REGION NORDHORDLAND

Nordhordland Biosphere Reserve

UNESCO application

Title: Nordhordland Biosphere Reserve - UNESCO application

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Nordhordland, September 2018

United Nations Educational, Scientific and Cultural Organization

Man and the Biosphere Programme

Nordhordland Biosphere Reserve

UNESCO application

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PART 1: SUMMARY

INTRODUCTION

From the outermost skerry,
where the ocean swell washes like the planet's own heartbeats onto the rocks,
across heaths and straits, infields and outfields, knolls and hillocks
all the way to where the landscape climbs steeply up towards the mountains,
and farm stands behind farm all the way to the sky,
Nordhordland is Norway in miniature.
Even if the whole region from Fedje to Stølsheimen was torn from the coast and set adrift,
it would nevertheless contain most of what this country has to offer.

Gunnar Staalesen, author

Nordhordland is a central part of Western Norway – from the coast to the mountains, safely anchored in a culture with roots stretching far back into history, and with a business life that spans from traditional farming and fishing to modern industry, oil and gas, hydroelectric power and aquaculture.

Today, the region faces major challenges. Urbanization and demands for greater efficiency put a strain on both culture and the environment. Many fear that future generations will not have the same quality of life. Designating Nordhordland as the first biosphere reserve (BR) in Norway will build common culture and common functions, helping the region fulfil the UN's Sustainable Development Goals.

A biosphere reserve (BR) is sustainable development in practice. By taking the best of the past as a basis for the region to develop in a modern and sustainable way, Nordhordland will pavethe way to a more sustainable world. Knowledge-based development is central to UNESCO's Man and the Biosphere (MAB) Programme. With this initiative, Nordhordland becomes an attractive and interesting area for research and development.

Established activities and great involvement
In 1995, a committee appointed by the Research Council of Norway suggested that Nordhordland was a suitable area for a BR. But the plans were not realized until 2009 when the municipal authorities forming the Nordhordland Regional Council, together with the University of Bergen, initiated a cooperation to apply for a BR. A pilot project started in June 2013 to find out if the Nordhordland region would satisfy the UNESCO criteria for a BR and to clarify the potential effects of a BR for the development of Nordhordland.

Since then, there has been comprehensive and systematic work both to prepare this application and to try out in practice what being a biosphere reserve will entail. The board and the working group appointed have demonstrated that a BR in Nordhordland will work well in an international context. The pilot project has facilitated several subprojects to, for example, encourage production and use

of local food and achieve a more coordinated management of the cultural landscape in the region. These projects have helped people understand the potential value of living in a BR. When the region applied to the Norwegian Environment Agency in 2016 to be approved as a BR candidate, and was granted this status, this was based on concrete experience made through the pilot project.

Lima Action Plan and the UN Sustainable Development Goals
The global strategy and the Lima Action Plan (LAP) for the MAB Programme emphasize the key role of the Programme in the UN Agenda 2030 and its Sustainable Development Goals (SDGs). The MAB Programme is part of the solution. Here we can combine development and protection.

The MAB Programme encourages that the planning of a BR should begin in the local community. Nordhordland has done just that. Preparing this application has taken more than four years. People have been informed and involved, and their suggestions for strategies and activities have been incorporated in this application. People in Nordhordland now know about the MAB Programme and there is broad support for the BR throughout the region. All the local authorities in the region support this nomination.

Zonation which reflects local values and challenges
The zonation of the proposed Nordhordland BR is based on the fundamental requirements for any BR- ensuring that the zonation is logical and that it reflects local values and challenges. We have chosen one core area for each of the three major types of landscape in the region. First, Lurefjorden represents the coast and the outer archipelago; it is also important because it shows the importance of the region as an arena for research and environmental monitoring. Second, the core areas of the National Salmon Fjord and the River Loneelvi have key positions in the fjord landscape. We have focused on the challenges linked to the co-existence of modern aquaculture and the management of an important wild salmon population as an example of the challenges facing modern Nordhordland. In the mountains, we have selected the cultural heritage monuments and the upland summer dairy farms in Stølsheimen as the third core area. These represent cultural heritage sites that have been essential for the development of the natural environment of this mountainous region.

Public and private funding
The economic framework for the future Nordhordland BR will be decided through the development of the strategy and management plan. Both public and private parties will contribute. The municipalities in the region have already committed to providing financial support. The County Council and the County Governor's Office have so far supported individual projects but have indicated that they will prioritize the type of activities that the proposed BR focuses upon. The University of Bergen has already contributed substantially, both directly and indirectly, as a channel for research and development funds. Private sponsors have provided funding during the pilot period and will provide further funding in the years to come.

With research as an integrated activity
Researchers at the University of Bergen first put forward the idea of a BR in Nordhordland, and the university has been a key collaborator on the project. This has led to further cooperation between local people in Nordhordland and research organisations, not only in Bergen but also in the rest of Norway. Nordhordland has always had a great deal of research activity. The designation as a BR will help to strengthen and develop this further, not least because the University of Bergen has established a UNESCO Chair in Sustainable Heritage and Environmental Management whose incumbent will cooperate closely with the BR.

A biosphere reserve for the future

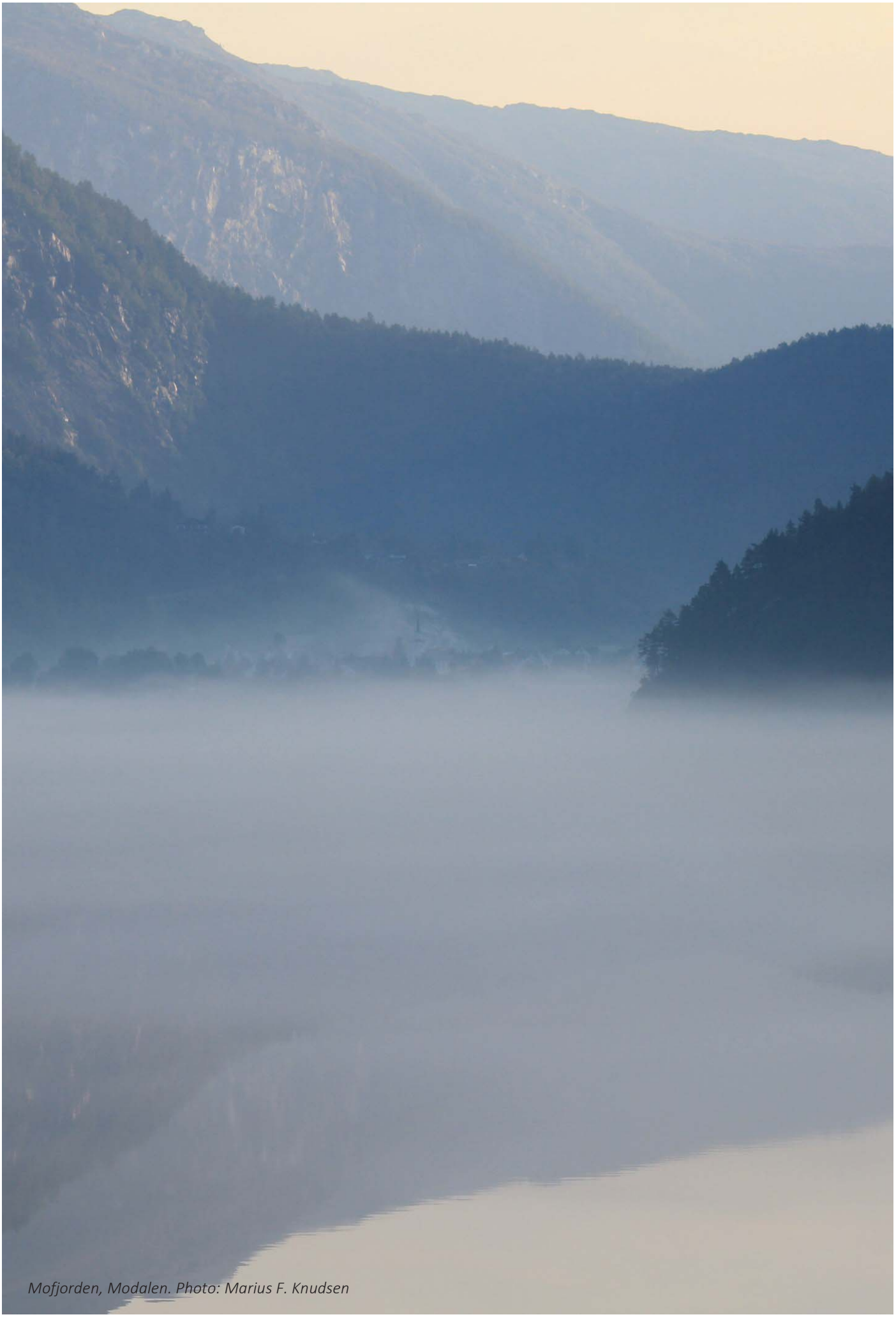
Nordhordland is rich in natural resources, and traditional values are still very much alive. The region also hosts future-oriented facilities and projects – embodied in, among other things, Technology Centre Mongstad, the world's largest facility for testing and improving CO_2 capture technologies, and CO2Bio AS, a company that will develop sustainable, bio-based omega-3 products using CO_2 and algae.

The proposed Nordhordland Biosphere Reserve will help preserve important natural and cultural resources and support research and teaching with a focus on the sustainable development of the region. It will also be dynamic and flexible in relation to future challenges. In this application, we have outlined the foundation and the ambitions for this proposed biosphere reserve. We see this as a beginning only. From now until the anticipated designation of the BR in 2019, there will be a comprehensive strategic process, developing a management plan which will identify both strategies and activities. Meetings will be held in every municipality in the region: associations and societies, the business community, politicians and the public will be able to make suggestions regarding present-day challenges and challenges they see as important in the future. We believe such a process will make for a resilient organisation and a strong biosphere reserve.

Ola Elvestuen
Minister of Climate and Environment

Karstein Totland
Leader of Nordhordland Regional Council

Dag Rune Olsen
Rector of the University of Bergen



Mofjorden, Modalen. Photo: Marius F. Knudsen

1 PROPOSED NAME

Nordhordland Biosphere Reserve

The Western Norwegian landscape - and the people living here

2 NAME OF THE COUNTRY

Norway

Apple flowers. Photo: Gro Serine Bantay.

3 FULFILMENT OF THE THREE FUNCTIONS OF BIOSPHERE RESERVES

Nordhordland is the first area in Norway to apply for the status of a biosphere reserve under the criteria of the Statutory Framework of the World Network of Biosphere Reserves. This provides great opportunities and presents some challenges. Not only must we build a solid foundation for the biosphere reserve in Nordhordland; we must also help define how Norway as a nation wants to be involved in the MAB Programme. We have therefore set up some general premises for our approach. The most important is that the region's status as a biosphere reserve must be fundamental for its further development- and that this development must be sustainable. All planned activity in the proposed biosphere reserve arises from this principal goal, which is clearly defined in the subsidiary goals.

Principal goal

Nordhordland Biosphere Reserve (BR) will be based on the best from the past and will pave the way for a future-oriented societal development that ensures the sustainable use of all types of resources for the benefit and pleasure of both the present inhabitants and future generations.

Subsidiary goals

1. Nordhordland BR will be a driving force enabling the region to attain the UN Sustainable Development Goals.
2. Nordhordland BR will contribute to the development of a society that preserves biodiversity, ensures the sustainable use of natural resources, and supports local culture and identity.
3. Nordhordland BR will make people in the region more aware, concerned and involved so that they increasingly assume responsibility for, and take control over, their own development.
4. Nordhordland BR will help increase local production of food and other biomass by utilising natural resources both on land and in the sea in a sustainable way.
5. Nordhordland BR will further develop local strategies to counter and reduce human-induced climate change.
6. Nordhordland BR will encourage innovation and green business development in the region.
7. Nordhordland BR will help develop sustainable tourism in the region.
8. Nordhordland BR will encourage knowledge-based development in the region through close cooperation with universities and research institutions in Norway and abroad.
9. Nordhordland BR will cooperate with schools and other educational institutions in the region to help increase knowledge about sustainable development.
10. Through Nordhordland BR, the region will develop and benefit from an international network and make sure that experience and knowledge is shared with other similar regions nationally and internationally.

3.1 Conservation – help to conserve landscapes, ecosystems, species and genetic variation

The proposed Nordhordland BR is centrally located on the coast of western Norway and comprises the coastal landscape between Bergen and Sognefjorden (Figure 3.1). Furthest to the west is the open ocean, well within the Norwegian continental shelf. This is succeeded by a low-lying coast, several kilometres wide, where a multitude of islets and islands protect the inshore fjord landscape. Here, fjords in many shapes and forms have been carved into the mountain landscape that rises to 1300 metres above the sea – and then drops steeply into Sognefjorden, the longest and deepest fjord in Norway.

The proposed BR has its foundations in a resource profile from the ocean through the mountains to the middle of Sognefjorden (Figure 3.2). We find marked climate gradients along this profile from the west to the east and from sea level to the mountaintops. In addition, geological processes and resource utilisation by the inhabitants over approximately 6000 years have shaped today's landscape, which is representative for the Western Norwegian Coast and unique in a global context.

Water is a central theme for the proposed BR because water has always been important for shaping the natural features of the region, and because people in the region have always utilised the lakes, the rivers, the fjords and the open ocean for hunting and fishing, for transport and for their power supply.

The proposed BR will help conserve the region as an entity, taking into account both nature itself and the interactions between man and nature. We have therefore given equal importance to nature

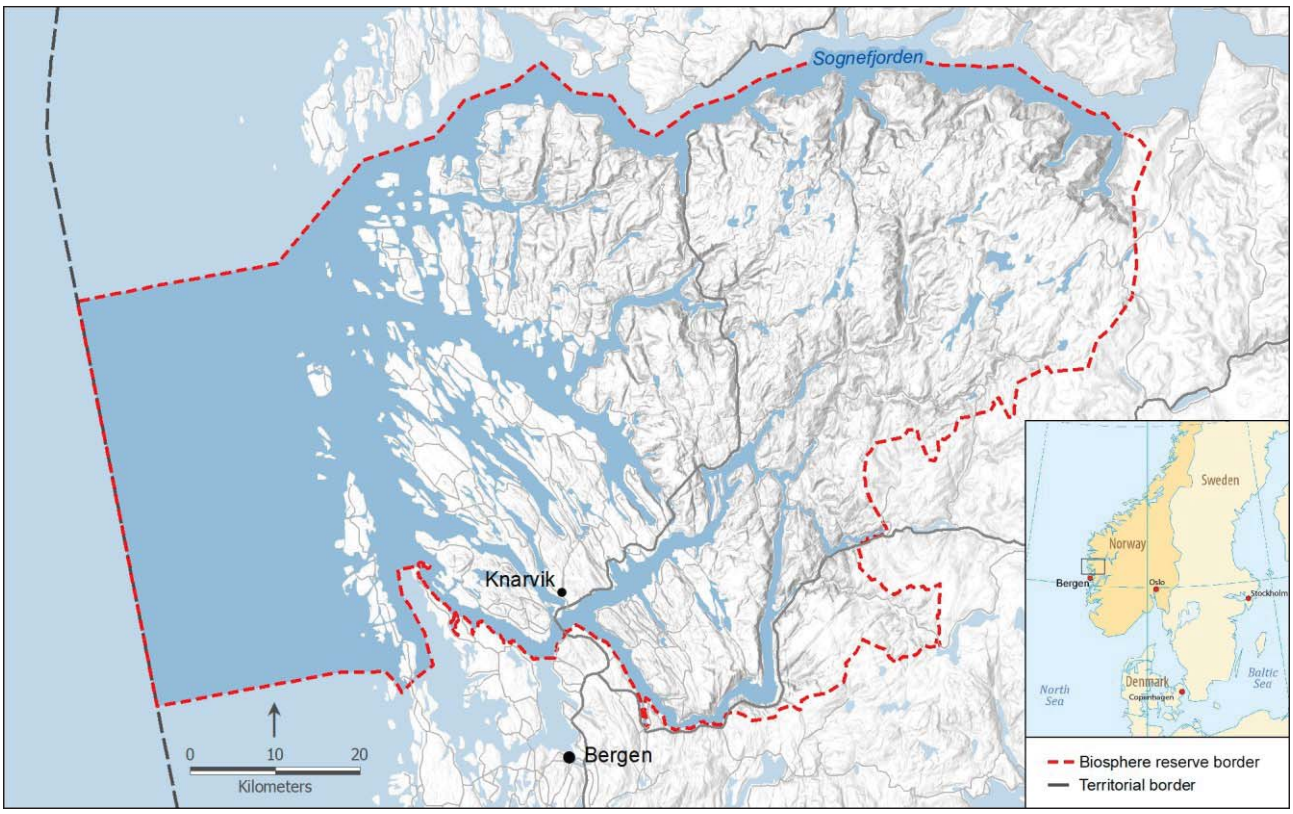


Figure 3.1. Boundary of the proposed Nordhordland Biosphere Reserve (BR) in Western Norway. Map: Lina Haggard, Peter Emil Kaland.

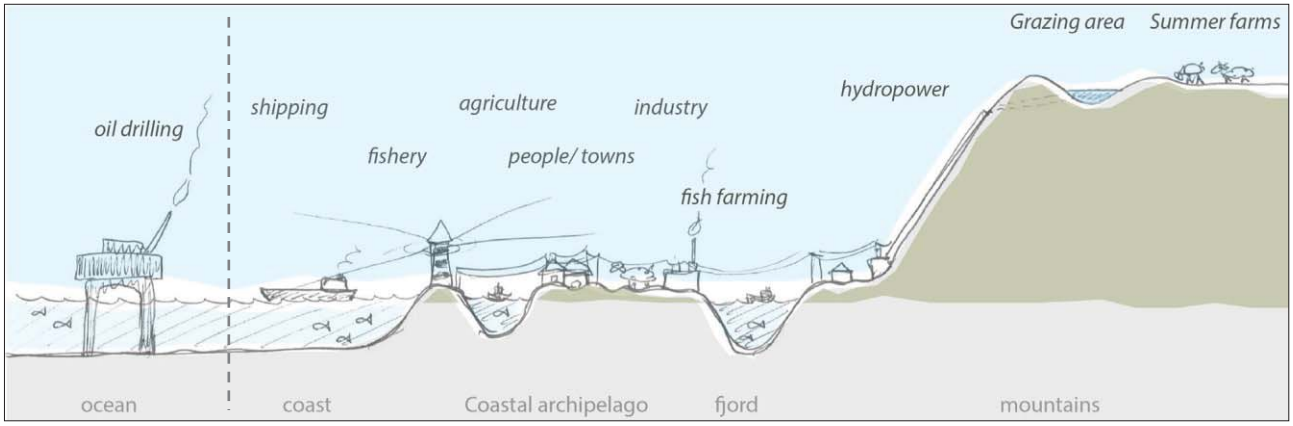


Figure 3.2. Profile of natural resources: A west-east section through the proposed Nordhordland BR shows how the resources have been utilised from the sea to the mountains. Illustration: Kjersti Isdal.

as we find it in the wild, to the cultural landscape as it has evolved through human activity over thousands of years, and to the regional culture and traditions as fundamental values for people living in Nordhordland today.

Forty-five areas in the proposed BR are currently protected under the Nature Diversity Act. The core areas, the marine core area of Lurefjorden, and the terrestrial area in Stølsheimen, with the buffer zone around the remains of the former upland summer dairy farms, are the largest of these protected areas. Norway has a well-functioning management regime in place to govern and manage these areas. Establishing a BR will add new dimensions to this. However, it will not require or imply more protection, but rather raise awareness, involvement and knowledge about the values of these areas for the well-being of present generations and a sustainable future for future generations.

The proposed BR is characterised by a high diversity of ecosystems with their associated flora and fauna. These have been categorised and described under three main sections: **the marine systems**, **the freshwater systems**, and **the terrestrial systems** (wetland and dry land), described in detail in chapters 11 and 14. The biodiversity in the ecosystems is protected through the Nature Diversity Act, which states: "*The aim is that the diversity of habitats is taken care of within their natural areas of distribution and with the species diversity and the ecological processes which characterise the individual habitats. The objective is that the functions, structure and productivity of the ecosystems are well preserved*". Diversity is also maintained through numerous other laws, regulations, acts and through management.

MARINE SYSTEMS

At the western edge of the proposed BR is the open archipelago which protects the mainland from the open sea. The ecosystems here are characterised by the deep ocean linked to the Norwegian Trench and the Norwegian Continental Shelf. The sea has clean, clear, Atlantic water with a high salt content. In the ocean depths are deep-water corals and, further in, large kelp forests. In addition to Lindåsosane – a system of small, shallow fjords – three major fjords stand out: the national salmon fjords of the island of Osterøy, Masfjorden, and Lurefjorden (Figure 3.1).

FRESHWATER SYSTEMS

The freshwater systems are characterised by a high diversity in the river systems flowing from the mountains to the fjords. These ecosystems are largely dependent upon nutrients and organic

material transported from the land by runoff and wind. The water quality and the biological processes in the water are therefore strongly influenced by the bedrock, biological processes, and human activity in the catchment basin. These river systems are especially important in regional and global contexts as spawning areas for Atlantic salmon. They are also important for generating hydroelectricity, particularly in the municipalities of Modalen and Masfjorden (FIgure 4.1). The rivers Modalselva and Haugsdalselva both have their sources in Stølsheimen, around 1200 metres above sea level.

TERRESTRIAL SYSTEMS

Wetland- The region has wetland areas that are typical for western Norway, where large amounts of precipitation, low summer temperatures, and a rapid exchange of water are characteristic features. While Nordhordland still has large areas of wetland, mostly bogs, these are smaller than they used to be because many of the bogs have been converted to farmland, industrial land, and residential areas.

Open lowland- Most of the open lowland has been shaped by human land use, such as livestock grazing, haymaking, burning and harvesting, over thousands of years. This interplay between people and nature goes back to the end of the last Ice Age. Here we find naturally occurring species, whose distribution and numbers are influenced by the intensity of land use, creating types like semi-natural meadow, shore meadow, coastal heath, and boreal heath.

Woodland- The woodlands of Nordhordland have changed over time, ever since the last Ice Age. Some have been planted, particularly during the afforestation period (1945-1980), and wood has been an important resource in many parts of the proposed BR. Today, the woodland faces several

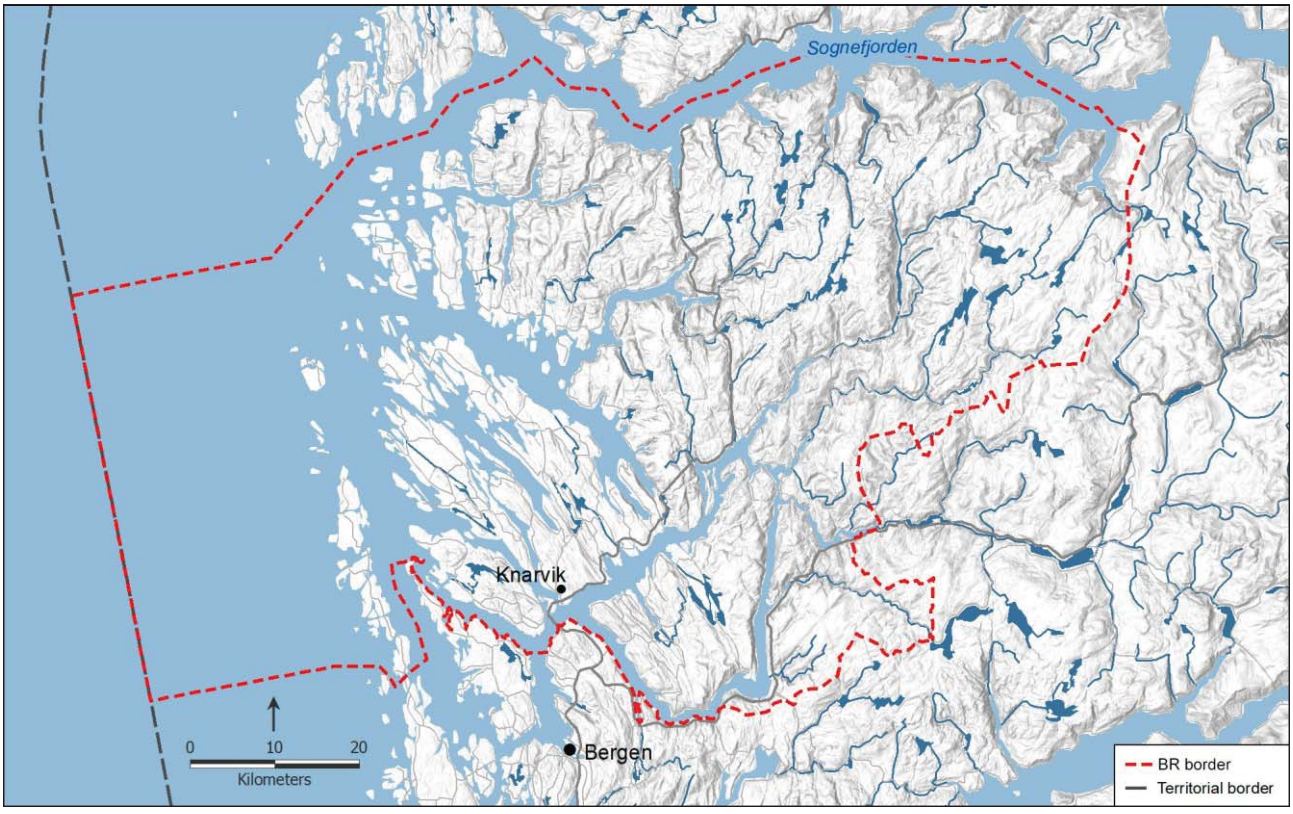


Figure 3.3: Nordhordland belongs to the wettest part of Norway. The mountains receive up to 3900 mm rain per year and give rise to the many rivers which flow down to the sea. Map: Lina Haggard, Peter Emil Kaland.

threats; the expansion of built-up areas and housing developments. Through the protection plan for coniferous forest, broad-leaved deciduous woodland, and areas with yew and holly, about 50 km^2 of woodland in Hordaland have been protected, mostly as nature reserves.

Alpine areas - The vegetation in the mountains varies from areas with high production to large areas of bare rock, gravel, stones and block field, where production is low. Many species in the mountains are specialists, and their distribution and survival may be negatively affected if conditions change. In Nordhordland, the municipalities of Masfjorden, Modalen and Vaksdal (Figure 4.1) have peaks rising to more than 1000 m above sea level, the highest being Runderabben, 1292 m, in Modalen. In Stølsheimen, the tree line is rising due to changing land use and climate.

Agricultural areas- Today, Nordhordland has a dispersed agricultural landscape and, on average, the smallest agricultural properties in Norway. Throughout the 5000 year-long history of agriculture here, people have felled trees, improved and increased the soil by transporting nutrient resources from outfield areas to infields, and created arable land and meadows. A combined livelihood of farming and fishing has been common practice in the outer regions along the coast. Farmland is an important habitat for many species and must be evaluated in combination with the surrounding habitats, especially open lowland and wetland.

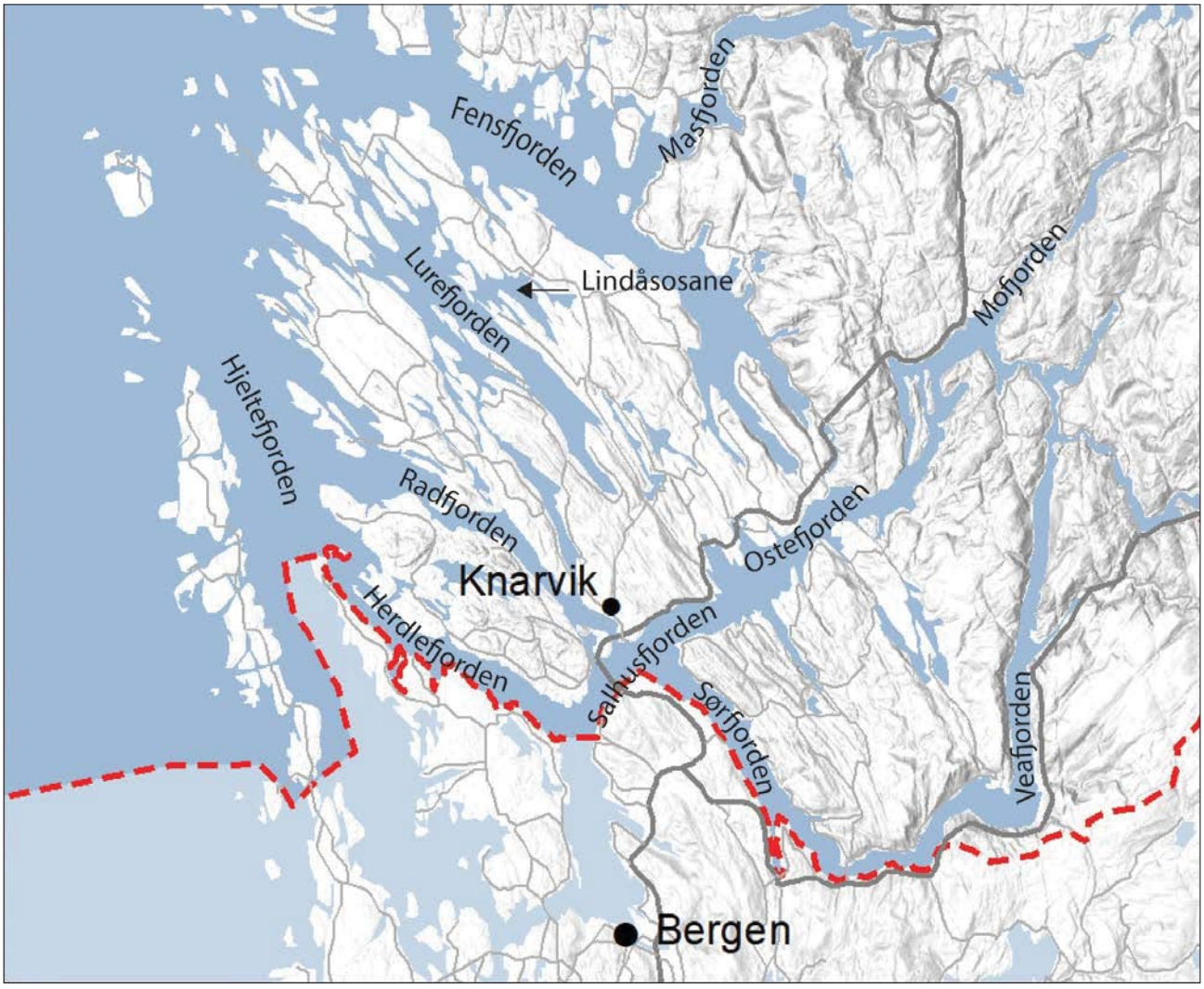


Figure 3.4: Names of the main fjords in Nordhordland. Map: Peter Emil Kaland.

Green areas in built-up areas - Green areas are generally strictly regulated, valuable habitats for individual species, and important suppliers of cultural services, such as recreation and social activities. The largest built-up areas in the proposed BR are the regional centre of Knarvik (around 6000 inhabitants) and the administrative centres of the various local authorities.

Important natural and cultural areas- In western Norway there are close connections between the natural and the cultural environments. The proposed BR contains more than 800 cultural heritage monuments. Two traditional cultural landscape areas, Lygra and Havrå, stand out. They are both included in the national Nature base (artsdatabanken.no). The proposed BR also has a large Landscape Protected Area, Stølsheimen, and many smaller nature reserves and natural monuments. All the vegetation in the proposed BR is greatly affected by resource extraction, mainly by farmers to provide their families with a reliable supply of food. The landscape, with its associated land use types, resembles a mosaic of different land-use intensities.

3.2 Development – creating economic and human development which is socioculturally and ecologically sustainable

Nordhordland is representative for much of the Norwegian coast, with different landscape elements such as the ocean, the coastal archipelago, fjords and mountains within a fairly compact area. This makes Nordhordland suitable as a model area for similar areas in other parts of Norway. Nordhordland has a wide variety of typical Norwegian businesses and industry and represents a good cross-section of the Norwegian population with regard to employment and housing. What makes Nordhordland suitable as the first Norwegian BR is therefore more than its nature; it is also the history and culture, the commitment and support for the BR, and the long-term visions established for the BR:

- **Nordhordland contains key resources for Norway**
  Nordhordland has large resources of hydroelectric power, and vast quantities of oil and gas are extracted from the seabed off the coast of the proposed BR. The region also holds a central position in the very important aquaculture industry. Establishing a BR in Nordhordland may help make these industries more sustainable.

- **The area supplies good ecosystem services**
  Ecosystem services are divided into four main categories: provisioning, regulating, cultural and supporting services. Due to its favourable natural conditions and varied geography, the proposed BR is rich in ecosystem services in all these categories (see Chapter 12 for details).

- **Nordhordland has a rich cultural history and living traditions**
  The proposed BR is built on an active and engaged society, promising fertile ground for continued sustainable growth.

- **The local authorities in Nordhordland want to use the BR to move sustainably forwards**
  The local authorities believe the BR will be very important for a positive development of the region. This will help the BR be successful.

- **Nordhordland cooperates extensively with the University of Bergen**
  Nordhordland's commitment to become a BR is motivated by the region wanting a knowledge-

driven, sustainable development for the future. This is secured through close cooperation with the University of Bergen and other research institutions in the region. Fish farming methods used all over the world have been developed at the research station at Matre, run by the Norwegian Institute of Marine Research.

- **Nordhordland has active facilities developing sustainable technology**
  Research and business development meet in the sustainable technology facilities located in Nordhordland. The region is home to the larges testing facility for carbon capture and storage (CCS) in the world at Technology Centre Mongstad. Harvesting some of the CO_2 emissionsfrom the Mongstad oil refinery, CO2Bio AS is testing processes producing microalgae as an omega-3 source for feed for aquaculture.

The proposed BR will work on two different levels: 1) The BR will take on specific tasks and activities on behalf of the whole Nordhordland region, such as implementing the UN Sustainable Development Goals (Agenda 2030), further developing regional culture, joint marketing, brand building and tourism development; and 2) in addition the BR will be instrumental in developing new organizations, industry and commerce, providing new skills, and in helping the region prepare for a life after peak oil. The BR will also strengthen international cooperation through knowledge sharing, project development and by attracting international funding.

There has already been a great deal of activity in these areas during the development of the BR, and there is potential for developing the region in the following fields, to name a few:

- **Nordhordland BR will help implement the UN Sustainable Development Goals**
  Through an overall approach to the MAB Programme's fundamental principle of sustainable development, we will inspire and help people living in the BR attain the UN Sustainable Development Goals.

- **Nordhordland BR will promote economic development and contribute to a green shift as the oil and gas industry decreases**
  The BR will help develop new sustainable commercial activity through cooperative projects.
- **Nordhordland BR will help developing a resilient, sustainable tourism industry**
  There is great potential for developing tourism in Nordhordland. The BR will strengthen the tourism industry and make it more sustainable.

- **Nordhordland BR will help developing sustainable agriculture and increase local food production**
  The BR will focus on developing sustainable agriculture, the use of natural resources, and local food production in the region.

- **Nordhordland BR will contribute to knowledge-driven development in the region**
  The BR will cooperate with research and educational institutions in Norway and abroad in order to develop functional solutions to complex problems.

- **Nordhordland BR will contribute to the overall management of the natural and cultural landscape**
  Some of the cultural landscapes in Nordhordland are becoming overgrown. The BR will promote the restoration of open landscapes and, at the same time, promote woodland that is commercially valuable, making the region a model for the management of Norwegian coastal landscapes.

- **Nordhordland BR will build regional identity**
  The BR will focus on possibilities and opportunities, helping people gain more control over their own future and regional identity.

- **Nordhordland BR will help improve quality of life – pride and enjoyment**
  Work in the BR will be based on open dialogue. "Everyone" will be involved. The aim is to improve the quality of life among all the people in the region making them proud of who they are and where they are from.

- **Through Nordhordland BR the region will have access to an extensive global network**
  The status as the first modern BR in Norway will make Nordhordland part of an international network. This will provide an opportunity for connecting to and learning from BRs all over the world.

3.3 Logistic support for demonstration projects, environmental education and training, research and monitoring related to local, regional, national and global issues concerned with nature conservation and sustainable development

An important reason for promoting Nordhordland as the first Norwegian BR is the close cooperation with the research and educational institutions conducting a substantial amount of research within the region (see the complete list in Chapter 16.1). In some sectors, Nordhordland is already working as we would like the whole BR to function in the future – as a model area for developing knowledge that can be used in other parts of Norway and abroad. Nordhordland BR will build on this foundation and further develop the cooperation between research institutions and local players in the private and public sectors.

Marine research is strong in Nordhordland and a substantial amount of research has been conducted in the marine ecosystems in Masfjorden, Lurefjorden and Lindåsosane, resulting in more than 100 scientific publications. The activity is still high, especially in projects working on challenges in the aquaculture industry. In this context, the research station at Matre, run by the Norwegian Institute of Marine Research, plays a key role; production methods developed there are used all over the world. Trial production of tunica (Sea squirts) in Øygarden and of algae, utilising CO_2 and heat from the oil refinery at Mongstad, are examples of projects aiming to find sustainable solutions for producing feed for farmed fish.

Multiple land-based research projects have developed from studies of nature or societal issues in Nordhordland. Researchers from the University of Bergen have used the region extensively, especially when studying the impacts of land use on terrestrial ecosystems. Ongoing research projects include HiddenCosts, which examines afforestation as an environmental initiative, and LandPress, which studies how changes in climate and land use are affecting Norwegian coastal heaths. Both projects are funded by the Research Council of Norway. The BR organisation is following up the KRUS project, focusing on increased utilisation of Norwegian wool, especially wool from the ancient outwintered sheep. Experience gained from the pilot project where, for example, the BR is a partner in the EU-funded SHAPE project, has also demonstrated the potential for research as an integrated part of the BR.

Photo 3.1: Developing a BR in Nordhordland means working for a sustainable future. It is all about what kind of society we want for our children. Photo: Modalen Municipality Council.

The University of Bergen has established a UNESCO Chair in '*Sustainable Heritage and Environmental Management – Nature and Culture*', with four associated professor II positions. Since February 2017, the UNESCO Chairholder, associate professor Inger Måren, has been part of the Nordhordland BR workgroup. She is also the project manager of a cross-disciplinary project following the establishment of the BR and the implementation of the UN Agenda 2030, funded by the MILJØFORSK programme of the Research Council of Norway. A survey amongst researchers at the largest research institution in western Norway, the University of Bergen, has revealed strong interest for more research in, and in connection with, the proposed BR and the interconnected sustainability agenda.

The role of the biosphere reserve organization

The BR organisation will focus on knowledge-based development and management, encourage increased contact between the region and research institutions, establish infrastructure and arenas for interaction between various stakeholders in the region (e.g. annual research conferences), and actively assist in establishing and funding new projects. The BR will also produce knowledge which will be used by the World Network of BRs. The pilot project for the Nordhordland BR was formally established as a cooperative project between the Nordhordland Regional Council and the University of Bergen. With this as a starting point, a solid foundation for further research and education focusing on sustainability has already been built.

The island of Fedje. Photo: Kjersti Isdal.

4 CRITERIA FOR DESIGNATION AS A BIOSPHERE RESERVE

4.1 Encompass a mosaic of ecological systems representative of mayor biogeographical region(s), including a gradation of human interventions

(The term "major biographic region" is not strictly defined but it would be useful to refer to the Udvardy classification system)

Nordhordland is a part of the western Norwegian coast – an area known for its natural beauty and strong cultural values. The natural environment is full of contrasts: the coast protected by a wide archipelago, a multitude of small and large fjords, and steep valleys partly covered with woodland rising gradually up into the high mountains. The variation in the landscape is great, from Fedje, an island reaching into the Atlantic Ocean, in the west, to Modalen at the far end of the narrow fjord, Osterfjorden, and finally the Stølsheimen mountains between Voss and Sognefjorden.

The proposed BR can be divided into regions based on major topographical features: 1) the marine areas, 2) the coastal areas, 3) the fjord systems, and 4) the alpine areas. Administratively, nine

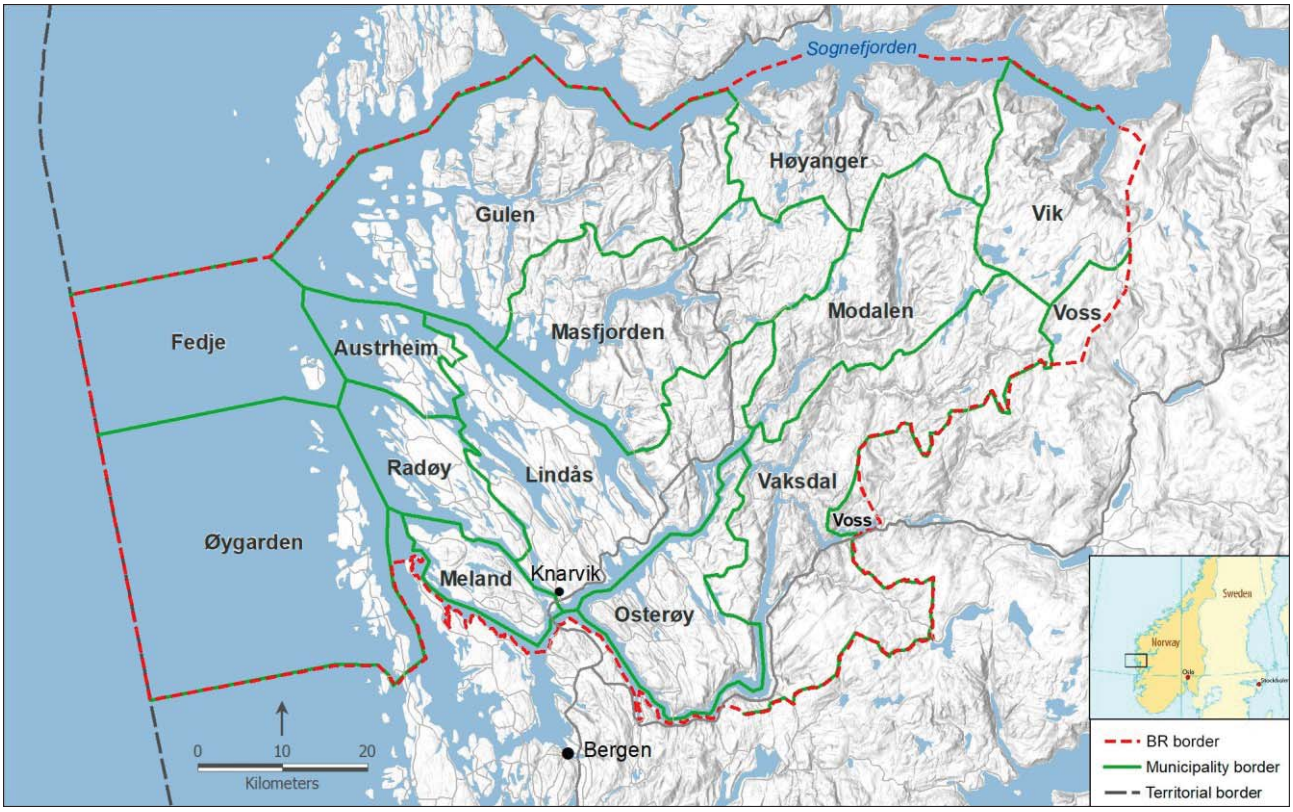


Figure 4.1. The municipalities comprising the proposed Nordhordland Biosphere Reserve constitute northern parts of the county of Hordaland to the south and southern parts of Sogn & Fjordane to the north. Map: Lina Haggard, Peter Emil Kaland.

municipalities, Austrheim, Fedje, Gulen, Lindås, Masfjorden, Meland, Modalen, Osterøy and Radøy, comprise the region today. Vaksdal, Øygarden and parts of the municipalities of Askøy, Bergen, Høyanger, Vik and Voss are also within the proposed BR. The permanent population is nearly 54,400.

The proposed BR covers approximately 669,800 ha (6,698 km^2). It stretches from the national territorial limit in the Atlantic Ocean in the west, through the low-lying, outer coastal landscape, the fjord landscape – where deep fjords have carved their way between high mountains – and ends in the mountains 1300 m above the sea level in the east. The various ecosystems are the result of both natural processes and human influence. The area has a clear west-east climate gradient (oceanity gradient) from a temperate oceanic maritime climate in the west to more continental conditions in the inner fjord area and in the mountains to the east. This is reflected in differences in both precipitation and temperature (see details in Chapter 11). In addition, there is a vertical climate gradient from the fjords to the mountains, which is mainly expressed as a temperature gradient, but also as gradients in geology, topography, and landforms. The two main gradients, which span a geographically very varied area, create a mosaic of ecosystems that are representative for western Norway.

People have lived here since the ice retreated after the last Ice Age some 12-10,000 years ago and have left their mark on the natural ecosystems. Within the proposed BR, there are numerous types of cultural landscapes from the outer coast to the mountains in the east, with great variations in the intensity and the extent of resource utilisation. This mosaic of more or less human-influenced ecosystems is unique in a European context and has a high conservation value.

Photo 4.1. The outer coastal landscape in the proposed Nordhordland Biosphere Reserve. Photo: Eivind Senneseth.

4.2 Be of significance for biological diversity conservation

(This should refer not only to the numbers of endemic or rare species, but may also refer to species on the IUCN Red List or CITES appendices, at the local, regional or global levels, and also to species of global importance, rare habitat types or habitats with unique land use practices (for example traditional grazing or artisanal fishing) favouring the conservation of biological diversity)

The great variation in geographical features, climate, site quality and human impact within the proposed BR gives rise to high biodiversity at the habitat and species levels.

Norway has few endemic species because the period from the last Ice Age is too short for species that are distinctive for Norway (or the Nordic countries) to have evolved. Other parts of Norway have a few endemic vascular plants, but there are no endemic species in the proposed BR.

The Global IUCN Red List includes 116 species in Norway. Of these, 33 do not satisfy the criteria for red listing in Norway but are assessed as Least Concern (LC). It is not clear how many of these 116 species are found in the proposed BR.

The Norwegian Red List for Species (2015) contains 4,438 species. Of these, 2,355 are classified as Endangered and 1,235 as Near Threatened. There are 560 national red list species in the county of Hordaland and 523 in the county of Sogn & Fjordane. We do not know how many of these occur in the proposed BR, but most are probably found here (see the complete list in Section 19.3).

Table 4.1. National red list species categorised as Critically Endangered (CR) in the counties of Hordaland and Sogn & Fjordane

Scientific name	English name	Category	Group of organisms
Bactrospora homalotropa		CR	Lichen
Calicium quercinum	Spike lichen	CR	Lichen
Collema leptaleum	Crumpled bat's wing lichen	CR	Lichen
Diploicia canescens	Lobed button lichen	CR	Lichen
Enchylium limosum		CR	Lichen
Gomphillus calycioides		CR	Lichen
Leptogium hibernicum		CR	Lichen
Ramonia subsphaeroides		CR	Lichen
Rinodina isidioides		CR	Lichen
Scytinium fragrans		CR	Lichen
Jamesoniella undulifolia	Marsh flapwort	CR	Bryophyte
Botrychium matricariifolium	Chamomile grape-fern	CR	Vascular plant
Rumex sanguineus	Wood dock	CR	Vascular plant

Nitidula rufipes		CR	Beetle
Panagaeus bipustulatus		CR	Beetle
Crex crex	Corncrake	CR	Bird
Uria aalge	Guillemot	CR	Bird
Lestica subterranea		CR	Wasp
Dipturus batis	Common skate	CR	Fish
Ethmia pusiella		CR	Moth

4.3 Provide an opportunity to explore and demonstrate approaches to sustainable development on a regional scale

(Describe in general terms the potential of the area to serve as a site of excellence for promoting the sustainable development of its region (or "eco-region"))

The proposed Nordhordland BR will focus on the sustainable development of the region as a whole: nature, culture, society, industry and commerce. This is in line with the goals of the MAB Programme as formulated in the 2016 Lima Declaration, particularly point 13: "*MAB's mission for the period 2015-2025 is to: develop and strengthen models of sustainable development in the World Network of Biosphere Reserves (WNBR); to communicate the experiences and lessons learned, facilitating the global diffusion and application of these models; to support evaluation and high-quality management, strategies and policies for sustainable development and planning, as well as accountable and resilient institutions; and to help Member States and stakeholders to urgently meet the SDGs through experiences from the WNBR, particularly through exploring, advocating and testing policies, technologies, education and new lifestyles and innovations for the sustainable use of biodiversity and natural resources and mitigation and adaptation to climate change*".

Nordhordland is representative for western Norway, rich in many types of natural resources. It is imperative to manage these resources responsibly for the benefit of future generations. Changes in society and technology have made the region a major player in developing hydropower, in petroleum production, and in fishing and aquaculture. The proposed BR will focus on how the Norwegian coastal regions will tackle environmental and societal challenges and develop society in a sustainable manner.

People have had a formative role in the region since time immemorial. Up to about 1970, Nordhordland was regarded as a comparatively poor region. Most people were farmers, fishermen and/or craftsmen like the generations before them. After agriculture was introduced in the Late Stone Age, the inhabitants used all available resources along the ecological gradient: fishermen with smallholdings on the outer coast, and farmers with extensive summer dairy farming in the mountains further inland. The region has also played an important role in the building of the Norwegian nation. Gulatinget, a legislative assembly in the Viking Age that met annually at Gulen, adopted Gulatingsloven (The Gulatinget Act) which later formed part of the basis for King Magnus the Lawmender's national act, thus showing the great regional and national role of the region during the Viking Age and the Middle Ages. Since petroleum was found in the North Sea in the 1970s, Nordhordland has experienced substantial growth in both income and population.

Sustainable development is only possible through positive interactions between people and nature. These interactions arise through cultural, socio-economic and ecological interplay, forming a complex totality. We must understand these complex socio-ecological systems in order to create sustainable development.

The proposed Nordhordland BR will place emphasis on the conservation of both biological and cultural diversity as well as on responsibility for an economic development that must be both modern, socio-culturally and ecologically sustainable. The ultimate goal is to make Nordhordland a demonstration area for modern Norway and for the experience gained to be useful in an international context.

The proposed Nordhordland BR will cooperate broadly with other BRs in Europe. Such cooperation has already been well established through the pilot project which is working closely with several established BRs in Sweden, Finland and Denmark, and with the NordMAB and EuroMAB networks. We believe that this cooperation will encourage a holistic approach to sustainable development in northern Europe.

