequence of such a scenario is demographic abandonment, while a positive effect is the preservation of the natural environment, which opens up an opportunity for the implementation of sustainable and neo-endogenous development concepts. The study of modernization processes from a historical perspective, post-transition processes and demographic changes from the perspectives of sociologists and geographers can be rounded off into an interdisciplinary whole. The scientific group concluded that these processes have skipped rather than changed rural Lika.

9 The fundamental causes and drivers for the challenges

The main causes and drivers of the challenges we faced in our case study were: the historical legacy of the Austro-Hungarian Military Frontier, which caused soldiers in this sub-region to grow up in family cooperatives under the supervision of the military authorities; the so-called agricultural overpopulation at the beginning of the 20th century, which was not resolved through the modernization of agricultural production but through emigration; the socialist legacy, which led to the fragmentation of farms due to the ideology of common ownership and the simultaneous decline of cooperatives; the transition period, which made this region suitable for malfeasance in the privatization of state-owned enterprises, causing a large number of unemployed people to move away; the economic crisis in Europe from 2008 to 2016 and the simultaneous accession of Croatia to the EU, which additionally affected the emigration of young people; and the pandemic, which made Lika a safe place to live and open to potential immigration by digital nomads.

9a A cause-and effect diagram identifying key drivers and their interrelationships

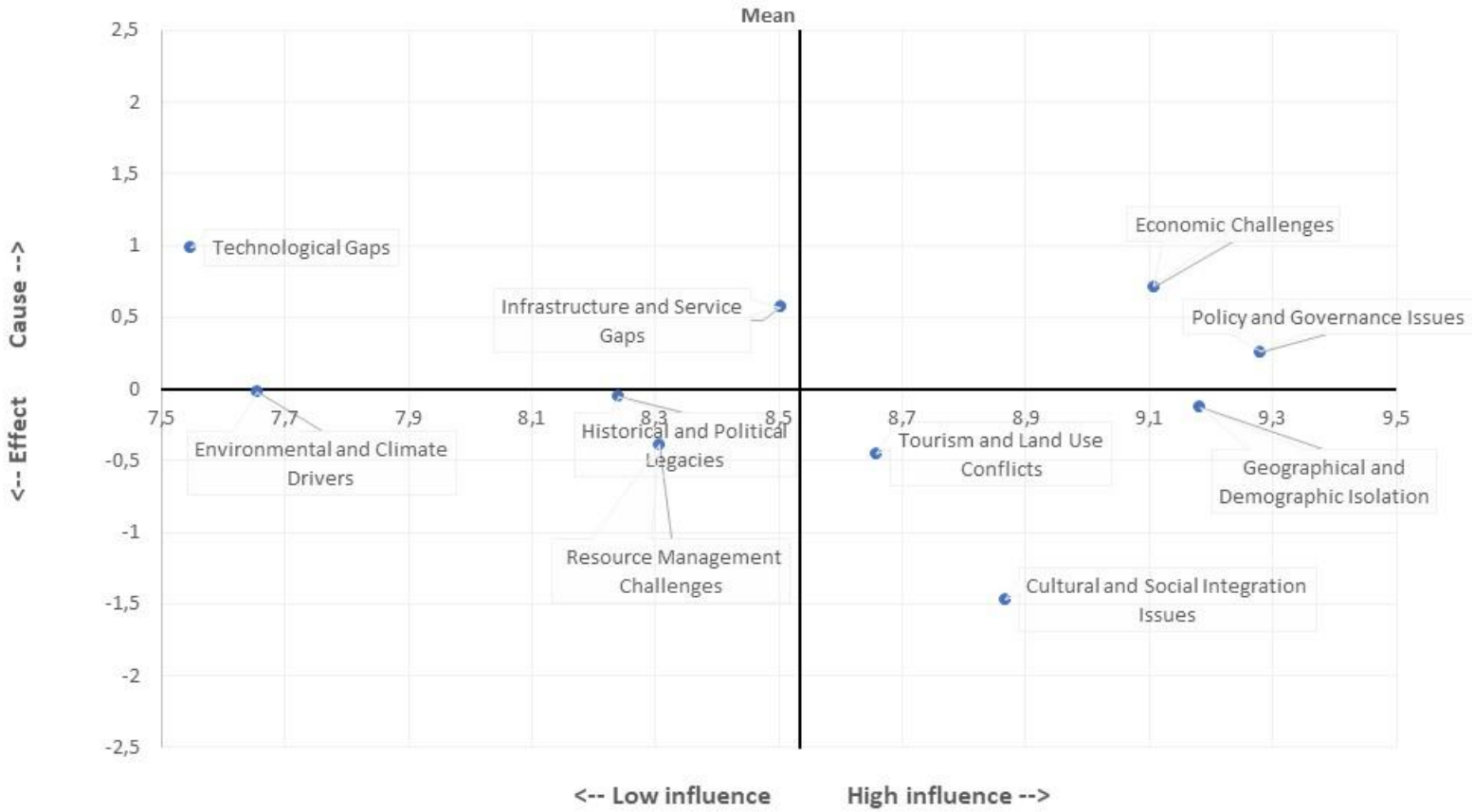


Fig. 2 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

The results indicate that Technological Gaps, Infrastructure and Service Gaps, Economic Challenges, and Policy and Governance Issues are causal factors, suggesting that they act as the main driving forces within the system. Among these,

Economic Challenges and Policy and Governance Issues exhibit high prominence, indicating that they are both key drivers and highly interconnected with the rest of the system, whereas Technological Gaps and Infrastructure and Service Gaps show relatively low prominence. In contrast, Geographical and Demographic Isolation, Tourism and Land Use Conflicts, Cultural and Social Integration Issues, Historical and Political Legacies, and Resource Management Challenges are identified as effect factors, reflecting dimensions that are primarily influenced by other factors. Among them, Geographical and Demographic Isolation, Tourism and Land Use Conflicts, and Cultural and Social Integration Issues display high prominence, while Historical and Political Legacies and Resource Management Challenges exhibit relatively low prominence. The findings suggest that technological, infrastructure, economic, and governance factors constitute the principal driving forces, whereas geographical, tourism-related, cultural, historical, and resource management issues represent the main outcomes of the system's causal relationships.



Fig. 3 A mountain landscape and road through the Velebit area

Photo: Ema Bašić

10 Who is negatively impacted by the challenge, and how?

Young people, women and the older population are negatively affected by the challenges. Due to the lack of jobs in the public sector and the impossibility of acquiring land for agriculture, young people are forced to stay in the cities where they were educated or go abroad. Due to the weakening of infrastructure at the local level (e.g. insufficient kindergarten capacity, inadequate health care for women) and, above all, due to traditional patriarchal conditions that often prevent them from inheriting farms, women in Lika suffer from a certain degree of disadvantage. The elderly population, most of whom live in villages, many of which are isolated and poorly connected to towns, do not have adequate social or medical care and often lack access to basic services such as post offices, stores and public transport.

11 Who is positively impacted by the challenge, and how?

Property and landowners are positively influenced by the challenges posed by tourism development and agricultural subsidies. Also positively affected are small groups of rural elites (e.g. owners of large farms who receive millions in subsidies, politicians and their families, and entrepreneurs who have no competition and are connected to established political parties). This also has a positive impact on digital nomads and their families, who can buy a house or a farm at a low price and enjoy the peaceful and quiet natural and rural environment, together with the great geographical location of the region (everything is close enough).

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

The Lika region and Lika-Senj County, where the region is located, have the smallest population in Croatia, but have a large amount of natural resources (especially forests and water) and the opportunity to earn money from renewable energy sources. For this reason, this region is of national importance in terms of the (unsustainable) use of resources, while the side

effect of this short-term attitude is that Lika is falling behind in socio-cultural, economic and general social terms. A small, over-aged population, unable to bring about economic recovery or political change, renders the community in general helpless. For this reason, relations between the centre and the periphery have remained unbalanced for almost two centuries.

To summarize, Lika does not have the population potential that could drive development, but it does have the potential of natural resources whose utilization is decided not by local communities but by the state and the capital market.



Fig. 4 The abandoned Hotel Velebno, located in the Velebit mountain area

Photo: Ema Bašić

14 The definition of the periphery trap in this case

The periphery trap in the Lika region: demographic decline leads to political inadequacy. The wealth of natural resources leads to a game of greed between the free market and the state. The weakening of basic infrastructure leads to the

desolation of villages. The weakening of higher levels of infrastructure leads to further depopulation. Further depopulation leads to a shortage of workforce. A good geographical location results in an easier way to leave. Ecological tourism opportunities result in the phenomenon of over-tourism.

15 The level of conflict

At the political level, there is no significant conflict; the main political party dictates the projects that are implemented in the region. The top-down approach is fully realized. Businesses and entrepreneurs are also satisfied, as there is no critical mass of people in local communities imposing certain restrictions on the use of land, water or timber. Local communities are affected by negative demographic processes and have difficulty finding professionals, especially in health and social services, but also in economic sectors such as construction and the provision of other services that enable a normal life; unfortunately, they miss out on some projects that are then imposed on them from above.

16 Description of the level of conflict related to the case study

The rural region of Lika is one of the many European regions whose voice is not (or is no longer) heard at the national and European levels, precisely because conflict requires a critical mass of people, which this region no longer has.



Fig. 5 The local open-air market, a place for selling local agricultural products and for everyday social interaction

Photo: Ema Bašić

17 Efforts to solve the challenge(s)

Earlier efforts to solve the challenge(s): In education, technical colleges were opened that trained young people in subjects that the market did not need. In healthcare, hospitals were equipped with modern technology, but there was no one to work there because doctors were not attracted to the region. Demographic measures were mainly related to financial support and the possibility of longer paid maternity leave for mothers, while at the same time the accompanying infrastructure for children was not built (lack of kindergartens, playgrounds and sports halls). In the economy, entrepreneurs from outside Lika were given the opportunity to realize megalomaniac projects that were not in line with the social structure of the local community, which led to the failure of the investments.

18 Research-related proposals for potentially solving these challenges

A research-related proposal could be summarized in the concept of neo-endogenous development. The concept implies the confluence of bottom-up and top-down approaches: asking local communities what kind of development (in all its dimensions) they need or do not need and adapting national interests to the specific region. It is important to remember that in a rural community of 654 people, you can sit down and ask (young) people: 1) you want to leave, what can we do for you to stay; 2) you want to stay, what can we do for you to live better; 3) you want to come/return, how can we help? The research in this case study would seek to provide local authorities with a package of proposals that directly addresses the relationship with local communities in the above sense.

Research practice that can help solve the challenge(s): the Scottish model of science-government collaboration. For example, experts from the Rural Policy Centre, SRUC (Scotland's Rural College), conduct research in the rural Scottish islands and Highlands. They produce a full and abridged report, and a specific representative in Parliament speaks about the issue in Parliament based on the report.

19 Visions of desirable futures of the involved actors and the source of information

The desirable future of the Lika region (according to the research conducted – historical analysis of archival documents, demographic analysis and analysis of 115 semi-structured interviews) could be summarized in the following sentence: to take from the modernization processes the best of what similar regions in developed countries have gone through before.

The preliminary results of the qualitative research (32 semi-structured interviews with young people aged 18 to 35) provide the most important insights into the reasons for staying in or returning to the Lika region: family still living in the region and real estate or land ownership that they will inherit; the geographical location of the region together with the peaceful and tranquil natural and rural environment, "Lika as the heart and lungs of Croatia"; the opportunities offered by digital nomadism; villages and small towns as a safe place to raise a family; and positive interpersonal relationships in small local communities ("they will take care of the children together with us").

20 Lessons-learned from the case study

Rigid regimes, such as those that prevailed in the Lika region in the 19th and 20th centuries, cause local communities to act in a state of so-called learned helplessness (i.e. the state will decide and help).

The political decisions made from above to solve the problem of so-called agrarian overpopulation through emigration and not to allow the modernization processes of industrialization (of agriculture) had lasting consequences.

Without a critical mass of people, social change can only be enforced from above and can cause more damage than the status quo.

The contemporary concept of sustainable development, which primarily means a balance of all four dimensions (ecological, socio-cultural, political and economic), together with bottom-up and top-down approaches, can bring about a desirable future.

These concepts must be strongly supported in the Lika region by an immigration policy targeting the relevant population groups.

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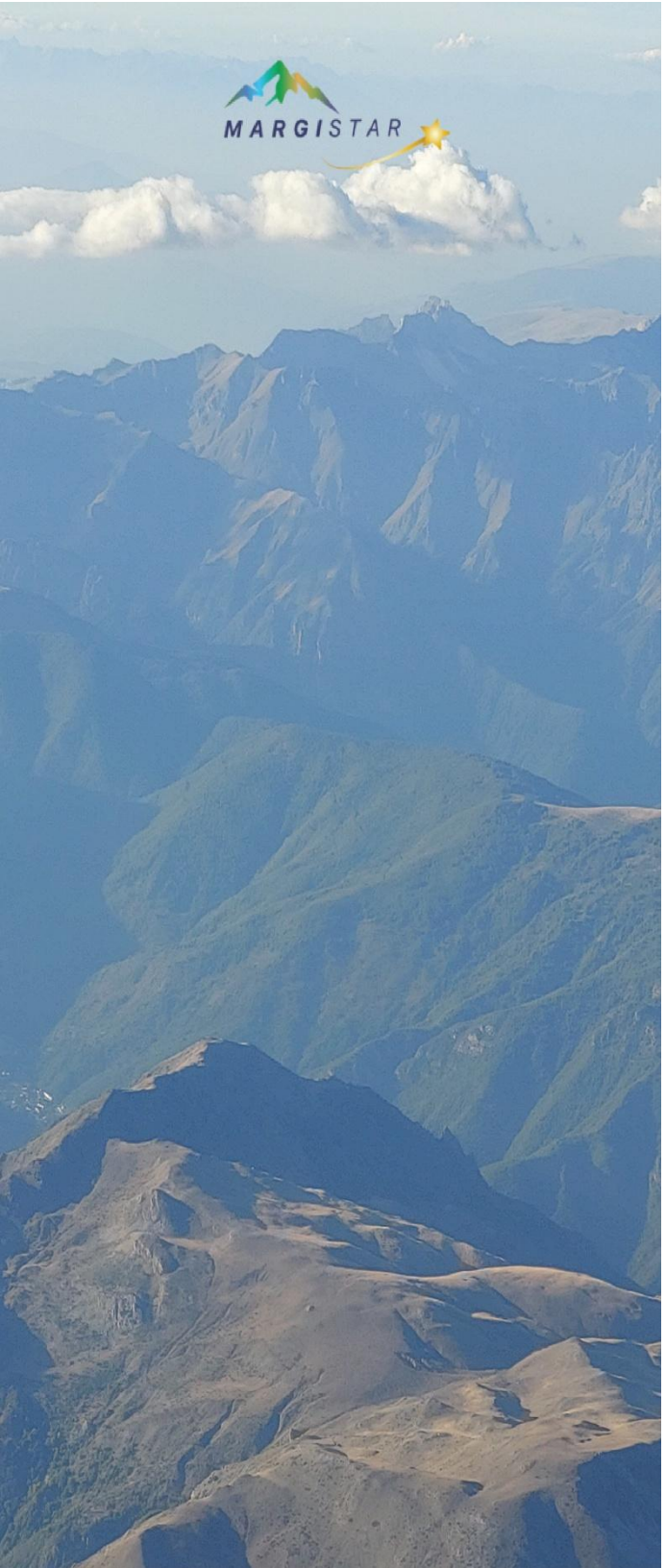

Towards sustainable agriculture and forestry in the Novohradské mountains

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1 Case study location

48° 41' 6.90"N, 14° 40' 22.40"E



2 Country

Czech Republic

3 For how long has the challenge been acute?

20 years

4 Challenge categories

Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Environmental challenges: Climate change, biodiversity loss, and/or ecological destruction.

5 Relevant UN Sustainable development goals

SDG15: Life on land.

6 Short description of the case study location

Novohradské hory extend over an area of 190 km² up to the state border. They have an average elevation of 810 m a.s.l., ranging from 645 to 1,072 m a.s.l. The soils are of average to low quality and are often waterlogged. The climate is colder than the average for the Czech Republic.

It is a sparsely populated and relatively undeveloped area due to unfavourable natural conditions and historical reasons, particularly depopulation following the expulsion of the German population after the Second World War and the introduction of a restricted border zone as part of the Cold War during the communist era. Novohradské hory were subsequently only sparsely repopulated by people from inland parts of the Czech Republic, while some villages, originally inhabited predominantly by Germans, have remained sparsely populated.

The area has relatively high natural value, partly due to the former restricted border zone. There are several protected areas, including Novohradské hory Nature Park (162 km²) and a large bird area (90.53 km²). At the end of the 20th century, there were plans to designate Novohradské hory as a protected landscape area (PLA), but the proposal was later abandoned. Recently, the debate on establishing a PLA has resumed.

The area includes five towns or larger villages; the remainder is very sparsely populated. Many people work in České Budějovice, the nearest large city. However, landowners, farmers and foresters, as well as municipal authorities and Local Action Groups, have the greatest influence on the landscape. Most agricultural land is privately owned. Some owners are small-scale landowners, while others are large investors who own hundreds of hectares. There are also different types of farmers, ranging from small-scale organic farmers to large-scale intensive farms. Forest land is predominantly owned by the state, followed by municipalities, churches and private owners (ÚHÚL, 2018). Tourism is currently low to moderate.



Fig. 1 Forested landscape in the Novohradské mountains

7 Key challenges in the case study

One of the problems is land degradation caused by unsustainable farming and the vulnerability of the area to climate change. Intensive farming on large fields in the lower parts of the area, involving the use of heavy machinery, chemical fertilisers and pesticides, causes biodiversity decline and land degradation, depletes soil organic matter, and increases the susceptibility of agricultural land to the adverse effects of climate change. On the other hand, particularly in the upper parts, where conditions are less suitable for agriculture, land abandonment and forest encroachment are occurring, with negative effects on plant species diversity and landscape heterogeneity. Forests consist largely (approximately 85%) of spruce and pine monocultures (ÚHÚL, 2018), which have low ecological stability and are vulnerable to drought, bark beetle outbreaks, and wind and snow damage.

The biggest problem in the Novohradské hory area, as in other LFAs/ANCs (Less Favoured Areas), is not low food production but the ongoing degradation of soil and land, the reduced capacity of soils to withstand drought due to erosion, and the

depletion of soil organic matter as a result of intensive management (The Union of Marginalised Areas in the Czech Republic, accessed at https://www.lfa.cz/).

8 A brief summary: What is this case study about?

The case study assesses the risk of land degradation due to unsustainable forestry and agriculture. It aims to help farmers identify sustainable ways to improve their prosperity. The innovation of agricultural and forestry systems involves supporting ecological forestry and agriculture, diversifying land use, and developing precision farming, as well as proposing mitigation and adaptation measures to increase efficiency and reduce the risk of losses due to climatic extremes. The application of social agriculture helps to develop non-productive farm functions and post-farming processes.



Fig. 2 Extensively-managed agricultural land has become less common than intensive farming on large fields

9 The fundamental causes and drivers for the challenges

Novohradské hory have long been a relatively neglected region, characterised by low financial support, low levels of capital among a large share of the population, and limited opportunities for prosperity. Natural and geographical factors have contributed to low population density throughout its history. However, the most significant driver was probably historical: the expulsion of the German population and the subsequent abandonment of many villages in the landscape, particularly those at higher altitudes and in less favourable conditions. The development of the whole of South Bohemia accelerated from the 1970s onwards, following substantial subsidies from the communist government and the construction of the Temelín Nuclear Power Station. New inhabitants arrived during this period; however, they faced many problems, including a lack of infrastructure and employment opportunities, as well as a complicated relationship with the land due to a lack of historical ties to the area.



Fig. 3 Ruins of the church of the Virgin Mary of Good Counsel, Pohoří na Šumavě, Czech Republic

9a A cause-and effect diagram identifying key drivers and their interrelationships

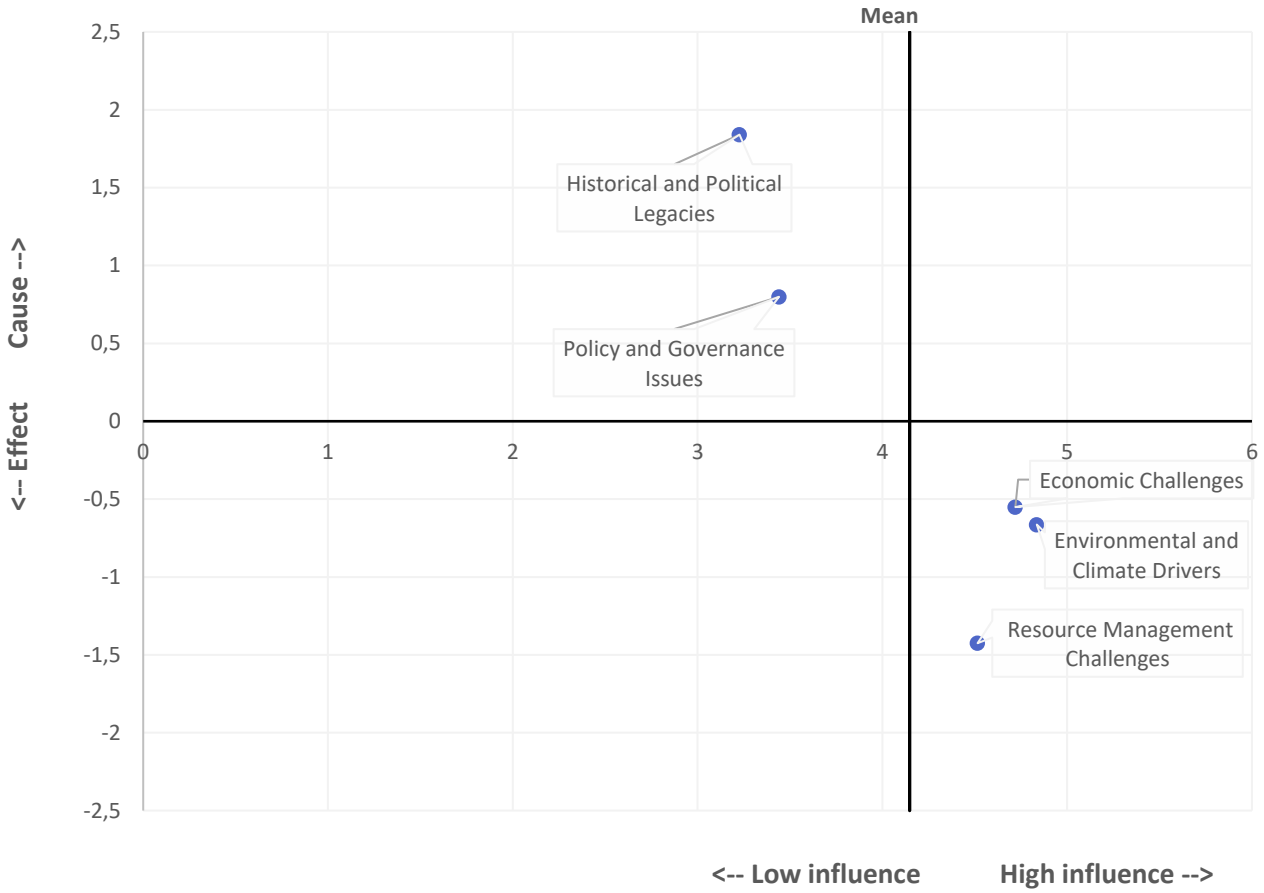

Fig. 4 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

The DEMATEL analysis suggests that Historical and Political Legacies and Policy and Governance Issues are the key causes of developmental problems. Their influence is moderate to low nowadays. The factors with the greatest influence today are

Economic Challenges and Environmental and Climate Factors, which are not the root causes of marginalisation but rather its consequences.

10 Who is negatively impacted by the challenge, and how?

Farmers are affected by environmental challenges that reduce the productivity of agricultural land, as well as by climate change, making them particularly vulnerable (Lososová and Zdeněk, 2014). The whole area is classified as an LFA/ANC, with farmers achieving approximately 50–75% of the income of those in other agricultural areas (https://www.lfa.cz/), and they are strongly dependent on ANC subsidies (Lososová and Zdeněk, 2014), which are, however, sometimes insufficient. This contributes to low prosperity and competitiveness.

Foresters are affected by the legacy of historically planned and managed forests, when timber production was the main management objective. Consequently, they are dealing with unstable spruce and pine monocultures, windthrow and bark beetle outbreaks, resulting in low and unstable timber production.

Local inhabitants experience the negative aspects of living in a very remote and historically neglected area, far from the capital, Prague. South Bohemia was one of the least developed areas until the 1980s. New inhabitants who arrived after the Second World War have developed relatively strong relationships with their new home area. They tend to be conservative and may react negatively to new influences from outside the region, while seeking to protect their territory from certain development projects. Current inhabitants are divided into two groups: those who support and those who oppose the establishment of a Protected Landscape Area.

11 Who is positively impacted by the challenge, and how?

Market chains, agricultural retailers and food processors exert downward pressure on the prices of agricultural products.

Landowners and investors from large cities acquire land and access relatively cheap labour and materials, but often do not reinvest the income generated from their land in Novohradské hory.

Non-local tourism service providers benefit from the natural beauty of the area, but the income generated is often spent elsewhere.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

Retailers and businesses involved in agricultural processing purchase products at very low prices. They provide processing, transport and marketing services and achieve substantially higher profits compared with farmers.

Large investors from cities purchased land at very low prices after the end of the communist era (Kerles, Info.cz). They now lease the land to farmers or manage the farms themselves, receiving EU subsidies, while living and spending the resulting income elsewhere.

The acquisition of EU subsidies by farmers who are not permanently attached to the location of the farm may, in practice, reinforce asymmetric relationships. New landowners generate profits that are transferred elsewhere, while permanent rural residents are required to bear the associated costs and expenses (Biczikowski et al., 2023).

People establishing tourism businesses often come from cities. They benefit from the natural qualities of the area, while tourism activities may also contribute to environmental degradation.

There is a continuing increase in the polarisation of Czech society (Kučerová, 2018), while differences in income between rural and urban households are becoming more pronounced (Střeleček and Zdeněk, 2011).

14 The definition of the periphery trap in this case

Farmers have low levels of prosperity and struggle to cover the costs of their employees. They are forced to sell their products at low prices, receiving approximately 20% of the final market price. Organic farmers face particular difficulties in selling their produce. Farmers generally lack the capital and capacity to process and market their products themselves. This situation often leads to the intensification of agricultural production in an attempt to increase profitability and reduces farmers' willingness to adopt sustainable management practices or organic farming. However, this further increases unsustainability and vulnerability to climate change and the risks of land degradation.

15 The level of conflict

There is a conflict between long-term, highly conservative inhabitants, who arrived shortly after the end of the Second World War, and more recent inhabitants, who have mostly moved from cities in different parts of the Czech Republic. These groups have different views on development, urbanisation, landscape protection and the establishment of a Protected Landscape Area (PLA).

16 Description of the level of conflict related to the case study

These differences are evident when comparing the opinions of the above-mentioned groups of inhabitants currently living in the area.



Fig. 5 Traditional land use and potential conflicts with the views of more recent inhabitants

17 Efforts to solve the challenge(s)

Participatory solutions to the above-mentioned challenges have not yet been developed, and directive solutions (e.g. through subsidies) imposed from the centre have not been particularly successful. Potential solutions may include community-based actions and initiatives, social innovations, new business models, entrepreneurial activities, new policy and planning instruments, science-based decision-making and solutions, nature-based solutions, and planning related to the use or conservation of mountainous areas.

Efforts should focus on changes to the subsidy system, including greater support for smaller farms and people living in the area, as well as more targeted support for mountain areas and organic farming. Currently, the management of grasslands receives less support than in the past. This situation should be addressed, which is one of the aims of the Union of Marginalised Areas in the Czech Republic (https://www.lfa.cz/). In addition, dialogue between local stakeholders, the Ministry of Agriculture and the scientific community should be strengthened. It is therefore necessary to highlight existing conflicts and create better conditions for communication, which can contribute to problem-solving.

Farm efficiency can be increased through the development of non-productive functions, such as agrotourism, local events, product processing, therapeutic activities and team-building activities. There are already some attempts by farmers to link agriculture with agrotourism; for example, one farmer operates a campsite and restaurant connected to the farm, where visitors can observe horses, sheep and other animals.

18 Research-related proposals for potentially solving these challenges

A method for assessing land degradation and ecological stability can be used to identify areas where mitigation and adaptation measures can be placed most effectively to prevent further degradation, including the use of nature-based solutions. This method will help identify the most suitable areas and propose effective measures to support sustainable agriculture and forestry.

Improvement of organic farming should focus on the optimal combination and improvement of existing organic farming practices to achieve higher productivity. These may include optimal crop selection for local conditions, precise crop rotation, fertilisation and agronomic practices, green manuring, crop diversification, the use of manure and other crop–livestock

linkages, the use of flower strips and other semi-natural elements, improved plant protection (i.e. biocontrol), intercropping, undersowing, etc. (Moudrý et al., 2008, personal communication).
Participatory approaches should be used to facilitate dialogue and mediation between local people (municipalities and new and long-term inhabitants) and people wishing to establish new businesses in the area.

19 Visions of desirable futures of the involved actors and the source of information

As mentioned above, processes leading to participatory solutions to the above-mentioned challenges have not yet started. Therefore, no visions of desirable futures have been developed yet. Some of the visions presented below are currently being discussed with local stakeholders within the framework of a Czech project funded by the Ministry of Education, which supports our activities within the COST project MARGISTAR.
Social farming and social farms can successfully respond to the challenges of social exclusion and the lack of social services and other opportunities in rural areas through alternative therapeutic activities, sheltered employment and integrative educational activities in a farm environment (Hudcová et al., 2017).
Non-productive activities on farms may include craft workshops, educational programmes for children, workshops, team-building events for companies and agrotourism (Farmářské listy, http://www.cmszp.cz).
A comprehensive approach should focus on the development of non-productive functions and pre- and post-farming processes. A wide range of plant and animal products can be processed directly on farms and sold as value-added products (Moudrý et al., personal communication). Processing activities and appropriate distribution channels should therefore be developed, while municipalities should support local farmers' markets.

20 Lessons-learned from the case study

Our case study has only just started; potential solutions will be discussed and developed over the next two years of the project.

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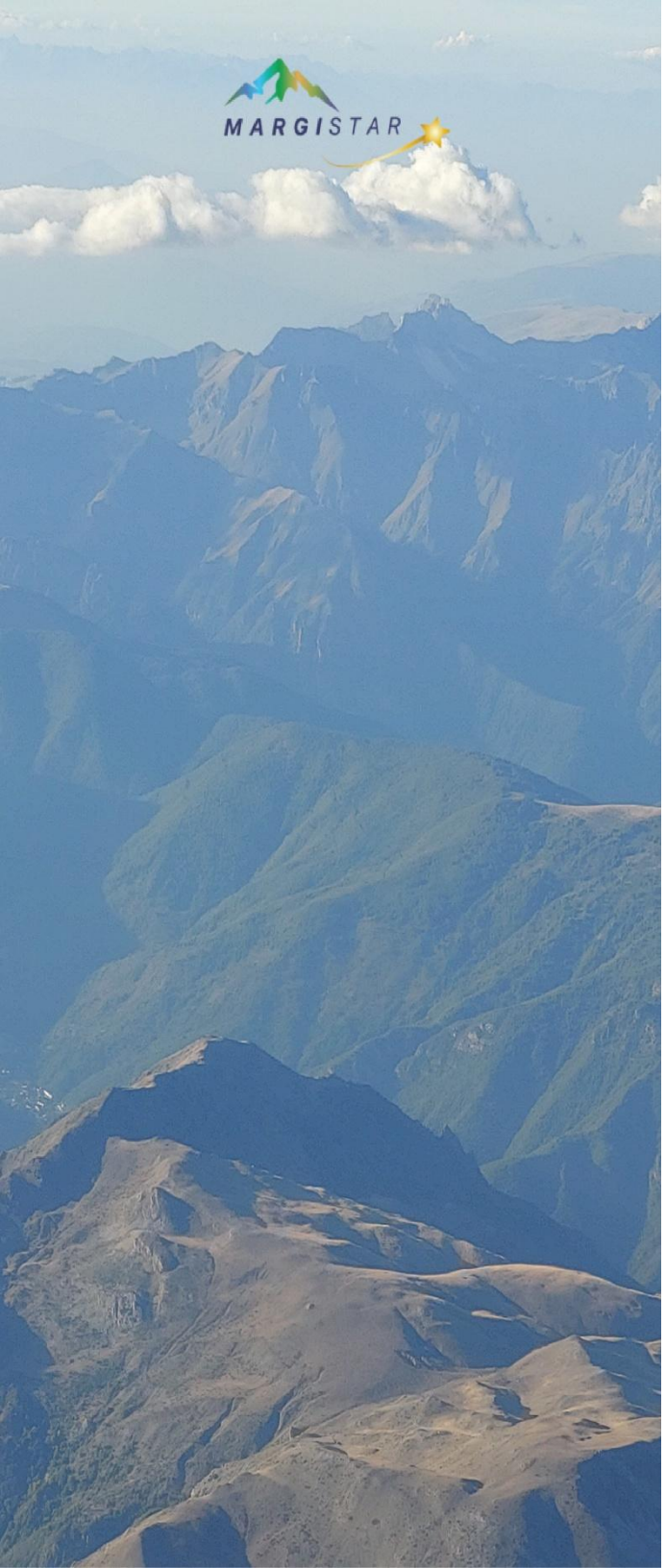

Deatnu

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1 Case study location

69° 54' 40.28"N, 27° 1' 47.42"E



2 Country

Finland

3 For how long has the challenge been acute?

10 years

4 Challenge categories

Economic challenges: Economic problems, poverty, and lack of employment and education opportunities.
Governance challenges: E.g., policies made at national and/or EU levels, top-down decision-making, lack of local participation in decision-making etc.
Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Environmental challenges: Climate change, biodiversity loss, and/or ecological destruction.

5 Relevant UN Sustainable development goals

SDG3: Good health and well-being; SDG10: Reduced inequalities; SDG13: Climate action; SDG14: Life below water; SDG16: Peace, justice, and strong institutions; SDG17: Partnership for the goals.

6 Short description of the case study location

The Deatnu River (Deatnu in Northern Sámi, Teno in Finnish and Tana in Norwegian) is a transboundary river between Finland and Norway and forms the northern boundary of the European Union. The river also flows through the Indigenous Sámi homeland, Sápmi. Located in the subarctic Northeast Atlantic region, the Deatnu River is one of the most significant spawning rivers for Atlantic salmon (*Salmo salar*) in Europe. A few decades ago, the Deatnu River was one of the few remaining large watersheds that still supported an abundant Atlantic salmon stock. At that time, there was little or no human impact on the system, except for fishing (Erkinaro et al., 2019).

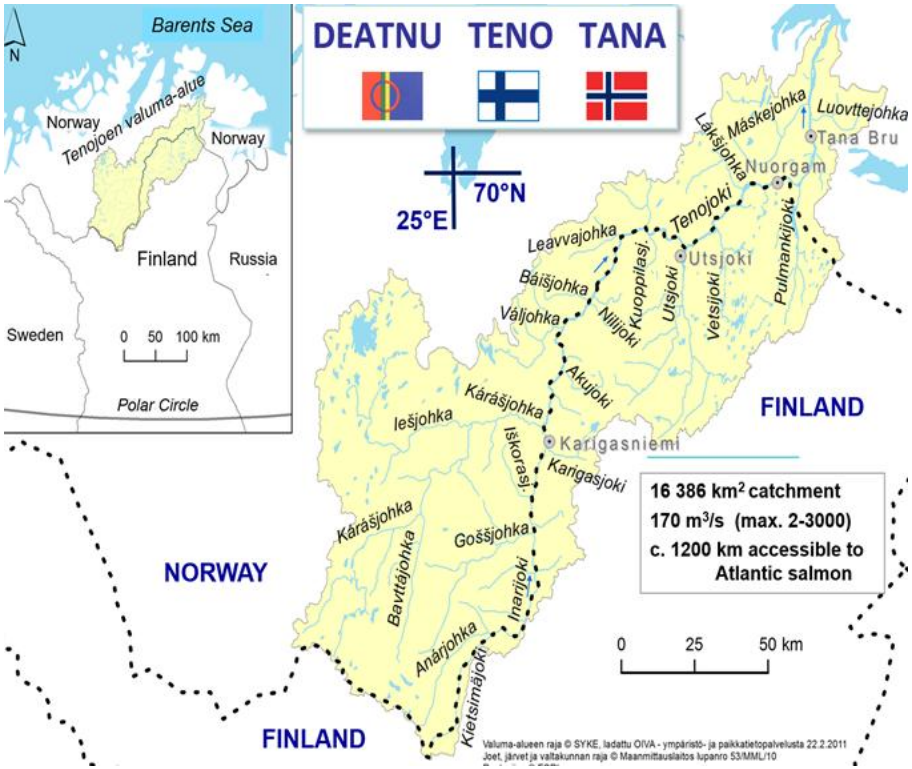

Fig. 1 Detailed location of the case study

7 Key challenges in the case study

The rapid invasion of pink salmon (*Oncorhynchus gorbuscha*) and the collapse of native Atlantic salmon (*Salmo salar*) have transformed river habitats, nutrient flows, migration patterns, and Sámi river culture.

In recent years, Atlantic salmon stocks have collapsed, resulting in the prohibition of salmon fishing in Deatnu in 2021. The ban remains in force. This has intensified tensions over authority, rights, and legitimate knowledge in salmon governance. For Sámi communities along the river, salmon is not only a resource management issue but also an integral part of Indigenous culture, identity, livelihoods, and the intergenerational transmission of cultural knowledge.

During the preparation of the fishing ban, the Finnish administrators responsible for policy design conducted a relatively limited desk-based assessment of its potential impacts. Following the implementation of the fishing ban in the summer of 2021, the Finnish Ministry of Agriculture and Forestry commissioned a study from us on its societal impacts. The assessment indicated that the fishing ban had a substantial impact on subjective and experienced health, as well as on subjective and objective well-being. Fishing culture was profoundly affected: older generations lost opportunities to pass on their fishing skills and cultural practices to younger generations, while opportunities to practise these skills and traditions were eliminated. The fishing ban also affected the local economy, resulting in an annual loss of €4,500,000—a significant amount for a small community. All these impacts, directly, indirectly, and cumulatively, affect human health and well-being, particularly in the Sámi community (Abernethy et al. 2022). Except for the economic impacts, which are less severe on the Norwegian side, the social and cultural impacts are similar in magnitude and type in Norway.

The case is further complicated by the spread of invasive pink salmon, whose ecological, social, cultural, and governance implications remain uncertain and contested. Human responses to the pink salmon invasion are also affecting the river system and its ecology. In Norway, strong mitigation measures, including large-scale, coordinated removal programmes, have been introduced in a large number of rivers (Thorstad et al. 2025). A large barrier has also been erected on the lower Teno River on the Norwegian side of the catchment to facilitate the removal of odd-year cohorts of pink salmon in 2023 and 2025 (Anon. 2026).

There have been increasing concerns about the potential effects on the migration of native species, particularly the downstream migration of Atlantic salmon smolts and the upstream return migration of adult salmon towards spawning grounds further up the river system. In addition, the barrier affects opportunities to catch pink salmon upstream of the barrier, particularly for fishers on the Finnish side of the catchment. At the same time, the depletion of Atlantic salmon and the

subsequent fishing ban have strongly affected local opportunities to maintain Sámi cultural, social, and economic practices associated with salmon fishing (Hiedanpää et al. 2020).

This dramatic situation has raised concerns about how Indigenous people can exercise their cultural practices and maintain their economic livelihoods, including fishing tourism. Indigenous Sámi fishing rights holders and the relevant administrations of both countries share an understanding of the severity of the situation. While the collapse of salmon stocks is widely acknowledged, the ways in which salmon policies have been formulated, justified, and implemented have been contested by many local and Indigenous Sámi actors.

8 A brief summary: What is this case study about?

Development issues at the Deatnu river area where the salmon population and wellbeing of people is in decline.

The Deatnu salmon case concerns one of Europe's most important wild Atlantic salmon river systems and a deep socio-ecological crisis that has unfolded over the last decade. Scientific monitoring has shown a severe decline in several salmon stocks, leading Finland and Norway to introduce increasingly strict fishing restrictions and, eventually, a near-total suspension of salmon fishing in many parts of the river system.

The issue extends far beyond fisheries management. For local communities in the Deatnu Valley, salmon is not merely a natural resource but a cornerstone of culture, identity, livelihood, and social relations. The restrictions have therefore generated significant social, economic, and cultural consequences, particularly for Sámi communities whose traditions, knowledge systems, and river-based way of life are closely connected to salmon fishing. Questions of Indigenous rights, environmental justice, governance legitimacy, and the distribution of conservation burdens have become central to the debate.

The case highlights the challenge of balancing ecological recovery with social sustainability. While conservation measures aim to secure the long-term survival of salmon populations, they also raise questions about participation in decision-making, trust between authorities and local people, compensation for losses, and the role of local knowledge in governance. In essence, the Deatnu salmon case is a complex struggle to reconcile biodiversity protection, cultural continuity, and equitable governance in a rapidly changing environmental context.



Fig. 2 Utsjoki municipality and Deatnu River

Photo: Juha Hiedanpää



Fig. 3 Teno River

Photo: Jaakko Erkinaro

9 The fundamental causes and drivers for the challenges

There are many potential causes of the weakening of Atlantic salmon stocks, including climate change, Norwegian fish farming, and recreational salmon fishing in Deatnu. These factors are not themselves the challenge of the poor state of Atlantic salmon stocks, but potential root causes of it. Indigenous and local community members raise important questions about the relative roles of salmon fishing in the stock decline, warming waters associated with climate change, changing environmental conditions in the river itself, salmon farming along the Norwegian coast, coastal salmon fisheries in Norway, and sea fishing for prey species of Atlantic salmon for the aquaculture industry. All of these factors may affect Atlantic salmon populations, but there is no definite understanding of how, or to what extent, they interact and contribute to the decline.

Climate change and biodiversity loss are manifestations of an ongoing global transformation driven by human activities. All organisms modify their environment, but humans, as a species, have transformed environments on an unprecedented scale (Lade et al. 2020). The term Anthropocene has been used to describe this pervasive human influence: a proposed geological epoch characterised by human impacts across the planet. At the same time, human activities have generated new systemic effects in which some species prosper while others decline. One expression of this global change is the rapid and substantial increase in the abundance and distribution of Pacific pink salmon (*Oncorhynchus gorbuscha*) in the North Atlantic (ICES 2024; Staveley et al. 2025). Introduced to the White Sea region from the late 1950s onwards, the recent explosive increase in these stocks, particularly in the Barents Sea area, implies large-scale changes to North Atlantic and river ecosystems, native salmon populations, and the cultures, social relations, and economies built around them (Sandlund et al. 2019; Staveley et al. 2025). Since 2017, pink salmon numbers have also increased rapidly in the River Teno (Erkinaro et al. 2026), with largely unknown consequences for native species and ecosystems.

9a A cause-and effect diagram identifying key drivers and their interrelationships

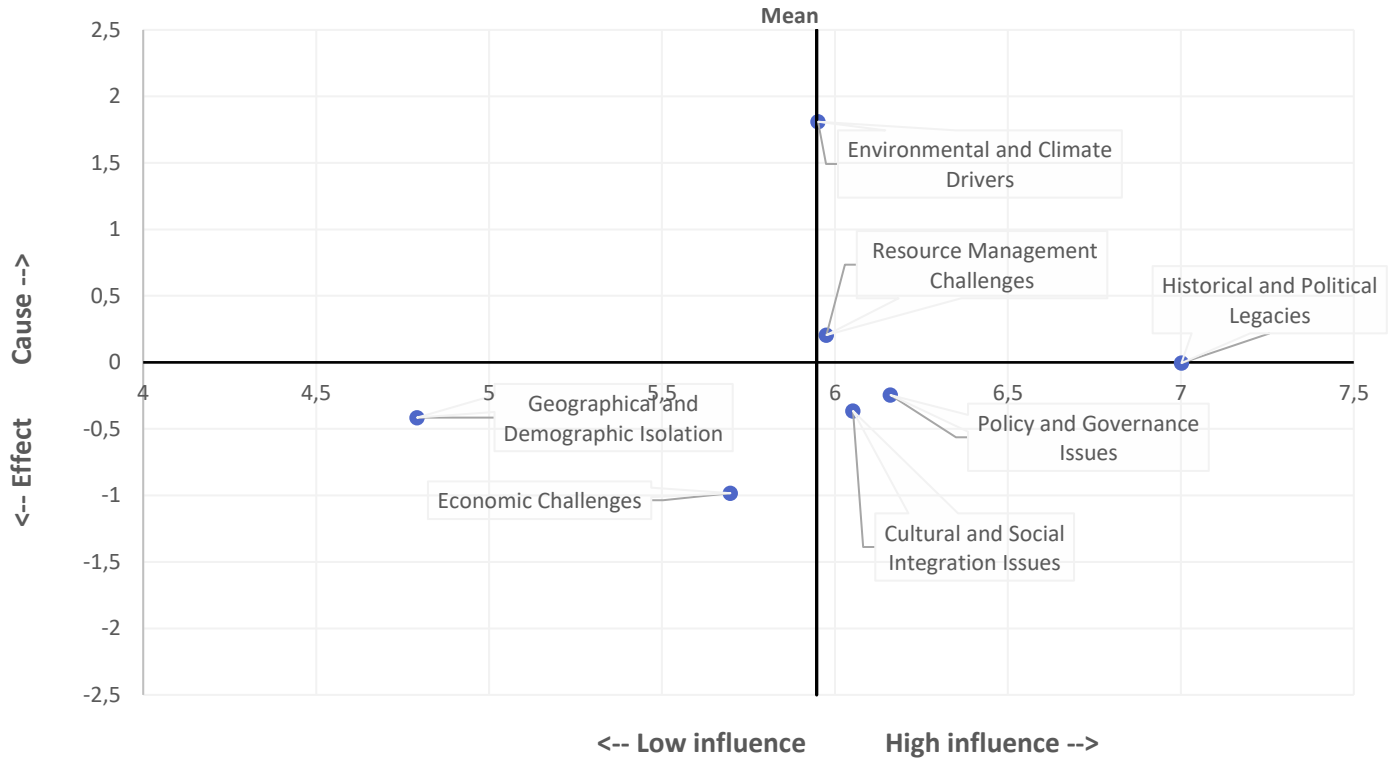

Fig. 4 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

The key drivers in the system are Historical and Political Legacies, Policy and Governance Issues, Resource Management Challenges, and Cultural and Social Integration Issues, all of which have an influence above the system average. Environment and Climate and Resource Management Challenges represent the main causal factors underlying the system's challenges. In contrast, Economics, Social and Cultural Integration, and Geographical and Demographic Isolation are the factors most strongly affected by the other factors in the system.



Fig. 5 Pink salmon

Photo: Panu Orell



Fig. 6 Atlantic salmon

Photo: Panu Orell

10 Who is negatively impacted by the challenge, and how?

Atlantic salmon populations are declining, Sámi cultural practices are being eroded, tourism is losing fishing opportunities, and Indigenous and local communities are experiencing a decline in economic opportunities.

11 Who is positively impacted by the challenge, and how?

Indigenous and local fishing rights holders have the potential opportunity to fish invasive pink salmon.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

In Utsjoki, the economy was based on one resource and one resource only: salmon.

14 The definition of the periphery trap in this case

Societal and environmental conditions are changing and becoming increasingly unfavourable.

15 The level of conflict

High.

16 Description of the level of conflict related to the case study

The Finnish and Norwegian governments have a tense relationship with local communities, including Sámi and Finnish communities in Finland and Sámi and Norwegian communities in Norway. Consequently, conflicts between states, Indigenous and non-Indigenous rights holders, and other resource users have long shaped resource management.
Declining salmon stocks have increased conflicts and reduced cooperation among fishers from different parts of the watershed (Næss et al. 2026). There is significant diversity among rights holders and stakeholders on both sides, yet a lack of effective collaborative forums remains a prevalent issue (Eriksen and Nuorgam 2025). Local influence on governance decisions remains limited, and the report underscores the complexity of the current cross-border governance regime (ibid.). Governance of the Deatnu watershed is fragmented, while weak communication among actors further undermines trust between local communities, Sámi communities, and the states (ibid.). The emergence of pink salmon, together with differing invasive-species policies in Finland and Norway and among Indigenous Sámi communities, has further diversified and complicated the bilateral and multispecies conflicts (see also Pellennec et al. Manuscript, and Hiedanpää & Erkinaro, Manuscript).

