Human Ecology
https://doi.org/10.1007/s10745-023-00468-z

A Heritage Without Boundaries: Nature-Culture Synergies in and around Norwegian Protected Landscapes

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Accepted: 11 December 2023

Abstract
We address the question of nature-culture synergies in protected mountain landscapes with a specific focus on the Norwegian National Park of Hardangervidda. Fragile and complex ecosystems developed from long-lasting socio-ecological grazing processes that started approximately 4000 years ago in Scandinavia are facing manifold environmental challenges and societal issues that endanger both natural and cultural heritages. Our goals are to clarify the nature-culture synergies and relationships and investigate holistic management and preservation of natural and cultural values. Our results highlight an urgent need to develop holistic conservation frameworks and methodologies for protected landscapes that integrate cultural and natural heritages and enhance the potential of local communities to protect threatened semi-natural environments and experienced-based knowledge for the future.

Keywords National park management · Landscape · Heritage · Biocultural diversity · Traditional ecological knowledge (TEK) · Conservation · Hardangervidda National Park · Norway

Introduction

In Norway, places like Hardangervidda National Park, often popularly perceived as 'wild' and 'untouched', have in fact evolved over thousands of years of human resource utilization, production, and management, starting 8500 years ago with relatively low-level interventions through reindeer hunting, fishing, and other food-gathering activities (Buskerud County Municipality, 2011: 10). The first traces of animal herding on the plateau of Hardangervidda date back 4000 years. Use of summer mountain pastures and iron extraction started 2000 years ago, and travelling merchants along established routes are recorded from the Middle Ages (e.g., salt, iron, livestock, etc.). During the early Iron Age (approx. 500 B.C.–550 A.D.), a complex infield-outfield system was created to accommodate an increasing need for winter fodder production for livestock caused by a changing climate and possibly also societal factors (Reinton, 1955). Land use intensity of outlying areas fluctuated through time with various agropastoral systems, but traditional land use activities reached their maximum extent in the mid-nineteenth century (Emanuelsson, 2009; Reinton, 1955), characterized by multiple uses that were spatially and temporally differentiated (Plieninger et al., 2016) and contributed to creation of the semi-natural environments of large parts of Hardangervidda and surrounding areas. These semi-natural landscapes are now some of the most threatened habitats in northern Europe (Emanuelsson, 2009), with areas of high biological and cultural diversity changing and deteriorating fast (Norwegian Biodiversity Information Centre, 2018) due to climate changes as well as social, economic, and political pressures (Bürgi et al., 2017). We argue that the general decline of mountain pastoralism and other traditional practices has gradually led to the deterioration of several semi-natural habitat types, including grasslands, as well as the loss of landscape characteristics and locally adapted knowledge systems and practices, resulting in diminished potential for future sustainable adaptations (Pilgrim et al., 2008).

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Published online: 01 February 2024

As part of the PARKAS research project on national park management (2018–2022, The Research Council of Norway MILJØFORSK-Programme), we assess whether the overall values, qualities, and diversity of the landscape, which were drivers of the national park preservation movement in Hardangervidda, are being holistically preserved and managed from four perspectives or concepts—landscape, biocultural diversity, traditional ecological knowledge (TEK), and heritage. We also consider how future solutions can be inclusive of a broader range of voices and concerns, thus generating higher levels of trust among the various stakeholders and governance structures.

Methods

We adopted a mixed approach entailing both qualitative and quantitative methods to investigate nature-culture synergies in north-eastern Hardangervidda. Fieldwork and interviews were conducted between 2019 and 2022 by Bele and Simon Nielsen.

Study Area

Hardangervidda in southern Norway, is Europe's largest peneplain—an undulating highland levelled by glacial erosion during the ice ages and today characterized by a barren, treeless plateau with scattered lakes and rivers stretching roughly from the Hardangerjøkulen glacier in the north to Gaustatoppen mountain (1,883masl) in the south, and from the Hardangerfjord in the west to the valley of Hallingdal in the east. Much of the plateau comprises Hardangervidda National Park, created in 1981 (cf. Hardangervidda National Park Regulations, 1981; 1998) under the Nature Conservation Act of 1954 (repealed by the Nature Diversity Act, 2009), the largest national park in mainland Norway at 3422 square kilometres.

Our study area is in the municipality of Nore og Uvdal (2,501 km^2, of which 873 km^2 are in Hardangervidda National Park; population 2509 in 2023 (Statistics Norway, 2023c)). It encompasses areas in North-Eastern Hardangervidda both inside and outside the national park borders (Fig. 1), which enabled comparison between protected and