4.4 Have an appropriate size to serve the three functions of biosphere reserves

(This refers more particularly to (a) the surface area required to meet the long term conservation objectives of the core area(s) and the buffer zone(s) and (b) the availability of areas suitable for working with local communities in testing and demonstrating sustainable uses of natural resources)

The total area of the proposed Nordhordland BR is 669,800 ha (6,698 km^2), of which 422,730 ha (4,227 km^2, 63,1 %) is terrestrial and 247,070 ha (2,470 km^2, 36,9%) is marine.

The proposed BR is designed as a broad cross-section from the open ocean through the coastal areas and fjords to the mountains in the east. This ensures that all the important terrestrial ecosystems in western Norway are represented. Lacustrine ecosystems in lakes and rivers of different shapes and different nutrient status are also represented. The marine area, with the open ocean, coastal waters and fjords, has great biological diversity. There are fjords with different threshold depths, which is important for biological diversity, and salinity gradients from high in the ocean to brackish in the innermost fjords. There are 43 nature reserves and over 800 cultural heritage monuments within proposed BR.

a) The core areas and the buffer zones have been chosen so that each ecosystem is represented in at least one area:
   - **Coast**. Lurefjorden and Lindåsosane, where the buffer zone includes four nature reserves and the Heathland Centre at Lygra.
   - **Fjord**. The national salmon fjords at Osterøy, and the river Loneelvi, which is permanently protected from hydroelectricity development.
   - **Mountain**. The Stølsheimen Landscape Protected Area.

b) Educational facilities are very good in the proposed BR, and distances to a variety of colleges and to the University of Bergen (UiB) are short. The close cooperation with UiB facilitates project development, promoting sustainability in environmental management, development of society, industry and business development.

4.5 Through appropriate zonation

(Det vises også til kapitlene 7.4, 9.2, 9.3, 14.1.3, 17.1.2 og 19.1)

See details in Sections 7.4, 9.2, 9.3, 14.1.3, 17.1.2 and 19.1.

Terrestrial	Marine	Total	Total
Area of the core areas	85 ha	13,540 ha	13,625 ha (2.0%)
Area of the buffer zones	43,360 ha	30,730 ha	74,090 ha (11.1%)
Area of the transition zone	379,285 ha	202,800 ha	582,085 ha (86.9%)
TOTAL	**422,730 ha**	**247,070 ha**	**669,800 ha**

A) A legally constituted core area or areas devoted to long term protection, according to the conservation objectives of the biosphere reserve, and of sufficient size to meet these objectives
(Describe the core area(s) briefly, indicating their legal status, their size, the main conservation objectives)

The following criteria have been set as guidelines for selecting the core areas:

- *The core areas must reflect the resource profile* (Figure 3.2), which is the governing principle for delineating the BR area: from the ocean in the west, through the coastal and fjord landscapes, across the mountains and down to Sognefjorden. The strong climate gradients from the outer coast to the protected inland valleys, and from sea level to the high mountains are imperative for the BR's many vegetation types, fauna and the way the inhabitants have used the resources.

- *The core areas must be legally protected*. The proposed BR has 43 nature reserves, 2 landscape protected areas, 1 nationally protected salmon fjord, and 4 watercourses that are permanently protected from hydroelectric power development. In addition are the many protected cultural heritage monuments. The core areas have been selected from these areas.

- *The core areas must represent central resources in the region*. Nordhordland is situated in the wettest parts of Norway, receiving up to 3900 mm of precipitation a year. This gives rise to the many rivers (Figure 3.3) that flow from the mountains. Outside the core areas, many of these are dammed in order to secure a steady supply of green hydroelectric power. The fjords, the coast and the sea are important areas for hunting and fishing and are utilised for transport. **Water** is therefore a central theme for the proposed BR.

- *The core areas must be important for the inhabitants of the region*. The selection of core areas has been the result of a long interactive process, involving the municipal authorities and politicians, local people, researchers and the Norwegian Environment Agency.

Based on the above criteria, four core areas were selected:

1. On the **coast**, the **protected marine area, Lurefjorden, along with Lindåsosane**, has been chosen as a core area. The area is characterized by a range of ecosystems and species diversity. Lurefjorden has depths of up to 440 m and shallow thresholds to the open sea. It may be characterised as a marine "lake". Lindåsosane is a part of Lurefjorden. It is a small fjord arm

with semi-enclosed ecosystems including a local herring population that is of great value for research. The core area is in the process of being legally protected; this process will be completed in 2019.

2. In the **fjord area**, the zonation has been decided based on protection of the *wild salmon* as a national resource. The **nationally protected salmon fjords near the island of Osterøy** comprise the core area, connected with the river Vosso, a nationally protected salmon river. Six salmon rivers flow into the Osterfjorden fjord-system (Vosso, Ekso, Modalselva, Dale, Loneelvi and Storelva) and several have salmon stocks that are adapted to the local environment in one specific river. Of these, the Vosso is characterised by having a population of perhaps the largest of all Atlantic salmon, with an average weight of over 10 kg. Salmon weighing as much as 36 kg have been caught here.

3. The river **Loneelvi** was chosen to represent the rivers that fall into the fjords from Osterøy. The character of the riverbed encourages a high habitat diversity, with e.g. aquatic birds, freshwater mussels and salmon. The river has a stock of smaller salmon, very different from the salmon in river Vosso. Loneelvi was protected from hydropower development under the terms of the "*Act relating to river systems and groundwater (Water Resources Act*)" §32-35, November 24, 2000.

4. In the mountains, the **Stølsheimen Landscape Protected Area (LPA)** was chosen. Ever since prehistoric time, domestic livestock have grazed the upland summer dairy farms, creating a distinctive cultural landscape in these mountains. Stølsheimen has been imperative in defining the identity of, and an important meeting place for, the inhabitants of Nordhordland, Voss and the villages on the south side of Sognefjorden.

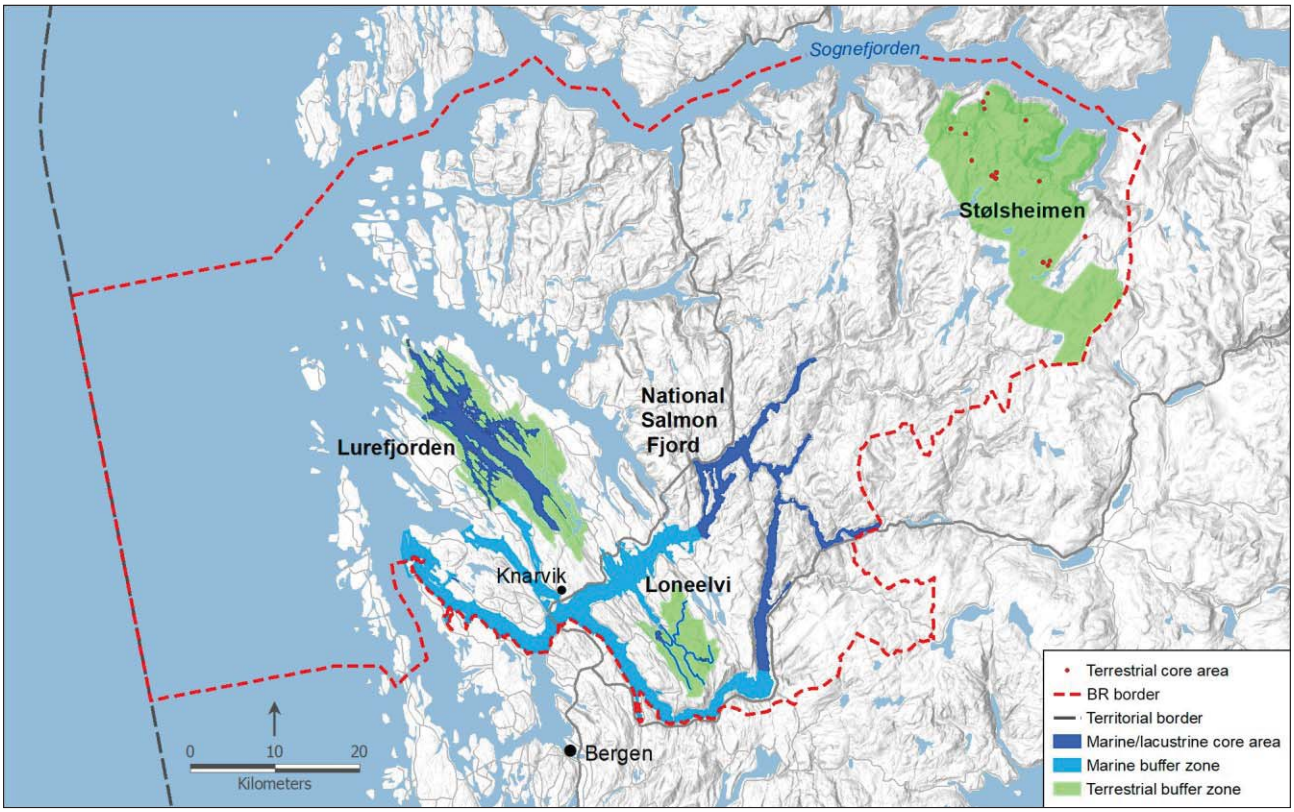


Figure 4.2. Map of the proposed BR showing the core areas and buffer zones. The rest of the area within the BR comprises the transition zone. Map: Lina Haggard, Peter Emil Kaland.

There is a massive development of hydropower in the mountains surrounding the Stølsheimen LPA. These mountains can therefore not be used as buffer zones, and consequently the LPA cannot be a core area. Instead, the protected cultural heritage monuments within the LPA are used as core areas and the LPA itself is used as a buffer zone (see below).

Cultural heritage monuments predating 1537 are automatically protected by the Cultural Heritage Act, and younger ones are protected by the Regulations relating to the Stølsheimen Landscape Protected Area.

B) A buffer zone or a zone clearly identified and surrounding or contiguous to the core areas, where only activities compatible with the conservation objectives can take place.
(Describe the buffer zone(s), their legal status, their size, and the activities which are ongoing and planned there)

1. **Lurefjorden and Lurosane**. The buffer zone protects the marine environment from pollution through runoff from the surrounding catchment area. The municipality councils have applied the Planning and Building Act and local regulations to minimise the influx of sewage and runoff. In addition, implementation of the EU Water Framework Directive ensures high water quality.

2. The **nationally protected salmon fjords near the island of Osterøy**. *Terrestrial buffer zone*: The fjord is narrow with almost impassable cliffs and steep sides to a height of 600-800 m, forming a natural terrestrial buffer zone along the fjord. *Marine buffer zone*: The purpose of the marine buffer zone is that the smolt will be able to swim safely past the salmon farms into the sea with minimum infection by sea lice (see the statement from the Norwegian Food Safety Authority (Section 19.3)).

3. River **Loneelvi**. This buffer zone is protected under the terms of the "*Act relating to river systems and groundwater (Water Resources Act)*" §32-35, dated November 24, 2000. The "Regulations on guidelines for protected river systems relating to national politics (1995)" state (point 3d) that: "*To achieve the goals, special emphasis must be placed on securing the value of those elements or areas in the drainage basins of the protected river systems that have been scientifically shown to have significance for the preservation of the river system*". Osterøy Municipality has applied the Planning and Building Act and local regulations to protect the environment of the main river and all side streams covering the catchment area.

4. **Stølsheimen Landscape Protected Area** is the buffer zone around the cultural heritage monuments.

C) An outer transition area where sustainable resource management practices are promoted and developed

(The Seville Strategy gave increased emphasis to the transition area since this is area where the key issues on environment and development of a given region are to be addressed. Describe briefly the transition area(s), the types of questions to be addressed there in the near and the longer terms. The Madrid Action Plan states that the outer boundary should be defined through stakeholder consultation)

About 87% of the area of the proposed BR is designated as transition zone, and approximately 86% of the population live in this. Use of the abundant natural resources of western Norway forms the basis for the livelihood of the inhabitants in the transition zone. Through cooperation with local people, businesses, industry, and local authorities, the BR will help to develop a society that ensures sustainable use of the resources and furthers the UN Sustainable Development Goals. Innovation and green development in relation to the transition to a post-petroleum future is a key theme. The BR organization is already involved in a similar process working with the aquaculture industry to try to reduce the impact from fish farming on the environment.

Because the region has so many jobs in industry, trade and services, many farmers combine traditional farming with other jobs, helping to support their income. This has helped to prevent people from moving away from the region to the nearby cities. Due to improved efficiency, new technologies, synthetic fertilisers and specialised operations, food production has nevertheless remained stable over the past 20 years. However, today only the best land is being used. Only small parts of the outfield areas are now used for grazing or for traditional harvesting of fodder. These areas are rapidly becoming overgrown with shrubs and trees. The proposed BR will focus on more sustainable utilisation of the agricultural resources through the projects "*Overall landscape management*", "*Conserve the topsoil*" and "*The taste of Nordhordland*".

The proposed BR wants to involve as many people as possible implementing the UN Sustainable Development Goals. We will focus on children and young people, cooperating with the schools in the region, and providing information and inspiration on how to ensure quality of life for future generations. We will also work closely with the schools supporting knowledge about local culture and local resources.

D) Please provide some additional information about the interaction between the three areas

The core areas and buffer zones have been chosen on the basis of the principles outlined in Section 4.5a. These areas all represent types of the nature found on the western coast of Norway. They also reflect the west-east profile on which the proposed Nordhordland BR is based.

Outermost is Lurefjorden, surrounded by the typical Western Norway island landscape. This archipelago is unique for Norway and has special natural and cultural values for the whole nation. In the middle is the fjord landscape, represented by the fjords around the island of Osterøy and the river Loneelvi. This landscape was carved out by the glaciers, and is, perhaps more than anything else, the landscape and the culture that the rest of the world associates with western Norway. Stølsheimen represents Norway as a land of mountains. Just half-an-hour's drive from the temperate areas close to the sea, you are in an arctic landscape. These three areas do, however, not exist in isolation. Both historically, and today, there are interactions between them, naturally and through human activity, which provide this part of the world with unique qualities and exciting possibilities. It is these possibilities the proposed BR will explore.

4.6 Organizational arrangements should be provided for the involvement and participation of a suitable range of inter alia public authorities, local communities and private interest in the design and the carrying out of the functions of a biosphere reserve

4.6.1 Describe arrangements in place or foreseen

(Describe involvement of public and/or private stakeholders in support of the activities of the biosphere reserve in core, buffer and transition areas (such agreements, protocols, letters of intent, protected area(s) plans))

The Nordhordland nomination form has been developed through a structured process emphasising ownership, representation and inclusion. The most important activities have been:

Project control
Through the application period, work on the proposed Nordhordland BR has been organized as a project owned by the Nordhordland Regional Council (comprising the mayors of the nine municipalities in the region). The administration of the Regional Council, Nordhordland Development Company IKS (NUI), has been project managers. NUI has appointed a project working group which has been in operation since June 2013. The Regional Council appointed a steering committee for the project, with representation from central stakeholders. These are:

- Three mayors
- The manager of Nordhordland Development Company IKS (NUI)
- One representative from the University of Bergen
- One representative from the County Governor's Office in Hordaland
- One representative from Hordaland County Council
- Two representatives from industry and commerce
- One representative from NGOs

The project working group is led by NUI and consists of representatives from this company and from the University of Bergen.

Political support
Ensuring solid political support for the application and for the future BR in all of the municipalities involved has been important. The project has been presented in municipal council meetings and in the regional Nordhordland Council meetings. The pilot project application was extensively debated in municipal council meetings. All the 11 municipal councils have voted in favour of the submission of the application, and have agreed to the related provisions, approved the principal goal and the subsidiary goals, and committed themselves to the funding described in section 17.4.11.

Strategic plan for the proposed biosphere reserve
In the period from the present and up to the designation by the ICC in 2019, a strategic plan (management plan) for the proposed BR will be developed, based on this application and the goals presented at the beginning of chapter 3. The management plan will specify strategies and list central activities in the future BR. The process of developing the plan will involve all stakeholders in the region, politicians and administrative staff in the municipalities, local industry and commerce, and representatives from the many NGOs. In addition, the county authorities, the University of Bergen, research groups and other external stakeholders will be invited to contribute. As part of the process,

there will be community meetings and workshops with the general population to get suggestions and feedback on concrete activities.

An inclusive planning process

The process of completing of the application to establish Nordhordland as a BR has been long. This has made it possible to present the plans to all stakeholders and to adjust them in accordance with the feedback received. Local people have been engaged in meetings as individuals and through representatives of the many cultural societies and interest groups in the region. The BR project has also been presented in meetings organised by the municipal and the county authorities. After the area received status as a candidate BR, work on disseminating information was strengthened. Through 2016, a photography competition engaged many amateur photographers and helped develop a photography database that demonstrates the uses of the resources in the BR. Local, regional and national media have reported frequently on the BR project. The BR candidate has its own web site and a Facebook page.

Project activities

Several projects have been developed so that the stakeholders, through concrete action, can experience what the status as a BR may entail:

- *The taste of Nordhordland*. Local food production, marketing, trademark building and sale of local products.
- *Campaign for Norwegian wool*. Wool is central to Nordhordland's industrial history and culture, and traditional skills in wool manufacture are kept alive. The project involves the entire value chain, aiming to increase the knowledge and use of Norwegian wool.
- *Holistic landscape management*. How to protect and develop the costal landscape of Nordhordland. What areas should be used for forestry and what to do in areas where invasive species have ruined the open landscape?
- *SHAPE – sustainable tourism*. Cooperating with international partners (including other BRs) aiming to develop sustainable tourism based on natural and cultural resources.

Research

The BR organisation is based on an agreement from 2013 between Nordhordland Regional Council and the University of Bergen aiming to prepare this application and encourage future research cooperation within the BR. The university was granted a UNESCO Chair whose incumbent will include coordinating the university's research in the BR. The BR organisation is also cooperating with other research institutions, including Consumption Research Norway (SIFO).

International cooperation

The BR organisation has been active in the MAB programme since 2013. Nordhordland has been present at meetings and conventions and was one of the pilot areas for the MAB Programme's new Global Communication Strategy and Action Plan. Nordhordland participates in the NordMAB network and has received valuable advice from NordMAB partners – and hosted the annual meeting of NordMAB in 2016.

4.6.2 Have any cultural and social impact assessments been conducted, or similar tools and guidelines been used?

(e.g. Convention on Biological Diversity (CBD)'s Akwé: Kon guidelines; Free, Prior, and Informed Consent guidelines, Biocultural Community Protocools, etc)

The plans for the future BR in Nordhordland have been continuously evaluated by the steering committee set up for the project, through the annual reports that have been produced, and through meetings with key stakeholders. Through this, central strategies have been developed. The work started with a broad process which resulted in a strategic plan for the pilot project in 2014. This has since been adjusted, but visions and central strategies have been kept according to the original plan. The project has received both political and popular support through cooperation with organisations and societies, representatives for local and regional authorities, and representatives from local industry. This cooperation will continue when the BR is established. All development will be based on broad and popular engagement, democratic rules and open, inclusive processes.

4.7 Mechanisms for implementation

Does the proposed biosphere reserve have:

A) MECHANISMS TO MANAGE THE HUMAN USE AND ACTIVITIES IN THE BUFFER ZONE(S)
Four central Acts regulate the use of nature in Norway:

- *"Act Relating to the Management of Biological, Geological and Landscape Diversity (Nature Diversity Act) (2009)"*
- *"Act Concerning the Cultural Heritage (Cultural Heritage Act) (1978)"*
- *"Act Relating to the Planning and Processing of Building Applications (Planning and Building Act) (2008)"*
- *"Act Relating to Outdoor Recreation (Outdoor Recreation Act) (1957)"*

Section 9.3 summarises these Acts. In addition, the Ministries publish Regulations which adapt the legislation to local requirements. Activities in all the buffer zones in the proposed BR are regulated by Acts and Regulations (see Section 17.1.2).

Buffer zones:

1. In **Lurefjorden and Lindåsosane**, the buffer zones will ensure that the fjord is not polluted by sewage and runoff from adjacent land. The municipal authorities of Lindås and Radøy work to preserve the environmental values in the core area and have applied the Building and Planning Act to reduce the pollution hazard originating from the people who live and farm in the buffer zone. As long ago as the 1980s, Lindås Municipality Council ensured that all sewage originating in the Lindåsosane drainage basin was pumped over to the fjord Fensfjorden, and in 2015 the land-use element of the municipal master plan for Lindåsosane, Lygra, and Lurefjorden introduced public-interest zones to protect recreational use and the natural environment on land and in the sea. In 2010, Radøy Municipality Council adopted a corresponding local regulation to prevent discharge from small sewage plants. To fulfil the requirements in the EU Water Framework Directive, Nordhordland Regional Council and the County Governor's Office in Hordaland have started work to reduce all polluted runoff to Lurefjorden. The public right of access laid down by the Outdoor Recreation Act gives inhabitants full opportunity to use the buffer zone.

2. The buffer zones of the **national salmon fjords at Osterøy** are intended to ensure that local aquaculture facilities reduce populations of sea lice to a minimum so that salmon smolt can swim out into the sea without being infected by sea lice. The Nature Diversity Act serves to protect the salmon smolt through two Regulations drawn up by the Ministry of Trade, Industry and Fisheries. The Norwegian Food Safety Authority is responsible for ensuring that the Regulations are adhered to (see Section 19.3). An intensive effort is being made to improve the health of both the farmed salmon and the wild salmon using new technology. The public right of access applies to the buffer zone, with certain restrictions regarding fishing.

3. The "*Proposition to the Storting no. 4 1972-73 On Conservation Plans for Watercourses*", along with the "*Supplement of Conservation Plans for Watercourses*" (2005) and § 32 of the "*Act relating to River Systems and Groundwater (Water Resources Act)*" of November 24, 2000 permanently protect the **River Loneelvi** from being developed for hydropower. The protection includes the drainage basin (the buffer zone). The public right of access applies in the buffer zone.

4. The **Stølsheimen Landscape Protected Area** comprises the buffer zone in the mountains. The Regulation which follows up the Royal Decree pursuant to the Nature Conservation Act (the precursor of the Nature Diversity Act) gives restrictions in relation to the public right of access (see Sections 17.1.2 and 19.1) and with respect to use of the cultural landscape and buildings.

B) A MANAGEMENT POLICY OR PLAN FOR THE AREA AS A BIOSPHERE RESERVE?

(If yes, describe. If not, state how such a plan or policy will be developed, and the timeframe. (If the proposed area coincides with one or more existing protected natural area(s), describe how the management plan of the proposed biosphere reserve will be complementary to the management of the protected area(s)).

During 2018 and 2019, a strategic plan for the proposed Nordhordland BR will be prepared. This will be fundamental for the future organisation and function of the BR and will contain:

- Vision – which describes in general terms what the BR will mean for Nordhordland and how it will function
- Objectives – which state a main goal and subsidiary goals of the programme
- Strategies – which show how we will work to reach the goals
- Measures – which, at an operational level, describe the planned activities in the BR
- Organisation – which describes how the BR will be organized, including a steering committee and advisory groups
- Financial aspects – budget – income and expenditures

The strategic plan will be essential for the priorities and the activities in the planned BR. The process of developing this plan will therefore be important. We will spend ample time and involve as many people as possible in this work. Both the owners (the municipalities in the BR) and all the stakeholders will be involved through various kinds of meetings and gatherings, working groups and open consultative rounds: societies, associations and organisations, schools, higher educational and research institutions, museums and cultural institutions, industry and commerce, and not least "ordinary" people in the future BR. In addition, we will invite the County of Hordaland and the County Governor of Hordaland to take part in the work and will draw on experience gained by other BRs that have been through similar processes.

(C) A DESIGNATED AUTHORITY OR MECHANISM TO IMPLEMENT THIS POLICY OR PLAN?

The final organisation of the BR will be decided through work on the strategic plan, but the present steering committee has set up some general guidelines for the ultimate organisation of the BR:

- The organisation of the BR must follow directly from the responsibilities assigned to, and the intended tasks and functions of, the BR. The organisation of the BR should therefore not be finalised before these tasks and responsibilities have been decided.
- The organisational model must be flexible and dynamic so that it can be adjusted to a variety of future scenarios.
- The management of the BR must be based on open and inclusive processes in which the many NGOs in the region participate.

The BR organisation will be responsible for implementing the management plan on a day-to-day basis. As today, all key stakeholders, and people from different parts of society should be represented in the steering committee. The committee will meet 4-6 times a year, develop strategies for future growth, and ensure that plans and budget are followed.

The BR organisation currently reports to the Nordhordland Regional Council, which has overall responsibility for the project. This will most probably continue when the BR is established, but in addition there should be some kind of representative (elected) general meeting to ensure broad participation and ownership to the activities in the BR.

(D) PROGRAMMES FOR RESEARCH, MONITORING, EDUCATION AND TRAINING?

(If yes, describe. If not, describe what is planned.)

There is already a lot of research being done in Nordhordland (see Section 16.1.1). Due to close connections and collaboration with the university and college sector, the proposed BR is in the forefront in regard to research and development. The designation of Nordhordland as a BR will help attract new research projects. The BR organisation will function as a cross-disciplinary intermediary for contacts and as a catalyst between research, management, business and industry, and the general population.

Encouraged by the work of developing a BR in Nordhordland, the University of Bergen, with support from the Norwegian National Commission for UNESCO, applied for and then received a UNESCO Chair in "*Sustainable Heritage and Environmental Management – Nature and Culture*". In February 2017, UNESCO appointed Inger Elisabeth Måren as Associate Professor to work on an interdisciplinary basis, to proactively promote the future BR in research and to implement the UN Agenda 2030. The first project directly linked to the future BR has already begun. In Aug 2018, a four-year research project, 'TRADMOD', started, with funding from the MILJØFORSK programme of the Research Council of Norway and led by the UNESCO chair Måren. The project is intended to pave the way for more interplay between industry and commerce, management and research to contribute to an environmentally sustainable development.

Nordhordland has a number of institutions doing research and disseminating knowledge. The field station of the Norwegian Institute of Marine Research at Matre has been one of the pillars in the development of modern aquaculture, and several of the techniques developed there are

now in use all over the world. The Heathland Centre at Lygra is important for research, teaching and disseminating knowledge about the coastal landscape, traditional practices, and biological diversity. The many museums and other cultural institutions in the region also disseminate valuable knowledge.

The Norwegian Environment Agency has overall national responsibility for the monitoring and conservation of Norwegian nature. There is comprehensive environmental monitoring of the sea, rivers and lakes, the landscape, and air quality across the country, including Nordhordland (see Section 16.1.1 for details). We will here only mention the extensive monitoring programmes for wild salmon, char and seabirds, and the monitoring programme through the EU Water Framework Directive, which will be implemented in the near future.

Photo: Vivel Skarvatun.

5 ENDORSEMENTS

5.1 and 5.2 Signed by authorities in charge of the management of the core areas and buffer zones

Authority in charge for the core areas and buffer zones for Lurefjorden, The national Salmon fjords, Loneelvi and the bufferzone in Stølsheimen:

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Lars Sponheim

County Governor of Sogn & Fjordane
County Governor Gunnar O. Hæreid
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Gunnar O. Hæreid

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Anne Gine Hestetun

County Sogn & Fjordane

Mayor of County Sogn & Fjordane Jenny Følling
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Jenny Følling

5.3 Signed as appropriate by the National administration responsible for the management of the core areas and the buffer zones

This signature is placed after the introduction at the very beginning of this application.

5.4 Signatures of of authorites, elected local government representing the local community in the transition area

Municipality of Masfjorden
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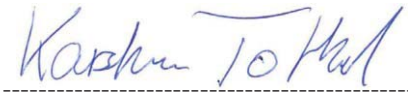

Karstein Totland

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Jarle Skeidsvoll

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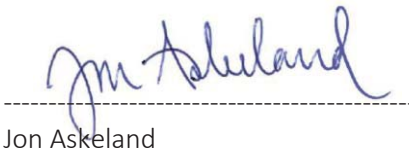

Jon Askeland

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Per Lerøy

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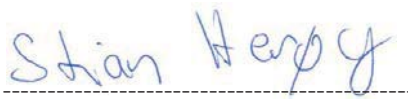

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Hallvard Oppedal

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Astrid Aarhus Byrknes

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Øyvind Helleland Oddekalv

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Tom Kristian Thorsen

Municipality of Vaksdal
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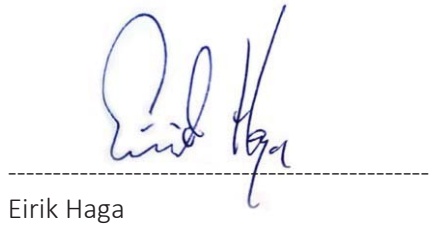
e-mail: eirik.haga@vaksdal.kommune.no



Eirik Haga

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e-mail: borge.haugetun@oygarden.kommune.no

Børge Haugetun

5.5 Signatures from the municipalities that have parts of their area within Nordhordland Biosphere Reserve:

Municipality of Askøy
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Terje Mathiassen

Municipality of Bergen

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Harald Schelderup

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Petter Sortland

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Olav Turvoll

Municipality of Voss
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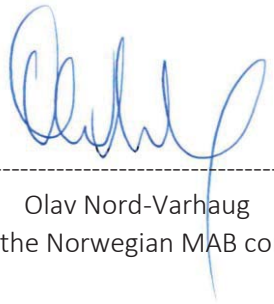
Hans-Erik Ringkjøb

5.6 Signed on behalf of the national MAB committee



Olav Nord-Varhaug
Head of the Norwegian MAB committee

Børilden, Austrheim. Photo: Eivind Senneset.

PART II: DESCRIPTION

6. LOCATION (COORDINATES AND MAPS)

6.1 Provide the biosphere reserve's standard geographical coordinates projected (all projected under WGS 84)

Cardinal points	Latitude	Longitude
Most central point	60.830486 N	5.325954 E
Northernmost point	61.11778 N	5.153265 E
Southernmost point	60.420683 N	5.528657 E
Westernmost point	60.833071 N	4.185495 E
Easternmost point	61.054069 N	6.493736 E

6.2 Provide a map(s) as a topographic layer of the precise location and deminilation of the tree zones of the biosphere reserve. (Maps shall be provided in both paper and electronic copies)

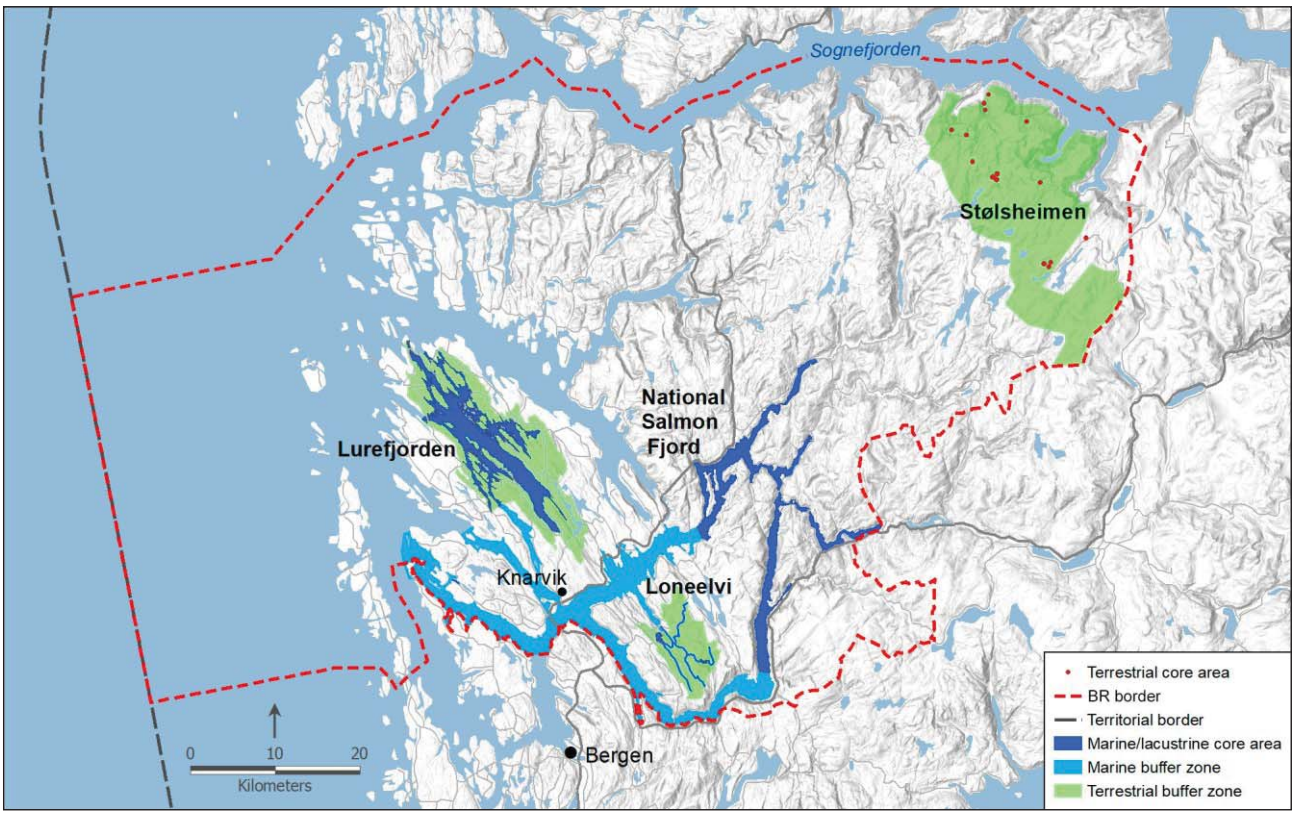


Figure 6.1. Map of the proposed BR showing core areas and buffer zones. The rest of the area within the BR boundary is the transition zone. Map: Lina Haggard, Peter Emil Kaland.

Fagerdalen, Stølsheimen. Photo: Bergens Tidende

7 THE AREA

7.1-3 The area of the core area, the buffer zone and the transition zone

The total area is: **669,800 ha** (both land and sea)

Table 7.1: The area of the core areas, the buffer zones and the transition zone.

	Terrestrisk	Marint	Total
7.1 Area of the core areas	85 ha	13,540 ha	13,625 ha (2,0%)
7.2 Area of the buffer zones	43,360 ha	30,730 ha	74,090 ha (11,1%)
7.3 Area of the transition zone	379,285 ha	202,800 ha	582,085 ha (86,9%)
TOTAL:	**422,730 ha**	**247,070 ha**	**669,800 ha**

7.4 Brief rationale of this zonation, in terms of the respective functions of the biosphere reserve. If a different type of zonation also exists indicate how it can coexist with the requirements of the biosphere reserve zonation

(e.g. if national criteria exist for the definition of the area or zones, provide brief information about this)

See also Sections 4.4, 4.5, 4.7, 9.2, 9.3, 14.1.3, 17.1.2 and 19.1.1.

The zonation of the proposed BR is based on Norwegian environmental legislation and the criteria of the *Statutory Framework for the World Network of BRs*. The core areas reflect central natural and cultural values in the region. The proposed zonation is based on suggestions from researchers, local politicians and representatives from industry and commerce in the region. We believe that this emphasis on local people in Nordhordland contributing to the design of the zonation is both correct and expedient. The proposal has also been a topic at meetings with the Norwegian Environment Agency, the Norwegian MAB committee and the MAB Secretariat.

When the BR was being planned, it was decided that each of the three landscape regions – *coast*, *fjord* and *mountain* – should have a core area. The climate gradients from the outer coast to the inland and from sea level to the mountains control the form of the landscape in Nordhordland. Precipitation increases from 1100 mm/yr in the west to as much as 3900 mm/yr in the mountains and gives rise to the many rivers which flow down from the mountains. The multi-faceted use of water is therefore a natural choice for a prioritised topic in the BR.

For several thousands of years, the entire landscape of Nordhordland has been exploited by the local people to produce food and this characterises the landscape. Three of the four core areas in the proposed BR are associated with the aquatic environment, whereas the fourth is linked to the mountains.

COAST

On the outer coast, the focus is on the marine environment in Lurefjorden and Lindåsosane (Lindåspollene). Researchers have been undertaking in-depth research here for about 50 years, initially on a herring strain in Lindåsosane which has been partly confined in a small fjord arm (Figure 19.2, Photo 14.1) for several thousand years, and then on the aquatic environment and the large population of the luminescent helmet jelly fish (*Perifylla perifylla*) in Lurefjorden. The Ministry of Climate and Environment started the process to protect the marine environment of Lurefjorden and Lindåsosane in 2015. This is expected to be completed during 2019. The buffer zone is intended to protect Lurefjorden and Lindåsosane from any runoff of polluted water from the surrounding catchment area of Lurefjorden.

FJORD

In the fjord area, the focus is on the effort to save the population of what is possibly the Atlantic Ocean's largest salmon, the Vosso salmon, and the other salmon and trout strains typical of the 6 rivers flowing into the national salmon fjords near the island of Osterøy. Unique cooperation is taking place here between the local people, the municipal authorities, researchers, environmental management, and industry and commerce to rescue the Vosso salmon strain. The aim is to rebuild the wild salmon strains to their former level. To achieve this, the smolt must be able to undertake the 160 km long swimming journey (Figure 19.5) from the mouths of the salmon river through the fjords to the ocean. In the fjords (marine buffer zone) the smolt has to pass 15 commercial salmon farms, without being mortally infected by parasitic sea lice (Figure 19.6). This requires the aquaculture industry to introduce new production methods that are more in line with nature. Major changes are being tested.

The River Loneelvi is one of the rivers flowing into a national salmon fjord. It is permanently protected from hydroelectricity development. It has a local salmon strain of small salmon and also has a high level of biodiversity, including several red-listed aquatic birds and freshwater pearl mussels due to the nature of its bed. Researchers have been following the fortune of this salmon strain for 40 years. The catchment basin of the river comprises the buffer zone.

ALPINE

The Stølsheimen Landscape Protected Area (LPA) is the self-evident area in the mountains. Most of this is in the alpine zone, but a small part reaches right down to Sognefjorden in the north. Nowadays, it is an important year-round recreational area for the whole region, including the city of Bergen, but until about 1970 upland summer dairy farming, numbering 56 farms, was the most important means of utilising the resources, with hunting and fishing in addition. The long history of land use, together with its present use, means that this upland area has a high identity value for local people. It also has great potential for sustainable development in cooperation with the local inhabitants. In Stølsheimen, protected cultural heritage monuments in LPA are core areas, and the LPA is the buffer zone (see 19.1.1).

In the buffer zones, the use of the natural resources has created open landscapes in the coastal area (the *coastal heathlands*) and in the alpine zone (the *upland summer dairy farm landscape*). After the Second World War, mechanisation and rationalisation in farming, along with global trends, have led to large parts of these outfield areas no longer being used for agricultural production. The consequence is an ongoing, gradual change to woodland, which threatens the high natural and cultural values attached to these open landscapes. The coastal heathlands in Nordhordland have been studied by University of Bergen researchers since 1970. Among other things, this has

led to the establishment of the Heathland Centre at Lygra (awarded prizes by UNESCO and the Europa Commision/Europa Nostra and to the designation of coastal heathland as a selected type of vegetation in accordance with decisions under the Nature Diversity Act. The Heathland Centre is in the buffer zone of the Lurefjord core area. In addition the Directorate of Cultural Heritage has characterised Lurefjorden and large parts of the buffer zone as "*Cultural landscape of national interest*".

8 BIOGEOGRAPHICAL REGION

(Indicate the generally accepted name of the biographical region in which the proposed biosphere reserve is located. (The term 'biographic region' is not strictly defined, but you may wish to refer to the Udvardy classification system.))

UNESCO definition: the proposed BR in Nordhordland is classified as West Eurasian Taiga, according to the Udvardy Classification System (Udvardy 1975).

National definition: the vegetation zones in the proposed Nordhordland BR comprise the boreo-nemoral zone (coniferous and broad-leaved deciduous woodland zone), southern boreal zone (southern coniferous woodland zone), middle boreal zone (middle coniferous woodland zone), northern boreal zone (northern coniferous and birch woodland zone), low alpine zone (uplands), middle alpine zone (moderately high mountains), and high alpine zone (high mountains) (Moen 1999).

Straumen, Modalen. Photo: Kjersti Isdal.

9 LAND USE

9.1 Historical

(If known, give a brief summary of past/historical land use(s), resource uses and landscape dynamics of each zone of the proposed biosphere reserve.)

The following briefly summarises the former exploitation of the resources on land and in the sea.

EARLY STONE AGE (9500 – 4000 BC)
The outer strip of the west coast of Norway became ice free during the Bølling and Allerød periods (11,700 – 10,700 BC), and the discovery of an agglomeration of bones belonging to marine and terrestrial mammals in a deposit at Blomvåg in Øygarden may suggest that the first people had settled in the area. The large number of settlements on the outer coast, dating from after 10,000 BC, are unquestionable signs of human activity. Their location is chiefly linked to marine localities where fish, marine mammals and seabirds constituted the principal diet. Some of the settlements which are located close to tidal currents were in continuous use for several thousands of years, resulting in thick deposits of sediments and artefacts from the human activities. Examples of such settlements are found at the entrances to the Lurefjord core area and at Skipshelleren in Veafjord (in the National Salmon Fjord core area at Osterøy).

LATE STONE AGE – INTRODUCTION OF AGRICULTURE (4000 – 1700 BC)
Agriculture had its breakthrough during the Late Stone Age. At first, people continued to occupy their old settlements, but evidence of grains and new weeds indicates the careful start of an agricultural economy. Pollen analytical investigations show that the landscape slowly became more open. The occupation layers at a rock shelter (Skipshelleren) contain bones of cows and sheep, but also bones of fishspecies including salmon. Towards the end of the Stone Age, the settlement pattern shifted from being related to good localities for fishing and hunting to areas with easily worked soil for farming – arable farming had become the most important way of utilising the resources.

BRONZE AGE (1700 – 500 BC)
Settlement spread into the fjord area. Hunting and fishing seem to have become more seasonal activities. A pollen diagram from the fjord farm Havrå, situated on a steep, south-facing slope on the island of Osterøy shows that the area had a rich broad-leaved deciduous woodland before it was cleared and settled. Pollen from grains and grazing plants shows that Havrå had begun to be used for farming during the bronze age.

EARLY IRON AGE (500 BC – AD 600)
Knowledge of iron production and the use of iron tools arrived during the last centuries before the Birth of Christ. This was an enormous technological advance which changed how both farming and fishing were carried out and had great consequences for the development of the cultural landscape. Many traditional farming tools began to be used during the first few centuries AD, and haymaking meadows and permanently manured fields became part of the landscape. Farming became organised as we know it in modern times, with permanent walls or fences round the infields to protect the fodder production, and an outfield area where livestock grazed during the summer.

The cultural landscape gained many new landscape elements, such as large stone walls, houses and arable land. This huge technological advance led to a major extension of the agricultural area.

At the same time, the outfield resources began to be used to their full extent. Well-known types of cultivated land, like pollarded woodland, wooded hay meadows, wooded pastures and mown and grazed bogs become common. On the coast, the woodland was gradually cleared, and extensive heathlands served as year-round grazing for domestic livestock. Grass was the most important fodder for the livestock, but leaves, heather, peeled bark and other kinds of rough fodder were also used in considerable quantities to be able to keep as many animals as possible.

Summer dairy farming in Stølsheimen

Upland summer dairy farming was perhaps the most significant innovation as regards the utilisation of outfield resources. By allowing livestock to graze the newly germinated grass after the snow thaws on the valley slopes and in the mountains, farmers gained access to protein-rich fodder that greatly increased the growth of their livestock during the summer. The intensive grazing around the summer farms, and the felling of trees for firewood and to produce dairy products, stopped the regeneration of the woodland. In many places, charcoal was produced; this was important for iron production. The consequence was a marked lowering of the tree line in these upland areas.

VIKING AGE AND MIDDLE AGES (AD 800-1500)

Agriculture was further intensified in the Viking Age (AD 800 – 1030), when farms were divided into two or more independent units and more land was cleared in the outfield areas. Most farms that have names today were already in use prior to 1350.

The abandoned farm on the island of Lurekalven, in the centre of the Lurefjord core area, was studied by archaeologists in the 1970s. This gave detailed information about how farming took place from the Viking Age up to the Black Death in 1350. The arable fields were small, but the soil

Photo 9.1: In the villages on the outer coast, it was important to manage heathland so that livestock could graze outside throughout the year in the mild climate. Photo: Peter Emil Kaland.

was up to 2 metres thick. This shows that soil had been added to the fields. Pollen analysis and archaeological excavations of the fields showed that the manner of farming was identical to that known from heathland landscapes further south in Europe (Plaggenwirtschaft, sod cutting), where the addition of soil mixed with all kinds of organic waste was an important part of the manuring. This farming practice, the use of sod cutting and use of spade instead of ploughing the small fields, was still in use on Syslak Farm in Lindås municipality up to 1970.

The Black Death in AD 1350 had great consequences within the proposed BR. Historical sources show that 44% of all the named farms in Lindås administrative area (skipreide) were still abandoned in 1520, and it is estimated that half the Norwegian population had died. Pollen diagrams from the area, however, show that the landscape was kept open. It was only by the beginning of the 17th century that all the named farms were being worked again and the population had recovered to the same level as in the early 14th century.

THE PRE-INDUSTRIAL CULTURAL LANDSCAPE IN THE 18TH AND 19TH CENTURIES

Many new cultivated plants arrived in Europe during the 17th century. The potato reached Nordhordland about 1750 and became an important source of starch that could provide food for a growing population. On the whole, traditional farming methods continued, combined with fishing. Cooperation evolved between people in the coastal and fjord settlements. The farmers along the fjords took some of the livestock belonging to the coastal farmers with them to their upland summer dairy farms, while the farmers on the coast allowed some cows and goats belonging to the fjord farmers to graze on the coastal heathlands during the winter. In this way, the total fodder and grazing resources could be better utilised, and more livestock could survive the winter. The outer coast had a surplus of fish, which could be bartered with timber from the fjord settlements.

THE GREAT LANDSCAPE TRANSFORMATION – THE EXCHANGES OF INFIELDS AND OUTFIELDS (1800-1945)

The population of Norway doubled during the 19th century. To be able to feed such a larger population, agricultural reforms were required. The largest was the exchanges of infields and outfields. The result was a dramatic change in the character of the cultural landscape. Each farm had its infield land collected into a single, continuous area. At the same time, the usual farmhouse clusters were broken up, and the farmhouses were dispersed on the land now owned by each farm. The opposite development took place in outfield areas. Up to now, the outfield had been commonly owned land. Now, each farmer got his own parcel of outfield. These exchanges meant that the cultural landscape took on the appearance we know today.

Great changes also took place in livestock production. It was important to increase the degree of self-sufficiency in meat. However, the old livestock breeds were considered as being poorly productive. From the 1880s, the traditional Norwegian sheep breed began to be replaced by breeds of large sheep imported from the British Isles, which needed significantly better fodder. Systematic breeding also took place to increase the production of cattle, pigs and hens. The old livestock breeds quickly declined and some were at risk of dying out.

In the villages in Nordhordland and Sogn, the primary industries were still the most important basis for the inhabitants, even though having extra jobs gradually became more common. The farm was the basis for most people, but it was the resource base which decided whether farming or fishing was the primary basis for the household. In the outer heathland zone, fishing was most important. While the men were out at sea, the women and children did the farm work. The combination of

fishing and a smallholding with a couple of cows and some sheep gave a high reliability of food and a sufficiently varied diet for the family. It was not necessary to have a large farm to survive, and the combination of the resources on land and in the sea allowed the population density to be comparatively high.

Along the fjords, fishing formed part of the household economy, but the topography and climatic conditions, with slightly higher summer temperatures, favoured farming. Whereas in the outer districts, the sheep could graze the heathland all the year round, the slightly cooler winters along the fjords led to so much snow that all the livestock had to be fed indoors. On the other hand, the farmers along the fjords had large resources in the woods and extensive grazing on the valley sides and in the mountains. The woodland provided leaves and peeled bark for fodder, and timber and firewood for domestic use and for sale. The fjord farms both west and east of Stølsheimen had low-altitude summer dairy farms as well as upland summer dairy farms where they fully exploited the grazing in the summer and autumn, and harvested grass from the outfield hay meadows. Hunting red deer and reindeer in autumn provided an important supplement of meat. The farmers from Nordhordland and outer Sogn had Bergen as an important market for fish, farm and handicraft products.

AGRICULTURE AFTER 1945

After the Second World War, the aim was that agriculture should produce as much food as possible at the same time as it released labour to other kinds of occupations. Strong rationalisation using improved tractors, feed concentrates, artificial fertilisers, herbicides and improvements in cultivated plants and livestock breeding were intended to ensure high agricultural production with a minimum of labour. Norway became self-sufficient in food, but this had great consequences for the cultural landscape and the working conditions for farmers. The cultural landscape had lost much of its biological diversity. The demand for high productivity in agriculture has resulted in only the most productive parts of the cultural landscape being used. Afforestation and decreased use of the outfield areas have led to the land becoming overgrown. Less cost-effective production units such as upland summer dairy farms suffered a sharp decline. Nationally, the number of upland summer dairy farms dropped from 52,900 in 1850 to 1,900 in 1993; none in Stølsheimen are now being used in a traditional manner. The results are expansion of scrub and woodland, and a higher tree line in the upland summer dairy farming areas.

DEVELOPMENT OF TRANSPORT

From the old days, the sea has provided the most important transport corridors for the people inhabiting the proposed BR. The archipelago with its multitude of small and large islands gave calm water for safe travel by boat, even when strong winds made the open sea dangerous. The inner water way from Bergen to Fensfjorden and on to Gulen and Sognefjord has thus always been a safe sea route between the villages in the proposed BR and to Bergen.

Between the two world wars, networks of main roads and local roads were gradually built, but the major period of roadbuilding, and the resulting increase in the number of vehicles, did not come until the 1960s. In the following decades, the road network attained a higher standard, with many ferries, bridges and tunnels. This resulted in a completely new pattern of communication, with a shift from sea to land transport. However, sea transport also changed after the 1960s, for example with the introduction of fast hydrofoils and catamarans. Taken altogether, the revolution in communications has provided a valuable infrastructure to form the basis for the major changes in industry, commerce and working life since 1960, and changes in the municipal structure.

9.2 Who are the main users of the biosphere reserve? (for each zone, and main resources used). If applicable, describe the level of involvement of indigenous people taking into account the "United Nations Declaration on the Rights of Indigenous Peoples".

See also Sections 4.5, 7.4, 14.1.3 and 17.1.2.