17 Efforts to solve the challenge(s)

Yes.

18 Research-related proposals for potentially solving these challenges

Cross-border collaboration between Norway and Finland faces challenges due to unresolved differences in economic interests, political priorities, legal frameworks, and attitudes. Effective cooperation requires a shift from state-centred resource protection towards integrated, relationship-based watershed governance that considers both national systems and internal differences among fishing groups and rights holders.
The watershed's transboundary nature creates unresolved issues regarding local participation and the extent of Indigenous rights. Norway and Finland must consider the interests, rights, and knowledge of local and Sámi communities on both sides of the border. While Sámi fishing rights are formally recognised in Finland, they remain insufficiently addressed in Norway.

Local actors often feel excluded from decision-making and have limited influence over management outcomes. Ongoing conflicts between local communities and the states, together with unresolved Indigenous rights issues, continue to impede effective multi-level collaboration. Findings show that participation does not necessarily lead to meaningful agency in decision-making, reflecting persistent power imbalances between the states and Sámi communities. Critically examining these dynamics is essential for the meaningful inclusion of Sámi perspectives in the collaborative governance of Deatnu (proposals from Pellennec et al., Manuscript).



Fig. 7 Traditional River Sámi fishing

Photo: Panu Orell

19 Visions of desirable futures of the involved actors and the source of information

We organised a Future Workshop in autumn 2024 (The Vision Workshop: The Admired) to explore participants' visions of an admired future for the Deatnu River valley. In total, 23 people, including facilitators, participated in the Vision Workshop. Participants were local Sámi and non-Sámi people from both the Norwegian and Finnish sides of the Deatnu River. They were relevant informants on Deatnu salmon management and the fishing ban, which has restricted fishing and affected local Sámi culture and traditional livelihoods in the area since 2021. The workshop began with an introduction to the methodology, followed by a short icebreaker session to introduce all participants. The original plan was to form one Norwegian-language group and one Finnish-language group working in parallel. However, as the two most widely used languages among participants were Northern Sámi and Finnish, the participants were divided into one Finnish-language group and one group comprising Sámi- and Norwegian-speaking participants to facilitate discussion. The Finnish-language group consisted mainly of Sámi and non-Sámi people living in the upper and middle parts of the river, particularly in the Utsjoki area. The Sámi- and Norwegian-speaking group included Indigenous participants from different parts of the river, along the riverbanks on both the Finnish and Norwegian sides. Both groups followed the stages of the vision methodology, and the workshop concluded with a plenary session in which all participants came together to discuss the outputs. The workshop lasted three hours. Prior to the workshop, ethical consent was obtained from all participants. The workshop resulted in two distinct perspectives on what constitutes an admired future and how it might be achieved. Admired Future 1 focused on the future well-being and prosperity of Utsjoki municipality. Participants considered how the local economy could be stimulated and how Finland (an EU Member State) and Norway (a non-EU Member State) could be treated as a single economic, social, and cultural region. Utsjoki, on the Finnish side of the Deatnu valley, was envisioned as a more welcoming and supportive place for newcomers, particularly people seeking to establish businesses and contribute to the local economy. The participants emphasised the need for new business ideas and models, while development activities, fishing, and other uses of natural resources should remain aligned with environmental sustainability. Overall, this group emphasised economic opportunities, the Deatnu area as an integrated region, and openness towards newcomers. Admired future statement: "We want the Deatnu River Valley to be a prosperous, peaceful area in the future, where it is easy to settle in and start a business. This is important for the region's vitality and the wellbeing of its people, and it is achieved when there are thriving new businesses and people who feel welcome and at home in the area." Admired Future 2 focused strongly on Indigenous Sámi rights and self-governance. The vision centred on Sámi self-governance across the Deatnu River valley on both sides of the national border. Salmon

management was envisioned as being based on Sámi traditional knowledge, respect for Sámi Indigenous rights, and decision-making by Sámi communities. The group did not place particular emphasis on other development issues; rather, its vision centred on self-governance and greater independence from the Finnish and Norwegian states and the structures perceived by participants as colonial. Admired future statement: "Salmon in the Deatnu/Tana River is managed based on local and traditional Sámi knowledge, Sámi cultural values and their Indigenous rights" (see Bjärstig et al. 2024).

20 Lessons-learned from the case study

Five key recommendations for policymakers, governance, and management are to establish a Community of Inquiry; critically examine the history of the present; engage in collaborative governance; adopt a multispecies management approach; and ensure Indigenous leadership in policy formulation and implementation.

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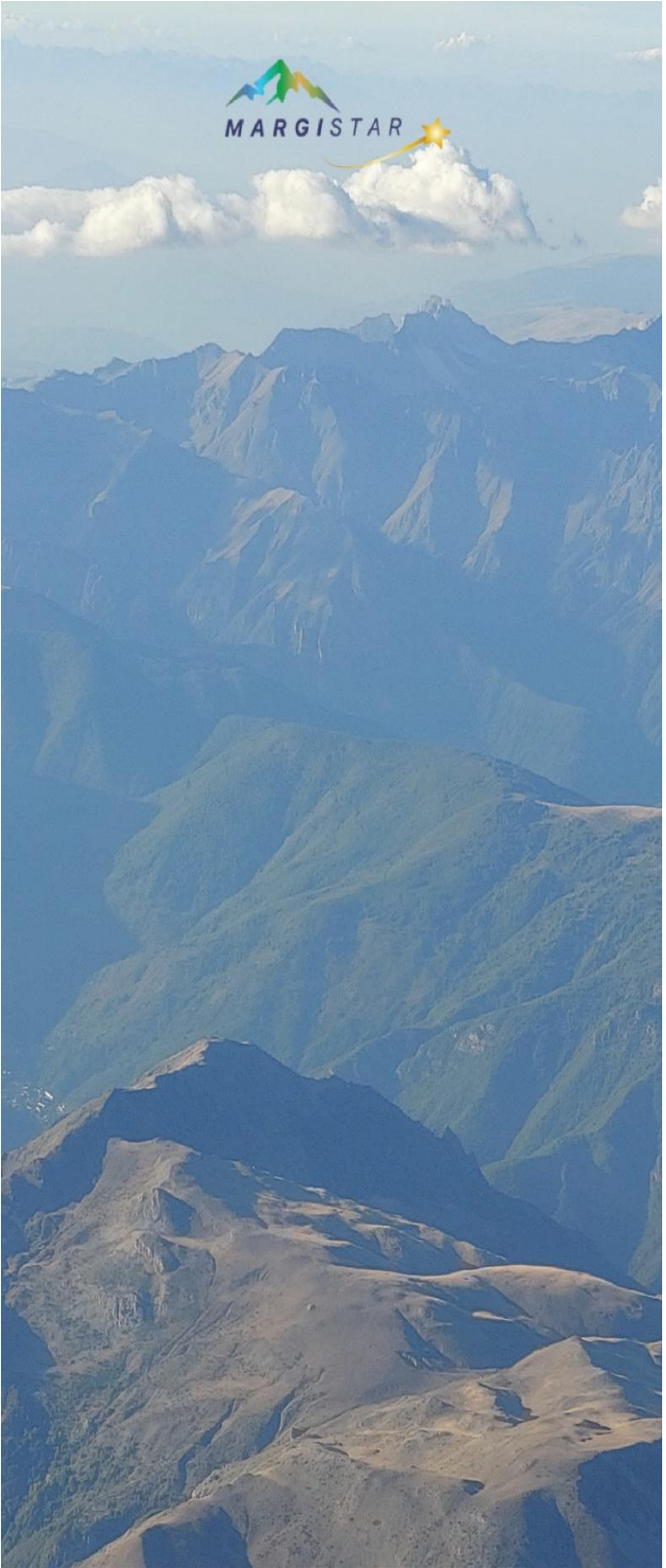

Reindeer herding and polycrisis in northern Finland

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1 Case study location

68° 40' 13.73"N, 26° 34' 23.95"E

2 Country

Finland

3 For how long has the challenge been acute?

15 years

4 Challenge categories

Economic challenges: Economic problems, poverty, and lack of employment and education opportunities.
Governance challenges: E.g., policies made at national and/or EU levels, top-down decision-making, lack of local participation in decision-making etc.
Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Environmental challenges: Climate change, biodiversity loss, and/or ecological destruction.



5 Relevant UN Sustainable development goals

SDG10: Reduced inequalities.
SDG15: Life on land.
SDG16: Peace, justice, and strong institutions.

6 Short description of the case study location

Reindeer herding is a significant part of Saami ethnic identity and practiced by Saami in their home region across northern Finland, Sweden, Norway (Horstkotte et al. 2022a), and Kola Peninsula of Russia. Also for ethnic Finn herders, herding constitutes a traditional nature-based livelihood having a long history. Reindeer herding area in Finland is divided into 54 Reindeer Herding Cooperatives (RHC). Reindeer numbers are higher in the northern RHCs than in the southern ones, and 13 northernmost RHCs belong to the Saami homeland area (https://paliskunnat.fi/reindeer-herders-association/cooperatives/). Traditionally reindeer herding has been dependent on natural pastures in extensive geographical areas, even though supplementary feeding in wintertime is currently practiced throughout Fennoscandia as a contingency strategy to difficult winter conditions, becoming more frequent due to climate change, loss of winter pastures due to forestry and other land uses, and even to mitigate predation causing reindeer losses (Åhman et al. 2022). Supplementary feeding is practiced more in southern RHCs than in northern ones in Finland.

Currently viability of reindeer herding livelihood is challenged by climate crisis, land use change, geopolitical tensions, and green transition. Reindeer herding in northern Fennoscandia is thus strongly affected by global environmental change (Horstkotte et al. 2022). It has been estimated that climate change is 2-4 times faster in the Arctic than global average (Rantanen et al. 2022). In Fennoscandia, 85% of the pasture areas for reindeer and sheep is affected by at least one land-use pressure and 60% is affected by multiple land-use pressures, co-occurring with predator presence and rising temperatures (Stoessel et al. 2022). Furthermore, green transition can be unjust for reindeer herders by increasing wind power development and mining projects in the Arctic (Normann 2021; Nilsson & Sarkki 2022). Therefore, reindeer herding is simultaneously impacted by multiple pressures challenging the continuity of the livelihood (Landauer et al. 2021).



Fig. 1 Working with reindeer in Poikajärvi district

Photo: Minna Turunen

7 Key challenges in the case study

A reindeer herder noted in a recent participatory scenario workshop that "it feels that nowadays after one lives through one crisis, the next challenge awaits". Building on this observation, we find that reindeer herding is facing a polycrisis, implying multiple and intertwined crises that challenge the continuity of herding for future generations. Herders pointed out in our workshops that (1) accelerating climate change is leading to difficult winter conditions requiring emergency measures; (2) the increasing focus on the green transition, including wind power and mining development, is disturbing grazing peace, while increasing predator abundance, particularly in some parts of the reindeer herding area, is also a problem; (3) the unstable geopolitical situation related to the Russian war in Ukraine is increasing the prices of fuel and reindeer feed; and (4) the overall encroachment of reindeer pastures by externally driven land-use development, which has continued for over a

century, remains a critical challenge to the continuity of reindeer herding. The findings from the two workshops with herders were that these challenges, or even crises, become interlinked in the practices and operational environment of reindeer herding.

8 A brief summary: What is this case study about?

We examine how an emerging and unpredictable polycrisis challenges the reindeer herding nature-based livelihood in Finland. A global polycrisis occurs "when crises in multiple global systems become causally entangled in ways that significantly degrade humanity's prospects" (Lawrence et al. 2022). It can also be experienced locally, for example in Arctic nature-based livelihoods exposed to intertwined global pressures. As polycrises are difficult to mitigate and future hazards cannot be avoided, adaptation is therefore crucial (Tooze 2022; Hoyer et al. 2023). Herders face a situation in which land-use projects and nature conservation linked to the green transition, rising fuel and feed prices resulting from Russian aggression against Ukraine, persistent inequalities in land use, and climate change simultaneously challenge the resilience of the reindeer herding livelihood. Herders do not adapt to, but rather adapt within, a polycrisis in which the operational environment of the livelihood is difficult to distinguish from wider-scale developments. Strengthening the core characteristics of reindeer herding is important in addition to attempting to adapt to each individual crisis separately.

9 The fundamental causes and drivers for the challenges

The drivers behind the changes, challenges, and polycrisis faced by reindeer herding can be approached by using the Shared Socio-economic Pathways (SSP) scenario narratives, which seek to explore future climate impacts, vulnerabilities, adaptation, and mitigation (e.g. O'Neill et al. 2020). The SSP scenario set includes five societal narratives: SSP1: Sustainability (Taking the Green Road), SSP2: Business-as-Usual (Middle of the Road), SSP3: Regional Rivalry (A Rocky Road), SSP4: Inequality (A Road Divided), and SSP5: Fossil-Fuelled Development (Taking the Highway) (Riahi et al. 2017). In terms of the relevance of these future narratives, we consider the green transition (SSP1), geopolitical tensions following the Russian aggression against Ukraine since 2022 (SSP3), perceived inequality in land use (SSP4), and accelerating climate change in the Arctic (SSP5) to be key drivers of the current situation and potentially of the future situation for reindeer herding. We find that these drivers are

neither mutually exclusive nor confined to the distant future, but instead coexist and collectively constitute the current reality for reindeer herders.

9a A cause-and effect diagram identifying key drivers and their interrelationships

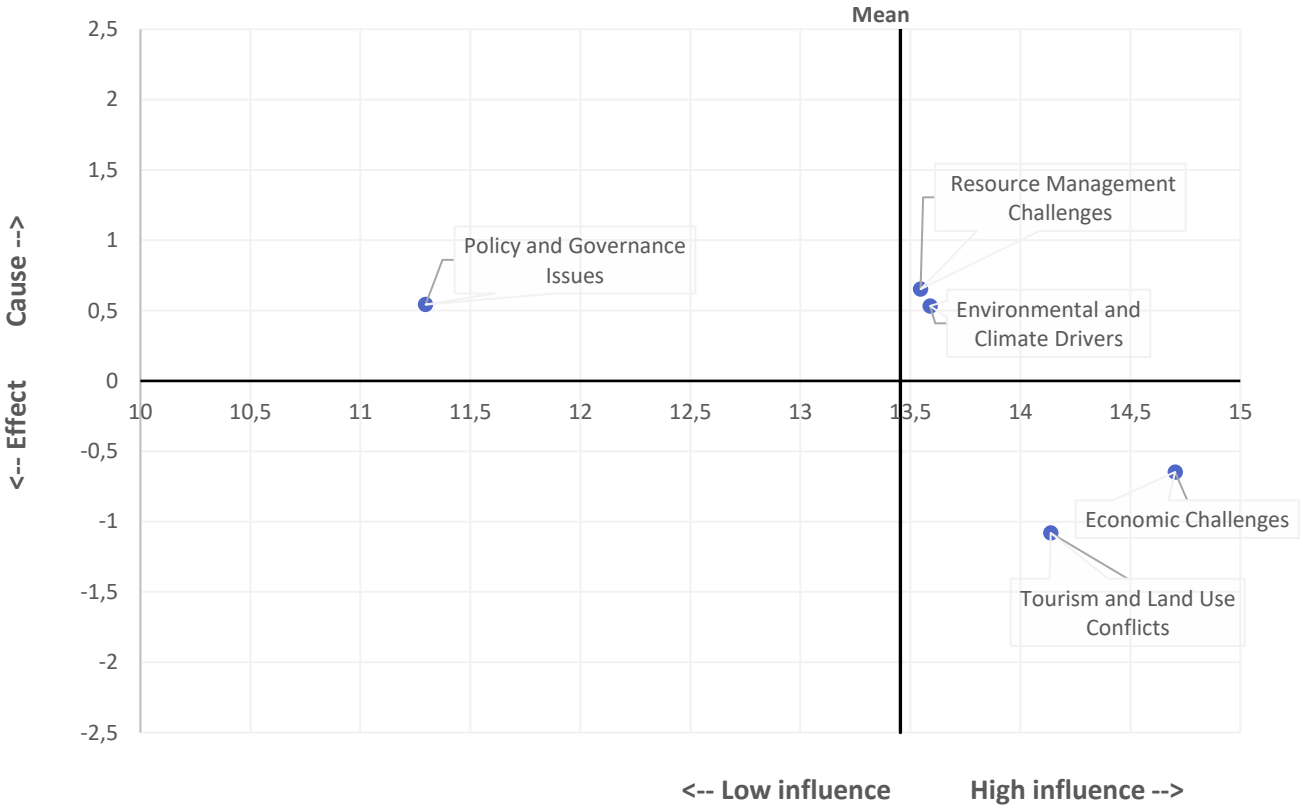

Fig. 2 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

The chart suggests that Policy and Governance issues, Resource Management Challenges, and Environmental and Climate drivers are the main causal factors influencing other factors. Their impact is manifested as Economic Challenges and Land Use Conflicts.

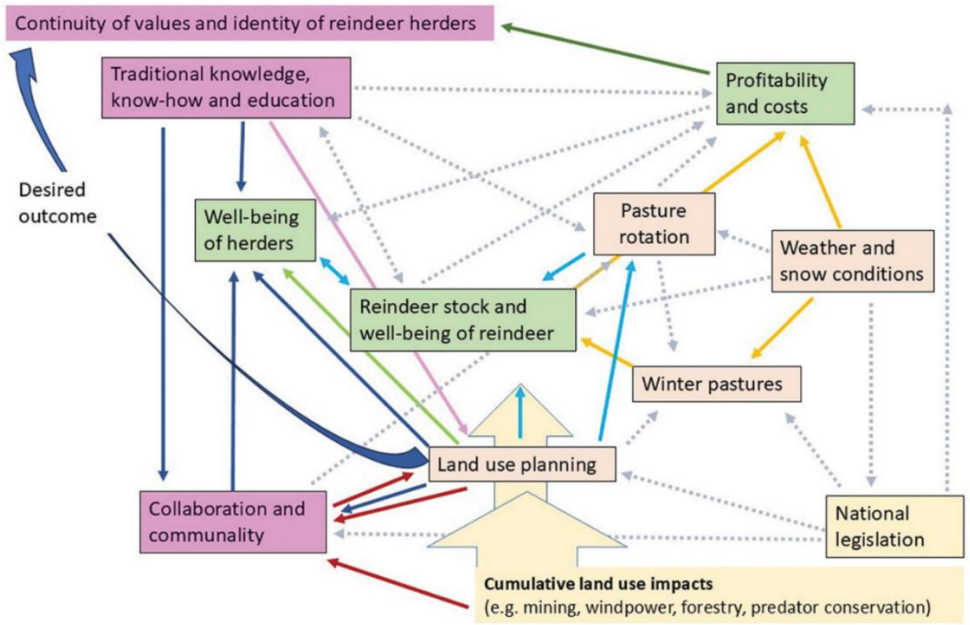

Fig. 3 Cognitive map of the operational environment of reindeer herding, synthesising four cognitive maps developed during the 2022 Futures Workshop in Inari. Colours indicate the focus of each breakout group; coloured arrows show key dynamics and grey dashed arrows other important feedbacks

Photo: adapted from Sarkki et al. 2025

10 Who is negatively impacted by the challenge, and how?

Reindeer herders are negatively affected by the current situation. Increasing wind power and mining developments, together with other land uses, lead to pasture encroachment and compromise the grazing peace that is important for herding. Predator conservation also contributes to reindeer losses, and even when compensation is provided, it does not cover all associated costs, including the time and fuel required to locate killed reindeer. Russian aggression against Ukraine has

increased the prices of fuel, which is needed for reindeer herding activities, and feed, which is provided to reindeer in many parts of the reindeer herding area, as long-term land-use changes, including forestry, have reduced the availability of natural pastures. In recent years, climate change has contributed to difficult winter conditions, as snow conditions can make it difficult for reindeer to access food. Together, these factors challenge the profitability and viability of the livelihood.

11 Who is positively impacted by the challenge, and how?

The green transition is creating new investment opportunities also in the Arctic. Forestry also benefits from these developments; however, in the workshops, herders considered that negotiations between herders and the state forestry enterprise Metsähallitus have improved, and that wind power and mining are currently greater challenges in areas where such projects are planned. Nature conservation can benefit reindeer herding, but when it is implemented in an exclusive manner, or when it contributes to increasing populations of large carnivores in the reindeer herding area, trade-offs can arise. Basically, the above-mentioned land users benefit when their projects are approved and local opposition does not hinder their implementation.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

Land-use decision-making is key to reindeer herding. Despite more than two decades of calls to enhance herders' opportunities to participate in land-use planning, problems remain, although some progress has also been made. The EU also drives the green transition, which, depending on how it is implemented through land use, nature conservation, and climate change mitigation, may not adequately allow for herders' participation in land-use decisions. Basically, the imbalance in centre–periphery relations, linked to both EU and national decision-making, is evident, particularly regarding predator conservation and the ways in which the forthcoming EU Biodiversity Strategy, with its focus on expanding the Natura 2000

protected-area network, and the EU Nature Restoration Law will be implemented. The Finnish state forestry enterprise Metsähallitus is also a key player in managing state-owned forests, which constitute the vast majority of forests in northern Finland. In terms of economic development, investments in wind power, mining, and tourism are not always in line with herders' interests and expectations.



Fig. 4 Windpark and reindeer fence as close neighbours?

Photo: Reindeer Herders' Association, Finland

14 The definition of the periphery trap in this case

Multiple drivers are causing multiple challenges for herders. The periphery trap in the reindeer herding case is linked to the idea of polycrisis. Based on this case, the periphery trap can be defined as "the local effects of multiple larger-scale drivers that produce continuously emerging and even surprising challenges for the reindeer herding livelihood, without any or significant possibilities to influence these drivers, on which the continuity of the livelihood depends". This has created a need to adapt within a polycrisis, meaning that past adaptations (e.g. increasing reliance on supplementary feeding and compensation) have themselves become part of the challenges.

15 The level of conflict

Some local conflicts have emerged around specific land-use projects or developments, alongside a lack of trust.

16 Description of the level of conflict related to the case study

There are some areas where land-use conflicts between reindeer herding and other land users are evident (e.g. related to mining, wind power, and predation of reindeer by large carnivores). Overall, there is some degree of mistrust between herders, other land users, and administrative authorities.



Fig. 5 Reindeer round-up

Photo: Philip Burgess

17 Efforts to solve the challenge(s)

Here, you can focus on one or a few solutions. The solutions can include, for example, community-based actions and initiatives, social innovations, new business models, entrepreneurial activities, new policy and planning instruments, science-based decision-making and solutions, nature-based solutions, and planning related to the use or conservation of mountainous areas.

Development of participatory planning tools for managing state-owned forests by the state forestry enterprise Metsähallitus. While there were many open conflicts between herders and Metsähallitus around 2000–2010, in our recent workshops in 2023, herders mentioned that forestry is currently not the biggest problem and that forest planning has improved.

The Reindeer Herders' Association and Wind Power RY (Tuulivoima ry) have jointly published views on good practices for wind power development planning in reindeer herding areas (see https://paliskunnat.fi/py/neuvonta/maankaytto/tuulivoima/).

Compensation schemes for predator damage have been developed, with some remaining challenges regarding the recognition of the time and fuel spent locating and documenting killed reindeer, as well as increasing dependence of the livelihood on compensation, especially in some Reindeer Herding Cooperatives where predator pressure is most acute.

Recent development of pasture management plans for Reindeer Herding Cooperatives. Herders can themselves design pasture management measures, but they have to choose from predefined solution alternatives, and these plans have no influence on other land users in the area. Thus, the plans can improve the internal organisation of herding practices, but cannot influence other land uses affecting pasture availability and grazing peace.

Many forms of integration between reindeer herding and tourism have developed. A reindeer herder from Ranua, Finland, seized a window of opportunity in 2022 and entered the reindeer leg-skin business in partnership with Reindeer Boot, a Mongolian shoe factory. While challenges remain, the new business venture provides welcome additional income for herders and is also compatible with traditional cultural practices associated with the reindeer herding livelihood (see blog Majuri and Sarkki, 2023: These Legs Are Made For Walking: How Finnish Reindeer Leg Skins Entered the International Shoe Business – MARGISTAR, https://margistar.eu/how-finnish-reindeer-leg-skins-entered-the-international-shoe-business/).

A co-management agreement: In 2013, Metsähallitus and the municipality of Muonio agreed to initiate collaborative planning for the disputed forests. Metsähallitus agreed with key local stakeholders, including reindeer herders and tourism entrepreneurs, that some areas would be excluded from conventional forestry operations, allowing only moderate thinning, selective logging, or small-scale openings in agreed parts of the area in question. The area is a pilot for "softer" forestry methods, and the agreement is in place until 2040. An important outcome of the project is a permanent cooperative group consisting of all stakeholders involved in the collaborative planning. The group meets regularly and monitors compliance with the agreement (Sarkki et al. 2022).



Fig. 6 Reindeer herders and researchers making snow observations together

Photo: Antti-Jussi Pekkarinen

18 Research-related proposals for potentially solving these challenges

We identified a set of adaptive actions with reindeer herders through a participatory future workshop. A key finding was that proactive adaptation measures are needed, particularly regarding land use, which affects multiple issues simultaneously. Examples of proactive adaptation include:

Green transition: Recognising the role of reindeer herders in ecosystem restoration alongside the implementation of the EU Nature Restoration Law. Promoting the concept of biocultural diversity, which should be safeguarded rather than focusing narrowly on biodiversity. Ensuring Saami Indigenous rights, including the right to herd reindeer. Developing green certification for reindeer meat. Establishing rapid and straightforward processes for granting licences to hunt predators.

Climate change: Restoring pasture areas for use by herders as a way of preparing for climate change by increasing flexibility and opportunities for pasture rotation. Providing sufficient resources for herders to adapt and plan for community-led adaptation. Establishing monitoring systems to anticipate difficult conditions (e.g. pasture condition, food availability, and the condition of reindeer in autumn).
Land use: Recognising reindeer herders as rights-holders and ensuring that they can genuinely influence land-use decisions in their home areas. Introducing legislative changes regarding reindeer numbers, compensation and subsidies, land use, and rights to use the land. Increasing the possibilities of reindeer herders to influence land-use planning is the most effective way to enhance the prospects for the continuity of the livelihood for future generations also in the face of unpredictable future challenges (Sarkki et al. 2026).

19 Visions of desirable futures of the involved actors and the source of information

We arranged two participatory future workshops with reindeer herders (see Rasmus et al. 2023 for a report of the first workshop). The workshops discussed with herders their dreams related to the livelihood, current challenges, and how the major drivers depicted by the SSP narratives challenge and change the livelihood.
In both workshops, the most frequently identified and discussed dream was that reindeer herding would continue for future generations within one's own family. Such continuity was linked to the key elements of the operational environment that form the essence of the reindeer herding livelihood and that herders hoped would continue in the future. This implies that herders consider the entire existence of the livelihood, or at least its core identity, to be under threat. In Workshop 2, the core of reindeer herding was considered to be built around winter pastures, pasture rotation, and the use of feeding as a tool to control the herds (*paimennusruokinta*). Furthermore, Indigenous rights, customary rights to herd reindeer, and communality among herders were considered "treasures" and key building blocks of herding culture. Likewise, in Workshop 1, values and reindeer herding identity, communality among herders, and traditional practice-based knowledge were considered to form "the soul" of reindeer herding. In Workshop 1, herders identified the following priorities underpinning the viability of the livelihood: (1) the ability of herders to influence decisions concerning their lives; (2) the availability of pastures to ensure grazing peace; (3) the economy and well-being of reindeer herders; (4) the continuation of communality; (5) know-how related to

reindeer herding; and (6) reindeer stocks and the well-being of reindeer. Maintaining and further enhancing these elements was considered important for the future of the livelihood.

20 Lessons-learned from the case study

Future polycrises will remain complex and unpredictable, requiring new ways of thinking about adaptation. We identified four general forms of adaptation: maladaptation, regressive adaptation, responsive adaptation, and revitalising adaptation. We found that proactive, livelihood-resilience-focused adaptation, or revitalising adaptation, is the most prominent way of coping with emerging challenges. The key question is how to enable revitalising adaptation, which focuses on strengthening the core characteristics of the reindeer herding livelihood rather than attempting to adapt to each individual crisis separately. If adaptation measures narrowly seek to overcome a single current crisis, they may create additional vulnerabilities and dependencies in the future. Our major finding was that increasing the possibilities for reindeer herders to influence land-use governance is important for enhancing the prospects for the continuation of the livelihood for future generations. However, this requires negotiations and value discussions with governmental actors and other land users, as increasing herders' rights may constrain other land uses in the reindeer herding area. We consider that increasing opportunities for herders to participate in decision-making and strengthening their land-use rights are among the most promising approaches for enabling revitalising adaptation in practice.

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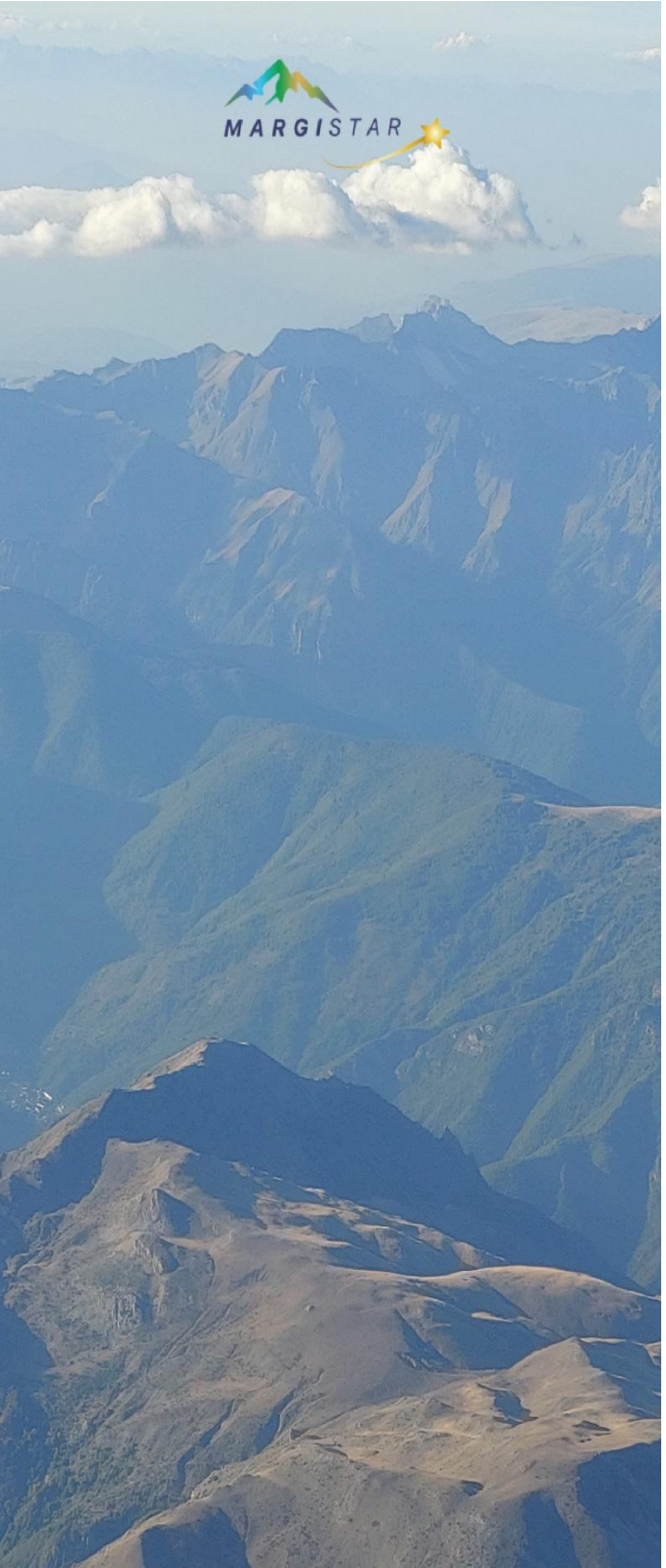

Bridging the digital divide: A case study in community-led broadband

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1 Case study location

52° 21' 2.74"N, -7° 19' 49.76"E



2 Country

Ireland

3 For how long has the challenge been acute?

10 years

4 Challenge categories

Economic challenges: Economic problems, poverty, and lack of employment and education opportunities.
Governance challenges: E.g., policies made at national and/or EU levels, top-down decision-making, lack of local participation in decision-making etc.
Service-related challenges: Poor cultural, social and/or commercial services.
Geographical challenges: Geographical handicaps (including long distances, lack of connectivity, difficult terrains etc.) and/or natural handicaps (e.g., soil productivity, growing season).

5 Relevant UN Sustainable development goals

SDG8: Decent work and economic growth.
SDG9: Industry, innovation, and infrastructure.
SDG11: Sustainable cities and economies.

6 Short description of the case study location

The Piltown area (the villages of Piltown and Fiddown) is one of many communities where no commercial ISP is offering fibre to the premises. It is widely accepted that broadband connectivity has a positive impact on GDP, firm-level productivity, and employment. Lower population densities and greater distances in rural areas often discourage private sector actors from investing in high-speed broadband infrastructure and new technologies, contributing to a digital divide between urban and rural communities.

Piltown and Fiddown are two small rural communities in Co. Kilkenny. They were not included in the National Broadband Plan. At the same time, their size and location are not attractive to private operators. As a result, broadband speeds were limited to 1–6 Mbps.

Using funding from Kilkenny Leader Partnership, Piltown Community Enterprise created a steering committee (Better Broadband for Piltown) to investigate the viability of installing community-owned fibre broadband infrastructure.

An Expression of Interest survey was carried out with the community, which showed high levels of support.

The steering committee carried out an extensive feasibility study to assess the feasibility of building a FTTH network in the area. In June 2020, the committee formed a board and registered as its own legal entity, Broadband 4 our Community, Company Limited by Guarantee (B4OC C.L.G.).



Fig. 1 Piltown: European Rural Inspiration Award nomination

7 Key challenges in the case study

To offer residents of Piltown and Fiddown full fibre-to-the-premises through a community-owned broadband network.
To optimise the delivery of low-cost, high-speed internet for the towns' digital future.
To make Piltown and Fiddown attractive places to live or start a business.
To build community support and support from external stakeholders.
To build the skills required within the community.

8 A brief summary: What is this case study about?

This case is about how a community responded to poor digital infrastructure, a problem faced by many rural regions. In this rural community, no commercial ISP offered Fibre-to-the-Premises (FTTP). As the town was not included in the Government's National Broadband Plan, the community responded by creating its own provider. Broadband for Our Community (B4OC) is

Ireland's first community-owned and managed FTTP network. The local community embraced the initiative, with landowners granting access to land, volunteers laying cables and sharing equipment and expertise. Four members of the community trained as fibre-optic technicians to install and maintain the network pro bono.

9 The fundamental causes and drivers for the challenges

The causes and drivers of the challenges experienced in Piltown and Fiddown revolve around the digital divide between urban and rural areas, primarily fuelled by economic and infrastructural disparities.

Central to these challenges is the cost-benefit analysis performed by private internet service providers (ISPs), which often deems rural areas less profitable due to lower population densities and higher infrastructure costs. This results in underinvestment in rural broadband infrastructure, leading to inadequate access to high-speed internet services.

The delay between the evaluation of broadband in the initial time period and the implementation of the NBP, during which the NGA threshold changed, highlights a significant issue in addressing rural broadband needs. As the NGA threshold was raised, communities like Piltown and Fiddown, which might have previously met or slightly exceeded the basic broadband access requirements, suddenly found themselves classified as poor performers in terms of broadband access. Such changes can leave rural areas in a perpetual catch-up cycle.

The delay in NBP implementation, coupled with evolving NGA standards, meant that the criteria for assessing broadband needs and allocating resources no longer reflected the reality on the ground for communities like Piltown and Fiddown.



Fig. 2 Community-led digital transformation in Piltown earned Digital Town Award in 2024

9a A cause-and effect diagram identifying key drivers and their interrelationships

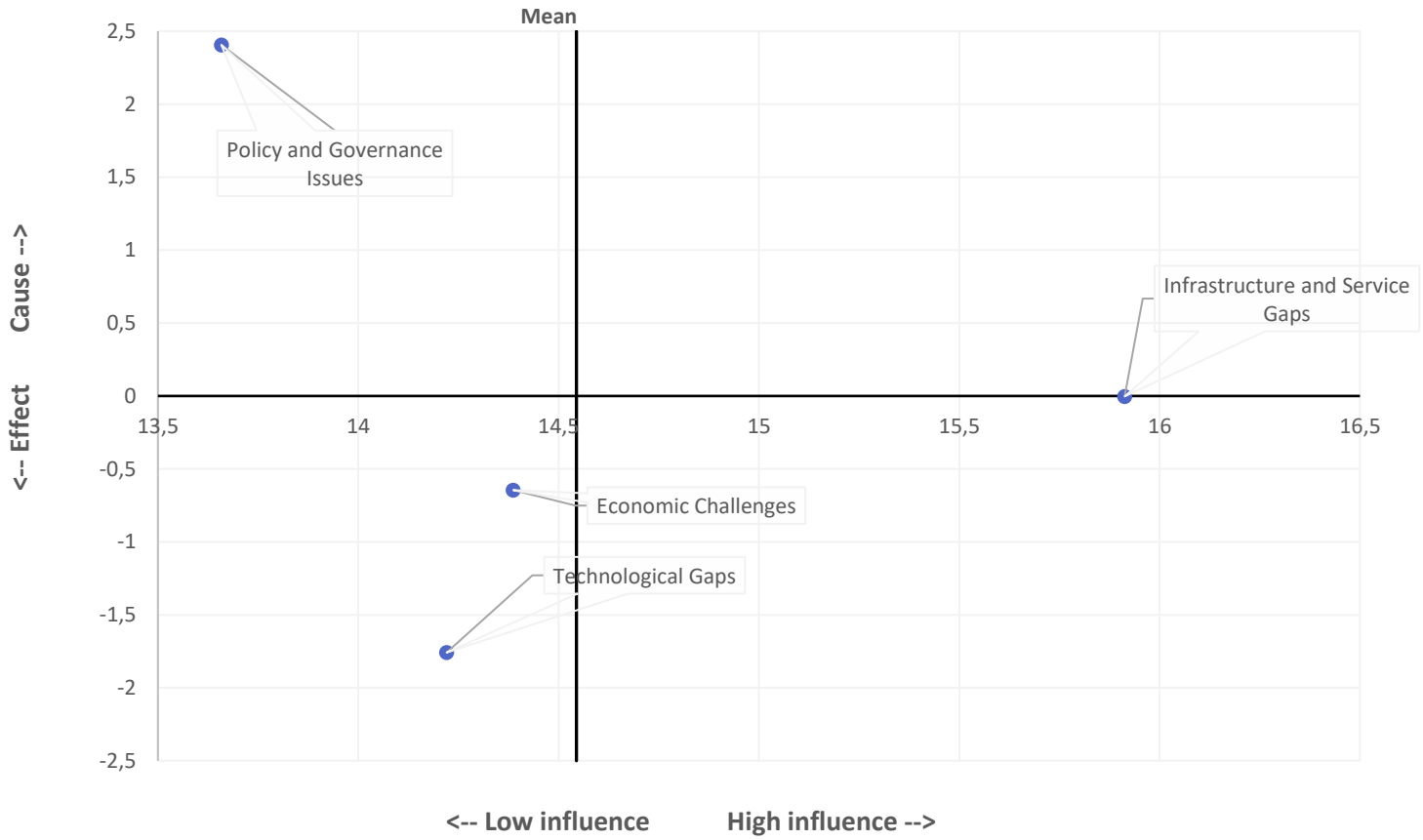

Fig. 3 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

The chart suggests that Infrastructure and Service Gaps represent the most influential factor causing Economic Challenges and Technological Gaps. The root cause (the driver) was Policy and Governance.

10 Who is negatively impacted by the challenge, and how?

The primary group negatively impacted by the lack of high-speed broadband access is the residents and businesses in rural areas, in this case communities like Piltown and Fiddown. These challenges can equally apply to marginalised mountainous areas. The absence of adequate broadband connectivity hinders local businesses' ability to compete and grow, as they cannot effectively engage in online commerce, access cloud services, or utilise digital marketing. For residents, this lack of connectivity affects quality of life by limiting access to online educational resources, telehealth services, and entertainment options like streaming and teleconferencing. Moreover, the lack of high-speed internet discourages new businesses and families from moving to these areas, exacerbating issues of rural depopulation and economic decline. This challenge presents a significant barrier to ensuring equal opportunities for rural communities to participate in the digital economy and access services that are increasingly considered essential in contemporary society.

11 Who is positively impacted by the challenge, and how?

Lack of high-speed broadband in rural areas indirectly benefits larger, urban-centric internet service providers (ISPs) and telecommunications companies that focus their infrastructure and service provision on more densely populated, profitable markets. These entities may view the high costs and lower immediate returns of extending services to rural areas as unjustifiable, thereby concentrating their efforts where they can maximise profits. As a result, their resources are not spread thinly over challenging rural deployments, allowing them to invest more heavily in urban and suburban areas to enhance service quality and expand their offerings. This focus reinforces their market dominance in regions already served and maintains their competitive edge by offering higher speeds and more reliable connections compared to what is typically available in underserved rural areas. Additionally, the absence of high-speed broadband in rural areas may lead to a lack of competition, allowing these larger ISPs to maintain higher prices and more control over the markets they do serve, as there are fewer alternatives for consumers to switch to.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

This case study also highlights the EU influence on centre-periphery relations. Here, changing definitions of Next Generation Access (NGA) broadband standards at an EU level contributed to exacerbating the imbalance in centre-periphery relations by shifting the goalposts for what is considered adequate broadband, to the detriment of a rural (peripheral) area. In nationally funded programmes, the lag between assessment and implementation can result in some areas being left behind. Urban areas typically already enjoy access to high-speed broadband that exceeds the minimum NGA standards, and the communities identified for support from the National Broadband Plan (because they had broadband access below the threshold at the time of evaluation) benefited from investment from the NBP to achieve the new NGA standards. However, those communities bordering on the basic threshold for NBP investment are left behind when new NGA standards are introduced, thereby widening the digital divide.

By developing community-owned broadband networks, rural areas can bypass the slower pace of central investment and directly address their connectivity needs. In essence, local funding of broadband infrastructure can be a pivotal factor in rebalancing the disparities between central and peripheral areas, offering a path towards greater digital equity and inclusivity.

14 The definition of the periphery trap in this case

The periphery trap is a cycle where rural areas remain in a state of underdevelopment due to inadequate infrastructure, specifically broadband access, which hinders economic growth, innovation, and quality of life. This trap is perpetuated by limited investment, where the perceived lower profitability of rural areas discourages private and public broadband infrastructure projects, keeping these communities at a disadvantage compared to urban areas, thereby reinforcing their peripheral status and associated challenges. This is exacerbated by reliance on centralised government funding and gaps in the central government's needs assessment and ultimate implementation, particularly where such plans need to accommodate rapid changes in ICT.

15 The level of conflict

No direct conflict, but the project arose from a perspective that the Government's plan was wrong and that the area would not get the quality of service required. In this sense, the problem was partly framed as addressing a problem created by the government – in that the area was excluded from the Government's National Broadband Plan. The project team in Piltown believed that the data used to make the assessment that service provision in Piltown was 'adequate internet' was wrong and outdated.

16 Description of the level of conflict related to the case study

Not applicable.

17 Efforts to solve the challenge(s)

Broadband for Our Community (B4OC): Broadband for Our Community is Ireland's first community-owned and managed Fibre-to-the-Premises (FTTP) network. It is a community-led initiative undertaken to supply, install and operate a not-for-profit FTTP network for local residents and businesses.

Vision – B4OC: The stated vision of the Board of B4OC is to deliver true, future-proofed high-speed broadband for our community of Piltown & Fiddown. This will be a network in which our community is invested.

Solution: A 6 km fibre-optic cable will link Fiddown and Piltown to the national fibre grid and provide the community with its own permanent high-speed internet network. The community-owned network can also provide residents with a landline service via Voice over Internet Protocol (VoIP).

Scale: The network is in place, with over 100 buildings serviced by the broadband network. The community plans to complete another 650 homes in both towns by the end of 2024. (https://leadercongress.eu/en/2023/11/20/better-broadband-for-piltown-2/)

Eventually, the B4OC fibre network will connect approximately 750 homes and businesses in a 3.4 square kilometre area, with an internet speed of at least 150 Mbps.

Technologies: The B4OC project comprises fibre-optic cabling, underground cable ducts, telephone poles and VoIP (Voice over Internet Protocol) access points for phone connections. Mapping and data-gathering were done with a collaborative geographical survey application.
Community involvement: The local community has embraced this initiative, with landowners granting access to land, volunteers working to lay cables, sharing equipment, and providing expertise pro bono. Four members of the community have been trained as fibre-optic technicians to install and maintain the network pro bono.
The board of B4OC is composed of local volunteers who meet every week (often through video conferencing) to coordinate funding and labour strategies to make this vision a reality.
Sustainable business model: Like regular telecommunications companies, there is a once-off connection fee and a monthly subscription fee with a guaranteed price for two years. However, unlike other commercial networks, the monthly fee is due to come down once the initial investment has been repaid in full. The business has an operational profit. (https://leadercongress.eu/en/2023/11/20/better-broadband-for-piltown-2/)

18 Research-related proposals for potentially solving these challenges

The accelerated use of an easy to use, affordable, broad based tool that allows rural towns and remote areas to measure digital readiness. An existing framework has been developed (see Lynn, T., Rosati, P., Conway, E., Curran, D., Fox, G., and C. O'Gorman, Digital Towns: Accelerating and Measuring the Digital Transformation of Rural Societies and Economies, 2022, Springer).

19 Visions of desirable futures of the involved actors and the source of information

Sources: Interview with B40C and published material based on interviews, etc. of key actors.
The stated vision from the Board of B4OC is: 'to deliver true, future-proofed high-speed broadband for our community of Piltown & Fiddown. This will be a network in which our community is invested.'

Brian Doyle, chair of B4OC, stated in an interview: "Given that laying fiber-optic cable is expensive, using the future-proofed FTTP model employed by the telecommunications industry was the only way forward." (https://www.siliconrepublic.com/comms/ireland-b4oc-fttp-broadband-internet-network-kilkenny-piltown-fiddown):
In an interview with Silicon Republic, Brian Doyle, chair of B4OC, outlined that the project is a "service by the community, for the community which is owned by the community and run in its interest", and that "we even hope to be able to pay a community dividend and the intention is that this money would finance other community projects". (https://www.siliconrepublic.com/comms/ireland-b4oc-fttp-broadband-internet-network-kilkenny-piltown-fiddown)
In a blog (Blacknight blog), local businesses outlined how the provision of this service is critical to their businesses and therefore the local area. For example, quoted in the blog, Kate Foley, O'Shea Farm/Iverk Produce, said:
"Quality broadband is critical for a business like ours…. This service will make this area far more attractive for everyone." (https://blacknight.blog/left-behind-by-the-national-broadband-plan-blacknight-helps-piltown-and-fiddown-get-fast-fibre-broadband.html#)
In a 2023 Leader Program review, the possibilities created by the project were set out as: "The success of the Piltown-Fiddown project will mean it can compete for businesses attractions to its community-owned Enterprise Centre; its school can use distance learning technology, its sick and elderly use online consultations; its residents can avail of streaming, teleconferencing and other leisure and utility services."(https://leadercongress.eu/en/2023/11/20/better-broadband-for-piltown-2/)

20 Lessons-learned from the case study

Delivering this project required several considerations around feasibility, such as costs and funding and the skills required, and implementation, such as choices around the network build, training of community members and design help.
The importance of industry contacts. Having access to an industry contact network that was ready and willing to share information and advice was essential to the success of the project. The suppliers and other smaller broadband companies based in Ireland and Northern Ireland were an invaluable source of information and help when it came to designing, building, testing and commissioning our network.

By and large, the difficult problems are not the technical problems of actually building the network. They were issues with people, land access and managing expectations.

However, the largest difficulties involved issues with people, land access and managing expectations. As a result, the project has several actions that they are taking to mitigate issues in the future. The first is actively attempting to improve communication with the community. This can be done by following a communication process before connecting an area, for example, identifying local allies and going door to door to explain the plan and receive local input. Additionally, the board is working on improving its social media activity as a means of communicating digitally with a wider audience.

Another lesson is ensuring users have a good experience regardless of whether the issue results from the network. This has entailed helping people improve their wireless network configuration or upgrading their equipment.