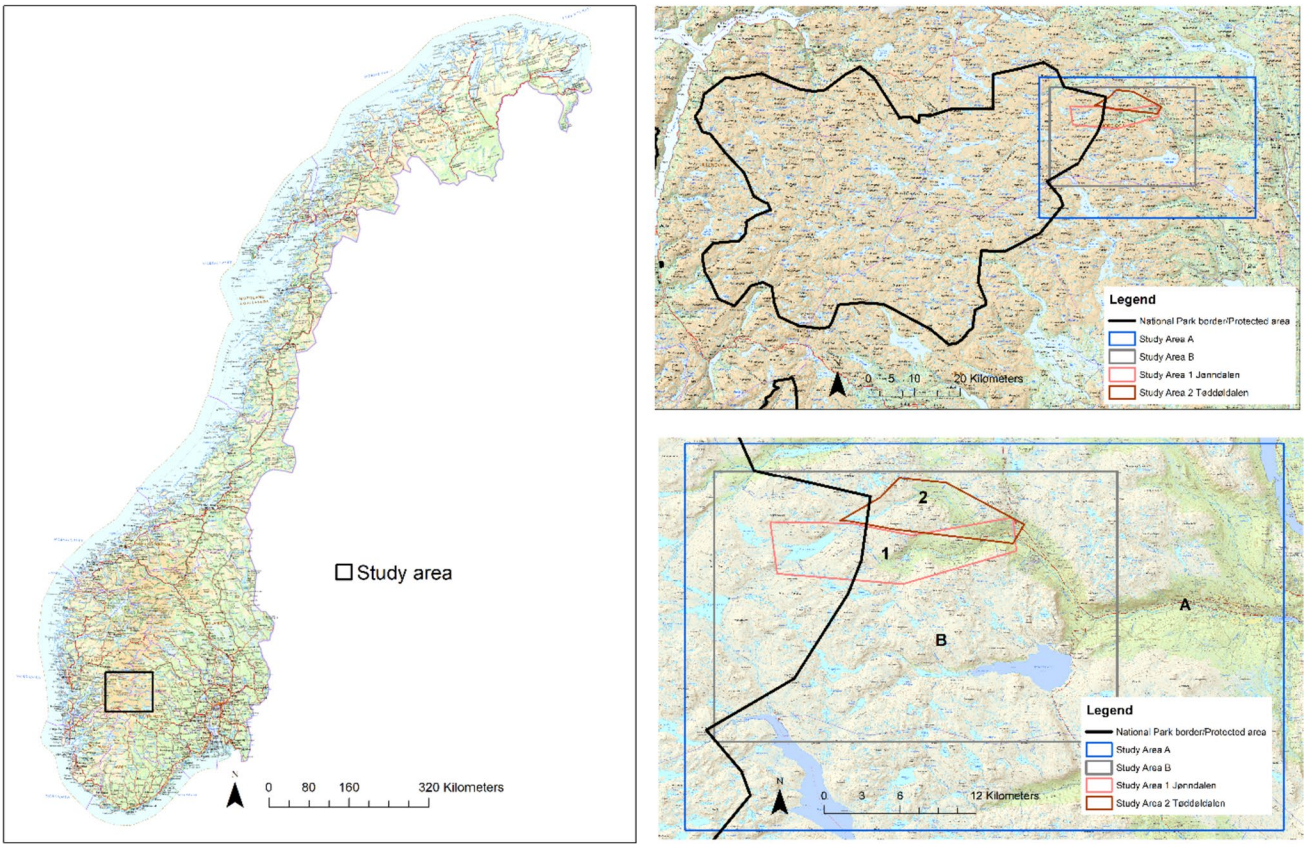


Fig. 1 **a, b, c** Maps of the study area in north-eastern Hardangervidda (Fig. **a**, left). Hardangervidda National Park, centred at 60° 25´N; 9° 15´E, is 3,422 km² and averaging 1100 metres in altitude (Fig. **b**, upper right). The map on the lower right (Fig. **c**) shows the different subareas of the main study area. Source: Geonorge.no

unprotected areas. Additionally, the area has good pastures and is rich in physical cultural heritage sites and important for both agricultural activities and tourism. Nore og Uvdal is primarily a rural municipality (Statistics Norway, 2023b) with 581 agricultural properties of which 59% are permanently occupied by 39.6% of the population (an average of 3 persons per farm). The livestock husbandry system has changed dramatically since the 1960s. From 1969 to 2022, the number of farms keeping cattle declined from 232 to 43 (82%), and the number keeping sheep has declined from 191 to 63 (67%). Eight farms kept dairy goats in 1969, but none are currently registered. The total number of livestock on outfield pastures declined by 34% from 1995 to 2022 (35% of cattle and 33% of sheep) (Statistics Norway, 2023a). In the 1970s, the municipality of Nore og Uvdal rejected hydroelectric power projects and actively committed to the establishment of the national park, reflecting an interest in environmental and management issues among the local elected administration, small farmers, and workers (Ibsen, 2002). Only small areas of the semi-natural habitats have previously been mapped, however, and there has been little focus on intangible cultural heritage or the role of traditional ecological knowledge (TEK) in management practices.

We selected two adjacent valleys as representative and complementary landscapes for our study (Fig. 2a, b). Tøddøldalen is a narrow V-shaped valley carved by a fast-flowing river with deep gorges and waterfalls, while

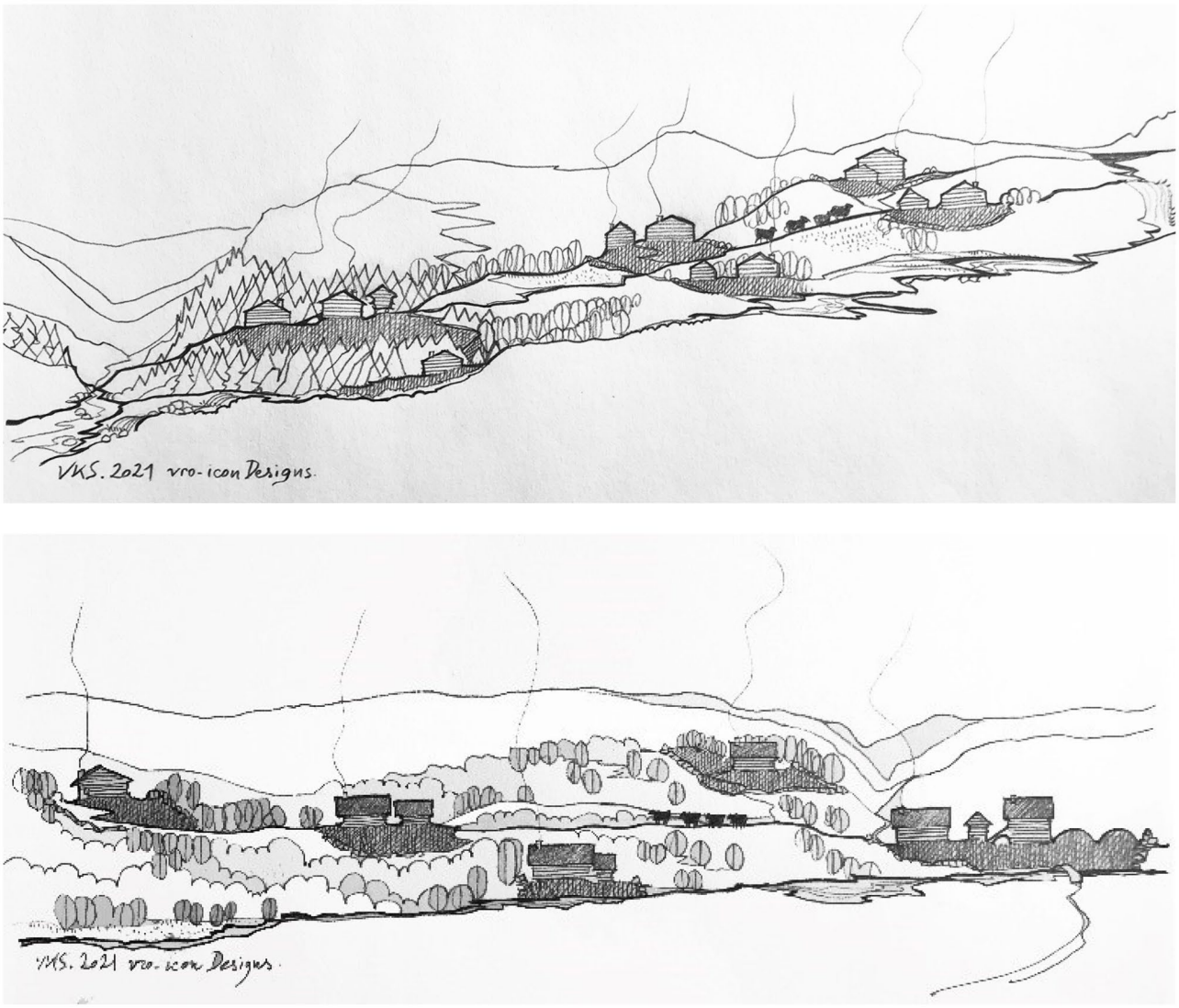


Fig. 2 **a, b** Stylistic illustrations of the natural terracing of the summer farms along the river in Tøddøldalen (Study area B2, above) and the horizontal summer farm structure along the river in Jønndalen (Study area B1, below). Original drawings, graphite pencil on paper. Author: Simon Nielsen

Jønndalen is a broader U-shaped valley drained by a river with a slower current.

Mixed Methodology

We adopted triangulation, a research approach involving multiple perspectives, to investigate how well integrated natural and cultural heritage are in land management to support the preservation and sustainability of biodiversity, landscapes, and heritage values (see Creswell & Creswell, 2018). We examined relevant literature and maps (Morgan, 2022), both as preparation for fieldwork and interviews and as for additional information concerning heritage values in the landscape (i.e., archives, written sources, historical maps, aerial photos, etc.). We supplemented information about traditional land use practices in Uvdal Herred (the old municipality unit) with an analysis of ethnological research accounts in the Norwegian Museum of Cultural History (NEG, 1946, 1947a, b, c, 1948a, b, c, 1955).