The proposed BR has no indigenous peoples as these are defined in the United Nations Declaration on the Rights of Indigenous Peoples.

Table 9.1: Principal users of the proposed BR, for each zone.

Area	Core area	Buffer zone	Transition zone
Lurefjord and Lindåsosane	Local people use the fjord for fishing and boat transport. The inner shipping water way along the coast has year-round through traffic of passenger and cargo vessels. Leisure boats with families on trips. Canoeing and kayaking. Researchers and students from Norway and other countries study the marine environment.	About 6,000 people live in the buffer zone. Many cabins for people from Bergen. Farming, businesses and tourism. Researchers, students and school pupils study the cultural landscape and cultural heritage monuments.	Public and private business activities. Farming, forestry and fishing. Provision of public services. Crafts and industry. Energy sector: Hydroelectricity, oil and gas. Aquaculture. See the overview in Sections 9.3, 10 and 17.1.2 on the inhabitants of the proposed BR.
River Loneelvi	Local people and tourists fish salmon with rods (certain restrictions). Hikers enjoy the countryside and its birdlife. Researchers and environmental managers study the salmon stock, freshwater pearl mussels and birds.	Local people use the buffer zone for farming and recreation.	
The national salmon fjords near the island of Osterøy	Local people use the fjord for fishing (with restrictions) and boat transport. Traditionally important for commercial salmon fishing. Boat traffic: kayaks, rowing boats, passenger and cargo vessels. Tourism.	15 aquaculture facilities farming salmon and trout. Environmental managers and researchers monitor the environment in the sea. Boat traffic. Leisure fishing.	
Stølsheimen	The cultural heritage monuments are important identity-creating sites for local people. Recreation and discovery area for mountain hikers. Researchers and environmental managers study cultural and natural history and future utilisation.	Owners of the upland summer dairy farms look after grazing livestock, fish and hunt. Important for hikers and skiers throughout the year. The Bergen and Hordaland Trekking Association and the Norwegian Trekking Association run cabins where people can stay overnight.	

9.3 What are the rules (including customary or traditional) of land use in and access to each zone of the biosphere reserve?

Three central Acts regulate land use in Norway: "*Act Relating to the Management of Biological, Geological and Landscape Diversity (Nature Diversity Act) (2009)"; "Act Concerning the Cultural Heritage (Cultural Heritage Act) (1978)"*; and "*Act Relating to the Planning and Processing of Building Applications (Planning and Building Act) (2008)*". In addition, the "*Act Relating to Outdoor Recreation (Outdoor Recreation Act) (1957)*" is important for people having free access to outfield areas through the 'public right of access'.

The objective of **the Nature Diversity Act** is to reduce the loss of biodiversity and ensure that the most valuable habitats survive. The Act implements international agreements and obligations for safeguarding natural values. The Act is applicable both on land and in the sea as far as the Norwegian territorial limit (12 nautical miles), as well as – to a limited extent – in the Norwegian Economic Zone (200 nautical miles). It has provisions for protecting areas and management plans for nature reserves, national parks and landscape protected areas. It has instruments for protecting prioritised species and selected habitats whose continued existence is threatened. The Nature Diversity Act also includes provisions for compensating landowners for economic loss because of protection.

The objective of **the Cultural Heritage Act** is to protect cultural heritage monuments and environments as part of the cultural heritage and as part of overall environmental and resource management. The strongest instrument in the Act is protection; all cultural monuments older than the Reformation (1537) are automatically protected. The Act also authorises the special protection of permanent cultural heritage monuments and cultural environments. In addition, §19 of the Cultural Heritage Act can authorise the protection of an area surrounding one or more cultural heritage monuments or cultural heritage environments. The purpose of area protection is to safeguard the effect of the monuments within their environment or the landscape. The Cultural Heritage Act must therefore be viewed in connection with the regulations associated with the Nature Diversity Act and the Planning and Building Act concerning land use.

The Planning and Building Act regulates all public planning of land use under municipal auspices. This takes place through a statutory division of responsibility between the Government, the county councils and the municipal councils. Municipal councils are obliged to draw up an overall local municipality plan that includes a social part and a land use part. The latter must show the relationship between the future development of society and land use and must define zones where consideration must be taken, accompanied by guidelines. These zones are, for example, areas where farming, outdoor recreation, and natural and cultural environments are protected. When these zones are used, local authorities can implement provisions to safeguard environmental values in the local community. There are obvious similarities in the thinking behind the Planning and Building Act and the concept of BRs. Both place emphasis on the relationship between social development and the exploitation of resources in the landscape.

The Outdoor Recreation Act confirms the ancient Norwegian custom, 'the public right of access'. It gives everyone the right to roam and to spend time in uncultivated, outfield areas such as woodlands, forests, fields, rivers, lakes, the coast and the mountains, irrespective of who owns the land. In §1a, the Act defines uncultivated land as land that is not tilled. §2 states that "*any person is entitled to access and passage through uncultivated land at all times of the year, provided consideration and due care is shown*". It is permitted to ride or cycle on paths and roads, and

to rest and stay overnight. §5 states that any person is entitled to pick berries, mushrooms and flowers in outfield areas. §6 states that "*any person is entitled to free passage on the sea by boat*". It is also permitted for anyone to fish saltwater fish in Norway. In principle, it is also permitted to fish anadromous species of fish (salmon, sea trout and sea char) in the sea with a rod, but not closer than 100 m from the transition between the sea and a river. Fishing in rivers and lakes requires payment of a fishing fee to the Government and the purchase of a fishing licence from the landowner. The right of public access also applies to the core areas and buffer zones, but state and municipal provisions may limit the rights here.

Table 9.2: Provisions and use of the various zones.

Area	Core area	Buffer zone	Transition zone
Lurefjord and Lindåsosane	The marine environment is protected. The right of public access applies, with restrictions.	Limits on the flow of sewage and other pollution to the sea. The right of public access applies.	The right of public access applies, with restrictions determined in Acts and municipal bye-laws.
River Loneelvi	Secures the reference value of the river. Avoids encroachments which reduce the value of the natural and cultural environments. The right of public access applies, with restrictions.	Protection of natural and cultural environments. Opportunities for outdoor recreation, particularly for local people. The right of public access applies.	
The national salmon fjords near the island of Osterøy	Farming of edible fish is banned. Fishing salmon and trout with rods or nets is banned. The right of public access applies, with restrictions	Restrictions on the concentration of sea lice. Monitoring of the marine environment. The right of public access applies.	
Stølsheimen	Cultural heritage monuments older than 1537 are protected. Younger cultural heritage monuments are protected through provisions from the Norwegian Environment Agency. The right of public access applies, with restrictions.	The right of public access applies, with restrictions given in the management plan for the landscape protected area.	

9.4 Describe women's and men's different levels of access to and control over resources.

(Do men and women use the same resources differently (e.g., for subsistence, market, religious/ritual purposes), or use different resources?).

In accordance with the Act relating to equality and a prohibition against discrimination (The Equality and Anti-Discrimination Act) of 21 June 2013, men and women have equal rights of access to and control of resources.

Kvalvika, Radøy. Photo: Kjersti Isdal.

10 HUMAN POPULATION OF PROPOSED BIOSPHERE RESERVE

10.1-3 The core areas, buffer zones and transition area

(approximate number of people living within the proposed biosphere reserve)

Table 10.1. The population in the proposed biosphere reserve. Seasonal residents are, in this case, interpreted as the many cabin owners who live in their cabins for parts of the year.

	Permanently	Seasonally
10.1 Core areas	0	0
10.2 Buffer zones	7,600 (14%)	2,800 (19%)
10.3 Transition area	46,800 (86%)	12,200 (81%)
Total	**54,400**	**15,000**

10.4 Brief description of local communities living in or near the proposed biosphere reserve

(Indicate ethnic origin and composition, minorities etc, main economic activities (e.g pastoralsim, tourism) and the location of their main areas of concentration, with reference to the map Figure 10.1)

MUNICIPALITIES IN THE PROPOSED BIOSPHERE RESERVE (REF MAP FIGURE 10.1).
Almost all of the proposed BR is within the territory of 11 municipalities: Austrheim, Fedje, Gulen, Lindås, Masfjorden, Meland, Modalen, Osterøy, Radøy, Vaksdal and Øygarden. Lindås, Meland and Radøy will from 2020 be one united municipality to be called Alver. The core areas of Stølsheimen and the National Salmon Fjords include parts of three additional municipalities (Høyanger, Vik and Voss), and these have small populations in the adjacent areas. Each of the 11 local municipalities comprising the majority of the proposed BR has its own characteristics. They differ in size and the number of inhabitants.

Austrheim
Austrheim is in the northern part of the county of Hordaland and is a coastal municipality with a substantial marine area; it includes 489 islands, islets and skerries. The ring road in Nordhordland goes through Austrheim; 13 bridges bind the area together. There is a great deal of leisure activity connected with the coast and the sea. The westernmost point on the Norwegian mainland,

Vardetangen, is in Austrheim. Mongstad, an international industrial area with an oil refinery, a supply base, a petroleum industry and a CO_2 capture and storage centre, is partly located in Austrheim, and the municipality also has a substantial maritime industry.

Fedje

Fedje is a small coastal municipality on the rim of the North Sea. Most of the inhabitants live on a single island surrounded by smaller islands, islets and skerries. Fedje is the westernmost municipality in Norway and has just over 550 inhabitants. Distances are short. You have to take the ferry or some other kind of vessel to reach Fedje. There are plenty of opportunities for varied outdoor life linked with both the sea and the land. Commercial life is also varied. The company Uniko AS provides safety courses for maritime and offshore concerns, Fedje Vessel Traffic Service Centre monitors the waters around Mongstad and Sture, and operates a pilot station. Little remains of the former fishing industry, but there is still one whaling licence which helps to provide an exotic atmosphere in the whaling season. Small tourism businesses are also upcoming.

Gulen

Gulen is on the coast between Sognefjord and Fensfjord, furthest southwest in the county of Sogn & Fjordane, bordering on the county of Hordaland. It has a varied and thrilling countryside with 1500 islands, islets and skerries, and a mainland characterised by small, crisscrossing valleys. Many small businesses characterise commercial life in Gulen. About 170 active farms make farming an important business. In recent years, aquaculture has expanded to become a major industry that operates 20 concessions to farm salmon. Fish processing also takes place. Gulen has a commercial harbour with extensive quays and other facilities that make it suitable as a base for petroleum activities.

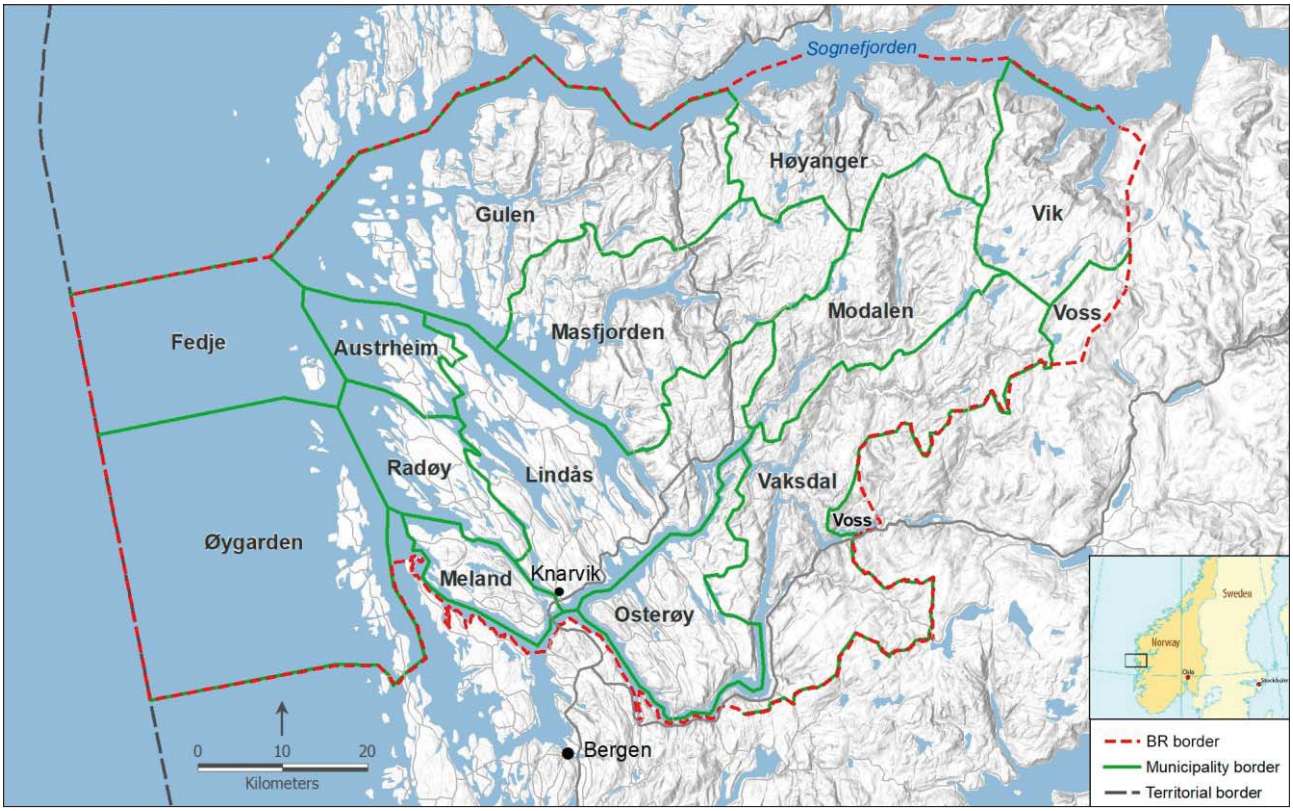


Figure 10.1. The municipalities comprising the proposed Nordhordland BR. Map: Lina Haggard, Peter Emil Kaland.

Lindås

Lindås is the largest municipality in Nordhordland and is growing steadily. Knarvik is the municipal and regional centre, only 25 minutes drive from the centre of Bergen. Lindås has a rich cultural life strongly based on volunteering. The sport event "Knarvikmila" is held every year and attracts more than 7,000 participants to join in one of the fitness runs. One of the world's best brass bands, Eikanger-Bjørsvik Brass Band, is based here. Most of the Mongstad oil refinery and technology centre is located in Lindås. Mongstad also has more than 100 supply companies and is the largest petroleum supply base in Norway and an attractive site for setting up new businesses and for innovation.

Masfjorden

Masfjorden is in the northern part of Hordaland. It offers plenty of lovely experiences for those interested in outdoor activities in both sheltered and dramatic landscapes. There are many societies and associations and, despite its small size, Masfjorden has many cultural activities. The countryside also provides a basis for jobs. A great deal of hydroelectricity is generated here, and there are many fish farms. The Norwegian Institute of Marine Research in Bergen has a large field station at Matre carrying out research on salmon and other maritime topics. Businesses engaged in tourism also have plenty to offer, both by the sea and in the mountains.

Meland

Meland borders the city of Bergen; it takes less than half an hour to drive from the centre of Bergen to Frekhaug, the centre of Meland. Nordhordland Bridge links Meland to the mainland, providing the geographical link between Bergen and Nordhordland. Meland has been growing rapidly, and

Photo 10.1. The oil refinery at Mongstad is the largest in Norway. Attached to it is a centre for testing and developing CO_2 capture and storage technology. Photo: Bergens Tidende.

now has just over 8,000 inhabitants. Settlement is mostly dispersed, but is mainly concentrated in the south, around Frekhaug. Meland has the largest Folk High School in Norway and one of the highest ranked golf courses in Europe. It has jobs in industry, services, agriculture, public services and management, and many people commute to Bergen and Lindås.

Modalen

Only one other municipality in Norway has fewer inhabitants than Modalen, but Modalen covers a large area. It is located innermost in Osterfjord and is the gateway to Stølsheimen, offering a network of paths for hikers and many simply-equipped cabins where they can spend the night. Modalen enjoys a large income from hydroelectricity generation and, despite its small population, it has built a large complex that combines sports facilities, including a swimming pool and a bowling alley, with a hall for cultural events. Jobs in Modalen used to be mainly connected with farming and a large sand and gravel pit. Several companies now provide information technology services and there are many jobs in tourism and shops, as well as within small craft and service.

Osterøy

Osterøy is the largest inland island in Norway surrounded by saltwater. Both a bridge and a ferry connect the island with its neighbour, Bergen. The landscape is varied and includes good hiking terrain for outdoor activities and experiencing the countryside in both summer and winter. Osterøy has a rich cultural life, many important cultural heritage monuments and an interesting cultural environment. Many kinds of jobs are available, such as in modern industry based on old handwork traditions, contractor and craft firms, agriculture, and fish farming.

Radøy

Radøy has a central location in Nordhordland. It is known as the green island, but actually consists of 269 islands, islets and skerries. The name 'green island' alludes to the lush, green, natural and cultural landscape that extends right down to the shore. One of the largest Stone Age settlements in western Norway is at Straume on the island of Radøy; it dates back to nearly 10,000 years ago.

Photo 10.2. Bøvågen, Radøy. Photo: Ragnar Floen.

The municipality has a rich cultural life, many active societies and organisations, and several sports facilities. In addition to small industrial and craft businesses, there are several larger firms, including some which undertake subsea work.

Vaksdal

Vaksdal is furthest south in the proposed BR, midway between the town of Voss and Bergen. The main highway, E16, and the main railway between Bergen and Oslo pass through Vaksdal, giving efficient east-west communications. The villages of Vaksdal and Dale are centres for hydroelectricity generation and textile manufacturing; Dale of Norway wool products can be bought here. There is plenty of space for outdoor activities and good opportunities for fishing in the fjord and the mountains. There are good, marked, hiking paths in Eksingedalen, a gateway to Stølsheimen, and Bergsdalen.

Øygarden

Øygarden is on the outer coast, and its islands shelter the fjords from the open sea. The municipality is comparatively flat, with the open sea to the west and Hjeltefjord to the east. The cultural life is varied and there are many societies and organisations. It takes about 45 minutes to drive from Bergen westwards to Rong, the administrative centre. Øygarden is one of the largest centres for aquaculture in Hordaland; the farms produce salmon, cod and shellfish. There are also comparatively many deep-sea fishing boats. The petroleum industry has two large plants in Øygarden; the Sture terminal is an important harbour for exporting crude oil and Kollsnes exports gas through pipelines to many European countries.

Table 10.2. Recent, current and forecast population figures for Nordhordland (incl. Vaksdal and Øygarden) for 2000 to 2040. Source: Norway Statistics.

	Population on 1 January			Forecasted population		
Local authority	**2000**	**2010**	**2018**	**2020**	**2030**	**2040**
1251 Vaksdal	4 192	4 107	4 127	4 208	4 382	4 517
1252 Modalen	354	344	380	394	430	453
1253 Osterøy	7 006	7 421	8 125	8 449	9 437	10 233
1256 Meland	5 353	6 631	8 079	8 717	10 633	12 249
1259 Øygarden	3 623	4 267	4 877	5 171	5 830	6 354
1260 Radøy	4 585	4 825	5 129	5 303	5 705	5 965
1263 Lindås	12 492	14 286	15 789	16 676	18 858	20 562
1264 Austrheim	2 527	2 738	2 902	3 048	3 404	3 659
1265 Fedje	682	594	561	556	538	517
1266 Masfjorden	1 774	1 635	1 730	1 700	1 715	1 702
1411 Gulen	2 489	2 302	2 345	2 420	2 509	2 629
Nordhordland incl. Øygarden and Vaksdal	**45 077**	**49 150**	**54 044**	**56 642**	**63 441**	**68 840**

Indigenous and immigrant peoples in the region
The only indigenous peoples in Norway are the Sami. No official register of who has Sami identity or background exists in Norway. Sami live everywhere in the country, but there are very few in Nordhordland. There are 4 600 immigrants living in Nordhordland (2016). 65% of these come from Europe, 11% from Africa, and 16% from Asia, including Turkey.

Employment - business and industry
Public services provide the largest number of jobs in this region, and the number of people employed in public service has risen over the last years. Osterøy has the largest number of jobs in industry. Industry and services are the biggest employers in the private sector, with Knarvik and the industrial facilities at Mongstad, Sture and Kollsnes as the leading employers. Even though the petroleum industry is experiencing a difficult time and a reduction in the number of employees, it is still important in the region, with facilities on land as well as offshore activities.

At Mongstad, about 100 businesses employ some 2,300 employees. Our state owned oil company, Equinor, has an oil refinery, supply base, port functions and various industrial firms. TCM Mongstad is a major centre for testing and developing CO_2 capture and storage technology. In Øygarden, Kollsnes has a plant for processing gas and at Sture there is an oil terminal.

Generation of hydroelectricity is also important for the region, not because it employs many people directly, but because it contributes significantly to municipal incomes. The last of the three major industries is aquaculture, which has expanded greatly in recent years and will probably become even more important in the future. In addition, the region has manufacturing companies of various kinds, both large international firms and smaller national ones. There is also a great deal of activity in building and construction, trade and provision of services. The agriculture in Nordhordland is not large compared to the rest of the country, the farms are in general small. More information on agriculture is provided in chapter 15.3 Tourism is less important at present, but the potential for growth is substantial, you can read more about this in chapter 15.2.

Unemployment rose sharply in Nordhordland early in 2015, especially in industry. By the end of 2016, 3.2% of the workforce was out of work (the national average was then 2.8%), but it has now flattened out somewhat and by the end of March 2018 it was 2.7% (the national average was 2.5%).

10.5 Names of the mayor settlements within and near the proposed biosphere reserve with reference to the map (Figure 10.1)

Knarvik (see map figure 10.1) is the administration centre for the municipality of Lindås and the regional centre in Nordhordland. In 1970, when only about 30 people lived here, it was decided that Knarvik was the natural choice for a regional centre and it experienced rapid development. Now, almost 6,000 people live in Knarvik and it has become a well-developed city centre with several regional functions, such as a casualty clinic and a police station. A regional health centre, where many specialist services will be brought together, will be completed by 2020. Knarvik has one of the largest upper secondary schools in the county. Knarvik Church, completed in 2014, is an architectural landmark.

Nordhordland also has many well-functioning small settlements. Each local authority has a town hall where the most important public services are located.

The proposed BR is adjacent to the city of Bergen (see map figure 10.1), the second largest city in Norway, and the centre of Bergen is about 20 km from the edge of the proposed BR. The region used to be linked to Bergen by ferry over the fjord between Steinestø and Knarvik, which had more traffic than any other ferry stretch in Norway. It was replaced by a bridge in 1994. Other large settlements outside the proposed BR are Voss in the centre of Hordaland, and Førde in the county of Sogn & Fjordane.

10.6 Cultural significance

(Briefly describe the proposed biosphere reserve's importance in terms of past and current cultural values (religious, historical, political, social, ethnological) and others, if possible with distinction between material and intangible heritage (c.f. UNESCO Convention concerning the Protection and the World Cultural and Natural Heritage 1972 and UNESCO Convention for the Safeguard of the intangible Cultural Heritage 2003)

Culture has always had a strong position in Nordhordland. There are no flamboyant buildings or internationally known memorials, but everywhere there is evidence of a rich cultural life and long cultural traditions. These are very much alive today, and are important for the identity of the proposed BR.

Historical cultural value

Numerous prehistoric finds show how people have used Nordhordland for thousands of years. Many Stone Age settlements and temporary dwellings have been found on either side of Fosnstraumen, a strait at Radøy where fish are abundant. Archaeologists have found huge quantities of flint flakes, as well as arrowheads and tools used for fishing; more than 230,000 finds are recorded. The first settlers came more than 10,000 years ago.

According to the 13th century sagas, Seim (situated in the Lindås municipality, was one of Harald Fairhair's (858-928 AD) five 'large farms ("stórbú") in western Norway. Seim is the only one of these in the counties of Hordaland and Rogaland which does not have, or has had, a stone church from the Middle Ages. This may suggest that the farm did not function as a 'King's farm beyond the 12th or 13th century.

The importance of the Gulating in Nordhordland for early democracy in Norway

The historical Gulating (political assembly) site at Eivindvik in Gulen was of great importance for the birth of democracy in Norway. The Gulating was a legislative, judicial and executive assembly in the Viking Age and the Middle Ages, one of the oldest and largest in the Nordic countries. The Gulating representatives gathered annually from about AD 800-1300 to discuss a wide range of matters, such as taxation, the building of churches, and military service. In addition, the Gulating was used to decide civil disagreements and pronounce judgement in criminal actions. At first, there was a common Thing where all weapon-bearing Freemen in western Norway had the right to participate and present matters they wanted discussed or passed judgement over.

After a single, national legislation was adopted in 1274, the jurisdiction of the Gulating was extended. When it was most powerful, it had jurisdiction over most of southern and western Norway and some upland settlements further east, as well as the Færoe Islands, Shetland and the Orkneys to the west. This widening of its jurisdiction brought about a shift from a common Thing to an assembly of elected representatives. Each county selected men who represented the district in which they resided. This was the precursor of present-day Norwegian parliamentarism.

Photo 10.3. Johannes Fosse making a wheel hub in his smithy. Photo: Western Norwegian cultural heritage.

The fisherman-farmer – ancient and modern Stril identity

The fisherman-farmer is a concept employed to describe the way people along the coast, including Nordhordland, exploited natural resources in the past. These resources, the fish in the sea and everything that could be harvested from the land, were exploited to their maximum. Livestock grazed the mountains and also utilised lowland grazing where heathland was burnt to foster the growth of new, nutritious shoots, and seaweed was gathered to ensure adequate winter fodder.

The term 'stril' – one who lived in Strilaland – appeared later. Strilaland was regarded as the area from which it was possible to row a boat to Bergen in a day. Historically, 'Stril' was a condescending nickname used by Bergen people, really a term of abuse. This resulted in the 'Strils' for a long time feeling themselves inferior; they had to almost beg Bergen residents to be allowed to sell their wares to them. This 'Stril' culture was founded on a way of life associated with frugality and poor living conditions. Right up until the 1960s, being able to move to Bergen was looked upon as a step up the social ladder. A gradual improvement took place during the latter half of the 20th century. 'Strils' were no longer primarily farmers and they no longer travelled to Bergen to sell their wares. They became educated and found other jobs, as in the rest of Norway. There was no longer such a big difference between townspeople and 'strils'. The rising standard of living in Norway brought a change to the whole country, including the people of Nordhordland. The inequalities were greatly reduced. The establishment of the refinery and the petroleum-related activities at Mongstad during the 1970s made a huge difference and laid the basis for the growth in the welfare economy that was to affect the entire region. At the same time, several important cultural personalities and sportspeople appeared on the 'Stril' scene, including some who used their local dialect and way of life, and this became valuable for the growing feeling of pride.

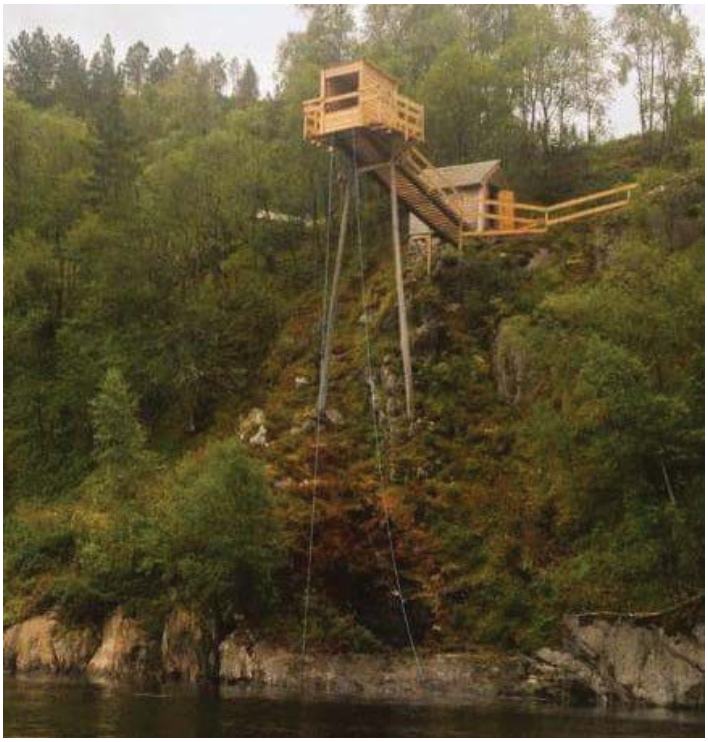


Photo 10.4: A recently renovated salmon trap at Askildneset. This was a well-developed fishing technique whereby a seine net - a bag that is open at one end – is set in the sea immediately beneath the trap. The salmon fishermen sit at the top of the trap, high above the fjord, and keep a sharp eye on the water. When a salmon enters the net, they close it by drawing a line. Photo: Erling Kleiveland.

Around the turn of the century, most of the population growth in the wider area, including Bergen, took place in Nordhordland. This brought about a completely different attitude regarding this region. 'Stril' is no longer a term of abuse, but a form of identification of the people living in the district around Bergen. 'Strils' themselves are proud to be 'Stril' and to be part of the Stril culture.

Photo 10.5: Old tapestries from Nordhordland in an exhibition at Rustica Gallery in 2017. Photo: Arne Høyland.

Local food and craft traditions

Having many occupations is something we associate with the 'Stril' culture, because these people had small farms and needed to be able to take on all kinds of jobs to make ends meet. Various kinds of craftwork were usual, such as carpentry, smithing and tanning. Smithing traditions go back a long way in Nordhordland, especially in Meland. Making hubs for wheels started here in the early 19th century, and around 1900 – 1920 at least 18 smithies were at work making hubs. This craft has been kept alive in Meland, even today.

Photo 10.6. Salted and dried mutton in the form of legs and sausages are examples of local food traditions in Nordhordland. Photo: Ikeland Farm.

Many of the farms along Osterfjord have been fishing salmon with nets and traps for a long time. The first trap was built at the end of the 19th century, and this form of fishing gave a valuable extra income to farmers who held salmon fishing rights along the fjord. Most of the fish were sold to buyers in Bergen. For generations, people along the fjord have become very skilful at using these kinds of nets and traps, but after salmon fishing was protected in 1982, the upkeep of the traps was neglected and most are no longer intact. Fortunately, a few have been renovated recently and bear witness to when salmon fishing in Osterfjord was prosperous.

Photo 10.7. A cluster of boathouses at Krossøy, Austrheim. Photo: Kjersti Isdal.

Photo 10.8. Bogatunet, Radøy. A long house divided into four rooms with different functions: a workshop with a loft, a room with open fire, a room for smoking fish and meat and a living room, as was typical of many 18th and 19th century farms. Photo: Helge Sunde.

Nordhordland has a rich handicraft tradition based on using wool from its numerous flocks of sheep. It was essential to be able to spin, knit and make clothes, likewise to weave tapestries and bedspreads. Knitting and weaving patterns often varied from village to village. The area has several old-established wool spinning and textile businesses; Hillesvåg Wool Factory (photo 15,4), Norlender Knitwear, Dale of Norway etc.

The local food traditions are characterised by ancient conserving techniques, such as salting, smoking and drying of meat and fish, which gave them a strong taste. Examples of local products are various kinds of smoked sausage, as well as cured legs of mutton and salted and dried ribs of mutton.

Architectural traditions in Nordhordland

The heathland landscape retains many remains of the old architectural traditions, including farms on sloping ground where the buildings are placed in rows, dwellings above and outhouses below, and long buildings in which different parts have different functions, as was the practice in the Middle Ages. Large stone walls to provide protection from severe westerly storms in winter have also been an important part of the coastal architectural tradition adapted to the climate. The use of stone for both dwellings and outhouses

Photo 10.9. The buildings at Havråtunet are clustered together. Photo: Arnt Flatmo.

can also be seen in settlements along the fjords and at upland summer dairy farms.Characteristic features of the vernacular architecture in the coastal landscape are the stave-built hay barns with their large stone gable walls facing southwest, the many stone buildings for storing peat and the numerous stonewalls separating infields from outfields. Boathouses by the sea are also important farm buildings (photo 10.7).

The fjord settlements in Nordhordland, such as Masfjord, show the symbiosis of economic geography. In return for either money or fish, coastal farmers could get their building timber here or build their houses which they could then move out to a small coastal farm. The general use of stone for building is found everywhere from the heads of the fjords to the coastal heathland, even though the fjord farms had easier access to timber. This must have had to do with the use of available resources – plenty of stones available from clearing farmland. Large stone barns dominate the landscape, but inside the massive stone walls is a complete wooden building, a timber hay barn. This architectural tradition was due to the climate: this is one of the wettest parts of Norway.

A similar use of the available resources characterises the architectural traditions at Matrefjella and Stølsheimen; there is easier access to stone from clearing land than to timber for contruction in the birch zone and on the upland plateau, so many of the buildings on the upland farms are stone built. They reflect the former architectural tradition down in the lowland settlements, with a room or an annex with a fire used for cooking and cheesemaking, a bedroom, a living room, and other rooms for storing dairy products.

In summary, it is the housekeeping on the farm and the ecological interaction between resources and technology that shape the architectural tradition on the coastal heathland and along the fjords, but there are also elements of the influence of urban architectural traditions, such as in the many trading and overnighting settlements along the inner passage north of Bergen.

Photo 10.10. Eikanger-Bjørsvik Brass Band. Photo: Anette Berentsen, NRK.

Organizations and brass bands
An important part of the cultural life in Nordhordland is associated with the many organizations which were established during the 20th century; many of these are still very active. Initially, these were primarily religious organizations and missionary societies, but there were also many associations for young people and adherents of so-called New Norwegian language. Even though there are fewer of these now, new ones have appeared. In addition, many organizations and associations with completely different interests have emerged, such as choirs, music societies and sports clubs, as well as resident and village associations, adult education organizations, and recreational clubs.

The many village halls used to be the natural venues. Many still fulfil this function, as is partly seen in the active revue circles in Nordhordland. Many festivals also take part in the region, attracting a lot of people. The most important ones are Knarvikmila, Utkant, Kraftspela, and Kystsogedagane.

Brass bands are particularly noteworthy in Nordhordland. Two are especially well-known in Norway and other countries: Eikanger Bjørsvik and Manger, which compete at a high level in both Norway and the rest of Europe. Both have been European champions, and Eikanger Bjørsvik won the European Championship for the third time in 2017.

Nordhordland today
While the 'Stril' culture and the 'Stril' identity still hold an important position in many villages, the rapid growth in the population in the south is affecting the villages and the cultural life there. Some traditions disappear, or become less apparent, and new ones appear. Many people who move here identify themselves with the urban culture in which they grew up, and do not take much part in the life of the village. Population growth in the region in the last few decades means that a greater focus is now being placed on bringing attention to what is special for Nordhordland; proximity to the ocean, the fjords and nature, and the 'Strile' culture – manifested in the skilful 'Stril' who used all the resources available and was both good with his hands and a proud exponent of his culture.

10.7 Specify the number of spoken and written languages (including ethnic, minority and endangered languages) in the biosphere reserve

(refer, for instance, to the UNESCO Atlas and Endangered languages)

Norwegian is the official language in Norway, which has two written standard languages, 'bokmål' and 'nynorsk'. The official written language throughout the proposed BR is nynorsk Norwegian. This means that all the teaching in the schools is in New Norwegian. In addition, Norway has a large number of dialects. Most people in Nordhordland have the 'Stril' dialect as their spoken language. The southern part is the exception. Many people have moved there from Bergen and this has influenced the spoken language. Fewer and fewer young people speak the 'Stril' dialect in this part of the region nowadays. Since it is legally established that people can demand to receive their education in their own written language, several municipalities in the area have established separate classes for 'bokmål' pupils in junior and lower secondary schools.

Coastal landscape in Nordhordland. Photo: Kjersti Isdal.

11 BIOPHYSICAL CHARACTERISTICS

11.1 General description of site characteristics and topography of the area

(Briefly describe the mayor topographic features (wetlands, marshes, mountain ranges, dunes, etc) which most typically characterize the landscape of the area)

The proposed BR stretches from the North Sea in the west to Stølsheimen in the east. It is designed as a profile from the sea in the west through the coastal and fjord landscape, over the mountains and down to Sognefjorden. The marine area in the west, the wide archipelago, and the fjord landscape towards the inland are typical for the outer part of western Norway. The topography on the outer coast is characterised by hills, knolls and depressions on land separated by straits and fjord arms. Further east and into the fjord area, mountains and valleys appear in the landscape as Stølsheimen is approached. The area has magnificent, varied scenery, and has been used by people ever since the end of the last Ice Age. Flat areas, like the arable farmland in eastern Norway or in other parts of Europe, are scarcely to be found.

The proposed Nordhordland BR can be divided into four regions based on the main topographical elements: 1) the marine area, 2) the coastal area, 3) the fjord systems, and 4) the upland area (Figure 11.1).

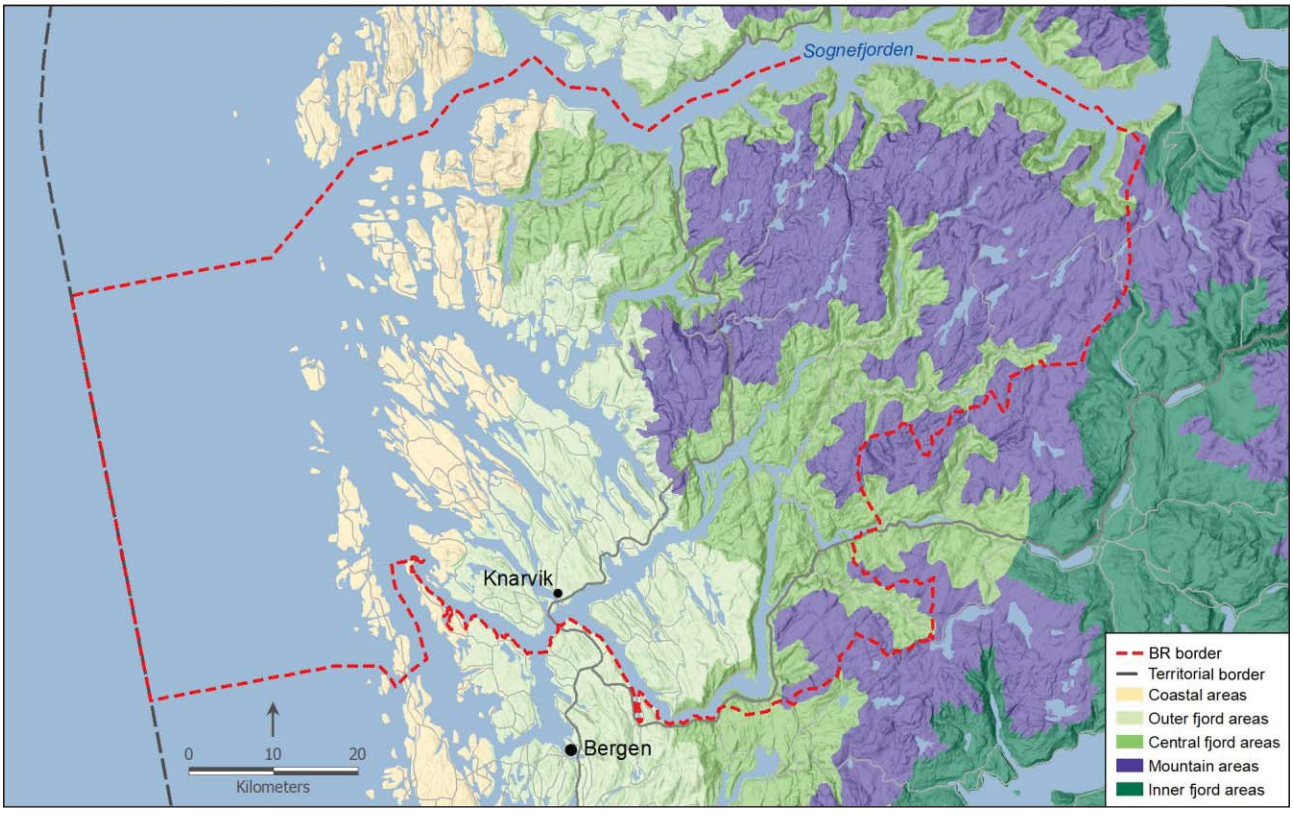


Figure 11.1: Landscape regions in Nordhordland (modified after NIJOS, 2011). Map: Lina Haggard.

MARINE AREA

The subsea topography of Nordhordland and Gulen is varied and complex. In the outer parts, there are relatively shallow areas with a multitude of skerries, islets and islands. The larger islands often have shallow thresholds and deep basins and are separated by narrow straits along which strong currents flow. One example is Radfjorden, between Radøy and Holsnøy, whose greatest depth is 211 m and has thresholds only about 7 m deep at its outlets in the north and south. Another is Lurefjorden, almost 20 km long and between 1.5 and 2 km wide; its maximum depth is about 440 m, and its thresholds in the northwest and north are 20 m and 11 m deep, respectively.

Lindåsosane, on the north-east side of Lurefjorden (Figure 3.4, 19.2), comprises three small, shallow, fjord arms, Straumsosen outermost, Spjeldnesosen in the middle, and Fjellangerpollen innermost. Three narrow straits (Lurestraumen, Lindåsstraumen and Veråsstraumen), with threshold depths of less than 3 m, link Straumsosen to Lurefjorden. The deepest part of Straumsosen is 62 m. The threshold between Straumsosen and the 89 m deep Spjeldnesosen is 10 m. Spjeldnesosen is linked to Fjellangerpollen, the innermost of the Lindåsosane, via Haukåsstraumen, a long, narrow strait with a threshold that is only 3 m deep. Fjellangerpollen is 81 m deep. In southern Nordhordland, Osterfjorden is about 645 m deep south of Ostereidet, and where Herdlefjorden meets Salhusfjorden the depth is about 490 m. In the north, Herdlefjorden has narrow straits and shallow thresholds towards Sætreosen (132 m), where shrimp fishing used to be good. In the west, Hjeltefjorden has varying depths, and basins are found at Toftøy (depth 315 m), Hjelmo (200 m), Nordøyni (543 m) and where Mangersfjorden meets Hjeltefjorden (427 m). In the inner part of Nordhordland, Fensfjorden and Austfjorden have a common, deep threshold south of the island of Røytinga in Gulen, and the greatest depth is almost 700 m off Sævråsvåg. The inner part of Fensfjorden divides into the deep Austfjorden (max 425 m) and the shallower Hindnesfjorden (max 265 m). Masfjorden is a branch of Austfjorden with a 80 m deep threshold near Masfjordnes and a maximum depth of 494 m.

Photo 11.1: Hellesøy Lighthouse, Fedje. Photo: Svein Nord.

COASTAL AREA

From the open sea in the west is a 20-30 km stretch of lowland interrupted by fjords and straits, and with some isolated hills. Geological literature refers to this landscape form as the *Norwegian strandflat*. This is one of the most characteristic landforms along the entire Norwegian west coast facing the Atlantic Ocean. It is thought to have formed during the past 5-10 million years, in the Quaternary Era, through the interaction of frost weathering and erosion by waves and ice. During ice-free periods, weathering and wave action formed huge quantities of unconsolidated material which was shunted out onto the continental shelf during the glacial periods. Because the sea level during the glacial periods was lower than it is today, erosion took place down to a level below the present-day sea level, which means that more of the strandflat is now below the present sea level than above it. The strandflat generally abuts against a steep slope on its landward side, with higher mountains further inland; and in the sea, it ends at a steep slope down to the continental shelf. The majority of people in the region live on the strandflat, where they earned their living for centuries by a combination of fishing and small-scale farming.

The topography is not dramatic, as it is further inland, but hilly and broken, often very steep, between sea level and a height of 60-70 m. Valleys and other depressions, as well as gentle slopes, have large bogs and mires. This formation of peat has made it possible to farm this area. The shore, the boundary between land and sea, mostly consists of bare rock and gives an idea of what the landscape was like before bogs and peat were formed. Rocks or sand are found in bays, and narrow inlets up the fjords often have brown mud. The only exception is along the Herdla moraine (Section 11.4.3) on the island of Herdla itself, where there is more unconsolidated material. The long stretches of shallow-water sand and gravel flats there are particularly important resting sites for migrating birds. Fjords and straits are important landscape elements in the coastal area and you are seldom more than 2 or 3 km from the coast. The fjords generally become deep only 100-500 m away from land. The great volume of water means that a great deal of water has to pass in and

Photo 11.2: The broad strandflat on the margin of the open sea in Nordhordland. Photo: Peter Emil Kaland.

out of narrow inlets as the tide flows and ebbs; this results in strong tidal currents and good fishing grounds that have been well known ever since the Stone Age.

THE FJORD SYSTEMS

A fjord is a landform which geologists and geographers explain in terms of a long, deep, narrow inlet in the sea or a lake, with steep terrain on three sides. Fjords formed when glaciers shaped the landscape in the course of several ice ages. A fjord is thus a U-shaped underwater valley, generally a pre-existing river valley deepened by ice erosion, and in western Norway this sea-water flooded valley is often surrounded by steep mountains.

A precondition for the precipitous mountainsides along the fjords is that there is hard bedrock, such as gneiss (Section 11.4). Valleys whose floor is less than 300-400 m are narrow, short and steep. For example, from Matre, at the head of Masfjorden, a narrow valley extends 4 km inland before it rises at 400 m to an upland valley, Eksingedalen, so steep and narrow that prior to the hydroelectricity development there it did not have a road along it. Modalen is the widest valley in the proposed BR and is mostly dominated by farmland due to the large quantities of sand deposited when the ice melted.

Photo 11.3: View of the narrow Mofjord with the place Straumen in front. Photo: Kjersti Isdal.

UPLAND AREAS

The upland areas in the proposed BR consist of plateaus with rounded knolls and peaks, and with wide valleys dotted with hundreds of lakes and tarns, along with rivers and mires. The highest peaks range from 400-500 m in the west to 1200-1300 m in the east. The plateaus are above the tree line and form an open landscape with wide vistas. Most of the area has a very thin soil cover, and bedrock is exposed over large areas.

These upland areas have large volumes of fresh water in the form of lakes, rivers, streams and mires, and these bodies of fresh water form prominent landscape elements that characterise the region. The significant freshwater resources and the short distance from the mountains to the fjords have resulted in several large and small hydroelectricity plants, which supply power to both this area and the Bergen region.

Photo 11.4: Typical upland summer dairy farming landscape in Stølsheimen. Photo: Inger E. Måren.

11.2 Altitudinal range

- The highest elevation above sea level is 1313 metres at Kleivfjellet in Stølsheimen, Vik municipality
- The lowest elevation above sea level is 0 metres
- The maximum sea depth is 1308 metres below mean sea level in Sognefjord, off Åkrestrand in Høyanger municipality

11.3 Climate

(Briefly describe the climate of the area, you may wish to use the regional climate classification by Köppen as suggested by WMO)

Nordhordland has a typical oceanic climate. According to the Köppen-Geiger climate classification, the low-lying areas have a temperate oceanic climate (classified as Cfb), characterised by lacking a clear dry season. The average temperature in each of the four warmest months is above 10°C, while

the warmest month is cooler than 22°C. Higher altitude areas are classified as having a subpolar oceanic climate (Cfc), as only 1-3 months have average temperatures above 10°C. The climate is influenced by the large-scale oceanic and atmospheric circulation in the North Atlantic, and a distinct local effect of the sloping west-facing topography as you move inland from the coast.

THE EFFECT OF THE LARGE-SCALE ATMOSPHERIC AND OCEANIC CIRCULATION

The large-scale summer climate at medium latitudes is dominated by the effect of the ocean's heat capacity, which gives temperatures that are cooler than the mean for the latitude near the coast and warmer in inland areas. In contrast, the winter climate is more influenced by the atmospheric and oceanic circulation, resulting in a relatively warm climate on the west coast. This characteristic is particularly marked on the north-west coast of Europe, where Nordhordland is situated. The main reason is that the storm path in the North Atlantic transports warm, moist air north-eastwards towards the European continent. The other reason is the transport of warm water northwards with the North Atlantic Current. In winter, when ocean temperatures are higher than the air temperature, the ocean liberates heat to the atmosphere and causes the downstream landmasses to warm. The oceanic and atmospheric processes are closely interlinked and explain why Norway is a climatic oasis in winter, with temperatures 10-15°C above what the latitude should indicate.

The average atmospheric pressure during the cold part of the year shows a dipolar pattern in the North Atlantic, with low pressure above Iceland and the surrounding seas (the Icelandic Low) and high pressure above the Azores (the Azores High). The differences in pressure between these is known as the North Atlantic Oscillation (NAO). The NAO is not a physical phenomenon, but it gives a good indication of the strength of the belt of westerlies and can be regarded as a proxy for the low-pressure activity in the North Atlantic. The correlation between the NAO and precipitation in Nordhordland is on average above 0.7 in winter, whereas it is a little less (around 0.6) for the temperature, which shows the clear influence of the low-pressure activity in the North Atlantic on the year-to-year climatic variations in Nordhordland.