Finally, a project of this length and complexity requires the board to retain and recruit members. The long-term viability of the project requires a regular influx of people to help.

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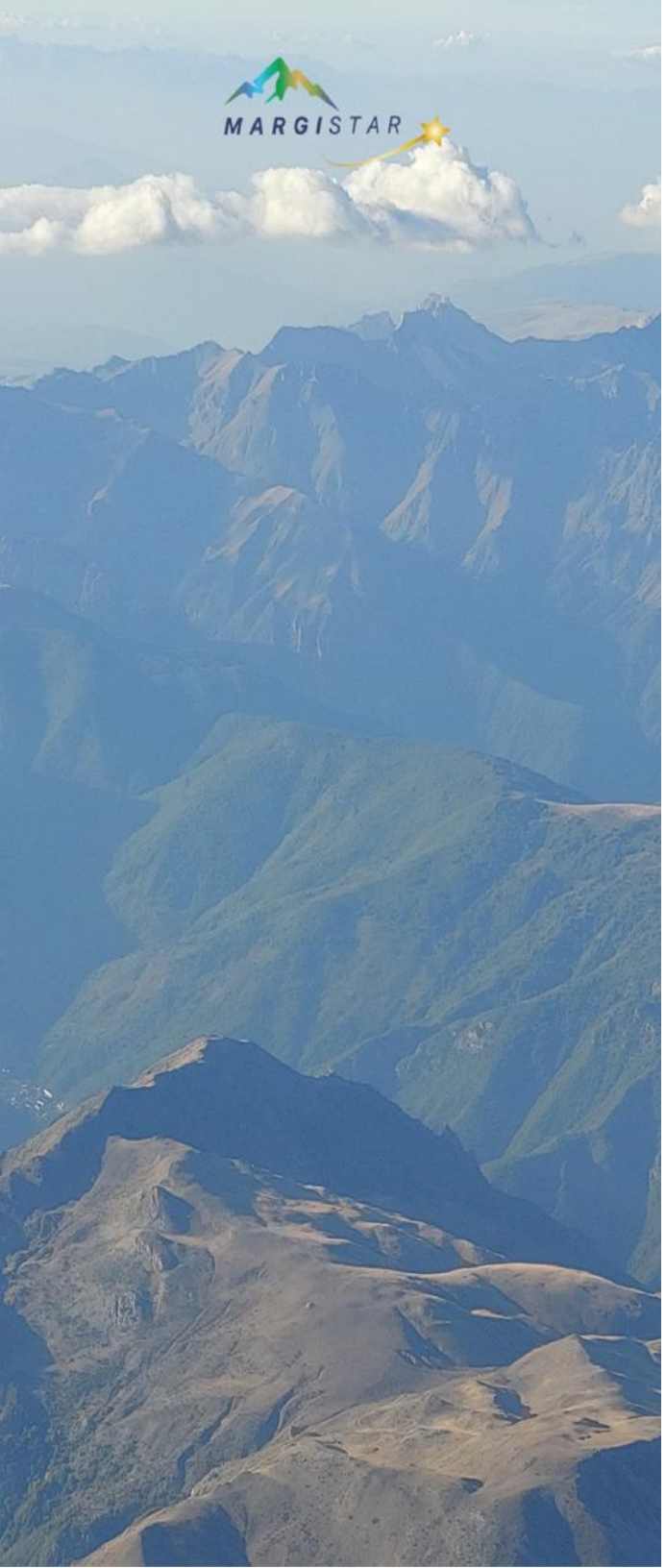

From the river to the people: how scientific research can contribute to the local development of mountain areas

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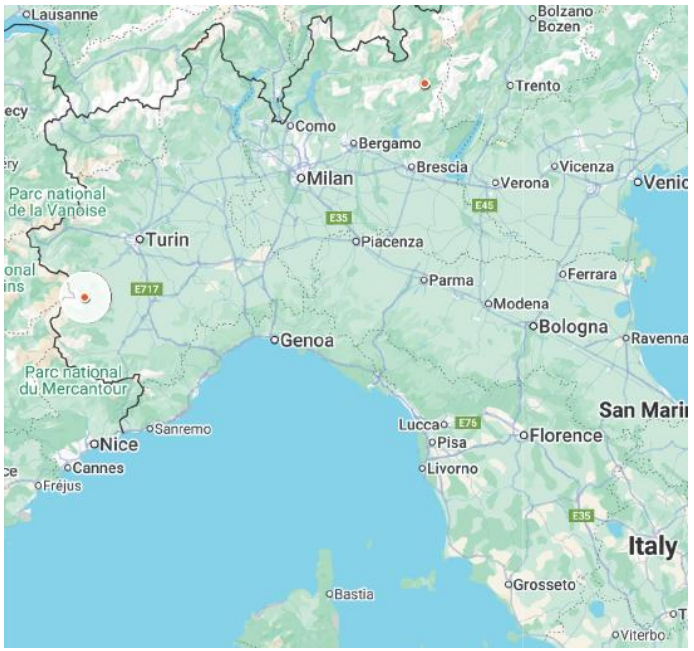
1 Case study location

44° 41' 29.83"N, 7° 10' 40.77"E



2 Country

Italy

3 For how long has the challenge been acute?

20 years

4 Challenge categories

Socio-cultural challenges: Demography, migration (out/in) and/or social and ethnic tensions.
Governance challenges: E.g., policies made at national and/or EU levels, top-down decision-making, lack of local participation in decision-making etc.
Service-related challenges: Poor cultural, social and/or commercial services.
Environmental challenges: Climate change, biodiversity loss, and/or ecological destruction.
Geographical challenges: Geographical handicaps (including long distances, lack of connectivity, difficult terrains etc.) and/or natural handicaps (e.g., soil productivity, growing season).

5 Relevant UN Sustainable development goals

SDG4: Quality Education, SDG8: Decent work and economic growth, SDG11: Sustainable cities and economies, SDG12: Responsible consumption and production, SDG13: Climate action, SDG15: Life on land.

6 Short description of the case study location

Ostana is one of the smallest mountain villages in Italy and is located in the Italian Cottian Alps (Piedmont Region), near Monviso mountain and about 50–60 kilometres from the main cities in the area (Turin and Cuneo, respectively).

Unlike several small villages in peripheral and mountain areas that are affected by the abandonment of local inhabitants, since 1980, a slow but constant process of resettlement has occurred in Ostana and contributed to creating a cohesive local community. Nowadays, there are about 90 official residents, with 50 of them living permanently (12 months/year) in Ostana. The composition of this social community is heterogeneous, including people who were born in Ostana before 1950, younger people who moved from bigger towns, and second-home owners concretely involved in the life of the village. Moreover, Ostana can rely on a group of temporary residents (for instance, cultural operators, artists, academic researchers, and professors) who actively participate in local projects and act as ambassadors and networkers.

Thus, in the last few decades, Ostana has become a leading model of socio-economic and cultural Alpine regeneration, as it is recognised at both local and national scales. The main reasons for this successful process are: (i) the start of a process of high-quality architectural renovation based on very strict rules, with private owners working in synergy with the municipality; (ii) the creation of an innovative centre ("Lou Pourtoun Building") as an attractive space for cultural production and civic engagement; (iii) the development of a dense network of collaboration with local and external stakeholders, including private companies, NGOs, universities and research institutes, and enterprises.

Nevertheless, the major challenges for Ostana village are represented by sustainable mobility, a decrease in financial resources provided by the government, and a lack of affordable housing solutions.



Fig. 1 Aereal picture of the artificial flumes (mesocosms) of the ALSTREAM Center on the left bank of the Po River in Ostana. This mesocosm systems allows to carry out eco-hydraulics experiments

7 Key challenges in the case study

While Ostana has been mostly perceived over the years as a beautiful destination for tourists, the village aims at attracting new (possibly permanent) residents and potential entrepreneurs and innovators who can contribute to social and economic growth.

In light of this, the main challenges for Ostana village are the following: The adoption of a sustainable mobility system. Since 2021, the municipality has been working on new mobility solutions based on the wider use of electric cars, a local carpooling system, and the installation of new infrastructure for recharging electric bikes. The municipality already provides a shuttle bus service during the main events. Yet, the distance from the main cities and the available transport still represent a relevant challenge.

The decrease in financial resources provided by the government. To overcome this problem, the municipality works on the development of a dense network of local and external stakeholders.

The lack of affordable housing solutions and social and cultural services. To improve the attractiveness of Ostana village, the municipality collaborates with private companies and tries to provide as many services as possible (for instance, the creation of co-working spaces and cultural services).

8 A brief summary: What is this case study about?

Ostana is a small village in the Italian Cottian Alps (1200 m ASL). Since 2019, it has hosted the Alpine Stream Research Center (ALPSTREAM), which is a facility recently developed by the Monviso Natural Park and local universities. Thus, it represents an interdisciplinary group that works on water management, biodiversity conservation and ecosystem services, education, and ecotourism. The activities of ALPSTREAM include lessons, field excursions, local and international summer schools, workshops, and research experiments. Thus, academic scientists are trying to contribute to the local revitalisation of Ostana by bringing students, local and international scholars, and other people to Ostana.

9 The fundamental causes and drivers for the challenges

The fundamental causes of the challenges experienced by Ostana are the peripheral and mountainous location of this village and its geographical distance from the main cities in the lowland areas. Also, the low population density and weak demographic growth can represent a limitation to the social and economic development of the Ostana community.



Fig. 2 Group picture of the participants of the "XV Meeting of PhD students and yearly carrier scientists in Freshwater Ecology". Ostana, 8-10 May 2019

9a A cause-and effect diagram identifying key drivers and their interrelationships

The analysis has not been conducted.

10 Who is negatively impacted by the challenge, and how?

The municipality, local residents and associations, and potentially interested new inhabitants (especially younger ones) are impacted by the challenges because of the difficulties in finding all the services necessary to work and live throughout the year in Ostana village.

11 Who is positively impacted by the challenge, and how?

Occasional (short-term) tourists, especially if they rely on their own cars, are positively impacted by the challenges.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

The main cities in the area (for instance, Turin, Cuneo, Saluzzo, and Pinerolo) are more attractive in terms of job opportunities and social and cultural services. Also, these main cities provide more affordable housing solutions, especially for young people.



Fig. 3 Picture of a lesson at the conference room of Lou Pourtoun Building

14 The definition of the periphery trap in this case

In this case, the periphery trap is defined as a geographically distant and marginalised area that is poorly attractive because it offers fewer opportunities for living and working continuously. Thus, in this case study, the periphery trap refers to a location that relies on occasional and short-term visitors and/or users, without the possibility of creating long-term and autonomous activities.

15 The level of conflict

Small communities, especially in isolated rural settings, are always at risk of conflict. However, the level of conflict seems to be very low in Ostana.

16 Description of the level of conflict related to the case study

Ostana has been able to build a community larger than those who are strictly residents. In this way, the construction of collective intelligence and a community that has chosen a project rather than a birth undermines the potential for conflict.

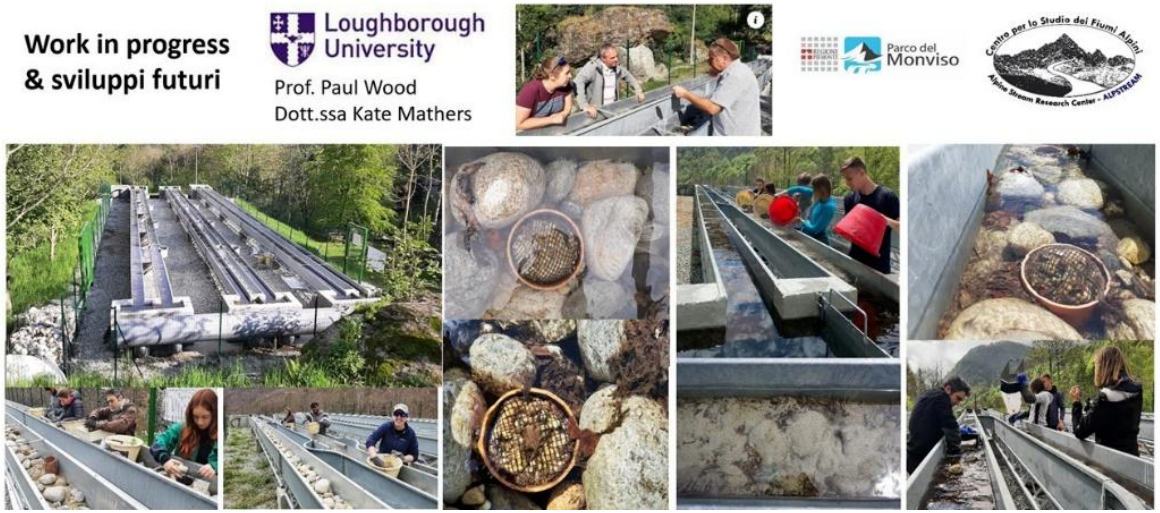


Fig. 4 Some pictures of a joint experiment with English visiting scholars at the flumes of the ALPSTREAM Center (May 2023)

17 Efforts to solve the challenge(s)

To address the aforementioned challenges, in the last few years the municipality of Ostana has worked on different solutions. The main ones are indicated below.

In 2012, an innovative centre, namely "Lou Pourtoun Building", was created as a space for co-working and aggregation for people. This facility was built by means of regional funds and relies on a conference room (about 90 seats), a small restaurant, two libraries (one for children and one collecting books and publications about the Alpine areas), and several rooms and common spaces for associations and stakeholders. Among these, one room is the laboratory of the Alpine Stream Research Center (ALPSTREAM), which is a facility recently developed by the Interreg-Alcotra programme "Terres Monviso". The Monviso Natural Park was the leader of the Interreg-Alcotra programme, but the ALPSTREAM Center includes researchers from the University of Eastern Piedmont, the University of Turin, and the Polytechnic University of Turin. Thus, it represents an interdisciplinary group that works on the conservation and management of Alpine rivers from an eco-hydraulic perspective.

Since its creation, researchers of the ALPSTREAM group have brought students to the ALPSTREAM Center for lessons, field excursions, local and international summer schools, workshops, and research experiments.
In addition, the "Lou Pourtoun" is managed by the Viso a Viso enterprise, which is particularly active in organising social and cultural events throughout the year, such as workshops, educational activities for children, musical and theatre performances, contemporary art exhibitions, movie screenings, and advanced training courses for institutes and universities.
In 2020, Ostana launched "Ostana Res", a Residency programme to attract professionals, researchers, artists, entrepreneurs, individuals, or families who want to spend a period in Ostana to develop their own projects, contributing to the growth of the community or simply experiencing life in the village. For instance, in 2023, Ostana hosted the famous writer Amitav Ghosh for a week.
In addition, from 2017 to 2019, six asylum seekers were hosted in Ostana, with excellent results in terms of social and professional integration. This experience contributed to raising awareness among residents of the need for an open and inclusive local society, created through the joint work and collaboration among residents, stakeholders, and local institutions.
When looking at young people, since 2022, Ostana has provided a one-year position in the framework of the Voluntary Solidarity Service (Servizio Civile Volontario). The selected person aids in different activities and projects for Ostana's community, and the municipality provides them with an apartment free of charge during the year of service.
3) With respect to green mobility and sustainability, in recent years the municipality has invested in new mobility solutions based on the wider use of electric cars, a local carpooling system, and the installation of new infrastructure for recharging electric bikes. The municipality already provides a shuttle bus service during the main events. Also, particular attention is paid to sustainable agriculture and forest management through collective actions and the involvement of the local community.

18 Research-related proposals for potentially solving these challenges

As a member of the ALPSTREAM research group, the research-related proposals deal with the institutional and educational activities of the ALPSTREAM Center as a way to bring students and people to Ostana and contribute, in collaboration with the municipality and other local stakeholders, to the revitalisation of this community. For instance, my colleagues and I organise summer schools, field excursions, and experiments involving university students who spend part of their teaching or

research activities in Ostana. Since 2021, the "Rural Erasmus Mobility" programme has been activated to allow students to spend three weeks in Ostana. We also collaborate with local people for networking.

19 Visions of desirable futures of the involved actors and the source of information

The desirable future of the actors I am working with (for instance, the municipality and the Viso a Viso enterprise) consists of the possibility of growing Ostana's community and attracting people, students, and scholars inclusively.
The municipality strongly believes in the presence of the universities in its territory, because culture and knowledge are always at the core of its promotional activity and territory management. This is demonstrated by the creation of the "Lou Pourtoun" aggregative centre, as well as the particular attention the municipality pays to the ALPSTREAM Center.
Similarly, the relationship between the ALPSTREAM researchers and the local enterprise Viso a Viso is strong and fruitful. Whenever possible, my colleagues and I involve the members of the Viso a Viso enterprise in the co-organisation of events, and vice versa.
Thus, local authorities and stakeholders are fully aware that the social and economic renewal of Ostana must be achieved through the promotion of innovation, knowledge, and education.

20 Lessons-learned from the case study

Probably, the major lesson learned from this case study is that the success of the revitalisation of Ostana village and its community is linked to the ability to provide socio-cultural services to people. Only by offering cultural services and opportunities and real aggregative spaces is it possible to create cohesive and aware communities that, in turn, share the same philosophy and decide to live in Ostana by combining tradition and innovation.
The strong heritage and traditions of this territory are still alive in the culture, language, and architecture of Ostana, and represent an important value of this village and its community. At the same time, the ability to invest in innovation and shared approaches represents the additional aspect explaining the renewal of Ostana. This innovative process consists of involving and collaborating with qualified research and educational institutes, with the possibility of providing people with excellent opportunities for training and education.

Finally, the ability to network is also a key factor in the strength of Ostana.

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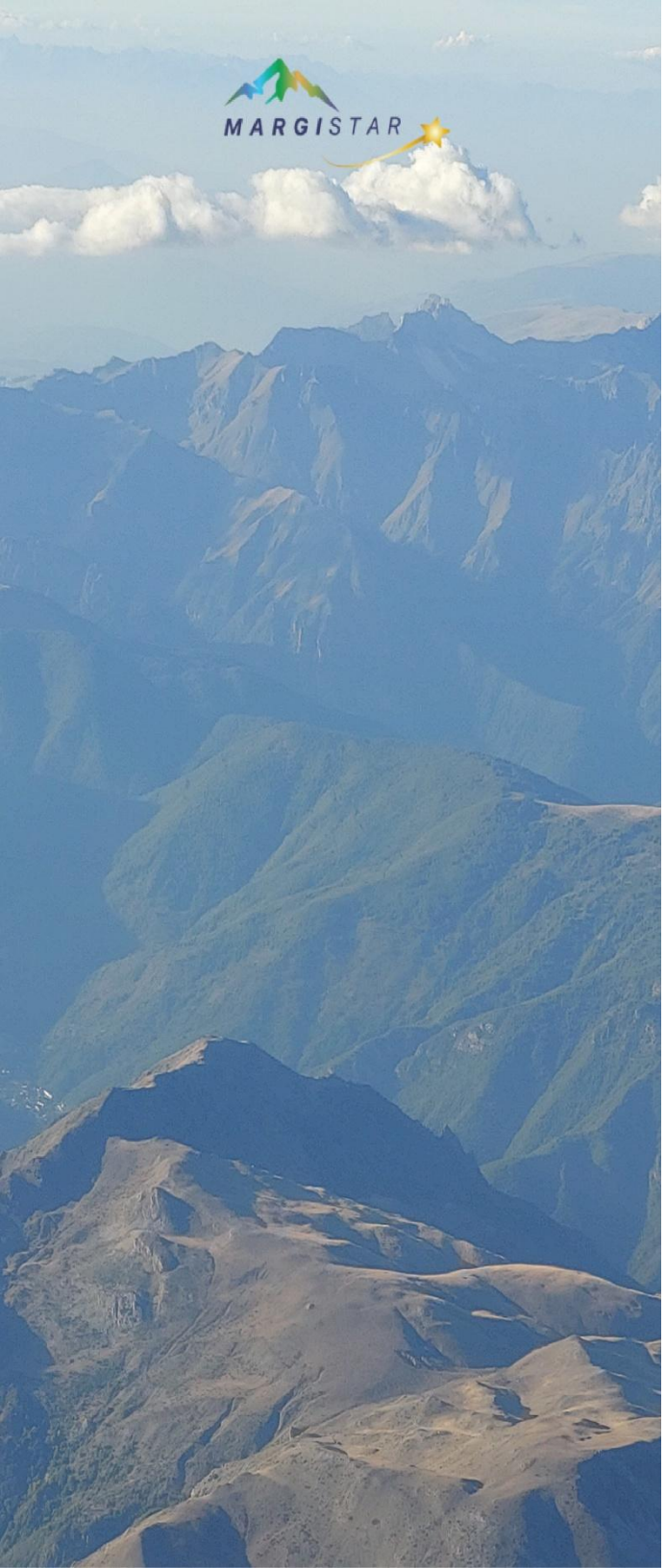

Innovating the margins: How BASIS transforms Val Venosta from periphery to pioneer

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1 Case study location

46° 37' 41.27"N, 10° 45' 55.80"E



2 Country

Italy

3 For how long has the challenge been acute?

20 years

4 Challenge categories

Socio-cultural challenges: Demography, migration (out/in) and/or social and ethnic tensions.
Economic challenges: Economic problems, poverty, and lack of employment and education opportunities.
Governance challenges: E.g., policies made at national and/or EU levels, top-down decision-making, lack of local participation in decision-making etc.
Service-related challenges: Poor cultural, social and/or commercial services.

5 Relevant UN Sustainable development goals

SDG3: Good health and well-being.
SDG4: Quality Education.
SDG10: Reduced inequalities.
SDG11: Sustainable cities and economies.
SDG16: Peace, justice, and strong institutions.
SDG17: Partnership for the goals.

6 Short description of the case study location

Val Venosta, covering 1,442 km² from 210 m at its entrance to 3,905 m at Ortles, has a population of 36,066 and shows a stable migration balance, with negative trends in Tubre, Stelvio, and Martello, and positive trends in Silandro and Malles. In this valley, the natural environment, with its ecosystem services, has played a fundamental role in enabling economic and social development over the past centuries. The environmental peculiarities of the Vinschgau Valley area have led to the creation of various protected areas. The following protected areas are located in the project area: Stelvio National Park (approx. 52,000 ha), Tessa Nature Park (approx. 8,900 ha), and various Natura 2000 sites (tot. approx. 9,000 ha).
Despite this, with an annual wage of €23,774, it is the poorest district in Bolzano. The economy, characterized by small family businesses (<6 employees) and a 25% employment rate in agriculture, struggles with diversification and global challenges. BASIS, located in Silandro and managed by a local association, repurposes a site with a heavy emotional legacy from its fascist-era construction. The site is owned by the municipality, and BASIS aims to stimulate social and economic revitalisation.

7 Key challenges in the case study

The BASIS project addresses key challenges, including the need for acceptance by the local population and the imbalance in the distribution of services between urban and rural areas. These issues reflect broader social and infrastructural gaps in the region, where urban centres often have more resources and services than their rural counterparts, potentially leading to disparities in economic development, access to healthcare, education, and other critical services. The project's success hinges on gaining the local community's support and finding innovative solutions to bridge these gaps, ensuring equitable development and fostering a sense of community inclusiveness.



Fig. 1 Val Venosta panorama

Photo: basis.space

8 A brief summary: What is this case study about?

The BASIS project in Vinschgau Venosta is an innovative approach to repurposing a former military barracks into a social activation hub. Through its initiatives, BASIS empowers local communities, encourages sustainable practices, and fosters a sense of belonging among participants. This holistic approach to community activation underlines BASIS's commitment to creating a dynamic and inclusive environment for innovation and collaboration. It aims to create a "third place" beyond home and work, offering space for new initiatives and fostering community projects. This adaptive reuse focuses on social activation, economic development, and cultural enrichment, acting as a catalyst for local development and innovation.

9 The fundamental causes and drivers for the challenges

The BASIS project's challenges stem from its location in a historically and emotionally charged area, economic disparities, and the struggle for acceptance among the local population. The area's economic challenges are exacerbated by a reliance on small-scale agriculture and a high rate of outmigration among younger, more educated individuals. Additionally, the imbalance in service distribution between urban and rural areas further complicates the socio-economic landscape. Furthermore, the long-term issues of brain drain and NEET levels in Italy are also important drivers of the challenges faced by Silandro. The youth labour market situation in Italy significantly differs from the EU average (Eurofound, 2016). Italy's activity and employment rates for young people are more than 10 percentage points below the EU average, while the NEET (Not in Education, Employment, or Training) and unemployment rates are at least 10 percentage points higher than the EU average. The data provided by the Cowork4YOUTH Observatory (2023) present information on the percentage of NEETs (Not in Employment, Education, or Training) in Italy and its regions for the years 2020, 2021, and 2022. In 2022, the national NEET percentage in Italy was 19%. These factors collectively hinder sustainable development and necessitate innovative approaches to community engagement and economic diversification.



Fig. 2 Coworking space

Photo: basis.space

9a A cause-and effect diagram identifying key drivers and their interrelationships

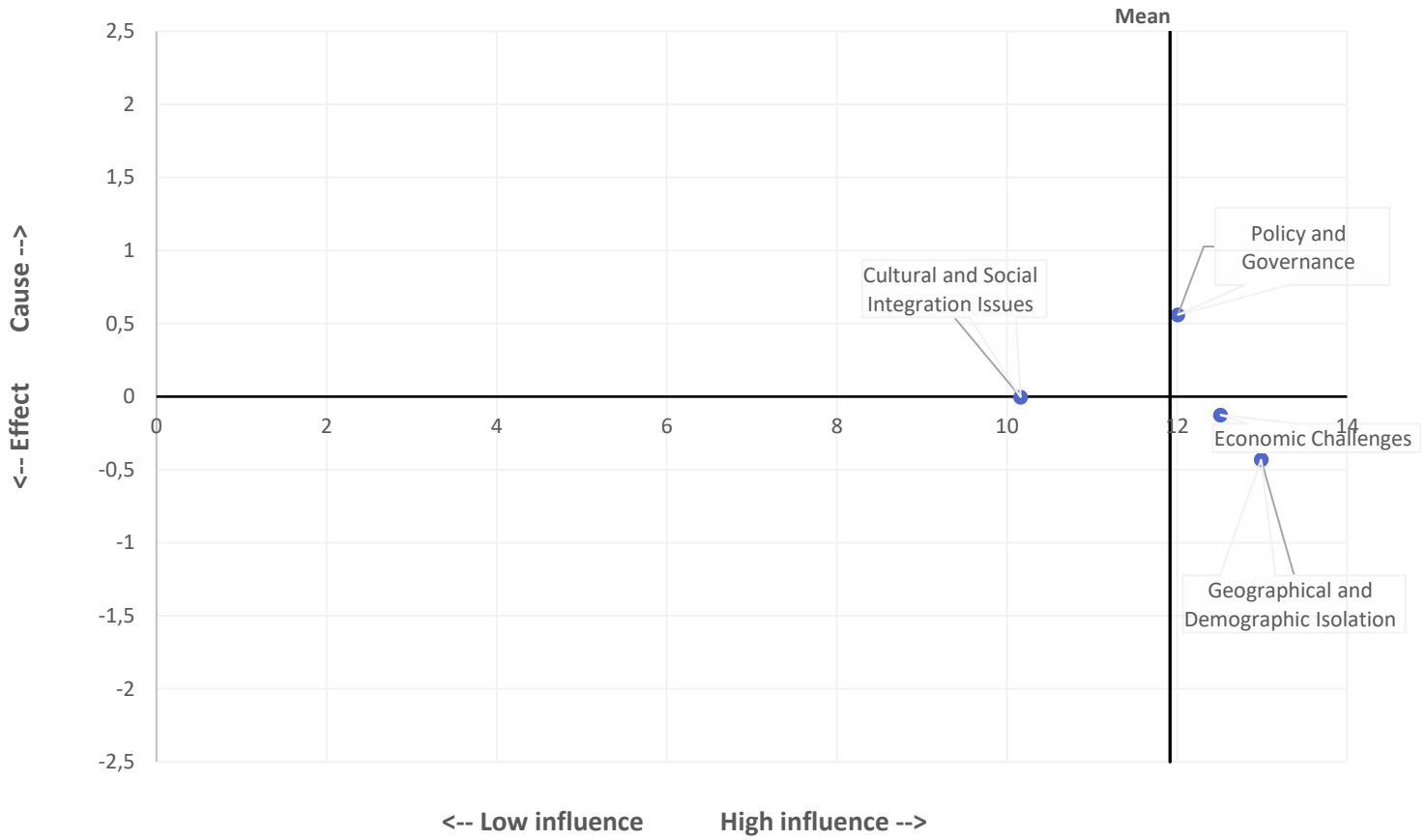

Fig. 3 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

The results indicate that Policy and Governance is the only causal factor, suggesting that it acts as the principal driving force within the system. It also exhibits high prominence, indicating that it is highly interconnected with the remaining dimensions. In

contrast, Economic Challenges, Geographical and Demographic Isolation, and Cultural and Social Integration Issues are identified as effect factors, reflecting dimensions that are primarily influenced by other factors. Economic Challenges and Geographical and Demographic Isolation display high prominence, whereas Cultural and Social Integration Issues shows relatively low prominence. Overall, the findings suggest that policy and governance constitute the key driver of the system, while economic, geographical, demographic, and socio-cultural challenges represent the main outcomes of the underlying causal relationships.

10 Who is negatively impacted by the challenge, and how?

Periphery traps disproportionately impact residents of marginalised regions, leading to diminished access to essential services such as healthcare, education, and economic opportunities. These challenges result in social and economic disparities, particularly affecting vulnerable groups such as the elderly, youth, and low-income families. Young and educated people from Silandro often migrate in search of better prospects, exacerbating the region's depopulation issue and creating a vicious cycle of decline. This brain drain hinders local development and innovation, as the remaining population struggles with reduced economic vitality and social cohesion. Community disengagement is a consequence of this issue, further exacerbating the rural-urban divide. Furthermore, these traps can lead to decreased investment and interest from external stakeholders, further isolating these areas and making recovery and development more challenging. The cumulative effect of these challenges underscores the urgent need for targeted interventions and innovative solutions to break the cycle of marginalization and promote sustainable development in these regions.

11 Who is positively impacted by the challenge, and how?

Urban centres, in the case of Silandro, Milan, and Vienna, benefit from the migration of talent and resources away from marginalised regions, enhancing their economic and cultural vitality. Real estate investors and developers find opportunities in lower property costs, potentially leading to regeneration projects. Community organizations and NGOs focusing on rural development may gain visibility and support, enabling them to drive sustainable initiatives. These dynamics, while rooted in the challenges of periphery traps, facilitate unintended positive impacts by attracting investment, fostering innovation, and

highlighting the need for balanced regional development. Through these mechanisms, stakeholders might leverage adversities to create opportunities, contributing to a nuanced landscape of impact where challenges in marginalised areas indirectly fuel growth and revitalisation efforts elsewhere, underlining the complex interplay between marginalization and development opportunities. BASIS is one such stakeholder, constituted by locals who decided to remain in the region and establish an association and social enterprise aiming to foster innovation in the local community and enhance civic engagement and employability.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

Centre-periphery relations are unbalanced primarily due to the concentration of economic, political, and social resources in central areas, leading to limited access and opportunities in peripheral regions. This disparity results in a vicious cycle where central areas continue to attract more resources and talent, exacerbating the situation in peripheral regions. These areas face challenges such as reduced public and private investment, fewer job opportunities, inadequate access to healthcare and education, and diminished infrastructure development. Consequently, peripheral regions struggle with economic stagnation, brain drain, and a lower quality of life, further deepening the divide between the centre and the periphery.



Fig. 4 Creative and thinking space

Photo: basis.space

14 The definition of the periphery trap in this case

In the BASIS case, the periphery trap is defined by the valley's economic fragility, reliance on small-scale agriculture, and significant outmigration, coupled with the historical and emotional complexity of repurposing military infrastructure for community development. This trap is further deepened by uneven service distribution between urban and rural areas, challenging the integration and acceptance of innovative community-led projects like BASIS within the local socio-economic fabric. Nordlund (2018) analyses core-periphery structures by focusing on peripheral dependency and core dominance, capturing the power-relational aspects of core-periphery dynamics and shedding light on the dependency of peripheral regions and the dominance exerted by the core.

15 The level of conflict

Emotional load of the building: built during fascism on land expropriated from the local population during the “Italianization” process. Lack of understanding among local stakeholders and youth of the importance of culture and creative industries for the social and economic development of the region. Gap between traditional businesses and “new ways of working”. Lack of governance pathways to support dissemination and bottom-up development, exacerbated by the periphery trap.

16 Description of the level of conflict related to the case study

The assessment of the conflict level in the BASIS case is nuanced, reflecting deep historical sensitivities and contemporary socio-economic dynamics. The building's origin during fascism and the "Italianization" process, involving land expropriation, casts a long shadow, impacting local perceptions and acceptance. Additionally, a lack of understanding regarding the role of culture and creative industries in economic and social development marks a significant gap in regional development strategies. The divergence between traditional business models and modern, innovative "new work" approaches further complicates this landscape. These factors collectively contribute to a complex conflict scenario, demanding sensitive, inclusive, and innovative approaches to bridge historical divides and embrace future possibilities. Collaborative workspaces, like BASIS, in economically and geographically marginal areas act as catalysts for local development, offering resources, networks, and infrastructure to mitigate the isolation often faced by entrepreneurs and creatives. For example, the design of physical-digital workspaces facilitates globally collaborative endeavours, dismantling geographical barriers and enabling remote global economic participation, as noted by Tucker, Gidel, and Fluckiger (2019). These spaces frequently focus on social innovation and community engagement, recognizing the significance of social capital in economic growth.



Fig. 5 Exhibition area

Photo: basis.space

17 Efforts to solve the challenge(s)

Efforts to solve the challenges faced by the BASIS project have involved a variety of community-based actions and initiatives. These include engaging the local population through cultural and educational programs, fostering an understanding of the value of creative industries for regional development, and bridging the gap between traditional businesses and new work paradigms. The concept of a coworking and collaborative workspace is at the core of most solution aspects. As intermediate spaces, coworking structures can be 'cradles' for the development of start-up entrepreneurship, intervene in public policies, become agents of social and political action, and serve as platforms for interaction with the neighbourhood (Merkel, 2015) by creating networks and promoting social action as 'pressure groups'. Moreover, they can enhance the potential of the social economy and contribute to its development as an alternative form of economic contribution that aims at redistribution

rather than accumulation. Avdikos & Merkel (2019) have highlighted the importance of developing networks in large cities for small and medium-sized spaces as a barrier to the expansion of corporate structures and the necessity of understanding and studying the diversity of coworking spaces to assess their dynamics and potential (2020). However, even if the turn towards local and resilient coworking places was already underway, the impact of the COVID-19 pandemic on coworking has rendered these local spaces vital pieces of an infrastructure of local resilience, as suggested by numerous analyses based on extensive surveys that predicted that work would shift away from global metropolitan areas (Manzini Ceinar & Mariotti, 2021). The development of coworking spaces in rural areas could therefore play a pivotal role in facilitating this new distribution of labour by providing access to broadband-enabled technology and spaces where home workers can co-work and collaborate (Price et al., 2022). This potential shift in the location of work, from urban to rural areas, could help build new networks within local communities, support other local businesses and service providers, improve the vitality and attractiveness of an area, and ultimately help develop the local economy.

18 Research-related proposals for potentially solving these challenges

This bottom-up approach could explore the impact of cultural and creative industries on regional development, the integration of traditional businesses with new work models, and the role of local youth. Farrugia and Wood (2017) advocate for a significant paradigm shift in youth studies, moving away from traditional temporal narratives towards a spatial understanding of youth. They highlight the need for an interdisciplinary approach that brings together insights from sociology, human geography, and other relevant fields to better understand the experiences of young people. Thus, to capture the societal and material dimensions of young people's lives, they introduce the concept of "youth spaces" (2017). This concept attempts to explore how young people negotiate, inhabit, and transform spaces, while highlighting the diversity of experiences across various spatial and cultural contexts. Heery, Naccarella, and McKenzie (2018) examine 'improvement-focused' evaluation methodologies, such as developmental evaluation, action research, and quality improvement, within the context of place-based initiatives. These methodologies are used to tackle complex problems through a whole-of-community approach. The authors underscore the significance of choosing appropriate 'improvement-focused' methodologies for place-based initiatives, considering their unique contexts and objectives. These methodologies facilitate a cyclical process of planning, acting, studying, and reflecting, which also builds evaluation capacity within communities.

19 Visions of desirable futures of the involved actors and the source of information

We conducted two-hour interviews with BASIS stakeholders, one EU project manager and one local project coordinator. They told us that they envision a future where BASIS serves as a model for sustainable development and social innovation across the EU. They could see BASIS leveraging EU funding and support to scale up successful initiatives, fostering a network of similar hubs throughout Europe. Their vision includes enhanced cross-border collaboration, sharing best practices, and driving policy changes at the EU level to support rural revitalisation and innovation. This vision is informed by the stakeholders' experiences with EU project frameworks, funding mechanisms, and the broader EU goals of social cohesion, economic development, and sustainability. At the local level, they also envision a future where BASIS becomes a central pillar of the local community and economy, deeply integrated with the needs and aspirations of the local population. They aspire to see BASIS fostering a vibrant local ecosystem of entrepreneurs, artists, and social innovators, creating jobs, and offering educational and cultural programs tailored to local needs. This vision might include strong partnerships with local schools, businesses, and government, ensuring that BASIS's activities contribute to solving local challenges such as youth unemployment, social inclusion, and cultural preservation. Their vision is shaped by direct interactions with the community, an understanding of local challenges, and the successes and feedback from ongoing engagement projects. Finally, a vision focusing on youth engagement and tackling brain drain at BASIS emphasizes creating an environment that attracts young talent and provides compelling reasons for young people to stay or return to the region. This vision entails developing comprehensive programs that offer educational opportunities, internships, mentorship, and entrepreneurial support tailored to the interests and career aspirations of young people.

20 Lessons-learned from the case study

From the BASIS case study, it is evident that addressing periphery traps involves a multifaceted approach that considers the socio-economic and cultural dimensions of marginalised regions. Engaging the community in the development process from the beginning and leveraging the unique historical and cultural assets of the area are crucial. This engagement fosters a sense of ownership and relevance among local populations, which is vital for the sustainability of projects aimed at revitalizing peripheral areas. Moreover, the case illustrates the potential of integrating traditional business models with innovative "new work" paradigms and the creative industries as a means to stimulate economic diversification and resilience. The role of local

youth is also central to the lessons learned, as they help unlock the endogenous potential of the community. The BASIS project highlights the importance of creating spaces that facilitate collaboration, innovation, and cultural exchange, serving as catalysts for broader socio-economic development. It is also important to consider the relationship between coworking spaces and the wider public space and surrounding communities. Merkel (2015, p. 133) characterizes coworking spaces as 'socio-material infrastructure' and as means of organizing work through the narrative of a community. They allow for interaction both within and between themselves and with other institutions. Drawing on the urban design methodology of Cohendet, Grandadam, and Simon (2010; Merkel, 2015), she characterizes them as "middle grounds", located between the "underground", the precarious base of creative workers, and the "upper ground" of political institutions and private organizations. In this way, she highlights their potential role as mediators and "pressure groups", developing Gandini's characterization of them as 'relational milieus' (de Peuter, 2017). These lessons underscore the need for strategies that are both inclusive and adaptive, capable of addressing the specific challenges and leveraging the unique opportunities presented by peripheral regions to move towards more equitable and dynamic futures.

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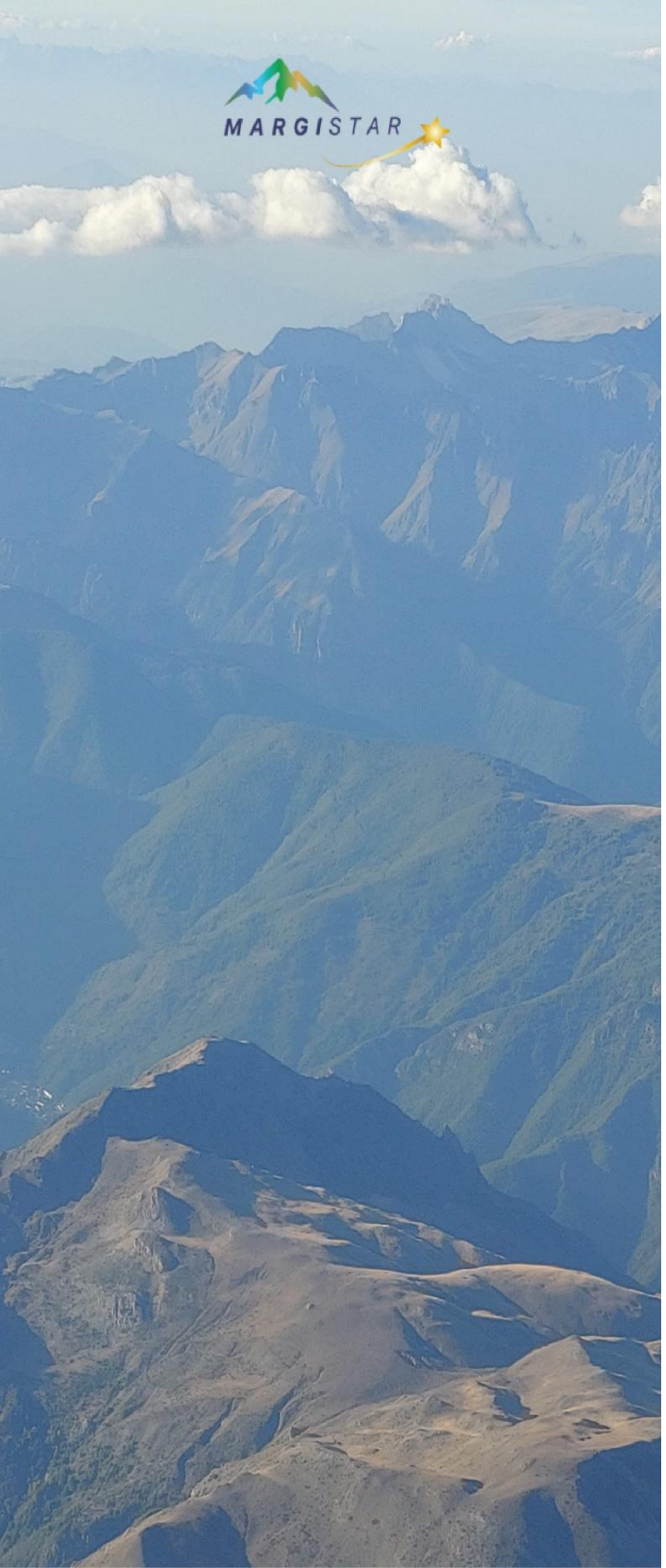

Valle Camonica mountain landscape [VALC]

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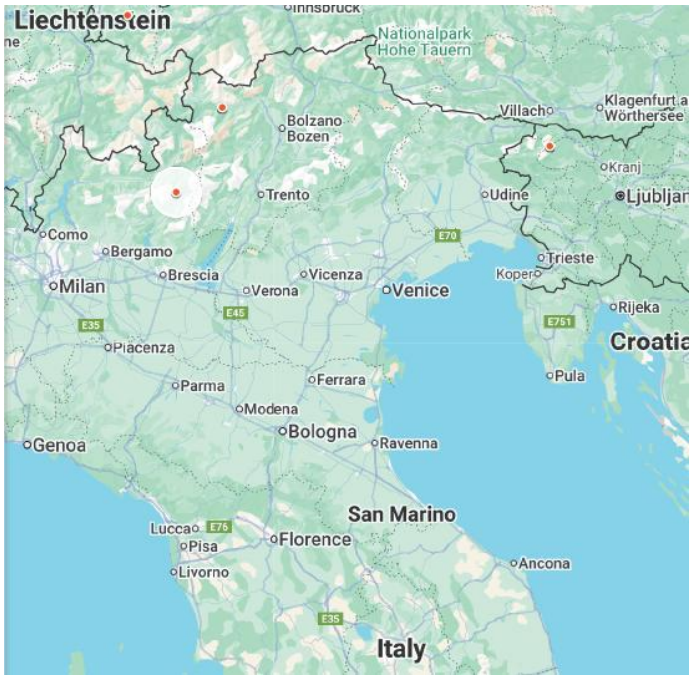
1 Case study location

46° 4' 54.48"N, 10° 20' 16.08"E



2 Country

Italy

3 For how long has the challenge been acute?

20 years

4 Challenge categories

Socio-cultural challenges: Demography, migration (out/in) and/or social and ethnic tensions.
Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Environmental challenges: Climate change, biodiversity loss, and/or ecological destruction.
Geographical challenges: Geographical handicaps (including long distances, lack of connectivity, difficult terrains etc.) and/or natural handicaps (e.g., soil productivity, growing season).

5 Relevant UN Sustainable development goals

SDG8: Decent work and economic growth.
SDG13: Climate action.
SDG15: Life on land.

6 Short description of the case study location

VALC is a valley located in the Lombardy region of northern Italy. It stretches for about 90 km along the Oglio River, nestled between the Adamello Regional Park and Stelvio National Park. Geographically, VALC is characterised by Alpine and pre-Alpine valleys ranging from 200 m ASL to 3,539 m ASL and is home to the Adamello Glacier, one of the largest glaciers in the Southern Alps (Pian di Neve). The valley is a UNESCO Biosphere Reserve (VALC – Alto Sebino). The land cover includes "forests [covering] 37% of the area and pastures 14%. Thirteen percent of the surface is not cultivated, while a large part of the territory, almost 36%, is unusable because it is covered by rocks or glaciers" (Gerosa et al., 2013). Up to 74 forest ecosystem types are represented in the area, classified into 21 wood categories (Gerosa et al., 2013). Land ownership in VALC is predominantly private, with many farms and properties passed down through generations within families, resulting in a problem of fragmentation similar to that found throughout the Lombardy region. VALC had 80,783 inhabitants in 2020 and is primarily rural, with a mix of agriculture, tourism, and small-scale industries driving the local economy. Culture plays a significant role in VALC, with a strong emphasis on preserving local traditions and heritage. The valley is famous for its UNESCO-listed rock art, with thousands of ancient petroglyphs scattered throughout the region. Key stakeholders in VALC include local and supra-local governance bodies (e.g. Lombardy Region, Comunità Montana, Unioni di Comuni, Municipalities), natural reserves and parks (PN Stelvio, Parco Adamello), residents, farmers and farmers' associations, tour operators and ski industry operators (especially in the higher part of the valley), environmental groups (e.g. Legambiente), and cultural organisations (e.g. Centro Camuno di Studi Preistorici).



Fig. 1 Forest landscape dominated by Norway spruce productive stands, Borno, Valle Camonica, Italy

Photo: Silvio Daniele Oggioni

7 Key challenges in the case study

VALC is experiencing several challenges, as reported below: Low accessibility of forest resources for harvesting operations and low economic viability (high); depopulation (-2.18% of the total population from 2011 to 2020) and ageing (more than 23% of the population is over 65 years old); land-use abandonment and land ownership fragmentation (low to medium); climate change impacts affecting the local economy (medium); low efficiency of economic operators (medium); weak land stewardship, especially among private owners (medium); and pressures from the tourism sector in some specific locations (high), particularly in the upper valley, where ski resorts and ski slopes are the main economic drivers.

8 A brief summary: What is this case study about?

Activities in VALC mainly deal with the environmental, social, and economic sustainability of coupled human and natural systems (CHANS): improving resilience and adaptation to climate change (e.g. drought and natural disturbances) of natural and semi-natural systems (croplands and forests) by modelling the effects of sustainable land-use practices on ecosystem goods and services and testing restoration activities; further developing the viability of local production systems and value chains (agriculture and forestry sectors) through cost-benefit studies and analyses; and promoting participatory governance and decision-making processes by organising and managing roundtables, meetings, and workshops with local stakeholders and other relevant actors in the area.

9 The fundamental causes and drivers for the challenges

Socio-cultural: demography, migration, and social/ethnic tensions — driven by a lack of jobs, ageing, service polarisation towards centres, the shift to secondary/tertiary sectors in the 1960s, centre-oriented infrastructure, and the digital divide. Natural resource use: land use and fragmented ownership – driven by ageing, declining interest in management and in the value of natural resources, and the post-1960s decline of agriculture and forestry. Environmental: climate change and biodiversity loss – driven by global emissions with local impacts, vulnerability resulting from decades of under-management (e.g. forests), land abandonment and rewilding, and wildlife-related conflicts. Geographical: natural handicaps – driven by intrinsic environmental constraints, low levels of territorial maintenance, and underinvestment in landscape and risk management.