We selected informants on the basis of their connection to the national park, ownership of summer farms, history of the farm, and type of practices (initial data provided by the municipality of Nore og Uvdal). We identified seven informants in the initial phase (five men and two women, approx. age 30 to 70). Six persons (five men and one woman, approx. age 40 to 80) were added in a second phase using "snowball sampling" (Parker et al., 2019). We conducted three daylong walking interviews on-site, two with a woman and one with a man, which offered an opportunity for deepening understandings of lived experiences (Lorimer, 2011). We held two local public workshops (approx. 45 persons), six interdisciplinary scientific seminars/conferences, and several meetings with representants of the municipality to supplement our data. Telephone conversations and digitally based solutions replaced the physical meetings during the COVID pandemics.

We conducted semi-structured, in-depth interviews, with a predetermined thematic framework for increasing data comparison among interviews (King et al., 2019), checking them afterwards by sharing the transcripts with our informants and comparing data in literature and archives. Fieldwork included botanical registrations and landscape analysis, conducted on five summer farms in each valley and along selected paths and droving routes (drifteruter, NO). Semi-natural habitats (nature types) were identified and classified according to national classification systems in Norway (Norwegian Biodiversity Information Centre, 2022). We recorded indicator species (vascular plants) in those habitats. We identified landscape forms, environmental constraints, architectural characteristics through onsite landscape analyses, including the location of farms and buildings (i.e., geographical variation, orientation, connection with national park), land-use history (i.e., natural resources utilisation, farm animals), building techniques, place names and facts connected to farmsteads and events. We consulted the Norwegian landscape reference system, historic maps and local history books with records dating back to the Middle Ages to complete the analyses (Kartverket, n.d.; Puschmann, 2005:50–53; Sønsterud, 1997–2000). We checked the current protection status of farms, summer farms, cultural heritage, archaeological sites, historical routes, and cultural landscapes in the data base *Askeladden* (Directorate of Cultural Heritage, n.d.). We conducted a supplementary approach to landscape through our own illustrations and paintings to capture our perceptions of nature, experiences, and the aesthetics of landscape (Figs. 3 and 4), in an attempt to shift from materialist constructs to affective landscape relations (Berberich et al., 2013; Ingold, 2011).

Applied Concepts

In this paper we examine our data through four complementary concepts.

Landscape

Over the past three decades new international frameworks for landscape policy and management have emerged, notably the European Landscape Convention (Council of Europe, 2000), The Florence Declaration on Heritage and Landscape as Human Values (ICOMOS, 2014), and the Convention for the Safeguarding of Intangible Cultural Heritage (UNESCO, 2003). In Nordic countries the pre-modern customary sense of landscape as the area of a coherent community continues to have resonance in national policy reflected in the Norwegian Government's White Paper on New Goals for Cultural Environment Policy (Jones & Olwig, 2008; Meld. St. 16, 2019–2020). Landscapes acquire new meanings over time through a layering of both cultural and natural values and attributes resulting from the interaction between human activities and environmental and ecological processes (Kaya, 2016; Schmeller, 2021; Taylor & Lennon, 2011; Wästfelt et al., 2012). They encompass the history and cultural traditions of a place in addition to its ecological value (Stenseke, 2016). Recently, the term 'community' has acquired a more complicated definition encompassing both local and non-local interests in claims for use or access as preconditions for landscape justice, social sustainability, and well-being (Egoz et al., 2011; Zhou et al., 2019), but also for biodiversity conservation (Inogwabini, 2020; Negri, 2005). Informed landscape management thus has the potential to address even the most major environmental and social challenges facing the world, and to guide future decisions.

Fig. 3 Original watercolour painting showing a hay barn in attractive summer farming landscape in July 2020, in Tøddøldalen. Watercolour on paper. Author: Simon Nielsen

Biocultural Diversity

The concept of biocultural diversity has developed as a new field of research and action from the early 1990s. Article 8(j) in the Convention on Biological Diversity (United Nations, 1992) highlights the benefits of traditional ecological knowledge for the conservation of biological diversity and advocates wider utilization of knowledge innovations and practices. UNESCO's (2008: 8) definition of biocultural heritage as "living organisms or habitats whose present features are due to cultural action in time and place" is based on an integrated view of nature and cultural heritage (Svensson et al., 2021) that is often associated with indigenous populations and rural communities, and represents an understanding of cultural landscapes as the outcome of long-term biological and social relationships (Agnoletti & Rotherham, 2015; Gavin et al., 2015; Lindholm & Ekblom, 2019; Maffi & Woodley, 2010; Oteros-Rozas et al., 2013). Biocultural traces often persist in many human-impacted landscapes, even long after abandonment, and can be seen as a remnant of historical traditional land use practices, or as a biocultural heritage (Eriksson, 2018; Negri, 2005). Here we use biocultural diversity as the dual approach to biological and cultural diversity in landscapes that has led to varying interests within the same location as defined by Maffi and Woodley (2010). The diversity of life on a local level is not only made up of ecosystems, species, and genetic diversity, but also ecological knowledge, cultural values, and practices, institutions, and language (ibid.).

Traditional Ecological Knowledge

Traditional ecological knowledge (TEK) is a function of long-term use and the transmission of experience from generation to generation that enables practitioners to adapt to change (Fernández-Giménez et al., 2012; Oteros-Rozas et al., 2013). There is no universally accepted definition of TEK, but Berkes (2018) applied the term to knowledge of the land. However, TEK is often undervalued in policy and decision making about landscape and ecosystem management, which instead privileges and is grounded in western science and thus encourages the separation of interests and approaches to tackling issues locally, which ultimately leads to loss of both heritage values and cultural landscape values (Sanderson et al., 2002). TEK's role in strengthening community resilience when responding to global environmental change and multiple challenges is increasingly recognised (Gómez-Baggethun et al., 2013). Knowledge systems and practices concerning nature and the universe are included in the UNESCO Convention for the Safeguarding of the Intangible Cultural heritage (UNESCO, 2003).

Fig. 4 Original watercolour painting showing cows grazing around burial mounts at Kruke summer farm in July, in Jønndalen. Kruke is the only summer farm still producing milk in our two valleys. Watercolour on paper. Author: Simon Nielsen

Heritage

Both the theory and practice of 'heritage' – the process of engaging with the legacy of the past – have undergone significant changes in recent decades, shifting from preservationist ideologies to adaptive management and the pursuit of more socially inclusive and collaborative approaches (Harrison, 2015) that are expert-supported rather than expert-led and celebrate heritage values that are both locally significant and nationally or internationally important. There is now widespread recognition of the plurality of heritage – including tangible and intangible aspects of cultural heritage alongside natural heritage, biodiversity, landscapes, traditions, knowledge, and lifeways (see, e.g., the Faro Convention on the Value of Cultural Heritage for Society (Council of Europe, 2005; Zubiaurre et al., 2022)). Heritage is a dynamic process constantly changed, adapted, and recreated through time within the landscapes and the society to which it belongs, with various, and sometimes contradictory, meanings and significance, depending on perceptions, time, and changing worldviews (Ashworth et al., 2007; Rigolot, 2018; Tengberg et al., 2012). Tangible and intangible heritages are interconnected (Pătru-Stupariu et al., 2019) and tangible matters can gain additional meaning viewed from an intangible perspective. Traditions, identity, and aspirations, which are the property of human culture and experience (Robertson, 2009), influence how local people interact with their environment and give meaning to their activities. UNESCO (2003) argues that intangible cultural heritage can only be heritage when it is recognized as such by the communities, groups or individuals who create, maintain, and transmit it. It is a vehicle to understand identity, cultural diversity, and biodiversity (UNESCO, 2003). In Hardangervidda, utilization of outlying resources has played a central role in the formation of cultural heritage as well as of landscape and natural heritages, which require a deep knowledge of the place, local natural resources, and social relations, including mobility (Oteros-Rozas et al., 2013) which, historically, has been a common social and ecological response to changes and environmental risks. But local heritage may differ from that recognised by professional groups and authorities (Robertson, 2009), which, in turn, may reduce cultural diversity and complexity. Ocak (2016) suggests that the loss of cultural heritage can have tragic consequences for the sustainability and interconnection of biological and cultural diversity.

