



The socio-ecological resilience of the Făgăraș Mountains

An analysis of the challenges and strategies for sustainable development in the mountainous areas of Romania.

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Introduction: context and justification

The Romanian mountain context

Romania's mountains (30% of the area) are complex ecosystems, essential for climate, water and biodiversity. They are vulnerable to climate change, depopulation and uncontrolled tourism.

The case of the Făgăraș Mountains

The highest mountain range, with remarkable ecological diversity, but also with socio-economic challenges: rural abandonment, the disappearance of traditional crafts, tourist pressures.

The need for an integrated approach

The lack of a coherent national strategy highlights the need for a rigorous scientific approach to the sustainable development of mountain areas.

Research Objective and Theoretical Framework

Assessing the socio-ecological resilience of mountain areas in Romania, with a focus on the Fagaras Mountains, and formulating strategic directions for sustainable development in the context of climate change and social pressures.

Definition of mountain areas

Eurostat criteria (altitude, slope, elevation variation) and national context (Mountain Law 2018, Order 1332/2019).

- Average altitude $\geq 500\text{m}$
- Average slope $\geq 15\%$ (350-500m altitude)
- Altitude variation $\geq 300\text{m}$ (1000-1500m altitude)

The Fagaras Mountains are an ideal laboratory for analyzing the intersection between natural conditions and contemporary socio-economic challenges.

- **High altitudes:** Moldoveanu Peak (2,544 m).
- **Severe climatic conditions:** Snow 6-8 months/year, risk of avalanches.
- **Isolated communities:** Strong traditions, but economic decline.
- **Conflicts of use:** Tourism vs. conservation, pastoralism vs. reforestation.

The challenges of delimiting mountain areas

Political and Financial Implications

Delimitations influence eligibility for EU funding and agricultural compensation (e.g. Measure 13).

Legal Fragmentation

The overlap of mountain areas with Natura 2000 sites and protected areas complicates governance.

Double Delimitation

The current situation (Order 1332/2019 vs. Order 3555/2007) creates confusion regarding eligibility for support.



Specialized literature

Socio-ecology

- **Berkes et al. (2002)** define resilience as the capacity of systems to absorb shocks, self-organize, and learn, without necessarily returning to a fixed previous state. They emphasize the importance of diversity, flexibility, and the avoidance of rigid optimization.
- **Chapin et al. (2009)** extend the analysis by introducing the concepts of vulnerability and transformability, in addition to resilience, and propose an adaptive governance based on collaboration, collective learning and the involvement of local actors.
- **Walker & Salt (2006)** promote resilience-based thinking that rejects traditional strategies focused on control and efficiency, believing that these reduce the capacity of systems to cope with change. They emphasize diversity, modularity, and learning, providing concrete case studies to illustrate applicability.



Key concepts: vulnerability, resilience, adaptation

1

Vulnerability

The degree to which a system is exposed, sensitive, and unprepared to respond to external shocks (climate, depopulation, poor infrastructure).

2

Resilience

The capacity of a system to absorb shocks, self-regulate, and transform positively. The result of natural, social, institutional, and economic capital.

3

Adaptation

The process by which systems modify their behavior to reduce the impact of change or take advantage of opportunities. It can be reactive, anticipatory, or transformative.

Ecosystem services and challenges

The Făgăraș Mountains provide essential ecosystem services, but these are threatened by various pressures.



Supply

Wood, water, mushrooms, medicinal plants.



Adjustment

Climate, air purification, erosion prevention.



Cultural

Landscape, spirituality, ecological tourism.



Support

Biogeochemical cycles, pollination, habitat.

Threats: habitat fragmentation, uncontrolled tourism, non-participatory conservation policies, underfunding.

Research questions and objectives

1. What are the main types of socio-ecological vulnerability in the Fagaras Mountains, and how are they distributed spatially and institutionally? (multi-level analysis, landscape – communities – institutions)
2. How have ecosystem services evolved in the last two decades in the Făgăraș Mountains, and what trends can be anticipated by 2050? (with the integration of satellite images, climate scenarios and socio-economic indicators)
3. What relationship exists between conservation and rural development policies and local people's perception of the benefits of nature? (field study, interviews, focus groups with farmers, NGOs, local authorities)
4. How could a national strategy for mountain areas be structured, anchored in local realities, but compatible with European policies?
5. Can the Făgăraș Mountains become a model of "mountain resilience" for the Carpathians and Eastern Europe? What institutional and economic instruments would be needed?

Objective: assessing the socio-ecological resilience of the Fagaras Mountains in the context of climatic, economic and institutional pressures

Research methodology

Interdisciplinary approach, combining qualitative and quantitative data to assess socio-ecological resilience.

Documentary analysis

Theoretical foundation, indicator selection, policy studies.

Field research

Participatory evaluation, interviews, focus groups, questionnaires.

Spatial analysis and climate modeling

Mapping of ecosystem services and risks, satellite imaging, climate models.

Summary and proposals

Development of the resilience model, strategic recommendations, policy brief.

Original contribution and opportunities

The research fills a knowledge gap, providing a systemic assessment and applied contributions.

Conceptual contribution

- Rigorous application of the SES model in a mountain context.
- Operational definition of "mountain resilience".

Methodological contribution

- Integrating satellite imagery with ground data and predictive models.
- Mapping ecosystem services and use conflicts.

Applicative contribution

- Substantiating a national mountain strategy.
- Implementation framework for biodiversity-based offsets.
- Inclusive governance proposal.



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**Thank you!
Any questions?**

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