9a A cause-and effect diagram identifying key drivers and their interrelationships

The results in Fig. 2 indicate that Infrastructure and Service Gaps and Geographical and Demographic Isolation are causal factors, suggesting that they act as key driving forces within the system. Both exhibit high prominence, indicating that they are highly interconnected with the other dimensions, with Infrastructure and Service Gaps showing the strongest causal influence. In contrast, Resource Management Challenges, Economic Challenges, Environmental and Climate Drivers, and Tourism and Land Use Conflicts are identified as effect factors, reflecting dimensions that are primarily influenced by other

factors. Among these, Resource Management Challenges and Economic Challenges display high prominence, whereas Environmental and Climate Drivers and Tourism and Land Use Conflicts show relatively low prominence. Overall, the findings suggest that infrastructure, services, and geographical and demographic conditions constitute the principal driving forces, while resource management, economic, environmental, and tourism-related challenges primarily represent outcomes of the system's underlying causal relationships.

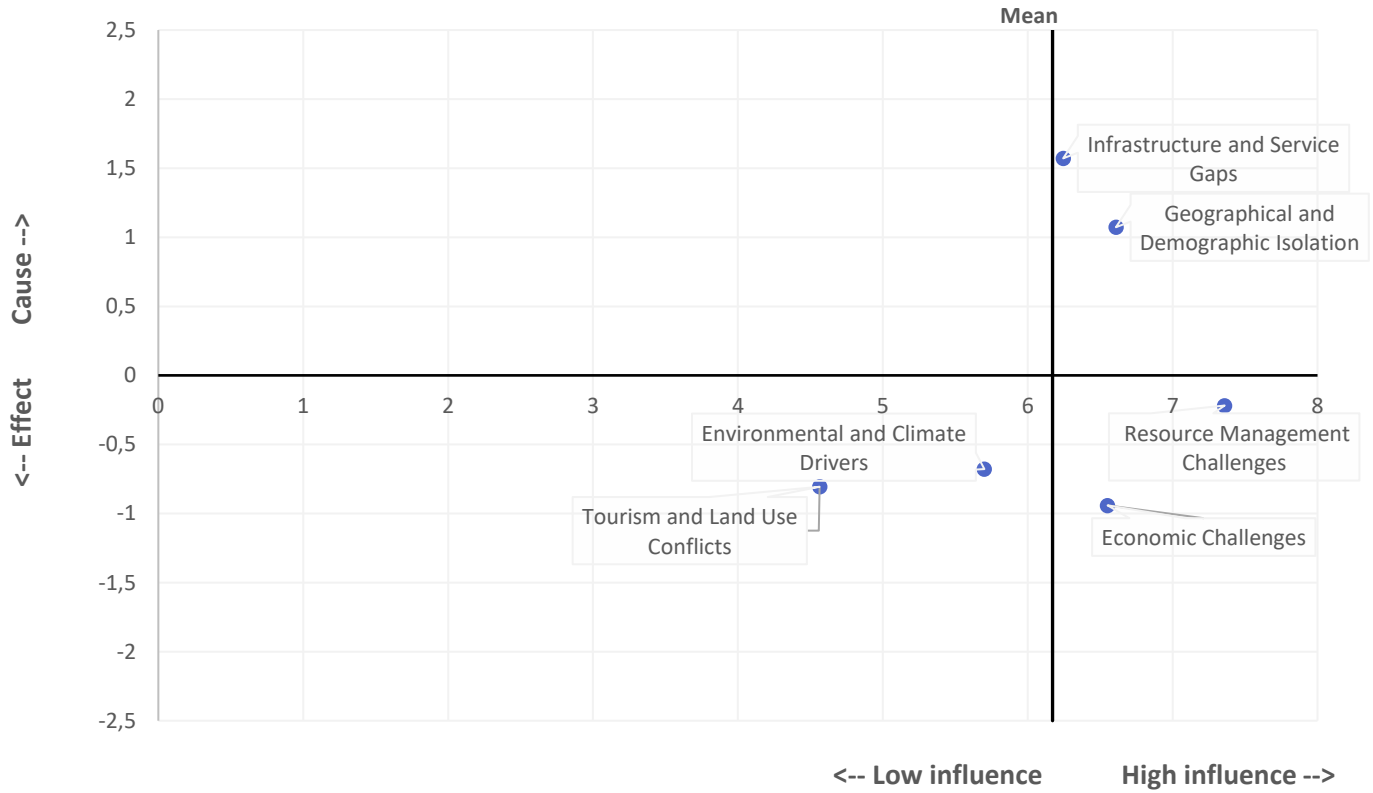


Fig. 2 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system



Fig. 3 Stacked Norway spruce logs, extracted by cable yarder, Borno, Valle Camonica, Italy

Photo: Silvio Daniele Oggioni

10 Who is negatively impacted by the challenge, and how?

The identified challenges have a negative impact on local communities in different areas: Scarcity and lack of delivery of services of public interest in the area (e.g. lack of public transport and schools), which in turn generates an outmigration trend, especially among younger generations. This problem therefore impacts the overall population of the Camonica Valley. Environmental challenges generated by climate change and, generally speaking, by long-standing territorial problems such as high hydrogeological risk in the valley. These aspects affect the overall population of the valley (e.g. problems with public transport generated by extreme events), the agricultural and forestry sectors, which are experiencing drier winters and an increase in average temperatures that will require these sectors to adapt in the coming years, and the tourism sector,

specifically winter tourism, which is facing unprecedented challenges due to less snow during the season and an increased need to use snow-making facilities, which increases energy and water consumption and overall business costs.

11 Who is positively impacted by the challenge, and how?

The aforementioned environmental problems are also opening up new positive scenarios, both in terms of possible crops in the valley floor (for example, viticulture has increased in the valley over the last 10 years and has expanded to areas where it could not previously be practised) and for tourism (increased summer turnover and increased demand).

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

Centre–periphery relations are unbalanced along several interlocking axes. Demographically, the area is a marginal inner territory losing population and dependent on distant centres for essential services such as healthcare, education, and mobility. Economically, it is a site of resource extraction whose wealth has historically flowed downstream to lowland areas without commensurate benefits returning to the mountain communities. It also suffers from an accessibility deficit, with weak transport links reinforcing its distance from service hubs. Finally, it remains fiscally and administratively dependent on top-down transfers and external decision-making, while a nested internal gradient leaves its higher and lateral valleys peripheral even relative to the valley-floor towns.



Fig. 4 Forest path, Edolo, Valle Camonica, Italy

Photo: Matteo Vizzarri

14 The definition of the periphery trap in this case

The periphery trap in this case refers to a combination of socio-economic and environmental challenges that perpetuate marginalisation and hinder the acceleration of sustainable development processes in the region. This involves factors such as limited job opportunities, an ageing population, and the concentration of services primarily in urban centres, leading to the outmigration of young people. Additionally, issues such as fragmented land ownership, reduced interest in traditional livelihoods, and environmental degradation further exacerbate disparities, trapping peripheral regions in a cycle of underdevelopment and environmental vulnerability.

15 The level of conflict

Medium conflicts right now, but this situation could be exacerbated in the coming years due to the effects climate change is having and will have on local value chains.

16 Description of the level of conflict related to the case study

The current level of conflict in the case study is assessed as medium, primarily due to existing socio-economic tensions and potential future exacerbation from climate change impacts on local value chains. While there may not be widespread or acute conflicts at present, underlying factors such as limited job opportunities, population ageing, and the concentration of services in urban centres contribute to social and economic strains. Additionally, climate change poses significant risks to local ecosystems and livelihoods, potentially disrupting traditional economic activities such as agriculture and forestry. These challenges could intensify competition for resources, exacerbating socio-economic disparities and increasing the likelihood of conflicts over land use, access to natural resources, and economic opportunities.

17 Efforts to solve the challenge(s)

Efforts to address the challenges occurring in VALC have primarily focused on community-based actions, social innovations, and policy interventions (mainly from the Mountain Community). One notable initiative is the promotion of sustainable tourism and cultural heritage preservation by local community groups and municipal authorities. Key actions regard improving the effectiveness of participatory planning and local enforcement through management and monitoring bodies (e.g. forest consortia). This includes the further development and sharing of knowledge about the adaptation, resilience, and vulnerability of natural and semi-natural ecosystems to climate change, anthropogenic land transformation, and habitat and biodiversity crises.

Additionally, there have been efforts to incentivise sustainable land management practices among local farmers and landowners through government subsidies and extension services (including payments for ecosystem services). These initiatives aim to promote agroecology, reforestation, and soil conservation measures, enhancing ecosystem resilience and

fostering local livelihoods. The local centre of the University of Milan – UNIMONT has been active in these areas and has collaborated with different types of institutions and stakeholders.
While these efforts have shown promising results in terms of promoting sustainable development and resilience in VALC, their long-term success depends on continued community engagement, institutional support, and integration with broader policy frameworks for regional development and environmental conservation. Ongoing monitoring and evaluation are crucial for assessing the effectiveness of these interventions and identifying areas for improvement.



Fig. 5 Abandoned chestnut forest, recolonized by native broadleaves, where stone walls delimitating small forest parcels are still visible, Edolo, Valle Camonica, Italy

Photo: Matteo Vizzarri

18 Research-related proposals for potentially solving these challenges

Development of nature-based solutions (design and implementation) for improving the resilience and adaptation of natural and semi-natural ecosystems;
Implementation of co-creation and stakeholder engagement practices, methods, and approaches for increasing people's awareness of challenges, issues, and potential solutions in the area;
Integration of research fields and disciplines for strengthening multi-scale, multidisciplinary, solution-oriented approaches;
Implementation of innovative and advanced modelling techniques, including remote sensing, for monitoring natural and semi-natural resources and simulating the environmental, social, and economic effects of landscape planning strategies (including climate scenarios);
Incorporation of science-based elements into current legislative frameworks, regulations, and norms impacting land use and economic sectors;
Improvement of participatory forest planning, including the implementation of payment schemes for ecosystem services to embed positive environmental externalities into legislative and planning instruments.

19 Visions of desirable futures of the involved actors and the source of information

The local mountain community in VALC, involving all municipalities in the valley, has expressed the need to build a vision of a desirable future centred around resilience to climate change and sustainable development. In the past, the university was involved in a project proposal (Fondazione Cariplo) to work on this; however, the proposal was not financed. This vision emerged through collaborative efforts with the university to develop a climate adaptation plan for the entire valley. Key elements of this vision may include implementing nature-based solutions to protect against extreme weather events, promoting sustainable land management practices to enhance ecosystem resilience, fostering diversified local economies through eco-friendly tourism and value-added agriculture, and strengthening social cohesion and community resilience.

20 Lessons-learned from the case study

The case study of VALC offers several lessons regarding periphery traps and potential solutions to overcome them:

Holistic Approach: Integrated strategies that simultaneously target job creation, community empowerment, natural resource management, and climate resilience are essential for sustainable development.
Community Empowerment: Engaging local communities in co-creation and decision-making processes so that they can take ownership of development initiatives is crucial.
Diversification of the Economy: Overcoming dependency on single natural resources in specific value chains is essential for resilience against economic shocks and environmental degradation. Promoting diversification through support for small-scale entrepreneurship, eco-friendly tourism, and value-added agricultural products can enhance local livelihoods and reduce vulnerability to external pressures.
Policy Integration: Coherent policy frameworks that integrate social, economic, and environmental objectives are necessary for addressing periphery traps effectively. Policy interventions should be informed by local realities, scientific evidence, and participatory processes, with an emphasis on promoting equity, inclusivity, and resilience in peripheral regions.
By applying these lessons, policymakers, practitioners, and communities can work together to break the cycle of marginalisation and achieve desirable futures characterised by sustainable development, social equity, and environmental stewardship in peripheral areas like VALC.

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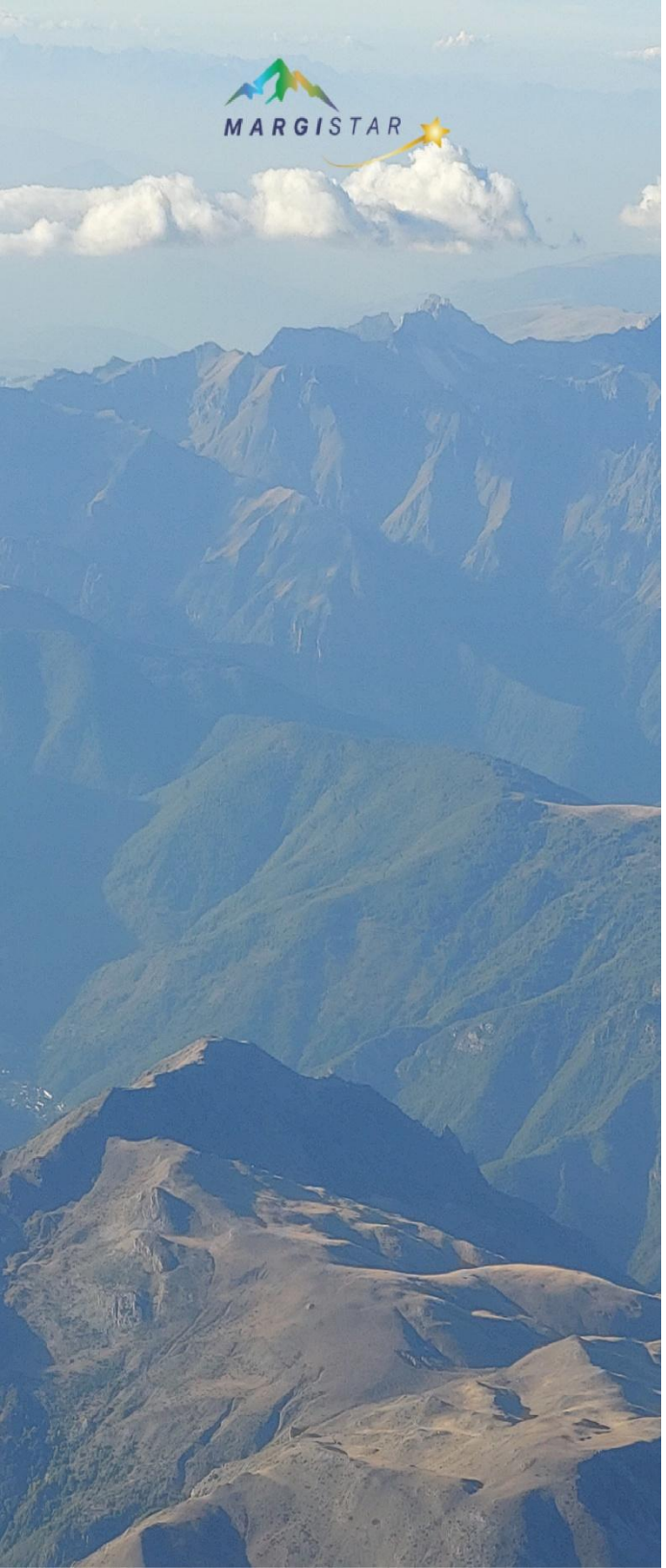

The Kuči Mountains

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ivan.lakovic@gmail.com

1 Case study location

42° 34' 54.88"N, 19° 35' 27.20"E



2 Country

Montenegro

3 For how long has the challenge been acute?

50 years

4 Challenge categories

Socio-cultural challenges: Demography, migration (out/in) and/or social and ethnic tensions.
Economic challenges: Economic problems, poverty, and lack of employment and education opportunities.
Governance challenges: E.g., policies made at national and/or EU levels, top-down decision-making, lack of local participation in decision-making etc.
Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Environmental challenges: Climate change, biodiversity loss, and/or ecological destruction.

5 Relevant UN Sustainable development goals

SDG2: Zero hunger, SDG3: Good health and well-being, SDG6: Clean water and sanitation, SDG10: Reduced inequalities, SDG15: Life on land.

6 Short description of the case study location

The Kuči Mountains cover approximately 220 square kilometres and include around 20 peaks reaching 2,000 m or higher. The southern part, the Žijevo massif, consists of rugged, rocky terrain, with Bosnian pine forests at higher elevations and some beech forests at lower elevations. The central ranges (Crna planina–Maglič–Širokar) and the northern range (Komovi) are characterized by extensive pastures and beech forests. The area contains two significant glacial lakes, Rikavačko and Bukumirsko, while the two streams, Opasanica and Veruša, which descend from the slopes of the Komovi, form the Tara River. Forests of Bosnian pine (*Pinus heldreichii* Christ.), which cover areas at higher altitudes, are currently threatened mainly by forest fires, pathogens, and pests. Beech forests (*Fagus moesiaca* (Maly) Czeczott) are important for timber production, nature conservation, and protection against gravitational hazards. They are rich in non-wood forest products and contribute to landscape aesthetics and the diversity of plant and fungal species, many of which are valuable for commercial use and provide benefits to the rural population.

Property rights are governed by traditional customary law, whose norms are generally respected with regard to who has the right to build and own a cottage and where such construction is permitted, as well as who may use particular pastures for grazing. The area preserves a rich and multi-layered cultural and historical heritage, which is reflected in housing architecture, customs and customary law, traditional poetry, anecdotes, the internal organization of katuns, and many other aspects of local life. The katuns of the Kuči Mountains form a distinctive socio-cultural system that reflects a common internal logic throughout the area.

From the perspective of active tourism, the mountain slopes provide numerous opportunities for outdoor activities, including hiking, trekking, mountaineering, sport and alpine climbing, ski touring, snowshoeing, caving, and mountain biking. In recent years, there has been a noticeable increase in the number of tourists engaging in these types of activities and visiting the area for active holidays.

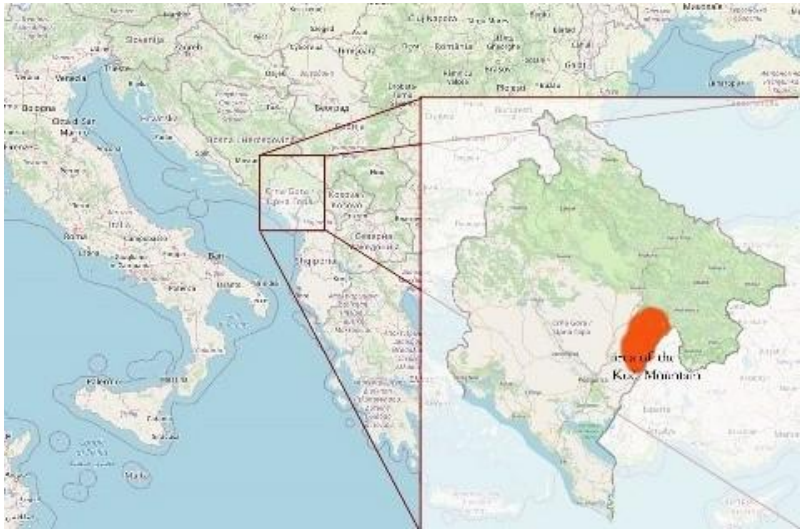

Fig. 1 The Kuči Mountains case study

7 Key challenges in the case study

The main challenge facing the area is depopulation and the abandonment of katuns (seasonal mountain settlements), driven by socio-demographic changes in Montenegrin society. After the Second World War, Yugoslavia, of which Montenegro was a part, underwent a period of rapid urbanization and industrialization. As a result, the rural population declined in both numbers and importance, leading to significant depopulation of the mountain areas that had traditionally supported livelihoods in the surrounding villages.

The current lifestyle does not encourage a reversal of this trend, resulting in the increasingly rapid abandonment of traditional ways of life in the mountains. Transhumant pastoralism, although economically viable for those who still practise it, is not widely pursued by younger generations. Consequently, the households that remain active in this sector are predominantly headed by middle-aged and older people.

At the same time, most people who still visit the mountains do so for tourism or recreational purposes. This has contributed to the deterioration of traditional katuns in terms of their architecture and construction, with new buildings being introduced

whose dimensions, design, materials, location, and scale significantly compromise the authenticity of the existing cultural landscape.
The lack of dedicated government policies addressing the specific challenges faced by mountain areas further contributes to the inadequate resolution of these issues.

8 A brief summary: What is this case study about?

The Kuči Mountains are an area in eastern Montenegro traditionally associated with the Kuči tribe, whose members have used the area for generations for transhumant pastoralism. There are approximately 200 katuns (seasonal mountain settlements used for sheep and cattle grazing) throughout the area, of which more than 150 have been abandoned. The remaining active katuns, unless transformed into tourism and recreational sites, are facing rapid depopulation and are expected to be abandoned.
Spread across three mountain massifs – Komovi, Maglič, and Žijevo – the Kuči Mountains are considered one of the best-preserved areas of traditional pastoral transhumance in Montenegro, with numerous well-preserved cultural heritage features.

9 The fundamental causes and drivers for the challenges

The fundamental causes and drivers of the problems facing the area stem from broader changes in perceptions of social, economic, and cultural life. Traditional forms of agriculture are no longer widely perceived as attractive or desirable, particularly among younger generations, who tend to prefer living in urban centres. The depopulation of villages directly contributes to the depopulation and abandonment of mountain settlements, which have traditionally been used by generations of local residents to supplement village life during the summer months.

As traditional agriculture and livestock rearing have lost much of their former social importance, fewer people see them as viable options for their future livelihoods. Without policies aimed at strengthening rural areas and supporting traditional livelihoods, there is little reason to expect a reversal of the depopulation trends affecting mountain areas. Tourism can contribute to maintaining the vitality of these areas, but it cannot fully replace agriculture as the main livelihood and way of life of mountain communities.

9a A cause-and effect diagram identifying key drivers and their interrelationships

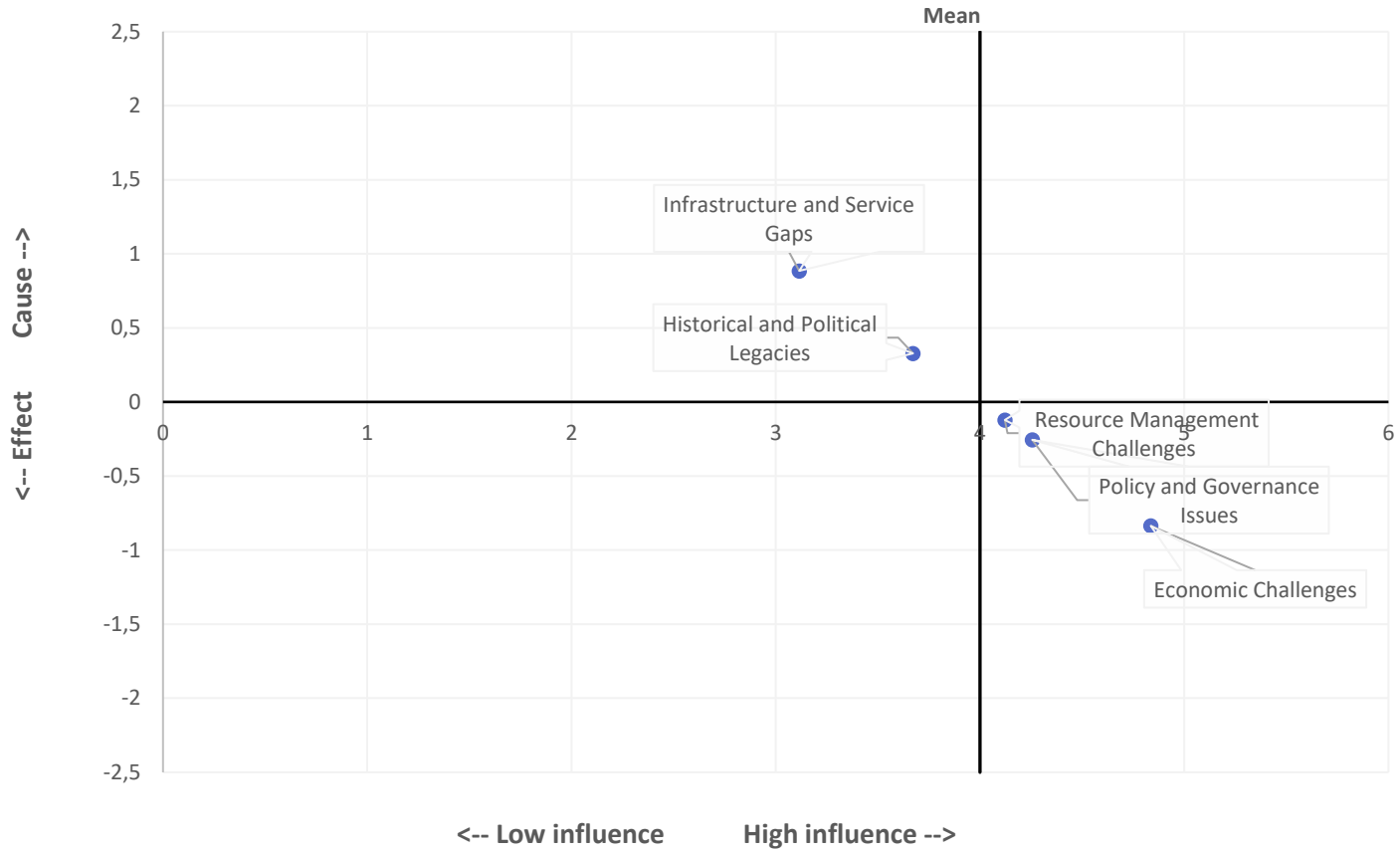

Fig. 2 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

The results indicate that Infrastructure and Service Gaps and Historical and Political Legacies are causal factors, suggesting that they act as driving forces within the system. Both exhibits relatively low prominence, indicating that their overall

involvement in the system is limited, although Infrastructure and Service Gaps shows a stronger causal influence. In contrast, Resource Management Challenges, Policy and Governance Issues, and Economic Challenges are identified as effect factors, reflecting dimensions that are primarily influenced by other factors. These factors display relatively high prominence, particularly Economic Challenges, which shows the strongest overall involvement within the system. Overall, the findings suggest that infrastructure, services, and historical-political factors constitute the main causal drivers, whereas resource management, governance, and economic challenges primarily represent outcomes of the system's underlying causal relationships.



Fig. 3 Extensive sheep farming in the rural area of Kuči, Montenegro

Photo: Ivan Laković

10 Who is negatively impacted by the challenge, and how?

The local population that wishes to continue practising a traditional pastoralist lifestyle is among those most directly affected by these challenges. As a result, most of the area has experienced drastic and extensive depopulation. The settlements and associated buildings are intended to support permanent or seasonal habitation; without inhabitants, they inevitably fall into

disrepair and eventually become ruins. Visitors who appreciate the landscape and engage in outdoor activities are also directly affected by the deterioration of scenic sites and the construction of inappropriate infrastructure.
Natural resources, particularly forests, are also severely affected by neglect, uncontrolled and illegal exploitation, and human-caused forest fires. Abandonment and depopulation are accompanied by the degradation of pastures due to the loss of natural fertilization, the disappearance of livestock paths and movement corridors, and the decline of shepherding as a traditional practice.

11 Who is positively impacted by the challenge, and how?

The positive effects of the current situation are felt mainly by those who do not value the traditional heritage of the area, engage in illegal forest harvesting, damage local roads through uncontrolled off-roading with 4WD vehicles and quad bikes, or construct residential and tourism-related buildings of questionable aesthetic value that undermine the traditionally developed landscape.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

The imbalance in centre–periphery relations is most evident in the severe neglect of the area by relevant stakeholders, the lack of dedicated policies and institutions, and the limited commitment, capacity, and coordination to implement existing policies.



Fig. 4 Traditional cheese production in a rural area of Kuči, Montenegro

Photo: Ivan Laković

14 The definition of the periphery trap in this case

As broader societal and government policies promote approaches that are at odds with the traditional development of mountain areas such as the Kuči Mountains, these areas face neglect, degradation, and a lack of prospects for

development. This, in turn, contributes to further depopulation and abandonment, paving the way for the disappearance of traditional livelihoods and, ultimately, entire mountain communities.

15 The level of conflict

There is a conflict ongoing on the level of understanding if, how, and by whom the mountain should be used.

16 Description of the level of conflict related to the case study

The case study area was used for transhumant pastoralism for generations, enabling the local population to survive the summer months and cope with drought conditions in the lower-lying villages. This way of life fostered a strong sense of identity and a rule-based social system that has survived to the present day. It remains an important reference point for understanding and shaping attitudes towards the future development of the area.

When socioeconomic conditions changed during the 20th century, government policies increasingly promoted an urban lifestyle as more desirable and offering better prospects. In response, the population gradually moved away from traditional ways of life and abandoned much of the heritage associated with them.

The continuation of these policies, despite their evident inadequacy in contemporary circumstances, causes further harm to areas that have already been seriously affected by their implementation over recent decades. Although these policies are not intentionally designed to produce such outcomes, their effects are clear and substantial: more than 70 percent of the existing seasonal settlements have been abandoned.



Fig. 5 Mountain shelter under the night sky

Photo: Ivan Laković

17 Efforts to solve the challenge(s)

There have been many efforts at different levels of society to address the problems facing the area, but none has involved a comprehensive attempt to tackle the issue as a whole. Instead, these efforts have been fragmented, focusing on individual and relatively small-scale problems whose resolution has had little effect on the overall situation. Most efforts have focused on road construction, often carried out through cooperation between the local population and government bodies at both the state and municipal levels. The introduction of a basic level of environmental protection through designation as a "Nature Park" has also failed to bring about any significant change on the ground.

18 Research-related proposals for potentially solving these challenges

One potentially helpful approach would be to develop architectural and construction guidelines for housing and tourism-related buildings that reflect traditional styles, dimensions, and materials. There is also a need, where possible, to incorporate certain principles of customary law into existing legislation, particularly those that have historically supported the survival of the community, protected natural resources, and defined land-use and property rights. These principles are still relevant to the management of common resources, but their absence from formal legislation creates numerous problems. Above all, however, a systemic approach is needed to promote cattle and sheep grazing as viable and sustainable activities and to encourage more families to return to this way of life.

19 Visions of desirable futures of the involved actors and the source of information

During the 2015–2017 project "Valorization of Montenegrin Katuns through the Development of Sustainable Agriculture and Tourism – KATUN," a comprehensive survey of the area's material cultural heritage was conducted, together with substantial research in the fields of forestry and agriculture. In interviews with local residents who expressed their intention to remain in the area and continue the traditional mountain way of life, all expressed the hope that younger generations would seriously consider returning to this lifestyle. Although none expected such a return to take the form of a large-scale movement, they believed that current economic trends might encourage more people to return to historically established forms of livelihood. In the meantime, they hope that road, communication, and housing infrastructure will reach a level that makes it easier for people to choose this way of life and improves living conditions for those who remain.

20 Lessons-learned from the case study

The failure to adequately consider and pursue political, social, and economic frameworks that differed substantially from traditional ones, despite their many positive outcomes, contributed to the marginalization of many traditionally used mountain areas in Montenegro. In creating an industrialized, urban-centred society in which most of the population was engaged in these sectors, Yugoslav and Montenegrin policymakers did not anticipate that such changes would profoundly affect rural

life and the traditional practices of rural communities. Over time, the marginalization of villages led to their depopulation, which in turn contributed to the depopulation and abandonment of their seasonal extensions in the mountains.

The current situation is highly discouraging, with only a small proportion of settlements having survived, and even these do not appear prosperous because of the advanced age of their inhabitants. There have been efforts by local communities, municipalities, relevant ministries, the University, and other stakeholders to address some aspects of the situation, but these efforts have not been supported by a comprehensive overall strategy. Some individual problems could be addressed through such efforts, but the overall pattern of decline, marginalization, and degradation remains.

Based on the results of these activities, it is of utmost importance to engage stakeholders at all levels in developing a comprehensive policy aimed at addressing the roots of the crisis rather than merely its manifestations. Strong and prosperous villages could provide the basis for renewed life in seasonal mountain settlements. Without such revitalisation, the mountain areas are likely to remain populated primarily in locations attractive to tourists, develop in ways that conflict with traditional land-use patterns, and lose many of their distinctive cultural, environmental, and socio-economic values and advantages.

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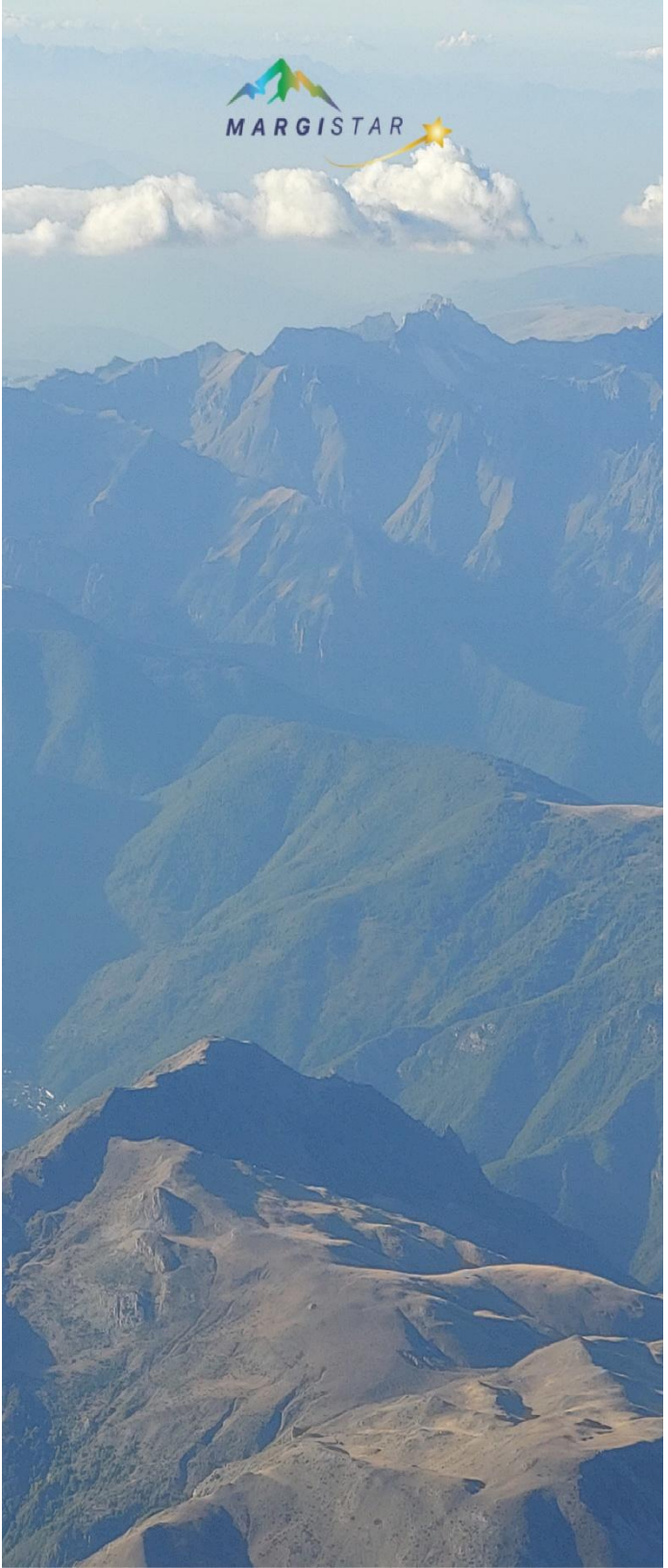

Evolution of shepherding practices and landscape impacts in Serra da Estrela

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cesgalhado@ciencias.ulisboa.pt

1 Case study location

40° 19' 23.05"N, -7° 36' 46.51"E



2 Country

Portugal

3 For how long has the challenge been acute?

20 years

4 Challenge categories

Socio-cultural challenges: Demography, migration (out/in) and/or social and ethnic tensions.
Economic challenges: Economic problems, poverty, and lack of employment and education opportunities.
Governance challenges: e.g., policies made at national and/or EU levels, top-down decision-making, lack of local participation in decision-making etc.
Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Service-related challenges: Poor cultural, social and/or commercial services.
Geographical challenges: Geographical handicaps (including long distances, lack of connectivity, difficult terrains etc.) and/or natural handicaps (e.g., soil productivity, growing season).

5 Relevant UN Sustainable development goals

SDG10: Reduced inequalities.

SDG15: Life on land.

6 Short description of the case study location

Serra da Estrela, situated in central-eastern Portugal, marks the transition between the Temperate and Mediterranean climates. Human activities and biogeological characteristics have intricately shaped the landscape, resulting in a diverse and complex territory. The Natural Park of Serra da Estrela, spanning six municipalities and 88,850 hectares, unofficially delineates the boundaries of this region and plays an important role in preserving local fauna and flora.

The massif's central plateau has a long history of transhumance, harbouring endemic species and important habitats. While the region is predominantly rural, agriculture constitutes less than 5% of employment. However, owing to the familial nature of local farming, the actual number of individuals engaged in agriculture is likely to exceed statistical estimates. The most prominent economic sectors include manufacturing, commerce, and construction. Serra da Estrela is a popular tourist destination, attracting visitors for its natural scenery, outdoor activities, and cultural experiences.

Land ownership is primarily private, with commons representing 20% of the mountain area. Holdings tend to be small and fragmented. Sheep grazing is a common practice, and the production of Serra da Estrela PDO cheese, made from the milk of two native sheep breeds, stands out as a key regional asset. The geographical scope of the Serra da Estrela PDO, which includes cheese, lamb, and curd products, extends well beyond the mountain area, allowing PDO-certified products to be produced outside the Serra da Estrela area.

Serra da Estrela is characterised by diverse geological formations, including impressive rock formations and valleys, and is classified as a UNESCO Geopark.

7 Key challenges in the case study

In Serra da Estrela, shepherding was an important activity for local livelihoods. Until a few decades ago, the mountain landscape was composed of large forest patches in a mosaic with open natural pastures. However, grazing pressure in Serra da Estrela has been declining due to social and economic drivers that have pushed shepherds and sheep towards the foothills or, more commonly, out of the sector altogether.

Shrubs are beginning to encroach on previously grazed land, and the impacts of the resulting increase in landscape continuity became evident in the extreme fires of 2017 and 2022. Mechanical shrub clearance is expensive and is further complicated by the absence of a cohesive territorial plan or strategy, given the dispersion of the territory across various administrative

levels. Serra da Estrela PDO cheese is often portrayed as a key product for territorial development, with an increasing market value. However, as there is no strict connection between its production and the mountain area, its contribution to landscape preservation remains unclear.



Fig. 1 Changes in social and economic dynamics have led shepherds to move away from traditional grazing practices, resulting in shrub encroachment on the landscape

8 A brief summary: What is this case study about?

In Serra da Estrela, Portugal, changes in social and economic dynamics have led shepherds to move away from traditional grazing practices, resulting in reduced grazing pressure. This shift has resulted in shrub encroachment on commons and previously grazed areas, particularly following the abandonment of pastoral activities. The consequences of increased landscape continuity and biomass accumulation became evident during the severe fires of 2017 and 2022. Given the

heightened risk of wildfires associated with climate change, there is an urgent need to explore strategies that can mitigate landscape homogenisation and maintain landscape fragmentation.

9 The fundamental causes and drivers for the challenges

Most drivers are closely interconnected: the absence of a cohesive territorial plan or strategy at the landscape level; incentives and mechanisms that do not adequately account for the additional challenges of mountain areas; low revenues from shepherding; declining population and livestock density, resulting in easier access to pastures; greater access to lowland pastures, reducing incentives to use higher-altitude pastures; and changes in livelihoods, including increased access to services and comforts that are now considered basic but may be incompatible with transhumance.



Fig. 2 Meeting with stakeholders from Serra da Estrela

9a A cause-and effect diagram identifying key drivers and their interrelationships

The analysis has not been conducted.

10 Who is negatively impacted by the challenge, and how?

Everyone is potentially affected. The abandonment of high-altitude pastures and consequent shrub encroachment contribute to landscape homogenisation and increased wildfire risk. The landscape loses its characteristic mosaic structure, with potential negative effects on biodiversity. However, the cheese value chain as a whole remains largely unaffected as long as shepherds retain access to pastures within the PDO region.

11 Who is positively impacted by the challenge, and how?

No one.

12 Does the case study link to unbalanced centre-periphery relations?

No.

13 In what ways are the centre-periphery relations unbalanced?

N/A.



Fig. 3 Sheepfold in the high-altitude grazing area of Serra da Estrela

14 The definition of the periphery trap in this case

Mechanisms designed to benefit peripheral areas did not account for different degrees of peripherality, thereby favouring certain areas while others became increasingly peripheral.

15 The level of conflict

N/A.

16 Description of the level of conflict related to the case study

N/A.



Fig. 4 Sheep in the village

17 Efforts to solve the challenge(s)

Commons engaging with shepherds to use their land and clear selected areas.

Municipalities that have established dedicated desks to assist small-ruminant producers with applications and other bureaucratic and production-related issues.
Municipalities that provide additional financial support to small-ruminant producers for transhumance and the maintenance of native breeds.
Local associations that engage with producers affected by major wildfires to ensure that they are adequately compensated, support the restoration of their burned land, and advocate for more inclusive planning (https://guardioesse.wixsite.com/guardioesestrela).

18 Research-related proposals for potentially solving these challenges

Result-based payments for keeping target areas open. This would entail identifying key priority areas to maintain landscape discontinuity, in association with key local actors, as well as defining target results, result-based indicators, and metrics to enable monitoring (Pinto-Correia et al. 2022).

19 Visions of desirable futures of the involved actors and the source of information

A foresight exercise indicated that a desired scenario among the stakeholders involved was one in which the cheese value chain has a strong connection with the territory and there is societal willingness to pay for ecosystem services. This would entail the recognition of grazing services; support for enterprises that contribute to biodiversity conservation; improved control of rural fires; consumers willing to pay a premium price for cheese; collaboration among local value-chain actors to promote cheese and traditional production; integrated nature tourism practices; growth of the PDO cheese market; greater recognition and valorisation of value-chain by-products, such as wool and lamb; technological innovation enabling greater efficiency in production and processing; greater social cohesion; improved spatial planning integrating forestry and pasture management; ensuring that native breeds are not at risk of extinction; and greater recognition of the profession and role of shepherds.
This scenario was the most positive of those discussed. Although it was framed as a desired scenario, a strong connection between the cheese and the territory would imply that the mountain is actively used and managed in ways that preserve

local culture and traditions, maintain the use of native breeds and local knowledge, and contribute to maintaining an open landscape. As wildfire incidence is likely to increase in the future due to climate change, the foresight group considered the maintenance of landscape discontinuity to be important. In this context, willingness to pay for ecosystem services is also important. Grazing in medium- and high-altitude pastures is currently not profitable. Since shepherds can feed their sheep in low-altitude pastures, provided that these are within the PDO area, they have limited economic incentives to move into the mountain areas beyond traditional practices. Shepherds should therefore be rewarded for the ecosystem services provided by grazing in medium- and high-altitude pastures, particularly for maintaining open areas and contributing to landscape management.

20 Lessons-learned from the case study

Despite divergent opinions and tensions among actors and interests, the shared threat of fire risk informs a desired future (Esgalhado et al., 2026, in press). The need for a cohesive territorial strategy capable of maximising synergies and coordinating the actions of different stakeholders was clear. An integrated territorial approach would require a Dialogue and Communication Platform; Bringing the community together by increasing understanding, setting common goals, removing obstacles, and developing projects. This would involve fostering dialogue among different actors of change and within the community. Communication and information sharing should be strengthened and reach the appropriate audiences.

Training in the agricultural sector, as well as at the local administration level, to ensure that territorial decisions are compatible with a long-term resilience strategy.

Educating retailers and consumers about the added benefits of supporting PDO cheese and high-altitude grazing.

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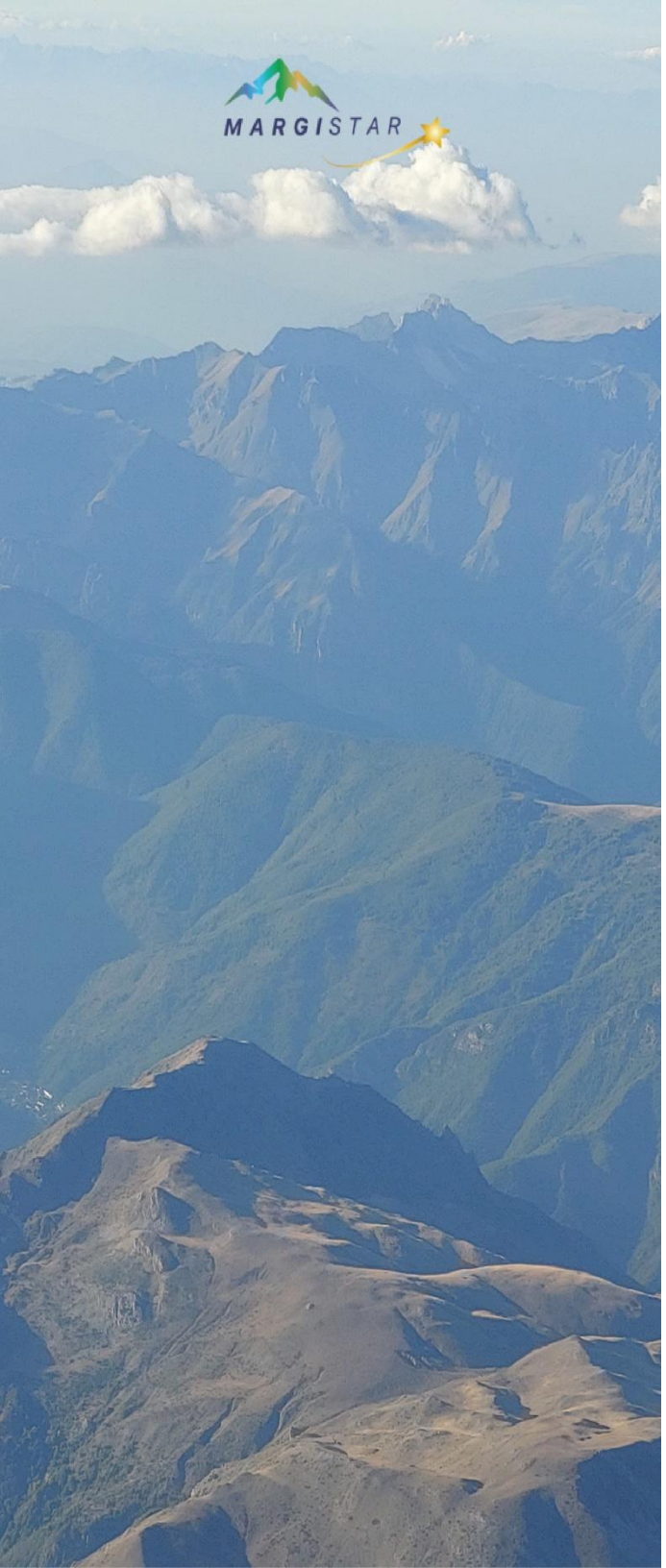

Abandoned gold mines of Romanian Western Carpathians

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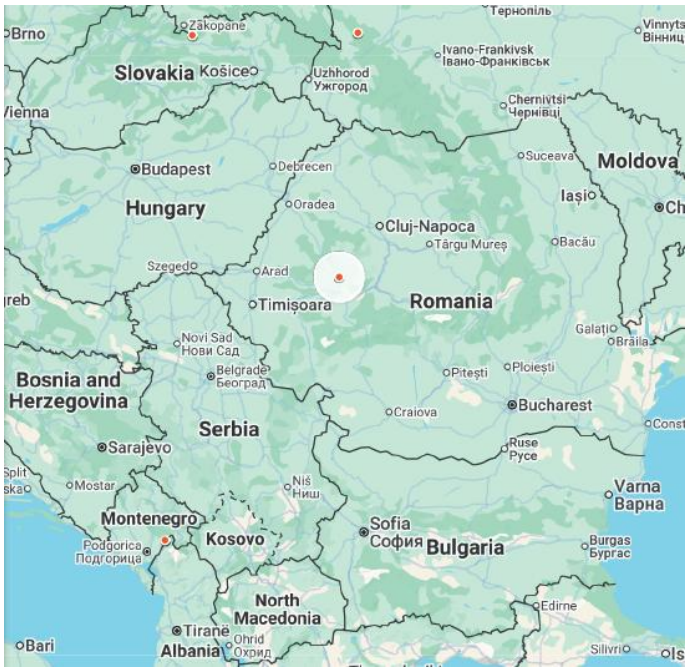
1 Case study location

46° 6' 56.20"N, 22° 50' 51.04"E



2 Country

Romania

3 For how long has the challenge been acute?

20 years

4 Challenge categories

Socio-cultural challenges: Demography, migration (out/in) and/or social and ethnic tensions.
Economic challenges: Economic problems, poverty, and lack of employment and education opportunities.
Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Service-related challenges: Poor cultural, social and/or commercial services.