Results

The Meaning of Heritage Related to Land use Practices

Our informants considered that heritage encompasses buildings, cultural-historical areas and sites, and other physical cultural elements in the landscape, such as the prehistoric hunting site of Dyregravshalli, the burial mounds at Kruke, iron extraction facilities and coal pits in Jønndalen, the sacred place of Kyrkjuna, and diverse stone fences and summer farm paths. It also includes the long history of the place and the cultural continuity of society's relationship to the landscape, and domestic reindeer husbandry on the Hardangervidda practiced for about 180 years, from 1780 to the 1960s (Vaa & Bitustøyl, 2012). Their cultural heritage also includes intangible and natural assets. They explained that previous generations had made responsible and efficient choices based on their practices, embodied experiences, and traditional knowledge of the landscape, and used their natural resources rationally and according to changing environmental conditions in the hope that careful management would provide in the long term for the next generation.

Informants include traditional summer farming practices, in which women had an essential role, in their cultural heritage. Up to the mid-twentieth century the whole agricultural community was commonly involved in outfield activities. The trading of goods and cattle farming associated with the use of old roads over Hardangervidda are perceived as one with the summer farms' physical place, geographical location, and immediately surrounding landscape, including cultivated fields, grazing areas, and resources on outlying land more generally. Semi-natural grasslands and other habitats (biocultural heritage) are acknowledged as part of the heritage connected to summer farming and pastoralism. The character and sjel (ENG: soul) of the place, local dialect, and sacred places associated with summer farms are also defined as a part of their intangible heritage. At present, however, in the two study valleys, only one dairy summer farm is still active, producing milk during the summer season (Fig. 4).

Among heritage of an intangible nature, our informants cited place names indicating locations, workplaces, land uses, sacred places, or places associated with superstitions. Many place names in our study area contain information about local agricultural conditions, e.g., 'Grønnmælroe' means that the grain didn't ripen, 'Smørholet' indicates good conditions for production of high-quality butter, and 'Venegrøstulen' refers to good pastures. They also inform about important geographical locations, nearby natural features, local flora, farmsteads, or individuals from the past. References to distinctive geological formations in the landscape (e.g., 'Kyrkjuna' is derived from the word church) or to local legends (e.g., 'Huldrehaugen' also called 'Trollhaugen,' means the troll's knoll) are also common (Appendix 1).

Domesticated and social animals also have valuable experience-based knowledge of the landscape, and an old lead cow, for example, will guide and train new additions to their herd (Tunón & Bele, 2019). Grazing livestock follow old paths in the landscape and graze the same areas over generations (Syse, 2022). In recent decades, the number of farm holdings with domestic animals and grazing livestock on outfield pastures has declined dramatically in Nore og Uvdal municipality (Statistics Norway, 2023a), putting at risk the continuity and permanence of these activities.

Landscapes, Aesthetic Values, and Biocultural Diversity

The study area is very varied in terms of relief, and the Jønndalen and Tøddøldalen valleys are a mosaic of natural and semi-natural parcels of land of variable sizes and profiles (e.g., pastures, marshes, outfields, clearings, etc.). Some of these parcels are completely or partially surrounded by distinct human-made boundaries (e.g., stone walls, cairns etc.) as well as natural boundaries (e.g., streams and rivers). As a result of their landform and geographical features and qualities, Jønndalen and Tøddøldalen supported a variety of activities and practices related to natural resources and communication between west and east.

The current state of biocultural diversity in the valleys is the combination of historical (Fig. 5) and ongoing land use and environmental processes. Semi-natural habitats and plant species diversity can be connected to former and present land use practices, and to TEK, for example local plant traditions (Høeg, 1974; Kollandsrud, 1908) (Appendix 1). Different types of semi-natural habitats were identified, such as hay meadows, semi-natural pastures, semi-natural fens and wet meadows, wooded pastures, boreal heath, and species-rich road edges and paths. In general, semi-natural habitats in Norway are red-listed (Norwegian Biodiversity Information Centre, 2018), mainly because of regrowth processes replacing biocultural diversity with mainly scrub and woodland after the abandonment of traditional land use practices (Norwegian Environment Agency, 2022). Due to the declining number of cattle and sheep grazing on the outfields (Statistics Norway, 2023a), there could be serious challenges associated with the maintenance of landscape and biodiversity values in the future. Traditional mowing of hay meadows is no longer practiced, but some of the meadows at summer farms (study area B1 and B2) have a potential for the re-introduction of traditional management regimes.

Fig. 5 Grazing conditions on Hardangervidda in 1909. Pastures connected to summer farms (green), sheep and reindeer pastures at high mountain areas (yellow), and private properties (red). Colour intensity is indicating pasture quality. See the original colours in the online version. Source: Trykt i Den priv. Opmaalings Lith. Off. Kr.a. The map is scanned from a paper version lent by SNO, the Norwegian Nature Inspectorate

Droving routes, such as Nordmannsslepene (Bremnes, 2007), and paths to summer farms and outlying areas are characteristic physical heritage in the landscape. Often, such paths also contain semi-natural ecologies (Appendix 1) that require active management to survive.

Burial mounds, such as the two located at Kruke (study area B1, Fig. 4), are important archaeological sites in the mountain landscape, but as unusual landforms they also represent specific semi-natural habitats (Tveit, 2005). Some areas near the summer farms are subject to modern cultivation, but still have some semi-natural characteristics. The most species-rich area recorded was at the summer farm Veneli (study area B1), a location with calcareous soil, and several plant species not found at the other summer farms. Veneli was abandoned in 1876 due to lack of fuel wood in the surrounding area. Only small patches of semi-natural grassland remain. There is now an urgent need for different management practices because grazing milk cows avoid the area due to an overgrown path, and the ruins of buildings and stone fences are overgrown by trees and bushes (Fig. 6). Most of the areas need management practices that maintain both semi-natural habitats and other heritage values related to them.

None of the observed indicator species for semi-natural habitats in the study area is red-listed (Norwegian Biodiversity Information Centre, 2021), but at a local level several of them are declining due to reforestation, lower grazing pressure, or simplification of the grazing system, e.g., *Botrychium lunaria, Gentianella campestris, Antennaria dioica,* and *Campanula rotundifolia* (Appendix 1, Fig. 7). Also, the burial mounds still support semi-natural species, such as *Achillea millefolium* (yarrow), *Ranunculus acris* (meadow buttercup), and *Anthoxanthum odoratum* (sweet vernal grass) (Appendix 1). The continued existence of those indicator species will depend on the maintenance, or reintroduction, of traditional land use practices.