INFLUENCE OF LOCAL GEOGRAPHICAL FEATURES

Even though the climate in Nordhordland is greatly affected by the large-scale atmospheric and oceanic circulations, it is the rising topography and the increasing distance from the coast from west to east that are the main causes of the marked regional climatic differences. The most striking is the great influence of the topography which results in a pronounced west-east rising gradient in the precipitation. Whereas the flat coastal areas in the west receive around 1300 mm, the rising terrain in the western part of Stølsheimen forces the moist air upwards and the precipitation

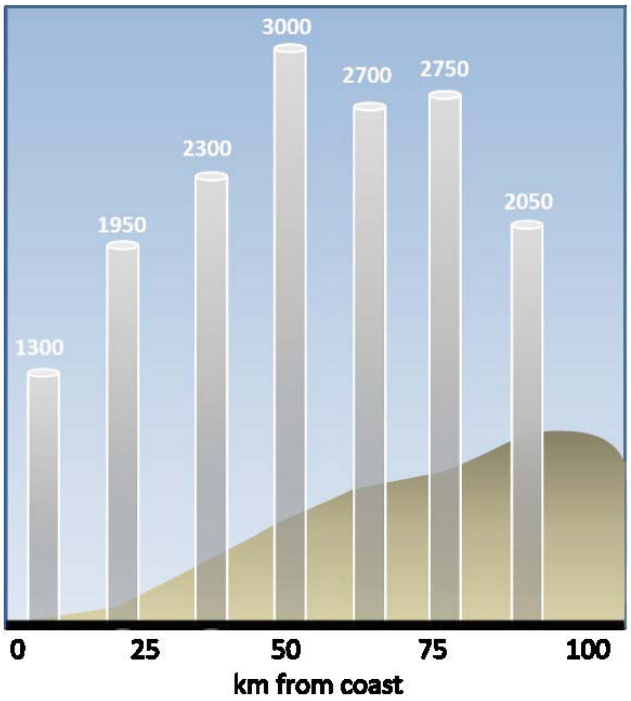
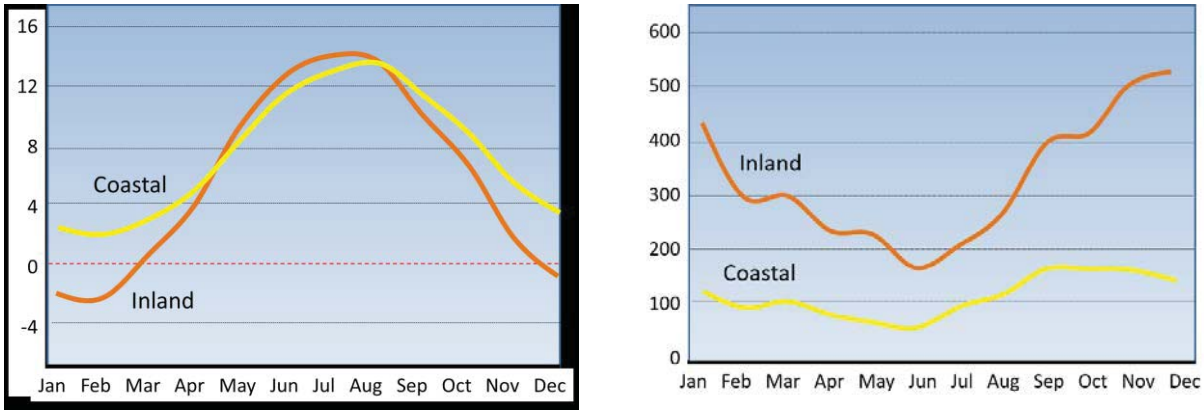


Figure 11.2: Average annual precipitation (mm) at available meteorological stations in Nordhordland grouped in bands spaced 15 km apart from the west coast eastwards into Stølsheimen. The topography is shown as an average in the same way.



a) *b)*

Figure 11.3. a) Seasonal cycle in the temperature (°C) at a typical coastal meteorological station (Hellesøy, yellow) and a typical inland meteorological station (Modalen, orange). The effect of differences in the height above sea level (84 m) are removed. b) Annual cycle in the precipitation (mm) at a typical coastal meteorological station (Hellesøy, yellow) and a typical inland meteorological station situated in the maximum annual precipitation zone (Haukeland, orange).

increases to 3000 mm/yr (Figure 11.2). The result is a classical precipitation maximum halfway in the coast, making this location one of the wettest in Norway. When the air gradually loses its moisture on its way up the mountainside, the precipitation declines again as we approach the upland plateau.

THE ANNUAL MEAN CLIMATE AND THE SEASONAL CYCLE

On the coast of Nordhordland, the seasonal cycle in the temperature is comparatively modest (Figure 11.3. a), and the difference in temperature from the warmest to the coldest month is around 11°C. This moderating effect of the heat capacity of the sea on the seasonal cycle becomes weaker inland, resulting in an increase in the temperature difference of around 16°C and a shift in the maximum temperature month from August to July (Figure 11.3a).

There is a steep west-east precipitation gradient which ensures that inland areas are two to three times wetter than areas on the outer coast. The topography also affects the seasonal cycle and shifts the difference between the driest and the wettest month from around 120 mm on the coastal to 350 mm in the upland areas (Figure 11.3b).

LONG-TERM CHANGE IN THE CLIMATE

Like the rest of Norway, this region has experienced a warming and an increase in precipitation over the past 100 years. Data from meteorological stations from 1900-2014 show a rise in the annual temperature of around 0.6°C /100 yr and 18%/100 yr more precipitation. The changes are most clear for the last 40 years. These changes are seen for every season, but are especially pronounced in autumn and spring, as regards both the temperature and the precipitation. Climate models show that if a considerable reduction in emissions of greenhouse gases does not take place in the coming decades, the temperature and precipitation will continue to rise and Nordhordland will become 3 to 5°C warmer and 5-20 % wetter by the end of this century.

11.3.1 Average temperature for the warmest month:

+13.0 to +14.5°C in the area near sea level

11.3.2 Average temperature for the coldest month:

+3.0 to-3.0°C in the area near sea level

11.3.3 Average annual precipitation:

2400 mm, average of available meteorological stations. Varies from min 1090 to max 3900 mm.

11.3.4 11.3.4 Meteorological stations in or near the proposed biosphere reserve

Table 11.1. Meteorological stations in or near the proposed Nordhordland biosphere reserve.

Name	Municipality	Height above sealevel	Start year	End year
Hellisøy fyr	Fedje	20	1867	2005
Fedje	Fedje	19	2004	
Hedla	Askøy	24	1919	1973
Blomvåg	Øygarden	30	2011	
Holsnøy	Meland	27	1974	2005
Eikanger	Lindås	72	1968	
Osterøy- Gjerstad-	Osterøy	60	1975	1983
Øvstedal	Voss	316	1944	
Akslebjørg	Voss	459	1944	1964
Brekkhus	Voss	202	1944	2004
Myrkdalen-Vetlebotn	Voss	700	2013	
Fjellanger	Vaksdal	501	1943	1961
Fjellanger II	Vaksdal	456	1943	2004
Eksingedal	Vaksdal	450	1895	
Gullbrå	Vaksdal	579	1944	
Modalen	Modalen	104	1895	1980
Modalen II	Modalen	114	1980	2008
Modalen III	Modalen	125	2008	
Haukeland	Masfjorden	196	1908	2002
Haukeland- Storevatn	Masfjorden	325	2003	
Matre Kraftstasjon	Masfjorden	7	1975	2013
Matre	Masfjorden	18	1908	1985
Masfjorden	Masfjorden	357	1899	1982
Frøyset	Masfjorden	13	1895	
Byrknesøy	Gulen	7	1922	1931
Takle	Gulen	38	1950	
Brekke	Gulen	240	1938	
Stordal Kraftstasjon	Høyanger	478	1978	1984
Sørebø	Høyanger	4	1996	
Ortnevik	Høyanger	4	1972	
Vik III	Vik	65	1895	
Vik- Vange	Vik	30	1990	2002

11.4 Geology, geomorphology, soils

(briefly describe important formations and conditions, including bedrock geology, sedimentary deposits, and important soil types)

Two features are particularly striking in Nordhordland:

1) The broken landscape with long, deep fjords and, furthest out, a multitude of islands and islets. This is the legacy of 30-50 ice ages over the past 2.7 million years.
2) Many fjords, valleys and ridges form semi-arcs round Bergen. These "Bergen Arcs" were formed more than 400 million years ago – and the ice has exposed them in recent times.

11.4.1 Bedrock on land

In Nordhordland, the bedrock is important for the availability of plant nutrients because ice scraped away most of the unconsolidated sediment 11,600 years ago. Over large areas, the bedrock therefore has only a thin soil cover and the most important plant nutrients come from the slow breakdown of this bedrock. This is clearly seen in the terrain- light-coloured rocks like gneiss and granite consist of minerals (especially quartz) which weather slowly and contain few nutrients. These rocks are often completely bare or have a poor vegetation cover. Schist, limestone and dark basic rocks weather more rapidly and contain more lime and other nutrients, and form more nutrient rich soil and habitat for more demanding plants and for agriculture.

The islands in the west, Askøy, Øygarden and Fedje, consist of Precambrian rocks that are more than 1000 million years old. They are mostly nutrient-poor gneisses but contain occasional zones of greenish-black amphibolite which give richer vegetation. There are also Precambrian rocks in the areas east and north of the Bergen Arcs. These are hard gneisses which are less eroded than the Bergen Arcs, and they rise up almost as a wall north-east of Fensfjorden. This Precambrian area extends right up to, and across, Sognefjord, and therefore covers the northern part of the proposed BR, including Stølsheimen. Small occurrences of pure quartzites and other rocks are found within the gneisses. The Bergen Arcs are located between the two large Precambrian areas and produce a unique, arc-shaped topography. They were formed during the Caledonian Orogeny, when Greenland and Europe collided a little over 400 million years ago. The Bergen Arcs were formed several kilometres beneath the then surface of the Earth and are composed of many different types of bedrock practically kneaded together. The most nutrient-rich rocks are schist and limestone, but the strata include everything, down to the most nutrient-poor quartzite.

11.4.2 Geomorphology – the large landforms

Norway has experienced about 30-50 ice ages over the last 3 million years and the fjords have become more deeply scoured out in each one. The ice sheet and glaciers have created the entire land surface (e.g. photo 11.5), including lofty waterfalls like Hesjedalsfossen at the head of Osterfjorden. Ice has the unique property that it can excavate depressions in the bedrock, and has created large and small lakes across the whole of Nordhordland, in both the mountains and the lowlands. Sognefjord, the longest and deepest fjord in Norway, is the northern boundary of the proposed BR. In contrast, Veafjorden, furthest south, is narrow and perfectly straight and runs north-south, perpendicular to the general ice movement westwards and it was, like most of the other fjords, excavated along zones of weaknesses in the bedrock. Veafjorden follows a joint zone, whereas the pattern of the fjords in the Bergen Arcs (up to 700 m deep), generally coincides with weak rocks. Masfjorden and the other fjords in the north-eastern gneiss area have high, steep sides which often drop precipitously into the fjord, whereas land is lower along the fjords in the Bergen Arcs.

There are two major features in the landscape which geologists believe the ice has not formed, even though it has "destroyed" or modified these, too. One is the upland plateaus. Stølsheimen and the other areas of high ground in the east have an undulating landscape with fairly equally high summits. These are *upland plateaus*, not sharp alpine peaks like those further north in Sunnmøre, for example. Geologists assume that these are the remains of an ancient plain formed by weathering and erosion down to sea level and then uplifted 30-60 million years ago. The other feature is the low land along the coast, just above and below sea level, the *Norwegian strandflat*. The outer parts of Lindås and Radøy are typical examples. The strandflat seldom has terrain higher than 70-80 m and it has a marked notch up to higher ground. We still do not know for certain how or when the strandflat here was formed, but it is apparent that the sea level has controlled the height.

11.4.3 Glacial deposits; clay, sand, gravel and moraine

Ice employs two mechanisms when it erodes. The greatest impact in volume is produced when ice tears huge blocks from the underlying bedrock. Such boulders, or glacial erratics, are found strewn over the landscape from valley floors to the highest peaks in the proposed BR. Most of the erratics were, however, further broken down to smaller rocks, gravel and sand whilst they were being transported beneath the ice sheet. They acted as sandpaper and ground down the bedrock. Eroding by grinding is a much slower process than by plucking, but this also produces clay. A third mechanism is that glacial rivers beneath the ice erode a great deal, creating, for instance, potholes in places where it is inconceivable that an ordinary river has ever flowed. Thus, glaciers produce debris consisting of rock fragments ranging from the smallest clay particle of less than 1/1000 of a millimetre to erratic boulders that may be many metres in diameter. Beneath the ice, all this is mixed to leave behind what is called moraine, and this is where we find much of the farmed land in the proposed BR, even though the ice transported most of it from Nordhordland into the sea to the west and deposited it on the continental shelf.

The best soil in Nordhordland resulted from a climate amelioration at the end of the last Ice Age, 12,700 years ago. Prior to that, the ice sheet had retreated far inland. It now advanced again and stopped at Herdla, outer Radøy and Austrheim 11,600 years ago. There it deposited what is called

Photo 11.5. Evidence of an ice age glacier in Austfjorden; the ice moved from left to right in the photograph, grinding and rounding the rock on the upstream side and tearing off large fragments on the lee. Photo: Jan Mangerud.

the Herdla moraine (Figure 11.4). Herdla itself mainly consists of sand deposited by glacial rivers in front of the ice sheet, but the ice also left behind some big blocks on top of the sand, which was buried some years ago. The ice sheet retreated eastwards from the Herdla moraine quite quickly. Some ground moraine was deposited here and there, particularly in valley depressions. This is productive soil because it contains both sand and clay, often accompanied by many stones. The ice sheet during the Ice Age was so heavy that it depressed the land, and this is important for how the soil has been distributed. When the ice sheet melted, the sea was higher than it is today. At Herdla, the highest sea level, the marine limit, was 32 m above the current shore, whereas inland along the fjords, such as at Matre, Modalen and Eidslandet, it is 55-65 m higher than present sea level. Several processes led to the deposition of more sediments below the marine limit than above, and in many places, the limit marks a distinct boundary for arable farming. Glacial mud was transported out into the sea and deposited as clay. Even though it was only a thin layer, it was important. The most marked deposits laid down at and below sea level when the ice retreated were sand and gravel terraces at the heads of the fjords and in the valleys. The highest ones mark the marine limit; they formed as deltas in the fjord when glacial rivers carried large quantities of sand, gravel and clay out through tunnels in the glacier snout. The tops of these terraces are quite flat and now make good areas for agriculture. The terraces are also valuable as resources of sand and gravel and, during the last 100 years, several have been entirely worked out to provide materials for constructing houses and roads in Bergen. During the subsequent land uplift, much of the sand was eroded by rivers to be re-deposited further down the valleys, thus producing soil over large areas.

Figure 11.4: The red line shows the position of the Herdla moraine in Nordhordland. Red dots show places that are known to have been ice free before the glacier advanced to the Herdla moraine. Map: Jan Mangerud.

11.4.4 Mire and peat

Soil that consists of plant remains is the soil type that has the widest distribution in lowland areas of Nordhordland. There is sometimes a thin layer of ling humus, generally mixed with a little regolith, which immediately overlies the bedrock, but in depressions it may be several metres thick bogs. The peat has grown beyond the margins of the lake to form blanket bogs. The large number of mires is mainly due to the unusually high precipitation in the region. Some centimetres down in the peat, the oxygen has been exhausted, and the plant material is no longer broken down; instead, the peat grows and becomes thicker. Mire soils have become much thinner in the last 150 years due to cultivation. When drainage takes place, the peat collapses, and draining and fertilisation allow air to enter, causing the organic material to break down and release CO_2. Thick layers of peat also used to be dug out and dried to provide both fuel and bedding for the livestock in barns. This practice has now ceased, but a trained eye can see the former cut edges on the bogs almost everywhere in the lowlands and far onto the uplands. Re-growth of taller plants is now in progress because the mires are no longer cut, grazed or mown.

11.4.5 Subsea geology

The youngest rocks on land in this area are just over 400 million years old. The mountain chain from that time was eroded down to a low plain through the millions of years that followed. The eroded material was carried as sand and clay out into the ocean by rivers, and these deposits now form the continental shelf. On this, there is an almost unbroken stratigraphical succession stretching from 400 million years ago to today. In the Troll Field, oil is being pumped up from 150 million-year-old sand which came from Nordhordland. Erosion on land increased when the ice ages began, and once more the eroded material was transported into the ocean. The uppermost strata on the shelf and the margin of the Norwegian Sea therefore derive from moraine and other sediments that were originally bedrock filling the fjords.

11.5 Bioclimatic zone

(Indicate the bioclimatic region in which the proposed biosphere reserve is located, refer to the table below and tick the appropriate box for each of the area of the biosphere reserve)

Table 11.2. Aridity index calculated using P/ETP; mean annual precipitation(P)/mean annual potential evapotranspiration (ETP).

Areas	Average annual rainfall/ mm	Aridity index		Core area(s)	Buffer zone(s)	Transition area(s)
		Penman	(UNEP index)			
Hyper-arid	P<100	<0.05	<0.05			
Arid	100-400	0.05-0.28	0.05-0.20			
Semi-arid	400-600	0.28-0.43	0.21-0.50			
Dry Sub-humid	600-800	0.43-0.60	0.51-0.65			
Moist Sub-humid	800-1200	0.60-0.90	>0.65			
Per-humid	P>1200	>0.90		x	x	x

11.6 Biological characteristics

List main habitat types (e.g. tropical evergreen forest, savanna woodland, alpine tundra, coral reef, kelp beds) and land cover types (e.g. residential areas, agricultural land, pastoral land, cultivated areas, rangeland).
For each type indicate
- REGIONAL if the habitat or land cover type is wildly distributed within the biogeographical region within which the proposed biosphere reserve is located, to assess the habitat's or land cover type's representativeness.
- LOCAL if the habitat or land cover type is of limited distribution within the proposed biosphere reserve, to assess the habitat's or land cover type's uniqueness.
For each habitat or land cover type, list characteristic species and describe important natural processes (e.g. tides sedimentation, glacial retreat, natural fire) or human impacts (e.g. grazing, selective cutting, agricultural practices) affecting the system. As appropriate, refer to the vegetation or land cover map provided as supporting documentation.

The proposed BR embraces a coastal landscape that contains marine, freshwater and terrestrial ecosystems and is representative for the outer and central parts of western Norway. The types of landscape and the ecosystems are categorised and described under three main headings:

1. Marine systems
2. Freshwater systems
3. Terrestrial systems (wetland and non-wetland)

To be able to present the breadth of these three categories, we have subdivided each according to the division of ecosystems in the "*Nature index for Norway*". This division gives an impression of the state of the main ecosystems in Norway using a selection of biodiversity indicators. The division has the following sub-categories:

- Ocean and coastal waters
- Fresh water
- Wetland
- Open lowland
- Woodland and forest
- Mountain (alpine)
- Agricultural area (NOU 2013)
- Green areas in towns and built-up areas (NOU 2013)

We have also added two categories from the report on national ecosystem services in Norway (NOU 2013:10, Chap. 12), so that all the principal ecosystems in the proposed BR are included.

- Characteristic aspects of the mammal fauna in the proposed Nordhordland BR
- Characteristic aspects of the bird fauna in the proposed Nordhordland BR

A newly evolved system to describe the variation in ecosystems and nature types present in Norwegian nature is "*Natur i Norge*" (Nature in Norway) (NiN). We show the relationship between the division of the proposed BR into three principal systems, the ecosystem division in the Nature Index for Norway and the *ecosystem services* report (NOU 2013:10) and how these systems are to be found in the type division and the principal type groups in "*Nature in Norway*" (Table 11.3).

Table 11.3. Relationship between the ecosystem divisions in different national systems in Norway, and how these fall into the three main categories, marine systems, freshwater systems and terrestrial systems, used in the proposed Nordhordland biosphere reserve. NiN = "Natur i Norge" (Nature in Norway).

Principal categories in the biosphere reserve application	Main ecosystem according to the Nature index for Norway	Main ecosystem according to the NOU report on ecosystem	Division of types according to Nature in Norway (NiN)
Marine systems	Ocean and coastal zone	Ocean and coastal zone	Marine benthic system Marine water bodies
Freshwater systems	Fresh water	Fresh water	Freshwater benthic system Limnic water bodies
Terrestrial systems	Wetland	Wetland	Wetland system
Terrestrial systems	Woodland and forest	Woodland and forest	Non-wetland system
Terrestrial systems	Alpine	Alpine	Non-wetland system Snow and ice system
Terrestrial systems	Open lowland (non-agricultural area)	Open lowland and agricultural area (cultural landscape)	Non-wetland system
Terrestrial systems		Green areas in towns and built-up areas	

11.6.1 Marine systems

OCEAN AND COASTAL WATERS (REGIONAL)

Furthest west in the proposed BR, like a barrier to the open sea, is the characteristic western Norwegian archipelago. Here, the strandflat has created a multitude of shallow areas linked together by numerous skerries, islets, and islands of various sizes. The larger islands are separated by narrow straits with strong currents and often shallow thresholds and deep basins. Along the outermost islands furthest west in the archipelago, large kelp forests (*Laminaria sp.*) thrive in the exposed zone of breaking waves between the Atlanic Ocean and the calmer waters further east. These kelp forests are an important habitat for many organisms, particularly because they form an area where fish fry can grow up. The largest kelp species in the northern Atlantic, *Laminaria hyperborea* (tangle), is regarded as a key species linked with particularly high biodiversity; more than 300 species of algae, animals and fish are known to be associated with these kelp forests.

Coral reefs have been recorded in deeper water still further west. Little is known about these, but according to old literature, the coral may be *Lophelia pertusa*. Out here, the warm, saline Atlantic Ocean water from the south meets the cold, less saline coastal water. Periodically, large volumes of Atlantic water pour over the shallow thresholds and banks, bringing with them southerly species, especially zooplankton and animals with free-living larval stages. Consequently, these areas include sites with the highest species diversity of zooplankton in Norway: 200-300 different species. The influx of Atlantic water transports many times more zooplankton into a few fjords in the proposed BR, like the inner part of Fensfjorden, than the local zooplankton production. Crustaceans, particularly copepods, including *Calanus finmarchicus*, are the most common zooplankton. *Calanus finmarchicus* is an extremely important resource for pelagic fish, like herring (*Clupea harengus*), brisling (*Sprattus sprattus*) and young saithe (*Pollachi's virens*), and it is also a key resource for the early life stages of many other species of fish.

Benthic invertebrates dominate sand and mud bottoms in sheltered waters where strong currents flow. The region has the largest diversity of such species in Norway: over 3,000 invertebrates larger than 1 mm. The largest are brown crab (*Cancer pagurus*) and lobster (*Hommarus gammarus*). The latter used to be very widely distributed but is now threatened by extinction here. Other typical molluscs in this area are Norway lobster (*Nephrops norvegicus*), *Siboglinum fiordicum* (a bristle worm), common sea urchin (*Echinus esculentus*) and orange-footed sea cucumber (*Cucumaria frondosa*). Fish which thrive in this kind of habitat include the flatfish, European plaice (*Pleuronectes platessa*), common dab (*Limanda Limanda*) and European flounder (*Platichthys flesus*), in addition to cartilaginous fish such as thory skate (*Raja radiata*) and thornback skate (*Raja clavata*).

Many other species of fish are more opportunistic than flatfish when it comes to their choice of habitat. These include the many species of cod (order *Gadiformes*). Atlantic cod (*Gadus morhua*) is probably the best known, and the stock on the Norwegian coast is commonly referred to as the coastal cod stock. Cod are found from the open sea to the heads of the longest fjords. Tagging and genetic investigations have shown that each individual fjord has its own distinct population and there is limited exchange between fjords. Other cod species include haddock (*Melanogrammus aeglefinus*), saithe (*Pollachius virens*), Atlantic pollock (*Pollachius pollachius*), whiting (*Merlangus merlangus*), ling (*Molva molva*) and cusk (*Brosme brosme*). All have an extensive range along the Norwegian coast from the innermost fjord to the extreme outer coast.

A special aspect of the proposed BR is the great variation in the fjord and small fjord arm systems. In addition to the large Sognefjord, there are many small fjords whose salinity vary from high at their mouth to brackish at their head and have a great variation in biological diversity, both flora and fauna. One example is Osterfjorden, which continues eastwards as the narrow Mofjorden. This is fed by the River Mo, which flows from Stølsheimen.

The subsea topography and the supply of fresh water from the mountains in the interior are, to a large extent, decisive for the hydrographic conditions: the currents and thereby also the distribution of the temperatures and chemical conditions of the sea water – such as its salinity, oxygen content and content of dissolved salts containing nitrogen, phosphorous, sulphur and other important elements for life in the sea. The outer coast in the west and the deep fjords which border up to Nordhordland, Gulen and Høyanger, are mostly healthy. The same applies to Osterfjorden, Salhusfjorden, Herdlefjorden, Hjeltefjorden, Fensfjorden, Sognesjøen and Sognefjorden. However, some smaller fjords and basins may be exposed to overloading of organic material from various sources: the sea's own production of plankton and benthic organisms; organic material supplied from the land by the runoff of fresh water and wind; and human-induced supply via sewage, runoff from farming, industrial waste water from manufacturing firms, and waste from fish farms and the fishing industry.

There is particularly strong research interest in four of the systems, Lurefjorden, Masfjorden, Lindåsosane and the national salmon fjords at Osterøy (see Chap. 16). Lurefjorden and Lindåsosane are a closed fjord system with shallow thresholds to the sea beyond. The thresholds are in three straits, at Bruknappen in Radsundet in the south, Fosnstraumen in the west, and Kjelstraumen in the north. Within this marine fjord system, there are also internal thresholds between Lindåsosane and Lurefjorden and between Fjellangervågen and Lindåsosane. The sea in this area thus has four levels, and ebbing and flowing take place. The very shallow threshold (<10 m) in to Lindåsosane results in a limited exchange of the water masses, which gives rise to anoxic conditions in the innermost basins. The anoxic, microbial processes and the biodiversity in these innermost water bodies are therefore not unlike those of, for example, the Baltic Sea or the Black Sea. Otherwise, the

ecosystem in Lindåsosane contains many of the same species of marine fish, seabirds and mammals that are found naturally on other parts of the coast. For instance, there is a herring stock that is known to spend all its life in this fjord system. The University of Bergen and the Norwegian Institute for Maritime Research have been studying this ecosystem, and the herring in particular, since the 1960s. The special environmental conditions have made it possible to perform marine biological studies here which are difficult to carry out elsewhere.

The somewhat deeper threshold (ca 20 m) to Lurefjorden ensures adequate exchange and oxygenation, but still prevents large quantities of clear, saline, Atlantic Ocean water from entering. Instead, the basin is filled up with the fresher, more turbid, coastal water. This means that visibility is extremely poor and makes Lurefjorden an unusually dark fjord. The most widespread organism in the fjord is the helmet jellyfish (*Periphylla periphylla*), a deep-water jellyfish found in every ocean except the Arctic. Lurefjorden also contains some organisms which are best known from arctic regions, including *Calanus glacialis*, a much larger and more nutritious copepod than its close relative *Calanus finmarchicus*. In addition, the arctic *Chlamys islandica* (Iceland scallop) is found here.

In fjords with deeper thresholds (>70 m), like Masfjorden, the fjord basin is filled with clear Atlantic water, and the optical properties, along with the biodiversity, resemble those found in the open sea. There is scarcely a single jellyfish here, but there are large numbers of the small (<10 cm) mesopelagic fish Mueller's pearlside (*Maurolicus muelleri*) and glacier lantern fish (*Benthosema glaciale*). These species, which live at depths of 200 to 1000 metres, are among the most widely distributed in the world's oceans, and Masfjorden has been a popular locality to study them in detail for over 40 years.

11.6.2 Freshwater systems

FRESH WATER (REGIONAL)

The sea exerts a strong influence throughout the region, both in shaping the landscape and for biological characteristics. This is because the mild, moist air currents from the sea meet the mountains on their way across the land and are forced upwards. The air is cooled and precipitation

Photo 11.6: Stonefly (left) and mayfly (right) are common benthic animals in Nordhordland. They are food for fish and widely used in ecological classification of rivers. A scraper net is used to collect them (photo on the right). Photo: Arne Fjellheim and Gaute Velle.

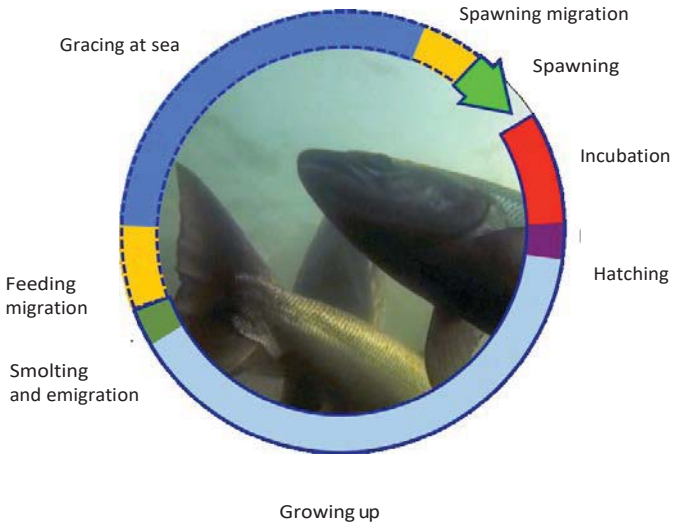


Figure 11.5: Salmon life cycle. Salmon live in both fresh water (the part of the circle with a continuous line) and salt water (the part of the circle with a stippled line) and are dependent upon good environmental conditions in both habitats. Illustration: Gaute Velle (photo: Bjørn Barlaup).

begins. The precipitation collects in streams and rivers that erode the landscape. Numerous large and small lakes are found in the valleys and on the upland plateaus.

The rivers and large lakes form the basis for an abundance of life. The ecosystems in the water consist of all trophic levels from primary producers (e.g. algae, bryophytes and higher plants), consumers (e.g. single-celled animals, zooplankton and benthic animals), predators (benthic animals and fish) to degraders (e.g. benthic animals, bacteria and fungi). There may be as many as 50,000 benthic animals per square metre of river bed (Photo 11.6). Such benthic animals comprise insects, snails and worms. The insects generally live for one year as larvae in fresh water before becoming adults and living for a couple of weeks on land. They lay their eggs in fresh water. Common insects include mayflies (*Ephemeroptera*), stoneflies (*Plecoptera*), caddisflies (*Trichoptera*) and non-biting midges (*Chironomidae*), and there may be over 100 different species of benthic animals in a habitat. The benthic animals are food for fish (trout and salmon) and form the basis for the fish stocks, which in turn are food for humans.

A large proportion of the fish in the rivers are also directly linked to the ocean. This applies to salmon and sea trout, which migrate between the rivers and the sea, i.e. anadromous species. Salmon and sea trout hatch from eggs to become fry in the rivers, where they live for a few years on benthic animals (Figure 11.5). After two to five years, big physiological changes take place in the fish as an adaptation to their future life in the sea. The fish migrate into the sea and grow rapidly on a diet of crustaceans and other fish. The salmon migrate into the open sea towards the Færoes and Western Greenland, while the sea trout remain within the fjord system not far from their natal river. After one to four years, the fish migrate back to the river to spawn. Salmon are about 15 cm long when they migrate from the river into the sea. When they return to the river to spawn they may be up to 130 cm long and weigh 25 kg.

11.6.3 Terrestrial systems

An overview of the terrestrial ecosystems found in the proposed Nordhordland BR is given here. Chapter 14 goes into more detail, describing these various ecosystems.

Vegetation zones

The proposed BR includes many different habitats from the outer fjords in the west to the montane areas in the east (Table 11.1). The variation in nature; the plant cover and the environmental conditions vary along spatial gradients and change often takes place gradually. The variation in the

vegetation in the coastal and fjord landscape of Western Norway is best illustrated by examining the vegetation zones which pass as broad bands from west to east (Figure 11.6). Temperature is the most important factor for why the vegetation changes from west to east and from sea to mountaintops. As long as the landscape is flat, the vegetation zones are broad, and the vegetation zones succeed one another, from the broad-leaved and coniferous forest zone (orange) near sea level to the open arctic (alpine) heathland vegetation on the summits (blue). The vegetation map (Figure 11.7) for the proposed BR gives a more detailed picture of the vegetation zones from sea level to the mountains, where the orange zone is classified as the northern broad-leaved and coniferous forest zone, but prehistoric coastal farmers replaced the forest with heathland, so that the zone in Figure 11.7 is divided by an approximately vertical, north-south trending red line, the area to the west now being mainly heathland. To the east is birch (*Betula pubescens*) and pine (*Pinus sylvestris*) woodland on nutrient-poor soil, and broad-leaveddeciduous forest with oak (*Quercus robur*), elm (*Ulmus glabra*), small-leaved lime (*Tilia cordata*) and hazel (*Corylus avellana*) on south-facing slopes with nutrient-rich soil. Mire is found in depressions.

The northern broad-leaved deciduous forest zone forms a broad belt along the coast and can also be traced into the fjord landscape. The southern coniferous forest zone (yellow) dominates on north-facing slopes and is slightly higher in the terrain. It consists chiefly of pine forest, but there is also some alder (*Alnus glutinosa*) woods and mire, as well as coppices of broad-leaved deciduous trees. The middle coniferous forest zone (light green) dominates higher in the valleys and on hill slopes. Coniferous forest is still important, but here we cross the altitude limit for grey alder (*Alnus glutinosa*)- bird cherry (*Prunus padus*) woodland, and many thermophilous plant communities and species. Mire covers large areas and typical sloping fens occur from this zone upwards through the northern coniferous forest zone (dark green). The subalpine birch woodland forms the woodland limit. Above this, the montane area can be divided into low alpine, middle alpine, and high alpine zones (blue). The low alpine zone stretches from the woodland limit as far up as bilberry (*Vaccinium myrtillus*), blue heath (*Phyllodoce caerulea*) and scrub vegetation. Above this, the middle alpine zone is found up to where continuous vegetation cover ends. The high alpine zone is the highest peaks,

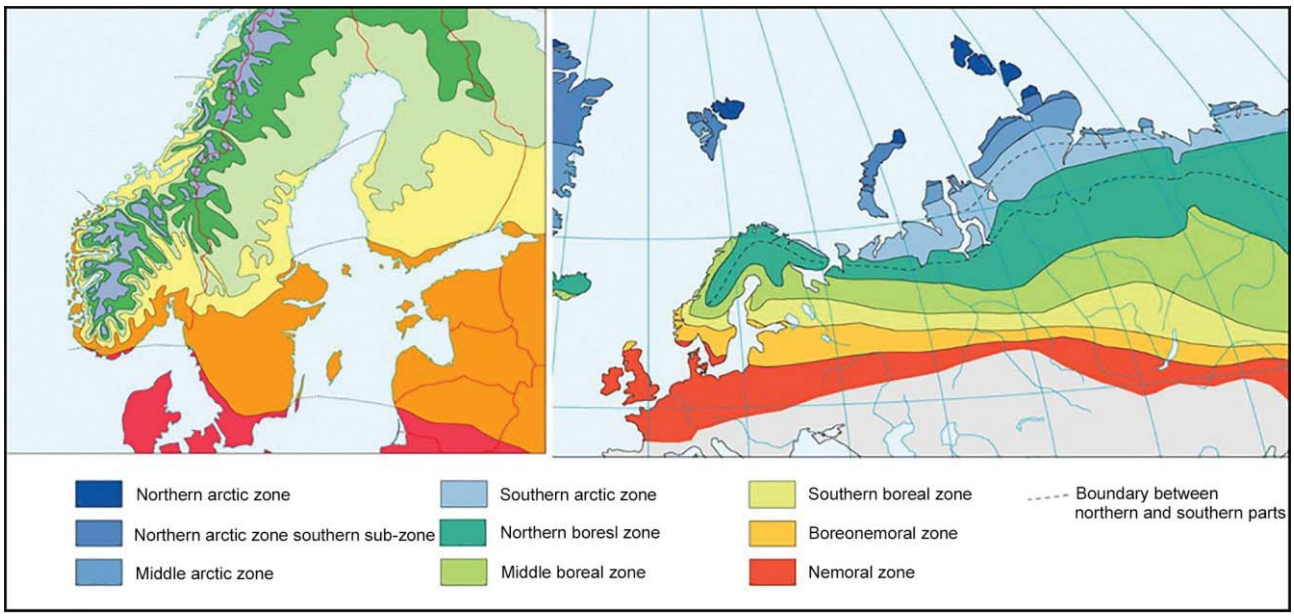


Figure 11.6: Maps of the major vegetation zones. From south to north, these zones shift from the thermophilous broad-leaved deciduous forest to the cold arctic zones. (Modified from Maps 67 and 69 in the Vegetation volume of the National Atlas of Norway).

where there is little continuous vegetation. Vascular plants grow as individual plants or in small populations on occasional, small patches of soil where weathering is especially active. Block fields are common.

All the vegetation zones in the proposed BR have been strongly influenced by farmers who used the local natural resources to obtain a reliable food supply for their families. Coastal heaths dominated on the coast, where farmers combined agriculture with fishing. Farmers who farmed in the deciduous woodlands along the fjords gathered large quantities of tree leaves in their outfields for fodder, and farmers in the pine woods sold timber for construction. Farmers in the fjord area also had summer dairy farms in the mountains, where they grazed livestock and hunted.

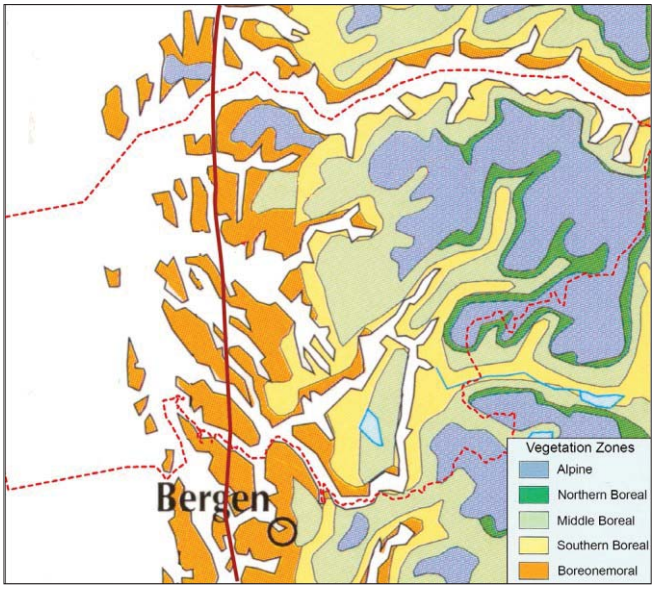


Figure 11.7: Vegetation zones in the proposed BR. Vertical red line: Boundary between the coastal heathland in the west and the wooded area in the east. Stippled line: Boundary of the proposed BR. Map: Modified from Figure 70 in the Vegetation volume of the National Atlas of Norway.

WETLAND (REGIONAL)
Wetland comprises mire and springs above and below the woodland limit and is characterised by the groundwater being near the surface and the soil being saturated with water. The total area taken up by springs is small, but mires are more common. They are formed where evaporation is less than the supply of water through precipitation and springs rising from the groundwater. Mire is normally defined as an area with a peat layer thicker than 30 cm and this nature type comprises approximately 6% of Norway's land area, but much more in Nordhordland, especially on the outer coast and in the mountains. Wetland also includes areas with thinner peat, whose vegetation is dominated by mire species.

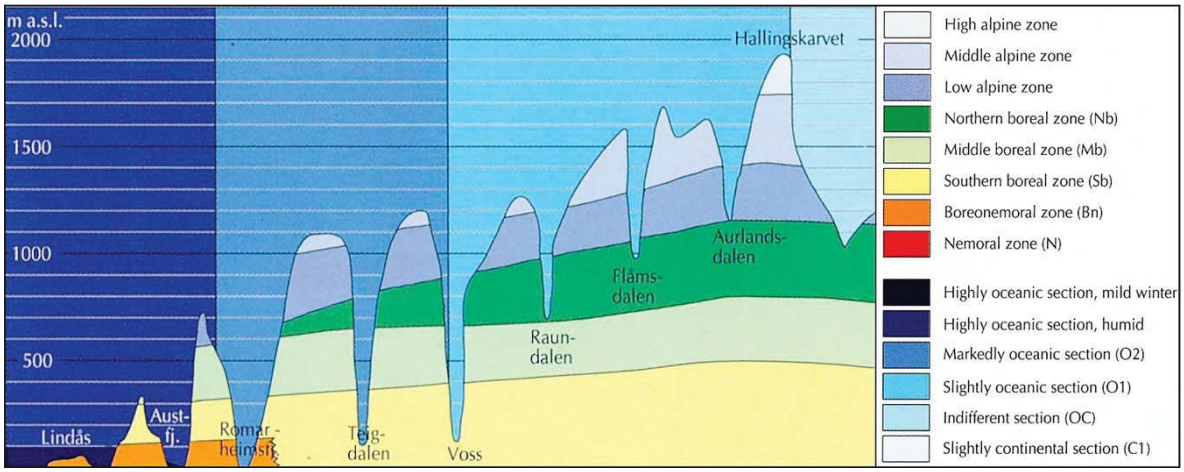


Figure 11.8: Profile from Lindås in the east to Gol in the west showing the altitudinal profile and the vegetation zones. (Modified part of Figure 20 in the Vegetation volume of the National Atlas of Norway).

OPEN LOWLAND (REGIONAL)

Open lowland is land below the woodland limit that has natural and semi-natural vegetation. Farmland, built-up areas and other areas with anthropogenic ecosystems are not regarded as open lowland in the ecosystem division in the Norwegian Nature Index. They are treated in separate sections here. Open lowland consists mainly of semi-natural heath and meadow, where the character of the habitat is shaped by lengthy land use of extensive livestock grazing and hay making. The area may be cleared of stones, but not ploughed, sprayed, fertilised or sown, or have only insignificant traces of such impacts. Open, natural ecosystems such as avalanche and landslide areas, and other naturally open areas below the woodland limit are also included. The nature index for open lowland therefore largely reflects the state of biological diversity in semi-natural ecosystems in lowlands. These types of ecosystems are found in several places along the sea-alpine gradient in the proposed BR, especially in mosaics with old agricultural areas.

WOODLAND AND FOREST (REGIONAL)

Woodland areas comprise all kinds of woodland, including birch woodland that grows in the montane areas, moist woodland and clear-felled patches which periodically can lack forest. Approximately 38% of Norway's land area is covered by forest, and the extent varies greatly with geographic location. In the proposed BR forests cover substantial areas along the coast and fjords. Some forest types, mostly pine and spruce, are categorised as productive whereas some are regarded as not being commercially exploitable. Productive forests cover about a quarter of the land area in Norway. Woodland has many ecological functions that include primary production, photosynthesis, water retention, decomposition and the nutrient recycling (see also Chap. 12). Woodland and forest contain a large number of species and over half the species we know in Norway are linked to this major ecosystem, particularly represented by groups like insects, birds, fungi and bryophytes. Many of these are adapted to habitats where natural processes of change are important, such as storms, floods and insect attacks.

MOUNTAINS (ALPINE) (REGIONAL)

The mountain areas comprise all the land above the forest limit, including landslide and avalanche areas, but not glaciers and other ground covered by snow and ice. This is a major ecosystem, covering more than a third of Norway's land area, and the majority of the eastern and northern parts of the proposed BR. The woodland limit, which delimits this ecosystem, is mainly determined by the temperature in the summer and the length of the growing season. In addition, wind and the amount of precipitation are important factors. Cold temperatures in summer mean that tree seeds do not mature in the alpine zone, thus preventing trees from spreading into this ecosystem. In addition, the woodland limit is affected by livestock grazing and the operation of the upland summer dairy farms. Wetland and fresh water are defined as separate ecosystems and do not form part of the nature index for alpine areas. Plants and animals in the uplands and mountains are exposed to many extreme stresses. The climate is severe, and factors such as low temperatures, high dehydration rates, short growing seasons, and snow conditions play important roles.

AGRICULTURAL AREAS (REGIONAL)

Agricultural areas are not part of the open lowland category in the Norwegian Nature Index. We include this category as one of the main ecosystems in the proposed BR because it comprises an important part of the land area. Agricultural areas can be divided into arable land (tilled ground), superficially tilled ground, and infield grazing grounds. In contrast to open lowland, this ecosystem has largely been altered by humans to produce food and other benefits. Agricultural areas and open lowland are nevertheless closely related both ecologically and economically and the two systems influence one another. In Norway, about 3% of the land area is arable land – a low figure compared

with many other countries. The cultural landscape in the proposed BR has been shaped by people over the 6,000 year-long history of farming which has modified the natural vegetation types. In the areas with the best soil, they felled the forests and, by hard work over a long time, broke up the natural soil profile with spades or ploughs. In infield areas, farmers created completely new, artificial plant communities such as tilled ground and grassland. The maintenance of these plant communities is entirely dependent upon the regular work efforts of farmers. Even though outfield areas may seem undisturbed, their vegetation is also more or less modified by agricultural practices over time. Over hundreds of years, farmers have harvested various species of plants for fodder, tools, building materials and firewood, and their livestock have grazed there. The land use in these areas has modified the natural plant communities over time to make them useful to people.

GREEN AREAS IN TOWNS AND BUILT-UP AREAS (REGIONAL)

Eighty per cent of the Norwegian population now lives in towns and built-up areas, and this proportion is growing. Good recreational areas in and near towns and villages can therefore give very many people the chance to enjoy outdoor life on a daily basis. Having nearby areas for outdoor recreation is most important for this, as the threshold for active outdoor recreation is lower, and it is easier to participate, especially for people who are not particularly active. Local authorities have a special responsibility to take care of these areas. Green structure plans, green belt plans and local environmental efforts are important measures. Urban ecosystems are difficult to delimit, but are generally characterised by, among other factors, fragmentation and a high proportion of covered surfaces, the predominance of individual species, a tendency for higher species diversity in suburbs than in neighbouring rural areas (particularly compared with agricultural areas), a tendency for more alien species, a higher concentration of pollution in both the atmosphere and water, and higher temperatures than surrounding areas. In the proposed BR there is a clear increasing trend of urbanization, particularly close to Bergen.

Key animal and bird species and their habitats

The proposed BR includes many important animal and bird species, each with different demands for their habitat. A habitat must satisfy several functions, but primarily provide food, nesting or breeding sites and cover. What decides the size of a habitat is the ecological niche of the species concerned and the extent to which food is available. Among the most relevant area-demanding species in Hordaland, which seem to be vulnerable to fragmentation are wild reindeer (*Rangifer tarandus*), goshawks (*Accipiter gentilis*) and capercaillies (*Tetrao urogallus*). Other areas that remain stable for several years and are easy to map are also generally recorded when the distribution of game species is being mapped. These include nesting colonies of grey herons (*Ardea cinerea*) and sand martins (*Riparia riparia*) and nesting sites of ravens (*Corvus corax*). These places will usually have little management interest.

CHARACTERISTIC ASPECTS OF THE MAMMALS IN THE PROPOSED NORDHORDLAND BIOSPHERE RESERVE (REGIONAL)

*Red deer (*Cervus elaphus*)*

The red deer is the most significant hunting resource in the proposed BR. As it is versatile and adaptable, it is difficult to point to areas that are especially important for this species. Good grazing areas are generally in lush deciduous woodland and woodland adjacent to arable land. Spruce plantations may serve a function as places for concealment, but are not important for grazing.

Table 11. 4. The number of red deer shot in 2017 in some of the municipalities in the proposed BR.

Municipality	No. of red deer shot
Voss	539
Osterøy	336
Vaksdal	205
Radøy	136
Masfjorden	117
Meland	116
Modalen	114
Austrheim	79
Lindås	70
Fedje	7

*Wild reindeer (*Rangifer tarandus*)*
This is a responsibility species (a species for which a certain region or nation has special responsibility to protect under the terms of the Bonn and Bern Conventions). The wild reindeer in the proposed BR are descendants of semi-domesticated reindeer and belong to the Fjellheimen Wild Reindeer District. Some 550-650 reindeer are present there in winter, divided between three sub-herds: Vikafjell (400-450), Vola (c. 100), and Kringsdal (30-50). The Fjellheimen Wild Reindeer District is organised as three hunting preserves, and the Fjellheimen Wild Reindeer Committee is an umbrella organisation for these. The Fjellheimen Wild Reindeer District comprises the montane area between Voss in the south and Sognefjord in the north, and between Fresvik in the east and Masfjorden in the west. It covers the local authorities of Voss, Modalen and Vaksdal in the county of Hordaland, and Aurland, Høyanger and Vik in the county of Sogn & Fjordane. Wild reindeer have been seen in the Raudberget Mountains in the eastern part of Voss, in recent years. Semi-domesticated reindeer were in this area previously, but since 1966, the animals have been managed as wild reindeer. The management area covers 1,700 km^2.

The local authorities have no formal responsibility for the population management of wild reindeer; the Deer Provisions of 2002 place this responsibility on the wild reindeer committee. However, their responsibility for land-use management gives local authorities an important role to play in securing the habitats of the animals. All the local authorities in the wild reindeer district take part in planning this. The aim is to secure the habitat and living conditions for the wild reindeer in the Fjellheimen Wild Reindeer District in the short and long term through inter-municipal plans, and to develop coordinated and overall management of the wild reindeer district. There are two measures: 1. complete the inter-municipal plan for the herd in the Fjellheimen Wild Reindeer District; 2. participate in preparing the regional plan for the Nordfjella Wild Reindeer District. These were unanimously adopted by all three county councils in spring 2014, as recommended by the steering committee.

*Otter (*Lutra lutra*)*
The European otter is regarded as a vulnerable species in Norway, but it is uncertain how many otters live in Norway. From 1900 to 1932, a bounty was paid for killing an otter, but the species was totally protected in 1982. It is a predatory mammal in the marten family and eats fish and amphibians. Norway has otters both in inland areas and on the coast. Otters in inland areas are constantly on the move and may roam up to 10-20 km a day seeking new rivers to catch fish. Along the coast, otters do not move as far, because fish are more readily available. Observations suggest that the species is expanding from the north and is continually becoming re-established in new areas of southern and eastern Norway. Both Masfjorden and Stor-Elvdal have special responsibility for taking care of otters. The most important threats are road accidents, drowning in fishing gear, and various pollutants.

*Red fox (*Vulpes vulpes*)*
The red fox is the most widespread species in its family and one of the most widely distributed mammals in the world. It is found in many municipalities in the proposed BR. The species has a flexible social organisation and often lives communally in large family groups in which pups from earlier broods remain in the parent's area. Both the size of the family groups and the size of the red fox territory vary with the amount, distribution and stability of the food supply: a territory may vary from 1 km^2 to over 20 km^2. The most important food is various kinds of small animals, rodents, hares, birds, frogs, fish, earthworms, snails, slugs, insects and berries. Carrion and waste food are important food sources in winter.

CHARACTERISTIC ASPECTS OF THE BIRDS IN THE PROPOSED NORDHORDLAND BIOSPHERE RESERVE (REGIONAL)

Coast
The municipalities on the outer coast have some of the most important breeding populations of species regarded as characteristic in western Norway. The arctic tern (*Sterna paradisaea*) and the common tern (*Sterna hirundo*) are two such species; the latter is on the national Red List. Tern colonies are also important for other species; common gulls (*Larus canus*) and waders take advantage of the collective defence of the breeding site provided by the terns, while the arctic skua (*Stercorarius parasiticus*) acquires its food by stealing fish from nesting terns and common gulls.

Photo 11.7. Great black-backed gull (Larus marinus) and common tern (Sterna hirundo). Photo: Arild Breistøl.