5 Relevant UN Sustainable development goals

SDG3: Good health and well-being.
SDG8: Decent work and economic growth.
SDG9: Industry, innovation, and infrastructure.
SDG10: Reduced inequalities.
SDG11: Sustainable cities and economies.

6 Short description of the case study location

It is a mountain area situated in the Western Romanian Carpathians, where the local population has relied on gold ore extraction and processing for hundreds of years. These activities have resulted in large quantities of barren ore, which were deposited on land owned by the state and municipalities. Land ownership was primarily state-based, although some land was also owned by private funds in the past. There were also private exploration activities in the area. Key stakeholders in this case study include state-owned companies that closed after 1989, local communities, small private companies, local authorities, and the national forest administration.



Fig. 1 Mountain area in the Western Romanian Carpathians

Photo: Iga Vasile

7 Key challenges in the case study

The most important challenge for this area is to retain its population, as many people left the area after the mining activities ceased. Economic development based on ecological activities, tourism, and natural forest products will also be a key challenge.

8 A brief summary: What is this case study about?

In the Western Romanian Carpathians, activity in the gold mines dates back to the Roman Empire. The mines were closed after 1995, and most communities lost their working-age population during this process, while activities related to mining were abandoned. Many people worked in this sector in various supporting activities, such as repairing mining machinery, specialised construction, transportation, and other services. The ore processing plant was also closed. As a result, the entire economic activity of the area was drastically reduced. Consequently, people gradually left the area in search of jobs in cities across Romania and in other EU countries.

9 The fundamental causes and drivers for the challenges

There were national-level reasons for closing the mining operations, and the main challenge is to find solutions for the people living in these areas.



Fig. 2 Abandoned railway in the region

Photo: Iga Vasile

9a A cause-and effect diagram identifying key drivers and their interrelationships

The results (Fig. 3) indicate that Policy and Governance Issues and Infrastructure and Service Gaps are causal factors, suggesting that they act as key driving forces within the system. Policy and Governance Issues exhibits relatively low prominence, whereas Infrastructure and Service Gaps shows high prominence, indicating that it is highly interconnected with the other dimensions. In contrast, Economic Challenges, Geographical and Demographic Isolation, and Resource Management Challenges are identified as effect factors, reflecting dimensions that are primarily influenced by other factors. Among these, Economic Challenges displays high prominence, while Geographical and Demographic Isolation and Resource

Management Challenges show relatively low prominence. Overall, the findings suggest that policy, governance, infrastructure, and services constitute the main driving forces, whereas economic, geographical, demographic, and resource management challenges primarily represent outcomes of the system's underlying causal relationships.

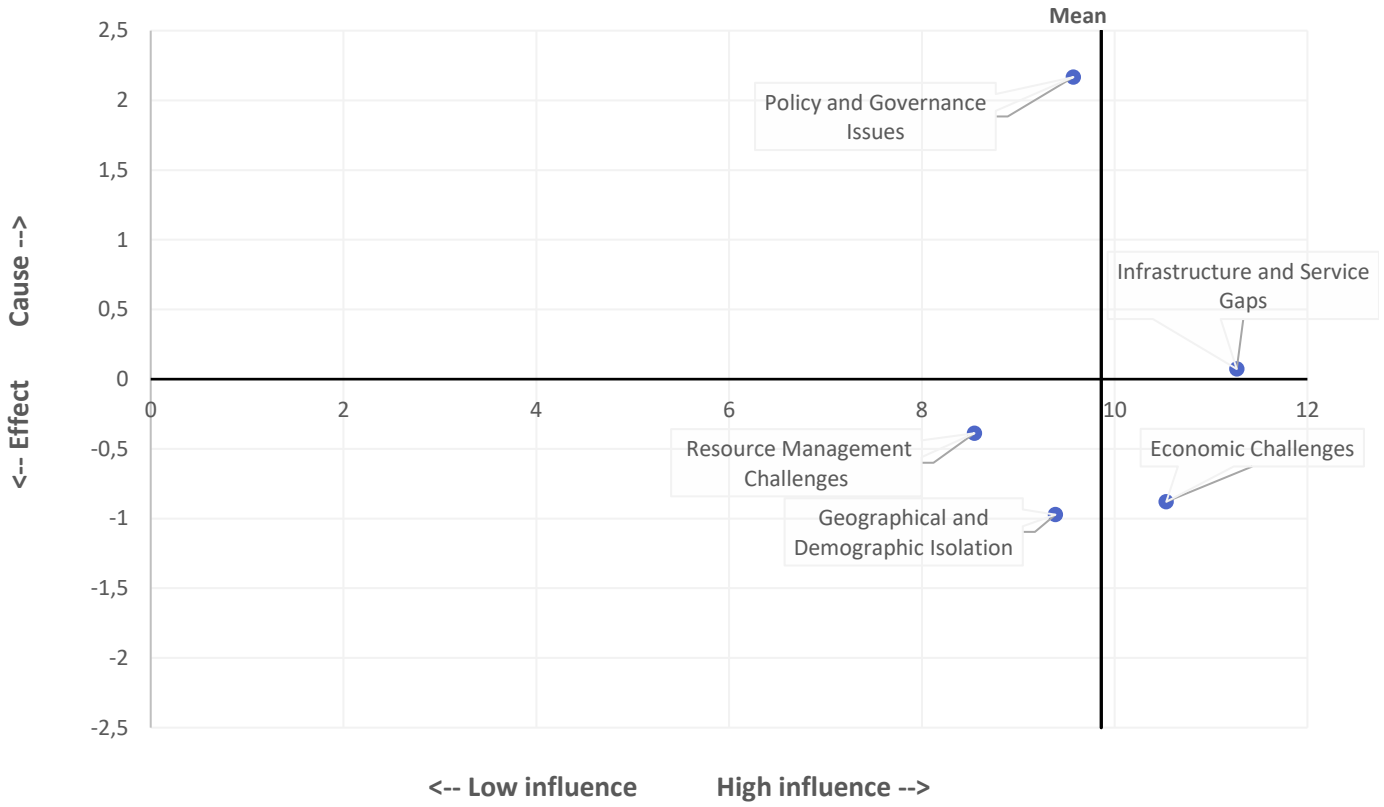


Fig. 3 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

10 Who is negatively impacted by the challenge, and how?

The local population was affected by the closure of the mining activities because many people lost their jobs.

11 Who is positively impacted by the challenge, and how?

Nature is gradually recovering following the cessation of mining activities.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

All mining and ore-processing activities relied on national and central state authorities, including the national bank and state-owned companies, which coordinated the activities and requested specific quantities of ore. After 1989, these centralised state companies were gradually closed over a period of 25–30 years.



Fig. 4 The region after the abandonment of the work in these lands

Photo: Iga Vasile

14 The definition of the periphery trap in this case

Innovative ways to help the local population remain in the area and secure a stable income.

15 The level of conflict

There were several stages in this "conflict". In the first stage, after 1989, the main challenge was to maintain jobs, but the number of employees was gradually reduced. From 1995 onwards, the number of employees was further reduced. The first conflict was between the state-owned companies and the local population. After the mining activities were closed, the

conflict shifted towards the relationship between local authorities and the local population. This conflict is still ongoing, but its intensity is relatively low because many people have already left the area.

16 Description of the level of conflict related to the case study

I have known this area for a long time and have spoken with people from the area and its surroundings.



Fig. 5 Abandoned construction in the region

Photo: Iga Vasile

17 Efforts to solve the challenge(s)

Yes, there have been some initiatives in this area, but they have not been very successful. Some private companies have tried to buy old buildings and facilities in order to develop new economic activities. Most of the solutions have come from private owners, both local and foreign.

18 Research-related proposals for potentially solving these challenges

In my opinion, there are some proposals that could have a positive effect on these challenges. First, there is a need for greater cooperation between local and central authorities.
Good cooperation will also be needed between local people and investors. With some support from specialised NGOs, for example through counselling and advice, these relationships could be improved.
There are also several large and small projects that could be developed. For example, local authorities could work together with national railway and forestry companies to implement a European-funded tourism project based on an old railway line used for tourism, accommodation provided by local residents, nature-based solutions, and other related activities.

19 Visions of desirable futures of the involved actors and the source of information

There are some visions that were developed by local communities, but some of them were abandoned over time for various reasons. I know about some of these visions from conversations with local people and from the press.

20 Lessons-learned from the case study

I think that these area's problems could be addressed if greater cooperation between local actors were possible. Support from central actors may also be needed, such as the national forest authority or national railway company.

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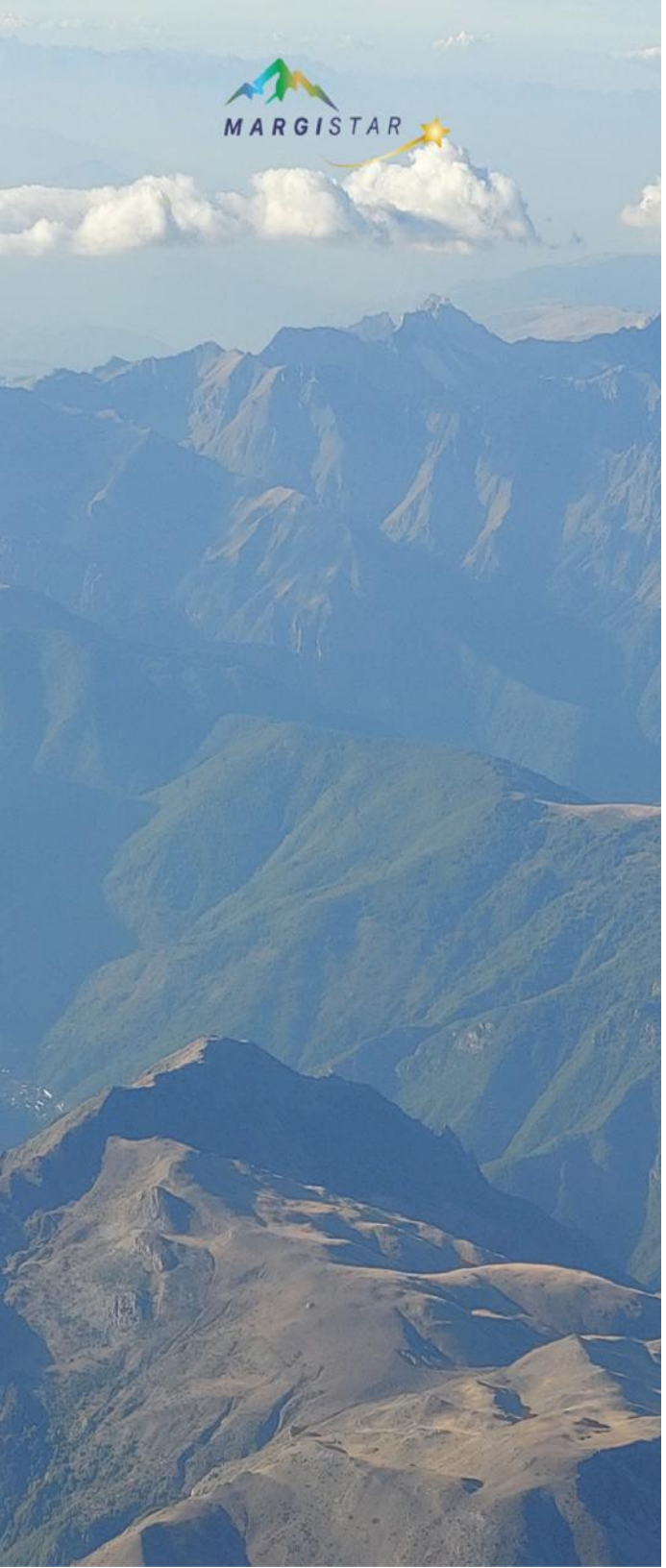

Tatra mountains

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1 Case study location

49° 10' 2.46"N, 20° 6' 11.59"E

2 Country

Slovakia

3 For how long has the challenge been acute?

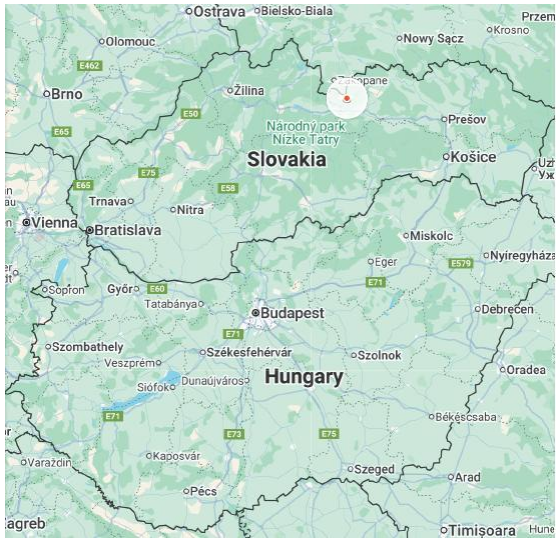
20 years

4 Challenge categories

Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Environmental challenges: Climate change, biodiversity loss, and/or ecological destruction.

5 Relevant UN Sustainable development goals

SDG3: Good health and well-being.
SDG8: Decent work and economic growth.
SDG12: Responsible consumption and production.
SDG13: Climate action.
SDG15: Life on land.
SDG16: Peace, justice, and strong institutions.



6 Short description of the case study location

The Tatra Mountains are the highest mountains of the Carpathian range, situated along the borders of Slovakia and Poland. The Tatras' dual-national park system comprises Slovakia's Tatra National Park (TANAP), spanning 73,800 hectares, of which roughly 30,703 hectares are strictly protected, alongside the Polish Tatrzański Park Narodowy (TPN), which encompasses approximately 21,000 hectares, with about 11,514 hectares under strict protection. These mountains encompass a significant conservation area within the framework of the NATURA 2000 network. In 1992, the Polish and Slovak national parks in the Tatras were jointly designated a transboundary biosphere reserve by UNESCO under its Man and the Biosphere Programme. Parts of the landscape have been actively managed for different purposes, including forest management focused on biodiversity conservation and increasing the ecological stability of forest ecosystems, as well as areas designated for recreation, tourism, ski resorts and climatic spa activities.

After World War II, in 1947, the town of the High Tatras, located in TANAP, was founded and given three basic functions: tourism, recreation and sport; climatic spa and treatment; and nature protection and research. Nowadays, inhabited parts of national parks are still strongly affected by human activities.

After the severe windstorms and bark beetle outbreaks of 2004, formerly managed forest habitats have been subject to recent rewilding efforts. This has spurred the spontaneous restoration of natural structural complexity within these previously homogeneous forests, enhancing habitat diversity and promoting the prevalence of specialist species.

Forests in TANAP are owned by the state (56%) and private owners (44%). The management of TANAP was recently transferred from the Ministry of Agriculture and Rural Development to the Ministry of the Environment (2023), and this transformation has caused some uncertainties and challenges in national park management. In addition, an ageing population and migration are also among the challenges facing TANAP.

7 Key challenges in the case study

Biodiversity conservation in the national park; natural disturbances and climate change (wind and bark beetle calamities in spruce stands); wildlife–urban interactions; diverse perceptions of wilderness; a low level of public education on natural processes and the significance of biodiversity for human well-being; inadequate communication of conservation efforts with

the public; a wide spectrum of actors' interests and values; social and demographic structure; management challenges (spatial planning, master plans, infrastructure and administrative changes); and tourism.



Fig. 1 Tatra Mountains Range

Photo: Zuzana Sarvašová

8 A brief summary: What is this case study about?

This case study is about the Tatra Mountains, the highest mountains of the Carpathian range, situated along the borders of Slovakia and Poland, which present a mountain natural environment. Nature conservation, human activities and values, perceptions of wilderness in the national park, as well as institutional changes create challenges for national park management. Our research focuses on screening and analysing the institutional framework of policies related to national park management and governance. We are searching for synergies and trade-offs between policies, the interests of key actors in nature conservation regimes, climate-smart governance, and societal challenges in the region.

9 The fundamental causes and drivers for the challenges

Causes and drivers: Climate events – windstorms and drought, which were intensified by bark beetle infestations.
Institutional and administrative changes – uncertainties, NP zoning, ownership structure, and the historical development of land management and governance.
Nature conservation interests versus the interests of local people.
Urbanisation and the development of recreational infrastructure.



Fig. 2 Forest after wind and bark beetle disturbances

Photo: Zuzana Sarvašová

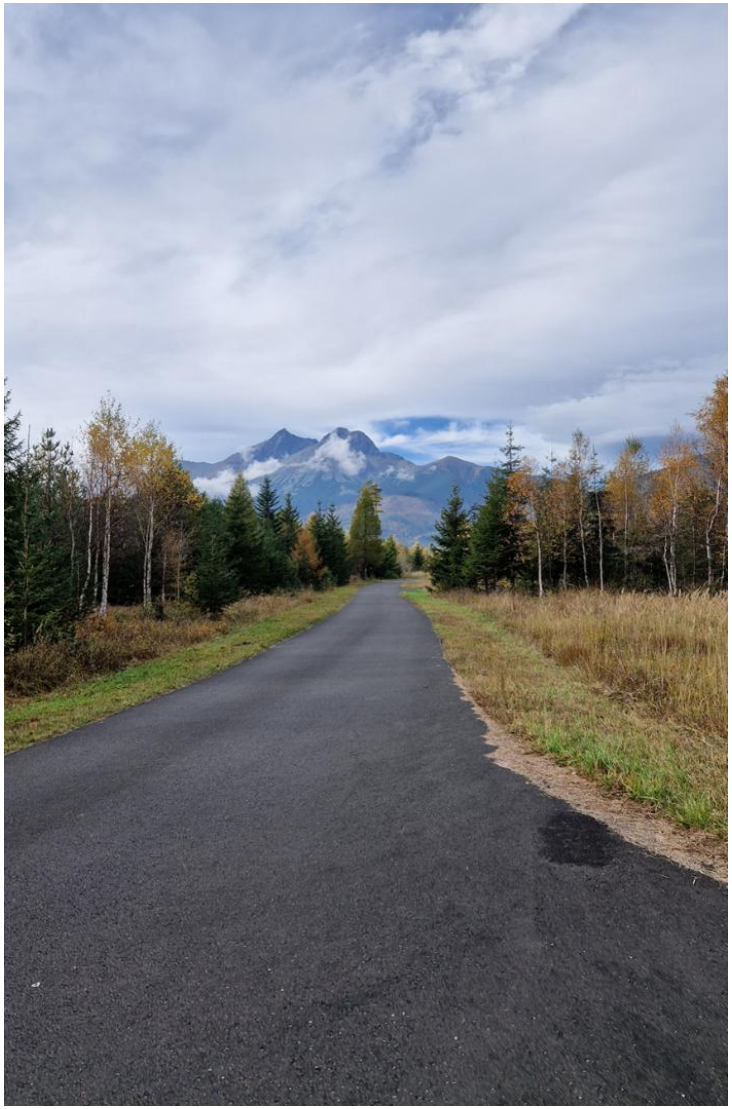


Fig. 3 Tatra Mountains Range

Photo: Zuzana Sarvašová

9a A cause-and effect diagram identifying key drivers and their interrelationships

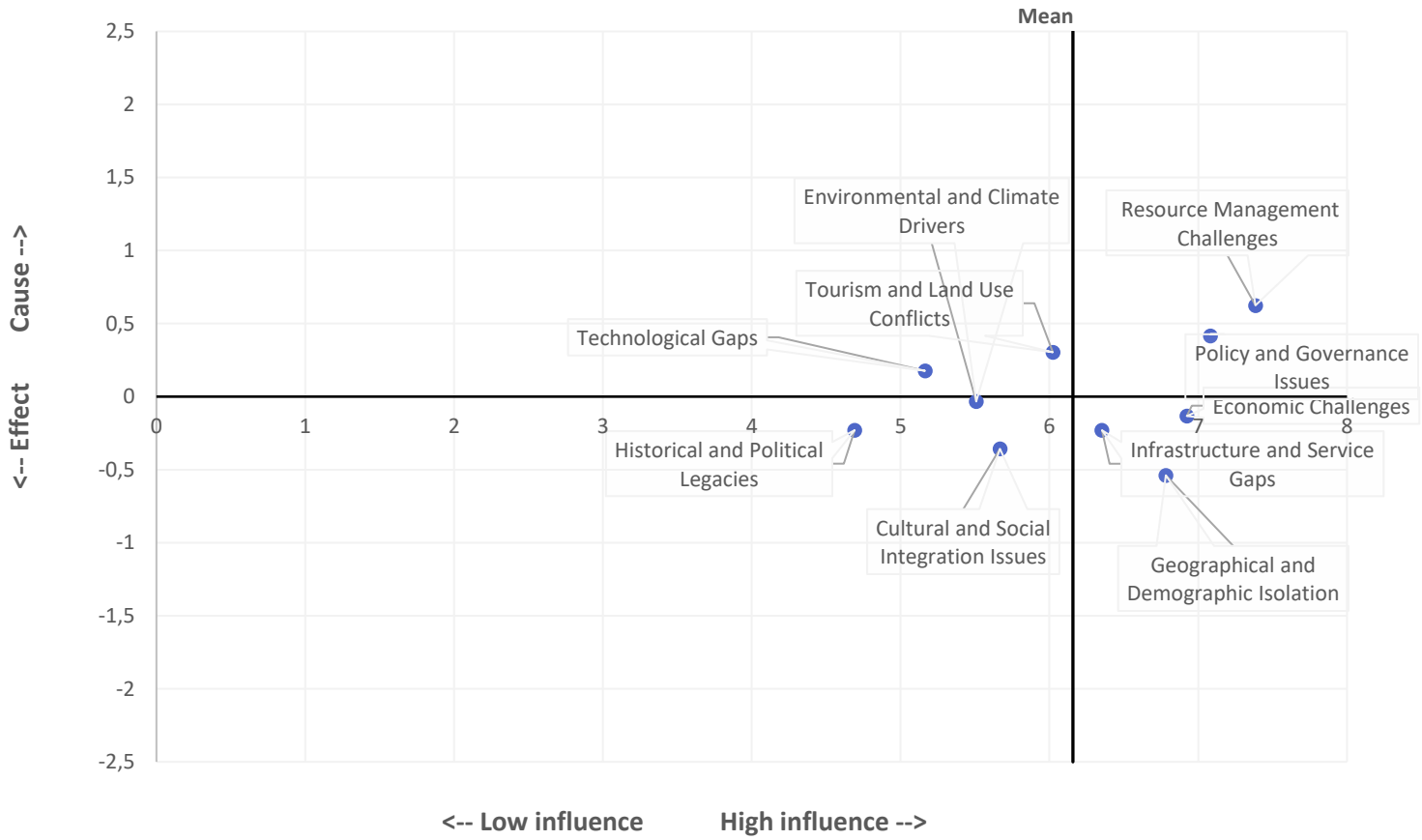


Fig. 4 Factors were categorised as "causes" or "effects", and “low” or “high” influential using the DEMATEL method helping to identify key drivers in the system

The DEMATEL results indicate that Resource Management Challenges and Tourism and Land Use Conflicts act primarily as cause-side drivers, while Technological Gaps also show a weaker causal influence. In terms of prominence, Resource Management Challenges have the highest overall influence, followed by Policy and Governance Issues, Economic Challenges, and Geographical and Demographic Isolation, indicating their strong involvement in the overall system. Conversely, Geographical and Demographic Isolation and Cultural and Social Integration Issues are predominantly effect-side factors. The results suggest that resource management, governance, and economic conditions are central to the network of drivers and effects shaping the area.

10 Who is negatively impacted by the challenge, and how?

Economic disadvantage: Economic activities are strictly regulated by law due to the national park status and strict nature conservation regulations. This negatively affects local inhabitants.
Institutional trap: Various actors in the national park have different interests, including those of the nature conservation and forestry sectors and local inhabitants. All are negatively affected by administrative tensions and conflicts.
Marginalisation based on location: Limited natural resources and infrastructure (e.g. water reservoirs and sewage systems), as well as weak transport connectivity (e.g. road networks and parking facilities), create additional challenges, particularly given the difficult terrain and nature conservation regulations.

11 Who is positively impacted by the challenge, and how?

Non-humans: Nature, ecosystems, habitats and species are protected due to strict nature conservation regulations.
Forest ecosystem service provision positively influences the health and well-being of people living in or visiting the national park.

12 Does the case study link to unbalanced centre-periphery relations?

No.

13 In what ways are the centre-periphery relations unbalanced?

N/A.

14 The definition of the periphery trap in this case

Marginalisation of the NP territory stems from its location – mountainous terrain, migration and an ageing population – as well as from its status as a national park. Economic activities and development are strictly regulated in protected zones; on the other hand, large areas are affected by tourism and recreational infrastructure. Traps in the NP also include institutional changes and tensions between actors with different values and interests, as well as frequent changes in personnel in decision-making positions.

15 The level of conflict

Different values among actors in the NP, different views and perceptions of nature conservation approaches (non-intervention/close-to-nature management), different views on NP administration and governance, frequent administrative and personnel changes, land-use interests and pressure from developers, and perceived injustice among landowners.

16 Description of the level of conflict related to the case study

The town of the High Tatras was founded in 1947 with three basic functions: tourism, recreation and sport; climatic spa and treatment; and nature protection and research.

Despite several proposals, the zonation of the national park is still missing. Strategic documents (MoE SR 2019) and legislation promote close-to-nature forestry in the state-owned part of the national park and propose a zonation with a non-intervention, strictly protected core zone and zones designated for other human activities. Despite several debates, no agreement has been reached on this. For more effective management of the NP, it is crucial to find solutions together with different groups

of key actors, rather than through a top-down mechanism, and to consider and discuss possible approaches to NP management.

17 Efforts to solve the challenge(s)

Here, you can focus on one or a few solutions. These may include, for example, community-based actions and initiatives, social innovations, new business models, entrepreneurial activities, new policy and planning instruments, science-based decision-making and solutions, nature-based solutions, and planning related to the use or conservation of mountainous areas.

18 Research-related proposals for potentially solving these challenges

In our research, we (IFE SAS and NFC) focus in particular on TANAP (Slovakia), aiming to address management challenges and co-create strategies for effective management and meaningful governance of TANAP. Our research focuses on participatory approaches, and together with the Polish TPN, we plan to organise stakeholder workshops, interviews, and other activities. As researchers, we will therefore seek to connect key actors involved in NP management, facilitate discussions, and work together to identify potential solutions.

We will focus on institutional analysis, conflict analysis, cost–benefit analysis of forest management and comparisons of different management approaches, as well as inhabitants' values and perceptions of wilderness.

19 Visions of desirable futures of the involved actors and the source of information

The desired futures will be discussed at a workshop in May 2024, followed by interviews and desk research on the identified topics. A confrontation of views, as reflected in the media (e.g. recent conflicts related to brown bears), is anticipated. Changes in the management and organisation of the NP, including the new management structure, as well as an unclear institutional structure and distribution of competencies due to the absence of zonation, make it difficult to anticipate the outcome at this stage.

20 Lessons-learned from the case study

This research is still in its early stages, so we will address these questions over the next 1–2 years.

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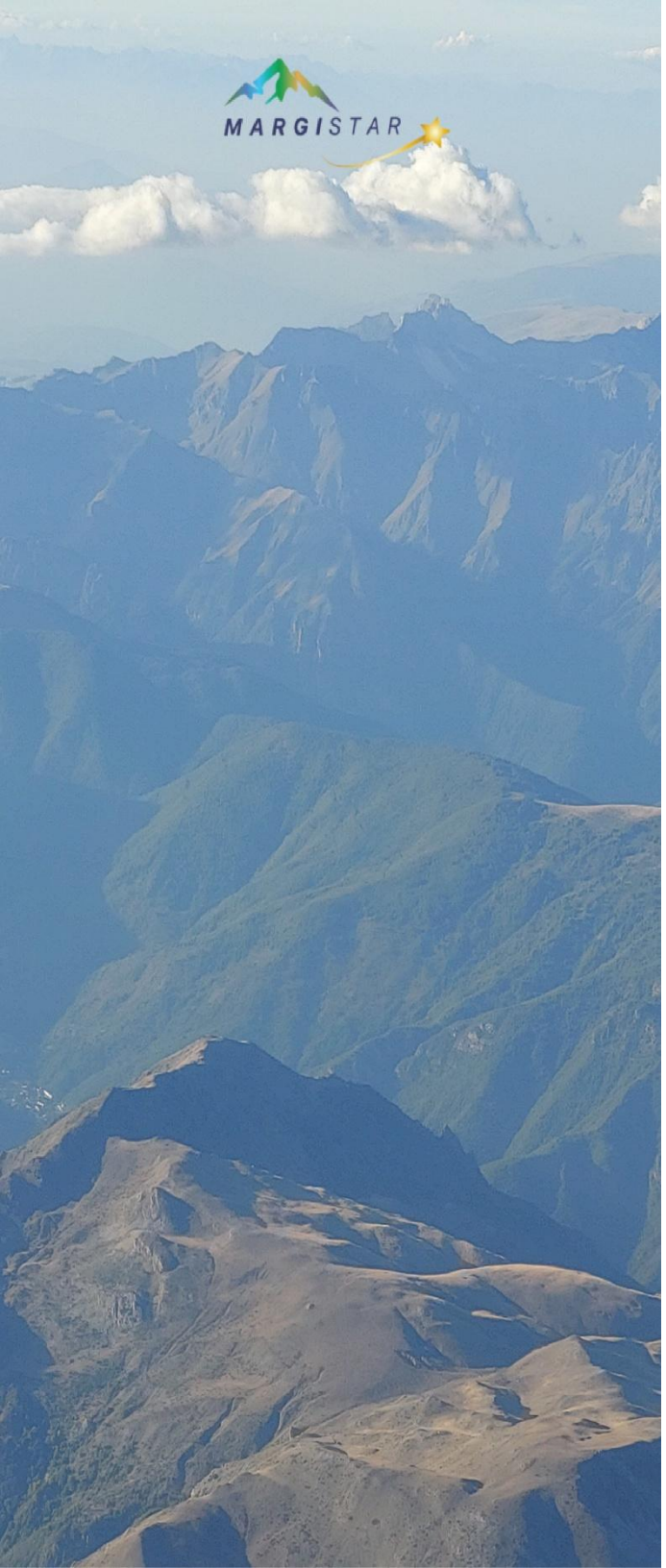

The interplay of agricultural abandonment and nature conservation in shaping land-use patterns in and around Triglav National Park

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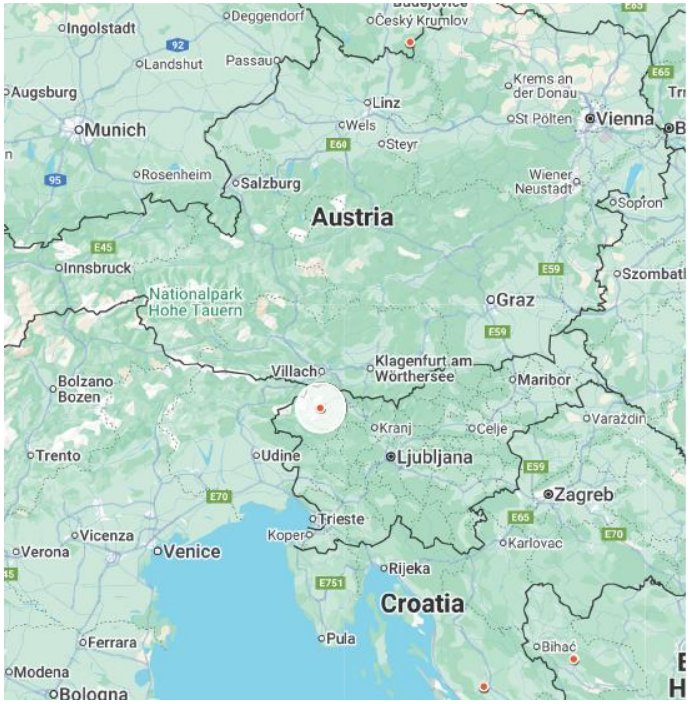
1 Case study location

46° 22' 31.80"N, 13° 50' 16.08"E



2 Country

Slovenia

3 For how long has the challenge been acute?

10 years

4 Challenge categories

Governance challenges: E.g., policies made at national and/or EU levels, top-down decision-making, lack of local participation in decision-making etc.
Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Environmental challenges: Climate change, biodiversity loss, and/or ecological destruction.
Geographical challenges: Geographical handicaps (including long distances, lack of connectivity, difficult terrains etc.) and/or natural handicaps (e.g., soil productivity, growing season).

5 Relevant UN Sustainable development goals

SDG3: Good health and well-being; SDG8: Decent work and economic growth; SDG10: Reduced inequalities; SDG13: Climate action; SDG15: Life on land; SDG17: Partnership for the goals.

6 Short description of the case study location

The Slovenian case study focuses on mountain regions in the Julian Alps, which experience varying degrees of marginalisation and face diverse challenges. The majority of these areas fall under the Natura 2000 network, with a significant proportion located within the protected area of Triglav National Park in north-western Slovenia. Slovenia faces an ageing population and declining reliance on traditional sectors such as agriculture and forestry, leading to the abandonment of more than 20% of family farms over the last two decades. Although nearly one in four residents owns forest land, the implementation of planned forestry activities remains notably low.

Slovenia's strategic geographical location at the intersection of the Alpine, Mediterranean, Dinaric, and Pannonian regions results in diverse agricultural conditions, traditions, cultural heritage, and landscapes. While regions characterised by tourism offer attractive living conditions, well-developed infrastructure, and vibrant cultural and social environments, they also face the environmental consequences of tourism and the abandonment of agricultural practices.

Key challenges include the economic viability of agriculture, wildlife presence, spatial pressures from other sectors and tourism, and the resulting increases in land and living costs. Remote highland areas face depopulation, land abandonment, a shortage of young residents, declining traditional agriculture, and inadequate infrastructure.

Although development subsidies are generally distributed evenly across the country, they may not adequately address the needs of regions facing greater agricultural constraints. Historical policies, ranging from Austro-Hungarian agricultural favouritism to the socialist period, have significantly shaped the agricultural landscape. Regulatory frameworks, in line with European Union standards, promote sustainable agricultural practices, yet landowners often receive no compensation for restrictions on land use.

Despite these obstacles, Slovenia emphasises sustainable forest management and organic farming. However, due to stringent requirements and bureaucratic hurdles, many such initiatives are excluded from subsidy schemes.



Fig. 1 A herd of cattle on a high-mountain pasture, Konjsko Sedlo

Photo: Luka Jemec

7 Key challenges in the case study

Governance: The absence of regional-level government in Slovenia leads to fragmentation of spatial management in the Julian Alps, particularly in the Triglav National Park (TNP) area. The division of responsibilities among municipalities hinders effective cooperation and dialogue, particularly for projects with regional significance. In addition, TNP has its own management plan and administration, further complicating coordination.

Natural resource use: Significant portions of the area are designated as protected areas, including TNP and Natura 2000 sites, imposing management restrictions on various activities such as agriculture, settlement, transport, and tourism. The decline of cultural landscapes due to the abandonment of seasonal pastoralism and forest encroachment poses additional challenges, although initiatives such as communal pastures and cooperatives demonstrate successful efforts to preserve these landscapes.

Environmental: Changes in land use, such as the encroachment of forest on high-mountain grasslands, diminish internationally important habitats. Abandonment also facilitates the expansion of populations of large carnivores and ungulates. Intensified tourism and settlement growth cause severe degradation in popular areas. Climate change increases the frequency and intensity of natural disturbances, such as windthrow, affecting forest stability, biodiversity, and infrastructure.
Geographical: Remote areas have limited access to cultural and social events due to their distance from major urban centres.
Economic: Small, uncompetitive, and fragmented farms persist, necessitating strategies for economic revitalisation.



Fig. 2 Restored traditional livestock watering pond, Zgornja Krma

Photo: Luka Jemec

8 A brief summary: What is this case study about?

The Slovenian case study is situated in the Julian Alps, a region in the north-western part of Slovenia. It encompasses diverse areas facing a range of challenges. These include Triglav National Park, which provides the highest level of nature protection

mandated by law. The region comprises mountainous terrain, hills, valleys, and settlements. While more tourist-oriented areas benefit from developed infrastructure and vibrant cultural scenes, they also face challenges such as environmental pressures from tourism and the decline of traditional agriculture. Other areas experience depopulation, land abandonment, and inadequate services. However, promising initiatives, such as tourist farms and agricultural partnerships, are also emerging in response to these challenges.

Conflicts associated with tourism, including traffic congestion and mass tourism, arise partly from the slow implementation of visitor management measures. Progress has been made in this area in recent years. Spatial changes, the loss of cultural landscapes and traditions, the decline of mountain pastures, and the degradation of endangered habitats are partly the result of increasingly difficult conditions for some forms of traditional agriculture, particularly seasonal pastoralism. A major challenge is the lack of policy coherence, with policies simultaneously promoting the conservation and expansion of large carnivore populations and the continuation of mountain pastoralism, despite the practical difficulties of achieving coexistence in some mountain areas.



Fig. 3 Carefully managed mountain meadows contribute to the preservation of a well-maintained cultural landscape, Bled

Photo: Luka Jemec

9 The fundamental causes and drivers for the challenges

9a A cause-and-effect diagram identifying key drivers and their interrelationships

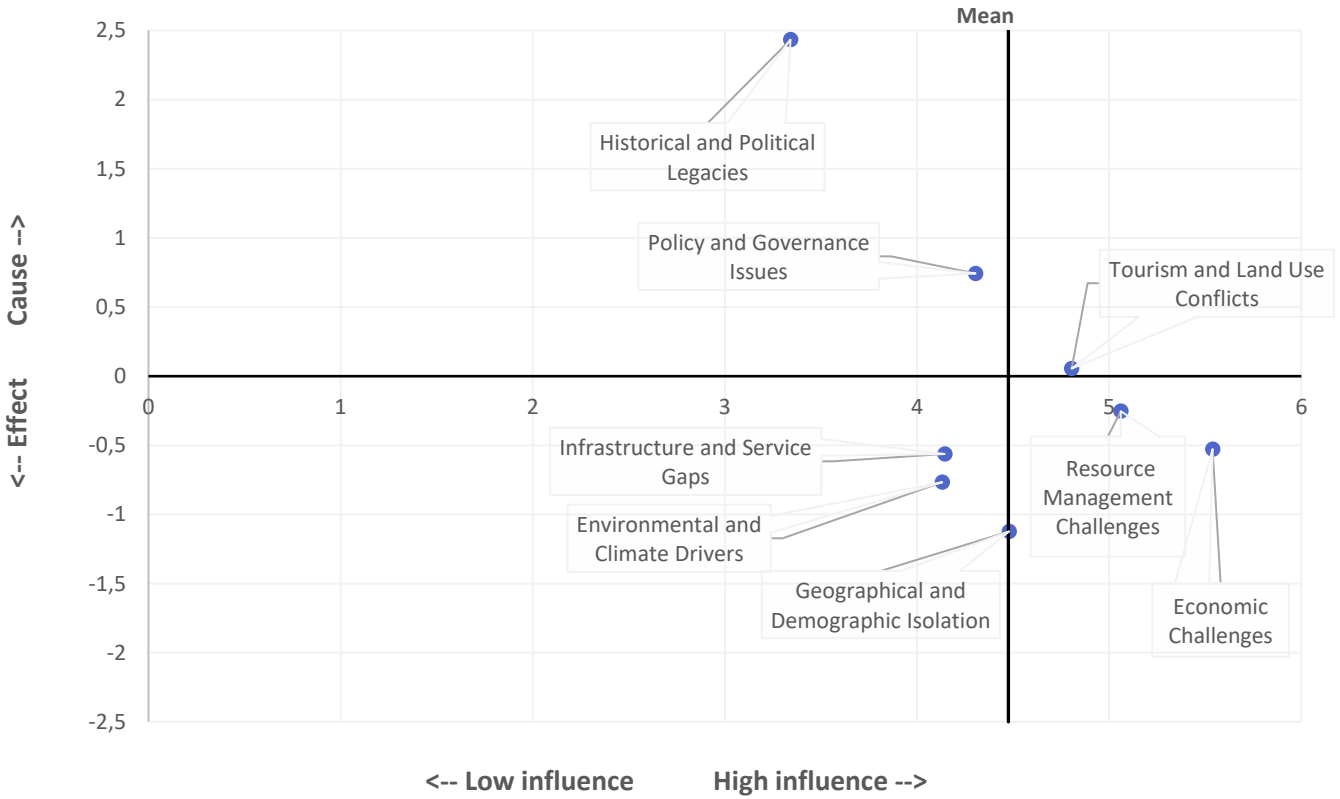


Fig. 4 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

The diagram shows that the main causes of developmental challenges are political and governance issues, historical and political legacies, and environmental and climate drivers, as these factors have the highest level of influence and act as triggers for other problems in the system. In contrast, economic challenges, infrastructure and service gaps, and resource-management difficulties appear primarily as consequences, shaped by the impact of the upstream structural factors, while geographical and demographic isolation and conflicts between tourism and land use occupy an intermediate position, influencing the system while also being shaped by it. The most important elements overall are economic challenges, tourism and land-use conflicts, and resource management. These three elements play the greatest role nowadays, but two of them are already effects of other factors.

10 Who is negatively impacted by the challenge, and how?

The following challenges have been identified: Mass tourism has a negative impact on the environment and the quality of life of local residents. In particular, traffic congestion and inadequate parking make it difficult for local residents to travel normally. Erosion, litter, dog faeces, excessive noise, and parking along access roads are also problems along popular tourist routes.

Large carnivores, particularly wolves, make grazing on mountain pastures increasingly difficult. Given the specific local circumstances, experts report difficulties in identifying effective measures to protect livestock from large-carnivore attacks. According to local stakeholders, the Ministry has been insufficiently responsive to these concerns. A further concern relates to international legislation and LIFE projects for large carnivores, which, according to these stakeholders, provide funding to institutions and thereby contribute to the expansion of carnivore populations.

Landowners face challenges within the national park due to numerous restrictions. Larger projects require approval from the park authority; the park has a right of first refusal on land sales; and in some areas, land management is prohibited. Landowners may also be fined for parking incorrectly on their own land.

11 Who is positively impacted by the challenge, and how?

The above-mentioned key developments in the National Park have positive implications for tourism workers, managers of natural attractions, and providers of other tourism and catering services.
The abandonment of agriculture facilitates the expansion of some species, such as large carnivores and ungulates, including deer and related species.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

There are differences in levels of development, income, and demographic trends. An important factor contributing to these disparities is the distance from motorways and larger towns.

14 The definition of the periphery trap in this case

Traditional agriculture is in decline throughout the area, mountain pastures are being abandoned, and the loss of cultural landscapes is becoming increasingly evident. Irrespective of agricultural activity, the development of villages depends mainly on their distance from motorways and major towns, as well as on the intensity of tourism. Consequently, there are differences in demographic trends, property prices, and other socioeconomic characteristics.

15 The level of conflict

The presence or absence of tourism has a significant impact on the quality of life and development opportunities in the local area.

There is also a conflict between conservation measures aimed at promoting large carnivores on the one hand and agricultural subsidies intended to maintain pastoralism in mountain areas on the other, as these objectives may be difficult to reconcile. This conflict has a major indirect impact on the management of agricultural land and the viability of farms.
The conflict between landowners and protected areas varies in importance. For some landowners who depend on the primary sector for their livelihoods, restrictions and prohibitions can have significant or even critical implications. For landowners who are not actively engaged in land-based activities, these restrictions are generally less important.

16 Description of the level of conflict related to the case study

Mountain farming has become economically unviable, while the presence of large carnivores, protected areas, and increasing restrictions makes it increasingly difficult for even the most committed farmers to continue the tradition of seasonal pastoralism. As a result, fewer and fewer people are employed in this sector. Most employment opportunities are concentrated in larger towns and more developed areas, leading people either to commute daily or to move from rural areas to urban centres. This is a key factor contributing to demographic differences between more remote locations and areas with better infrastructure and transport connections. Tourism has developed in areas with numerous natural attractions and scenic landscapes, where it can provide a source of income for local residents and contribute to maintaining the population. However, tourism also creates additional pressures and challenges. The impacts of tourism are highly visible and consequently receive considerable public and political attention. By contrast, the challenges faced by mountain farming are often less apparent, as they unfold gradually over longer periods. However, the tourism sector is strongly dependent on the maintenance of cultural landscapes shaped by traditional agricultural practices. The continuing decline of mountain farming therefore threatens not only agricultural production and cultural heritage, but also the landscape qualities upon which tourism development relies. Despite this interdependence, agricultural challenges frequently remain overshadowed by debates surrounding tourism pressures and visitor management.

The difficulties in managing large carnivores are a key factor contributing to the abandonment of mountain farming in recent years. Farmers are unable to adequately protect their livestock and are therefore forced to reduce or abandon farming activities.

Protected areas are generally well designed in principle, but are poorly accepted by local residents in practice. Instead of being encouraged and rewarded for sustainable and environmentally responsible agricultural and forestry practices, landowners within the national park face restrictions that, according to local stakeholders, may conflict with several constitutional rights.



Fig. 5 Sustainable grazing practices support biodiversity in mountain pastures, Konjsko sedlo

Photo: Luka Jemec

17 Efforts to solve the challenge(s)

To mitigate the effects of overtourism, some local authorities have introduced measures such as parking management schemes, road closures, restrictions on motor vehicle access during peak times, and visitor limits based on the area's carrying capacity. Some municipalities have also adopted good practices, such as providing free public transport to the most popular destinations.

An example of good practice in improving the economic resilience of mountain farms is the Planika Dairy Cooperative, which operates as a farmer-owned cooperative and processes milk from local farms into high-value dairy products, thereby supporting local agricultural livelihoods.

18 Research-related proposals for potentially solving these challenges

Several research projects have been conducted in the surrounding areas, and their results and lessons learned could potentially be transferred to this area:

Interreg Alpine Space, PlanToConnect: Mainstreaming Ecological Connectivity in Spatial Planning Systems of the Alpine Space (2021–2027);

Interreg Alpine Space, MOSAIC: Managing Protective Forests Facing Climate Change Compound Events (2022–2025);

LIFE for SEEDS: Conservation of Priority Grassland Habitats in Slovenia through the Establishment of a Seed Bank and In Situ Restoration (2021–2026).

Self-organised research (WG2):

We aim to identify the reasons for the abandonment of sustainable pastoralism in mountain areas. With input from local stakeholders, we will seek to identify suitable solutions and propose examples of best practices from other mountainous regions, enabling local farmers to continue farming sustainably and preserve the cultural landscape.

We will analyse land-use changes in cultural upland mountain landscapes to disentangle the effects of subsidies and protection as potential pathways for preventing the loss of upland cultural landscapes.

19 Visions of desirable futures of the involved actors and the source of information

Future visions are included in Regional Development Plans, which are prepared for each region. The current plans cover the 2021-2027 period. The selected case study encompasses two regions: the Gorenjska Statistical Region (north-eastern part) and the Goriška Statistical Region (south-western part). However, the strategic view of development in these areas is very general and is framed as a "vision". For the Goriška region, the vision is a "green, innovative, safe and connected region", characterised by a high quality of life, developed services and employment opportunities for young people, and

intergenerational cooperation. A greener region implies the sustainable use of resources, adaptation to climate change, and the protection of biodiversity. The vision for the Gorenjska region is "High quality living for all generations in a connected, energy-efficient and clean Alpine region!", which sets similar objectives.
Municipalities within the national park area aim to preserve the cultural landscape, traditional agriculture, and boutique, sustainable tourism (newspaper article).
Farmers seek greater rights over their own land and a reduction in predator populations, or areas without predators where coexistence is considered unfeasible (roundtable discussions, meetings, reports on workshops organised by Triglav National Park, letters to the Ministry, and meetings of the Agriculture Committee of the National Council).
The national park aims to promote coexistence between agricultural use, residents, and wildlife. It seeks to limit tourism in accordance with environmental carrying capacity (meeting minutes, website).
Nature conservation organisations and the Ministry of Natural Resources and Spatial Planning aim to maintain predator populations in the Alpine region and ensure ecological connectivity between the Dinaric and Alpine regions (conferences, websites).

20 Lessons-learned from the case study

We can conclude that some regulations and recommended thresholds are becoming outdated because spatial and socio-environmental conditions can change relatively quickly. For example, tourism may exceed the carrying capacity of an area, while the status and distribution of particular species and habitats may change over time, making it problematic to define conservation requirements unambiguously across the entire European Union. For example, the occurrence of wolves in Slovenia was relatively low when the Bern Convention was adopted, whereas the situation has changed substantially since then. Their current protection status may constrain the country's ability to address emerging human–wildlife conflicts.
Secondly, we have observed that the establishment of parks and protected areas without the consent of landowners and without adequate compensation can be poorly accepted by local communities. Finally, the Slovenian Constitution states that the state should ensure the economic, cultural, and social development of the population in mountain and hilly areas.