Paths connecting summer farm sites and those parts of the old droving routes (today, also used as tourist routes) that are still grazed are among the most species-rich habitats recorded in the area because of grazing animals, trampling effects, former hay transport, and travellers along the paths (Svalheim & Sickel, 2017). Trees such as birch (*Betula pubescens*) were pollarded and coppiced to produce small wood and winter fodder (leaf) and they are now classified as a biological heritage.

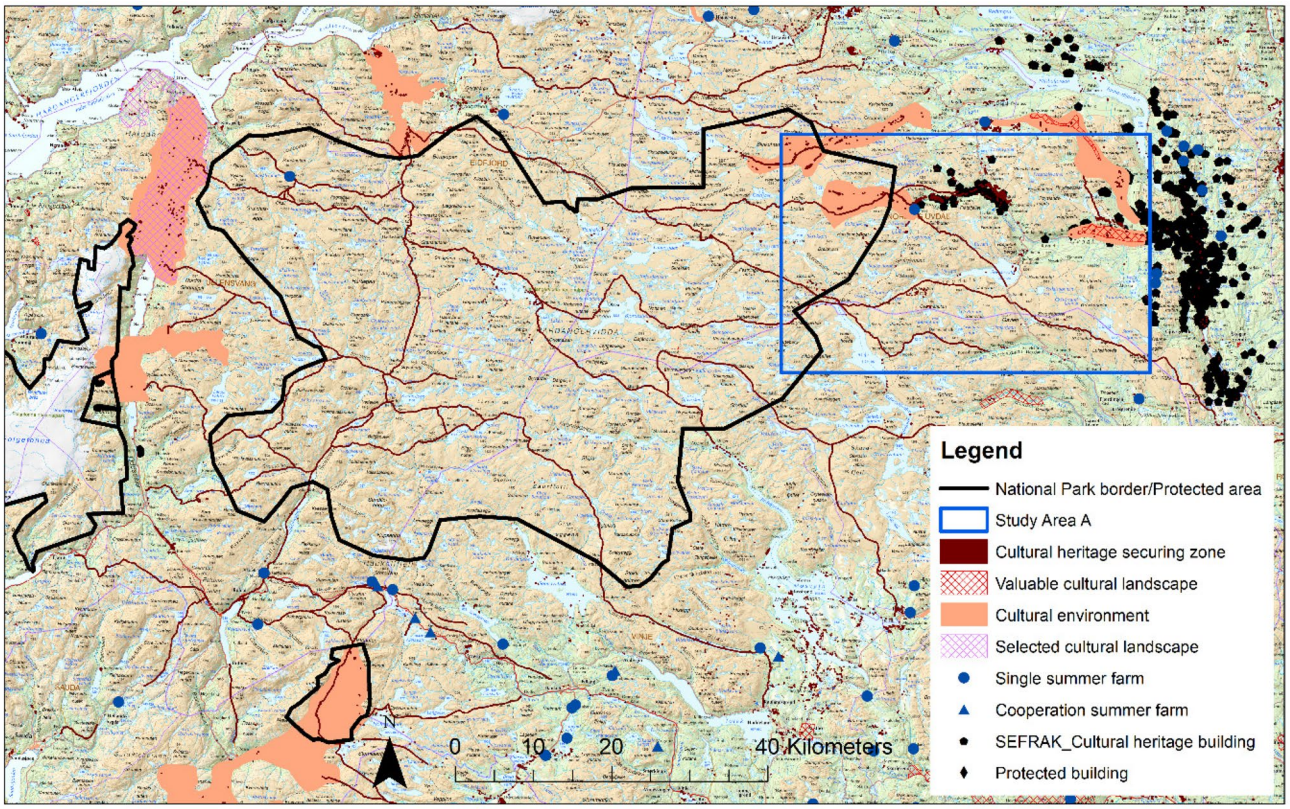
Threats and Challenges

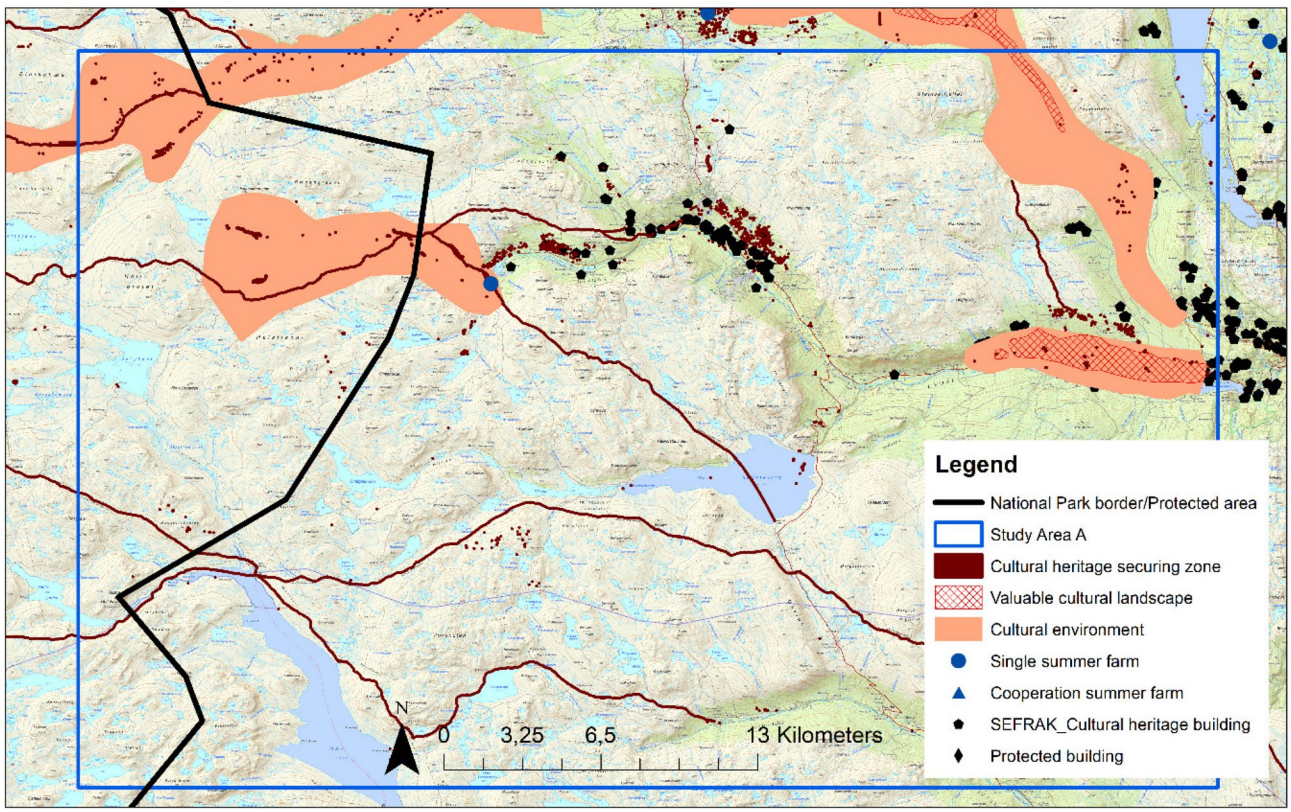
A common local perception is that the activities that once connected people in the villages and farmsteads to the outlying fields and the mountains through seasonal movements

