Landscape evolution – insights from the Research Symposium SNP+ 2025

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Abstract

The second edition of the Research Symposium SNP+, organized on the occasion of the 111th anniversary of the Swiss National Park (SNP), explored landscapes as a multidimensional phenomenon. Far from being a static physical structure, a landscape embodies ecological, cultural, historical, perceptual, and political dynamics. The symposium contributions highlighted ambiguities in landscape perception, the potential of landscape in mediating tensions between nature and society, and showcased a variety of approaches for investigation and research.

This article synthesizes key insights from the symposium, focusing on four topics: (1) landscape as a multidimensional experience, (2) contested use of landscape, (3) potential for up-scaling, and (4) methodological diversity in landscape research. Long-term datasets from the SNP underscore the critical importance of historical perspectives for understanding landscape evolution driven by different factors, from climate change to biodiversity loss. Ultimately, the symposium emphasized that research not only generates knowledge but also enables landscapes to act as bridges between disciplines, practices, and societies.

Profile

Protected area

Swiss National Park

Mountain range

Alpes, Switzerland

Figure 1 – Landscape in the lower Engadin. © Stefanie Gubler

Introduction

After the first successful Research Symposium SNP+ in 2023 (Gubler et al. 2024), the 111-year anniversary of the Swiss National Park (SNP) served as motivation to hold a second edition of the symposium focusing on the broader topic of landscape evolution. The symposium topic *Landscapes under the magnifying glass* was inspired by a comprehensive review of the SNP's photographic archives conducted on the occasion of the 111-year anniversary. This review examined a wide range of historical images that document the SNP's landscapes and their changes over time, systematically categorized by habitat type (meadows, forests, aquatic habitats, high altitudes, as well as man-made infrastructure). Based on a curated selection process, 56 historical photos were re-taken in 2023 and 2024 at the exact same locations. These so-called re-photographs, together with their historical counterparts, document the changes that have occurred in the landscape over the past century and invite us to reflect on these changes. The photo pairs highlight the dynamic nature of landscapes – whether changes were fast or almost absent – and provide a tangible entry point into wider questions about natural processes as well as the perception, use, and conservation of landscapes. Building on these photographs and the accompanying exhibition on display at the SNP Visitor Center in Zernez until March 2027, the second research symposium examined the topic of landscape and its changes from a research perspective (see Figure 1).

Thanks to the vision of those who founded the SNP in 1914, a long-term research tradition has been established there. Nature and all its processes were to be protected in the SNP and subject to investigation and monitoring: *"For science, the national park is an invaluable field of observation, unique in its kind due to the complete elimination of human interference with the natural balance"* (Schröter 1920: 5, translated from German by deepl. com). Over the years, extensive knowledge about how and why physical landscapes have or have not changed in the SNP has accumulated. For instance, from the very beginning, botanical observation sites had been established (e. g., Braun-Blanquet 1931), the first rock glacier measurements worldwide were taken (Chaix 1923), the meteorological station Buffalora was installed, forest (Burger 1950) and ungulate observation

(e.g., Baechler 1919) started, along with many other studies on plants, forest, and animals. In 2012, an adjacent regional nature park was established and in 2017 the area was designated as a UNESCO Biosphere Reserve: Thus, landscape research was further strengthened in the Engadin and Val Müstair valleys, with an expanded focus that encompasses not only the natural sciences but also the cultural and social dimensions of landscapes.

The second Research Symposium SNP+ started with a keynote on the understanding of landscape through language, which was followed by three sessions on landscape research in the social sciences, the natural sciences, and from the perspective of young researchers. In addition, seven posters were presented. The event ended with final reflections by the Swiss Academy of Sciences (Figure 2). With over 80 attendees from multiple scientific fields, the symposium provided a platform for interdisciplinary exchange and addressed the challenges of understanding landscapes in their physical, cultural, and perceptual dimensions. This article synthesizes the main themes and insights that emerged from the symposium.

Landscape as a multidimensional experience

One of the central premises of the symposium was that landscape consists of and enables multi-perspectives and can be perceived by all senses, from sight to smell, sound, touch, and even taste. Landscapes provide the physical foundation for life and simultaneously give us space for living, working, recreation, culture, and commerce. Or, as defined by the European Landscape Convention, landscape is *"… an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors"* (European Landscape Convention 2020). Additionally, landscapes provide benefits or services to humans that are often not made explicit, such as a sense of identity and connectedness (Keller et al. 2022). The symposium aimed at examining these multiple facets of landscape research. Ross S. Purves from the University of Zurich presented landscapes as a *slippery concept:* landscapes are complex, layered, mutable, and strongly shaped by subjective experience (e.g., Purves et al. 2023; Wartmann & Purves 2018). Approaches used in the *Landscape monitoring Switzerland* (Wartmann et al. 2021), for instance, demonstrate that subjective perception (e.g., through sensory experience, attribution of meaning or cognitive processes; see also Koegst et al. 2023) is crucial for assessing the quality of a landscape and that this subjectivity can change the attribution of quality to landscape – even if the physical parameters of the assessed landscape remain unchanged. In addition, historical knowledge and land-use legacies as known, for instance, from the forest *God da Tamangur* (Bürgi & Lock 2024) influence current perceptions and acceptance of landscapes.