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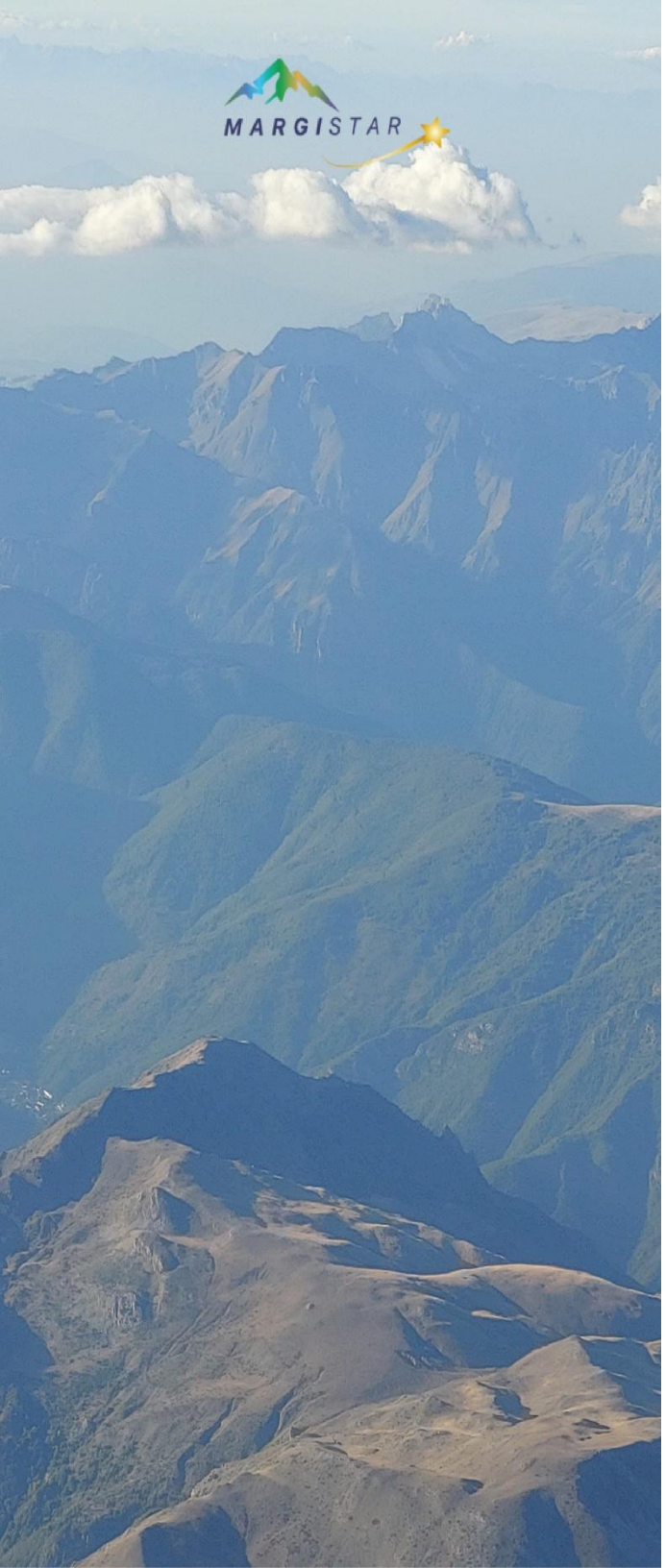

Macizo del Caroig, Eastern Spain

Artemi Cerdà[a]

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artemio.cerda@uv.es

1 Case study location

39°2'24.94"N, 0°53'13.81"W



2 Country

Spain

3 For how long has the challenge been acute?

50 years

4 Challenge categories

Socio-cultural challenges: Demography, migration (out/in) and/or social and ethnic tensions.
Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Environmental challenges: Climate change, biodiversity loss, and/or ecological destruction.
Geographical challenges: Geographical handicaps (including long distances, lack of connectivity, difficult terrains etc.) and/or natural handicaps (e.g., soil productivity, growing season).

5 Relevant UN Sustainable development goals

SDG5: Gender equality; SDG6: Clean water and sanitation; SDG7: Affordable and clean energy; SDG8: Decent work and economic growth; SDG13: Climate action; SDG16: Peace, justice, and strong institutions.

6 Short description of the case study location

The Macizo del Caroig is a rural area located inland in Valencia Province, eastern Spain. The mountainous terrain and scrubland vegetation have been affected by land abandonment over the last 60 years, and today the population is concentrated in the main towns, which have themselves experienced population decline. From a human perspective, much of the mountainous terrain is now sparsely inhabited, while remaining rich in biodiversity. Traditional rainfed agriculture is increasingly at risk due to the low prices of agricultural products. Policies aimed at promoting agriculture and tourism in the study area have so far had limited success. Forest fires are an increasing risk due to the accumulation of biomass. Most of the land is privately owned, with only a few publicly owned areas, which increases the difficulties of effective land management. Landowners are key stakeholders, while shepherding has largely disappeared. The traditional landscape, together with its social and economic characteristics, is undergoing substantial change, while global warming and declining water availability are placing additional pressure on the Macizo del Caroig. The visit will illustrate the societal and economic characteristics of the Macizo del Caroig and its communities, and will provide an opportunity to share solutions to the main challenges.

7 Key challenges in the case study

Land degradation, land abandonment, soil erosion, soil biodiversity, recovery of populations, economic development, traditions and heritage.

8 A brief summary: What is this case study about?

The Macizo del Caroig is a limestone plateau covering approximately 2,500 km² in eastern Spain that was largely abandoned during the 1960s due to rural depopulation. Since then, declining population density and forest recovery have contributed to an increased risk of forest fires, the recovery of wildlife populations and forest cover, and a decline in traditional land-use activities.

9 The fundamental causes and drivers for the challenges

Abandonment driven by economic changes.

9a A cause-and effect diagram identifying key drivers and their interrelationships

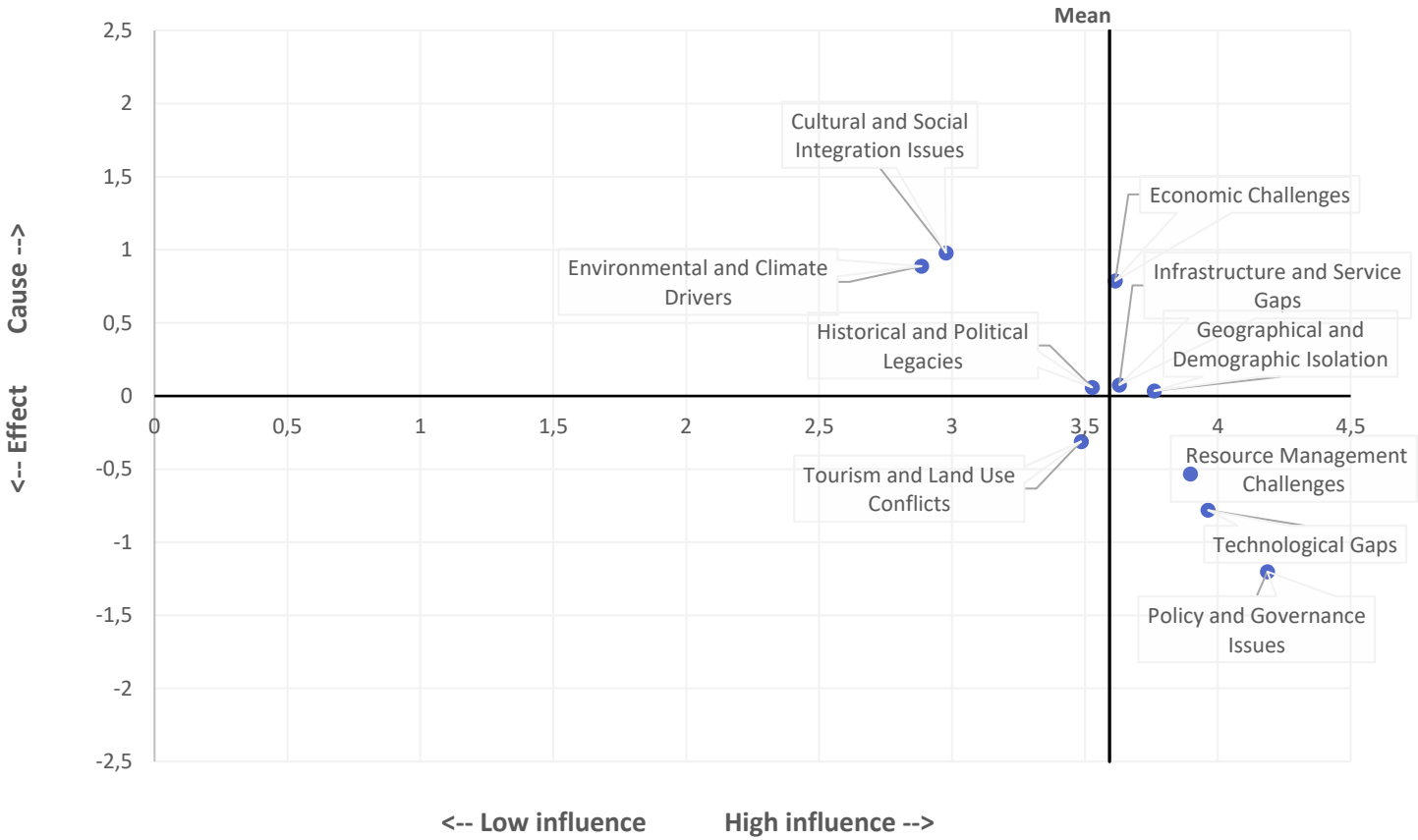

Fig. 1 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

In a DEMATEL cause-and-effect diagram, factors above the horizontal axis represent net causes that drive system behavior, while factors below are net effects that receive influence. The vertical axis measures net impact, positioning factors like Cultural and Social Integration Issues as top drivers and Policy and Governance Issues as primary outcomes. The horizontal axis indicates overall prominence or systemic importance, with the vertical mean line dividing lower-impact factors on the left from high-impact factors on the right. Factors such as Resource Management Challenges, Technological Gaps, and Policy and Governance Issues fall into the high-importance quadrant, making them central to the system despite being effect variables. To solve these downstream problems efficiently, strategic interventions must target key root cause drivers like Economic Challenges and Infrastructure Gaps.

10 Who is negatively impacted by the challenge, and how?

Local citizens, farmers and shepherds.

11 Who is positively impacted by the challenge, and how?

Urban areas.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

Due to land abandonment.

14 The definition of the periphery trap in this case

The potential to attract and retain population from urban areas.

15 The level of conflict

Medium.

16 Description of the level of conflict related to the case study

The main conflict is related to land abandonment, which is largely accepted by the local population.

17 Efforts to solve the challenge(s)

Yes, via funding from the EU. Not successful.

18 Research-related proposals for potentially solving these challenges

Yes, via research and investment.

19 Visions of desirable futures of the involved actors and the source of information

Improve tourism and increase the income of local partners.

20 Lessons-learned from the case study

This is a remote area that can be seen as an example for many areas in the Mediterranean.

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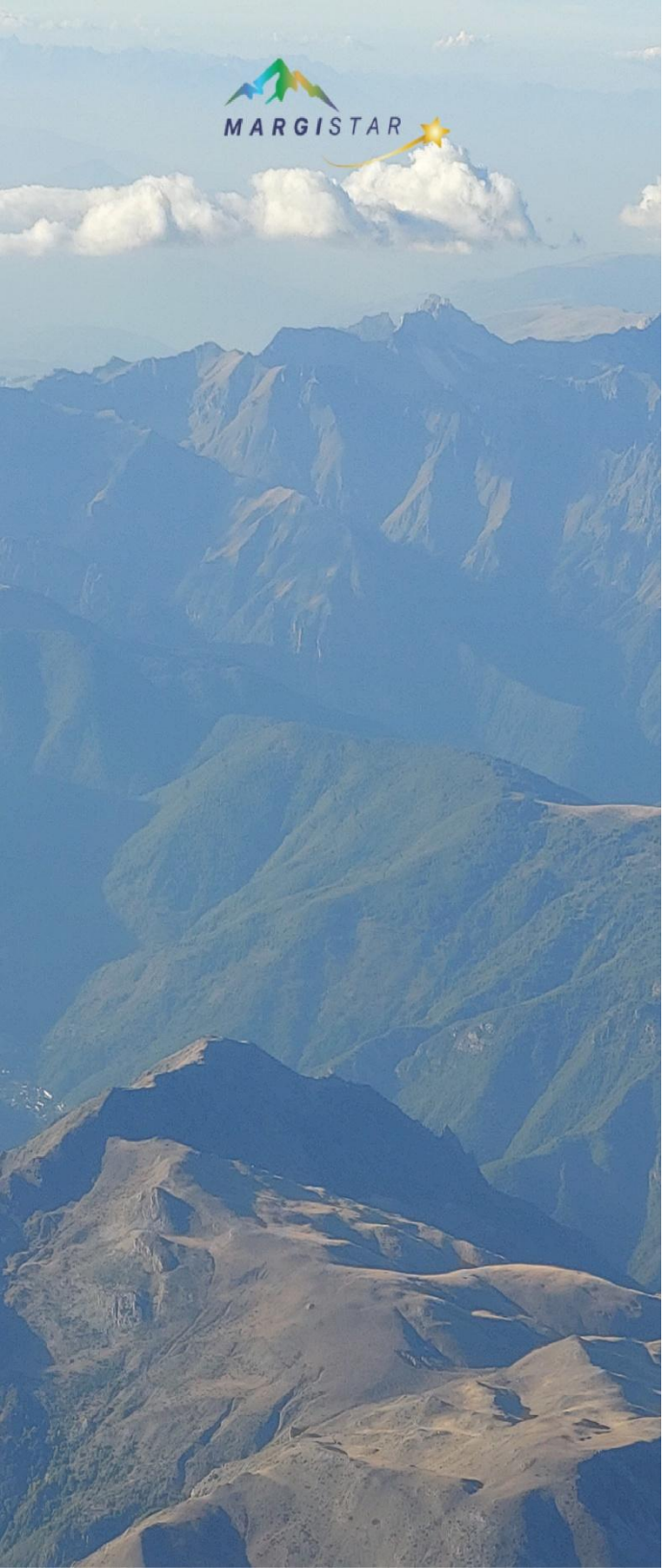

Rural depopulation in Teruel as losing bioeconomy opportunities

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1 Case study location

40° 15' 3.96"N, 0° 45' 10.87"E



2 Country

Spain

3 For how long has the challenge been acute?

20 years

4 Challenge categories

Socio-cultural challenges: demography, migration (out/in) and/or social and ethnic tensions.
Governance challenges: e.g., policies made at national and/or EU levels, top-down decision-making, lack of local participation in decision-making etc.
Natural resource use challenges: use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.

5 Relevant UN Sustainable development goals

SDG2: Zero hunger.
SDG6: Clean water and sanitation.
SDG12: Responsible consumption and production.

6 Short description of the case study location

Teruel is mainly located on a plateau at approximately 600 m a.s.l., with higher mountainous areas reaching up to 2,020 m. Its continental climate creates challenging conditions for competitive agricultural activities. The key stakeholders are irrigated farmers, who are organised in municipal associations. River water use is regulated by the Water Law. Collaboration among individual stakeholders is very limited. The Spanish Civil War had a strong impact on the area, and many inhabitants retain highly conservative attitudes and individualistic approaches. There is a lack of innovative businesses and territorial marketing initiatives. Water availability in rivers is becoming increasingly uncertain due to climate change.

7 Key challenges in the case study

Loss of cultural knowledge and practices related to the management of irrigation commons, together with challenges in maintaining future agricultural opportunities that depend on irrigation to remain competitive.

8 A brief summary: What is this case study about?

Teruel is the most sparsely populated province in Spain, with municipalities that are typically very small and have a strong agricultural component, particularly black truffle production in the south. Rural tourism has also developed to some extent in recent years, although Teruel is not among Spain's leading rural tourism destinations.

Farmland is progressively being abandoned, resulting in spontaneous afforestation. A key aspect of the periphery trap is that, after five years without irrigation, farmland may lose its irrigation rights, making the water available for use downstream, including in urban areas. At the same time, the loss of historical irrigation rights restricts opportunities for future bioeconomy-related development. In addition, the collective arrangements and local knowledge associated with managing irrigation rights are progressively being lost.

9 The fundamental causes and drivers for the challenges

Drivers: Climate change is increasing the variability and uncertainty of river water availability for irrigation.

Causes: Increasing competition among different uses of river water. Reduced dependence of farmland owners on agricultural income diminishes their interest in maintaining well-managed commons and reduces their engagement in collective social activities and management.

9a A cause-and effect diagram identifying key drivers and their interrelationships

The analysis has not been conducted.

10 Who is negatively impacted by the challenge, and how?

Rural (current and potential) farmers, who lose both irrigation rights and the traditions associated with managing the commons.

11 Who is positively impacted by the challenge, and how?

Urban water consumers.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

Water policy governing the cessation of irrigation rights does not adequately consider its potential effects on rural areas, particularly in relation to future economic development.

14 The definition of the periphery trap in this case

As water legislation is primarily designed from an urban perspective, its potential effects on rural areas resulting from restrictions on irrigation rights are not adequately considered.

15 The level of conflict

The level of conflict is low, as farmers have become increasingly fatalistic and perceive themselves as having limited influence over decision-making processes.
Implicit tensions exist between farmers who do not contribute to the commons and those who comply with collective management arrangements, but these tensions rarely develop into open local conflicts.

16 Description of the level of conflict related to the case study

See point 15.

17 Efforts to solve the challenge(s)

No efforts to my best knowledge.

18 Research-related proposals for potentially solving these challenges

Making the problem and its consequences visible, while investigating potential solution pathways and the roles of the different stakeholders.

19 Visions of desirable futures of the involved actors and the source of information

No information.

20 Lessons-learned from the case study

Loss of the commons as a form of rural social capital, which also affects other aspects, such as the capacity for collective self-organisation to advocate for the preservation of historical irrigation rights.

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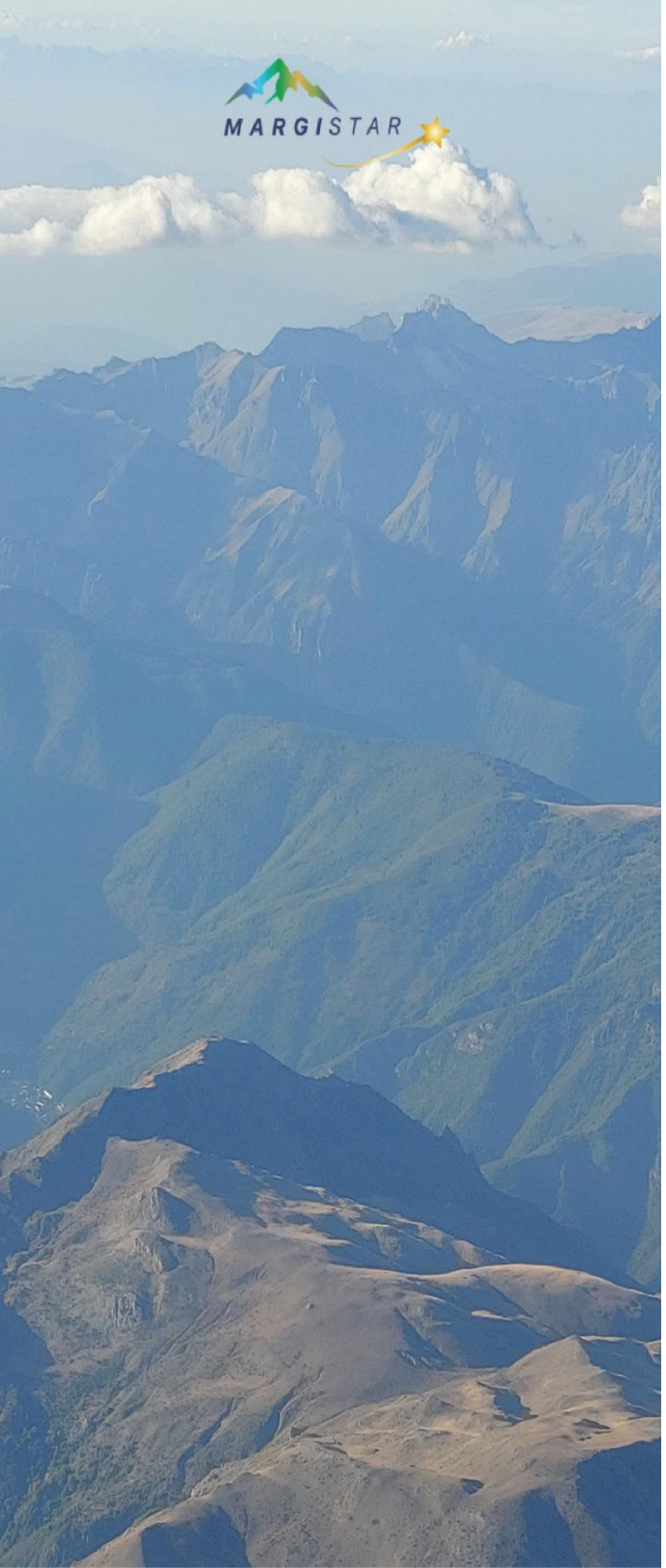

Faraján in the river Genal valley (Málaga, Spain)

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1 Case study location

36° 36' 59.83"N, -5° 11' 13.63"E



2 Country

Spain

3 For how long has the challenge been acute?

20 years

4 Challenge categories

Socio-cultural challenges: Demography, migration (out/in) and/or social and ethnic tensions.
Economic challenges: Economic problems, poverty, and lack of employment and education opportunities.
Governance challenges: E.g., policies made at national and/or EU levels, top-down decision-making, lack of local participation in decision-making.
Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Service-related challenges: Poor cultural, social and/or commercial services.
Environmental challenges: Climate change, biodiversity loss, and/or ecological destruction.
Geographical challenges: Geographical handicaps (including long distances, lack of connectivity, difficult terrains etc.) and/or natural handicaps (e.g., soil productivity, growing season).

5 Relevant UN Sustainable development goals

SDG3: Good health and well-being.

SDG4: Quality Education.
SDG5: Gender equality.
SDG6: Clean water and sanitation.
SDG7: Affordable and clean energy.
SDG8: Decent work and economic growth.
SDG9: Industry, innovation, and infrastructure.
SDG10: Reduced inequalities.
SDG12: Responsible consumption and production.
SDG13: Climate action.
SDG14: Life below water.
SDG15: Life on land.
SDG17: Partnership for the goals.

6 Short description of the case study location

The River Valley is located in the westernmost part of the Malaga province (Andalusia, Spain) and comprises 15 municipalities: Gaucín, Benarrabá, Algatocín, Benalauría, Benadalid, Atajate, Alpandeire, Faraján, Júzcar, Cartajima, Parauta, Igualeja, Pujerra, Jubrique and Genalguacil. Most of them have between 300 and 600 inhabitants. Therefore, they are mountain villages characterised by isolation and great geological and ecological value. The main problem they have to tackle is depopulation caused by the lack of economic dynamism, in spite of the locally generated resources of the area. Young people move to the coast or the nearest main town (Ronda), so the population is increasingly aged. Chestnut groves and *Quercus* forests, especially holm oaks and cork oaks, stand out for their potential and beauty among its diverse landscapes. Chestnuts are a source of economic wealth for the valley (http://www.saboramalaga.es/en/product/chesnuts/), as are cork and free-range feeding of Iberian pigs. After a period of local economic growth in the 1990s, fostered by the FEDER funds, a chain of small local businesses developed around the exploitation of local resources: chestnut products, charcuterie, bakeries, typical meal restaurants, etc. This also promoted the opening of several establishments for rural tourism and accommodation. The strong crisis that started in 2007 caused a regression that has worsened in recent years, resulting in the loss of much of the economic and demographic potential that existed a decade before. Nowadays, there are advisory services and certain financial support from the CADEs (Centro Andaluz de Desarrollo Empresarial, Andalusian Centres of Entrepreneurial Development) for Lower Genal (located in Cortes) and Upper Genal (located in Ronda), as well as from the Development Groups of Sierra de las Nieves for European funds. In a short time, the Sierra de las Nieves National Park will be established in the easternmost part of the valley, which can attract public and private investments and interests.



Fig. 1 Faraján landscape

Photo: Jesús Delgado

7 Key challenges in the case study

It is necessary to promote the development of strategies based on local heritage and locally based resources, and to encourage the empowerment and training of the local population in this regard. Some of the issues to be addressed could include the development of an inventory of heritage resources of different kinds (pilgrimage, festivals and art, food production) and the promotion of training and financing for entrepreneurial ideas among local business people. It would

also be important to support declining autochthonous breeds, such as the golden-blonde pig, or traditional crops, such as cherry trees. The potential of the Genal River Valley is huge in different areas. The most remarkable aspect that can serve as the backbone of the aspects mentioned above is gastronomy and food-product development, especially all those related to chestnuts and Iberian pork. In this sense, it is worth noting a meat-processing company from Faraján, which has created chestnut ham. In this regard, in December 2023, the municipal government of Faraján organised the first slaughter festival, attracting great regional and even national interest.

8 A brief summary: What is this case study about?

One of the main challenges that the Genal River Valley and its municipalities have to face is depopulation. A shortage of sustainable job opportunities, isolation and a lack of entrepreneurial training limit economic development, despite the huge ecological and heritage richness that the valley has offered throughout the centuries. Local communities should take advantage of the valley's beautiful landscape and cultural richness in terms of historical heritage, festivals, traditions and gastronomy, which offer significant potential for development. Rural tourism and production based on local resources would be the milestones upon which an effective socio-economic development plan should be built.

9 The fundamental causes and drivers for the challenges

Undoubtedly, a fundamental aspect would be the scarcity and difficulty of communication, both physical and digital. This is reflected in the scarcity of services, due to the small population and, consequently, limited demand. At the public level, this leads to cuts in different services, including basic services such as health and education, while at the private level, it results in a lack of investment and interest in these territories and their communities.

9a A cause-and effect diagram identifying key drivers and their interrelationships

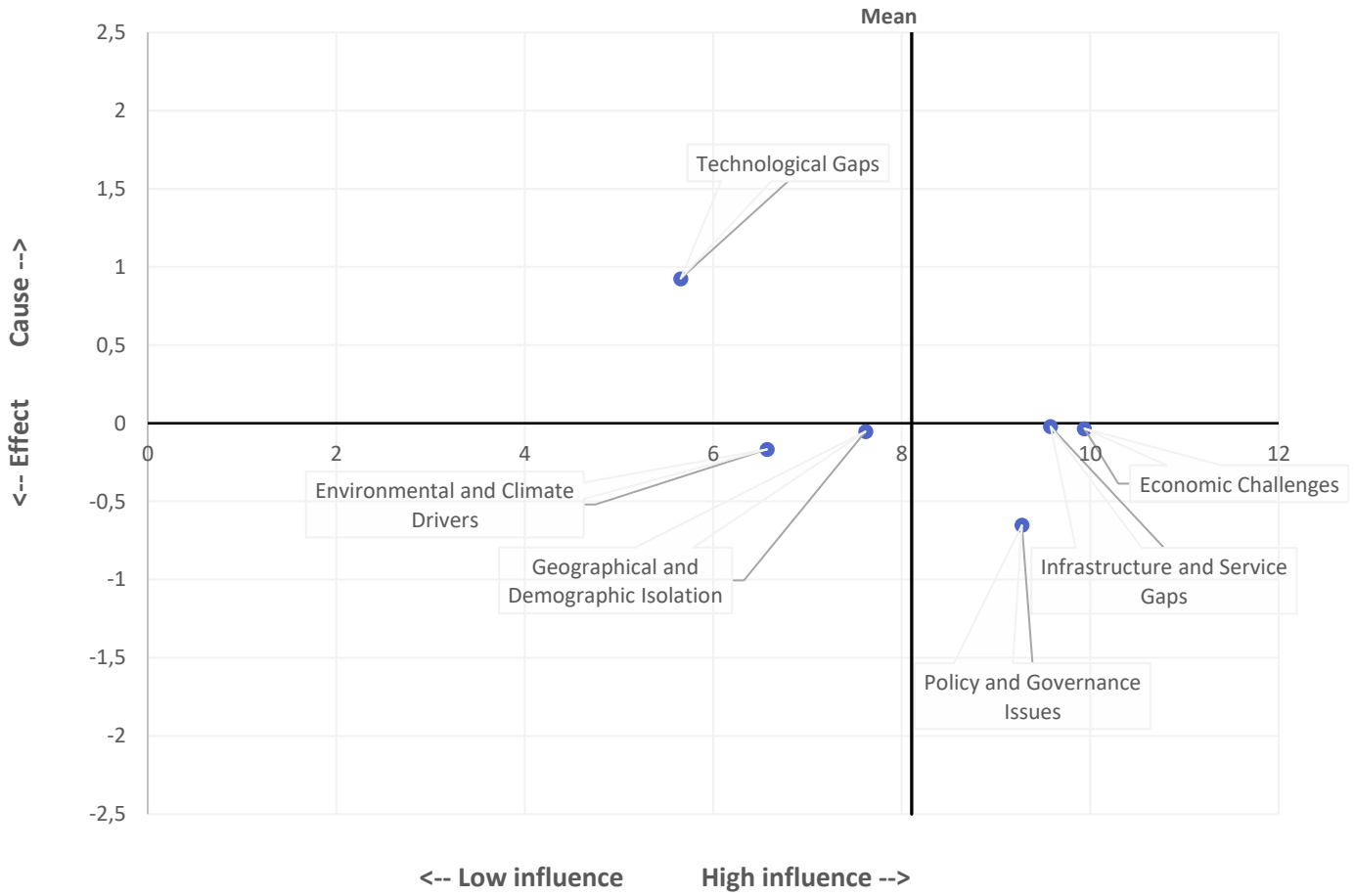

Fig. 2 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

The results indicate that Technological Gaps is the only causal factor, suggesting that it acts as the main driving force within the system. Although it exhibits relatively low prominence, it shows a comparatively strong positive causal influence. In contrast, Economic Challenges, Infrastructure and Service Gaps, Policy and Governance Issues, Environmental and Climate Drivers, and Geographical and Demographic Isolation are identified as effect factors, reflecting dimensions that are primarily influenced by other factors. Among these, Economic Challenges, Infrastructure and Service Gaps, and Policy and Governance Issues display high prominence, indicating that they are highly interconnected within the system, whereas Environmental and Climate Drivers and Geographical and Demographic Isolation show relatively low prominence. Overall, the findings suggest that technological gaps constitute the principal driving force, while economic, infrastructure, governance, environmental, and geographical factors primarily represent outcomes of the system's underlying causal relationships.



Fig. 3 Immaculate festival program

10 Who is negatively impacted by the challenge, and how?

In any case, the environment is an important consideration. Since addressing these challenges would lead to improved development of the area, a certain territorial impact is necessary. The key issue is to keep this impact as low as possible and always ensure that it is in the interest of preserving environmental sustainability.

11 Who is positively impacted by the challenge, and how?

Addressing these challenges would lead to improvements in local development, which would have a positive impact on the quality of life of local communities, both at the individual level, by improving services, working conditions and employment opportunities, and at the administrative level, by increasing revenues and investments that would have a positive impact on territorial development.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

The physical and digital isolation of rural mountain areas leads to a situation of remoteness from the centres and flows of political decision-making, economic development and service provision, which is repeatedly detrimental to these areas. The scarcity of demand, due to severely depleted populations, does not attract investment or economic interest, and local populations must make an additional effort to pursue training and develop social and economic entrepreneurship initiatives.



Fig. 4 Farajáan and chestnut woods

Photo: Jesús Delgado

14 The definition of the periphery trap in this case

The Genal Valley, and in particular the Upper Genal, known as the Havaral, has always remained on the fringes of the main communication routes, which, together with the very rugged nature of the terrain, has fostered physical isolation for centuries. This physical isolation has been reinforced in recent decades by digital isolation, due to the difficulties in accessing broadband internet connections in the area, an issue that has been repeatedly highlighted by local communities.

15 The level of conflict

It is not particularly important in the short term, although it may become much more relevant over time.

16 Description of the level of conflict related to the case study

It is not as important in the short term in relative terms because it affects relatively small population groups, especially when compared with nearby major population centres. On a small scale, it tends to regulate itself through people moving to nearby, more urbanised areas with greater job opportunities or, while continuing to live in rural areas, commuting to nearby areas for work. However, the continuation of this model may have greater and more severe consequences over time, especially in terms of the loss of traditional rural livelihoods, the abandonment of farmland, and the loss of biodiversity, specific biotopes, and links to sustainable agroforestry and livestock management.



Fig. 5 Farajánslaughter Festival

17 Efforts to solve the challenge(s)

First of all, it is necessary to draw attention to these territories at a national and even European level. The Genal Valley and the municipality of Farajánn, despite being an ecological jewel in Andalusia, are relatively unknown, even at a regional level.

For this reason, increasing knowledge and awareness across Europe could bring external interest in the development of this valley, as well as promote self-confidence and empowerment among local inhabitants.
Secondly, community-based actions supported and/or promoted by local and regional public administrations will help to create a roadmap based on innovative, entrepreneurship-led solutions, especially focused on the specific features of this valley (chestnut groves, cork trees, heritage, etc.), to promote economic and demographic regeneration and to identify funding resources that will strengthen such development strategies. Since the search for funding opportunities for such initiatives is a very relevant aspect of territorial development, it would be necessary to obtain advice from rural development experts regarding this issue.
Local communities should be the pillar of their own development, but isolation and a lack of training can limit this process. By participating in training activities, learning about strategies and good practices from other similar areas, and receiving support from educational and public administration institutions, it would be possible to help address rural depopulation by offering sustainable opportunities within the framework of traditions, local economic resources and heritage awareness, rural tourism, and local food production.

18 Research-related proposals for potentially solving these challenges

It is important to promote the development of strategies based on local heritage and locally based resources, and to encourage the empowerment and training of the local population in this regard. Some of the issues to be addressed could include the development of an inventory of heritage resources of different kinds (natural and cultural monuments, festivals, food production), as well as the promotion and assessment of training and financing opportunities for entrepreneurial ideas among local business people.

19 Visions of desirable futures of the involved actors and the source of information

A working group was created and worked with representatives of the different local councils and specialists from the University of Malaga to promote development initiatives based on the opinions of local community actors, using different methodologies (focus groups, interviews, and reviews of articles and papers). A master's thesis was also carried out in this

field. Regarding the visions of desirable futures, it is possible to address depopulation by offering sustainable opportunities within the framework of traditions, local economic resources and heritage awareness, rural tourism, and local food production, supported by entrepreneurial training and financial advice and support.

20 Lessons-learned from the case study

The depopulation of rural areas is a crucial issue of growing concern at the European level due to the socio-economic and ecological consequences it may entail. Rural areas perform functions such as territorial structuring, the provision of public services, economic activities and products, and the preservation of the natural environment and rural heritage, among others, which may be jeopardised if there is no stable population to sustain them. As mentioned above, it is possible to address depopulation by offering sustainable opportunities within the framework of traditions, local economic resources and heritage awareness, rural tourism, and local food production, supported by entrepreneurial training and financial advice and support.

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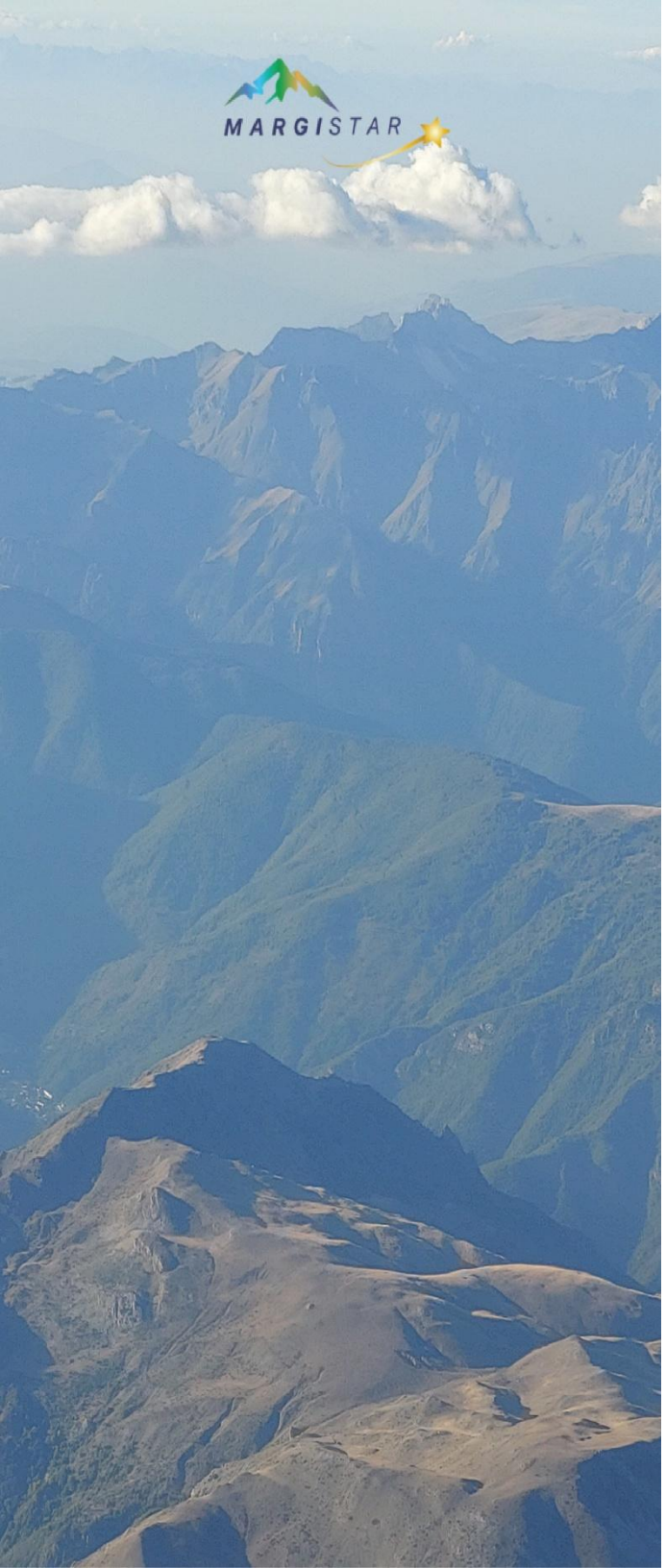

Making waterways sustainable – the environmental re-trial of Swedish hydropower in Ångermanälven and Vojmån

Therese Bjärstig[a], Annelie Sjölander Lindqvist[b]

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1 Case study location

64° 23' 56.22"N, 16° 56' 45.67"E



2 Country

Sweden

3 For how long has the challenge been acute?

5 years

4 Challenge categories

Governance challenges: E.g., policies made at national and/or EU levels, top-down decision-making, lack of local participation in decision-making etc.
Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Environmental challenges: Climate change, biodiversity loss, and/or ecological destruction.

5 Relevant UN Sustainable development goals

SDG6: Clean water and sanitation.
SDG7: Affordable and clean energy.
SDG13: Climate action.
SDG14: Life below water.

6 Short description of the case study location

In Sweden, hydropower facilities are undergoing a process of environmental re-trial, which aims to protect water environments while also ensuring electricity production. Since Sweden has almost 2,000 hydropower plants and dams, the re-trials are estimated to take 20 years. To organise and streamline the process, facilities are split into regional trial groups. Prior to the development of licence applications, County Administrative Boards (CABs) are tasked with leading stakeholder collaborations for each group.

Our case, Ångermanälven, is a river that flows through central Norrland. It is 463 km long, and its catchment area covers 31,860 km². Ångermanälven has an average flow of 500 m³/s. The Ångermanälven originates in southern Lappland and flows through the municipalities of Vilhelmina and Åsele, and then down through the county of Ångermanland, before flowing into the Bothnian Sea. The river has many large-scale power plants, and the main rapids are Nämforsen, Moforsen, Forsmoforsen, Nässundforsen and Granvågforsen. The main tributaries are Vojmån, Fjällsjöälven and Faxälven. Ångermanälven is one of the rivers most affected by hydropower development in Sweden.

Hydropower generates renewable energy, but it also causes local environmental damage. Hydropower is at the centre of a "dual environmental challenge", where the national need for green energy has to be balanced against local degradation of water environments. Regional stakeholder collaboration has been introduced as part of the decision-making process. Collaboration processes should include operators of all facilities built for hydroelectricity production, as well as concerned national agencies, municipalities and interest organisations. However, no stakeholders (including operators) are legally obliged to participate.

7 Key challenges in the case study

We will identify and analyse factors and trade-offs that may facilitate or hinder coordination, collaboration and local participation in the application of governance measures through which power is transferred from central governments to actors at lower levels of the political-administrative hierarchy. Henceforth, the project addresses the challenges that can arise when collaborative governance actors (from the public, private and/or civil sectors) pursue their interests and agendas, and when administrative and legal boundaries may constrain deliberated outcomes. The case contributes knowledge on how

the implementation of regional collaboration in the transition to a fossil-free society can be facilitated while simultaneously protecting river basin ecosystems.

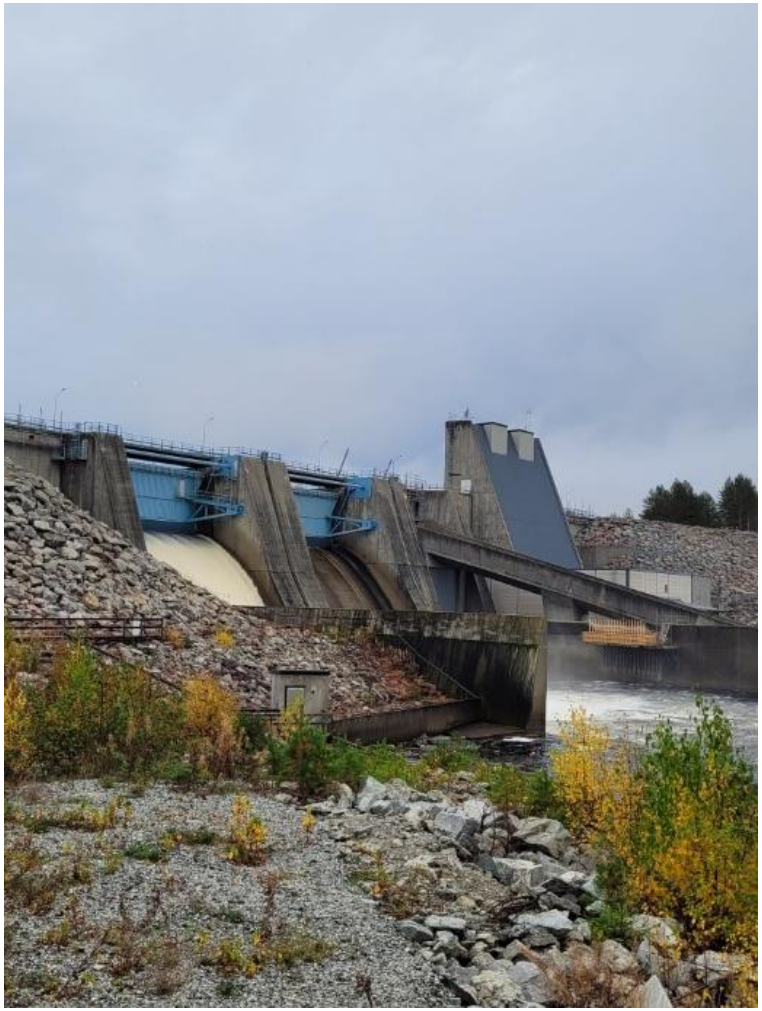

Fig. 1 Hällby dam

Photo: Magnus Bjärstig

8 A brief summary: What is this case study about?

This case zooms in on how regional collaboration in hydroelectricity production can be designed to allow for sustainable and legitimate management of Swedish river basins, and how participation can facilitate the development of an applicable knowledge base for evaluation processes. Through a context-sensitive approach, we will develop a model for fair and effective regional collaboration preceding the retrial of the environmental conditions for hydropower. In achieving this objective, the project recognises the cross-cutting challenges and opportunities in implementing collaborative governance regimes (CGR).

9 The fundamental causes and drivers for the challenges

The government bill Water Environment and Hydropower (prop. 2017/18:243) motivates the renewal of the environmental conditions for hydropower. The bill assesses the role of hydropower in green energy production. It states that hydropower is "an incredibly important resource" and is significant for balancing supply and demand, providing energy security, and enabling the green transition of the energy system (prop. 2017/18:243:63). Moreover, it is stated that small-scale hydropower facilities, despite having marginal production shares, can be important for local energy supply. Old hydropower facilities may also have cultural values of national interest. At the same time, it is recognised that hydropower has contributed to the environmental degradation of water bodies and their ecosystems (prop. 2017/18:243:61–64). Balancing these interests and conducting collaborative processes that are both effective and legitimate is thus a challenge.

9a A cause-and effect diagram identifying key drivers and their interrelationships

The results (Fig. 2) indicate that Economic Challenges is the only causal factor, although it exhibits relatively low prominence, suggesting that it acts as an underlying driver with limited overall influence within the system. In contrast, Resource Management Challenges, Policy and Governance Issues, and Environmental and Climate Drivers are identified as effect factors. Among these, Policy and Governance Issues and Environmental and Climate Drivers display high prominence, indicating that they are highly interconnected within the system but are primarily influenced by other dimensions, whereas

Resource Management Challenges shows relatively low prominence. Overall, the findings suggest that economic challenges constitute the main causal driver, while policy and governance, environmental and climate, and resource management issues primarily represent outcomes of the underlying causal relationships.

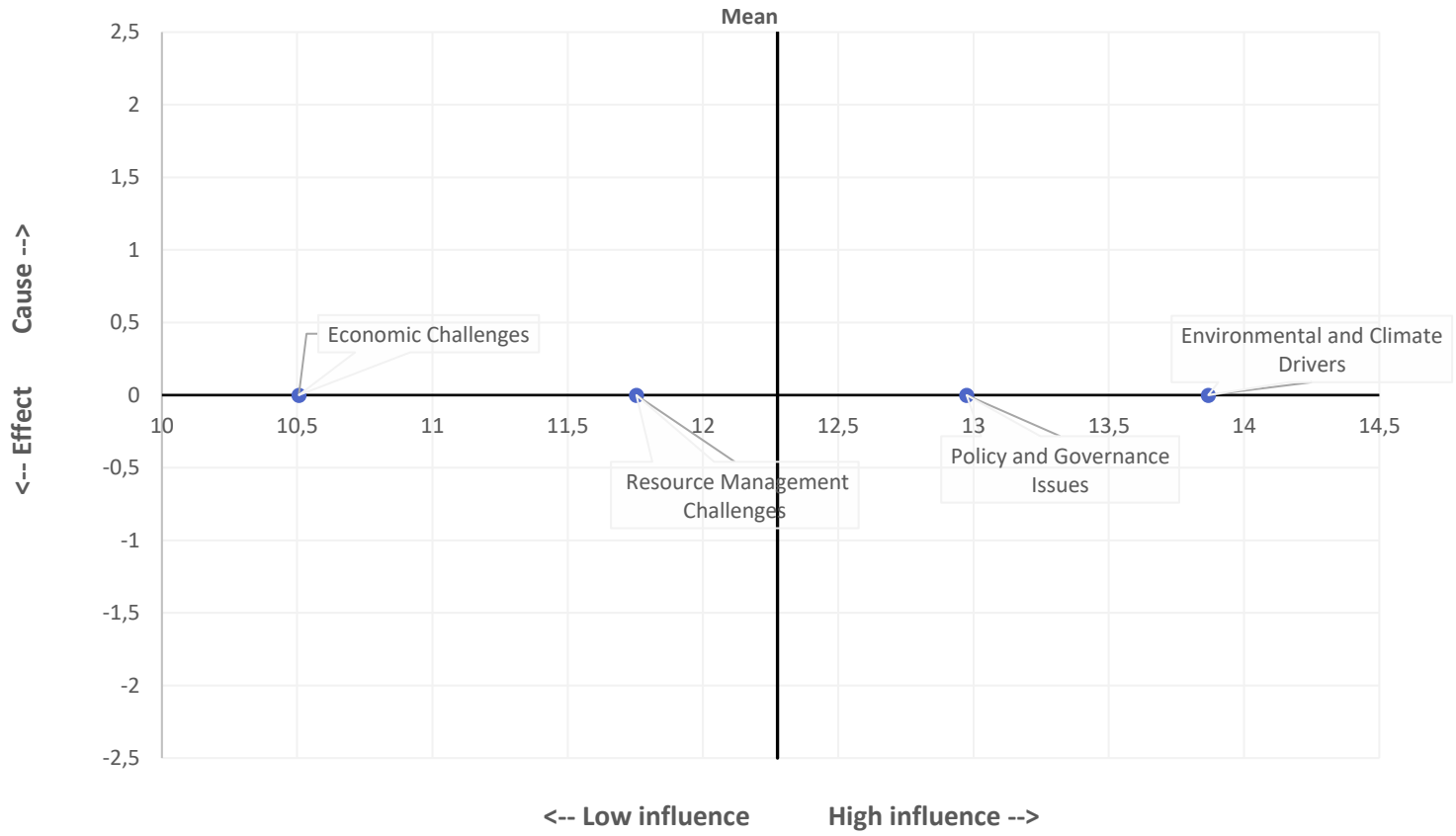

Fig. 2 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

10 Who is negatively impacted by the challenge, and how?

Local communities, Indigenous reindeer herders, and other stakeholder groups rely on the river for their livelihoods or recreation. Plant operators may also be challenged if the court decides that they have to implement river restoration measures to safeguard the aquatic environment.