Another characteristic species is the great black-backed gull (*Larus marinus*), the seabird on the coast of western Norway that can best be called a Norwegian responsibility species. Norway has 32% of the world population; Hordaland has 6% of the Norwegian population. The coastal municipalities in the proposed BR have some of the most important breeding localities of great black-backed gulls. They also have one of the most important populations of eagle owls (*Bubo bubo*) in western Norway. Proximity to the seabird colonies and areas where they can remain undisturbed by humans is central for their occurrence. The areas of sea in the northwest, in Øygarden and Fedje, are not only important for seabirds in summer. In the autumn and winter, they are used as moulting and overwintering areas for such species as long-tailed ducks (*Clangula hyemalis*), eider ducks (*Somateria mollissima*), and auks.

Fjord and woodland

The steep hillsides clothed in broad-leaved deciduous woodland are important localities for species that require large territories and prefer old woodland. Here, woodpeckers like the white-backed woodpecker (*Dendrocopos leucotos*), grey-headed woodpecker (*Picus canus*), and lesser spotted woodpecker (*Dendrocopos minor*) find the dead and dying trees they depend upon. The nesting holes they excavate later become attractive nesting sites for other birds that nest in holes – e.g. tits, pied flycatchers (*Ficedula hypoleuca*), redstarts (*Phoenicurus phoenicurus*) and owls. The counties in western Norway have management responsibility for the white-backed woodpecker, which has declined greatly in northwestern Europe. The distribution of the grey-headed woodpecker is also centred on western Norway.

Alpine

Mountains make up a third of the area of the proposed BR. Characteristic species here are willow grouse (*Lagopus lagopus*) and ptarmigan (*Lagopus muta*). Both were placed on the most recent Norwegian Red List because of a marked decline in their populations over many years. The ready availability of willow grouse and ptarmigan is essential to maintain a good production of chicks of the gyr falcon (*Falco rusticolus*), which is found in the proposed BR. Other birds of prey present in years when plenty of small rodents are available are the golden eagle (*Aquila chrysaetos*), rough-legged buzzard (*Buteo lagopus*) and kestrel (*Falco tinnunculus*). Waders include the golden plover

Photo 11.8: Grey-headed woodpecker (Picus canus) and white-backed woodpecker (Dendrocopos leucotos). Photo: Rune Voie.

(*Pluvialis apricaria*), purple sandpiper (*Calidris maritima*) and a few pairs of dotteral (*Charadrius morinellus*).

Cultural landscape

Many types of cultural landscape in the area are becoming overgrown, and the birds that occupy such habitats have suffered the most dramatic declines in recent years. In Europe, up to 53% of the birds nesting in cultural landscapes have disappeared in the past 30 years. Important species in cultural landscapes of the proposed BR are lapwing (*Vanellus vanellus*), curlew (*Numenius arquata*), starling (*Sturnus vulgaris*) and skylark (*Alauda arvensis*), all on the Norwegian Red List from 2015. The importance of small farms, woodland edges and less use of pesticides may be decisive for the future existence of these birds.

Cultural landscape. Photo: Heidi J. Mongstad.

12. ECOSYSTEM SERVICES

12.1 If possible, identify the ecosystem services provided by each ecosystem of the biosphere reserve and the beneficiaries of these services

(Please refer to the Millennium Ecosystem Assessment Framework and The Economics of Ecosystems and Biodiversity)

Ecosystem services are goods and services we receive from nature as direct and indirect contributions to human well-being. The term covers both physical goods and non-physical services. They are directly linked to ecosystems (communities of organisms such as plants, animals and micro-organisms) and the environment in which the organisms live. If ecosystems are to deliver services over time, sustainable use must be ensured. BRs are thus perfect candidates for enhanced focus on ecosystems and ecosystem services. This chapter follows the division of the ecosystems employed in the national report "*Natural benefits – on the values of ecosystem services*" (NOU 2013:10) which covers the whole gradient from the ocean to the mountains, as in the proposed BR (Table 12.1). Ecosystem services are divided into four main categories; **provisioning services** are products we get from ecosystems, like food, water and firewood; **regulating services** are the natural regulation of processes in ecosystems from which we derive great benefit, such as water cleansing, air cleansing and protection from floods and erosion; **cultural services** cover immaterial benefits which we receive from ecosystems. These include aesthetic and spiritual experiences, recreation and health; and **supporting services** are fundamental functions in ecosystems which are essential for other ecosystem services. These may, for example, be soil formation, recycling of nutrients and primary production. The proposed Nordhordland BR is rich in ecosystem services attached to all these categories.

Sustainable protection of the ecosystem services is essential if we are to be able to look after them. This topic is addressed in "*Nature for life. Norway's national biodiversity action plan*" (Report to the Storting 14 (2015-2016)), whose primary objective is that Norwegian ecosystems should be in a good state. The national review of natural benefits and the values of ecosystem services (NOU 2013:10) concludes that we have varying knowledge about the values of ecosystem services in different ecosystems. All except one of the ecosystems covered by the NOU report are found in the proposed Nordhordland BR (Table 12.1). This demonstrates the diversity of ecosystems and services present here.

Table 12.1. Overview of ecosystems with associated ecosystem services present in the proposed biosphere reserve. The ecosystem division follows the one used in the national ecosystem services report (NOU 2013: 10).

Ecosystem	Examples of important ecosystem services
Ocean and coastal zone	*Provisioning services*: Fish and other seafood, biochemicals, biodiversity and genetic resources for new businesses *Regulating services*: Sequestration of carbon, water purification, kelp forests and coral reefs which reduce storm damage on the coast *Cultural services*: Tourism, aesthetic appreciation, inspiration for culture, art and design, recreation, outdoor life, cultural heritage and local identity *Supporting services*: Nutrient recycling and primary production
Freshwater	*Provisioning services*: Drinking water, biodiversity, energy and fish *Regulating services*: Flood control and water purification *Cultural services*: Tourism, aesthetic appreciation, recreation, outdoor life *Supporting services*: Nutrient recycling
Wetland	*Provisioning services*: Good water quality and biodiversity *Regulating services:* Regulates water volumes and help to give good water quality, effective in removing bacteria, microbes, excess nutrients and sediment. Good ability to absorb and store water, thus providing flood control. Carbon storage. *Cultural services*: Aesthetic appreciation *Supporting services:* Nutrient recycling
Woodland	*Provisioning services*: Timber, firewood, biodiversity, bioenergy and biochemicals *Regulating services*: Carbon storage, water purification, air cleansing *Cultural services:* Aesthetic appreciation, inspiration for culture, art and design, recreation, outdoor life *Supporting services*: Nutrient recycling
Alpine	*Provisioning services*: Grazing areas for livestock (food production), biodiversity, game and berries *Regulating services*: Buffer against natural disasters *Cultural services*: Tourism, aesthetic appreciation, inspiration for culture, art and design, recreation, outdoor life *Supporting services*: Primary production
Open lowland and agricultural areas (cultural landscape)	*Provisioning services*: Food production, biodiversity, genetic resources for new businesses *Regulating services*: Binding of carbon, water purification, buffer against natural disasters, pollination and biological control *Cultural services*: Tourism, aesthetic appreciation, inspiration for culture, art and design, recreation, outdoor life, cultural heritage and local identity *Supporting services*: Nutrient recycling and soil production
Green areas near built-up areas	*Provisioning services*: Biodiversity *Regulating services*: Air cleansing, flood control and pollination *Cultural services:* Recreation and well-being *Supporting services*: Nutrient recycling and primary production, climate regulation

OCEAN AND COASTAL AREAS

The ocean and the coastal areas are species-rich ecosystems, and in Norway as a whole, there are more than 10,000 species in the coastal ecosystems alone. The coastal fishery along the coast of Norway has been declining for the past 40 years. Nevertheless, the proposed BR is estimated to have some 100 full-time fishermen today. The varied fishery has a number of efficient supply services. The local coastal fishing fleet, mainly vessels under 11 m long, carries on a varied fishery aimed at members of the cod family, pelagic fish, shellfish and cartilaginous fish. The biological diversity (see Section 11.6), in addition to the varied geography, bottom conditions and natural seasonal fluctuations make the fishery very dynamic, and the fishermen make use of a variety of gear, such as lines, nets and pots, depending upon the species, the locality and the season. In the open sea, in water shallower than 20 metres, tangle seaweed is harvested to produce alginates. In the deeper areas, both in the open sea and in fjord basins, saithe, cusk and ling are fished using lines. In calmer waters, on sand and mud bottoms, crabs, lobsters and Norwegian lobsters are caught in pots. The coast of the proposed BR has a quay where local fishermen and larger vessels fishing beyond the proposed BR land their catches. Harvesting the marine resources in the proposed BR has roots going back to the Early Stone Age (see Section 9.1) and is an important element for understanding the culture of western Norway.

Aquaculture is one of the new industries in Nordhordland, producing seafood for a national and international market and creating important jobs and values in the region. Salmon and rainbow trout are the principal fish farmed. Osterfjorden and Sørfjorden are very well suited for farming rainbow trout. Fry and young fish are produced at several specialised plants and distributed to other parts of western Norway. Most of the adult fish produced in the proposed BR are exported. The industry has had an explosive development since its start in the 1970s.

Photo 12.1. Researchers working in a pilot project to cultivate micro-algae at Mongstad. Photo: University of Bergen.

Research has been essential for the development of the aquaculture industry, and the research station at Matre is an important platform for this work and for fishing trials. In addition to fish farms, there are a few smaller plants in Nordhordland that farm mussels and also a pilot plant at Mongstad which produces micro-algae using CO_2 supplied by the Mongstad oil refinery and sunlight. The micro-algae could become a sustainable biological resource with great potential for producing oil as an important constituent of, for example, feed for farmed salmon. Another important provisioning service from the ocean is oil and gas from the Troll Field on the continental shelf in the ocean just beyond the proposed BR. Mongstad and Øygarden, with their good harbours, are central sites for the activity on land. These provisioning services from the petroleum industry are important for industrial and technological development in Nordhordland and provide many jobs regionally.

The ocean and the coast also provide many regulating services. Large amounts of carbon are stored in the sea, in micro- and macro-algae and elsewhere. The kelp forests and several coral reefs are important habitats for many species and also have an important function in curbing storm waves, thus helping to reduce damage along the coast. Among the supporting services, the sea has considerable primary production, and the ocean and the coast can recycle nutrients.

Several cultural services are linked to both the ocean and the coast in Nordhordland. Their importance as arenas for recreation, outdoor life, tourism and enjoying nature is outstanding. In addition, the cultural heritage, both material and immaterial, associated with these ecosystems is substantial, in part because they are important for identity, a sense of belonging, and inspiration, and as many other parts of coastal Norway there is a vibrant culture connected with sea voyage and work.

FRESH WATER

Fresh water is a central contributor to ecosystem services, and the proposed BR has considerable fresh water resources, including rivers, streams, waterfalls, dams and lakes. Fresh water is first and foremost the source of clean drinking water, and it also provides goods such as fish, and is the source of electricity production in hydroelectric power plants. As a regulating service, bacteria, microbes, excess nutrients and sediment are cleansed from the water when it seeps through soil and wetland with a vegetation cover. Soil and wetland have a good ability to absorb and store water, thus regulating the supply of water and helping to reduce flooding. Water also transports nutrients, which help to make soils fertile. Water is important as a cultural service through recreation and fishing, aesthetics, education and tourism. Water also plays a key role as a supporting service and ensures that the ecosystems both on land and in the water function, for instance through primary production, degrading, and recycling of nutrients. Water has been decisive for much of the industrial development in the proposed BR as a provisioning service to the hydroelectricity production, which, because of high precipitation and favourable topographic conditions, is extremely important in the region.

WETLAND

In a wetland system, the soil is saturated with water. The system includes springs and mires, and the vegetation is adapted to the water-saturated conditions. Mires occur where evaporation of water is less than water entering in the form of precipitation or seepage of groundwater. Nordhordland has a great number of wetland systems. Hydrology, vegetation, substrate and the interplay between these three factors are important in these wetlands. Wetlands supply many ecosystem services and provide habitats for many specialised species, several of which are on the Norwegian Red List because they are threatened or vulnerable. From olden times, mires in both the lowlands and the mountains have fulfilled an important provisioning service in the form of delivering peat for fuel.

Some mires were both grazed and cut for fodder and were thus important for livestock production. In more modern times, mires have become an important source of peat for use in, for example, gardens. Nowadays, however, the regulating services wetlands provide are most valuable. One of the most important services is reducing flooding. Climate change and broader knowledge about flood control have enhanced our understanding of the wetland system as a regulating service. Wetlands are also a very important storage medium for carbon, and mire soil as a carbon reservoir has achieved new focus in recent years. Wetland also helps to purify water. Cultural services provided by wetlands include the aesthetic and recreational values of some mires, for example for those interested in birdwatching.

OPEN LOWLAND AND AGRICULTURAL AREAS (CULTURAL LANDSCAPE)

Open lowland and agricultural areas may be described as *cultural landscapes* in the proposed BR. This group of ecosystems includes semi-natural grassland, an ecosystem where traditional use is a requirement for its origin, form and functionality. Semi-natural grassland is shaped through interactions between the natural resources and use by man over time. Examples of semi-natural grassland are habitats such as semi-natural meadow, semi-natural shore meadow, boreal heath and coastal heath. Semi-natural grassland habitats are described in the Norwegian Red List for Ecosystems and Habitat Types. Agricultural areas were other ecosystems at one time, such as open lowland, wetland or woodland, and the Norwegian Classification of Land Types groups them in three classes: cultivated for arable crops; surface cultivation for establishing grassland; and infield grazing grounds. The cultural landscape provides many important ecosystem services, particularly with regard to food production. Nowadays, meat, milk, wool, hides, vegetables, fruit and heather honey are among the products from Nordhordland. Fishermen and farmers have traditionally supplied the provisioning services in the proposed BR, and important cultural services are now linked with the landscape of the fisherman-farmer of the past.

Open lowland and agricultural areas provide many cultural services, such as paths for recreation and outdoor life, which are important for developing tourism. The cultural landscape is also an important habitat for many species, several of which are now rare. Some 20% of the species in cultivated areas are red listed in Norway. It is essential that grazing continues in order to maintain the semi-natural grassland and its biodiversity (including genetic variation). In recent years, interest for old and threatened livestock breeds has increased, including the short-tailed sheep, coast goat, fjord cattle, red-polled cow, and Westland horse. The short-tailed sheep is particularly important for the coastal region. This is the original breed of sheep which grazed along the entire coast from time immemorial. In Nordhordland, they can graze outdoors throughout the year thanks to the mild, snow-free winters. Another interesting grazing system practiced in the proposed BR is grazing around the upland summer dairy farms. Stølsheimen is one of the most important upland summer dairy farm clusters in western Norway and holds a central position in Norwegian cultural heritage. In many Norwegian upland areas, the grazing landscape and the use of summer dairy farms developed more than 2,500 years ago, at the transition from the Bronze Age to the Iron Age. It is likely that it became more usual to use the uplands for livestock grazing in the Viking Age, and remains of buildings from that time have been found.

The cultural landscape in Nordhordland has many important regulating services. The soil is an important store for carbon, plants and trees help to improve the air quality since vegetation can absorb pollution, and roots can bind soil and prevent erosion and landslides in this area receiving large amounts of precipitation. Several ecosystems have supporting functions in that soil is formed, nutrients are recycled, and primary production takes place. Agriculture is less important in Nordhordland today than it used to be. There is about 58 km^2 of superficially cultivated land, and on average Hordaland farmers have the smallest farm properties in Norway. Abandonment of farms, fragmentation and

Photo 12.2. The Heathland Centre at Lygra in Lindås. Here the public can learn about maintaining the traditional use of old types of agricultural land, such as the coastal heathlands. Photo: Peter Emil Kaland.

development of areas for housing and other buildings are now among the biggest threats to this type of landscape.

WOODLAND AND FOREST

Woodland and forest cover 38% of mainland Norway, and most of the area is under the coniferous tree line. Birch, spruce and pine are the most common tree species. Woodland and forest offer several important ecosystem services, one of which in Nordhordland is forestry on the coast. Several forestry plantations originating from right after the Second World War are now ready for felling. Forests provides provisioning services in the form of timber, fuel, paper, bioenergy and biochemicals. The forests in the proposed BR are rich in species, and about 60% of the species in Norway (i.e. 40,000 species), are linked to woodland and forest, particularly fungi and insects. Woodland and forest provide important regulating services by taking up CO_2 from the atmosphere and building up biomass. The vegetation helps to bind soil and prevent erosion. Trees provide shade, and forests may influence the amount of precipitation and access to water both locally and regionally. Trees are important for air quality because they help to remove pollution from the atmosphere. Old deciduous and coniferous woodlands are important habitats for many red-listed species, including specialised bird species. Forestry in Nordhordland is an important industry based on renewable biological resources. It is the most important influencing factor in woodland today and, particularly along the coast, tree planting has several functions in addition to producing timber, including storm protection, windbreaks and shelter for farms and villages.

Woodland offers cultural services in the form of recreation, aesthetics and outdoor life values. It also provides supporting services, such as soil formation and nutrient recycling. It provides habitat for many insects and microorganisms, which break down organic material. From the outer coast via the fjords to the mountains, Nordhordland has a mosaic of woodland and agricultural land providing a host of services.

MOUNTAINS (ALPINE)
The alpine zone is the area above the tree line, except for wetland and fresh water, and is well represented in the proposed BR. Human impact is greatest around the tree line, where there are summer dairy farms with large grazing areas (see also open lowland), such as Stølsheimen. While the alpine ecosystem is one of those regarded as being most stable over time, encroachments take place in the form of reduced livestock grazing, building of hydroelectricity infrastructure, water diversion, dam building, road construction and building of private cabins. Climate change is also altering the lower limits in this zone, shifting treeline upwards. Alpine areas offer such provisioning services as game hunting and berry picking, which are still popular activities in Nordhordland. Cultural services are prominent in the mountains: recreation, enjoying natural history and scenery, outdoor life, and tourism are such services that are very popular in both summer and winter. The alpine ecosystem has important regulating services in that large areas collect water and regulate flooding; high mountains attract lightning strikes and thus protect lower-lying areas, and vegetation cover hinders erosion.

GREEN AREAS NEAR BUILT-UP AREAS
Nature in built-up areas and towns provides many ecosystem services. With regard to regulating services, rivers, lakes and trees in parks and avenues can help to prevent floods and bind soil, thus hindering erosion. Green areas are also an important habitat for many species of insects and birds. Cultural services, like enjoying natural features and recreation, are important for aesthetics, which in turn contribute to quality of life. Examples of regulating services are purification of wastewater and reducing the impacts of extreme events. Urban and peri-urban green areas are also habitats for insects, birds and bats, which in turn play an important role in pollination of flowering plants and trees. Green areas are also important habitats for species providing biological control, such as regulating pests and vector-borne diseases that attack plants, animals and humans. The ecosystems regulate pests and diseases through the activity of predators and parasites. Birds, bats, flies, wasps, frogs and fungi function as natural controllers of these.

12.2 Specify whether indicators of ecosystem services are used to evaluate the three functions (conservation, development and logistic) of the biosphere reserve. If yes, which ones and give details

Mapping ecosystem services is a good way of demonstrating the general aspects that characterises a biosphere reserve. Report to the Storting No. 14 (2015-2016) *Nature for life – Norway's national biodiversity action plan* states that the main strategy of the Government for nature diversity is sustainable management that ensures that all activity and use take place in such a way as to lead to Norwegian ecosystems maintaining as far as possible a good state over time. One step in this follow-up is to support the efforts of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). A national council of experts has recently put forward an important proposal for how to define a good state for ecosystems in Norway (*Comprehensive technical system for the determination of good ecological condition, 2017*). This system covers both marine and terrestrial ecosystems, and is based on scientific indicators and existing and available scientific knowledge about the state and development of Norwegian ecosystems, and also on the existing classification system.

A review of existing knowledge shows that the Water Provisions, the Nature Index and marine management plans are all important sources of indicators for the good state of an ecosystem. The

same applies to the red lists for species and habitats, and the Black List for Species. These are all based on knowledge from monitoring and other available knowledge. Data taken from Nature in Norway (NiN) are valuable for localising ecosystems in Norway. The proposal for a scientific system for defining a good ecological state identified seven important properties for determining whether the state is good: *primary production, distribution of biomass between trophic levels, diversity of functional groups, important species and structures, area assessments attached to the survival of species, changes in the composition of species and biotic factors*. These properties for good ecological state will be mapped for ecosystems in the proposed Nordhordland BR.

12.3 Describe biodiversity involved in the provision of ecosystems services in the biosphere reserve

(e.g. species or groups of species involved)

Biodiversity is an important element of ecosystem services and can also be looked upon as an important ecosystem service in itself. Genetic variation and species richness have been regarded by many as the memory and intelligence of nature, with great value for its power to resist and its potential for development if environmental change takes place. Loss of biodiversity thus leads to reduced ability to meet these future challenges. Protecting biodiversity is thus essential to attain the goal of taking good care of ecosystems and the ecosystem services they provide in Norway. The proposed BR has the potential to maintain or improve biodiversity regionally, directly ensuring the provision of ecosystem services as follows:

- Marine vegetation – harvesting algae
- Fish, shells and shellfish – food production by fishing and setting pots
- Bees and wild pollinating insects – pollinate agricultural crops and produce honey
- Predators (mammals, birds, bats, spiders, insects and fungi) – regulate pest outbreaks and diseases on food plants in the cultural landscape
- Trees – play a role in cleansing the air, absorbing CO_2, creating variation in the landscape, timber production, shelter belts and felling. Trees were also used earlier for livestock fodder and to make implements.
- Evergreen dwarf shrubs – food in winter for sheep that remain outdoors year around
- Herbs and grass – food for grazing livestock in summer
- Wild berries, herbs and fungi – people living in the proposed BR have for centuries harvested edible plants and mushrooms in outfield areas. Some plants were also used to dye wool or cure disease.

Photo 12.3: People living in the proposed BR have for centuries harvested edible plants and mushrooms in outfield areas. Photo: Inger Måren.

12.4 Specify whether any ecosystem services assessment has been done for the proposed biosphere reserve. If yes, is this assessment used to develop the management plan?

The proposed Nordhordland BR aims to be a pioneer area for mapping ecosystem services, both as an instrument for monitoring and to impart information about ecosystem values in a wider sense than just a purely economic one. Protecting and developing these ecosystem services will play an important role in the framework of the management plan for the future Nordhordland BR. The *NOU 2013:10* report *Natural benefits and the values of ecosystem services*, published in 2013, and the Report to the Storting *Meld. St. 14 (2015–2016) Nature for life – Norway's national biodiversity action plan*, will be used as guidelines in this work.

Eldsfjellet, Nordhordland. Photo: Heidi J. Mongstad.

13. MAIN OBJECTIVES FOR THE BIOSPHERE RESERVE'S DESIGNATION

13.1 Describe the main objectives of the proposed biosphere reserve, integrating the tree functions (conservation, development and logistic), presented below (sections 14 to 16), including components of biological and cultural diversity. Please specify the indirect pressures and/or organizational issues.

MAIN GOAL

Nordhordland Biosphere Reserve will be based on the best from the past and will pave the way for a future-oriented societal development that ensures the sustainable use of all types of resources for the benefit and pleasure of both the present inhabitants and future generations.

SUBSIDIARY GOALS

1. Nordhordland BR will be a driving force enabling the region to attain the UN Sustainable Development Goals.

2. Nordhordland BR will contribute to the development of a society that preserves biodiversity, ensures the sustainable use of natural resources, and supports local culture and identity.

3. Nordhordland BR will make people in the region more aware, concerned and involved so that they increasingly assume responsibility for, and take control over, their own development.

4. Nordhordland BR will help increase local production of food and other biomass by utilising natural resources both on land and in the sea in a sustainable way.

5. Nordhordland BR will further develop local strategies to counter and reduce human-induced climate change.

6. Nordhordland BR will encourage innovation and green business development in the region.

7. Nordhordland BR will help develop sustainable tourism in the region.

8. Nordhordland BR will encourage knowledge-based development in the region through close cooperation with universities and research institutions in Norway and abroad.

9. Nordhordland BR will cooperate with schools and other educational institutions in the region to help increase knowledge about sustainable development.

10. Through Nordhordland BR, the region will develop and benefit from an international network and make sure that experience and knowledge is shared with other similar regions nationally and internationally.

MAIN GOAL

Nordhordland Biosphere Reserve will be based on the best from the past and will pave the way for a future-oriented societal development that ensures the sustainable use of all types of resources for the benefit and pleasure of both the present inhabitants and future generations.

The principal goal for Nordhordland is to use the status as a BR as an active instrument to ensure a sustainable development of the region. This is fundamental both for the activities in the BR and for how they are implemented.

Based on the principal goal of the BR, one may say that the main focus for the BR is development of the transition zone, which comprises 86% of the total area and where 81% of the population live. The core areas and the buffer zones that have been selected are of course also important. They represent central values for the region and are characteristic examples of western Norwegian nature and how the region's inhabitants have exploited the natural resources in a sustainable manner for centuries. A vital task for the BR is to cooperate with the inhabitants and the authorities to ensure that these resources are well looked after. The overall goal is that establishing a BR will have a positive influence on life in Nordhordland both today and in the future.

We will achieve this by working closely with all our stakeholders- people from the local community, from commerce, from various research groups, and from the local authorities. Through this cooperation we will develop projects that are beneficial to society, leading to a future oriented, knowledge-based development.

The Nordhordland region faces a multitude of challenges – a major one is finding new kinds of employment as the petroleum industry is phasing out. The Nordhordland BR will develop arenas for teamwork, involving inhabitants of the region, to jointly find solutions and mark out a course that will ensure a better future for all the inhabitants of the region.

SUBSIDIARY GOALS

The Nordhordland BR will be based on a dynamic development of activities reflecting central challenges in society. It is therefore important to underline that the subsidiary goals listed represent general priorities. The specification and development of activities associated with these subsidiary goals will happen in close dialogue with the principal stakeholders in the region. The first phase of this is developing a management plan – a task that is planned for winter/spring 2018 and 2019.

The subsidiary goals relate directly to the strategy of the MAB Programme as presented in the Lima Action Plan 2016-2025. The brackets below demonstrate the connection between each subsidiary goal and the different sections of the Lima Action Plan.

1. Nordhordland BR will be a driving force enabling the region to attain the UN Sustainable Development Goals. (Lima Action Plan A1)

The Norwegian Government endorsed the UN Sustainable Development Goals (SDGs) in 2016. These will be implemented in every aspect of society (Section 13.2). The BR can be an important instrument for implementing the SDGs in Nordhordland. The aim is that everyone – politicians,

people in business and the general public – becomes accustomed to thinking and acting sustainably, so that green values are given priority and plans are laid for sustainable use of the region's ecosystems.

2. Nordhordland BR will contribute to the development of a society that preserves biodiversity, ensures the sustainable use of natural resources, and supports local culture and identity. (Lima Action Plan A1, A1.5 and A2.3)

Today, Nordhordland is a driving force in Norwegian business and industry. The region is central for oil and gas production, processing and delivery, for efficient utilisation of the hydropower resources in the region and not least for the future-oriented aquaculture industry. This is positive for the region, but further development also demands an increasing emphasis on the sustainable utilisation of the resources.

The region has roots back to the time when the ice retreated from the Norwegian mainland, and numerous Stone Age sites bear witness to the excellent opportunities for fishing and hunting in the area. For centuries, the culture was built up around the frugal, but independent, fisherman-farmer. The sea tied together the many small settlements, and the experience of a common identity was strong. Today, there is still a rich cultural life that builds directly on the legacy of the past.

Nordhordland, like everywhere else, is however, exposed to strong external pressure, amplified by its proximity to the city of Bergen. Greater mobility and the influx of new inhabitants make it especially important to build upon local cultural activities and to clarify and reinforce regional identity. The strong culture – both the traditional cultural heritage and the experience gained by working together and solving problems – gives the region special advantages which the BR will build upon.

3. Nordhordland BR will make people in the region more aware, concerned and involved so that they increasingly assume responsibility for, and take control over, their own development. (Lima Action Plan A2.3)

The BR will draw as many people as possible into its work through information, contact-creating activities and cooperative projects. The inhabitants of the region will be involved through the measures that will be set in motion and the opportunities created for discussion and dialogue.

This is in keeping with the fundamental idea behind the MAB Programme as specified in the Lima Action Plan 2016-2025. From the outset, the development of the Nordhordland BR has been a broadly rooted project. Openness and inclusion have been fundamental in the process so far and will form the basis of all activities in the future BR.

4. Nordhordland BR will help increase local production of food and other biomass by utilising natural resources both on land and in the sea in a sustainable way. (Lima Action Plan A4.4)

Life in Nordhordland was traditionally based on a combination of farming and fishing. The resources were used to their fullest potential. The inhabitants lived of the land and could even sell some of the surplus to the citizens of Bergen. Much of this activity has disappeared in the last fifty years and

been replaced by modern industry. In many places, outfield areas have become overgrown. Most of the food is no longer produced in the local community. The BR will try to change this trend and increase local food production in order to provide local people with access to high-quality food and make them appreciate their own resources and identity.

5. Nordhordland BR will further develop local strategies to counter and reduce human-induced climate change. (Lima Action Plan A1.4)

Nordhordland is surrounded by sea and has deep fjords and steep mountains. The region is therefore strongly exposed to some of the consequences of climate change through extreme weather, floods and rock and snow avalanches. This makes it important to have a better understanding of the likely results of climate change, and to do whatever is possible to limit human-induced climate change and proactively mitigate its negative impacts. The BR will support this both by providing adequate information and through cooperation with major industrial companies.

6. Nordhordland BR will encourage innovation and green business development in the region. (Lima Action Plan A1.5, A5)

Today, industry is the driving economic force in Nordhordland. The large oil and gas resources off the coast have created many jobs and great economic value. As this activity is expected to decline in the future, there is a need for innovation and re-structuring. Through close cooperation with research, business and the authorities, Nordhordland BR wants to take part in this process by promoting the change to business activities that are “greener” than the present ones. The region is very well positioned for carrying out the green shift by building on existing skills for innovation and product development.

The Nordhordland region is a central area for Norwegian fish farming. Most of the produce are exported. The volume of this business is now so great that the fish farms depend on imported feed. The aquaculture industry also faces significant pollution challenges. Nordhordland BR wants to help make the business more sustainable.

Historically people from Nordhordland have been visionary and they plan for the long term. Nordhordland has a tradition for cooperation between businesses and across municipal boundaries. This is in line with the main goal of the BR- building common arenas for dialogue and supporting cooperative efforts.

7. Nordhordland BR will help develop sustainable tourism in the region.

Nordhordland is located between two of the prime tourist attractions in Norway, the Hardangerfjord and the Sognefjord, and is near the tourist city of Bergen which has close to 2 million overnight stays and is visited by some half a million cruise ship tourists each year. Yet Nordhordland has very little tourism. The potential, however, is significant both for capitalizing on those who often visit the region, primarily using huts and cabins, and by increasing the number of new, visitors both from Norway and from other countries. The BR will endeavour to ensure that this development takes place in a sustainable manner by building upon, and with respect for, existing cultural and natural

values, and integrating tourism with other developments in the region, so that it is experienced as a positive contribution – also by those not directly involved in the tourism business.

8. Nordhordland BR will encourage knowledge-based development in the region through close cooperation with universities and research institutions in Norway and abroad. (Lima Action Plan A4)

The plan to establish Nordhordland BR has been developed in close cooperation between the local authorities in the region and the University of Bergen. The university is represented in the project's steering committee and, together with Nordhordland Regional Council, has been responsible for a considerable portion of the funding for the pilot project. Further development of the BR is based on maintaining this cooperation and expanding it to include other local, national and international universities and other research institutions. Several national and international development projects have already been established in which universities, also in other countries, are engaged. Applications for several such projects are being processed. A UNESCO Chair has been established at the University of Bergen and the appointee will be working closely with the Nordhordland BR.

9. Nordhordland BR will cooperate with schools and other educational institutions in the region to help increase knowledge about sustainable development. (Lima action Plan A4.2, B1 and B2)

Nordhordland BR will focus especially on children and young people. The aim is to inform and engage the students and to help them acquire skills on living sustainably from they enter kindergarten and all the way through upper secondary school. The BR will be a driving force and a coordinator for information on, and activities concerned with, sustainable development. The BR wants to help to build up skills that meet the challenges and requirements of the region. This will be done in close cooperation with the schools in Nordhordland.

10. Through Nordhordland BR, the region will develop and benefit from an international network and make sure that experience and knowledge is shared with other similar regions nationally and internationally. (Lima Action Plan B2.1, B5.1)

With a few exceptions, Nordhordland has little experience with international cooperation, but there is an expressed desire to do this in the future. By establishing the proposed BR, Nordhordland will gain access to an international network, both directly through the MAB Programme and indirectly by working together with the research and educational institutions.

Nordhordland will be the first BR in Norway. This gives the region a special responsibility to share knowledge and experience with others. The BR is representative for many of the resources that will be important for Norway's future, so the experiences from Nordhordland will be of interest also for the rest of the country. Nordhordland will through this be instrumental in developing a wider commitment to the MAB Programme in Norway in general.

13.2 Describe the sustainable development objectives of the biosphere reserve

(If appropriate, please refer to Agenda 21, Rio+20 and SDG post 2015)

UN's 17 SDGs are normative for the MAB Programme globally, and the Nordhordland BR will integrate these into its continuing work. In this, we have focused on the goals that are particularly relevant for the region because they refer to challenges faced by Nordhordland. We have taken as our starting point the subsidiary goals which the UN has listed under each SDG, and made it clear what the focus will be for the work in the proposed Nordhordland BR.

Our prioritisation is based on existing plans for the local authorities in the region (agricultural plans, climate plans, local government business plans, etc.) and on higher-level plans for the region (Water Framework Directive, Intermunicipal plan for business and social development, etc.). The prioritisations will be adjusted in connection with the preparation of a management plan for the BR in 2018 and 2019 (see Section 13.1). We have therefore included references to our goals as they are formulated in that section.

SUSTAINABLE DEVELOPMENT GOAL NO. 2:

	End hunger, achieve food security and improved nutrition and promote sustainable agriculture	**Goals for the BR: 1, 4**

Norway has a well-functioning system for economic support against poverty and hunger, and the population has access to a large selection of healthy food that ensures good nutrition. The challenges for Nordhordland are therefore on a different level. Through the biosphere initiative, Nordhordland wants to build an understanding of global contexts and the need to think sustainably.

The transition to an industrial society and the development of jobs in the oil and gas industry have led to a situation where the agricultural resources are not fully utilised. Outfield areas are becoming overgrown by scrub. The region is dependent upon importing food, fodder for livestock, and feed for fish farms. From a sustainability perspective this is problematic. The BR therefore aims to ensure that a larger part of the local natural resources are utilised and that traditional farming and fishing practices are encouraged. This will happen through improving the practical conditions for such utilisation and by encouraging use of all available resources.

Norway has always had a good fishery management. Through systematic monitoring and a strict set of regulations, the country has managed to maintain sustainable fish stocks. Nordhordland has a role to play in this by communicating knowledge to other parts of the world. Nordhordland wants to be a leader in the development of a sustainable fish-farming industry, and the proposed Nordhordland BR will work closely with both researchers and the industry to help to achieve this.

SUSTAINABLE DEVELOPMENT GOAL NO. 3:

	**Ensure healthy lives and promote well-being for all at all ages**	**Goals for the BR: 1, 3**

Norway has a well-functioning health system with free access to all kinds of health services for all inhabitants. Preventive health care is well organised at national, regional and local levels. The BR will, nevertheless, promote good public health with particular focus on integrating local cultural and natural resources in this work. The activities of the BR will complement established health services and closely collaborate with the health sector.

The establishment of a BR in Nordhordland also means strengthening relations with several universities and research institutions. This will improve the quality of such work and help ensuring that knowledge gathered within the BR may easily be transferred and help solve similar problems elsewhere.

SUSTAINABLE DEVELOPMENT GOAL NO. 4:

	**Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all**	**Goals for the BR:** **9**

Norway has a well-developed education system which ensures that all young people have access to education for a minimum of 13 years. Government loans and grants are given for further education at universities and colleges. There is therefore no need to strengthen the education sector in Nordhordland in general. Schools and other educational institutions will however be central partners for the proposed BR. We will work together with these institutions, from kindergartens to universities, to help to improve knowledge about sustainability and to increase knowledge and understanding of local culture and local resources.

Today many of the people in the region are employed in the petroleum industry. In the future the importance of his sector will gradually decrease, and the region will therefore have to develop new, greener industry. We will prioritise activities that make the region resilient and facilitate this development.

Nordhordland is close to the city of Bergen and experiences a significant leakage of skilled workers to Bergen and to the Norwegian capital, Oslo. The BR will implement measures to strengthen the labour market in the region, thereby helping to retain this competence in Nordhordland.

SUSTAINABLE DEVELOPMENT GOAL NO. 6:

	**Ensure availability and sustainable management of water and sanitation for all**	**Goals for the BR: 1, 4**

Water is a recurring theme for the proposed Nordhordland BR – from large lakes in the mountains through rivers teeming with fish, waterfalls that provide hydroelectricity, fjords and straits, to the open sea with its enormous resources. Historically, all these resources have been fundamental for life in the region, and it is not much different today. Nordhordland has for many years built up skills in the management of the water resources: utilisation, preservation and quality assurance. This is also secured through the Drinking Water Regulations. The core areas, the river Loneelvi, the National Salmon Fjord and the Lurefjord, each in its own way, provide examples of this work – both of the challenges and the solutions that are being worked on. Like most of Norway, Nordhordland today has a reliable, good supply of drinking water. Work in the BR will help to maintain this in the future.

But there is still a lot to be done, and the BR will work closely with the authorities which have direct responsibility for water management. The region can, at the same time, function as a demonstration area for integrated sustainable use of all water resources.

SUSTAINABLE DEVELOPMENT GOAL NO. 7:

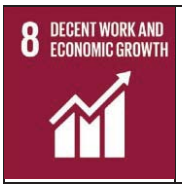
	**Ensure access to affordable, reliable, sustainable and modern energy for all**	**Goals for the BR: 1, 2**

Norway, and especially western Norway, has a rich variety of sources of energy, both fossil and renewable: oil and gas, hydroelectricity, waves, and wind. The petroleum resources off the coast of Nordhordland are very important and are partly processed within the proposed BR. The BR aims to bring about a greater degree of sustainability in this industry, and at the same time help pave the way for the transfer to new sources of energy. Much of the competence attached to the extraction of oil and gas can also be used to further develop solar energy, wind and wave power.

Globally, Norway is the 7th largest producer of hydroelectric energy, and today all Norwegians are guaranteed green energy at a low price. Extensive hydroelectric development has taken place within the proposed BR in the mountains around the Stølsheimen Landscape Protected Area, and energy is supplied from there to the region and the city of Bergen. At the same time, the original habitats and open mountain areas are preserved inside the Landscape Protected Area, which is an important buffer zone in the BR.

With the competence and the natural resources present in Nordhordland, the region can play an important role as a driving force for the development and coordination of various renewable sources of energy.

SUSTAINABLE DEVELOPMENT GOAL NO. 8:

	**Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all**	**Goals for the BR: 2, 6, 7**

Nordhordland wants to support innovation and attract resources and competence which may strengthen the region's business and industry. The role of the proposed BR will be to help this development be more sustainable and ensure that it, as much as possible, utilize local resources. The organisation for the proposed BR has already begun a project concerned with sustainable tourism, and several projects which concern utilisation of local resources. We wish to promote local products and develop products and services based on the local environment.

SUSTAINABLE DEVELOPMENT GOAL NO. 9:

	**Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation**	**Goals for the BR: 1, 6**

The industrial sector in Nordhordland is in a transition phase primarily due to the decline of oil and gas activities. The proposed BR will contribute to making this development sustainable by connecting players from politics, education and commerce, arranging venues for such interaction, and bringing local stakeholders closer to researchers in Norway and in other countries.

SUSTAINABLE DEVELOPMENT GOAL NO. 12:

	**Ensure sustainable consumption and production patterns**	**Goals for the BR: 1, 3, 9**

There is already a great deal of focus on sustainable production, environment-friendly solutions, and recycling both in the public sector, in industry and commerce, and among the general public in Nordhordland. Through active communication and dialogue with all stakeholders, the Nordhordland BR will help increase understanding for this work and for the SDGs in general. The schools in the region will be important partners in this work.

SUSTAINABLE DEVELOPMENT GOAL NO. 13:

	**Take urgent action to combat climate change and its impacts by regulating emissions and promoting developments inrenewable energy**	**Goals for the BR: 5, 8**

Nordhordland differs from many other BRs because there are several major industrial companies in the region, including the largest oil refinery in Norway. Because of this, it will be especially important for the BR to help to create greater understanding of the effects of climate change, of what can be done to prevent further global warming, and on how to reduce the local consequences of climate change. This will be done through information to the general public in the region, by working together with established authorities and by involving both private individuals and organisations. The BR organisation will take advantage of its contacts with research and educational institutions to strengthen this work.

SUSTAINABLE DEVELOPMENT GOAL NO.14:

	**Conserve and sustainably use the oceans, seas and marine resources for sustainable development**	**Goal for the BR: 4**

Much of Nordhordland is surrounded by sea, and what takes place in the sea has great significance for the entire region. Several of the core areas in the proposed BR are marine. The established buffer zones ensure that these can develop well. Increasing the sustainable use of the marine resources will be given high priority in the BR.

SUSTAINABLE DEVELOPMENT GOAL NO. 15:

	**Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss**	**Goals for the BR: 1, 2, 3, 4**

As a nation, Norway is characterised by a close relationship between people and nature. In this respect, the Nordhordland region is representative for large parts of coastal Norway. The tradition of using natural resources in both business and recreation is still fundamental for most people in the proposed BR. The sustainable use of natural resources is thus a prerequisite to enable inhabitants in the region to enjoy the same quality of life in the years to come.

The BR organisation is already strongly involved in projects that promote sustainable nature management. Several of these have come about following initiatives from the inhabitants in the region. These activities will be strengthened and extended when the BR is formally established.

SUSTAINABLE DEVELOPMENT GOAL NO. 17:

	**Strengthen the means of implementation and revitalize the global partnership for sustainable development**	**Goals for the BR: 8, 10**

The Nordic, European and World networks of BRs have already been important in developing the commitment to a BR in Nordhordland. Representatives for the future BR have been elected onto various boards and committees in the MAB Programme. We have organised international conferences and taken part in projects along with representatives from other countries. This work will be strengthened and further developed when the BR is formally established. The goal is that Nordhordland as a region will be able to play a more active role on an international arena and that we will be able to share our own experiences with people all over the world.

13.3 Indicate the main stakeholders involved in the management of the biosphere reserve

In Norway, protected areas are managed by the Ministry of Climate and Environment on behalf of the Norwegian Government. The Ministry has delegated the management responsibility to the Norwegian Environment Agency, which has an operative section, the Norwegian Nature Inspectorate, whose task is to take care of protected areas so that the protected values and the purpose of the protection are not lost or depreciated. The Inspectorate has its head office in Trondheim and has about 60 local offices across the country. The County Governor is the Government representative in each county and is responsible for implementing decisions, goals and guidelines from the Parliament and the Government.

The Directorate for Cultural Heritage (which is also subordinate to the same Ministry) is responsible for managing the cultural heritage (cultural heritage monuments and cultural environments). It has delegated the management responsibility for cultural monuments older than the Reformation (AD 1537), which are automatically protected, to the County Councils.

All the core areas in the proposed BR are thus managed by the Norwegian Environment Agency or the Directorate for Cultural Heritage. This also applies to the buffer zones of the Stølsheimen and Loneelvi core areas. The buffer zones of the National Salmon Fjord at Osterøy are managed by the Norwegian Food Safety Authority (see the attachment to Section 19.3). The buffer zone of the marine protected area, Lurefjorden and Lindåsosane, is protected by the Municipal Sub-plan for the Municipality of Lindås and the EU Water Framework Directive which are intended

Hordaland County Council and Sogn & Fjordane County Council have the principal responsibility for managing the terrestrial part of the proposed Nordhordland BR, while the Directorate of Fisheries and the Ministry of Climate and Environment have the management responsibility for the marine areas.

13.4 What consultation procedure was used for designing the biosphere reserve?

Norway once had a BR in north-eastern Svalbard, but it was withdrawn in 1997 because, as it had no inhabitants, it did not meet the criteria in the Statutory Framework. Since then, several attempts were made to revive the idea of having a Norwegian BR, but the plans did not take off until 2010. That year a conference organised by the Norwegian UNESCO Commission decided that:

1. A proposal for a BR in Nordhordland should be put forward.
2. The rector of the University of Bergen should apply to get a UNESCO Chair established at the university in order to support the interdisciplinary research in the BR.

In October 2010, Nordhordland Regional Council announced that they wanted to pursue the idea of establishing a BR in Nordhordland. The council chairman appointed a BR-committee comprised of four municipal mayors and one representative of the University of Bergen. This committee laid more detailed plans for the BR. The following design for a future BR in Nordhordland was agreed upon:

1. The BR was to be developed along a west-east resource profile from the sea in the west, through the archipelago, into the fjord landscape and up to the mountain area in the east. This would bring out the marked climatic and ecological gradients in the coastal landscape of western Norway.

2. The BR had to be founded on the sustainable use of the nature and natural resources on which the people on the coast of western Norway live:

   • Nature
   - with great contrasts from the protected coast with a wide archipelago to the fjords and high mountains.

   • Water
   - which is a key element both because the proposed BR receives large amounts of precipitation and because large parts of it are sea, fjords, rivers and lakes.

   • Fish
   - because the marine resources have been, are, and will be – central for business and commerce and for cultural identity of the region.

   • Oil and gas
   - because the oil and gas resources in the region make the climatic challenges particularly relevant.

The design of the BR was presented to three municipal councils and the inhabitants in general through newspaper articles and meetings. In addition, the project to establish a BR was presented to Swedish MAB experts in autumn 2010. Since then, the project has received invaluable assistance from Swedish experts throughout the process.

The plan for the BR was first presented to the MAB Secretariat in Paris in February 2011. It was well received, not least because it focused on the sustainable management of the huge resources along the coast of western Norway, which have both national and international importance. In August

2011, the person responsible for BRs in Europe came on a review visit to Nordhordland. She had several constructive meetings with politicians and with the management of the University of Bergen.

The BR organisation has mainly used established communication channels, newspapers, radio and TV to spread information about the programme to the general population. By degrees, new channels were established: a web page and a Facebook account. The information imparted through these channels was also sent to all relevant web sites in the region – principally municipal web sites. The project was presented at many meetings with relevant NGOs, ranging from agricultural organisations to Rotary clubs. Those in charge of the project paid several visits to local authorities in the region, holding meetings with administrative and political leaders and giving municipal councils information on the project. This meant that the interest and the wish to realise the vision of a BR in Nordhordland were steadily growing.

Parallel with this, information on MAB and the project was disseminated at the University of Bergen. Internal communication channels were used to spread information about the programme and several meetings were held to present and discuss it at different levels in the university. This took place at the same time as the university successfully applied and was given funding for a UNESCO Chair.

The BR project was formally initiated on June 13, 2013, when a cooperation agreement between Nordhordland Regional Council and the University of Bergen was signed. All the mayors and chief administrative officers of the nine local authorities which are cooperating were present, as was the university rector and the county governor of Hordaland. The agreement stated that Nordhordland Regional Council owned the project and the University of Bergen was the principal cooperative partner. A board, a project manager and a working committee were then appointed.

It was decided that the BR project in Nordhordland would use the same application procedure as in Sweden, where a pilot project application is initially prepared, documenting that the proposed BR meets the criteria of the MAB Programme. If this application is approved by the national MAB Committee, the area will be given the status of a candidate BR and the main application to the Government can be prepared.

Work on the pilot project application began in August 2013 and the board approved the application in September 2014. The pilot study was put forward and approved by all the 10 (9 plus one new) municipal councils in the region and of Hordaland County Council. It was then approved by the County Governor of Hordaland. In March 2015, the application was submitted to the Norwegian MAB Committee. At the same time, the Norwegian Environment Agency became involved in the process to quality control the application's suggested core areas and buffer zones. When this was clarified, the pilot project application was approved by the national MAB Committee in October 2016. The BR project received the status of candidate BR, and the formal work on this application, as described in Sections 17.1-4 and elsewhere, could begin.

13.5 How will stakeholder involvement in implementing and managing the biosphere reserve be fostered?

From day one, the BR project has been founded on the basic principle that development must take the interests of the local inhabitants into account. Through formal and informal processes, including

discussions with interested parties and presentation of proposals in political bodies, everyone has therefore had an opportunity to influence the guiding principles on which the Nordhordland BR, as presented in this application, is based.

The same applies to the activity and project portfolio of the BR. This is a result of close dialogue with, and is mainly based on initiatives from, interested parties in the region. Close cooperation with these groups has enabled us to further develop the initiatives and ensure firm foundation in the values of the MAB Programme. By involving all interested parties in this way, the pilot project has established a firm basis for the BR among a large proportion of the population of Nordhordland. This basis will be further built upon when the BR is formally established.

Our strategy for involving groups of interested parties in the future BR is based on some basic principles:

- *Openness and transparency*

All information on activity in the BR is openly available for all who are interested. In addition, we use various means to try to ensure that the information reaches everyone.

- *Consultation and dialogue*

We believe the best way to get people involved is to listen to their suggestions and take the problems facing them seriously. We have chosen an approach where we explain broadly how the BR organisation works before we discuss possible solutions with the stakeholders.

- *Establishing realistic expectations*

A final decision on what role the BR organisation should take relative to other actors concerned with sustainable development in the region has not yet been taken. We do however have clear ideas on how to move forward (see Section 13.1). We believe that it is of crucial importance to the success of the BR to set realistic expectations on what issues the establishment of a BR may help solve, and how this should be done.

- *Concrete and practical solutions*

The proposed BR will work in many areas within the three main axes of the MAB Programme: conservation, support and development. To create involvement and interest in relation to these tasks, we have tried to set concrete targets and work on practical solutions with which people can identify.

The stakeholders will be involved in the proposed BR in several ways:

- *Strategic process in 2018 and 2019*

This will be a wide-ranging process in which the details in the strategy and tasks of the BR organisation will be further developed and made more concrete. Politicians, NGOs, businesses and industry as well as people in general will be engaged in this process, which will result in a complete Management Plan.

- *Formal representation in governing bodies*

Through the formal structure we have chosen for organising the proposed BR, in which both owners and interested parties are represented, we have ensured broad representation and involvement. The current projects in the proposed BR are organised in a similar way.

- *Communication and outreach activities*

The BR project has invested a lot of effort on communication, and this will be further extended when the BR is formally established. More communication channels will be established, and active outreach to stakeholders throughout the region will be intensified.