Figure 2 – Jürg Pfister, Secretary General of the Swiss Academy of Sciences, reflecting on the outcomes of the Research Symposium SNP+ and the meaning of landscapes. © SNP/Hans Lozza

Temporal and spatial scales further enrich the landscape perspective. Research in the SNP region ranges from large-scale regional assessments (e.g., HABITALP; Lotz 2006) to the study of fine-grained landscape elements such as springs (von Fumetti & Abderhalden 2024). Small-scale features, like microfauna in springs or alpine pasture vegetation, may appear marginal yet hold long-term significance for landscape trajectories and history.

Contested use of landscape

Owing to the multidimensional character of landscapes, landscapes accommodate multiple, and at times competing, interests that may give rise to conflicts. The symposium's contributions examined how landscapes embody tensions between nature and culture, for instance in the historical use of forests as pastureland (e.g., Bürgi & Lock 2024), or between conservation and use. The ongoing debate about large carnivores, in Switzerland particularly wolves, provides a striking example. The wolf can symbolize wilderness for some visitors, evoke fear among affected local populations or tourists, and pose management challenges for policymakers (Gattiker & Timcke 2024), all while playing a crucial and acknowledged ecological role in the Alpine ecosystem. Taken together, these perspectives highlight landscapes as arenas of negotiation, in which diverse perceptions, emotions, and interests intersect and are contested. Rather than treating conflicts as contradictions, the symposium underscored the potential to view conflicts as opportunities for exploring diverse perspectives and land-use approaches, as was shown in a contribution on the acceptance of the bear in the Central Apennines in Italy (Mayer et al. 2023).

Environmental education emerged as a key strategy for fostering coexistence between culture and nature, as is frequently done through dedicated courses for students in the SNP region, organized by diverse research

Figure 3 – Word cloud generated from the abstracts submitted to the research symposium. Word extraction and translation to English done by ChatGPT; Wordcloud generated by https://wordclouds.ethz.ch/.

institutions across Switzerland. By raising awareness, such initiatives can soften conflicts and enhance mutual understanding across different stakeholder groups (Buchecker et al. 2023). Ultimately, landscapes can be framed as societal negotiation processes, shaped by collective decisions about use, values, and identity.

The potential for up-scaling

A recurring theme at the symposium was the transformative potential of local initiatives and participatory approaches (Mayer et al. 2023). Projects such as regional nature parks demonstrate how grassroots efforts can spark off broader societal changes (Keller et al. 2022, 2025). For instance, as part of a ZHAW initiative of the Research Group for Wildlife Management supported by the Biosfera Val Müstair, measures such as the installation of bear-proof waste containers and electric fences to protect beehives were developed to prevent bears from becoming habituated to humans (Rempfler et al. 2009) and were later scaled up to other regions (e.g., Lower Engadin, Albula, Poschiavo), contributing to Val Müstair's continued absence of conflict-prone bears since the arrival of one of the first bears in Switzerland, i.e. JJ3. Moreover, emerging technologies hold considerable potential to both scale up landscape research and provide non-invasive monitoring opportunities in protected natural areas. Two dimensions of scalability were particularly emphasized:

- **Political scaling**: Local projects can inspire policy shifts at regional and national levels. For instance, conflicts from high red deer densities arose in the surroundings of the SNP for decades (Blankenhorn et al. 1979). The sustained population growth could only be halted by two measures, which allowed stabilizing the population at a lower density (Haller 2002; Haller & Jenny, 2013): the introduction of small-scale hunting ban areas around the SNP and the implementation of special hunts following the short regular hunting season in September, both of which were supported by scientific research.

- **Methodological scaling**: Technological advances such as eDNA analysis (Leugger et al. 2025), remote sensing (Rossi & Wiesmann, 2024) or artificial intelligence for camera trap evaluation (Timcke 2025) extend research capacities to remote and inaccessible landscapes. These methods are minimally invasive, scalable, and particularly suitable for sensitive environments such as protected areas.

The scalability potential of local initiatives and methods has the capacity to extend beyond individual projects, enabling broader societal, ecological, and policy impacts. By integrating participatory approaches with innovative, minimally invasive technologies, such efforts can inform regional management strategies, enhance conservation outcomes, and serve as models for replication in other landscapes and jurisdictions.