Fig. 6 Ruins of buildings overgrown by trees and bushes at the summer farm Veneli. Small patches of semi-natural grassland remain. Photo: Bele

and historical trails across and within natural boundaries are today disrupted by the artificial administrative boundaries of the national park (Fig. 8a, b), which are regarded as quite incompatible with the patterns and social systems established in the past. Different sets of rules apply on each side of the park boundary, and this has upset the course of traditional

Fig. 7 Some of the indicator species that decline at a local level due to land use changes and reforestation. From left to the right*: Botrychium lunaria* (common moonwort)*, Gentianella campestris* (field gentian)*, Campanula rotundifolia* (harebell) *and Antennaria dioica* (mountain everlasting). Photos: Bele


Legend
National Park border/Protected area
Study Area A
Cultural heritage securing zone
Valuable cultural landscape
Cultural environment
Selected cultural landscape
Single summer farm
Cooperation summer farm
SEFRAK_Cultural heritage building
Protected building
N
0
10
20
40 Kilometers


Legend
National Park border/Protected area
Study Area A
Cultural heritage securing zone
Valuable cultural landscape
Cultural environment
Single summer farm
Cooperation summer farm
SEFRAK_Cultural heritage building
Protected building
N
0
3,25
6,5
13 Kilometers

◂**Fig. 8** **a, b** Maps showing heritage aspects as selected on municipal and national registers: (**a**) Above: In the Hardangervidda National Park, and the surrounding areas; and (**b**) Below, Study Area A. The orange pink areas show important cultural environments, and the black dots and black diamonds respectively show cultural heritage buildings from before 1900 AD (SEFRAK register) and protected buildings as defined by the Norwegian heritage authorities. SEFRAK stands for «Sekretariatet For Registrering Av Faste Kulturminner» (our translation: The Secretariat for the Registration of Permanent Cultural Heritage) and is a nationwide register of older buildings and other cultural monuments in Norway. Source: Geonorge.no

activities and knowledge transfer (Simon, 2012). Our sources indicated that the knowledge associated with traditional use of outlying land is rapidly disappearing and that the open landscape, characteristic both of Hardangervidda and the surrounding areas, is changing as scrub and trees grow back and as the tree line moves higher (Bryn & Potthoff, 2018).

Pastoralism and transhumance systems practiced in Hardangervidda since the Bronze Age (Ryvarden, 2011) continue, but the range of social and physical activities connected to them, as well as the use of summer farm buildings and natural resources have simplified, as in other parts of European countries (Bele et al., 2021). In general, grazing conditions for sheep and suckling cows are good in Hardangervidda and the surrounding areas. Nearly 40% of the total area of the national park is now grazed by sheep (Rekdal et al., 2009), and large areas are also grazed by cattle (Fig. 9). Central parts of Hardangervidda are not grazed by domestic animals but by wild reindeer (Vaa & Bitustøyl, 2012). A few summer farms are still in use for milk production (Fig. 9), others are in disrepair or ruins, mainly due to gradual abandonment since the late 1800s. Some of the old summer farms are still used for shelter, second residences, or tourist huts, but changes in the functions of summer farms leads to a depletion of cultural meaning, and loss of heritage, landscape, and biodiversity values.

Many informants expressed a fear that the traditions and TEK will disappear with the last generation that practiced summer farming, and that their voices are not properly heard by the authorities, reflecting the absence of local heritage narratives from "authorized" heritage discourses (Smith & Akagawa, 2009). Women's voices also remain in the background (indeed, we found it difficult to reach women). Women's knowledge related to the local ecosystem e.g., preparation of dairy products, harvesting of wild berries, herbs, etc., is being lost. TEK is threatened by abandonment of plots of land, cessation of traditional activities, and mistakes made during official registration such as in maps, documents, and reports. For example, the original name of the summer farm Venegrøstulen (meaning a summer farm endowed with fertile grasslands), is misprinted on official maps using the name Venegrøvstølen *(*-grøv- wrongly indicating the presence of a moat or a ditch). Such errors contribute to annihilating the identity of a place and transforming local history and its meaning for people.

Development and Hopes for the Future

To be able to manage the landscape sustainably, the mountain farmers are dependent on an integrated and coherent pastoral system stretching from valley to high mountain that ensures the natural resources currently used for agriculture, forestry, hunting, and fishing are sustainable. State subsidies, for example, operate with deductibles too high to keep the cultural landscape open. Rural depopulation, food market competition, and a warmer climate are parallel problems that contribute to the abandonment of previously managed mountain areas. Our informants reported feeling powerless and helpless, unable to rely on support from public authorities, and finding it a daily challenge to take care of the original "soul of the place" and transmit their accumulated knowledge to younger generations so they can learn how to maintain the landscape and local natural resources. Informants told us that it might be easier for people from outside, i.e., us, to recognise their cultural landscape values.

The total population of the municipality is estimated at 2509 inhabitans (Statistics Norway, 2023c), of whom approximately 471 are children between the ages of 0 and 19, but the prognosis for the population growth in the next 30 years for this group is ca. -17%, which is a concern for the future (Statistics Norway, 2022). Nevertheless, on a positive note they reported that younger generations are returning to the area, and some are taking over farming activities.

The farms that can have a steady income from tourism (e.g., provide recreational accommodation) in addition to livestock farming have presumably greater economic robustness, but informants expressed concern that development should not impair landscape aesthetics, should respect traditional and therefore locally distinctive building styles, and must be carefully planned over the long-term. Our interviews revealed great potential for developing local food products and building local brands, but many reported that it has proved difficult to make this type of investment profitable because it requires a stable food market, complying with regulations (e.g., Norwegian Food Safety Authority), and competing with the food industry.

Outdoor activities, hunting tourism (fish, birds, and reindeer), and holiday cottage rentals are of great value for the local community, and the local alpine resort as well as mountain lodges provide important seasonal employment. The municipality currently has 4141 holiday cottages (Statistics Norway, 2023b) and 238 hotels and restaurants, compared to the 581 farm holdings (Statistics Norway, 2023b). According to some informants, tourists who visit the area want to experience the qualities of an 'authentic' living place and the tranquillity of a simpler way of life away from mass tourism.