- *Annual BR conference*

The project has previously organised a large conference on sustainable development. The experience gained from this was extremely positive and we now plan for an annual gathering for all stakeholders where we will discuss central challenges and the continuing development of the BR.

- *Project development*

The BR organisation will have some permanent tasks, but a significant part of the activity will be project based. Many such projects have already been established concerning, among other things, local food, developing local businesses, traditional crafts (The Wool Project) and nature management (The Landscape Project). The organization aim to always have a variety of projects running- each of which will contribute to sustainable development in the region. We believe that working in such a concrete way is the best means of engaging a wide variety of people in the region.

13.6 What are the expected main sources of resources (financial, material and human) to implement the objectives of the biosphere reserve and projects within?

(Please provide formal commitments and engagements)

Economy and the use of resources must be viewed in context with the tasks assigned to the BR project as summarised in Section 13.1. This will become more apparent when the final strategy for the BR is in place, when it has been decided which activities the BR will be engaged in and when a final form of organisation has been found.

The budget for the BR is based on a staff of three full time employees. It also includes expenses for information activities, for travel and for meetings. A lot of the work will be organized as projects, and there may be additional people engaged on a project basis. As a rule, all BR projects will be externally funded. For some projects, there may also be a form of overhead so that the projects contribute to the basic financing of the BR.

Both local authorities and members of different governing bodies (such as members of the steering committee) are expected to invest considerable unpaid work in the BR- typically attendance of the mayors or of members of the municipal administration at meetings connected with the BR.

The institutions which will contribute the main funding of the commitment to the BR are:

The local authorities, the University of Bergen, Hordaland County Council, the Norwegian Government (via various ministries), sponsors and business and industry.

Section 17.4.11 contains a detailed budget.

Old Norwegian Sheep, also called "vildsheep". Photo: Marius Flemmen Knudsen.

14. CONSERVATION FUNCTION

14.1 At the level of landscapes and ecosystems (including soils, water and climate)

14.1.1 Describe and give the location of ecosystems and/ or landscape cover types of the biosphere reserve

The proposed BR is characterised by a high diversity of ecosystems with their associated flora and fauna. The landscape types and ecosystems can be categorised and referred to in different ways. We focus on three main divisions, the **marine systems**, the **freshwater systems** and the **terrestrial systems** (wetland and non-wetland) (see Chap. 11). To bring out the breadth of these three divisions, we subdivide them into the following categories: *ocean and coastal zone, freshwater, wetland, open lowland, woodland* and *alpine* (after the division of ecosystems which follows the **Nature Index for Norway**). We have also added the categories Agricultural areas and Green areas in towns and built-up areas, in the same way as the description of ecosystem services in Norway (NOU 2013:10, Chap. 12). All the main ecosystems in the BRs are thus included.

The biodiversity in these ecosystems is protected through the Nature Diversity Act, which states that: "*The objective is to maintain the diversity of habitat types within their natural range and the species diversity and ecological processes that are characteristic of each habitat type. The objective is also to maintain ecosystem structure, functioning and productivity to the extent this is considered to be reasonable*."

The ecosystems are an important resource base for people – and have been for a long time (see also Chapters 9, 11 and 12). Thus, within all ecosystems or natural environments there are also important cultural environments (see Chapters 7 and 9). Natural environments and cultural environments are linked. Many ecosystems and their biodiversity are completely dependent upon unbroken land-use practices such as haymaking, grazing, burning and harvesting to maintain their functions. These are semi-natural habitats that have their origin precisely through their use by generations of humans. Almost all Norwegian nature today has been affected in one way or another by people.

MARINE SYSTEMS

Ocean and coastal zone

The ocean and coastal zone embrace bodies of open water and saltwater benthic systems. The marine water bodies cover ecosystems of floating, drifting or swimming organisms in bodies of open salt water. Areas of sea within and outside the proposed BR are the northern North Sea, dominated by the Norwegian Trench with a depth of 200-400 m. It is ocean currents and vertical circulation systems that bring about an exchange of water between water bodies. The sea has complete food chains, with phytoplankton as the most important primary producers, crustacean plankton as the most important plant consumers, and a complex food chain of predators. The saltwater benthic

systems, or marine bottom systems, are the ecosystems which are in, on or near the bed of the sea, fjords, fjord arms or littoral basins.

Furthest out in the proposed BR is the open archipelago which protects the mainland from the open sea in the west. Ecosystems here are characterised by deep areas linked to the Norwegian Trench and the continental shelf. The water bodies are characterised by clean and clear Atlantic water with a high salt content. Out in this deep water are deep-water corals, and, further up the extensive kelp forests. The marine organisms here, such as pelagic fish, like herring, Atlantic mackerel and Atlantic Bluefin tuna (*Thunnus thynnus*), are found in the open water bodies and the Atlantic water, more than the actual coast. Further east, on the inner coast of the outermost, protective islands, is the more topographically complex archipelago comprising a multitude of islands, islets and skerries linked together by narrow passages, straits with strong currents and channels. Fresh water is mixed in here, along with associated organic material making the water bodies more turbid than further west. The bottom here is often sand and mud, and contains an abundance of invertebrates, in addition to flatfish and skates. Still further east we find a characteristic system of fjords and small fjord arms whose ecological contrasts make the proposed BR particularly interesting. In addition to the large Sognefjord in the north, there are many smaller fjords whose salinity changes gradually from high at the fjord mouth to low furthest in to the fjord, and with great variation in biological diversity, both flora and fauna. In addition to the system of small fjord arms, Lindåsosane, and the three fjords- the national salmon fjords at Osterøy, Masfjorden and Lurefjorden, are particularly highlighted.

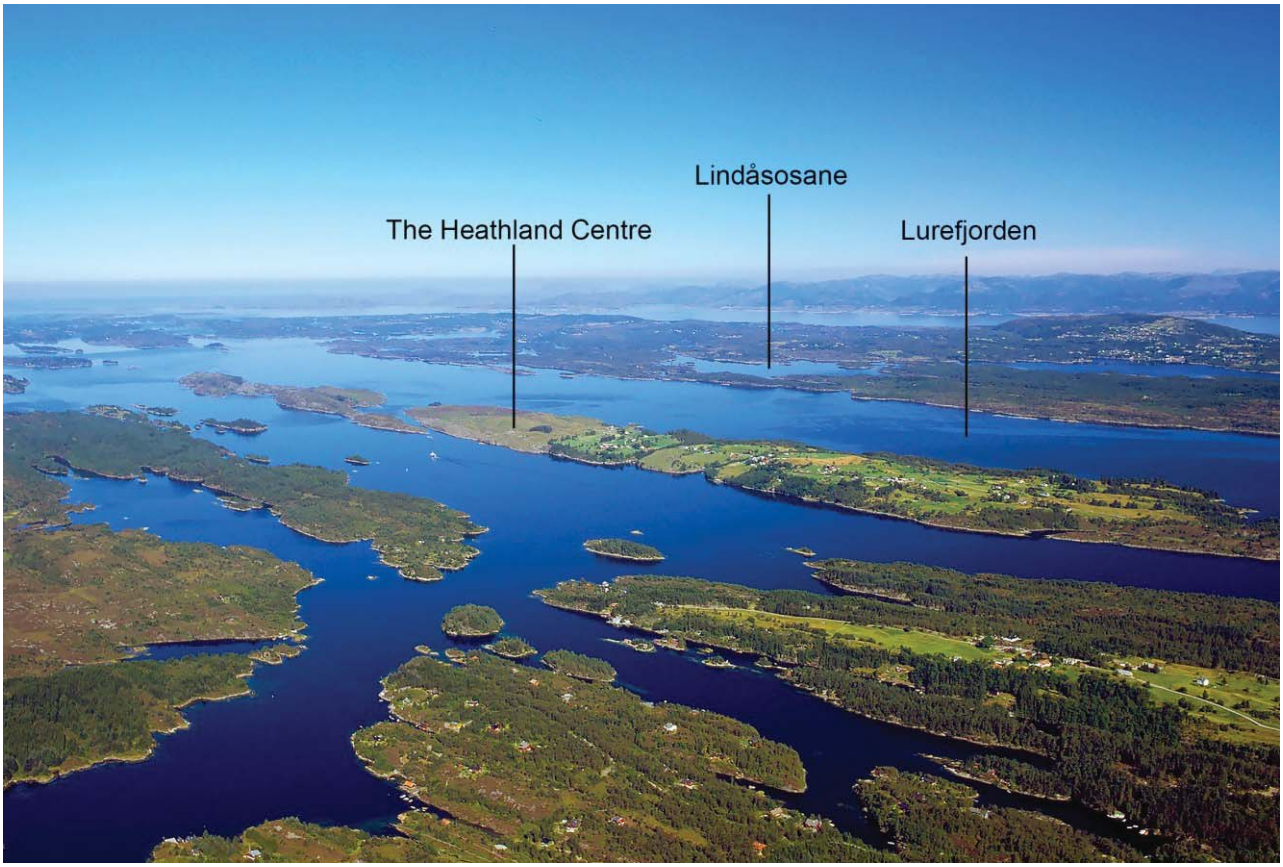


Photo 14.1. Aerial photograph of Lurefjord, Lindåsosane and the Heathland Centre, viewed from the south. Photo: Peter Emil Kaland.

Lindåsosane (Lindåspollane) is composed of three small basins, Straumsosen, Spjeldnesosen and Fjellangervågen (Photo 14.1). As a consequence of the shallow threshold (3.5 m) at the mouth of the fjord arm, the exchange of tidal water is substantially delayed and generally only the surface layer is exchanged. In practice, the shallow threshold makes Lindåsosane is a marine lake. The basin water is only exchanged when the heavier Atlantic water enters and sinks. The old, often oxygen-depleted, deep water is then forced out. This only takes place in cold winters when saline seawater with a low temperature is pressed towards the coast; several years may pass between each major exchange. This special environmental situation attracts special organisms which can live in these conditions. The ecosystem in Lindåsosane contains many of the same marine fish, seabird and mammal species as on other parts of the coast. They also include a local herring population that never leaves the fjord arm.

The national salmon fjords at Osterøy are known for their association with six salmon rivers. The River Vosso, which contains the world's largest Atlantic salmon, the Vosso salmon, has received a great deal of attention because its entire salmon stock was in danger of being lost. When the salmon leave the river as smolt, they swim out of the fjord to feeding areas in the Atlantic Ocean. Likewise, when they return after one to four years, they swim the fjord on their way back to the river to spawn. The fjord also has local populations of sea trout, spending their whole life there.

Masfjorden is an example of a fjord with a comparatively deep threshold (>70 m), and its greatest depth is nearly 500 m. The depth of the threshold is decisive for the relationship between fresh water and Atlantic water, and the threshold depth at Masfjorden favours a rich influx of clear Atlantic water. This means that the ecosystems here resemble those found in the open sea and include, for instance, large numbers of the mesopelagic fish, Mueller's pearlside (*Maurolicus muelleri*) and Lanternfish (Myctophidae), which live in the open water at a depth of about 200-300 m. The topography in the fjord is characterised by steep rock slopes which meet on a flatter, muddy floor, where creatures such as shrimps, Norwegian lobsters and bivalves can be found.

Lurefjorden has a 20 m-deep threshold and its maximum depth is about 400 m. There is less Atlantic water here and consequently more turbid fresh water. This makes Lurefjorden a much darker fjord than, for example, Masfjorden, and also influences the ecosystem structure. Lurefjorden is known for its population of helmet jellyfish (*Periphylla periphylla*), a tactile organism that does not require good visibility to find food, like fish do. Hence, few fish live here, but, on the other hand, there are several organisms which are now best known from arctic regions, such as *Calanus glacialis*.

FRESHWATER SYSTEMS

Freshwater systems consist of limnic water masses and freshwater benthic systems. The limnic water masses comprise floating, drifting and swimming organisms in the open water bodies of rivers and lakes. Freshwater benthic systems comprise ecosystems in, on or near the beds of rivers and lakes. The ecosystems largely depend upon nutrients and organic material transported from land by runoff and wind. The water quality and biological processes in the water are therefore strongly affected by the bedrock, biological processes and human activity in the catchment basin. Nutrients function as fertilisers, and algae and larger vegetation in the water utilise them for growth. The more runoff of nutrients, the higher the biological production in the water. If the biological production becomes too high, the vegetation will clog the water bodies and rotting vegetation will consume the oxygen in the water. The vegetation is used as food by small animals, like benthic creatures and zooplankton, and these small creatures are food for fish. The small animals are an important part of the ecosystem and its ecosystem services because they filter the water and help to break down organic material.

Conditions in lakes are more stable than in rivers. The temperature on the floor of deeper lakes is always 4^0C. Little light is available there and there is little exchange of oxygen with the atmosphere. This means there may be a lower oxygen level towards the floor of lakes and low biological production of algae. The fauna living there is therefore specialised, generally communities of non-biting midges and Oligochaetes. These animals live by filtering water and eating organic material that sinks towards the bottom. More light is available higher in the water, and there may be a high production of single-celled algae, which in turn become food for small crustaceans.

Running water has a large variation in physical conditions. Water levels and water currents vary during the day and night, and the benthic substrate is stirred and moved by the current. The oxygen level is generally high. There may be a high production of algae and bryophytes, and in some places also much other aquatic vegetation. The animals living here are adapted to high water velocities and have streamlined bodies and strong legs to hold them in place.

Freshwater systems are important for hydroelectricity production in Nordhordland, particularly in Modalen and Masfjorden. Both the rivers Modal and Haugsdal have their sources in Stølsheimen, about 1200 m a.s.l. The River Modal flows into Osterfjord and the River Haugsdal into Matresfjorden in Masfjorden. The River Matre comes from the mountains around Stordalsvatnet (476–444 m), on the county border to Sogn & Fjordane, and flows into Matresfjorden. The rivers have rapids, small lakes, pools and waterfalls before reaching the fjord.

TERRESTRIAL SYSTEMS

Wetland

Nordhordland has quite large areas of wetland, mainly mire. Their area has been much reduced by conversion into agricultural land or for the development of industrial premises or housing. Grants used to be given to convert mire into agricultural land, but the focus now is to protect wetland areas because of the values they represent (see also Chap. 12). The region has both nutrient-rich and nutrient-poor wetlands; nutrient-poor mires on hard, acidic bedrock dominate. Nordhordland has wetland areas that are typical for western Norway, where large amounts of precipitation, sometimes low summer temperatures, and rapid water exchange are characteristic. The wetland area often has a high species diversity of both flora and fauna. The fauna includes species that are specialised for living in wetland, use wetland regularly or more occasionally. The flora has many features in common, particularly toleration of water saturation and flooding and the need for soil with little access to oxygen. Vascular plants with these properties are called hydrophytes; they especially include peat mosses, some grasses and sedges.

Open lowland

Most of the area in open lowland is formed as a result of use over very many years for livestock grazing, hay making, and fodder harvesting. The area may be cleared of stones, but not ploughed, sprayed, fertilised or sown, or has only insignificant traces of such impacts. Avalanche and landslide areas below the woodland limit are also included here. Natural conditions such as bedrock, soil, topography, climate and natural vegetation have helped to decide how people have used these areas. This use, in turn, has helped to shape some of the natural requirements of the habitats, and their origin, form and functionality. This interaction between man and nature dates back to the end of the last Ice Age (see Chapter 9). Historically, nutrient transport has taken place from outfields to infields. The species found in open lowland are mainly dominated by those occurring naturally there, and the intensity of its use has affected their distribution and relative numbers. Open lowland includes many of the main habitat divisions in the non-wetland ecosystem in ‘Nature in Norway’.

These include the four characteristic habitats where use over time has been important for their character: **semi-natural grassland, shore meadow, coastal heathland** and **boreal heath**.

Semi-natural grassland comprises both natural grassland and hay-meadows, and can be characterised as a grass-dominated ecosystem which is either completely open or has a few trees. The habitat has been formed through extensive use for grazing and/or hay making over many decades. Natural grassland and hay-meadows have much in common as regards to flora, but there are also some characteristic differences. Hay-meadows generally have a somewhat larger area whose surface is cleared, and also a larger proportion of herbs. These meadows are regarded as critically endangered and have an action plan for their protection. Semi-natural grassland is an important habitat for many species, particularly vascular plants, fungi and insects.

Semi-natural shore meadow is also an open, grass-dominated ecosystem. It occurs in the upper part of the shore belt, and is formed by extensive use, mostly grazing, but also hay making in some places, over many years. It contains a considerable number of salt-tolerant species.

Coastal heathland is an open habitat characterised by species belonging to the heath family, particularly heather (*Calluna vulgaris*). This habitat has been managed by burning, grazing and cutting. Coastal heaths are principally distributed along the outermost coast, which has mild winters and receives precipitation evenly throughout the year. Coastal heaths evolved through the clearing of woodland to provide open grazing. The proposed BR has many dated coastal heaths (see also Chapter 9). Coastal heath has a rather unusual mode of use, including year-round grazing and heather burning, which is not usual in other habitats. The life form of one particular species, heather, is very important for the structure and function of the habitat. The species composition of the heathlands, both the diversity and their relative numbers, is largely controlled by the life cycle of the heather and the people who manage this species. The flora of coastal heath is dominated by several fire specialists, light-demanding herbs and grasses, and is especially rich in mites, springtails, spiders and insects. Coastal heaths are critically endangered as a nature type and have an action plan for their protection.

Boreal heath is characterised by many heath species, including dwarf shrubs such as heathers, juniper (*Juniperus communis*) and dwarf birch (*Betula nana*). The proportion of grasses is higher on more calcareous soils. The habitat has evolved through tree felling and grazing, and is strongly associated with areas where upland summer dairy farming was formerly common, such as in Stølsheimen. Boreal heath must be kept clear of scrub and trees, and be extensively grazed by livestock, to prevent it from becoming overgrown and changing its character to woodland. Summer dairy farming was an energy-demanding form of farming, and the need for wood for fuel helped to keep large areas more or less free of woodland. Now that this kind of farming is scarcely practised any longer, large areas of boreal heath are being lost to woodland.

Woodland

The woodland in the proposed BR has been changing over time, ever since the last Ice Age. People have cleared it and made open land; for instance, coastal pine woodland was felled allowing coastal heathland to evolve. Plantations were planted, particularly around 60-70 years ago, and forestry has become a resource in several parts of the proposed BR. The woodland is threatened from several quarters, such as peri-urban development. Forestry operations themselves, including clear felling, ditching, soil improvements and planting, have major impacts on the biodiversity. The Conservation Plan for Coniferous Forest, Broad-leaved Deciduous Woodland and Yew and Holly sites has led to the protection of about 50 km^2 in Hordaland, mostly as nature reserves. Two are described below.

The **beechwood at Vollom, Seim** is the northernmost self-regenerating beechwood in the world and the scientific community has shown considerable interest in it for teaching and research purposes (Photo 14.2). Around 1/3 of the total area of beechwood is protected as a nature reserve, to conserve a beechwood of great interest for phytogeography and vegetation history. Seim is on the south side of Lurefjorden, about 4 km north of Seim, in Lindås. A long, narrow fjord arm almost divides the area in two. The bedrock consists of gneiss and granite. The climate is oceanic, mild and wet. Pollen analyses show that beech reached this area 1000-1500 years ago. The beechwood has been linked with the Viking Age King's farm at Seim, and genetic studies have shown that the trees are related to Danish beech. A feature that is typical for beechwoods is that the woodland is locally so dense that its floor almost lacks understorey vegetation. More open parts have a poor understorey vegetation comprised of species like bilberry, oak fern, wood sorrel, wavy hair-grass, greater wood-rush and hairy wood-rush. Most of the trees in the beechwood are fairly young, 80-100 years, as until the last century timber was regularly felled here.

Temperate rainforest in the Heltveit-Bjørge Nature Reserve at Hindnesfjorden in Lindås. The protected area covers part of a steep, northeast-facing slope stretching from Storskrebukta in the north to an area of low hills in the inner part of the fjord in the south, and is about 719.2 da in area. This was the first reserve in Hordaland to be agreed upon in response to voluntary conservation. The area has qualities that are atypical for Nordhordland, including bedrock that gives rise to nutrient-rich soil, and broad-leaved deciduous woodland with a high diversity of species. This woodland grows on a belt of mica schist and similarly favourable bedrock. Because of the topography, the reserve receives relatively little sunshine, thus helping to ensure high atmospheric humidity. Several species communities therefore indicate that the area has the character of a temperate rainforest. One of its most important qualities is the occurrence of rare species of lichen (Table 14.1) characteristic for temperate rainforest. The great variation of different kinds of woodland within a

Photo 14.2. Beechwood at Vollom, Seim. Photo: Inger E. Måren

small area is an important quality in itself, and the mica schist and related bedrock help to further increase the value. The vascular plant flora is not especially rich, but includes several species typical for broad-leaved deciduous woodland, and also pale St. John's-wort, which is rare in this region. A healthy population of petty featherwort (near threatened) has also been found on a rock face In Kvalvika in the scree fields one can find several suboceanic species, like Taylor's flapwort, greater whipwort and lesser whipwort. *Neckera crispa*, bitter scalewort and *Metzgeria conjugata* are some of the other bryophytes recorded in this reserve.

Table 14.1. A selection of lichens of conservation value recorded in the area.

Scientific name	English name	Red List status
Bacidia abstinens NT (Near Threatened)		
Degelia atlantica VU (Vulnerable)		
Degelia cyanoloma VU		
Fuscopannaria sampaiana VU		
Gomphillus calycioides CR (Critically Endangered)		
Hypotrachyna sinuosa N		
Leptogium burgessii Burgess' skin lichen VU		
Lobaria pulmonaria Tree lungwort LC (Least Concern)		
Lobaria virens LC		
Pannaria conoplea LC		
Pseudocyphellaria intricata EN		
Pseudocyphellaria norvegica EN		
Pyrenula laevigata LC		
Pyrenula occidentalis NT		
Sclerophora peronella NT		
Sticta fuliginosa LC		
Sticta limbata LC		
Sticta sylvatica LC		
Thelopsis rubella EN		
Thelotrema suecicum NT		

Alpine (mountain)

The tree line in Stølsheimen is now rising as a consequence of reduced livestock grazing and summer farming. The vegetation in the mountains varies from areas with high production – which have been, and still are, valuable for grazing livestock and game – to large areas of bare rock, gravel, stones and block fields, where production is low. The soil is thin and poorly developed in many places, and the supply of nutrients is poor. Many species in the mountains are specialised and, if conditions change, their distribution and survival can be at risk. Hunting of game has taken place in the mountains for a very long time. It is now regulated and is limited to certain times of the year; the bag permitted is based on sustainable management. Peaks rising above 1000 m are found in Modalen, and Masfjorden, the highest Kleivfjellet 1313 m being in Vik.

Agricultural areas

People have been felling forests and clearing land, improving and increasing the soil by transporting nutrients from outfield areas to infields, throughout the 5000-year history of agriculture in Nordhordland. Nordhordland has a hilly and an irregular agricultural landscape, and the farms are on average the smallest in Norway. The combination of farming and fishing has always been a very common livelihood in this region. The abandonment of farming nowadays is the main reason why so much former agricultural land is no longer in use. There is now ca 58 km^2 of farmed land in Nordhordland. Agricultural areas are an important habitat for many species of flora and fauna, and must be viewed in relation to surrounding habitats, particularly in open lowland and wetland areas.

Green areas and built-up areas

Green areas in built-up areas are a type of ecosystem that is valuable for many species. Green areas are generally strictly regulated, for instance parks with trees and flowerbeds. The biggest built-up areas in the proposed BR are Knarvik, Frekhaug, Valestrandfossen, Dale, Vaksdal, Lindås and Manger, with populations from about 6000 in Knarvik to around 1000 in Manger. In addition to being important habitats for individual species, green areas are also important suppliers of cultural services such as recreation (see Chapters 11 and 12 for details).

Important natural and cultural environments

Natural and cultural environments are closely related and the Naturbase (artsdatabanken.no) records of two cultural landscape areas that are extremely valuable: **Lygra** and **Havrå**. The proposed BR also has a large landscape protected area, **Stølsheimen**, as well as several smaller nature reserves and natural monuments. All of the vegetation cover in the proposed BR has been strongly influenced by the efforts of farmers to obtain a reliable supply of food for their families, and the

Photo 14.3. The Heathland Centre at Lygra in Lindås is a living museum that aims to protect the coastal heathland, a type of cultural landscape formerly common along the whole west coast, but which is now becoming overgrown. Photo: Peter Emil Kaland.

many kinds of cultivated land made the landscape look like a patchwork quilt. Heathland dominated on the coast, where farmers combined farming with fishing. Farmers who farmed land in the deciduous woodland areas along the fjords gathered large quantities of leaves in the outfields for fodder, and those living in the pine wood areas harvested and sold timber. Farmers along the fjords also had summer dairy farms in upland areas, where they grazed their livestock, produced dairy products like cheese and butter, and hunted.

Lygra comprises Ytre Lygra and the island of Lurekalven in Lindås (Photo 14.3). The traditional coastal heathland farming here shaped the landscape by burning and harvesting of heather, cutting and drying of peat, and grazing of sheep and cattle. Ytre Lygra comprised five farms, separated by stone walls. Many of the farm buildings are still standing, and many have been restored. The heathlands mainly comprise heather, herbs and grasses, with some deciduous woodland and some planted spruce trees, cover the outer part of Lygra and Lurekalven. The north-western part of Lurekalven is now a bird sanctuary (for gulls), but few birds have bred there in recent years. Both Lygra and Lurekalven have many protected cultural heritage monuments, including remains of Stone Age dwellings, graves, charcoal kilns, and an abandoned medieval farmstead (Lurekalven). The farmers at Ytre Lygra kept up the traditional way of using their outfields until the end of the 1970s. The heather was regularly burnt and cut, and sheep grazed there all year round. The Heathland Centre is now established there. It is a semi-public Foundation set up to impart knowledge about the coastal heathland management culture and how to protect it. The landowners and the Centre collaborate to keep up the old practices, and the Centre works in close cooperation with the University of Bergen and is part of the Museum Centre in Hordaland.

Photo 14.4. Photograph of Havrå Farm from 1950. The farm fields were not exchanged and the maze of small tilled fields and hay meadows is clearly seen in the photograph. Photo: Sigurd Angell.

Havrå is a farm in Sørfjorden, near the southern coast of the island of Osterøy. The farmland, which is still divided into small fields, demonstrates the way of life prior to the period when extensive exchanging of small fields took place in much of Norway near the end of the 19th century (Photo 14.4). A cluster of farm buildings belonging to eight farms occupies part of the steep hillside. Research shows that farming began at Havrå towards the end of the Late Stone Age with grazing and the gathering of leaves for fodder, and the first fields were cleared for tillage in the Early Bronze Age. The land has been worked continuously since then. Population growth after the Middle Ages put more pressure on farmland. This led to land in western Norway being divided into strips and small fields to provide a living for more farmers. The individual farms on a home farm were also grouped in a cluster to make as much land as possible available for production.

The farm is just over 200 ha, divided into tilled fields, home gardens, hayfields, strips where leaves were gathered, and strips used for firewood. There are many stone walls, clearance cairns, marker stones and aerial cables. Buildings include grinding mills, drying barns, sheds for milking cattle on spring grazing areas, hay barns, sheds for sheep and goats, smithies and boathouses. Most of the present buildings date from the 19th century, but the oldest is from the 1250s. Juniper-clad hay barns surround a core comprised of dwellings. When the whole farm was in operation in the 1950s, 34 people lived at Havrå. Farming has gradually declined since then. Historians have shown a great deal of interest in Havrå since the 1930s, which has led to it being one of the best documented old farms in western Norway. Today, Havråtunet Foundation owns two of the farms and leases one. The aim is to get all the farms working again. Preserving knowledge about the traditional farming techniques and practices is in focus. The farm was the first in Norway to be protected under the terms of the Cultural Heritage Act.

Stølsheimen Landscape Protected Area was protected in 1990, and has an area of 377 km^2 (photo: 14.5). The Regulation concerning the protection states that: *"The purpose of protecting Stølsheimen is to safeguard a characteristic and beautiful mountain and fjord landscape in western*

Photo 14.5. Cattle grazing in Åsedalen, Stølsheimen Landscape Protected Area. Photo: Hans Kristian Dolmen.

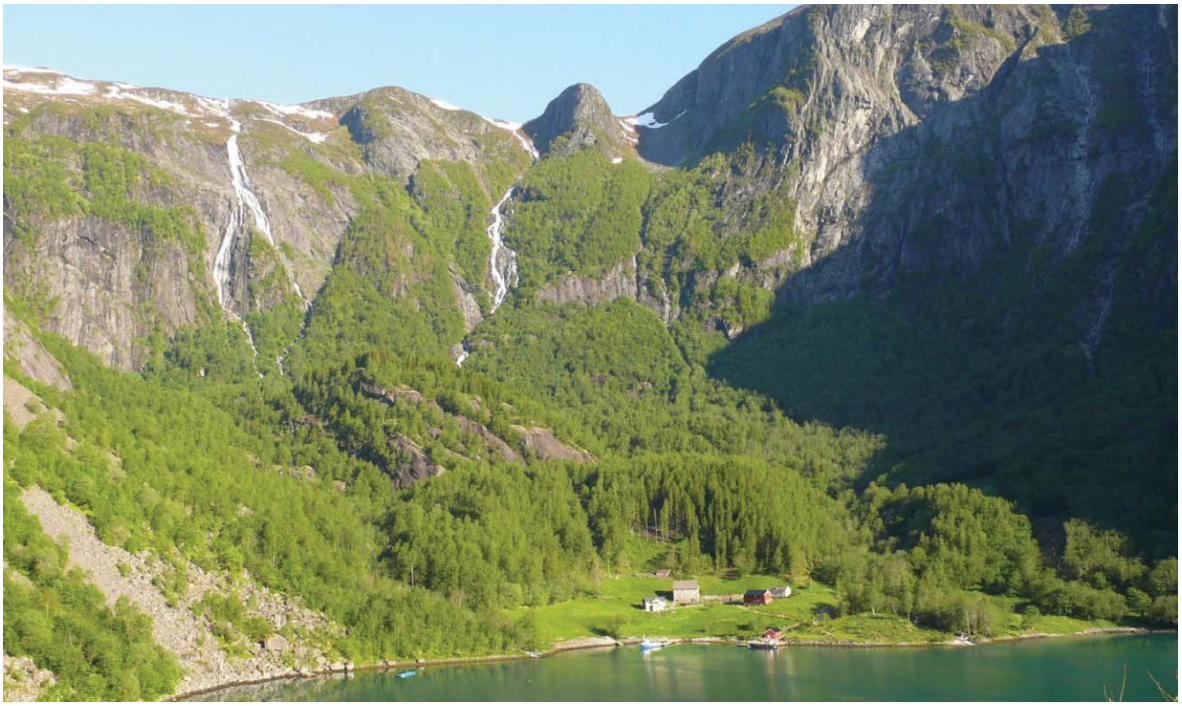


Photo 14.6. Finnabotn in Finnafjord. The steep hillsides contain many examples of trees that have been topped and trimmed to provide livestock fodder and wood for tools over hundreds of years. Photo: Nils Kvamme.

Norway containing cultural heritage sites, cultural landscapes and natural environments that are little affected by technical encroachments, at the same time as the area shall be able to be used for farming, outdoor recreation, hunting and fishing". Stølsheimen is a broken, upland landscape bordering onto a dramatic fjord landscape in the north. The protected area includes Finnafjorden, one of the few remaining road-free fjord arms in the county (Photo 14.6). Stølsheimen is an important area for trekking in the summer and for cross-country skiing in winter, particularly for people in Hordaland and the Bergen district. It is characterised by its many former summer dairy farms. A report has been prepared recording all such farms in the area. The protected area covers a core area of Stølsheimen which is relatively unaffected by hydroelectric power development, which is found around the margins of the protected area.

14.1.2 Describe the state and trends of the ecosystems and/ or land cover types described above and the natural and human drivers of the trends

Halting the loss of biodiversity is an important national objective in Norway, and this also entails protecting the ecosystems to which these species belong. A Nature Index has therefore been prepared which compiles information on the population trends of the species over time at the main ecosystem level. When changes in the nature index are studied, we can assess whether the political goal for biodiversity conservation has been achieved. The index is also used to prepare national and international reports. The index is based on 301 indicators (as of 2015) consisting of species or groups of species which represent the biodiversity in the ecosystems (see also Chap. 11). Each indicator is scaled against a reference state, and the scaling varies between 0 and 1 (0 corresponds to the extinction of the species; 1 corresponds to species in their "best conceivable state"). This scaling makes it possible to calculate an average across several indicators, and can thus give an impression of the total status of biodiversity. Figures 14.1 (marine) and 14.2 (freshwater and

terrestrial systems) illustrate the nature index values for the main ecosystems in Norway. For example, the nature index for open lowland in western Norway is 0.4. This means that the average of the indicators in the ecosystem is at a level which is about 40 % of what would be expected if open lowland was in its "best conceivable state". The proposed BR in Nordhordland falls geographically within the nature index for western Norway.

Changes in biodiversity and ecosystems may be due to many factors, both human-induced and natural. The nature index supplies information on reasons for the changes in the state, based on data and the assessments of experts. The factors are:

- Harvesting and extraction of resources
- Alien species
- Pollution
- Climate change
- Changes in land use and physical encroachments
- Changes in currents in the sea
- Avalanches and rock falls
- Floods
- Insect attacks
- Miscellaneous

The indicator species found in different ecosystems are affected by these factors to varying degrees.

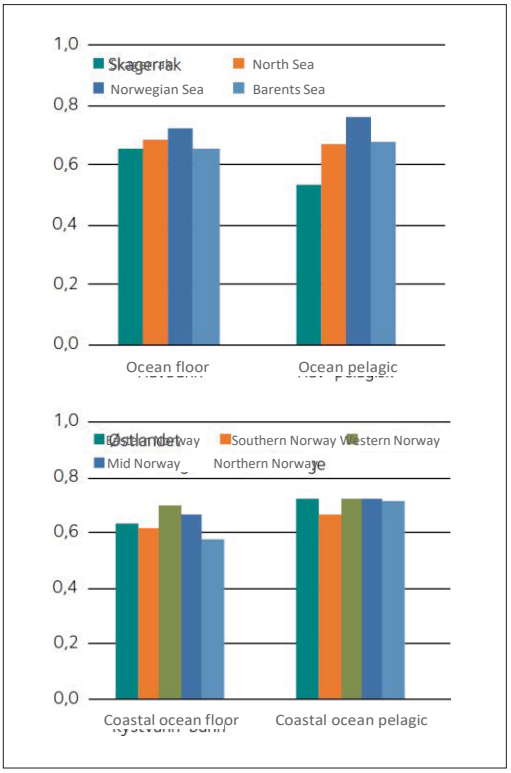


Figure 14.1. Nature index values for the marine ecosystem in 2014 for various marine areas and regions which illustrate the value in western Norway (Vestlandet= Western Norway: green) relative to other regions in the country (Fig. 3.5. in the Nature Index for Norway 2015).

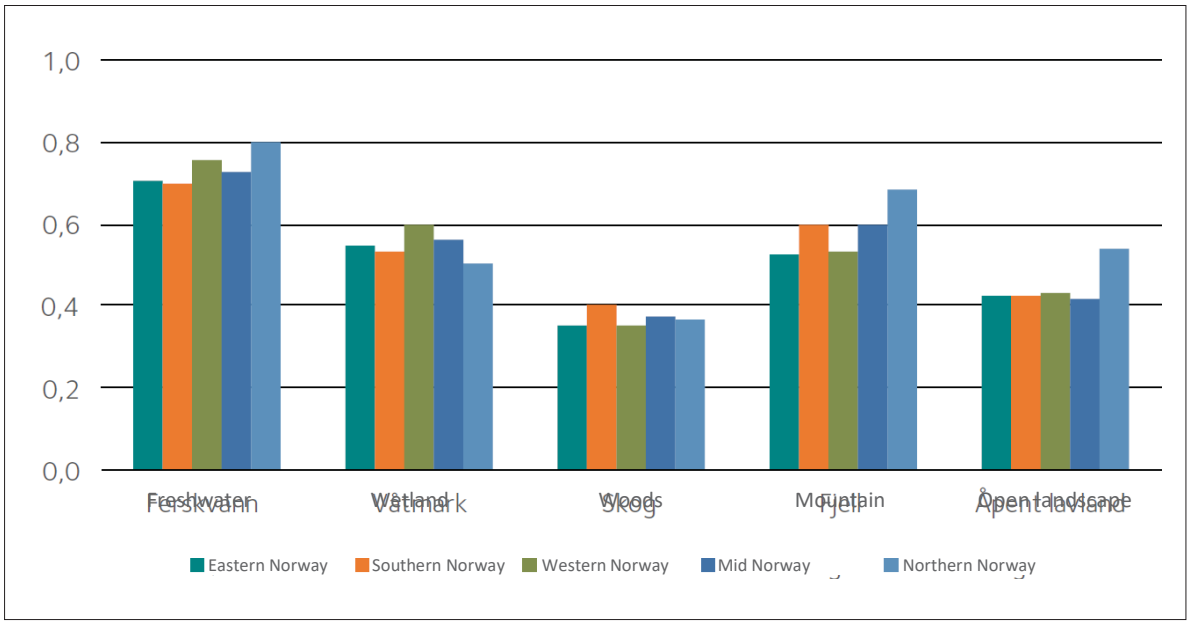


Figure 14.2. Nature index values for the freshwater and terrestrial ecosystems in 2014 for various regions. (Figure in the Nature Index for Norway 2015). (Western Norway: green).

Many of the indicators in the marine ecosystem are sensitive to harvesting and climate change; in the terrestrial and freshwater ecosystems, land-use changes and encroachments are particularly important threats. This also applies to the proposed BR.

14.1.3 What kind of protection regimes (including customary and traditional) exist in the core area(s) and buffer zone(s)?

Habitats and biodiversity are protected by the Nature Diversity Act. Several habitats that are critically endangered have action plans to protect them. The Water Framework Directive is used to monitor and protect the freshwater system. See also Sections 4.5, 7.4, 9.2, 9.3, 17.1.2 and 19.1.

THE CORE AREAS

Lurefjorden and Lindåsosane (Lindåspollene)

Lurefjorden is now in the process of being protected in accordance with §39 (protected marine areas) of the Nature Diversity Act. A draft document has been prepared for consultations regarding the "*Regulations relating to the protection of the Lurefjorden and Lindåsosane marine protected area in Lindås, Radøy and Austrheim, Hordaland*." The objective is to maintain the conservation values of the rare and vulnerable habitats in the fjord without substantial external impact. The protection covers about 70 km^2 of sea, delimited towards land along a depth contour 2 m below the zero contour on the chart. The Regulation states that:

In the marine protected area, no person may initiate anything that directly or indirectly can destroy or reduce the protected assets in the conservation objective.

a. The vegetation, including seaweed, kelp and other marine plants, is protected from damage and destruction. Planting of vegetation is forbidden.

b. The animal life in the sea and attached to the sea floor is protected from damage and destruction. Release of organisms is forbidden.

c. The area is protected from such measures as the establishment of different kinds of facility, filling, construction activities, placing constructions on the sea floor, other permanent or temporary installations, laying pipes or cables, discharging waste water and other concentrated pollutants, dredging, extraction and dumping of sand, earth or rocks, blasting, drilling, discharge of cooling water from land, disturbance of the water body and anchoring. Dumping of rubbish is forbidden. This list is not exhaustive.

The national salmon fjords at Osterøy

The objective of the protection regime is given in the "*Regulations relating to special requirements concerning aquaculture-related activity in or near national salmon rivers and national salmon fjords*", published by the Ministry of Trade, Industry and Fisheries on 22 June 2009. § 1 states that: "*The Regulation shall contribute to a selection of the most important salmon stocks being given special protection by setting special requirements concerning aquaculture-related activity in or near national salmon rivers and national salmon fjords*" (see the letter from the Norwegian Food Safety Authority in Section 19.3). The protection regime for the national salmon fjords at Osterøy is aimed at ensuring that the six salmon rivers which enter the salmon fjords can retain their vigorous, local strains of wild salmon. Aquaculture facilities for salmon are therefore not permitted in these fjords. In connection with a project named "*Redningsaksjonen for Vossolaksen*" (The rescue operation for the Vosso salmon), research fishing is now in progress in the Vosso river to follow the trend in the salmon stock. The long-term goal of the rescue operation is to ensure a vigorous and harvestable salmon stock that tolerates normal fishing.

Loneelvi

The River Loneelvi is protected under the terms of "Royal Proposition no. 4 (1972-73) *Concerning conservation plans for rivers*", "*Supplement to the conservation plans for rivers*" (2005) and §32 of the "*Act relating to watercourses and groundwater (The Water Resources Act)*" of 24 November 2000. The local salmon stock is not regarded as being under threat and its status is evaluated annually by the environmental authorities and the local fishing association.

Stølsheimen

There are 31 core areas in the Stølsheimen Landscape Protected Area (LPA):

- 6 cultural heritage sites in Askeladden database (Table 19.1) are protected by the Cultural Heritage Act of 9 June 1978 no. 50 because they predate the Reformation (AD 1537)
- 7 undated cultural heritage sites in Askeladden database: 5 house ruins (tofts) and 2 reindeer hunting pitfall traps which may predate the reformation. (Table 19.1)
- 18 additional undated house ruins (tofts) (Figure 19.8) documented in the official ancient monument map in the management plan of 1998.

The Regulation from 1990 (published 1998 in Management Plan for Stølsheimen landscape protected area, *http://www.nordhordlandbiosphere.no/samarbeid-med-universitetet-i-bergen.365856.nn.html*) concerning the landscape protection area, § 4.1, states that "disturbance of standing cultural heritage structures from recent times, such as buildings, roads, livestock pens, etc." is forbidden. Thus, all 13 cultural monuments listed in the database "Askeladden" (Table 19.1), with the addition of 18 house ruins (Black squares on Figure 19.8), which are mapped in the "*Management Plan of the Stølsheimen landscape protected area (1998)* ", have legal protection. These are all core areas.

Photo 14.7. Sylvarnesdalen. The spade marks the mire that provided the pollen diagram dating the beginning of upland summer dairy farming here to the Viking Age. In the background are the two summer farmhouses overlooking Sognefjorden. Photo: Mons Kvamme.

There were once 56 summer dairy farms in Stølsheimen where cattle, goats and sheep grazed and were milked. Over the past 50 years, extensive archaeological investigations and related studies of the vegetation history have taken place in mountainous areas in Norway in connection with hydroelectricity developments; these have shown that such farming began far earlier than formerly assumed, even several centuries BC. The buildings have stood on the same sites for many centuries, and been repaired or demolished and rebuilt as necessary. No such detailed studies have been undertaken within the LPA, but the proposed Nordhordland BR has undertaken a test investigation of the meadow belonging to the summerfarm Sylvarnesdalen (570 m) (Figure 15.1.1.7) in the eastern part of the LPA (Photo 14.7). The pollen diagram shows the characteristic vegetation changes that document the beginning of upland summer dairy farming, and ^{14}C dating gave 1200 years BP (Viking Age). Moreover, Bjergane (893 m) (Figure 15.1.1.7), the upland summer dairy farm belonging to Le Farm in Arnafjord – situated about 1 km outside the LPA – was ^{14}C dated to AD 140-380 (Early Iron Age). There is every reason to assume that summer dairy farming in Stølsheimen has followed the same pattern as in other upland areas, and that a large number of the 56 farms were established in prehistoric times (pre-AD 1030 in Norway). Thus, the meadows and other constructions around the farmhouses are cultural heritage monuments that will be covered by the automatic protection paragraph of the Cultural Heritage Act when their age is proven.

THE BUFFER ZONES

Lurefjord and Lindåsosane (Lindåspollane)

The purpose of the buffer zone is to prevent the environment in Lurefjorden and Lindåsosane being damaged by polluting sewage and discarding of rubbish. The following legislation is applied to ensure this: The *Planning and Building Act*, the *Water Resources Act*, the *Pollution Act* and the *Manure Regulation*.

In 2015, Lindås Municipality Council approved the "*Municipal Sub-plan for Lindåsosane, Lygra and Lurefjorden*" pursuant to § 11-1, 3rd paragraph and § 11-5 of the Planning and Building Act. The terms, together with the map in the sub-plan, are legally binding for future land use (see § 11-6 in the Planning and Building Act). The municipal sub-plan contains a number of environmental measures to safeguard outdoor recreation, farming, and the natural environment (on land and sea). A municipal ruling in the 1980s ensured that all sewage that drained to Lindåsosane was pumped over to Fensfjorden. On 2 September 2010, Radøy Municipality Council, in case 046/10, adopted a "*Local regulation relating to discharges from small sewage plants for the Municipality of Radøy*".

Nordhordland Regional Council and the County Governor of Hordaland are now working together to fulfil the EU Water Framework Directive. The intention is to put in place a local regulation for the discharge of sanitary effluent from houses and holiday homes in the entire Lurefjorden catchment area (see Figure 7.11 and Section 17.1.2), which it is planned to adopt in autumn 2018.

In 2016, the Directorate for Cultural Heritage designated Lurefjord and the majority of the buffer zone "*cultural landscape of national interest*" on account of the important cultural heritage monuments and cultural heritage landscapes in the area (Heathland Centre, the world's northernmost beechwood, the large Stone Age settlements associated with tidal currents in the strait leading to Lurefjord, as well as Lurefjord itself, an important part of the inner lead.

The national salmon fjords at Osterøy

Terrestrial buffer zone: The salmon fjords are narrow and deep (100-350 m), bordered by steep slopes rising to 600-800 m, which form a natural, sharply defined, terrestrial buffer zone.

Marine buffer zone: The marine buffer zone is intended to ensure that the smolt, on their emigration from the fjords, are as little as possible negatively affected by human activity. The main threat in the buffer zone is for the smolt to be seriously infected by sea lice, which kills them. The great increase in the louse population is due to the parasite having acquired so many hosts in the trout and salmon farms in the buffer zone. The Ministry of Trade, Industry and Fisheries regulation from 2009 lays down strict limitations for fish farming in and near the national salmon fjords, and the Norwegian Food Safety Authority has introduced new stringent requirements to limit the louse problem (see the enclosure in Section 19.3). To protect the smolt in the migration period, it is mandatory for all the aquaculture plants on the route taken by the smolt along the fjords out into the open sea to keep the louse population beneath a specified level. This requirement seems to be having a positive effect and is helping to protect the emigrating smolt.

Loneelvi

The buffer zone (catchment area of the river) is protected pursuant to § 32 of the "*Act relating to Watercourses and Groundwater* (*The Water Resources Act*)" of 24 November 2000. The 1995 "*Regulations concerning national political guidelines for protected watercourses*" state that: "*To achieve the goals, special emphasis must be placed on providing a basis (point 3d) for securing the value attached to occurrences/areas in the catchment area of the protected watercourses which scientific investigations have shown are of significance for the conservation value of the watercourse*". The buffer zone is comparatively large for a coastal river, and the landscape has great value due to its cultural heritage monuments and cultural heritage landscapes. The buffer zone has three Red Listed plants, and several Red Listed bird species nest there. Much outdoor recreation takes place in the buffer zone.

Stølsheimen

Stølsheimen Landscape Protected Area (LPA) constitutes the buffer zone around the cultural heritage monuments. This solution has been chosen because of the extensive watercourse regulations right up to the western and eastern boundary of the LPA and the largest ski resort in western Norway (Myrkdalen) being located up to the southern boundary. The Regulations relating to the protection of the Stølsheimen Landscape Protected Area (FOR 1990-12-21 no. 1087) pursuant to the Act of 19 June 1970 no. 63 regulate the management regime: "*All encroachments or activities that may alter the nature or character of the landscape are forbidden, such as erection of buildings, plant and permanent installations, removal of, or encroachments on, fixed, post-Reformation, cultural heritage sites, such as buildings, roads and old livestock pens, erection of aerial cables, road building, land drainage and other means of making land dry, extraction, land filling, levelling and storage of earth and rock, mining and quarrying, watercourse regulation, dumping of rubbish, manuring and usage of chemical substances, and discharge of concentrated pollution, etc. The list is not exhaustive*."

The Norwegian Environment Agency has appointed a steering committee for the LPA. On 16 February 2017, this committee issued a guiding management plan based on the 1990 Regulations, which also takes up provisions in the new Nature Diversity Act:

§ 9 The Precautionary Principle: If the administrative authority lacks knowledge or has inadequate knowledge about the consequences for nature diversity of a measure, weight will be placed on the Precautionary Principle.

§10 Ecosystem approach and cumulative environmental effects. This is intended to ensure that new impacts are subjected to an overall assessment of the load to which the ecosystem is, or will be, exposed.

§11 The cost of environmental depreciation must be borne by the initiator. This is a guideline for the administrative authority, and entails that the initiator of the nature diversity damage must bear the cost of the damage and of preventing or limiting it.

§12 Environmentally sound techniques and methods of operation. This regulation applies to the methods of operation, techniques or location to avoid or limit damage to nature diversity. Use must be made of such methods, techniques and location which, based on an overall assessment of past, present and future use of the diversity and economic factors, produce the best results for society in general.

§48 General exemption. The administrative authority may grant exemption from a protection decision if it is not contrary to the purpose of the protection decision and cannot make a significant impact on the conservation value, or if safety considerations or important public interests make it necessary.

14.1.4 Which indicators or data are used to assess the efficiency of the actions/strategy used?

Both the 'Nature Index for Norway' and the new proposal for a scientific system for good ecological state are based on, among other things, the use of indicator species relating to state and development. Table 14.2. shows the number of indicator species that are sensitive to various pressure factors listed in the 'Nature Index for Norway'. Different ecosystems have indicator species with different influences. In the scientific system for good ecological state (which is not defined in the 'Nature Index for Norway'), a limited number of indicators are used which reflect the structure and function of the ecosystem, and take its natural dynamics into consideration. In this context, an indicator may be defined as a variable, or as a value given by a variable. The indicator must supply information about properties which define an ecosystem (see also Chapter 12). By using indicators, it is possible to reduce the number of variables and measurements that are required to say something about the ecological state of an ecosystem. OECD (2003) defined a set of fundamental criteria for environmental indicators, and grouped these in three main categories: 1) relevance and utility value; 2) analytically trustworthy; and 3) measurable.

Table 14.2. The number of indicator species regarded as being moderately to very sensitive to various pressure factors in each ecosystem. Many of the species may be sensitive to several factors and/or present in more than one ecosystem.