11 Who is positively impacted by the challenge, and how?

Increased electricity production can help fulfil national goals for green energy, while some restoration measures can benefit migratory fish and the ecosystem.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

The energy produced is not primarily used locally in northern Sweden, but is instead exported to the southern parts of Sweden.



Fig. 3 Effects of hydropower damming, illustrated by a dewatered river channel

Photo: Therese Bjärstig

14 The definition of the periphery trap in this case

This reflects a north–south or rural–urban divide, where hydropower is both a problem and a solution, with the "costs" often borne locally and the benefits realised more regionally or nationally.

15 The level of conflict

Moderate.

16 Description of the level of conflict related to the case study

Depending on the actors involved and the previous history of conflict and levels of trust, it is challenging to find solutions that the concerned actors can stand behind.



Fig. 4 Collaborative riverwalk in the Ångermanälven and Vojmån area with all involved actors engaging in the re-trial process in the area

Photo: Therese Bjärstig

17 Efforts to solve the challenge(s)

The solution is to enhance ongoing collaborative processes and implement collaborative governance.

18 Research-related proposals for potentially solving these challenges

The aim of this study is to develop suggestions for an improved collaborative governance model that enhances both efficiency and legitimacy in the upcoming processes.

19 Visions of desirable futures of the involved actors and the source of information

We have not identified any visions of desirable futures per se, and have thus marked NO above. However, we have learned that these vary between actors, according to the survey interviews we have conducted. Some prioritise environmental issues, some prioritise energy supply, and yet others prioritise cultural and social values in their desirable futures.

20 Lessons-learned from the case study

This is still ongoing research, and we are not yet able to tell.

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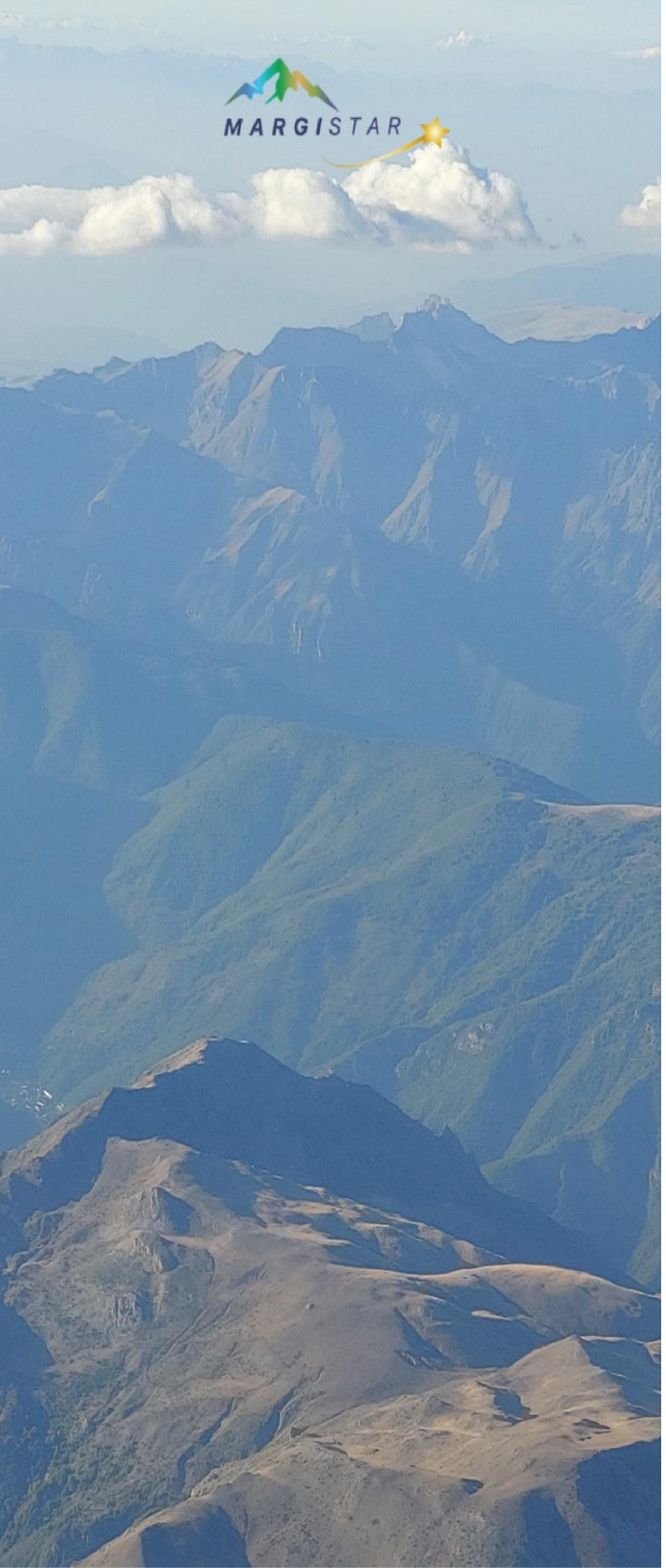

Conservation assessment and analysis through stakeholder perspectives: Adatepe village in Mount Ida

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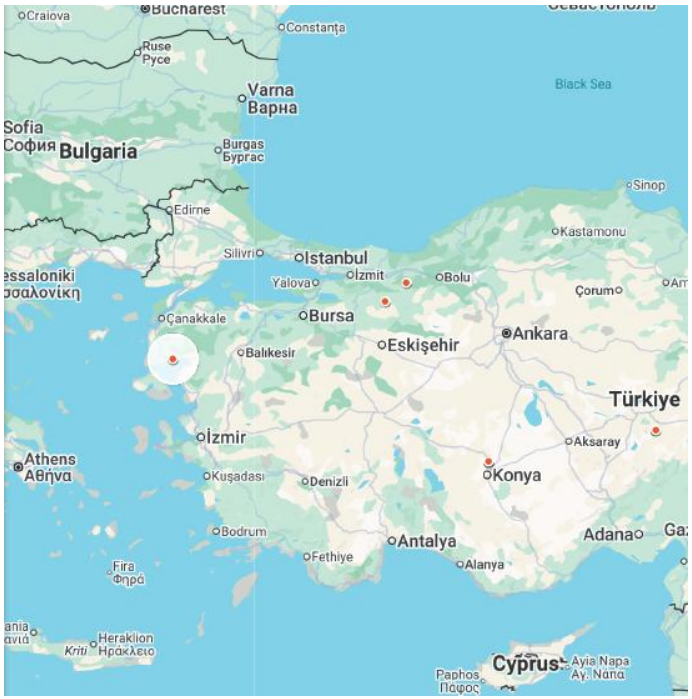
1 Case study location

39° 34' 9.59"N, 26° 37' 5.45"E



2 Country

Turkey

3 For how long has the challenge been acute?

10 years

4 Challenge categories

Socio-cultural challenges: Demography, migration (out/in) and/or social and ethnic tensions.
Economic challenges: Economic problems, poverty, and lack of employment and education opportunities.
Governance challenges: E.g., policies made at national and/or EU levels, top-down decision-making, lack of local participation in decision-making etc.

5 Relevant UN Sustainable development goals

SDG8: Decent work and economic growth.
SDG15: Life on land.

6 Short description of the case study location

Conservation of rural mountainous settlements is essential for maintaining ecological integrity and traditional cultural heritage. Mount Ida, the subject of epics and stories dating back to ancient times and associated with Zeus in Greek mythology, offers a wide range of tourism and recreational opportunities due to its geographical location, underground and surface water resources, and rich flora and fauna. Adatepe Village, located on the southern slope of Mount Ida, is one of the rural settlements that merits protection because it preserves traces of past cultures and possesses rich natural, cultural, and social heritage. According to the findings, cultural changes in the village's social structure resulting from migration, together with the high average age of residents, represent key weaknesses in the area. Inadequate infrastructure, the decline of agriculture and animal husbandry, and the insufficient protection of the ecological environment, original settlement pattern, and traditional architectural character constitute key threats to the area.

7 Key challenges in the case study

The study used a SWOT analysis to assess the conservation status of the area from the perspectives of different stakeholders, including tourists, residents, and public officials. Based on the opinions of interdisciplinary experts, recommendations were developed using the AHP method to address the region's weaknesses and threats and support the revitalisation of the area. The study aims to contribute to the protection of Adatepe Village in both theoretical and practical terms, provide an example for other mountain-slope villages, and inform policymakers in this regard.

8 A brief summary: What is this case study about?

Adatepe Village, located on the southern slope of Mount Ida, is one of the rural settlements that merits protection because it preserves traces of past cultures and has rich natural, cultural, and social heritage. Although the settlement has many positive characteristics in terms of conservation, it also faces several negative aspects associated with uncontrolled tourism activities. The study conducted a SWOT analysis to assess the conservation status of the area from the perspectives of different stakeholders, including tourists, residents, and public officials.

9 The fundamental causes and drivers for the challenges

Although the settlement has many positive characteristics in terms of conservation, it also faces several negative impacts associated with uncontrolled tourism activities.

9a A cause-and effect diagram identifying key drivers and their interrelationships

The analysis has not been conducted.

10 Who is negatively impacted by the challenge, and how?

Cultural changes in the village's social structure resulting from migration, together with the high average age of residents, represent key weaknesses in the area. Residents are negatively affected by these challenges.

11 Who is positively impacted by the challenge, and how?

Mount Ida offers a wide range of tourism and recreational opportunities due to its geographical location, underground and surface water resources, and rich flora and fauna.

12 Does the case study link to unbalanced centre-periphery relations?

No.

13 In what ways are the centre-periphery relations unbalanced?

N/A.

14 The definition of the periphery trap in this case

Inadequate infrastructure, the decline of agriculture and animal husbandry, and the insufficient protection of the ecological environment, original settlement pattern, and traditional architectural character constitute key threats to the area.

15 The level of conflict

There is no potential conflict.

16 Description of the level of conflict related to the case study

Not relevant.

17 Efforts to solve the challenge(s)

None.

18 Research-related proposals for potentially solving these challenges

In the study, recommendations for the area were developed using the AHP method, based on the opinions of interdisciplinary experts, to address the region's weaknesses and threats and support its revitalisation.

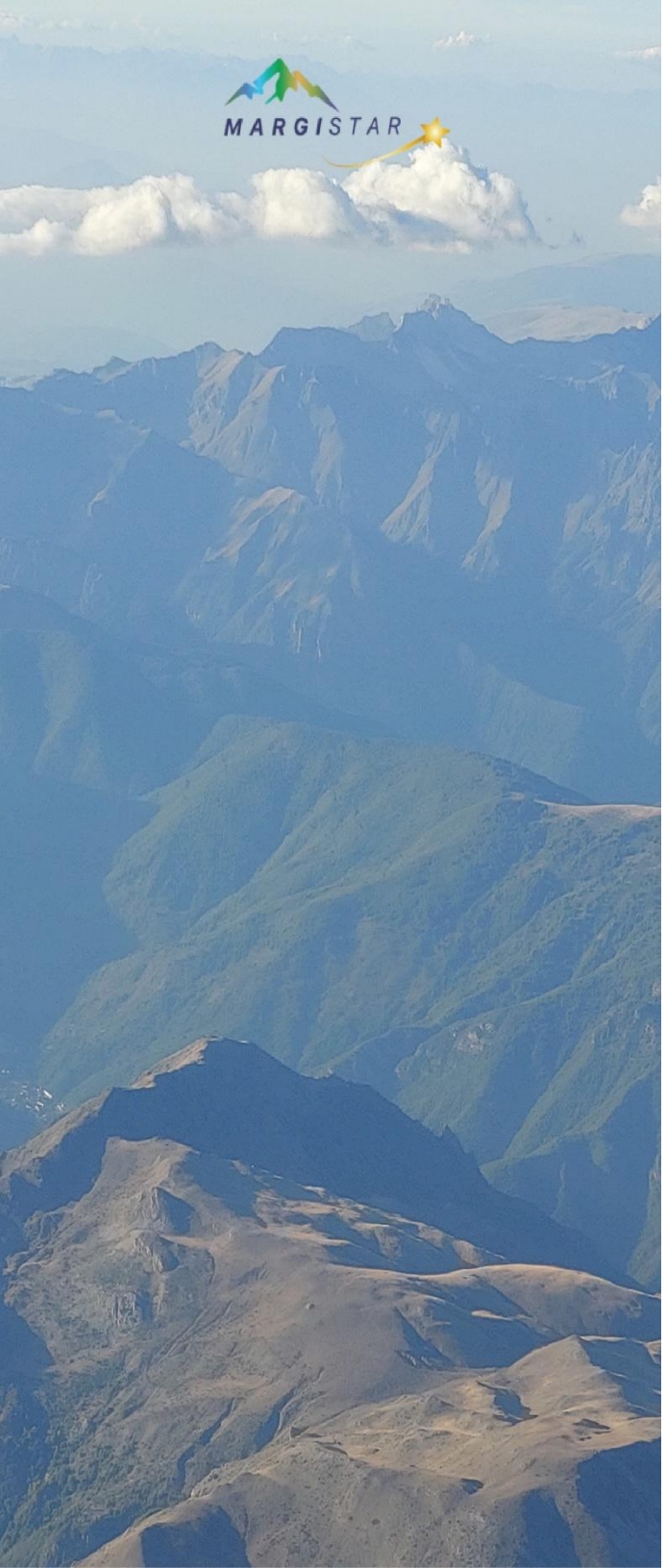
19 Visions of desirable futures of the involved actors and the source of information

None.

20 Lessons-learned from the case study

Adatepe Village, located on the southern slope of Mount Ida, is one of the rural settlements that merits protection because it preserves traces of past cultures and possesses rich natural, cultural, and social heritage.

21 References



Challenges affecting agricultural soils on Mount Erciyes: potential impacts of climate change and periphery traps

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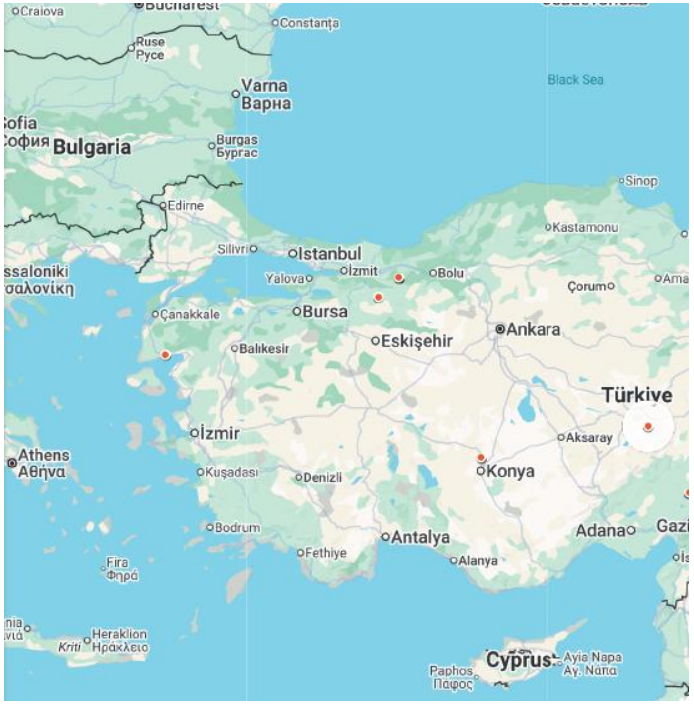
1 Case study location

38° 32' 3.98"N, 35° 38' 48.01"E



2 Country

Turkey

3 For how long has the challenge been acute?

10 years

4 Challenge categories

Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Environmental challenges: Climate change, biodiversity loss, and/or ecological destruction.

5 Relevant UN Sustainable development goals

SDG8: Decent work and economic growth.
SDG11: Sustainable cities and economies.
SDG13: Climate action.
SDG15: Life on land.

6 Short description of the case study location

The study was carried out in the Tomarza district of Kayseri Province and in agricultural areas with volcanic-origin soils located east of Mount Erciyes. The selected area is predominantly agricultural, with winter squash cultivated for both its fruits and seeds. A steppe climate dominates Kayseri Province. Winters in the region are cold and snowy, while summers are dry and hot. The average annual precipitation in Kayseri Province ranges from 350 to 400 mm. According to long-term meteorological data (1960–2012), the lowest average temperatures occur in January and February (−6.8°C and −5.3°C, respectively), while the highest average temperatures occur in July and August (30.5°C and 30.4°C, respectively). The lowest precipitation occurs in August and the highest in April.

Geological formations belonging to the Palaeozoic, Mesozoic and Cenozoic periods occur within Kayseri Province. Volcanic rocks are widespread throughout the province and its districts. Ignimbrites, andesitic rocks, volcanic ash and other volcanic deposits are particularly prevalent in the districts of İncesu, Develi and Tomarza, especially around Mount Erciyes. Local communities depend primarily on agriculture for their livelihoods, while Mount Erciyes is also an important destination for ski tourism. In recent years, the combined effects of climate change and unsustainable agricultural practices have increased the risk of soil erosion and contributed to rural out-migration. One contributing factor is that tourism increasingly provides a more readily available source of income for local people than agriculture. This situation contributes to the depopulation of mountain villages and the increasing marginalisation of agricultural areas. Key stakeholders include farmers and villagers, Erciyes University, various government organisations, and non-governmental organisations operating in the area.

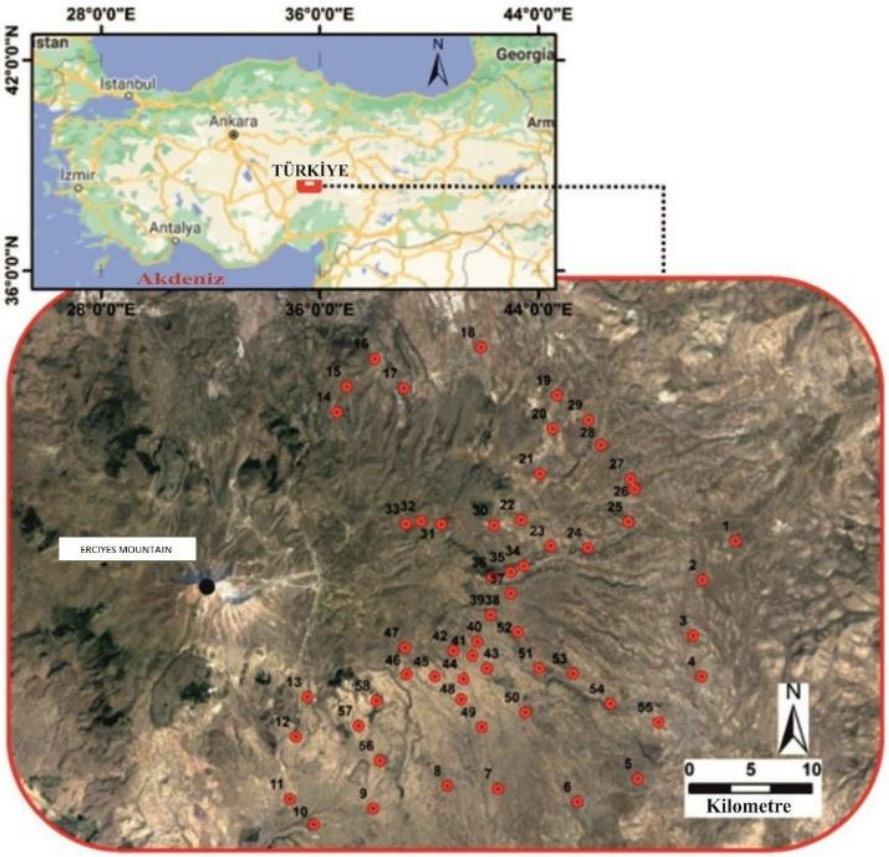


Fig. 1 Precise location of the case study area

7 Key challenges in the case study

Key challenges include the increased susceptibility of agricultural soils to erosion as a result of unsustainable agricultural practices and the associated decline in soil quality. This situation reduces the value and productive potential of agricultural land and creates challenges for the livelihoods and well-being of local communities that depend on land-based activities. When combined with increasing tourism pressure, these processes contribute to rural out-migration.

8 A brief summary: What is this case study about?

Climate change is expected to continue altering management practices in agricultural systems. Vegetable cultivation is an important source of food, particularly in mountainous regions at elevations above 1,200 m, where anthropogenic pressures can increase the vulnerability of agricultural land to degradation. At the same time, tourism pressure contributes to the abandonment of agriculture in mountainous areas and the depopulation of rural villages. In this study, soil erosion susceptibility and selected physical soil properties were assessed in high-elevation areas used for vegetable cultivation on the eastern slope of Mount Erciyes.

9 The fundamental causes and drivers for the challenges

Soil samples were required for various analyses. A key challenge encountered during the study was that farmers were reluctant to allow access to their land for soil sampling. This was mainly attributed to the demographic changes associated with rural out-migration, which had left predominantly older residents, mostly over 60 years of age, in the villages. The resulting demographic structure was associated with a community perceived as relatively resistant to new practices and innovations.

9a A cause-and effect diagram identifying key drivers and their interrelationships

Two groups of drivers, Environmental and Climate Drivers and Resource Management Challenges, were assessed as having a very high mutual influence on each other. The relationship was therefore considered strongly reciprocal, with each factor substantially affecting the other. Under these circumstances, a formal DEMATEL analysis could not provide a meaningful differentiation between cause and effect, as the two factors would be positioned as mutually influential rather than representing clearly distinguishable causal and effect factors. Consequently, the relationship was recorded as a very high mutual influence and formal DEMATEL analysis was not conducted.

10 Who is negatively impacted by the challenge, and how?

In the rural areas on the eastern side of Mount Erciyes, farmers and agricultural producers are the stakeholders most directly affected by these challenges. The identified difficulties directly affect their livelihoods, and the decline in the profitability of vegetable production has made employment in the tourism sector increasingly attractive. This has contributed to rural out-migration in the region. The increasing vulnerability of soils to erosion, resulting from unsustainable agricultural practices such as monoculture, inappropriate tillage and excessive irrigation, is also a source of concern among farmers and contributes to uncertainty about the future of agriculture. Consequently, some agricultural areas are being abandoned.

11 Who is positively impacted by the challenge, and how?

This situation also has positive effects on the tourism sector. Seasonal workers for the ski resort on Mount Erciyes can be recruited from farmers who have left agriculture. Similarly, as Kayseri is a city with a growing industrial sector and expanding organised industrial areas, the movement of farmers out of agriculture can provide an additional labour force for these sectors.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

In this regard, the disadvantages of insufficient integration between environmental and agricultural policies, together with the growing dominance of tourism over other economic sectors, can be highlighted.

14 The definition of the periphery trap in this case

The perception that rainfed agriculture is inherently inferior to irrigated agriculture, which is considered optimal under all conditions, constitutes a periphery trap. Similarly, the belief that sustainable development and economic prosperity depend primarily on tourism, and that other environmental, agricultural, and social considerations can be subordinated to tourism development, represents a periphery trap.

15 The level of conflict

Based on the findings of the study, I concluded that maintaining agricultural production in these areas requires practices aimed at improving soil quality. This, in turn, requires maintaining a sufficient agricultural labour force. However, this may create challenges for the tourism sector, as part of its labour force is currently drawn from people who have left agriculture.

16 Description of the level of conflict related to the case study

Both the prevailing tourism-oriented approach and planning documents, such as the Mount Erciyes User Plan and the Erciyes Mountain Master Plan, clearly prioritise tourism development. Considering local conditions and the current level of technological development, the continuation of vegetable cultivation on the eastern side of Mount Erciyes depends on retaining a sufficient agricultural labour force. However, as tourism offers a more readily accessible and potentially attractive source of income than agriculture, it creates competition for labour and places tourism and agriculture in a potentially conflicting relationship.

17 Efforts to solve the challenge(s)

Agricultural subsidies were increased across the country to help reduce rural out-migration. Mechanisation and precision agriculture were also encouraged. Projects related to the EU Green Deal were prioritised among proposals submitted to various funding programmes aimed at improving soil quality. However, these measures were largely general policies and did not constitute area-specific interventions capable of addressing local conditions and generating place-based solutions.

18 Research-related proposals for potentially solving these challenges

Given the importance of tourism to local economic development, ecotourism could be developed in the villages on the eastern side of Mount Erciyes where vegetable cultivation is practised. Tourism activities could be developed without marginalising agricultural production. Farmers in these villages could be encouraged to adopt good agricultural practices and participate in platforms such as WWOOF. In this way, local residents could continue agricultural production while also increasing their income through involvement in tourism-related activities. At the same time, the development of livestock farming could provide a local source of animal manure, which could be used to improve soil quality and reduce soil erosion. These measures could contribute to maintaining agricultural productivity, increasing the value of agricultural land, and supporting its long-term conservation.

19 Visions of desirable futures of the involved actors and the source of information

There is a general sense of discouragement regarding agriculture among local residents. People living and farming in the area generally perceive agriculture as providing limited prospects for their future. The majority, particularly younger people, consider either moving to the city to work in organised industry or establish a business, or seeking employment in the tourism sector. It is also worth mentioning that the Rural Development Agency has started implementing the Socio-Economic Development of Rural People Programme. This information was obtained through interviews with local residents conducted during soil sampling.

20 Lessons-learned from the case study

This case study shows that, in the villages where vegetable cultivation is practised on the eastern slopes and foothills of Mount Erciyes, agricultural land is becoming increasingly degraded as a result of unsustainable agricultural practices. The value and productive potential of agricultural land that has become highly vulnerable to erosion are consequently reduced, contributing to the abandonment of agricultural activities. In areas where precipitation is already limited and agricultural production is challenging, the loss of the agricultural labour force may further increase the likelihood of land being withdrawn from agricultural production. Climate change and tourism pressure, which can be considered periphery traps in this context,

together with the declining economic attractiveness of farming, are likely to alter the socio-economic and land-use dynamics of the region.

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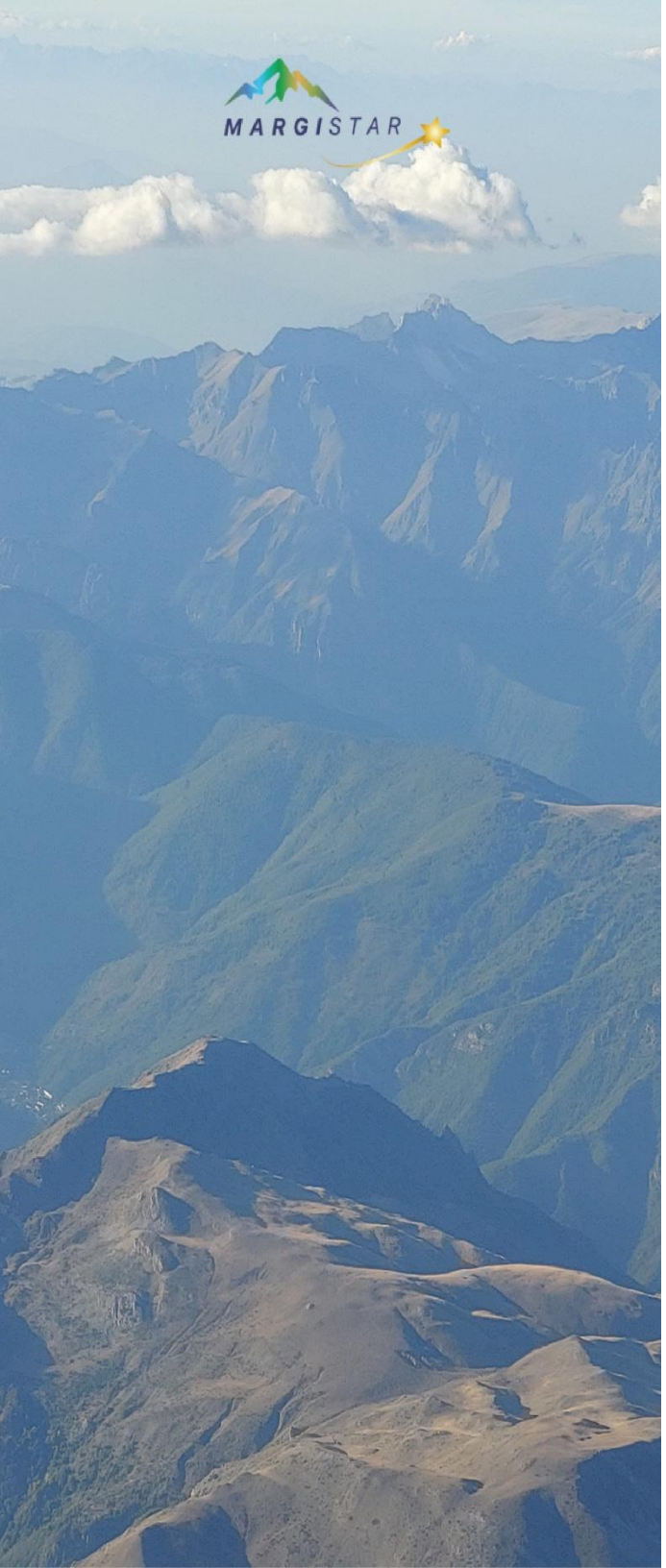

Management of plateau areas in state forests: a legal analysis of Düzce Province

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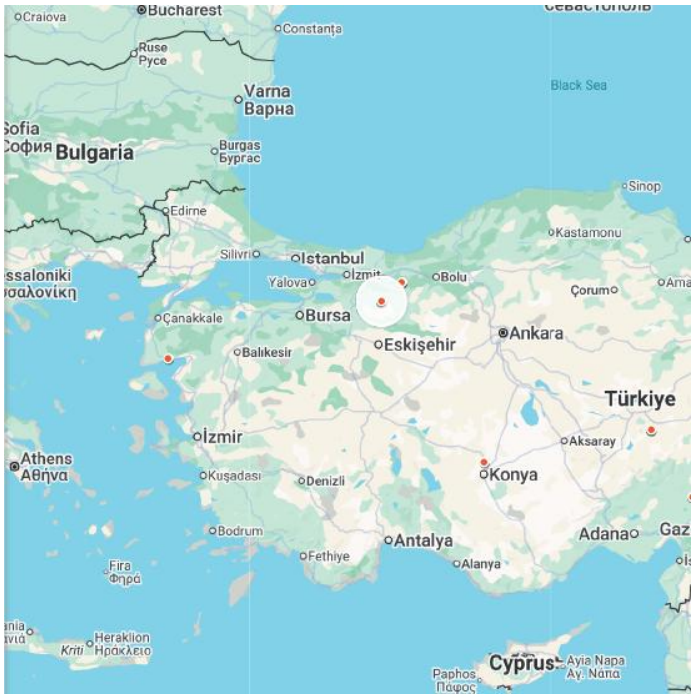
1 Case study location

40° 23' 42.36"N, 30° 35' 4.20"E



2 Country

Turkey

3 For how long has the challenge been acute?

10 years

4 Challenge categories

Socio-cultural challenges: Demography, migration (out/in) and/or social and ethnic tensions.
Economic challenges: Economic problems, poverty, and lack of employment and education opportunities.
Governance challenges: E.g., policies made at national and/or EU levels, top-down decision-making, lack of local participation in decision-making etc.
Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Service-related challenges: Poor cultural, social and/or commercial services.
Environmental challenges: Climate change, biodiversity loss, and/or ecological destruction.
Geographical challenges: Geographical handicaps (including long distances, lack of connectivity, difficult terrains etc.) and/or natural handicaps (e.g., soil productivity, growing season).

5 Relevant UN Sustainable development goals

SDG3: Good health and well-being.
SDG4: Quality Education.
SDG5: Gender equality.
SDG6: Clean water and sanitation.
SDG7: Affordable and clean energy.
SDG8: Decent work and economic growth.
SDG9: Industry, innovation, and infrastructure.
SDG10: Reduced inequalities.
SDG13: Climate action.
SDG15: Life on land.
SDG17: Partnership for the goals.

6 Short description of the case study location

Düzce Province is located close to major cities such as Istanbul, Ankara, Bursa and Eskişehir. It borders Bolu to the west and north, Sakarya to the east, and Zonguldak to the southwest, while its northern boundary extends to the Black Sea. The province lies between 40° and 42° N latitude and 30° and 33° E longitude. Its average elevation is approximately 150 m a.s.l. Düzce has a population of approximately 410,000 and covers an area of 249,200 ha. Of this area, 75,121 ha are cultivated agricultural land, 2,085 ha are meadows and pastures, 131,692 ha are forest, and 40,302 ha are classified as other land. Approximately 59,162 cattle are raised in 9,152 agricultural enterprises. The provincial economy is based primarily on agriculture, trade and industry. Hazelnuts are the most important agricultural product. Düzce also has five organised industrial zones and is among the provinces benefiting from investment incentives.

Düzce has been inhabited by different civilisations, including those of the Greek, Roman, Byzantine and Ottoman periods, from the Bronze Age to the present day. Today, the province is home to people from diverse cultural backgrounds, including Abkhaz, Laz, Kurdish, Greengrocer, Muhajir and other communities, who live together peacefully.

The plateaus of Düzce form a continuous geographical system extending from Kardüz Plateau towards Abant National Park. Kardüz, Kızık, Pürenli, Balıklı, Hira, Sinekli, Derebalık, Torkul, Odayeri, Sırık, Keklik, Çiçekli, Şehirli, Kocayayla, Topuk, Twins, Fernti, Yeniyurt and Sakarca plateaus constitute the potential basis for the development of a "Highland Corridor".

Improving the administrative and legal governance of these plateau areas requires effective cooperation among the key stakeholders. These include local communities living in the plateaus, the Düzce Governorship Special Provincial Administration, the Forest Management Directorate, the Provincial Directorate of Agriculture and Forestry, the Directorate of Environment, Urbanisation and Climate Change, the Directorate of Culture and Tourism, the Directorate of Commerce, Düzce University, the Chamber of Commerce and Industry, and forestry and livestock cooperatives. Effective multi-stakeholder governance and coordination among these institutions and organisations are essential for improving the management of the plateau areas.

7 Key challenges in the case study

The main problems affecting the plateaus are as follows. Plateau areas located within and outside forest boundaries are governed by different legal frameworks. Plateau buildings located within forest areas have become state property and are

leased to their users for periods of 10 years. Consequently, even within the same plateau, users of immovable property located within forest areas are required to pay rent, whereas users of property outside forest areas are not. Rental rates also vary between regions. Permission must be obtained for the renovation of immovable property located within forest areas, while new construction is not permitted on forest plateaus.

Illegal construction is also occurring on plateaus outside forest areas, partly due to inadequate monitoring and enforcement. Disputes may arise among heirs because immovable property located within forest areas can be transferred to only one heir. Pastures located within and outside forest areas are likewise subject to different legal frameworks. Transhumance activities do not receive direct state support.

Among the immovable properties located within forest areas, those for which the users have been incorrectly identified cannot be leased. Properties that cannot be leased must subsequently be demolished. Additional difficulties concern lease administration and accounting procedures, as well as the existing system for collecting rental payments.

8 A brief summary: What is this case study about?

The Regulation on the Detection and Management of Plateau Areas in State Forests in Turkey established, for the first time, principles for the management of plateau areas located within state forests. This study presents proposed solutions to the practical problems identified in the implementation of the current legal framework. These include clearly defining plateau boundaries, preventing illegal construction, strengthening monitoring and inspections, managing pastures under a unified administrative framework and completing their registration, resolving issues concerning the transfer of immovable property to heirs, providing state support for transhumance activities, and making more effective use of underutilised immovable property. For the long-term sustainability of the plateau areas, the existing legal framework should be reviewed and an effective and integrated management model should be developed.

9 The fundamental causes and drivers for the challenges

The boundaries of the plateau areas were determined on the basis of forest cadastral maps, without taking into account the functional and spatial integrity of individual plateaus. As a result, parts of the same plateau may be located within forest areas while other parts lie outside them, resulting in their management under different legal frameworks.
Buildings located on plateaus within and outside forest areas are therefore subject to different administrative and legal provisions. For example, users of buildings within forest areas are required to pay rent, whereas users of buildings outside forest areas may not be subject to the same requirement.
The plateaus are not differentiated according to their primary functions, such as livestock production or tourism. Consequently, the existing legal framework cannot adequately address the different needs and activities associated with these areas.
Similarly, pastures located within and outside forest areas are governed by different legal frameworks, which limits the potential for integrated management of livestock activities across individual plateaus.
Additional administrative difficulties concern the payment and collection of rents for buildings located within forest areas. Late-payment interest may be incurred when rental payments are not made within the prescribed deadlines. Rent payments must be made through the relevant Forest Management Directorates, which may create additional administrative burdens. There are also lengthy procedures for obtaining permission for building renovation works. Furthermore, inadequate enforcement of sanctions against non-payment of rent contributes to reduced rental fee collection.

9a A cause-and effect diagram identifying key drivers and their interrelationships

The analysis has not been conducted.

10 Who is negatively impacted by the challenge, and how?

Users of immovable properties in forested and state-registered plateau areas in Turkey are negatively affected by these difficulties. Transhumant livestock keepers are particularly affected because different practices and legal requirements apply to different parts of the same plateau.

Users of immovable properties within forest areas are required to pay rent and must visit the relevant Forest Management Directorate to make their rental payments. At the same time, the failure to impose sanctions on users who do not pay rent, such as demolition or termination of rental contracts, creates uncertainty and may undermine the effective management of these properties. Users may also be unable to challenge the inclusion of the immovable properties they have constructed in the state's assets.

Users are required to obtain permission for renovation works on existing buildings, while the construction of new immovable properties is not permitted on plateaus for which a site plan has been prepared and registered. In addition, inheritance-related disputes may arise among heirs concerning these properties.

Transhumant livestock keepers also face difficulties because different public institutions are responsible for pastures located within and outside forest areas, requiring them to obtain permissions from multiple institutions and comply with different administrative procedures.

11 Who is positively impacted by the challenge, and how?

Before the regulation was introduced, employees of the Forest Management Directorates prepared reports concerning the occupation and unauthorised use of immovable properties on plateaus within forest areas, in accordance with the relevant legislation, and referred these cases to the courts. Court decisions generally resulted in the confiscation of the relevant immovable properties. Since new construction is no longer permitted on registered plateaus, the number of new cases has decreased considerably, and court proceedings related to such offences have consequently become much less frequent. In this respect, both the Forest Management Directorates and the courts have been positively affected.

In addition, all immovable properties located on plateaus registered within forest areas have been incorporated into the assets of the General Directorate of Forestry. In this context, these immovable properties have become state property as fixtures belonging to the General Directorate of Forestry.

The General Directorate of Forestry has acquired 12,157 immovable properties in 384 registered plateau areas and has leased them to users for periods of 10 years. The Directorate has therefore benefited from the rental income generated from these properties.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

The General Directorate of Forestry is a special-budget organisation. Forest areas and the immovable properties located on them are recorded in separate budget accounts. In rural areas, however, correcting errors identified during the initial assessment and registration process can take a considerable amount of time. In some cases, under the relevant legislation, rental agreements cannot be concluded if identified errors are not corrected within one year. Furthermore, if rent remains unpaid for two consecutive years, the relevant immovable property is subject to demolition.

In practice, however, demolition of such properties at the local level may be difficult to implement, partly due to political and other local considerations. These discrepancies between the requirements of the legal framework and its practical implementation create administrative and management imbalances.

14 The definition of the periphery trap in this case

Conflict has arisen between local communities and the state because immovable properties located on forested plateaus have been incorporated into state ownership. As local users are required to pay rent for these properties, there is a potential risk that their sense of ownership and responsibility for maintaining and protecting the areas may decline. The application of different legal frameworks to different parts of the same plateau may also create inequalities among users and raise concerns regarding the principle of equal treatment.

Furthermore, restrictions on the use of plateau areas may contribute to a decline in transhumance activities and increase the likelihood of young people migrating from rural areas to cities.

15 The level of conflict

The level of conflict can be discussed under several headings.

Conflict between institutions: Institutions such as the General Directorate of Forestry, the Ministry of Environment, Urbanisation and Climate Change, the Ministry of Agriculture and Forestry, and the Ministry of Culture and Tourism do not always evaluate plateau areas as integrated geographical units. As a result, different legal frameworks and administrative practices may be applied even within the same plateau.
Conflict between public institutions and local communities: The interaction between public institutions and local people living on the plateaus, together with the application of different legal and administrative practices within the same plateau, may result in unequal treatment among local users. This situation may create tensions concerning the principle of equality.
Conflict related to sustainability and development: Since plateaus are not classified according to their intended uses, such as livestock production, agriculture or tourism, several sustainability-related problems may arise. These include difficulties in maintaining and transferring plateau culture to future generations, the gradual decline of agriculture and animal husbandry, and uncontrolled tourism activities. These processes may contribute to increasing out-migration from the plateaus to urban areas. At the same time, inconsistencies may arise between development plans and their implementation in practice.

16 Description of the level of conflict related to the case study

Within the framework of the Regulation on the Detection and Management of Plateau Areas in State Forests, which came into force in 2013, layout plans were prepared and registered for plateau areas located within forests. The immovable properties located on these plateaus were incorporated into state assets and leased to their users for periods of 10 years. The regulation imposes various restrictions on people living on the plateaus. However, these restrictions do not apply to plateaus that are not classified as forest areas, resulting in different legal and administrative conditions across plateau areas.

For the long-term sustainability of the plateaus, they need to be considered and managed as integrated geographical and socio-economic systems. Since plateaus are not classified according to their intended uses, such as livestock production, agriculture or tourism, their development potential cannot be adequately addressed. Inadequate infrastructure and limited access to transport, education and healthcare services contribute to the gradual decline of transhumance activities. The

limited availability of employment opportunities and the lack of conditions that could make the plateaus attractive places to live and work further contribute to increasing migration towards urban areas.
The sustainability of the plateaus is also challenged by the fact that their specific characteristics and needs are not fully recognised across public institutions and by insufficient coordination among the institutions responsible for their management.

17 Efforts to solve the challenge(s)

The problem of referring cases concerning immovable properties on plateaus located within state forests to the courts, where court decisions generally resulted in the confiscation of these properties, has largely been addressed by the General Directorate of Forestry through the Regulation on the Detection and Management of Plateau Areas in State Forests. However, the regulation has also created new problems concerning implementation and ownership.
With regard to ownership, plateau areas should first be planned and managed in a holistic manner.
The practical problems arising from the implementation of the Regulation on the Detection and Management of Plateau Areas in State Forests should be systematically identified, and the relevant legislation should be revised or further developed accordingly.
The intended uses of individual plateau areas should be clearly defined, and appropriate long-term development projections should be prepared.
For plateaus with defined intended uses, the relevant public institutions, such as the Ministry of Health, the Ministry of Culture and Tourism, the Ministry of Agriculture and Forestry, and the Ministry of Environment, Urbanisation and Climate Change, should develop investment programmes and undertake the necessary actions within their respective areas of responsibility.
The living conditions of local communities should be improved by increasing access to essential services and infrastructure, including transport, education and healthcare.
Employment opportunities on the plateaus should be expanded through activities such as livestock production, the processing and marketing of local products such as cheese, agriculture, small-scale industry, and the sustainable use and protection of natural resources. These measures could help reduce out-migration to urban areas while supporting the continuation of transhumance practices and the transmission of associated cultural traditions to future generations.

18 Research-related proposals for potentially solving these challenges

First, plateau areas should be evaluated and managed as integrated geographical units. Their location within or outside forest areas should not undermine their spatial and functional integrity. For this reason, forest cadastral maps should be reviewed and updated specifically to reflect the boundaries and integrity of plateau areas.

The intended uses of the plateaus should be clearly defined, and future development projections should be prepared through appropriate management plans. The responsibilities of the relevant public institutions and the areas in which they should invest should also be clearly identified. For example, in plateaus where tourism is a priority, local communities should be provided with appropriate training, while government incentives should support the development of accommodation and food and beverage services and the establishment of appropriate tourist routes and facilities. Such planning should be carried out under the leadership of the Ministry of Culture and Tourism, with the active participation of other relevant public institutions, universities, non-governmental organisations, the private sector and local communities.

Out-migration to cities should be reduced by improving access to essential services and infrastructure, including transport, education and healthcare, while also expanding local employment opportunities.

The implementation of these recommendations in a small number of pilot plateau areas could provide practical experience and data that could subsequently be used to develop management plans for other plateau areas.

19 Visions of desirable futures of the involved actors and the source of information

I worked as a Forest Engineer at the Forest Management Directorate for 13 years. During this period, I was involved in forest cadastral activities in areas classified as forests; the granting of permits under the relevant legislation for activities such as mining, hydropower plants and forest parks; the provision of government incentives to local people living in forest villages; and the sale, leasing, transfer and allocation of immovable properties belonging to the General Directorate of Forestry.

Public institutions use their strategic plans to define and achieve their objectives over the coming years. The Court of Accounts is responsible for auditing public administrations. In its audits, the Court of Accounts has identified various problems related to the management of institutional immovable properties. These include "Failure to Complete the Data Entry Procedures for Digitised Institutional Real Estate Layout Plans"; "Failure to Include Some Buildings and Facilities in Plateau Areas in the Layout Plans and to Record Them as Fixed Assets, Resulting in Revenue Losses Due to the Failure to Identify Tenants within the Legally

Prescribed Period"; "Problems Related to the Processing of Layout Plans for Immovable Properties in Plateau Areas, the Recording of Fixed Assets, and the Completion of Tenant Identification"; "Incorrect Determination of Estimated Rental Values for Leased Immovable Properties"; and "Recording Revenues Obtained from Leases in Areas Classified as Forests under Different Account Codes", among others.

The General Directorate of Forestry has established a legal framework for plateau areas for the first time, thereby providing a formal basis for their management and protection. However, the regulatory framework introduced by the General Directorate of Forestry should be further revised on the basis of problems identified during its implementation. This revision should involve the active participation of relevant stakeholders and should aim to ensure the holistic assessment, integrated management and long-term sustainability of plateau areas.

20 Lessons-learned from the case study

This study aims to evaluate plateau areas in Turkey holistically; determine their intended uses through the active participation of relevant stakeholders; identify the public institutions responsible for different aspects of their management through the preparation of plateau management plans; and increase state incentives to strengthen the attractiveness and economic opportunities of plateau areas. These measures are intended to reduce out-migration to cities and support the transmission of transhumance culture to future generations. The study will also help identify the procedures and practical road maps required to achieve these objectives.

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Legislation Information System Database.