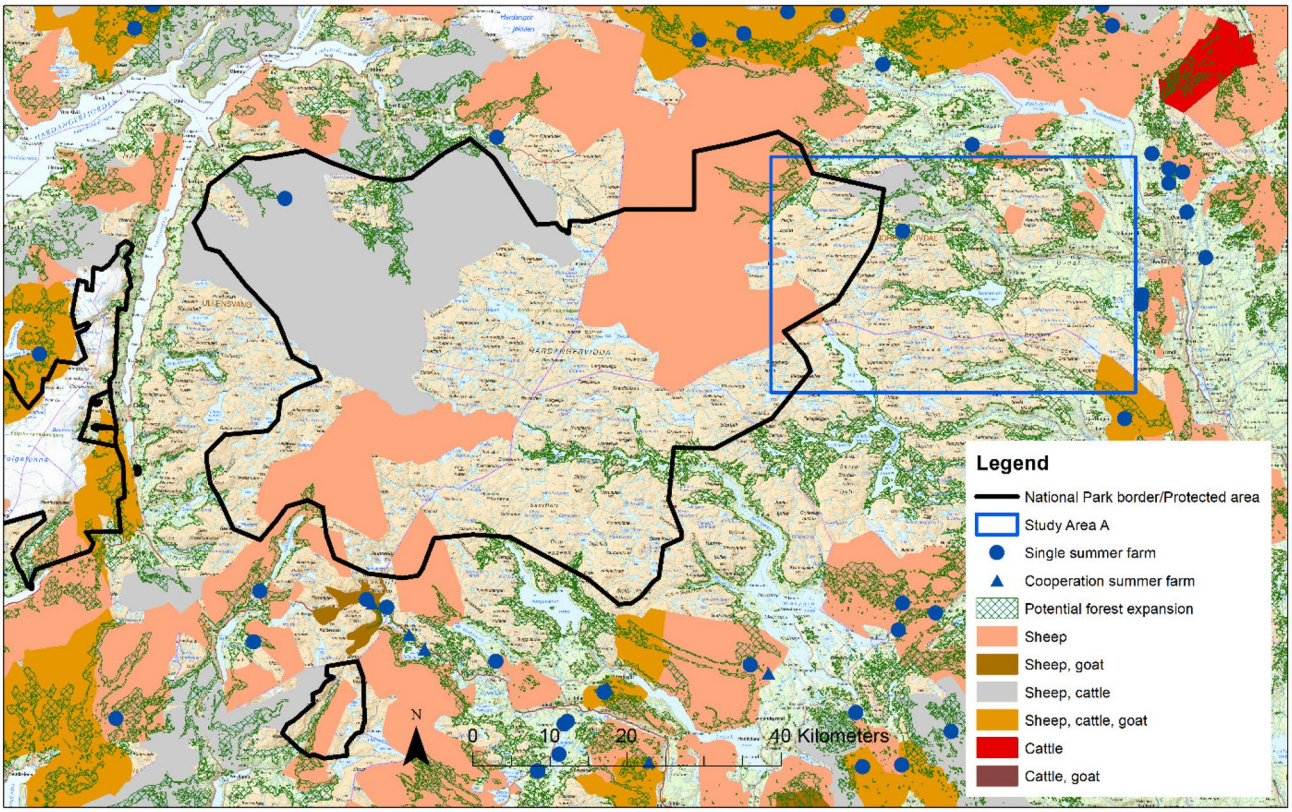


Fig. 9 Summer farming practice, grazing activities (year 2021) and the modelled potential forest expansion (Bryn et al., 2013) for Hardangervidda National Park, and surrounding areas. Source: Geonorge.no, Kilden.nibio.no

Media and marketing coverage of Hardangervidda, however, presents the area as undisturbed and natural and makes little mention of the human dimension of traditional livestock mountain farming. Our informants emphasised the need to present more fully and accurately farmers' role as landscape caretakers in the area, as they are also throughout Norway, and that more information about the landscape and its history should be available on site for visitors.

Discussion

The critique of the artificial and longstanding separation of natural and cultural heritage is now well established in the literature (Agnoletti et al., 2015; Ocak, 2016; Stenseke, 2009). Current diversity patterns are a result of both historical and current land use practices, and the survival of species diversity at landscape level needs a high variety of land use types (Maurer et al., 2006). There is today a pressing need to understand how biodiversity and cultural diversity are connected in order to design effective long-term management strategies, (Maffi & Woodley, 2010).

Nature conservation initiatives tend to adopt environmental and climate mitigation approaches that often keep cultural and natural heritages separate (Agnoletti & Rotherham, 2015; Granberg et al., 2022; Lowenthal, 2005; Stenseke, 2016), which impacts negatively on the protection and management of both (Granberg et al., 2022; van Londen et al., 2019). Many disciplines now assert that the nature-culture divide is obsolete and approaches drawn from a combined, expanded field of integrated natural and cultural heritage management are needed (van Londen et al., 2019). Our research in Hardangervidda has shown that a nature-culture separation is inconsistent with how local populations perceive and act upon the landscape and heritage left them from their predecessors.

Recognising Nature and Culture Synergies

Our interview data show that our informants define their heritage in a broad sense that include tangible, intangible, and biocultural diversity, and perceive natural and cultural values as intertwined synergies. Semi-natural environments with high biological diversity and various indigenous forms of natural and cultural heritage that constitute the value and character of the site are directly connected to physical activities, experiences, memories, and perceptions. Conversely, some cultural heritage – burial mounds, paths, droving

routes, and summer farms, for example – support semi-natural heritage, a result of the actions and interactions of natural and human factors (Council of Europe, 2000, Art.1, a). Our results are in accordance with other studies showing that local people working with the land interpret landscape in a holistic way and integrate their experiences with their environment (Antrop, 2005). Management strategies are needed that combine cultural, visual, and biodiversity aspects to encompass complex landscape characteristics (Bridgewater & Rotherham, 2019).

Considering Diversity as a Totality

Our research underlines the dynamic interactions between nature and culture and highlights the importance of assessing the whole landscape, but it also indicates that this diversity and complexity is far from being comprehensively recognised at political or administrative levels. Ample attention has rightfully been given to important topics. For example, the wild reindeer (*Rangifer tarandus*) population is today a near threatened species (NT, Norwegian Biodiversity Information Centre, 2021) and the largest remaining population in Europe. Also, the Sámi heritage (100 years old or older), and archaeological sites and early historical structures or monuments older than 1537 (marking the Reformation in Denmark–Norway), have long been automatically protected by law (Cultural Heritage Act, 1978). Other topics have received a superficial assessment at most. For example, knowledge about utilization of local nature resources is frequently absent from debates although it is crucial for several red listed habitats, cultural sites, and architectural traditions. Our informants also expressed a lack of focus on women's knowledge related to summer farming practices, invaluable supplement to the hunting and fishing traditions which make up a large part of the acknowledged heritage, even though activities are already more gender mixed today. Geographically, the lower summer pasture zones have disappeared from local management debates.

These findings reflect Pătru-Stupariu et al.'s conclusion (2019) that landscape researchers often address only land-use practices that have a direct or visible impact on the landscape, emphasising the tangible aspects of heritage. Despite the recognition of intangible heritage as an essential component of cultural diversity and social cohesion, landscape research still often overlooks the intangible attributes of the society, whether historic or recent. Wästfelt et al. (2012) also show that authorities engaged with landscape management and maintenance tend to work with small parcels of land, predefined values, and individual stakeholders, and in doing so, fail to assess the wider landscape as a complex, socio-ecological dynamic entity created in space and time.

Marginalisation, compartmentalisation, and sectorial division between different policy fields put the landscape's functional structure at risk, and are threatening the unity of cultural heritage sites, as well as the survival of semi-natural habitats and individual species dependent on them (Granberg et al., 2022) (Appendix 1). This might have grave consequences for the appropriate preservation of heritage, landscapes, and biocultural diversity in the National Park, and of course for local lifestyles – traditionally, socially, and otherwise.

Understanding the connections between different landscape characteristics and values may ultimately lead to better environmental management and protection (Atik et al., 2016). Hoagland (2017) proposes a dualism theory for conservation where TEK and scientific knowledge are applied equally in natural resource management. We see a similar need for more complex management strategies of semi-natural habitats (Hernández-Morcillo et al., 2013; see also Stenseke, 2016). There should be more determined attempts to comprehend the overall spectrum of natural and cultural heritage, such as vegetation ecology, paleoecology, archaeology, and recent cultural history (Hjelle et al., 2012). Existing and new mechanisms and knowledge should also be explored and incorporated into practical tools and applications.