	Harvesting	Alien species	Climate	Land use	Pollution	Total number of indicators
Ocean bottom	28	0	29	17	2	33
Ocean-pelargic	18	2	27	5	2	34
Coastal waters bottom	21	5	34	9	11	37
Coastal waters - pelargic	15	9	27	3	3	37
Freshwater	3	8	8	29	18	33
Wetland	1	3	3	31	6	33
Forest	10	1	16	67	11	87
Mountain	10	0	18	21	0	31
Open lowland	6	4	4	25	9	29
Sum	102	32	166	207	62	

Table 14.3. The number of species of national management interest which are also indicators in the nature index, distributed among the main ecosystems. The species may fall into more than one category and more than one ecosystem.

	Responsibility species	Species with very high conservation value	Species with high conservation value
Ocean	21	8	2
Coast	5	7	2
Freshwater	1	7	7
Wetland	3	7	2
Forest	4	14	8
Mountain	14	10	1
Open lowland	4	10	2

In addition to these systems, the Red List for Ecosystems and Habitats in Norway identifies changes at the habitat level and the Red List for Species those at the species level. The Black List for Norway is also a good instrument for identifying the species it is not desirable to have in an ecosystem, since they can pose a threat to naturally occurring species. Habitats and biodiversity are protected through the Nature Diversity Act. Several habitats that are critically endangered have action plans to protect them. The Water Framework Directive is used to monitor and protect the freshwater system.

14.2 At the level of species and ecosystem diversity

14.2.1 Identify main groups of species or species of particular interest for the conservation objectives, especially those that are endemic to this biosphere reserve, and provide a brief description of the communities in which they occur

The 'Nature Index for Norway' includes many individual species, also called individual indicators, it is desirable to protect. Many of these are the same as are found on the Norwegian Environment Agency's list of species of interest for management nationally. The same interest for protecting them applies in the proposed BR in Nordhordland. The national list contains about 4,600 species or subspecies. In all, 154 species that are relevant for management are also 'Nature 'Index indicators, 79 are responsibility species, 74 are other species with special interest for management, and 27 have great interest for management. Some are in more than one category. Table 14.3 shows how these species are distributed among the main ecosystems.

The ocean and alpine ecosystems have a particularly large number of responsibility species, and both these main ecosystems are well represented in the proposed BR. In the ocean, these include important fish such as Greenland halibut, Atlantic halibut, Atlantic salmon, common ling, capelin, mackerel, etc. as well as tangle and sugar kelp, harbour seal, northern minke whale and Atlantic puffin. The alpine ecosystem has well-known species like ptarmigan, rough-legged buzzard, wild reindeer, wolverine, gyrfalcon and various other birds that frequent the mountains, along with a number of plants such as arctic poppy, glacier buttercup and swollen thread-moss. The numbers of other species with particular management interest are more evenly distributed across the ecosystems, but most are in the woodland (14), alpine (10) and open lowland (10) systems. These include many threatened species, some well-known, such as arctic fox, the large predators and

several species of auks, as well as various species of insects and other invertebrates, vascular plants, bryophytes and fungi. Woodland (8) and freshwater (7) have the most species with great management interest, including several bird species and various species of invertebrates, plants and fungi.

The status of the responsibility species in the various ecosystems has shown a positive trend in recent decades. The ocean has had a positive development from a nearly average state in 1990 to a good state in 2010 and 2014. The responsibility species for the coast have shown a corresponding trend, but had a poorer state at the outset. The trend for the responsibility species in the alpine ecosystem has not been good: their status has gone from good to moderate. The status in woodland has been good overall, and the responsibility species in wetland have increased from a moderate to a good status and become stabilised up to 2014. In open lowland the trend is the opposite, with a sharp reduction in the status. The freshwater ecosystem has shown a positive trend.

14.2.2 What are the pressures on key species? In other words: what are the threats (example unsustainable management of forest), their immediate causes (drivers of change like forest change or habitat change), their underlying causes (example overgrazing, fire, pollution), and the main driving forces (example: economic, political, social, external. Etc) and the area(s) concerned?

The individual species have threats that correspond to those found for the main ecosystems, described in Section 14.1.2. in the scientific system for a good ecological status. These also adhere to the species in the proposed BR:

- Harvesting and extraction of resources – excess consumption has a negative effect on individual species
- Alien species – both planted and dispersed from original plantations or gardens, or released
- populations
- Pollution – eutrophication near cultivated land and acid precipitation lead to changes in the species composition in fresh water and on land
- Climate change
- Land-use changes and physical encroachments – termination of the customary use of the cultural landscape is an especially important threat to the key species there, both flora and fauna
- Changes in currents in the sea, eutrophication
- Avalanches and rock falls
- Floods – due to more extreme weather
- Insect attacks
- Bird populations are locally reduced due to domestic cats, American mink (*Nevelson vison*) and red foxes (*Vulves vulves*)
- Outdoor recreation activities linked with the sea and the coast may disturb nesting birds.

14.2.3 What kind of measures and indicators are currently used, or planned to be used to assess both species groups and the pressures on them? Who undertake this work, or will do so in the future?

In marine and freshwater environments, places adjacent to the mouth of small fjords and bays must be inspected from time to time to ensure that the regulations are complied with, especially in periods when biologically important events (e.g. spawning) take place. For migratory species, like salmon and trout, free passage from the stretches of river where they grow up out to the sea is important. Culverts and pools must be so designed that they do not hinder migration. The development of hydroelectric power also means that less water flows along the rivers, and the regulation of the rivers also reduces flood peaks which generally help to wash out fine particles from the river bed substrate. The bed therefore becomes compacted, making it difficult for the fish to find suitable spawning places. During the marine phase of their life cycle, both salmon and sea trout are vulnerable to the environmental conditions in the fjords and may be negatively affected by lice, diseases or unfavourable hydrochemical conditions. Both salmon and sea trout are therefore indicator species which provide information about the environmental state of the entire system from the open sea to fjords and rivers; if their stocks are good, the whole system is in good health. In addition to fish, the management authority uses benthic animals as indicators to judge the ecological state of watercourses. Benthic animal indices have been developed to judge the degree of acidification and the extent of organic contamination. One of these indices, the Raddum Index for acidification, was developed in the Nordhordland region.

In the terrestrial environment, the proposed BR will use habitat mapping as described by 'Nature in Norway'. Habitats and individual species will be recorded in the Naturbase and the Artsobservasjon databases. Some action plans already exist for selected habitats, where management is undertaken in specific areas. They are prepared because it is desirable to succeed in protecting biodiversity where traditional conservation is regarded as impractical. The Norwegian Nature Inspectorate is responsible for protected areas. Measures to reduce threats in core areas and buffer zones must be monitored by the County Governor's environmental office. Agricultural facilities and fish farms are recorded and monitored by municipal and county authorities.

14.2.4 What actions are currently undertaken to reduce the pressures?

Measures in the proposed BR are carried out on the basis of national action plans and the Nature Diversity Act. Many measures have been undertaken or are being planned to reduce negative effects on freshwater ecosystems and secure ecosystem services. Knowledge is a key aspect in these measures. International efforts led to a reduction in long-distance pollution when the connection between acidification and long-transported pollution was understood in the 1980s. The biodiversity in fresh water in Norway is rising now as a consequence of reduced acidification. Knowledge-based management, cross-sectorial cooperation and concrete measures have also led to fewer negative effects of watercourse regulation and utilisation of water resources.

A good example in Nordhordland is the "*Life in the rivers*" project being undertaken by a power supply company (Bergen Peninsula Municipal Power Company), and researchers from Uni Research. The project aims to control the flow of water in the rivers throughout the year according to the needs of the fish, and to lay gravel on stretches of the river bed that have become compacted due to river regulation, so that the fish can spawn there. The life in the rivers is simultaneously monitored to find out whether the measures are working as intended and to ensure that the work is

being done where it is most needed. One of the cornerstones of water management is to look upon water as living ecosystems. National salmon rivers and national salmon fjords have been established to protect the stocks of anadromous fish.

The EU Water Framework Directive is used to manage the water in Nordhordland from the mountains to the fjords. The main goal of the Directive is to ensure the protection and sustainable use of the aquatic environment, and if necessary to implement preventative or improving environmental measures to secure the environmental state of fresh water, groundwater and coastal water. Species in the water, including benthic animals and fish, are used as indicators to measure the environmental state. Under the terms of the Directive, the management of water and watercourses must take place in such a way that various pressure factors and all water are viewed in context with one another.

14.2.5 What actions do you intend to take to reduce these pressures?

A central goal for the Nordhordland BR is to support existing measures and management plans for protecting nature diversity both at sea and on land. Special measures aimed at the cultural landscape are given high priority. We need both economic and structural strategies to develop this. One structural strategy will be to get new management cooperation for sheep grazing. This entails improving the infrastructure, such as erecting fences and building sheep shelters. Economic incentives to keep the sheep on outfield grazing must be implemented to compensate for lack of profitability in this kind of farming. We must also improve the marketing of regional products so that such farming brings a good income to part-time farmers.

We must have the same strategic goals for coastal forestry, aimed at limiting threats and relieving negative effects of forestry. In the mountains, upland summer dairy farming, tourism and recreation will be natural starting points to implement measures to reduce threats to the natural and cultural environments here.

Measures that are already ongoing will be continued:

- More focused management in selected areas
- Reduce and steer traffic in vulnerable areas
- Take special consideration in the nesting season
- Improve and increase outfield grazing
- Support measures to preserve wild salmon and sea trout

14.3 At the level of genetic diversity

14.3.1 Indicate species or varieties that are of importance (e.g. for conservation, medicine, food production, agrobiodiversity, cultural practices etc.).

When human beings have become dependent upon just a few species, it is especially important to conserve their genetic variation and their wild relatives, such as the wild salmon. Diversity in the genes is the best insurance for avoiding new diseases and changed climatic conditions may have negative consequences for future yields. Diversity at the genetic level has only been mapped to a very limited extent in Norway, and this also applies in the proposed BR. Fishing in the sea, rivers and lakes has been an important activity for centuries. Many lakes in the mountains lacked natural fish populations and people released trout in them to provide a reliable source of food. Salmon have also been fished for a very long time and represent a cultural heritage and an important economic

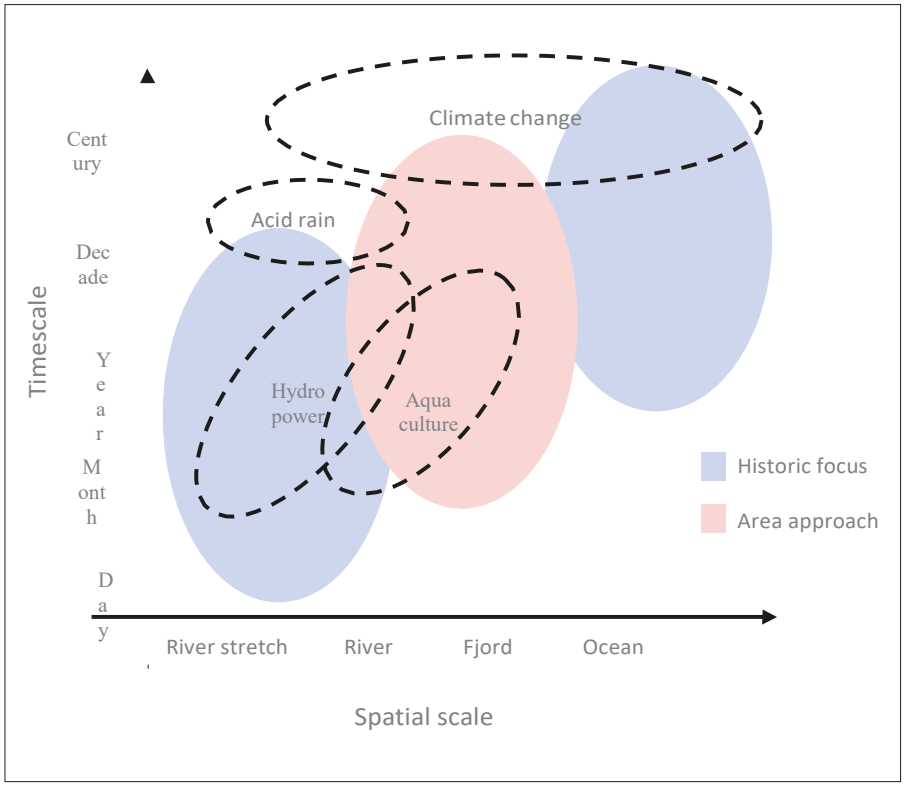


Figure 14.3. Production of hydroelectricity, aquaculture, acid precipitation and climate change are assumed to have a negative effect on salmon in rivers, fjords and the sea. The pressures take place over a time scale of days to centuries. In the past, focus has been on measures to help salmon in the rivers or the sea, as shown in blue. New measures (the area approach) focus on all the habitats (shown in pink). Illustration: Bjørn Barlaup.

resource in rivers and the sea. Reduced exchange of sea water may have negative consequences for the species living in Lindåsosane. Marine mammals, members of the deer family, birds and the semi-domesticated reindeer, in the proposed BR, have been little mapped with respect to genetic variation.

Studies show that deliberate patch burning of heathland over hundreds of years has led to an evolutionary development of the key species, common heather (Calluna vulgaris), so that its seeds germinate better after such burning than common heather seeds from boreal heath that has not undergone deliberate patch burning. This kind of management, and other traditional practices in the proposed BR, together with specific breeding programmes, have also had a positive effect on the maintenance of old livestock breeds, like Old Norwegian Sheep, West Norwegian Fjord Cattle cattle and Norwegian Fjord Horse, as well as the honey bee. Norwegian White Sheep now dominate in Stølsheimen.

Photo 14.8: Old livestock breeds in Nordhordland: Old Norwegian Sheep, Norwegian Fjord Horse and West Norwegian Fjord Cattle. Photo: Inger Elisabeth Måren.

Photo 14.9. The Vosso salmon before the population collapsed, and after measures were put in place. The River Vosso used to be the most productive salmon river in the Osterfjord system, giving an average weight of over 10 kg and an average catch of some 11 tons/year up to the end of the 1980s. A dramatic decline in the catch took place then, and the population failed to recover despite the protection of both the river and the inner part of the fjord from the beginning of 1992. The population is now beginning to slowly recover. Photo left: unknown. Photo right: Inge Sandal.

14.3.2 What ecological, economic and social pressures or changes may threaten these species or varieties?

The most important threats to these species are largely the same drivers as for ecosystems and species (see Section 14.2). Reduced exchange of sea water may have negative consequences for the renewal of the basin water in Lindåsosane, which can have serious consequences for organisms living in the marginal zone, thus reducing the abundance of species in these systems. This means that the sluice gates must not be closed, so that normal exchange from tidal water can take place on a daily basis and, when opportunities are present for renewal of the deep water, pave the way for the influx of heavier water masses. Under no circumstances must the exchange of sea water over the thresholds be hindered in winter, since the chances are greatest for heavier sea water to be able to enter then and improve the environmental conditions at depth. Farming involving discharge of manure must take place under controlled conditions, especially when the manure tanks are emptied in early spring (February-April) when the ground is still frozen, because rivers and enclosed parts of fjords that are spawning grounds for fish (e.g., herring which lay their eggs on the sea floor) are particularly sensitive to pollution since it drastically changes the habitat.

Salmon live over much of northern Europe, and can be found living under very different conditions within regions and even rivers in the same region. This means that salmon are adapted to their local habitat and there are genetic differences between salmon in different rivers. Farmed fish have especially divergent properties and genes relative to wild fish. They are adapted to life in a pen and a high growth rate. The genes and properties of wild salmon depreciate if farmed fish that have escaped are able to migrate up the rivers to spawn and mix their genes with those of wild salmon. In 2016, it was found that two-thirds of the wild salmon populations in Norway had acquired genes from farmed fish, indicating that this is a serious threat to wild fish.

Photo 14.10. Species and groups of species that are in decline because farming has ceased: bumble bees, adders (protected in Norway and many other European countries) and honey bees. Photo: Inger Elisabeth Måren.

The status of populations of wild salmon and sea trout varies through the region, from rivers where angling is not permitted, to populations that are regarded as lost or in a critical state, to populations that are reduced or require consideration. The two factors contributing most negatively for returning anadromous fish are aquaculture and hydroelectricity production. The River Frøyset is now being limed (organised by the Norwegian Institute for Water Research and Uni Research) for the benefit of the salmon. The salmon in Modalen died out in the 1970s as a result of acidification. Work has now begun to release salmon from the River Vosso in Modalen. The Vosso salmon, a population that produces among the largest salmon in the world, was almost brought to extinction in the 1980s (Photo 14.9); acidification was a contributory cause of this decline. Despite being protected in 1992, the population did not succeed in recovering. Several measures were initiated and research was undertaken, and in 2000 the Vosso project was begun to identify the threat factors and find possible measures that could be tried in fresh water and the fjords to save the population. Vosso salmon roe stored in the gene bank were released in the River Modal, and a liming plant is planned to start there.

Fewer livestock in the outfields leads to them becoming overgrown, and the plant communities living there thus change. This in turn leads to changes in the species composition in groups such as insects, spiders, birds and molluscs, and some animals that require an open habitat disappear. The old livestock breeds may also be threatened by changed land use, and unbalanced breeding using predominantly Norwegian white sheep is having negative consequences.

14.3.3 What indicators, at the level of the species, are used, or will be used, to assess the evolution of population status and associated use?

The herring is an indicator species (an *indicator species* is an organism whose presence, absence or abundance reflects a specific environmental condition. Indicator species can signal a change in the biological condition of a particular ecosystem, and thus may be used as a proxy to diagnose the health of an ecosystem), and it is important to follow the changes in its population status. This can be done in many ways. In January to March, acoustic methods (echo sounder and sonar) are used

to follow the status of the spawning population. New year-classes are monitored using a fry trawl in June. One simple indicator that can reveal early danger symptoms is if eider ducks fail to come to Lindåsosane at the end of March or the beginning of April, when the herring should be spawning. The absence of predators (also cod and haddock with herring roe in their stomach) are the first sign that spawning has failed.

Censuses of game species, primarily red deer, are performed to manage these species. Seabird censuses are carried out as part of a major national seabird monitoring project (see Chapter 16).

14.3.4 What measures will be used to conserve genetic diversity and practices associated with their conservation?

To support the conservation of marine genetic diversity, marine organisms can be sampled at different trophic levels and the results reported to the authorities responsible, for instance by annually undertaking trial fishing or acoustic records in the overwintering area for herring to follow population changes before spawning. Corresponding sampling of environmental conditions (particularly O_2) and other groups of animals (e.g. plankton, shells) can be also done.

To prevent farmed fish from mixing ecologically and genetically with wild fish, the managers of aquaculture facilities try to prevent salmon from escaping from farms. However, this is not entirely possible; farms reported 170,000 escaped fish in Norway in 2015. Consequently, in many rivers in Hordaland, the aquaculture industry cooperates with local owners of fishing rights, scientists, and management authorities to record and remove farmed fish that have escaped. Fish are removed from the River Vosso with nets; and in many other rivers, such as the Dale, Ekso and Loneelvi, they are caught by angling, broodstock fishing and harpooning. To check how much interaction takes place between escaped and wild fish, samples of both escaped and wild fish are taken regularly. In 2017, there was also a major influx of pink salmon (*Oncorhynchus gorbuscha*) along the Norwegian coast; several were found spawning in rivers in Nordhordland. Pink salmon have their natural area of distribution in the Northern Pacific Ocean. They have been released in northern Russia and have dispersed southwestwards to Norway, where they are not welcome. They may occur in great abundance, and it is feared they may become established in Norwegian rivers and out-compete the indigenous salmon and sea trout, or infect them with diseases and parasites.

Genetic diversity can be preserved in terrestrial ecosystems by encouraging the spread of viable populations of various groups of organisms (both plants and animals) in their natural range and in the cultural landscape. The areas where the species function ecologically and the ecological conditions upon which they depend must also be maintained. Genetic variation in domesticated species must be managed to help to secure the resource base for the future. This management objective does not apply to alien organisms, according to the Nature Diversity Act.

We want a sustainable future! Photo: Stine Karin Sæle.

15 DEVELOPMENT FUNCTION

15.1 Potential for fostering economic and human development which is socio-culturally and ecologically sustainable

15.1.1 Describe how and why the area has potential to serve as a site of excellence/model region for promoting sustainable development

Nordhordland is the first area in Norway to apply for the status of BR. We have placed importance on Nordhordland being representative for coastal Norway and that it gives a good impression of the cultural environment and the natural resources from which the population along the west coast of Norway live. This part of the country has many resources, but it is only during the last hundred years that technological development has enabled their effective utilisation. This has given the region a great increase in prosperity, but a great responsibility rests on the inhabitants and the authorities to utilise the resources sustainably so that future generations may also enjoy them.

A central role for the proposed BR is to create a platform for constructive cooperation between the various interested parties in Nordhordland – associations and organisations, people concerned with trade and industry, managers and those involved in research – with which the BR organisation will work actively to create a good climate for cooperation. The BR organisation will promote the awareness of the inhabitants about the SDGs by providing teaching in schools and through participation in social debates, so that the authorities consider the goals when they take political decisions. In this way, we want to contribute to an economic development that is socio-culturally and ecologically sustainable. The proposed BR has the necessary qualities to function as a model region to promote sustainable development because:

Nordhordland is a piece of Western Norway in miniature
The proposed BR covers 669,800 hectares, including both sea and land. This area includes most of the habitats found in western Norway: the sea and coast, the archipelago forming a broad belt of islands, islets and skerries, deep fjords, and lofty mountains – and good farmland and barren outfields, open heathland and extensive woodlands, montane areas, and wetland systems. The distinct climatic and ecological gradients from the sea to the mountains and from west to east are unique to the west coast of Norway. You can get from the outermost coast to the highest mountains in a short time – and experience all kinds of weather in just one day.

Most types of habitation are present in Nordhordland; scattered farms, small clusters of houses, modern villages, and small towns like Knarvik, the regional centre. There is no large town, but this dimension is well looked after by the proximity to the city of Bergen.

As regards trade and industry, the region also has a great variation in heavy industry, modern service and ICT activities, and smallholdings where part-time farmers uphold old traditions.

The proposed BR contains resources that are central for Norway as a nation
The majority of the most of the key resources for the modern nation are present in Nordhordland:

- **Water**: The coast of western Norway receives large quantities of precipitation, and the proposed BR has several hydroelectricity plants. Norway is the sixth largest producer of hydroelectricity in the world and the largest in Europe.
- **Fish**: Western Norway has large resources of pelagic fish. Norway is the largest manufacturer of fishing gear in Europe, and Nordhordland contains an important portion of the aquaculture industry in Norway.
- **Oil and gas**: Norway is a major European producer of oil and gas. This is now the largest industry in Nordhordland, because of the oil refinery at Mongstad, the gas processing plant at Kollsnes and the crude oil and LPG terminal at Sture, as well as a major supply function.

The proposed BR will help to develop these important resources in a sustainable manner. This will be an important contribution from the region towards the green shift and will secure good jobs for coming generations.

Nordhordland has a rich cultural history and living traditions
As described in chapter 10.6, people have inhabited Nordhordland since the Early Stone Age, and activities of the first people in the region is well documented by archaeological excavations. The main Thing (local parlament) in Western Norway in the Viking Age was in Gulen, and the rules that were handed down by oral tradition in prehistoric times were written down there as the Gulating Act shortly before AD 1100.

From the Late Stone Age until the 1950s, the coastal inhabitants lived from a combination of farming and fishing. Food was reliably available and this was the ordinary way of living. In the fjord district, the farmers exploited the fish in the fjord, the agricultural landscape with its forests on the valley

Photo 15.1. We need actively run farms to experience the values in the cultural landscape, as here in the landscape park at Sæbø. Photo: Jostein Vågenes.

slopes, and the montane summer dairy farms. Even though farming throughout the proposed BR has become more efficient, traditional methods are still preserved as a living tradition.

Multioccupations – the combinations of hunting and fishing, farming and forestry, handicraft and small industries – have always held a strong position in Nordhordland and are important for society here. The many associations that grew up in the 1900s are varied and remain active. A positive attitude to voluntary communal work remains strongly rooted in everyday life in the villages and hamlets and supports culture and identity. A living and engaged society is the best foundation for a good BR and for further sustainable growth.

Nordhordland has close and robust cooperation with the University of Bergen
The University of Bergen and other research institutions have been undertaking many kinds of research in Nordhordland for a long time (Section 16.1). These activities will be expanded with the establishment of the BR.

Nordhordland's commitment to become a BR is motivated by the desire of the region to have knowledge-based, sustainable development for the future. Research and the exchange of knowledge will hold a central position in this. Emphasis will be placed on attracting relevant research groups to the area; for this, the present cooperation with the university is important.

The University of Bergen has been allocated a UNESCO Chair in "*Sustainable Heritage and Environmental Management, Nature and Culture*" linked to the MAB Programme. The university will build up a multidisciplinary research group, among other things, to coordinate research in Nordhordland. This commitment will give Nordhordland a good basis for extending its cooperation with other research institutions, which can inject new knowledge and skills into the region.

Nordhordland will use the commitment to the BR to promote sustainable development
The main objective for Nordhordland as a future BR is to achieve a general development of society. This is described in more detail in Section 13.1, but the most important objectives are:

- The local authorities in Nordhordland want to use the commitment to the BR actively. They have taken the initiative for the project to establish the BR and want to use it as part of the development of society in the area. They want to create a broad dialogue to the research community and trade and industry to draw attention to the challenges facing Nordhordland in the years to come, and to implement measures needed by the region to solve these. The proposed BR will be a useful link between the region and the research groups. Many people are already engaged in the project or one of its subprojects.

- The proposed BR is intended to help the region to achieve the SDGs and to build a common regional identity. The status as a BR is intended to inspire and mobilise the entire community to be aware of the SDGs, and to participate in achieving them. This will give a new, positive dimension to the future development of the society. The BR will combine historical knowledge and traditions with today's good community and cultural life to build a strong regional identity, to be identified with a distinct label.

- The proposed BR wants to contribute to further economic development and contribute to new, innovative development of commerce and industry. Nordhordland is a strong industrial region, closely linked with the oil and gas industry. These non-renewable resources will gradually be reduced and eventually it will no longer possible to extract them. The region therefore

has challenges attached to the green shift. Through the commitment to the BR, we wish to contribute to new, sustainable industrial activity to ensure that coming generations experience just as good a life in this region as we do today. This will call for readjustments, managerial skills and innovation.

- A green environmental focus is concerned, among other things, with greater energy efficiency, innovation in production of renewable energy, and the importance of raising awareness of the different issues concerning this. The changes in climate give opportunities for new growth and development, and the region has good examples of good and environment-promoting initiatives in commerce and industry and among the local authorities and the public in general. The region has many environment-certified companies and organisations that focus on the environment. These provide a good basis for further effort.

- The proposed BR will help to create better understanding of the effects of climate change. Nordhordland has a significant petroleum industry. While this is important for value creation and employment, it also has great consequences for the climate. Mongstad is the largest point source of emissions of CO_2 in Norway. The inhabitants of the region are closely engaged in the national debate on CO_2 storage, and there is great anticipation and hope that research and testing of the carbon capture and storage plant at Mongstad willl reduce the CO_2 emissions from the refinery.

- As a consequence of climate change, precipitation is increasing and storms are becoming more severe in Western Norway. The winters are milder than earlier. The change causes more damage due to the bad weather and more landslides, rockfalls, and floods. Even though this has not created huge problems for society, Nordhordland must also be prepared for the consequences of climate change and take account of them in its planning.

Photo 15.2. The aquaculture industry is substantial in Nordhordland. Ola Braanas (photo) is one of the principal figures in salmon farming. Photo: Marit Hommedal.

Photo 15.3. Many of Nordhordland's firms are associated with the use of the area's natural resources. These businesses will be strengthened by focusing on the long-term, sustainable use of these resources. Photo: Bergens Tidende.

- The proposed BR will contribute to overall management of the landscape. Different kinds of landscape will be mapped and their appropriate management will be considered. This includes identification of places where overgrowth by trees has become a problem and of where there are areas for profitable forestry. Future development will be based on this mapping.

- The proposed BR wants to contribute to more awareness, pride and joy. Through the commitment to the BR, we want to help to create greater awareness, participation and involvement concerning the region's resources and opportunities, and to encourage everyone to take on more responsibility and control for their own development. We will draw as many people as possible into this work and pave the way for activity and dialogue. In particular, we will facilitate initiatives that concern children and young people. Through this work, we hope to create more pride in our society.

15.1.2 How do you assess changes and successes (which objectives and by which indicator)?

Some of the criteria used to assess how far the objectives are attained:

Response to the BR

We will be able to measure success in many areas: knowledge about the areas that the BR will concentrate on, involvement in social media, attendance at events and meetings, involvement in the BR's projects, and initiatives for new measures from both private individuals and organisations.

Research

We have a good overview of the research going on in the region (see Chap. 16), and therefore a good basis for evaluating how the establishment of the BR will affect the trend in this activity.

Through the cooperation with the University of Bergen and other research institutions, plans are in process for how this can take place, and we have already been successful in applying to the Norwegian Research Council for a project to follow up the start of the BR.

These are some of the subjects that are especially interesting:

Carbon Capture and Storage (CCS)
The Technology Centre at Mongstad is a plant for testing and development of technologies for CO_2 capture and storage. If the climate targets are to be attained, an important goal in addition to reducing CO_2emissions is to solve the problem of separating CO_2 from combustion gases and storing it safely. Norway is concentrating research on Carbon Capture and Storage, and the Technology Centre at Mongstad is involved in this.

Solving the Sea Lice problem in the aquaculture industry
The University of Bergen, the Norwegian Institute of Marine Research, and other research institutions are heavily involved in projects, in cooperation with the firms, to try to find solutions to the problem of sea lice in the aquaculture industry. The fjords in the proposed BR can function as localities for testing these solutions.

Visibility and trademark building
Nordhordland is relatively little known nationally or internationally. Increased visibility and establishing a more distinct trademark will therefore be important values the commitment to the BR can give the region. This will help to stimulate the setting up of new businesses and increase tourism, and the result can be quantified.

Photo 15.4. Hillesvåg Wool Spinning Mill manufactures wool and yarn on old machines and has recently been designated an Économusée. Visitors can follow the whole process from the wool entering the mill to the finished product. Photo: Kjersti Isdal.

Contribute internationally to the MAB Programme
The establishment of the Nordhordland BR will give the region access to the World Network of BRs and other regional networks (NordMAB, EuroMAB). The BR organisation wants to actively participate in these networks and will evaluate the degree of international cooperation over time.

Project evaluation
Since much of the activity of the BR organisation will be based on projects, evaluation of these will be very important for assessing how far the BR has achieved its goals. Good routines for evaluation will be built into all the projects for which the BR is responsible.

Economy – external funding
The proposed BR plans to have activities that are also based on external funding and income-generating activity, such as, for example, the grant recently awarded to the University of Bergen's UNESCO Chair from the Norwegian Research Council. These will be important parameters for evaluating the success of projects.

Innovation and entrepreneurship
The region already has several groups that are working to strengthen innovation and entrepreneurship, including the Nordhordland Development Company which has managed the development of the BR. Good statistics are available here regarding new firms and innovation activity. We will also use figures from Innovation Norway showing the awards of grants for development of trade and industry in the region and from the industrial and trade organisations in Nordhordland, which have figures for innovation activity.

More tourism
There is great potential for growth in tourism in the region (see Section 15.2). It will be possible to measure this using several indicators, such as increased profitability in existing businesses, new tourism offers in the region, and not least by statistics for overnight accommodation. The BR organisation will obtain statistics from several of these indicators.

Sustainable farming and food production
The BR will focus on sustainable development of agriculture in the region and proper utilisation of the natural resources (see Chapter 15.4.4 description of started projects; the Holistic Landscape Management, Conserve Soil and take care of Local Food Production (Project: "*The Taste of Nordhordland*"). In addition to evaluation of projects, we will use established evaluation channels as described in Section 15.3.3.

15.2 Tourism in the proposed biosphere reserve

Holiday and leisure tourism are not particularly widespread in Nordhordland, but tourism in more general terms is important throughout the area. The region has everything from medium-sized hotels via guest houses to simple farmhouse accommodation and huts for renting. The activities on offer vary and are attached to culture, the mountains, the fjords and the sea. As the region has around 7,500 privately owned cottages and holiday homes, along with visitors who are working, this market has the greatest significance.

The region has great potential for tourism. The beautiful countryside, the cultural life, and not least the fact that many people now see a future in developing exciting tourism offers, suggest that the

tourist industry will be much more important in the years to come. The proposed BR has therefore already become strongly involved in tourism projects and is taking part in an EU-funded project (SHAPE) to promote sustainable tourism. This activity will be strengthened if the BR is formally established.

Table 15.1. Tourism providers in the proposed Nordhordland BR.

Tourism providers	Number
Hotels	8
Guest houses	6
Cabins for rent	35
Bed and breakfast	15
Marinas	20
Cafes and restaurants	45
Private owned cabins and holiday homes	7 500

15.2.1 Describe the type(s) of tourism and the touristic facilities available. Summarize the main touristic attractions in the proposed biosphere reserve and their location(s).

CULTURAL ATTRACTIONS

The Gulating, Gulen

In Eivindvik, a 10th century English-Celtic cross marks the site where the Gulating first met. At Flolid, 4 km east of Eivindvik, is the Millennium Site, a beautiful park to which the Thing, according to early sources, was moved. Monumental art installations by Bård Breivik can be seen here. The largest is the majestic Gulating Wall.

The Heathland Centre, Lygra, Lindås

The Heathland Centre at Lygra has won national and international awards. Through exhibitions and practical demonstrations, it shows visitors how the heathland was used in the past, and how this use shaped the characteristic heathland landscape. You can walk on good paths in a historic landscape which has remained little changed for more than 2,000 years. The Centre is well equipped for research and offers teaching at every level from kindergarten to university.

The Western Norwegian Emigration Centre, Sletta, Radøy

A museum providing information about the widespread 19th century emigration from Norway to America. The site includes a church that was originally built by Norwegians who emigrated to the American Mid-West; it was moved from America to Sletta. Over the last years, more buildings from the American prairie that were typical of the period have been moved and re-erected at the museum. Visitors can experience the history of emigration through films and a guided tour.

Havrå Farm, Osterøy

Havrå is an outstanding example of a Western Norwegian cluster farm, with the farm buildings gathered in a cluster resembling a hamlet. Until the middle of the 19th century, such clusters of dwellings and outhouses, surrounded by small meadows and tilled fields, were common in the Western Norwegian landscape. At Havrå, the cluster has been preserved as it was in the old days. The farm is a unique memorial of farming methods, building practices and working life on numerous farms in Western Norway. Havrå is protected under the terms of the Cultural Heritage Act.

Osterøy Museum, Osterøy
Osterøy Museum dates from 1920. This folk museum has become an important regional institution presenting the local history of Osterøy, including building traditions and traditional handicraft products. The collection and exhibits are in old houses scattered around the site and in a modern building. The oldest building is the 17th century Fjellskålnesloftet.

The Coastal Museum, Øygarden
The Coastal Museum in Øygarden traces the way of life on the outermost coast from the end of the Ice Age until today. Special emphasis is placed on the use of energy and how people down the ages utilised what nature around them has to offer. The museum also has a maritime exhibition with traditional buildings, boats and tools.

Bjørn West Museum, Matre, Masfjorden
Bjørn West Museum takes its name from a guerrilla base in the Matre mountains. The museum recounts the dramatic story of the last military action in Europe in the Second World War.

Buildings
Some of our historical buildings with exhibitions that are open for guiding at certain times of the year: the summer house of the composer Ole Bull, Bogatunet, Holmestova, Sjøbua at Holme.

Festivals
- Kystsogevekene, every municipality – different cultural events for a whole week.
- The Utkant Festival, Gulen – music festival
- Taste of Austrheim, Austrheim – local village festival

Photo 15.5. The Utkant Festival in Gulen is one of the most popular music festivals in Nordhordland. Photo: Eivind Senneseth.

- Knarvikmila/The reat Fjord Run, Lindås – a running festival for all levels. International participants.
- Ullveka (Wool week), every municipality– focuses on Norwegian wool and traditional handicraft attached to it.
- Fishing festivals, local village days, agricultural events, etc. are held in various places throughout the year.

ATTRACTIONS BASED ON NATURE

With its beautiful coastline and archipelago, the proposed BR is an ideal place for activities associated with the sea. There are good opportunities for sea fishing; several firms have cabins to let to fishermen. The broad archipelago with hundreds of islands, islets and skerries protects Nordhordland from the open sea. In summer, there are scores of boats; many small boat harbours provide good facilities. You can also rent small boats, canoes and kayaks to explore the coast.

Sea sport week

The sea sport week was a festival which, in recent years, exploited the potential for sea-based activities, offering all sorts of sea sport activities on the sea and in the fjords. It ceased in 2017, but local enthusiasts immediately took up the challenge and started a similar event called Sea Pleasure.

The inner passage

The Directorate for Cultural Heritage has designated “the inner shipping water way” a cultural historical landscape of national interest. It is in Lindås, Radøy and Austrheim municipalities, and it extends from Alversund in the south to Kjelstraumen in the north.

Photo 15.6. Nordhordland offers many activities linked with the sea. A kayak brings you into close contact with nature. Photo: Eivind Senneseth.

The mountains and opportunities for hiking

Nordhordland is a paradise for those who enjoy hiking. Stølsheimen is a mountainous area between Sognefjord in the north and the Bergen Railway in the south, and the sea in the west and Nærøyfjord in the east. It is a lofty and varied alpine landscape that towers over deep fjords, rising to bluish-grey, naked summits reaching heights of 1200-1300 m. The Norwegian Trekking Association has cabins and a network of marked paths can be used by hikers in summer and winter alike.

Hiking trails

The North Sea Trail and the Bergen-Trondhjem Post Trail are good examples of hiking trails through the cultural landscape along the coast. Books and maps have been published covering the areas of many of the local authorities in Nordhordland, and much effort has been made in recent years to improve marking and provide better signposting.

Sea fishing and fishing in fresh water

Fishing is good in Nordhordland. Not far west in the sea are many good fishing spots where big cod and wolf fish willingly bite on the hook. The numerous lakes, rivers and streams have a rich selection of fish, including salmon, trout, char, eels and pike. The inner fjords have traditional ways of fishing salmon, including the fish traps. Several of these have been renovated and can be an interesting experience for tourists in the future.

Activity firms:

- Meland Golf is an 18-hole course at Fløksand in Meland. It is regarded as one of the best golf courses in Norway.
- Vått og Vilt AS holds sea paddling courses and excursions for firms in the Nordhordland fjords.
- Stordalen Mountain Lodge offers varied countryside activities in the mountains at Masfjorden

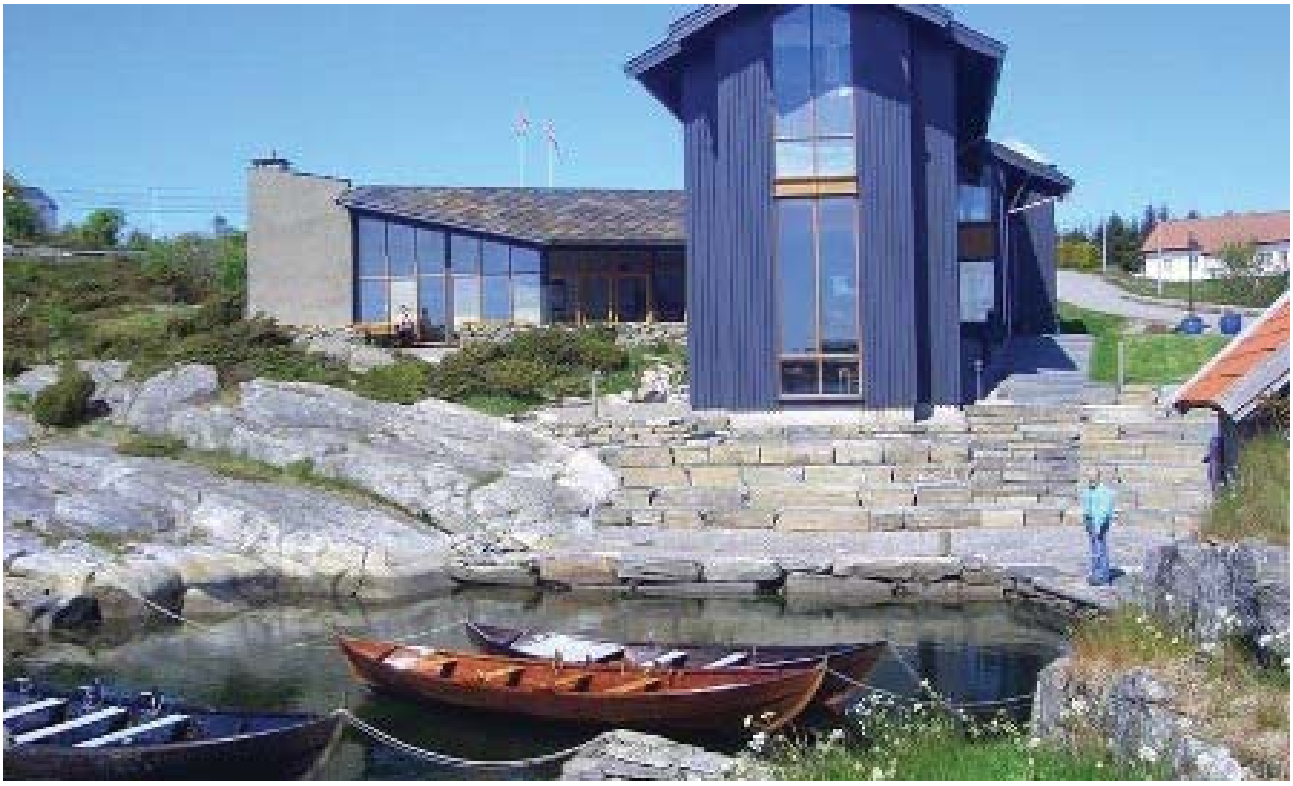


Photo 15.7. In Øygarden, you can experience the traditional coastal culture. Photo: Coastal Museum in Øygarden.

including guided hikes, abseiling, cycling on roads or mountain tracks, kayaking on the fjord, boulder climbing in Matredalen and hikes in the mountains.
- Aktiv i Modalen offers guided hikes in Modalen, wild mushroom picking courses, bicycle rental, etc.

SPECIFIC DESTINATIONS

Mo in Modalen

Mo, the administrative centre of Modalen, is a cultural historical treasure. It is about one and a half hours drive by car from Bergen, but also accessible by sea. Along the quay promenade past the old wharfs are shops, a post office, cafes and restaurants, overnight accommodation, an art gallery and Bryggjeslottet, which has a swimming pool, bowling alley, library and fitness facilities.

Fedje

Fedje is a small village out on the fringe of the open sea on an island whose closest neighbour in the west is Shetland in the UK. About 560 people live here, linked to the mainland by a ferry taking half an hour. Fedje has been licenced to have an inn since the 17th century. Visitors can, for example, fish, hike on part of the North Sea Trail or take a lighthouse safari. The island has cafes, restaurants and overnight accommodation facilities.

15.2.2 How many visitors come to the proposed biosphere reserve each year? (Distinguish between single-day visitors and overnight guests, visitors only visiting the proposed biosphere reserve or only passing on the way to another place). Is there an upward or downward trend, or a particular target?

There are no separate statistics for the number of people visiting the proposed BR. However, based on information from the tourism association and tourism businesses, we have general knowledge about tourism in Nordhordland. Several hotels get most of their income from people visiting the area in connection with their work. Holiday and leisure tourism have never been a marked feature of this region, but people staying in the many huts in the district provide a good market for those with attractions and activities to offer, as well for cafes, restaurants and shops.

Photo 15.8. Skjerjehamn is one of the old settlements licenced to have an inn. The main building, from 1891, has been renovated, and new owners have brought life and development to the area. It now has a harbour for small boats, overnight accommodation and spa facilities. Photo: Skjerjehamn AS.

Nordhordland is only a short distance by car from the centre of Bergen and is a natural goal for day trips. Probably some of this can be regarded as holiday and leisure tourism, but mostly it concerns Bergen people on family outings, or clubs and associations arranging trips for their members. The number of such day trips has declined in recent years, but they still provide cafes and restaurants, and firms offering attractions, a good income.

Table 15.2. The development of number of guestnights 2000 – 2017 in Hordaland County.

Number of guestnights			Hordaland County		
Year	Hordaland County	Total Norway	% of year 2000	% change year	% of Norway
2000	1 732 414	16 364 658	100 %		11 %
2001	1 706 118	16 415 944	98 %	-2 %	10 %
2002	1 695 834	16 187 526	98 %	-1 %	10 %
2003	1 645 785	15 636 323	95 %	-3 %	11 %
2004	1 749 644	16 359 892	101 %	6 %	11 %
2005	1 819 609	17 110 116	105 %	4 %	11 %
2006	1 905 697	17 773 072	110 %	5 %	11 %
2007	2 007 954	18 525 889	116 %	5 %	11 %
2008	2 021 051	18 221 657	117 %	1 %	11 %
2009	1 908 043	17 654 074	110 %	-6 %	11 %
2010	1 956 811	18 393 018	113 %	3 %	11 %
2011	2 047 549	19 203 237	118 %	5 %	11 %
2012	2 099 020	19 803 632	121 %	3 %	11 %
2013	2 088 703	19 767 163	121 %	0 %	11 %
2014	2 224 231	20 435 106	128 %	6 %	11 %
2015	2 419 414	21 666 436	140 %	9 %	11 %
2016	2 466 823	22 623 150	142 %	2 %	11 %
2017	2 610 490	23 280 047	151 %	6 %	11 %

The Hordaland County hosts several prosperous tourist destinations with Bergen and the fjords as the peak selling points. As table 15.2 describes the tourism is steadily increasing and the county had 11% of the total amount of guest nights in Norway in 2017. The number of guest nights in Hordaland County increased with 6% from 2016 to 2017. Tourism has good prospects for further development. The trends in tourism show that travellers are now more interested in taking part in good activities and experiencing authenticity and nearness to culture, nature and people. Both the commitment to become a BR and the impression given by trend research give a good basis for the industry in the region to grow. It will be important to work for local cooperation in the industry to ensure that the product is well packed and to give travellers an overall good experience.

The potential is also great for building up day tourism for individual travellers staying in Bergen and also for developing offers for cruise passengers coming to Bergen. The statistics from Bergen Tourism Association show that the city had around 880,000 hotel guests within the holiday and leisure segment in 2016. To help overnight accommodation businesses in Nordhordland, we should also look at how we can improve the prospects for holidays from a base within the region.

15.2.3 How are tourism activities currently managed?

The Nordhordland Tourism Association was established in 1987 but ceased to exist in 2011 when it was decided that the coastal municipalities in Hordaland would join the Bergen Tourism Association. This took place formally in 2017 when the Nordhordland local authorities and the largest tourism businesses in the region became members of the new Bergen Region Tourism Association. This has more than 400 members and is regarded as the most successful destination company in Norway. The tourism industry in Nordhordland will probably receive broader marketing and, hence, more customers than earlier. In autumn 2017, a person was appointed to have special responsibility for tourism in the coastal municipalities.

15.2.4 Indicate possible positive and/or negative impacts of tourism at present or foreseen and how they will be assessed (linked to Section 14)?

There are so far no known negative consequences of tourism in Nordhordland. There is too little tourism for that. All tourism that has taken place to date has been positive for the business itelf, and for commerce and well-being in the region. The great increase in cruise passengers to Bergen has, nevertheless, triggered a debate about how many tourists Western Norway can take. With a large number of day visitors, it has been stated that several attractions cannot tolerate such large numbers and that visitors get a poorer impression of the city. Nordhordland can perhaps help to provide a solution here by being a sustainable, competitive goal for day excursions for cruise passengers.

15.2.5 How will these impacts be managed, and by whom?

All travel goals, attractions, natural environments and cultural heritage sites have a threshold for how much traffic and human impact they can tolerate. In Norway, the Government provides guidelines for sound management, which are implemented by local authorities and those involved in the tourism industry.

Photo 15.9. The SHAPE (Sustainable Heritage – Partnerships for Ecotourism) project aims to enable authorities, businesses and society to develop innovative solutions for sustainable tourism. Photo: Linda Sæle Kjenes.

In Nordhordland, we have an opportunity to be one step ahead in this and want to pave the way for sustainable tourism. Together with other BRs and regional parks in Northern European countries, the proposed BR joined a project supported by the EU Northern Periphery and Arctic Programme. This SHAPE (Sustainable Heritage – Partnerships for Ecotourism) project aims to enable authorities, businesses and society to develop innovative solutions for sustainable tourism. The project will show how it is possible to commercialise sustainable, profitable companies and experiences based on local resources. SHAPE will work on practical solutions, collect these experiences and make them available to other places that have similar challenges.

15.3 Agricultural (including grazing) and other activities (including traditional and customary)

The landscape and topography on the west coast of Norway are fragmented, and farms are small. Agriculture has always been important for settlement in the region and remains important for the villages in Nordhordland today. The farming has been central, whereas forestry has gone from afforestation to harvesting. In the past, proximity to the sea made it possible to combine agriculture and fishing in the coastal areas, whereas along the fjords, agriculture, forestry and upland summer dairy farming were combined. These combinations gave farmers a relatively high assurance of being able to feed their families. Nowadays, because of mechanisation, intensification, artificial fertilisers and specialisation, far more food is produced by far fewer people. However, the biodiversity in the cultural landscape has suffered because large parts of the open outfield areas have gone out of production, or spruce saplings have been planted in them, as agriculture declines and the forestry industry grows.

15.3.1 Describe the type of agricultural (including grazing) and other activities, area concerned and people involved (including men and women)

Agriculture

In the 1960s, agriculture was still one of the most important industries in the region. The post-war period had been encouraging, with mechanisation, better animal husbandry, and more intensive land use. The tractor took over from the horse, and artificial fertilisers, breeding of cultivated plants, plant protection and cultivation of newly cleared land should have allowed high production with less labour on the farms. Because of this development, the cultural landscape lost much of its biodiversity, and the species-rich hay meadows almost disappeared. The demand for productivity led to that only the best configured and most easily worked areas were preferred. As the economy was weaker, fewer of the younger people took over, but after a decline in the mid-1970s, livestock numbers remained fairly stable until the turn of the century.