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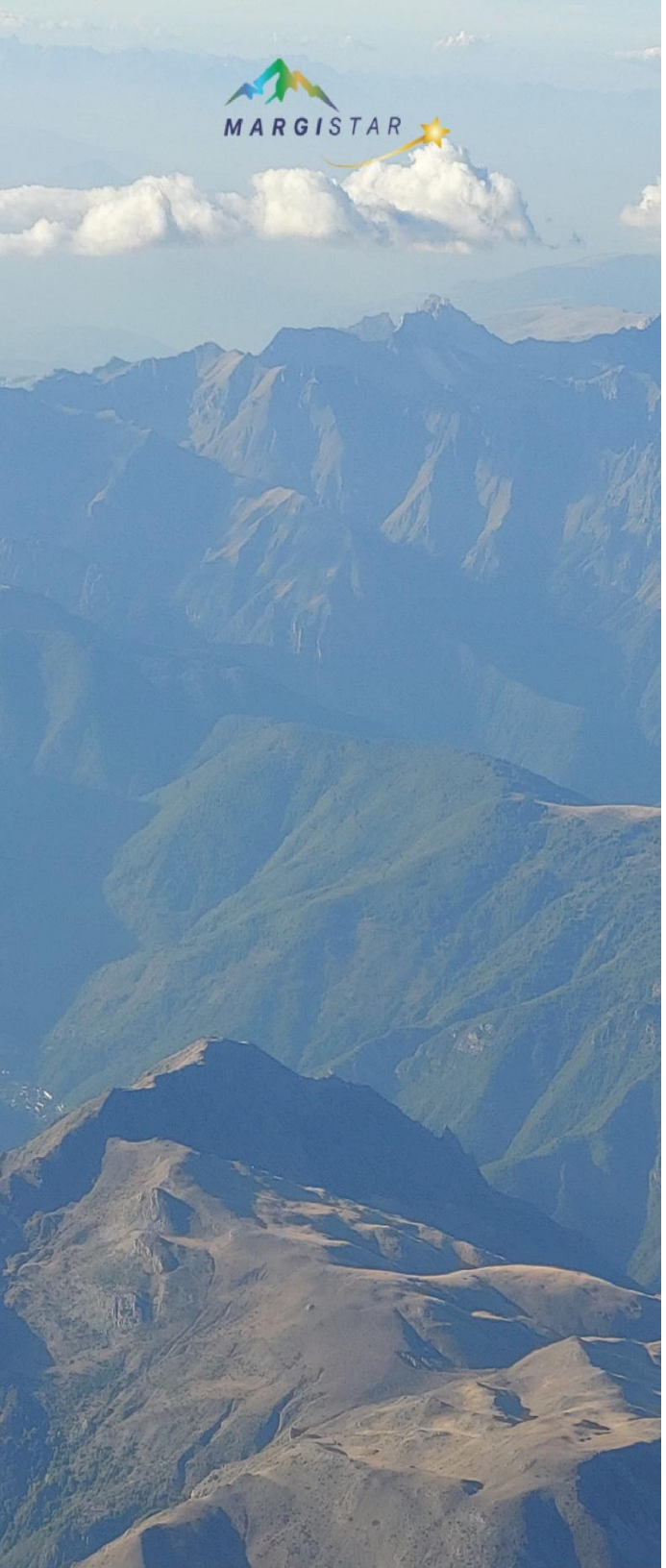

Increasing the resilience of karst mountain ecosystems to desertification

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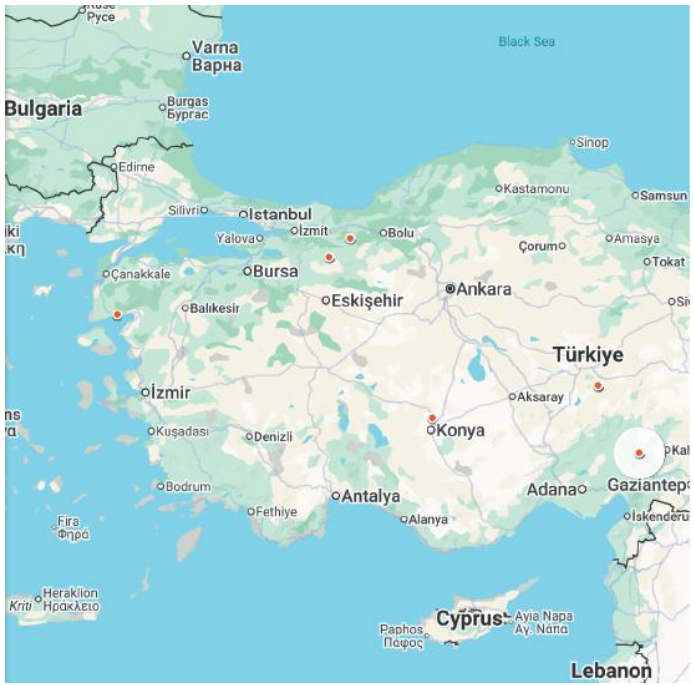
turgaydindaroglu@hotmail.com

1 Case study location

37° 32' 47.90"N, 36° 24' 36.00"E



2 Country

Turkey

3 For how long has the challenge been acute?

50 years

4 Challenge categories

Economic challenges: Economic problems, poverty, and lack of employment and education opportunities.
Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Environmental challenges: Climate change, biodiversity loss, and/or ecological destruction.
Geographical challenges: Geographical handicaps (including long distances, lack of connectivity, difficult terrains etc.) and/or natural handicaps (e.g., soil productivity, growing season).

5 Relevant UN Sustainable development goals

SDG1: No poverty.
SDG11: Sustainable cities and economies.
SDG13: Climate action.
SDG14: Life below water.
SDG15: Life on land.

6 Short description of the case study location

This study was carried out in Kahramanmaraş Province, located in the Mediterranean region of Turkey. The study area, covering 1,431 hectares, is situated between 37°33′09″ and 37°35′56″ N latitude and 36°22′22″ and 36°22′21″ E longitude. The elevation of the study area ranges from 870 to 1,500 m a.s.l. Although the Mediterranean region is generally characterised by arid or semi-arid conditions, the climate of Andırın, Kahramanmaraş, is characterised as semi-arid in the southern parts and humid in the northern parts. The area experiences minimum and maximum temperatures of 12.6°C and 34°C, respectively, with an average annual precipitation of 1,427 mm. Approximately 58% of the annual precipitation occurs between January and May (MGM, 2017).



Fig. 1 Landscape in the study area

7 Key challenges in the case study

In addition to the negative effects of climate change, the ecosystems of the Mediterranean karst mountains, which are fragmented by inappropriate land use and karst geomorphology, face an increasing risk of desertification (Dindaroglu et al., 2019). The limited agricultural areas within these karst landscapes are concentrated in natural depressions where soil depth is greater and are located immediately adjacent to natural forests and pastures. This spatial configuration further increases human pressure on natural ecosystems.



Fig. 2 Soil is the critical element in the Mediterranean karst mountains

8 A brief summary: What is this case study about?

In addition to the negative effects of climate change, Mediterranean karst mountain ecosystems, which are fragmented by inappropriate land use and karst geomorphology, face the threat of desertification. Field studies have identified deterioration in soil, vegetation and water relationships, particularly negative effects on the physical and chemical properties of the soil, in fragmented mountain ecosystems. To promote sustainable forest and soil management within karst ecosystems, stakeholders need to share a common vision and address challenges such as promoting organic farming, raising public awareness, and ensuring long-term economic benefits.

9 The fundamental causes and drivers for the challenges

Land-use changes in the region are generally shaped by climate, which affects different biophysical drivers such as water availability, soil fertility and wildfire occurrence. Regarding perceptions of climate change impacts, there is strong awareness among local stakeholders of the impacts of climate change on Sarımsak Karst Mountain. The perception that water availability has declined is shared by local people and forestry professionals, who believe that less water is now available in forest soils than in the past.

Karstic formations impose certain limitations on land use. Firstly, livestock husbandry has become an increasingly risky activity over time due to the limited availability of grazing land and agricultural land in the karst area (Hamdouch & Zuindeau, 2010). As a result, households have sought alternative sources of income, such as the migration of younger generations to urban areas for wage labour. Secondly, livelihood diversification has been necessary for poorer households, such as landless individuals or those with limited access to farmland, to reduce income instability and increase the likelihood of maintaining livelihood security. Among the biophysical drivers in the region, wildfires are important natural disturbance agents in Mediterranean forest ecosystems, shaping their structure, composition and overall functioning (Dindaroglu et al., 2021).

9a A cause-and effect diagram identifying key drivers and their interrelationships

Factors to the right of the mean threshold line (Fig. 3) hold the highest overall importance/influence in the system. Among these, Resource Management Challenges serves as a critical core cause factor due to its high influence and positive position above the horizontal axis. Conversely, Tourism and Land Use Conflicts and Geographical and Demographic Isolation function

as key effect factors, showing high importance but negative values below the axis. To the left of the mean, Environmental and Climate Drivers acts as a net cause factor driving other variables despite moderate overall influence, whereas Policy and Governance Issues and Economic Challenges operate as lower-influence effect factors that are heavily influenced by the system's root causes.

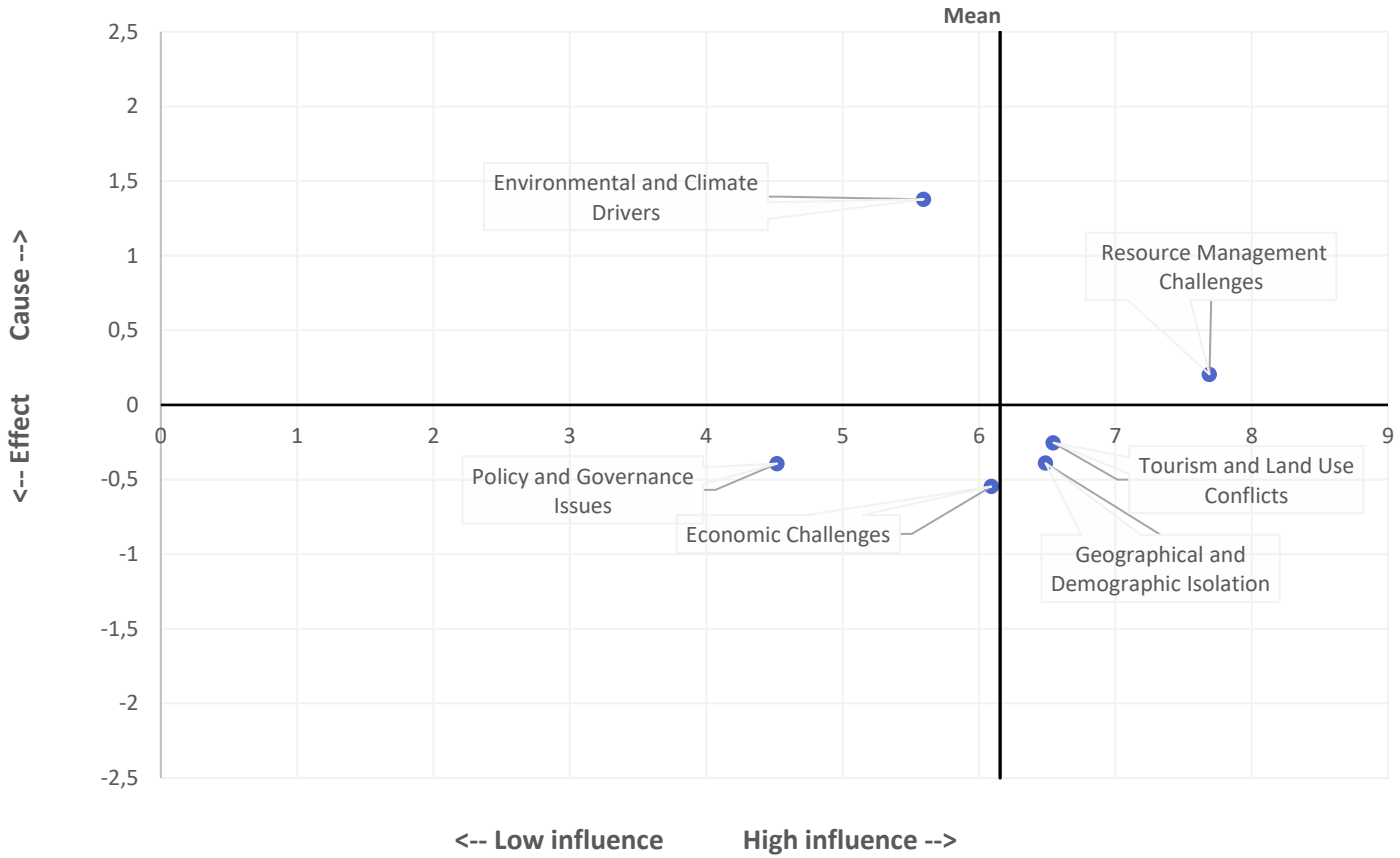


Fig. 3 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

10 Who is negatively impacted by the challenge, and how?

The lack of local livelihood opportunities deepens economic problems and poverty. Limited employment and educational opportunities force people to migrate. Periphery traps associated with the distribution and fragmentation of productive land affect everyone living in the region, but particularly the younger population. Due to the unique structure of karst ecosystems, the fragmentation of fertile land areas causes land use and ownership to become concentrated around a single natural resource (Bennett and Mulongoy, 2006). When the negative effects of climate change and biodiversity loss are added to these existing challenges, finding solutions to the problems becomes increasingly difficult.

11 Who is positively impacted by the challenge, and how?

No stakeholders are positively affected by these challenges.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

Unbalanced centre–periphery relations are partly caused by the characteristic geomorphological structure of karst regions. Karst ecosystems develop through the dissolution of soluble bedrock. While fertile soils and water reserves may occur in depressions within these ecosystems, fertile soils are generally concentrated in pockets between exposed rock formations. Land use has consequently developed around these fertile areas (Guo et al., 2013). Many other areas are unproductive and unsuitable for agricultural production. These geomorphological conditions can contribute to the development of centre–periphery traps in karst ecosystems. People living in these marginal areas, who have limited access to productive land, may therefore have fewer opportunities to secure a sustainable livelihood and derive sufficient economic benefits from local resources.



Fig. 4 The karstic geomorphology together with the lack of local livelihood opportunities deepens economic problems

14 The definition of the periphery trap in this case

All these developments have led to changes in and a decline in agricultural and livestock production. The decline in soil health has resulted in lower production levels, leading to reduced incomes and subsequent economic and social disadvantages.

People in the region are also involved in silvicultural activities in nearby forest areas. However, the labour-intensive nature of this work, limited social security coverage and seasonal working conditions discourage local people from engaging in forestry activities. One of the most important issues is therefore to address the social security needs of people living in the region and of those who could contribute to its future development.

15 The level of conflict

No conflicts were identified.

16 Description of the level of conflict related to the case study

No conflicts were identified.



Fig. 5 Soil samples taken in the study

17 Efforts to solve the challenge(s)

Stakeholders have a critical role in developing future visions and ensuring forest and soil sustainability. This underscores the need for a shared vision among stakeholders for the effective protection and management of forests. Karst ecosystems have unique geopark characteristics and support endemic biodiversity (Singh et al., 2021). Increasing local livelihood opportunities through ecotourism projects is highlighted, recognising the importance of public participation in achieving economic, social and psychological well-being.

Challenges associated with karst forests, including their strict protection status, are discussed, with suggestions to modify restrictions on activities such as irrigation canal construction. The importance of effective land allocation and innovative sustainable management practices is emphasised. Proposed solutions include providing information, implementing projects, and addressing the potential impacts of climate change, migration and soil degradation (Zou & Ma, 2021).

The use of organic fertilisers and support for farmers through the provision of fertilisers, pesticides and irrigation are recommended. Concerns are also expressed about the potential conversion of agricultural land to tourism-related uses, highlighting the need to estimate future land-use changes. The conclusion stresses the importance of considering long-term economic benefits and well-being, advocating systematic ecotourism planning and addressing issues related to education, property, housing and livelihoods.

Degraded forest ecosystems should be rehabilitated. For this purpose, locally appropriate target plant species should be selected based on ecological conditions, and rehabilitation should be carried out using an ecological corridor approach to avoid disrupting the hydraulic systems characteristic of karst ecosystems (Dindaroglu, 2021).

Collaboration and dialogue among stakeholders are considered crucial for overcoming conflicts (Payne & Calton, 2017), while policy changes and incentives are identified as opportunities to support forest protection. Raising public awareness of soil health and encouraging the use of organic fertilisers are also highlighted. Recommended strategies include livestock farming, beekeeping, non-wood forest product production, silvicultural practices, climate change adaptation, ecotourism development, and the protection of clean water resources.

18 Research-related proposals for potentially solving these challenges

Public participation is considered very important for achieving economic, social and psychological well-being. The focus of this study is on improving local livelihoods through ecotourism initiatives. Challenges associated with strict conservation requirements in karst forests are explored, together with suggestions for adjusting restrictions, particularly for activities such as the construction of irrigation canals. Proposed solutions emphasise the importance of efficient land allocation and innovative sustainable management practices, including information dissemination, project implementation, and addressing potential challenges related to climate change, migration and land degradation.

Recommendations include encouraging the use of organic fertilisers and providing farmers with support for fertilisers, pesticides and irrigation. The conclusions emphasise the importance of considering long-term economic benefits and well-being, promoting systematic ecotourism planning, and developing projects that address issues related to education, property, housing and livelihoods.

Recognising the fundamental role of cooperation and dialogue among stakeholders in conflict resolution, policy changes and incentives are identified as opportunities to support forest conservation. The importance of raising public awareness of soil health and promoting the use of organic fertilisers is emphasised. Recommended strategies include livestock farming, beekeeping, non-wood forest product production, silvicultural practices, climate change adaptation, ecotourism development, and improving access to clean water resources.

19 Visions of desirable futures of the involved actors and the source of information

Participants consider soil health to be a crucial component of ecosystem services and recognise its vulnerability to the impacts of climate change. Residents, forestry professionals and other participants demonstrate a good understanding of how climate change affects forests and the provision of ecosystem services. They are also aware of the influence of climate change on soil health and its interactions with agricultural and production activities. In addition, they have some understanding of the risks and uncertainties associated with the effects of climate change on forest ecosystems. However, when considering future climate change, they emphasise the need for each sector to develop appropriate frameworks for addressing potential changes based on projections, scenarios and possible future conditions.

The group suggests that decisions concerning the future management of the region should consider the needs and expectations of both the local community and the GDNNP. Despite current limitations, ongoing changes in land use and land cover, together with anticipated climate change impacts, are expected to significantly affect the provision of ecosystem services that are important to society. In the context of ecotourism, a sustainable approach is considered essential for preserving visual quality and the geo-park character of the area, as well as maintaining the structure and quality of recreational forests used for floristic tourism. Changes in fire regimes may lead to shifts in forest composition and structure, potentially resulting in the loss of ecosystem services that are currently expected from these ecosystems.

Farmers carefully manage the limited soil resources available in the area and are aware of the impacts of climate change. Due to constraints on agricultural and pasture land, local residents aim to maximise the efficiency of the resources available to them. They believe that changes in fertilisation and irrigation practices, supported by technological advances, could improve soil recovery and agricultural productivity.

20 Lessons-learned from the case study

Amid various challenges, including the inherent limitations imposed by the geomorphological characteristics of karst ecosystems, the limited availability of fertile soils, and a lack of technical expertise in the region, conducting the necessary studies for the protection and management of agricultural land, pastures and forests is challenging. For example, the full ecotourism capacity and potential of the region remain unknown, while investments in infrastructure, technological development and administrative capacity are required to assess and manage this potential effectively.

A notable lack of public awareness regarding climate change and possible responses to its impacts has also been identified. Participants emphasise the need to increase public awareness and expand the construction of irrigation dams and canals. Many participants acknowledge that they are not adequately prepared to respond to the impacts of climate change on soil health.

Farmers would like the region to remain focused on agriculture over the next two decades; however, achieving this goal will require increased access to irrigation and labour. The areas suitable for agriculture and pasture are significantly constrained by the characteristics of karst ecosystems. In agriculture, there is a preference for crops with lower water requirements, such as olives and oats, but there is currently no systematic approach to crop selection or an adequate irrigation system to support

it. Reducing input costs is also considered essential. The effects of pesticides, wildfires, insect pests and climate change also represent significant challenges in the study area. Although efforts are being made to control insect pests, participants consider these measures to be currently inadequate.

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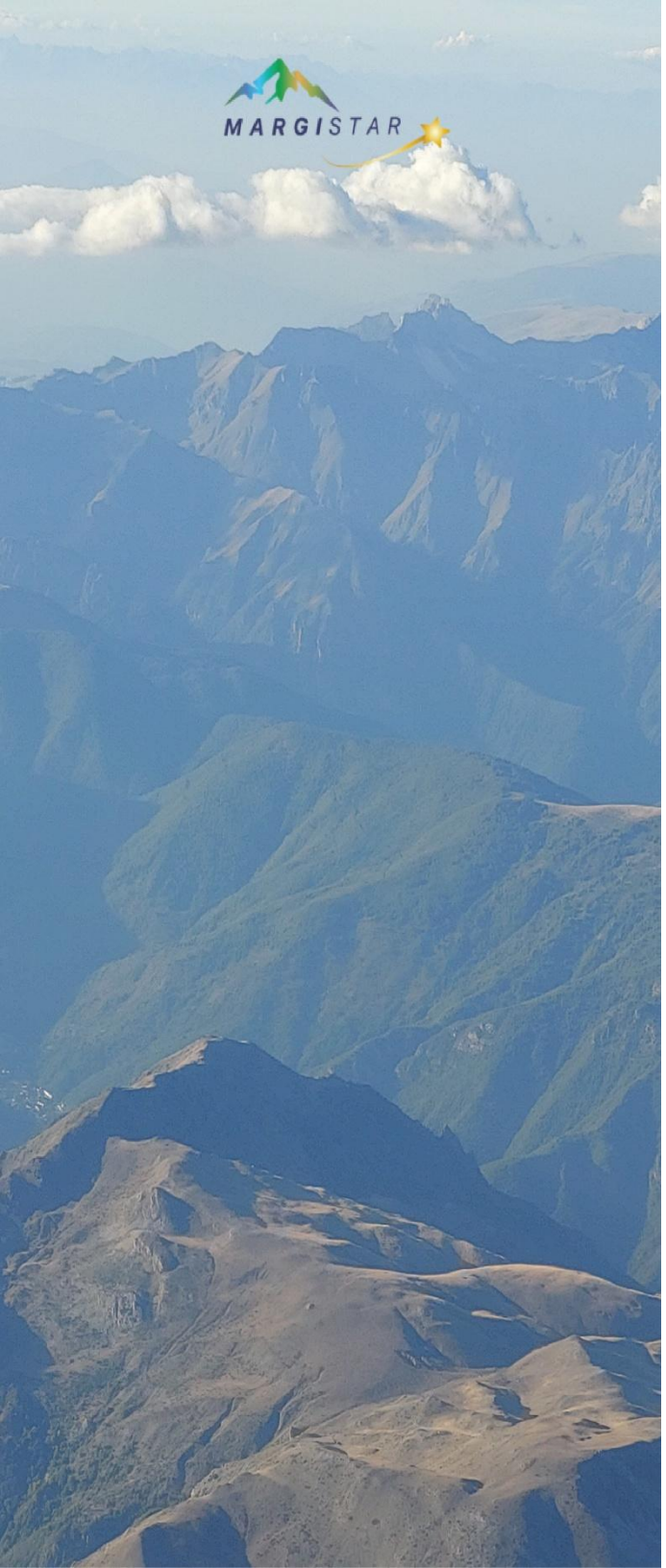

Sustainable management of Kardüz Upland

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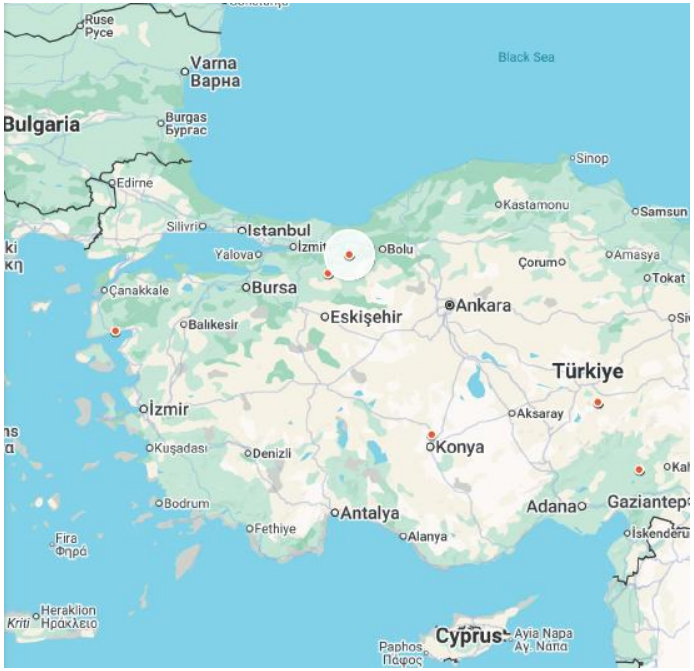
1 Case study location

40° 39' 57.78"N, 30° 58' 35.33"E



2 Country

Turkey

3 For how long has the challenge been acute?

20 years

4 Challenge categories

Socio-cultural challenges: Demography, migration (out/in) and/or social and ethnic tensions.
Economic challenges: Economic problems, poverty, and lack of employment and education opportunities.
Governance challenges: e.g., policies made at national and/or EU levels, top-down decision-making, lack of local participation in decision-making etc.
Natural resource use challenges: Use and ownership of land, focus on single natural resource, and/or lack of possibilities for local livelihoods.
Service-related challenges: Poor cultural, social and/or commercial services.
Environmental challenges: Climate change, biodiversity loss, and/or ecological destruction.
Geographical challenges: Geographical handicaps (including long distances, lack of connectivity, difficult terrains etc.) and/or natural handicaps (e.g., soil productivity, growing season).

5 Relevant UN Sustainable development goals

SDG1: No poverty.
SDG9: Industry, innovation, and infrastructure.
SDG10: Reduced inequalities.
SDG15: Life on land.
SDG17: Partnership for the goals.

6 Short description of the case study location

Kardüz Upland is located 48 kilometres from Düzce and covers an area of approximately 180 hectares at the top of the mountain, at an altitude of 1,830 m a.s.l.. As we drove through the forest, we observed evidence of significant investment in hydroelectric generators, although these were not operational. Unfortunately, due to climate change, the project can no longer secure a sufficient water supply to operate continuously and efficiently. We continued our visit to a small community comprising mostly subsistence farmers and residents living in unregulated housing, some of which is used as summer homes by residents of nearby towns and cities. These settlements are connected by relatively poor transport infrastructure and have limited access to local services. Climatic conditions mean that residents can live in the uplands only during the summer months. Speaking to a local shepherd, we observed that, although traditional economic activities are in decline, cultural transmission between generations remains evident, both in farming practices and in other aspects of rural life. Notwithstanding this, there was limited evidence of economic activity and employment opportunities. As we travelled to and from Kardüz Upland, it became clear that the mountain and its forests have considerable potential for tourism, particularly for outdoor recreation and experienced hikers. Kardüz Upland has been designated as a "Culture and Tourism Protection and Development Zone" by a decision of the Council of Ministers and is currently being evaluated as a potential winter tourism destination. In many respects, this follows an established development pathway in Turkey, where similar initiatives have been implemented in various parts of the country, for example, at the Bolu Kartalkaya Ski Centre. A similar initiative could have a transformative effect on the area and local community by creating employment opportunities throughout the year.



Fig. 1 The top of the mountains in Düzce, Turkey

7 Key challenges in the case study

This is a distinctive mountainous area characterised by pastoralism, winter tourism and forestry activities undertaken by the public forest management sector. Multiple conflicts occur in the area, generating social, economic and environmental (ecological) impacts.

8 A brief summary: What is this case study about?

The mountainous area involves multiple stakeholders, with forest-dependent villagers, the General Directorate of Forestry, and the Ministry of Culture and Tourism being key actors. The aim of the case study is to analyse the roles, interests and interactions of these stakeholders from the perspectives of legislation, sustainable forest management and ecotourism.

9 The fundamental causes and drivers for the challenges

Kardüz Upland is a distinctive mountainous area with the highest elevation in the region, encompassing forest ecosystems, high levels of forest biodiversity and an alpine zone. The area is characterised by the close interaction of social, economic and ecological features, which collectively shape its development and contribute to ongoing changes in the area.



Fig. 2 Kadırga Festival in summer season, Düzce, Turkey

9a A cause-and effect diagram identifying key drivers and their interrelationships

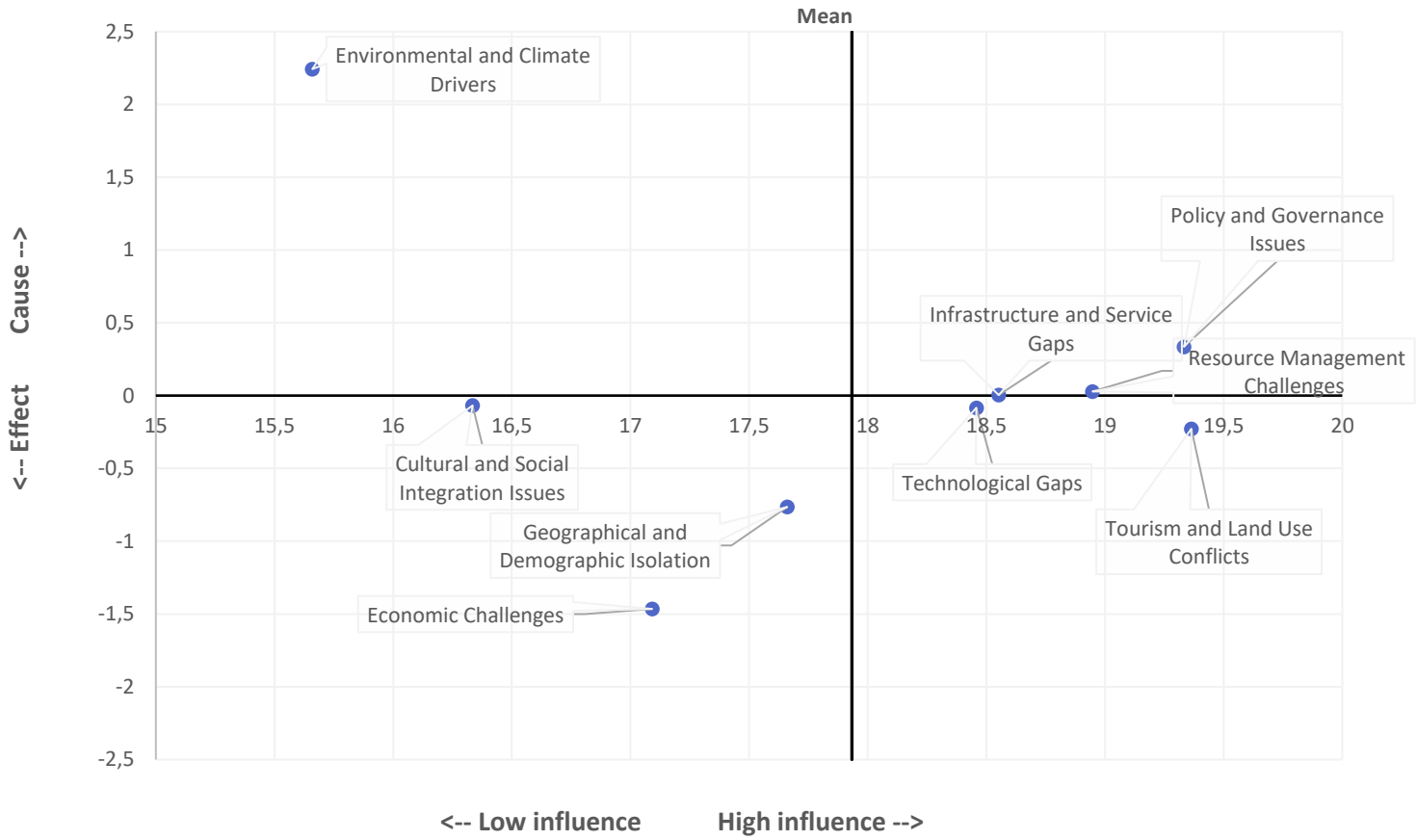


Fig. 3 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

The results indicate that Environmental and Climate Drivers, Infrastructure and Service Gaps, Policy and Governance Issues, and Resource Management Challenges are causal factors, suggesting that they act as driving forces within the system.

Infrastructure and Service Gaps, Policy and Governance Issues, and Resource Management Challenges exhibit high prominence, indicating that they are highly interconnected with the other dimensions, whereas Environmental and Climate Drivers show relatively low prominence despite having the strongest causal influence. In contrast, Technological Gaps, Tourism and Land Use Conflicts, Economic Challenges, Geographical and Demographic Isolation, and Cultural and Social Integration Issues are identified as effect factors, reflecting dimensions that are primarily influenced by other factors. Among these, Technological Gaps and Tourism and Land Use Conflicts display high prominence, while the remaining factors show relatively low prominence. Overall, the findings suggest that environmental, infrastructure, governance, and resource management factors constitute the principal driving forces, whereas technological, tourism-related, economic, geographical, and socio-cultural issues primarily represent outcomes of the system's causal relationships.

10 Who is negatively impacted by the challenge, and how?

The transition of Kardüz Upland from a predominantly forested area towards tourism development has created negative impacts for forest management and forest-dependent villagers.

11 Who is positively impacted by the challenge, and how?

The tourism industry and private-sector businesses benefit economically from the development of winter tourism in Kardüz Upland.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

Forest-dependent villagers and pastoralists were excluded from the decision-making process concerning the change in the status of the area.



Fig. 4 Winter season of the mountains in Düzce, Turkey

14 The definition of the periphery trap in this case

The designation of Kardüz Upland for tourism development, particularly winter tourism, represents a significant change in the area's development trajectory. The effects of this status change and subsequent investments are expected to extend beyond Kardüz Upland itself and affect the wider region. This may create a periphery trap if tourism development concentrates economic benefits and decision-making in specific sectors and locations while marginalising existing forest-dependent and pastoral livelihoods.

15 The level of conflict

There are several types of conflict in Kardüz Upland. The first concerns forest-dependent villagers and other local residents, who remain uncertain about how the planned tourism development and associated changes will affect their livelihoods and living conditions in the coming years.

16 Description of the level of conflict related to the case study

Forest-dependent villagers and pastoralists are likely to be affected by the new situation, which may generate further conflicts with private-sector interests and tourism management. Forestry activities and the protection of natural resources may also become sources of conflict in the coming years. These potential conflicts and their implications therefore require careful analysis.

17 Efforts to solve the challenge(s)

There is an urgent need to establish a participatory stakeholder management committee for Kardüz Upland. The committee should bring together representatives of all relevant stakeholders to discuss the challenges facing the area and identify ways to address potential periphery traps in the region. The stakeholders need to develop a shared understanding of the situation and promote science-based decision-making, nature-based solutions and integrated planning for Kardüz Upland.

18 Research-related proposals for potentially solving these challenges

The Sustainable Development Goals (SDGs) and nature-based solutions, combined with participatory approaches, could provide a useful framework for developing more sustainable mountainous areas. Stakeholder theory and stakeholder analysis could further contribute to understanding and addressing the challenges faced by mountainous communities and supporting more inclusive decision-making processes.

19 Visions of desirable futures of the involved actors and the source of information

We have been familiar with the region for approximately 25 years and has worked with a range of stakeholders, including forest management authorities, forest-dependent villagers and pastoralists. Interviews with these stakeholders have been conducted over the past several years, and stakeholder data have been collected to document their expectations and perspectives. In addition, relevant reports and planning documents concerning Kardüz Upland have been reviewed.

20 Lessons-learned from the case study

Stakeholder analysis and stakeholder typology can be used to better understand the different interests, relationships and potential conflicts in Kardüz Upland and to identify appropriate solutions. This approach can also improve understanding of the underlying mechanisms of periphery traps and help identify potential pathways towards desirable futures.

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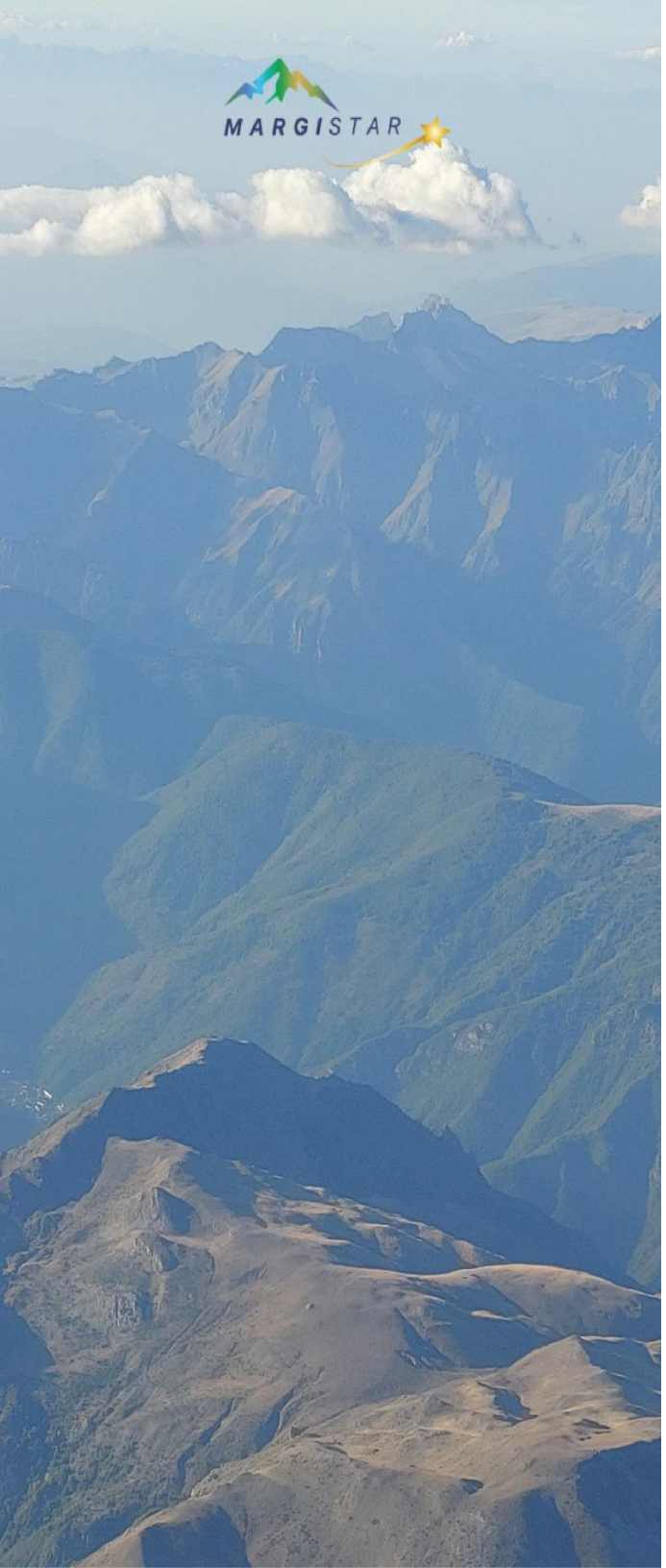

Skolivski Beskydy in the Ukrainian Carpathians

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1 Case study location

49° 12' 0.00"N, 23° 12' 36.00"E



2 Country

Ukraine

3 For how long has the challenge been acute?

20 years

4 Challenge categories

Socio-cultural challenges: Demography, migration (out/in) and/or social and ethnic tensions.
Economic challenges: Economic problems, poverty, and lack of employment and education opportunities.

5 Relevant UN Sustainable development goals

SDG1: No poverty.
SDG3: Good health and well-being.
SDG4: Quality Education.
SDG8: Decent work and economic growth.
SDG9: Industry, innovation, and infrastructure.
SDG12: Responsible consumption and production.
SDG13: Climate action.
SDG15: Life on land.

6 Short description of the case study location

Skolivski Beskydy is a mountain range in western Ukraine, belonging to the group of ranges known as the Eastern Beskids within the Outer Eastern Carpathians. The elevation of the study area ranges from 349 to 1,268 m a.s.l. The climate is temperate continental in the lower parts and cold and wet in the upper parts. Most of the population lives in rural areas (71.7% of the total population). Approximately one in five residents of the communities is employed in agriculture, forestry or fishing. On 14 April 2021, the Cabinet of Ministers of Ukraine adopted a resolution entitled "On Amending the List of Settlements Granted the Status of Mountain Ones", developed by the Ministry for Communities and Territories Development of Ukraine. The main criterion for classifying a settlement as a mountain settlement is its location at an elevation of 400 m or higher above sea level. All settlements in the study area are classified as mountain settlements and are characterised by a high degree of economic and socio-cultural dependence on forest resources. An important component of the daily livelihoods of the population in these communities is the collection of non-wood forest products, including mushrooms, berries, nuts, medicinal plants, bark, roots, sap and resin. These products are important for subsistence, including dietary supplementation, and as an additional source of household income.

Forests cover almost 71% of the total area. Approximately 60% of the total forest area belongs to the commercial forest category, 21% to various categories of protected forests, and the remainder to protective and recreational forests. All forests in the study area are managed according to forest management plans, which are revised every 10 years. The average growing stock is 300 m^3/ha, with an annual increment of 6.0 m^3/ha.

The key stakeholders include the local population, local authorities, forest users, nature conservation administrations, logging and wood-processing enterprises, NGOs and other relevant organisations.



Fig. 1 Spruce-dominated managed forests

7 Key challenges in the case study

Underdeveloped transport infrastructure; unemployment, low wages and labour migration; inadequate equipment of medical facilities; drying of secondary spruce forests and illegal logging; and insufficient financial resources in local budgets to meet the needs of the social and economic development of mountain areas.

8 A brief summary: What is this case study about?

Skolevskyi Beskids is a mountain range in western Ukraine, belonging to the group of ranges known as the Eastern Beskids, within the Outer Eastern Carpathians. This area plays an important role in tourism and recreation in the Lviv region, with well-developed infrastructure in key cities. However, unemployment and low wages persist, accompanied by labour migration. Traditional sheep farming and dairy farming have almost disappeared, while local craft industries have declined. The education sector faces challenges, including low enrolment in secondary schools and a growing need for school buses to transport pupils.

Probable causes and drivers may include insufficient allocation of funds and the use of funds for purposes other than those intended. The ideology underlying the development of mountainous areas may also be considered flawed.



Fig. 2 Traditional houses in the Skolevskyi Beskids

9 The fundamental causes and drivers for the challenges

Probable causes and drivers may include insufficient allocation of funds. Funds may be allocated to purposes other than those intended. The ideology underpinning the development of mountainous areas may be flawed.

9a A cause-and effect diagram identifying key drivers and their interrelationships

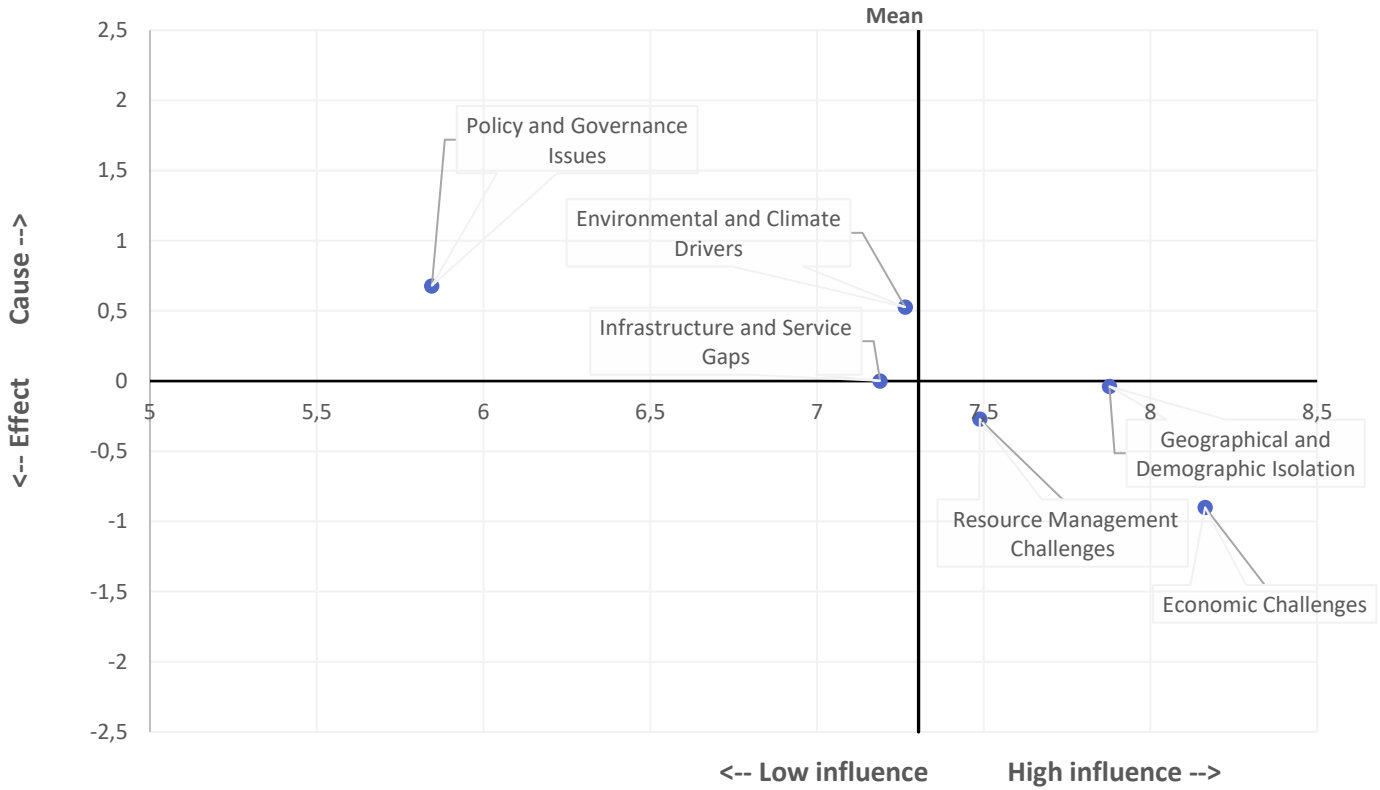

Fig. 3 Factors were categorised as "causes" or "effects", and "low" or "high" influential using the DEMATEL method helping to identify key drivers in the system

The DEMATEL analysis indicates that Policy and Governance Issues and Environmental and Climate Drivers are the main causal factors, exerting a greater net influence on the system than they receive. Infrastructure and Service Gaps occupy an intermediate, relatively balanced position. Resource Management Challenges, Geographical and Demographic Isolation, and Economic Challenges are predominantly effect factors, being more influenced by other dimensions than influencing them. Economic Challenges have the highest overall prominence, indicating strong interrelationships within the system, despite their predominantly reactive position.

10 Who is negatively impacted by the challenge, and how?

The group most affected by the challenge is the local population, particularly the younger generation, due to limited access to quality education and healthcare and the need to leave their homes and migrate abroad in search of better employment opportunities. Children often grow up with their grandparents while their parents work abroad.

11 Who is positively impacted by the challenge, and how?

No one.

12 Does the case study link to unbalanced centre-periphery relations?

Yes.

13 In what ways are the centre-periphery relations unbalanced?

The state's declared policy of decentralisation is being implemented with difficulties, both due to objective factors, such as dispersed settlement patterns and significant distances between villages, and subjective factors, such as the reluctance of certain executive authorities to comply with legislation concerning community amalgamation.



Fig. 4 Younger generations need to leave their homes and migrate abroad in search of better employment opportunities

14 The definition of the periphery trap in this case

Periphery traps are obstacles within regional contexts that significantly impede economic, social, or overall development and require detailed analysis for their prediction and successful mitigation.

15 The level of conflict

Medium level.

16 Description of the level of conflict related to the case study

No details provided.



Fig. 5 All settlements in the study area are classified as mountain settlements and are characterised by a high degree of economic and socio-cultural dependence on forest resources

17 Efforts to solve the challenge(s)

National support for mountainous areas of Ukraine through the Cabinet of Ministers of Ukraine Resolution "On Amending the List of Settlements Granted the Status of Mountain Ones" (2014).



Fig. 6 Infrastructure facilitates, but does not in itself constitute, sustainable economic development

18 Research-related proposals for potentially solving these challenges

To improve accessibility, excessive attention has traditionally been focused on 'hard infrastructure', while structural funds have promoted 'soft' projects supporting business, entrepreneurship, and innovation. These efforts should continue, while also recognising that some investments in physical infrastructure are justified.

Infrastructure facilitates, but does not in itself constitute, sustainable economic development. Improved infrastructure can enhance connectivity and contribute to increased exports, but it can also expose local markets to greater competition.

Broadband internet can be developed through public–private partnerships (PPPs), as the regulatory framework supporting PPPs financed through structural funds was improved for the 2014–2020 programming period. Expanded broadband access can support economic development, education, and governance.

Mountain areas are centres of biological diversity and contain many protected areas. Managing these sites, as well as utilising them for recreation, tourism, educational activities, and related research, can provide additional employment opportunities in remote areas where alternatives are limited.

19 Visions of desirable futures of the involved actors and the source of information

No information.

20 Lessons-learned from the case study

The case study highlights the need for more integrated approaches and structures for coordinating cross-sectoral policies to address demographic, economic, and ecological challenges in mountainous regions. A specialised programme is required to establish frameworks that enable regional and national programmes to leverage opportunities and address development challenges in mountain areas, while fostering cooperation among programmes operating in different mountain ranges. Such approaches to action and cooperation can be implemented within the framework of 'place-based policy' to address periphery traps effectively and support progress towards desirable futures in mountainous regions.

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