Managing Heritage Without Boundaries

Ambiguities, overlapping uses, widening, or even blurring of boundaries are opportunities to increase cooperation and integration among disciplines in the landscape. Our results show that the local people do not follow administrative boundaries and do not recognise a separation between nature-culture or tangible-intangible values. Rather, connections established among people, environment, and natural resources use geographical features, climatic zones, and vegetation cover diversity available from the valleys to the alpine plateau. The park administrative borders, originally established to protect the natural ecosystems against industrialism, increasingly operate as a disruption to the long-established exchanges that are essential to the maintenance and preservation of the semi-natural ecosystems that need cultural intervention. Little attention has been given to the immediate border zones where different legislations apply; inside, where management is by three supervisory county committees, the Nature Diversity Act operates, where the Sámi natural resources are included, and cultural heritage can be included as additional conservation measures (Cultural Heritage Act, 1978), and outside, where the Planning and Building Act (2008) is applied and managed by the local municipalities, promoting sustainable development for the resident populations. Ultimately, different regulations across the park boundaries disrupt geographical connections and might influence farmers to stop or change farming activities in the park and its immediate vicinity (Fjellstad et al., 2009).

The interruption of the maintenance of summer farms (buildings and places) puts semi-natural habitats at risk.

Involving Communities

To ensure the proper preservation of semi-natural environments in the study area, nature conservation management needs to address divisions among policy, practice, and geography through incorporating diversity and the TEK of the local populations (Berkes, 2018; Hoagland, 2017; Leibowitz, 2017). It may however prove difficult to achieve such an approach. Local communities sometimes find landscape protection regulations obstructive or impenetrable (Fjellstad et al., 2009). To capture local perceptions and values in our research, we used active participation and collaboration strategies (Tengberg et al., 2012). Trust, a key concept in the PARKAS research project, was central to our interviews. Building trust between management authorities and the local community is needed in Hardangervidda to provide opportunities for all landscape actors to be heard and collect knowledge that clarifies issues of diversity and shows nature-culture synergies. A comprehensive assessment of tangible and intangible cultural heritage should then be introduced in park management, where communication, openness, participation and exchange of knowledge and experiences are vital ingredients to inform strategies and decisions.

Understanding the results of a specific activity through craftsmanship or tradition can assist in understanding and, subsequently, preserving semi-natural and cultural values (e.g., dairy production is made concrete in the form of a *seter* and its landscape and plants). It is essential to communicate the full significance of traditional knowledge, embodied experiences, and perceptions about local practices and heritages (natural and cultural). Cebrián-Piqueras et al. (2020) note a high level of correspondence between scientific knowledge and local knowledge, which should be seen as interdependent and highly permeable. Bridging traditional local and scientific knowledge systems however, requires equitable engagement (Tengö et al., 2017). There is an urgent need for Hardangervidda National Park and the surrounding areas to introduce knowledge-sharing processes and shared stewardship into policy and management to ensure a more holistic approach to nature-culture values preservation.

Integrated Approaches for Management Practices

Our research establishes the necessity for a holistic understanding of landscapes, as emphasised by the European Landscape Convention (Council of Europe, 2000). The Convention further encourages authorities to adopt policies and measures at a local level. For our study area on Hardangervidda, as well as for other protected landscapes in Norway, we recommend a management strategy that perceives heritage broadly across several boundaries (protected/not protected, nature/culture, tangible/intangible, scientific knowledge/TEK). We further recommend involving landscape, biocultural diversity, and heritage concepts more fully in nature conservation policy to ensure a strong connection between natural and cultural values in management and land use practices inside and outside protected areas. Management actions in the landscape should also be based on results from knowledge exchange between TEK and scientific knowledge. Potential benefits of TEK include more sustainable management practices, as well as socioecological resilience and adaptive capacity to handle changes (Hernández-Morcillo et al., 2013). To ensure a more holistic and sustainable management strategy, we recommend that a more systematic, co-creative, intersectional, collaboration-process should be integrated between management authorities and the local community to raise awareness and knowledge about nature-culture synergies in and around Norwegian protected landscapes.

Conclusion

Our study sheds light on cultural and natural heritage in protected areas and help raise awareness of endangered semi-natural environments. Results reveal that local inhabitants close to Hardangervidda National Park perceive their heritage broadly, regardless of the park borders, including both natural and cultural heritages, and their tangible and intangible aspects. To preserve them, it is important to secure the transmission of local knowledge about natural and cultural heritage value, diversity, and identity, and understand the synergies between them. Local communities with this knowledge demand higher levels of trust and a clear and consistent policy line connected to protection and regulations, which implies that the dialogue between them and the management authorities has hitherto been too ineffective. It increasingly becomes necessary for management to maintain close collaboration across sectors, and between holders of local and scientific knowledge; equally important is to re-explore TEK and learn about landscape-based practices from the whole historic and contemporary landscape. Only by combining scientific and local knowledge and by involving local inhabitants in management processes, can a holistic and sustainable approach be applied in protected areas that preserves heritage and semi-natural environments.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s10745-023-00468-z.

Acknowledgements This paper is based on research undertaken as part of the PARKAS research project (*Building trust to environmental*

policy as catalyst for a green transition, 2018-2022), funded by the Research Council of Norway, through the environmental research initiative MILJØFORSK programme (REF. NR. 280325), as well as through the Research Council of Norway, Contract No. 342631/L10, and own funding from the Project Owner and partners. We are grateful to all our informants and local people in *Nore og Uvdal* municipality for sharing their knowledge with us.

Authors' Contributions Bele and Simon Nielsen planned and carried out the fieldwork and the interviews in the study. They also analysed and processed the collected data for publication. Bele, Simon Nielsen, Fairclough, and Herring developed the theoretical framework together, and Bele and Simon Nielsen prepared the first versions of the text. The original artwork (watercolours and graphite drawings in Figs. 2a, b, 3, and 4) was created by Simon Nielsen (all rights reserved). The photographs (Figs. 6 and 7) were taken by Bele. All authors discussed the results and commented on the manuscript, and all authors reviewed the manuscript. Bele led the writing process.

Funding Open access funding provided by Norwegian Institute of Bioeconomy Research This paper is based on research undertaken as part of the PARKAS research project (*Building trust to environmental policy as catalyst for a green transition, 2018–2022), funded by the Research Council of Norway, through the environmental research initiative MILJØFORSK programme (REF. NR. 280325), as well as through the Research Council of Norway, Contract No. 342631/L10, and own funding from the Project Owner and partners.*

Availability of Data and Materials The interview data, which include local people's voices are anonymized in the manuscript under confidentiality agreements between the researchers and the participants. The interview data cannot be shared openly because it represents a risk of harm and re-identification for singular individuals.

Declarations

Ethical Approval Information from interviews and workshops has been collected and analyzed in accordance with the ethical guidelines from the National Research Ethics Committee for Social Sciences and Humanities in Norway (NESH), which includes privacy protection and research ethics. Current legislation on personal data protection (Act on the processing of personal data; GDPR) has also been maintained. Those who participated in the interviews and workshops were informed of their rights, and the data collection was handled confidentially.

Competing Interests We have no conflicts of interest to disclose.

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