Yet even with technological advances, ground truthing – direct field observations – remains indispensable for validating remote sensing data and ensuring robust interpretations. The SNP's 111-year research tradition constitutes an unparalleled resource in this context. Its long-term datasets allow researchers to track ecological and geomorphological processes over a century, offering insights into the interplay of climate, biodiversity, and land use (e.g., Schütz et al. 2003; Siegrist 2022; Gubler & Robinson 2025). Preserving and continuing these datasets is essential for future generations of landscape research.

Methodological diversity in landscape research

The diverse contributions underscored that understanding landscapes requires a comprehensive array of methodological approaches, combined with both inter- and transdisciplinary research frameworks. No single method suffices to capture the full complexity of landscapes; instead, a spectrum of approaches is required. A recently conducted project in Switzerland, ValPar.CH, on nature's values and services, provides a compelling example of how methodological diversity

can be translated into practice to generate a holistic understanding of landscapes. The ValPar.CH project addressed the *multiple values* of landscape and nature by combining ecological, social, economic, and planning perspectives. Ecological analyses included species distribution modeling, assessments of Nature's Contributions to People, environmental geodata, and remote sensing. Social perspectives were captured through surveys, transect walk interviews, geosemantic text analysis, and focus groups. Economic perspectives involved quantifying monetary values of Nature's Contributions to People. From a planning and management angle, scenarios were developed that linked natural processes, human-induced changes, and stakeholder visions. Complementary analyses included the development of archetypes of land systems and policy studies on governance structures. These strands were finally brought together in a co-production perspective that synthesized findings and translated them into recommendations for diverse stakeholder groups (Keller et al. 2025). Similarly, the symposium itself showcased the methodological richness of contemporary landscape research and served as a platform for co-producing knowledge, demonstrating how the integration of diverse tools and perspectives can yield more comprehensive and implementable insights (Figure 3).

Conclusion: research creates knowledge– landscape builds bridges

A consistent message across contributions was that landscapes are in flux (e.g., Wartmann et al. 2021). Physical processes and human activities continuously reshape landscapes, sometimes abruptly – such as through rockfall or landslides or through the construction of hydropower dams or other infrastructure – or gradually, as in glacier retreat or encroachment of pastures (e.g., Haller et al. 2013). Understanding these transformations requires integrating historical and contemporary perspectives. Long-term research provides critical insights into the drivers of change, whether climate dynamics, biodiversity decline, or land-use intensification. The symposium demonstrated that landscape is constantly evolving – geologically and ecologically – and so are the cultural and societal relations to landscapes. To understand and responsibly manage landscapes, research and long-term monitoring on landscape and its changes are indispensable since they document changes, enhance visibility, and deepen our understanding of how climate, biodiversity, and human actions interact over time. Long-term research is particularly vital for identifying landscape transformations in the global context. In this regard, the SNP's unique long-term datasets are a scientific treasure, shedding light on ecological change, hydrological cycles, geological dynamics, and socio-cultural transformations (Baur & Scheurer 2014).

Through its long-term collaboration with the Swiss Academy of Sciences, serving both as a network in the scientific community and as a bridge between science and policy, along with the other regional institutions, the research setting in the Lower Engadin and Val Müstair provides an exceptional platform for interdisciplinary research and exchange, as exemplified by the discussions and findings presented at the symposium.

As emphasized during the symposium, landscapes can function as bridges between disciplines – natural sciences, cultural studies, planning, and law – and between research and practice. But disciplines are not inherently capable of understanding each other, and translational work is necessary to facilitate meaningful dialogue. This is a key role of the Swiss Academies. Both the Research Commission of the SNP and the Forum Landscape, Alps, Parks aim at fostering this dialogue by providing network opportunities. The symposium both highlighted the challenges of comparing and understanding different viewpoints on landscapes while also emphasizing the potential of the landscape approach for interdisciplinary collaboration. While some of the research results presented at the Symposium are restricted to a local setting (the SNP and its surrounding area), the methods applied can inspire research in other areas too. In addition, debates about the plurality of landscapes values are an important topic for all Switzerland (e.g., Keller et al. 2025) and beyond.

In sum, the Research Symposium SNP+ reaffirmed that landscapes are dynamic, contested, and multidimensional. Research not only generates the knowledge needed to understand them but also fosters the societal and disciplinary bridges necessary for their sustainable future. After one intense day full of talks and discussions in Zernez and a visit of the special exhibition on the re-photographs in the exhibition centre of the SNP, discussions were continued on three excursions through the beautiful landscapes of the lower Engadin, the Val Müstair, and the SNP – locations that are widely appreciated for their cultural heritage, for their interplay between nature and culture, and for their wilderness.

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