Many new barns were built in the period around and after the “Stepping-up resolution” for agriculture in 1975 (Storting 1975). Most farmers erected buildings for milk production by 10-20 cows, and some outbuildings were erected for sheep and egg production. At the same time as the stepping-up decision, many older farmers retired even though the next generation refused to take over. This meant that plenty of land was available to rent for those who remained as farmers, and they therefore built barns for more land than they themselves owned.

There was overproduction in agriculture in the early 1980s, and this brought less profit. Some farmers gave up farming and found better paid work. Nowadays, most of those who farm also have

Photo 15.10. Agriculture has always been important for settlement in the region, and remains important for the villages toda. Here from Austrheim. Photo: Kjersti Isdal.

another job. Some, however, have invested much and have built large cow byres where the livestock are milked by robots; this is probably the main reason why the volume of production has been maintained. The variety of many smallholdings and some large farms means that agriculture still has an important position in the region. The number of sheep has increased sharply (Table 15.3). The sheep do not only produce meat, but are also important for managing the cultural landscape. Several pasture associations have joined forces to clear and fence large, continuous areas for grazing. Many of the sheep in the region also graze the good upland pastures in inner parts of the proposed BR in summer.

The most common sheep breed in the region is the Norwegian White Sheep. This is a collective term for a cross-bred population of the long-tailed sheep derived from cross-breeding of Norwegian and British breeds (Dala, Steigar, Rygja and Cheviot), which became common from the end of the 19th century. These breeds have a fine type of wool (undercoat) which was better suited for the textile industry which developed in the 19th century. Their popularity therefore grew rapidly and the numbers of the original sheep breeds (short-tailed sheep derived from Old Norwegian Sheep and the Old Norwegian Spæl Sheep) declined. These were outwintered sheep with rougher wool (undercoat and guard hairs), which were no longer popular. Flocks of Old Norwegian Sheep were ultimately so reduced that the breeds were in danger of becoming extinct. Today, they are popular again, and the use of their wool has also grown in popularity.

The coastal heathland have received a great deal of focus as pasture for flocks of Old Norwegian Sheep (”wild sheep”). The reason is that the evergreen heather has approximately the same nutrient value all the year round. These sheep are well adapted to the coastal climate and do well on the heather pasture. They lamb outside , and are only gathered in twice a year to be sheared and slaughtered, respectively. Sheep rearing in the region is in good shape today. Those keeping

sheep mostly get their main income away from the farm and make use of the local resources due to their interest in farming and in respect for tradition and culture, a most valuable contribution to the farming industry and the "appearance" of the landscape in the region.

Table 15.3: Overview of the numbers of cattle and sheep in Nordhordland in 1969-2016. Source: Norway Statistics.

	Milker cows		Suckler cows		Cattle in all		Sheep over 1 year	
Year	**No. of producers**	**No. of animals**	**No. of producers**	**No. of animals**	**No. of producers**	**No. of animals**	**No. of producers**	**No. of animals**
1969	0	-	0	-	2 246	18 158	2 020	21 833
1979	0	-	0	-	1 448	16 442	1 502	25 957
1989	0	-	0	-	1 057	15 349	1 005	24 937
1999	423	4 153	177	784	744	14 776	777	26 964
2000	381	3 947	190	893	709	14 295	772	27 428
2001	353	3 674	178	876	660	13 735	773	28 247
2002	321	3 400	177	934	616	13 230	739	27 170
2003	304	3 426	168	1 029	573	12 918	688	26 768
2004	285	3 263	160	960	560	12 591	632	25 534
2005	273	3 203	139	878	511	12 091	592	25 922
2006	239	2 975	136	817	467	11 137	553	24 858
2007	214	2 825	129	828	437	10 874	543	25 620
2008	197	2 734	114	789	385	10 195	552	26 981
2009	188	2 638	118	862	362	10 018	529	27 670
2010	176	2 665	119	923	343	10 009	519	28 267
2011	165	2 525	108	879	321	9 772	534	28 466
2012	160	2 523	109	891	304	9 793	527	27 804
2013	154	2 497	101	907	296	9 775	522	26 494
2014	138	2 315	100	908	295	9 665	522	22 635
2015	134	2 380	95	916	280	9 624	532	23 702
2016	144	2 561	98	962	273	9 936	549	24 502

More and more farmers are producing food on a small scale for the local market ("Farmer's Market", "In the Farmyard", tourism), and are well received by the consumers. Many of these farmers look upon the villages, with their cultural landscape, cultural heritage monuments and history of life and the way of life for those living here, as resources to begin new village industries.

The big challenge for agriculture is the profitability of other industries (especially the petroleum industry). Much emphasis has been placed on raising production in each unit to keep up with the trend in incomes. Terrain, configuration and shifting weather make it difficult for agriculture to compete with alternative industries. The result is more and more part-time working. Some young people, nevertheless, see a future in farming. One aspect is that agriculture near a city offers a potential for production that has a market, for instance, local food, fruit and berries.

Forestry

Afforestation in outer parts of the region began at the end of the 19th century, but most of the trees were planted from the mid-1950s to the mid-1970s. The incentives were a desire to increase

the value of the land and to make the open landscape more attractive and more sheltered. The woodland in the inner parts of the region has had comparatively more significance for a long time, for both building materials and firewood.

After the war, afforestation was a major task that had the mission to help build society, not least in Hordaland, the county in Western Norway with most woodland and forest. Forest products were in short supply and were considered as a major resource which, in time, would help to increase the profitability of the fairly small farms on the coast. Planting protection woodland to protect other woodland and the cultural landscape from the sea and the wind was also important.

Red deer came to the outer parts of the region with the woodland. There is now a comparatively dense population of red deer throughout the area, and many are killed each year. These are mostly consumed by the hunters and their families and friends, but the potential for leasing shooting rights is high.

Planting of woodland declined in the late 1990s. No more planting took place on heathland and in areas with high biodiversity and valuable landscape qualities. Consideration for the cultural landscape has now greater attention. Sitka spruce trees largely spread themselves, and Scots spruce trees are only planted after trees are felled. Environmental considerations have thus come more and more into forestry. When forest roads are being planned and built, consideration is now given to habitats, biological diversity, and watercourses.

Nordhordland now has large areas of woodland that are soon mature for felling. In recent years, many kilometres of high standard forest roads have been built, and several forest contractors are operating in the area throughout the year. A quay for shipping timber was built in 1985 at Eidsnes in Lindås, on the E 39 highway. It was slightly extended in 2000, and in 2016 further extended to a length of 135 metres, making it one the largest in this coastal county. The Nordhordland Forest Owner's Association also owns an area of about 6 ha in association with the quay. Nordhordland and Bergen take the timber, and up to 80,000 cubic metres are shipped annually. However, forestry as an industry remains poorly developed in Nordhordland. It is reasonable to say that its potential is great, and there is a need for advice and follow-up so that the industry can develop and become reliable and profitable.

15.3.2 Indicate the positive and/or negative impacts of these activities on the biosphere reserve objectives (Section 14)

Positive impacts

- There has been a strong technological development of agriculture since the Second World War. Mechanisation, artificial fertilisers, breeding of cultivated plants and plant protection have led to more food production with less labour.
- Industry, trade and the service industry have gone strongly in the region, particularly after 1970. This has had the positive effect that farmers have been able to combine traditional farming with other work. This has improved private economies and reduced depopulation.
- Local traditions for agricultural production have experienced a renaissance because there is now a large market that seeks locally produced food. This is sold through grocery shops, supermarkets, direct to the customer, at the "Farmer's Market" in Bergen, farm shops and food festivals.
- The extensive planting of trees, particularly between 1950 and 1975, has caused many problems for the region, but also led to a much larger area of productive forest in parts of the

Photo 15.11. Nordhordland has a fragmented landscape and many smallholdings. Sheep farming is common, as here at Morken on the island of Radøy. The photograph shows a group of Norwegian White Sheep. Photo: Kjersti Isdal.

BR. It will give many new jobs in the years to come.

- The growing interest for maintaining cultural landscapes in more or less authentic use has become some of the offer to outdoor recreation, education and tourism.
- Grazing of coastal heathland by the Old Norwegian Sheep (”wild sheep”) has increased noticeably. Little effort is needed, the landscape is kept open, and the farmer gets a good price for the tasty meat. Honey from the coastal heaths gives an extra income.

Negative consequences:

- Demands for high productivity have led to only the best part of the infield area being actively farmed. The cattle are fed high-quality grass supplemented by imported concentrates. The need for outfield grazing has therefore been greatly reduced.
- Large parts of the outfield areas have become overgrown with scrub, or spruce has been planted there. This increases the fire risk due to the build up of large quantities of biomass.
- Prior to the Second World War, there was a mosaic of different vegetation types related to cultivation, with a high biodiversity developed over hundreds of years of farming. Some of this diversity is lost when the area becomes overgrown.
- A great reduction in the area of tilled land and in livestock reduces the degree of self-sufficiency and a reliable food supply in the event of crises.
- Planting of spruce has changed the cultural landscape. Many inhabitants miss the open cultural landscape which was characteristic of the coastal part of Nordhordland.

15.3.3 Which indicators are, or will be used to assess the state and its trends?

Information about the status and trends in agriculture is available in many annual reports. They give figures for, among other things, the number of agricultural properties, the areas used, the numbers of livestock, production and economy. Those that are most used are:

- Norway Statistics
- Norwegian Agriculture Agency, the Agricultural Register
- The development of the Production Subsidy
- Forest Fund Systems
- The register of Livestock Licences
- Deliveries of milk and of animal slaughters recorded in the delivery database

The Norwegian Institute for Bioeconomy helps to ensure food safety, sustainable resource management, innovation and wealth in the value chains for food, forestry and bio-based industries. It is an important source of information on trends in agriculture.

Several sources provide brief information about important habitats and species, including Naturbase, Rovbase and Artsdatabanken (artskart). The Norway Statistics annual Agricultural Surveys will also be valuable for tracing trends in the farming industry. In addition, the local authorities have registers of:

- Number of red deer killed. Most also have data from the spring census.
- Statistics for felling and planting within the forest industry.
- 'Municipal and State Reporting' gives general information on input of resources, priorities and achievement of municipal goals, including the conversion of farmland and woodland to other purposes.
- Maps and surveys showing trends in the use of farms and land resources in the municipality.
- Establishment of small businesses in the agricultural sector; producers of local food, social entrepreneurship, farm tourism and other small-scale industries.
- Sale of farming properties. (Young people and others are keen to buy a farm to realise their dream of a good life in the country.)

Photo 15.12. An Old Norwegian Sheep ram on the heath at Lygra. Photo: Inger Elisabeth Måren.

15.3.4 What actions are currently undertaken, and which measures will be applied to strengthen positive impacts or reduce negative on the biosphere reserve objectives?

Agriculture is, and always will be, important for the proposed BR. Maintaining agriculture makes it more attractive for people to live in Nordhordland and is important for how visitors experience the region. Measures that promote the continuation of active farm production will therefore be decisive. This work will take place in close cooperation with public authorities (agricultural and forestry management) and with the farmers' organisations.

At the same time, the BR can to some extent contribute to growth in the more traditional exploitation of the resources and by re-establishing the cultural landscape that traditionally was linked with such operations. This may be fostered by imparting knowledge, establishing infrastructure, such as trademark building or channels for marketing traditional products, and through specific projects such as the "holistic landscape management" project, one aim of which is to avoid more overgrowth of outfield areas by scrub. Other examples are:

Local food
Increased production of local food is important for the proposed BR and it is essential to think afresh to achieve this. The demand for locally produced, high-quality food is high and still rising. The BR is working with Nordhordland Regional Council on the "*Taste of Nordhordland*" project, which is marketing local food from many small producers. Many of them base their products on old food traditions combined with new methods to develop tasty products in a safe environment. An effort is being made to build up a better network between the producers, which is intended to make the producers more visible and the products known and available locally, regionally and nationally. This may provide a stimulus for new workplaces in farming and be an attraction for tourism in the BR.

Forestry
The extensive planting of trees in outfield areas, particularly between 1950 and 1975, has led to forestry becoming a growing activity within the proposed BR. Good infrastructure, comprised of forestry roads and a large quay for shipping timber, has been built. Forestry is expected to give many jobs in the years to come.

Old breeds of domestic animals
A positive trend in the past 40 years has been the growing interest for preserving the old breeds of domestic animals (cattle, sheep and goats). These have valuable genetic properties, some of which the modern, highly productive breeds have lost. The significance of such properties for breeding future domestic animals has been recognised. A good example is the short-tailed Old Norwegian Sheep (”wildsheep”). This was the usual breed of sheep throughout the country until the 1880s when, because these sheep were smaller than the modern long-tailed breeds and usually had only one lamb, it was replaced by these modern breeds. After the Second World War, only a small number, around 1000, were left, on an island south of Bergen. Now the "wildsheep" have again become popular among coastal farmers and consumers because they are hardy and grazethe coastal heathland all the year round. They lamb outside, effectively graze the vegetation and hinder overgrowth. Little effort is required to look after them, and keeping them can easily be combined with other jobs. Their meat is tasty and has a low fat content. The farmer gets a good price for the meat, because the products have hit the market among people wanting high-quality ecological food. The population is now approaching 50,000, spread along the whole coast.

Cultural landscape
Thanks to the increased interest for maintaining knowledge about traditional cultural landscapes, western Norway still has such types of landscape intact and living, and the agricultural authorities give grants to farmers who maintain such landscape. Two major steps have been taken in the proposed BR to maintain old cultivated fields and cultural landscapes:

- The way the steep farmland at **Havrå Farm** on Osterøy, where farming methods have remained virtually unchanged for hundreds of years, is run was documented in a film as early as 1950. Havrå is one of the best preserved and very last cluster farms in western Norway and was protected as a cultural environment in 1998. It is now part of the Museum Centre in Hordaland.

- The **Heathland Centre at Lygra** is a national centre for maintaining biodiversity in the coastal landscape and preserving knowledge about the coastal heaths. The coastal heaths are run here using methods that are as authentic as possible, integrated with the working of the infields on five farms. The centre works in close cooperation with the University of Bergen, and is part of the Museum Centre in Hordaland. The Heathland Centre has been awarded the UNESCO prize for preserving and running cultural landscape, and the EU Commission's EUROPA NOSTRA highest prize for safeguarding the cultural heritage.

15.4 Other types of activities positively or negatively contributing to local sustainable development, including the impact / influence of the biosphere reserve outside its boundaries

15.4.1 Describe the type of activities, area concerned and the people involved (including men and women)

Nordhordland is an actively developing region. Large parts of the area are experiencing a substantial growth of their population, business life is changing, and the local culture is being challenged. Factors which will have great influence on development in Nordhordland are:

Municipal mergers
In the last few years, the Government has been reviewing the structure of local authorities in Norway with a view to amalgamating some to establish more efficient administrative units. In Nordhordland, the initial plan was to merge all nine municipalities into one. A referendum held in 2016 showed that most of the municipalities were opposed to this. They are continuing as independent units. However, from the beginning of 2020, Lindås, Meland and Radøy will be merged into a single municipality, to be called Alver. The regional cooperation will continue, but it is not clear just how. Nor is it clear what this will mean for the activity in the proposed BR or how it will be organised. The new cooperation will naturally be influenced by one large municipality working together with six small ones.

Communications
The most important infrastructure project being planned is the Nyborg Tunnel between Åsane (Bergen) and the Nordhordland Bridge, the gateway to the region from the south. It will remove the queues and shorten the driving time by about 10 minutes. While this will make it easier to take advantage of what the city has to offer, it will also make it more likely that the southern parts of the

region will become a dormitory suburb of Bergen. It is not yet known when this project will start. More frequent journeys of the express boat between Knarvik, Frekhaug and Bergen is another important step, which will enable more efficient use of the fjord for communication. Politicians in the region keenly support this commitment.

Petroleum industry
The oil and gas industry in Norway will eventually be reduced, but there is still a great deal of activity. For instance, great expectations are linked to the giant Johan Sverdrup oil field. This is one of the five biggest fields on the Norwegian shelf, with predicted resources amounting to between 1.9 and 3.0 billion barrels of oil. The oil will be shipped to Mongstad where it will be stored and refined. This is a so-called elephant field and will secure Mongstad and the supply service industry in the region stability, income and jobs for many decades. Despite the CO_2 emission this entails, every effort will be made to develop this project using the most environment-friendly and sustainable solutions. Production will start in 2019 or 2020.

Nordhordland Health Clinic
The Nordhordland Health Clinic will provide various cooperating health services to improve the health and security of the region's inhabitants. The building is being planned and will be placed in the centre of Knarvik, the regional centre. This is the biggest health-related cooperation project in the region and will ensure a broad use of skills in the health sector, and give the region new jobs for skilled employees.

Joint regional aquaculture plan
The aquaculture industry is extremely important for the region. The way is now paved for a joint regional plan for the marine areas in Nordhordland. This will involve and engage broadly, and the industry is very keen to begin the work. The date for its start is still undecided.

15.4.2 Indicate the possible positive and / or negative impacts of these activities on biosphere reserve objectives. Have some results already been achieved?

None of the activities outlined in Section 15.4.1 will have directly negative consequences for the further development of the BR, but the strong development taking place in the region demonstrates the need for an effort that can help to steer this in a sustainable direction.

The merger of local authorities is an important administrative reform and may have significance for how the BR is managed and funded. However, there is no reason to believe that the loyalty relative to the commitment to the BR will be changed when the three large municipalities merge into one entity.

The Nyborg Tunnel will reduce the travel time and hopefully the accident figures, which are relatively high on this stretch of road today. An increased frequency in the express boat service to Bergen also has only positive effects for the region. In combination, these will be good environmental and social development measures.

Bringing oil to land from the Johan Sverdrup Field is important for the local authorities to secure jobs and income. Managing this in the best way by helping to reduce the environmental consequences and at the same time pave the way for innovation and sustainable development in society will be the most important task for the region.

The Health Clinic gives the region an excellent opportunity to work interdisciplinarity in, for instance, various aspects of public health. This is very important from a social development perspective.

To put in place a joint aquaculture plan that ensures sustainable use of the sea will be very positive for the region. It is excellent that the industry is so keen on the work that will begin, and wishes to contribute.

15.4.3 What indicators are, or will be used to assess the state and its trends?

We will employ existing figures and statistics to evaluate these rather general development aspects and their possible significance for the further development of the proposed BR. Some that are relevant include:

- Norway Statistics: statistics concerning population and types of industry and commerce.
- Norwegian Association of Local Authorities: various statistics linked to municipal administration and operation.
- Research Council of Norway: statistical material linked with research.
- Norwegian Labour and Welfare Administration: labour market figures.
- Hordaland County Council (statistikkivest.no): central features of development.

In addition, several organisations keep regular statistics about, among other things, profitability in various industries and businesses, the size of companies and the number of new firms. We can also measure the contribution of the region to the nation's gross national product.

15.4.4 What actions are currently undertaken, and which measures will be applied to strengthen positive impacts or reducing negative ones on the biosphere reserve objectives?

Work on the pilot project for the proposed BR began in 2013. Much of the activity has concerned developing strategies, establishing the project organisation, and securing the economic basis for the commitment to the BR. Out-reach activities have been very important and the project committee has made a big effort to provide information and get people and organisations interested in the BR.

At the same time, we started activities that directly support the objectives of the BR. This has been done both to gain experience and to show the inhabitants of the region what the commitment to the BR can eventually contribute. For example, the BR organisation took the initiative for a regional conference on sustainability in spring 2017, attended by some 50 people. Much of the activity in the future BR will take place in subprojects that help to solve specific problems faced by the region. At present, we have three types of projects:

- Projects where the initiative has come from people or organisations in the region
- Projects for which the BR organisation has taken the initiative
- Projects that are already ongoing, but which it has been natural to convert to BR projects because the tasks are linked to the commitment to the BR

More projects are being developed. In the future, we envisage projects for children and young people that focus on the SDGs and preventative measures regarding public health.

Table 15.3. Overview of the most important projects resulting from the commitment to the biosphere reserve.

Projects resulting from the commitment to the biosphere reserve
Taste of Nordhordland – local food The project is intended to promote local food and culture. Local producers of food and enthusiasts of local food take part. The project is progressing well and funding is in place.
Holistic landscape management This project concerns overgrowth, aiming to turn what many regard as a problem into a resource for the region, at the same time as re-establishing open land where this is desirable. The pilot project is fully funded, a project manager has been engaged, and work is taking place to find relevant pilot areas.
SHAPE – sustainable tourism SHAPE (Sustainable Heritage Areas Partnerships for Ecotourism) is a 3-year EU-funded international project that aims to help to develop sustainable tourism based on natural and cultural heritage. The partners are BRs and regional parks in Sweden, Finland, Scotland, Greenland and Iceland. It began in May 2017.
Wool week – a commitment for Norwegian wool The basis of this very active project is local traditions. This project aims to get Nordhordland to take a lead in the work to promote and process Norwegian wool. A project manager is in place.
Branding and communication The project aims to further develop a regional trademark and help the region to be more visible nationally and internationally.

Photo 15.13. Wool week is all about the use of Norwegian wool. Photo: Linda Sæle Kjenes.

15.5 Benefits of economic activities to local people

15.5.1 For the activities described above, what income or benefits do local communities (including men and women) derive directly from the site proposed as a biosphere reserve and how?

The steps described in Section 15.4.4 and corresponding activities that will be developed contribute directly towards fulfilling the goals of the proposed BR. The benefit derived by the inhabitants will therefore be linked to the overarching benefit to the region from the commitment to the BR. It will be possible to determine the resulting economic value for those steps that create new jobs, such as the local food project, the wool project, the SHAPE project and future business measures. In the case of other initiatives, the benefit will be more measurable in the feelings of quality of life, safety and satisfaction experienced.

Studies in other countries moreover show that BRs can have a positive regional-economic effect when they develop a distinct trademark and can be marketed as a destination for both tourism and new firms. We expect similar effects in Nordhordland, not least because this will be the first BR in Norway.

One goal in becoming a BR is that it will inspire and contribute to sustainable development in business and industry which eventually will give the community benefits and income. However, it will be difficult to see that such results come from the commitment to the BR alone, since this development takes place in cooperation with many people and organisations, and parallel to more overarching trends nationally and internationally. The following measures will help to provide a stimulus for a sustainable, economically profitable development, as our aim to become a BR is described:

- By working purposefully for the SDGs locally, the region will acquire a solid and distinct trademark that will contribute to a positive reputation. The region will attract more inhabitants and more income.

- By supplying knowledge-based information and stimulating innovation, we will contribute to increased entrepreneurship and sustainable business life. The commitment to the BR will, at the same time, help to market local, sustainable firms.

- By creating a trademark for local products, we will develop a larger market and contribute to increased sales.

- By stimulating sustainable tourism in the region, we will strengthen this industry and other businesses that indirectly benefit from more visitors. In the tourism industry, the added value a tourist contributes economically to the destination, beyond the actual tourism product, is well documented.

15.5.2 What indicators are used to measure such income or other benefits?

We will mainly use the figures listed in Section 15.4.3 to evaluate the utility value of measures we start. In addition, an evaluation procedure is built into all BR projects. The BR prepares an annual report which evaluates the activity. This is discussed by the steering committee. Other procedures will be considered as the need arises.

15.6 Spiritual and cultural values and customary practices

15.6.1 Describe any cultural and spiritual values and customary practices including languages, rituals and traditional livelihoods. Are any of these endangered or declining?

Table 15.4. Overview of traditions and possible risks threatening them today.

Tradition	Description	Any threats
Strile dialect	From time immemorial, people in Nordhordland have spoken the Strile dialect. The term "Stril" is old, and over the years it has been used as a negative nickname for fishermen and farmers from the islands and villages around Bergen, in Nordhordland and Midthordland. Nowadays, being referred to as a Stril is something to feel proud about and which conveys a sense of belonging.	The Strile dialect is changing. Due to increasing urbanisation, many people now speak a dialect more closely resembling that of Bergen, especially in built-up areas that have experienced a lot of immigration, and among the younger generation in villages.
Market Day and the Stril culture	Market Day is celebrated in Bergen every June as a symbol of the ancient culture when the Strils travelled to the city to sell their wares. People dress up in traditional clothes and journey to the market in Bergen, preferably by boat, to sell local products. Important for identity and pride.	No threats, except for competition from other events and activities
Many organisations	Nordhordland has long traditions of local cultural activity linked to village communities. This is shown by the great variety of clubs and societies. The word "dugnad", signifying a voluntary communal effort, is a characteristic here, and has great significance in the community.	
Religion and the Chapel Movement	Christianity and the chapel culture have traditionally been strong in this region. Many chapels and churches were built here in the latter half of the 19th century and the first half of the 20th century, and both the chapels and the churches were natural and important meeting places for the villagers. Even though the churches no longer have large congregations and some chapels are not in use, Christianity and the chapel culture are still important for many people and hold a strong grip in the region. There are about 20 churches, the last of which was completed in 2014 in the regional centre, Knarvik.	

Strong culture for bands	Nordhordland has many high-quality school bands, brass bands and concert bands. Two of the brass bands (Eikanger-Bjørsvik and Manger) compete at a high level in Norway and on the Continent. Both have been European champions. They began in the early 1970s. Recruitment to the bands is good. The Folk High School at Manger has a course in band music, and attracts pupils from all over the country.	
Village and community halls	The many village halls used to be a natural meeting place. Many still have a function, in part because of the many revues performed in Nordhordland. There is also a desire to erect a larger, centrally located building that all branches of the cultural life can use.	
The coastal culture	People in Nordhordland have always used the sea extensively for travelling and fishing. Every farm had a boathouse or the right to have one, and often had several boats, suitable for a particular kind of use. Various types of fish were caught, such as cod, herring, mackerel and salmon.	The change in communications from sea to land has had negative consequences for the traditional use of the sea. Much of the use of, and knowledge about, the sea has been lost, particularly among the younger generation.
Salmon fishing using a salmon trap	Many farms along the fjords used to have the right to fish salmon. They used a trap to capture salmon using high wooden towers from which they kept watch and released an open, stationary seine net when they got a glimpse of a salmon. There were plenty of fish then and the method gave such big catches that farmworkers often had a clause in their contract saying they must not be served salmon more than twice a week.	Wild salmon are under threat in several rivers and strict fishing restrictions are in place. The old traps are no longer in use and knowledge of this way of fishing is in danger of disappearing. Some enthusiasts in Osterfjord are, however, keen to preserve the tradition and several traps on Osterøy have been restored.
Lyrics and literature. Singers and writers who are important for cultural life in Nordhordland	Aslaug Låstad Lygre – a well-known poet Olav Nygard – a well-known poet Kjersti Wiik – has collected local songs and folk songs, especially for children Ivar Meedås – troubadour Claus Sellevoll – comedian and ambassador for Stril culture Salhusvinskvetten – song and revue group promoting Stril culture	

Cultural landscape	The cultural landscape is an important part of our identity and pride. The landscape lacked woodland just a few generations ago. Grazing kept the vegetation down. People feel closely linked to the cultural landscape and want it to be kept.	Today, with less farming in the region, much of the outfield area near infields has become overgrown and this landscape rapidly disappears in many places.
Upland summer dairy farming	People on the coast milked their livestock outdoors in outfield areas close to their farmhouses, whereas those living further up the fjords had summer dairy farms in the mountains. These were the best ways of utilising the natural resources and gave them fodder for their livestock all the year round.	Outdoor milking and upland summer dairy farming are now almost a thing of the past. The former dwelling houses are now mostly used as cabins and huts. Livestock are still taken to upland pastures in summer, but the use of the closest outfield areas is declining and many are becoming overgrown or spruce trees have been planted there.
National costumes	Many people in Nordhordland use their national costumes on special occasions such as weddings, confirmations, christenings and Independence Day (17th May).	Living tradition
Independence Day (17th May)	Independence Day (17th May) is celebrated in all the villages and towns. People walk in processions and often gather in schools afterwards, where there are entertainment, food and games for the children. Many people wear their national costume.	Living tradition

Photo 15.14. Fish being sold from boats in Bergen. From the Knudsen Collections (UBB-KK1318-3504).

Handicrafts	Being able to turn your hand to many kinds of jobs is a common element of the Stril culture. People had only small farms and needed to work hard to manage. Various kinds of craftwork were common, such as carpentry, smithing and tanning. Smiths who specialise in making hubs for wheels is an example of craftsmen who are still active today.	The industrialisation at the end of the 19th century moved craft production from the farms into factories. Much local knowledge has been lost, but some has survived through enthusiasts and bearers of traditions. There is now renewed interest for learn the old crafts.
Handicrafts and textile work	Nordhordland has a rich handicraft and textile tradition based on wool from the local sheep. It was essential to be able to spin, knit, weave and mat clothes, bedspreads and tapestries. Knitting and weaving patterns generally varied from village to village. There are several old wool spinning and textile firms in the area. The interest for using wool for cloth and textiles is still alive. It is popular to knit your own clothes, even among the younger generation.	Although this is still very popular, there are not many people who have the skills for producing the yarn themselves, as was a common knowledge in the old days.
Local food production; the Farmers' Market	The local food traditions are characterised by old conserving techniques such as salting, smoking and drying meat and fish, which give a strong taste. Examples of local products are various kinds of smoked sausages and mutton (cured leg of mutton, salted and dried ribs of mutton).	No threats. Interest for local food traditions is increasing and has led to more people learning the old techniques to be able to produce and sell food from their own farms. The market is growing, and many shops have separate counters for local food. The Farmers' Market in Bergen, and local markets, such as in connection with festivals, are good places to sell food.
Architecture and building traditions	Nordhordland has a characteristic architectural tradition in which stone is used to an unusual extent, especially in outhouses. There might be many outhouses on a farm, which were used for special purposes: cooking house, ice house, peat house, quern house, smithy, etc. Timber was difficult to come by, but the fields had many stones that could be used for building. The dwellings were called scuttle houses, because they were timber houses with a scuttle above (a low loft with a sloping ceiling). The timber was often protected by a stone wall in the north and/or south. Barns were often built with an outer, open, wooden framework with a solid timber building within it. The buildings were adapted to the availability of building materials and the climate.	Many of the old dwellings have been modernised, and are thus taken care of, whereas other buildings, such as the many outhouses, are more often dilapidated.

Festivals	Many festivals are held in the region and they attract many people. The most important events are 'Knarvikmila', 'Ocean Sport', music festivals such as 'Utkantfestivalen' and 'Kraftspela'and 'Coastal Heritage Weeks'.	
Integration efforts	The local authorities and many voluntary organisations help refugees to adapt well to their new life in the region. This concerns everything from basic needs which the local authorities attend to, to providing companions for walks, helping with homework, and multi-ethnic cultural evenings, etc.	

15.6.2 Indicate activities aimed at identifying, safeguarding, promoting and/or revitalising such values and practices

Cultural values have traditionally played an important role in Nordhordland. In the past, many activities were essential tasks to obtain food and provide a place to live, and clothes. Today, many people are keen to take care of these traditions and the knowledge they carry with them for the future. This is important because it is part of the identity and pride of people in the region. An overview of the most important attractions in the proposed BR that are based on culture is given in Section 15.2.1.

Courses and projects

Various activities and projects are continually taking place, in the individual municipalities and the region as a whole, that are linked with the development of local resources to promote culture and identity. These include putting up signs and providing information, building dry-stone walls, preparing cultural heritage paths and visits to historic buildings, and promoting local food and commercial use of Norwegian wool. Much effort is also being made to develop attractions.

Photo 15.15. National costumes from Nordhordland. Photo: Husflidstova.

15.6.3 How should cultural values be integrated in the development process: elements of identity, traditional knowledge, social organizations, etc?

A key task for the management of a BR in Nordhordland is to bring people together, so that they can discover values and traditions they have in common and create networks. The values and traditions of the region form a common identity and are the basis for an intraregional network, built on an ecological and socio-economic basis, which strives to formulate common solutions for sustainable development. Cultural values will be a basis for commitments for projects concerning local food, wool and yarn, traditional crafts and architectural traditions, which may help to provide more local jobs and strengthen the local economy. A project regarding sustainable tourism based on cultural values has already started.

The coast and the fjords play a central role in both the geography and the culture in Nordhordland. The proposed BR will be an enthusiastic supporter of activities linked with the coastal culture. The BR hopes to encourage and promote many of the existing traditional societies and associations.

Photo 15.16. The Schoolband tradition in Nordhordland is deep rooted and still very much alive. Photo: Eivind Senneseth.

15.6.4 Specify whether any indicators are used to evaluate these activities. If yes, which ones and give details)

(Examples of indicators: presence and number of formal and non-formal education programmes that transmit these values and practices, number of revitalisation programmes in place, number of speakers of an endangered or minority language)

Examples of indicators are figures for the number of visitors to museums and at activities linked with these museums. The number of associations and societies, voluntary groups, events and festivals also provide indicators about activity in the region, and its trends.

Kvingo, Masfjorden. Photo: Gro Serine Baarøy.

16. LOGISTIC SUPPORT FUNCTION

16.1 Research and monitoring

16.1.1 Describe existing and planned research programmes and projects as well as monitoring activities and the area(s) in which they are (will be) undertaken in order to address specific questions related to biosphere reserve management and for the implementation of the management plan (please refer to variables in Annex 1)

Hordaland, which includes parts of the proposed BR, is in one of the strongest counties in Norway for research and development (R&D), particularly due to the high activity in the university and college sector. In 2011, this sector spent over 45% of its expenditure on its own R&D, whereas the institute sector spent 29% and the business community 25%. Proximity to many research organisations – the University of Bergen, Uni Research, the Western Norway University of Applied Sciences, the Norwegian Institute of Marine Research, the Norwegian Institute of Bioeconomy Research, the National Institute of Nutrition and Seafood Research, the Geological Survey of Norway, the Foundation for Industrial and Technological Research, the Bjerknes Centre and the Norwegian Institute for Nature Research – is particularly important. Like the rest of the county, Nordhordland aims to increase its research focus in the public and private sectors, and the Regional Research Strategy for Hordaland 2015-2019 states that development and new knowledge are important for tackling future problems linked with reorganisation and innovation. It is desirable for more research to contribute to innovation, sustainable value creation, improved solutions of tasks, and knowledge-based and holistic management. To be successful in this, closer cooperation with local, regional and national institutions in the private and public sectors is desirable. The regional research strategy is in line with the national one, particularly the *Long-term plan for research and higher education 2015-2024* (Report no. 7 to the Storting). The objectives of the *Regional Research Strategy for Hordaland 2015-2019* are to:

1) Strengthen the regional innovation system by paving the way for better cooperation between regional participants and research groups in the county and getting more private individuals and public participants to undertake research.
2) Identify key tasks and responsibilities for local and regional authorities linked to research and development in Hordaland.
3) Be the document that steers Hordaland County Council's sphere of responsibility within the research field.
4) Suggest priorities for national and international research.
5) Provide an overview of research in Hordaland.

Business and industry in the region include some firms that focus strongly on research and others less. Research in important sectors such as petroleum and offshore, marine, maritime, culture and tourism, innovation and development is often concerned with the use and further development

of existing knowledge. However, the expenditure of business and industry on R&D carried out by their own staff is lower than in many other parts of Norway. Interactions between researchers and business and industry should be strengthened: and this is a key role for the proposed BR.

The University of Bergen wants to cooperate with the authorities, businesses, industry and the inhabitants of Nordhordland on a broad research front to support Nordhordland's plan to develop the area in a more sustainable direction. A preliminary investigation at the university to assess the interest of researchers in becoming involved in Nordhordland showed that departments from every faculty were interested in taking part in such work.

We expect that the designation of the Nordhordland BR will greatly increase awareness of the MAB Programme. It will also serve as a magnet and attract new research, e.g. by stimulating the application for funding through the Research Council of Norway, the EU or local sources. The BR organisation will function as a multidisciplinary intermediary of contacts and as a catalyst between research, management and the public, and establish cooperation with, for instance, the Ministry of Agriculture and Food and the Ministry of Local Government and Modernisation.

RESEARCH

The UNESCO Chair at the University of Bergen

As a contribution towards the establishment of the Nordhordland BR, the Rector at the University of Bergen, supported by the Norwegian National Commission for UNESCO, successfully applied to UNESCO to have a UNESCO Chair in "*Sustainable Heritage and Environmental Management – Nature and Culture*" at the university, whose core activity will be linked to work within the MAB Programme. In February 2017, UNESCO appointed Inger Elisabeth Måren as the Chairholder, to work in a multidisciplinary and purposeful way to promote the BR in research and implement the UN Agenda 2030. As part of this work, Inger Måren was included in the project "*OASIIS, UNESCO BRs & Sustainable Development Goals, bridging the SDGs – 2017*", which has made the following three recommendations, on the basis of proposals made by 191 participants from BRs in 40 countries:

1. BRs should become sustainable business hubs to leverage the economic benefits of the designation. BRs as an enabling and inspiring space for businesses that align with the UN Sustainable Development Goals. BRs acting as facilitators rather than implementers of sustainable development, catalysing and leveraging opportunities for sustainable businesses.

2. Use the BR designation to maximize local assets to deliver local and global opportunities and benefits. Harness the potential of the BR designation and the skills and experience of citizens to facilitate, accelerate and incubate opportunities for local and global residents.

3. Use the BR designation to give global visibility to citizens and businesses who actively maximize local assets foreconomic benefits. Promote and raise the profile of citizens' economic activities and initiatives under the BR designation both locally and globally. In order to spread knowledge, access new markets, be immediately identifiable and connect with economic benefit whilst aligning with the UN Sustainable Development Goals.

United Nations Educational, Scientific and Cultural Organization

UNESCO Chair on Sustainable Heritage and Environmental Management-Nature and Culture, University of Bergen

Figure 16.1.: The logo of the UNESCO Chair at the University of Bergen, whose primary task is to work on the MAB programme.

A selection of research or teaching projects empirically based in Nordhordland or of particular importance to the region is described below:

bioCEED – Centre of Excellence in Biology Education
bioCEED concerns cooperation between the University of Bergen (under the direction of the Department of Biological Sciences, with contributions from many partners at the university) and many private and state-run research, industrial and environmental institutions in Norway and other countries. bioCEED develops biological education that meets future requirements in science and society by linking scientific knowledge, practical skills and relevance for society throughout the teaching programme, and by bringing the strengths of the research structure into pedagogical practice. The objective is for the students to develop fundamental scientific skills and attitudes, at the same time as they prepare themselves to solve important problems in science, industry and society. An important aspect of the bioCEED approach is to give the students opportunities, as part of their biology studies, to do practical work in private firms, state-run institutions and voluntary organisations that are scientifically relevant for them. It is anticipated that this can also take place in the BR, in order to make early contacts between the students and future employers in the region.

Ongoing marine projects
Several ongoing research projects may have great value for a more sustainable aquaculture. Norwegian fish farmers normally use some 2.8 million tonnes of wild fish for feed to produce about 0.8 million tonnes of salmon and trout annually, but a rapid development is taking place where more plant products are used, thus reducing the use of wild fish. In addition, trials are being performed using marine organisms located lower in the food chain.

1) Trial production of sea squirts (tunicates) is taking place at Rong in Øygarden. This animal lives on micro-organisms and rapidly produces huge quantities of protein. If the project is successful in producing high-quality sea squirts on an industrial scale, they can become an important ingredient in fish feed and perhaps in many other products.
2) At Mongstad, trials are in progress to produce micro-algae using CO_2 and heat from the oil refinery. These micro-algae can also be used as a fish feed ingredient.
3) UNI Environment is responsible for marine biological research regarding the new generation of floating and enclosed plastic fish pens that are now to be tested by the aquaculture firm Marine Harvest.

Photo 16.1: In tunicate (sea squirt) farms in Norwegian fjords, it is possible to produce protein at rates that are 100 times higher per square metre of sea surface than is possible per square metre of land surface anywhere in the world. The photo shows tunicates at the trial plant in Øygarden. Photo: Bård Amundsen.

Ongoing terrestrial research projects

TradMod – A Research Council of Norway project in its GREEN TRANSITION programme (2018-2023) "*TradMod: From Traditional Resource Use to Modern Industrial Production: Holistic Management in Western Norway*". The Norwegian west coast is one of the most resource-rich parts of the country, and has a varied economy based on fishery, aquaculture, agriculture, generation of hydroelectricity and the petroleum industry. This resource-based economy is changing in response to the shifting dynamism in human patterns of usage, particularly in "domesticated ecosystems" or socio-ecological systems. We need a better understanding of relationships between land use, environmental quality, climate change, ecosystem services and biodiversity. The project will use the land-use gradient in the proposed BR, from the coast to the mountains, to answer questions on sustainable development and greening of the economy.

FunCaB – A Research Council of Norway project in its CLIMATE RESEARCH programme (2015-2018) "*The role of Functional group interactions in mediating climate change impacts on the Carbon dynamics and Biodiversity of alpine ecosystems*". The alpine areas in Norway are important habitats for many plant and animal species, and contribute important ecosystem functions and services such as carbon storage, livestock pasture, and regulation of floods and avalanches. To understand how changes in the climate affect the entire ecosystem, we must understand the direct effects of climate and climate changes on each of these functions and services, and how these changes affect interactions between them. The FunCaB project is studying this using field experiments and model simulations to provide indications of the consequences of climate and climate changes for biological diversity and carbon storage on a larger scale and under different future climate scenarios. The results will help to increase knowledge about the feedback between terrestrial ecosystems and the climate system.

PRIME – A Research Council of Norway project in its FINNUT programme (2015-2018) "*How implementation of PRactice can IMprove relevance and quality in discipline and professional Education*" investigates how an increased level of practical experience influences learning in higher education. PRIME is a cooperative project between bioCEED, Uni Research Environment, and private and public places of employment where biologists work. The project evaluates how different teaching methods (particularly focusing on practical work) affect the career of candidates and their chances of getting a job after completing their degree.

KlimaLand – A Research Council of Norway project (2014-2018) "*Consequences of climate policy for ecosystem services from arable land*". Recognising that knowledge about the benefit for climate of planting trees on arable land is limited, this project will provide knowledge about the effect of agriculture on the climate. It includes pilot studies of carbon storage on arable land under Nordic conditions – one in the proposed BR – to compare with results from studies in other countries. The project will supply new knowledge about instruments for climate policy and management of land and ecosystem services based on prioritisation between different ecosystem services, and balancing and synergies between climate, biodiversity and other environmental targets.

KRUS – A Research Council of Norway project in its BIONÆR programme (2015-2018) "*Increased use of Norwegian wool*". The project aimed to contribute to the discussion about sustainable cloth by focusing on a local value chain and cloth with local origins. Norwegian wool and the special qualities of the various breeds play a significant role for Norwegian textile traditions and how people traditionally clothed themselves. The work towards lasting and beautiful cloth and textiles led to a better understanding of where the cloth comes from, and the significance of the raw materials for the finished textiles. An important dilemma for Norwegian wool is that it has not been marketed

Photo 16.2: Left: the KRUS project examines Norwegian wool and the qualities of the various breeds. Photo: Tone Tobiasson/KRUS. Right: Sorting wool from outwintered sheep at Lygra. Photo: Inger E. Måren.

sufficiently. KRUS has tackled this dilemma through breeding trials, cooperation, branding, product development and new business models. Wool from older breeds is particularly difficult to market, due to the declining quality of some wool varieties, and some of this wool is becoming a waste problem. However, this type of wool is central for Norwegian craft traditions.

LandPress – A Research Council of Norway project in its GREEN TRANSITION programme (2016-2019) "*Land use management to ensure ecosystem service delivery under new societal and environmental pressures in heathlands*" is studying how changes in climate and land use influence Norwegian coastal heathlands. When farming ceases or is reduced, the land becomes overgrown and there is a loss of habitat, biodiversity, ecosystem services and functions. Extreme weather (periods of drought) and overgrowth increase the risk of wild fires. Such fires have high costs to society with regard to extinguishing them, compensating losses, and risks for the inhabitants. Active farming may have value for society, beyond producing food, by producing ecosystem services that reduce the fire hazard. LandPress tests whether heather burning reduces drought damage and also the area of drought-damaged heathlands. One of the main localities is at the Heathland Centre, and part of the "International Drought Experiment", placing the Norwegian research in a larger context across geographical regions with collaborators at the University of Bergen, Møre Research in Ålesund, the Norwegian Institute of Bioeconomy Research, and Norway Statistics.

HiddenCosts – A Research Council of Norway project in its CLIMATE RESEARCH programme (2017-2020) "*Hidden costs of implementing afforestation as a climate mitigation strategy: A comprehensive assessment of direct and indirect impacts*". HiddenCosts addresses afforestation as a climate mitigation strategy and largely focuses on positive properties in the form of increased carbon uptake. Several of the localities being studied are linked to the Heathland Centre. The project aims to go into greater depth and introduce more aspects of the afforestation dilemma into the climate debate. HiddenCosts uses a multidisciplinary approach which 1) integrates "Earth System" and regional climate modelling, 2) performs in situ observations of biodiversity, ecosystem structures and carbon storage, and 3) evaluates ecosystem services, including the value people place on various landscape scenarios (afforestation, natural overgrowing and open landscapes with continued management), with collaborators from Uni-Research, the University of Bergen, Møre Research and Norway Statistics.

ArtsApp – A Research Council of Norway project in its FINNUT programme (2018-2022) "*How technology influences motivation and interest for memorising biological species*". Knowledge of species has declined over recent years and this may affect our ability to manage ecosystems in the future. Through cooperation between educational institutions at various levels, this project will modernise how people learn about species, by developing an interactive learning tool, an application for mobile telephones (an app). The project will investigate how the use of the app influences motivation and provides learning benefits for students and pupils, and improved in response to these evaluations. The knowledge generated will be of great value for other areas that use technology in teaching, and will promote biodiversity conservation in the proposed BR.

ENVIRONMENTAL MONITORING

The Norwegian Environment Agency has the overarching national responsibility for monitoring and protecting the natural environment in Norway. Extensive environmental monitoring is undertaken at sea, in rivers and lakes, landscapes and the quality of the air. These monitoring activities are national and include the proposed BR in Nordhordland. The Section for Environmental Monitoring and Mapping at the Norwegian Environment Agency has the principal responsibility for acquiring knowledge on the state of the environment, mapping habitats and biodiversity, and coordinating the work of the Agency with the Research Council of Norway and national and international research groups in the institute and university sectors. The Section has a coordinating role for all monitoring programmes and mapping in the Agency, as well as responsibility for management tools such as the Nature Index and the Environmental Sample Bank, and also for reporting and using Norwegian environment data internationally.

Norway has three important lists that can be used when monitoring the natural environment: the **Red List for Species**, the **Red List for Ecosystems and Habitat Types** and the **Black List for Alien Species**. The Red List for Species assesses the risk that individual species will die out. The assessment is undertaken on the basis of the present population size, in addition to the trend of the species over time. The Red List for Ecosystems and Habitat Types covers terrestrial, limnic and marine ecosystems, and assesses the risk of an ecosystem or a habitat disappearing. The proposed BR in Nordhordland contains a number of red-listed species and habitats. The Black List for Alien Species is a list of alien species in Norway that occur outside their natural area of distribution and have a high probability of spreading in the environment, affecting indigenous species and habitats. Several coastal environments, including Nordhordland, work actively to keep black-listed species under control.

In addition to these lists, a number of important national databases with specifically mapped information in Norway are used for research and monitoring:

- **River delta database** contains updated overviews of the land use situation in large Norwegian river deltas.
- **Havmiljø.no** is a website and an instrument providing analyses of the environmental value of marine environments and their vulnerability for acute oil contamination in different periods of the year.
- **Encroachment-free natural environments – access to maps** shows which areas in Norway were not directly affected by major technical encroachments as of January 2013.
- **Environmental sample bank** is an archive containing samples from the Norwegian environment and is an important tool in the national and international struggle against contaminants. It provides information on samples and species from which samples have been taken.

- **Naturbase.no** gives specifically mapped information on selected areas for natural history and outdoor life. The map is useful, for example, for local authority planners, consultants, landowners and local tourism operators.
- **Rovbase.no** is a tool containing important information for the management of brown bears, wolverines, wolves, lynx, and golden eagles. The database is kept up-to-date by the County Governors' offices, the Norwegian Nature Inspectorate, and the Norwegian Institute for Nature Research. Rovbasen is developed and operated by the Norwegian Environment Agency.
- **Vannportalen.no** is the official web portal for the EU Water Framework Directive in Norway giving information on the implementation of the Regulations concerning water management in Norway (the Water Regulations) and other work connected with the Directive.
- **Arealis** provides land use and planning information from the whole country and contains an overview of the inhabitants, cultural heritage monuments and sites, pollution, the coast, fisheries, agriculture, landscapes, natural history, avalanches and landslides, lakes and so on. Information on thematic data and thematic maps is in digital form.
- **Norge.no** is a guide to digital services (self-service solutions) from government authorities, county councils and municipality councils, and gives information on weather and climatic conditions.

With the help of all these support functions, it is possible to extract information on the proposed BR at various scales, from the entire area to individual species.

Monitoring in protected areas
Monitoring of protected areas in Norway supplies knowledge about the status and trend of encroachments in the form of point elements, such as buildings, and linear elements, such as roads and ditches. In addition, the area cover is also monitored. The monitoring concerns protected areas in general and especially mire reserves.

The **Water Framework Directive** is an important national instrument to monitor, manage and regulate coastal waters, lakes, rivers and groundwater on the mainland. The Directive permits the assessment of the ecological state of all occurrences of water of a certain size, using a common set of indicators. It requires the fulfilment of environmental goals. Sectoral authorities (the Norwegian Water Resources and Energy Directorate, the County Governors, the Norwegian Directorate of Fisheries, the Norwegian Public Roads Administration, and the municipality and county councils) have the responsibility through the use of Acts and Regulations that are in force:

- Planning and Building Act
- Water Resources Act
- Pollution Act
- Manure Regulations, etc.

Marine mapping
This mapping is done county by county and in close cooperation with local authorities, county councils and other public organisations. The aim is that all counties with a coastline will be fully mapped in 2018. Norwegian sea areas, including those that are part of the proposed BR, have overall management plans with goals for environmental quality. An indicator-based monitoring system has been prepared for marine areas, including the various groups of organisms in the ecosystems, the state of the physical environment, pollution and impacts of human activity. Based on the indicator species, separate thematic indices can be made for selected groups of species, ecosystems and impacts.

Ecosystem monitoring of coastal waters ("Økokyst") monitors and maps the environmental state of selected areas along the Norwegian coast. The monitoring obtains knowledge about selected components in the marine ecosystem and is intended to detect undesirable effects of nutrients and particles at an early stage, and the effects of climate change on the ecosystem.

Marine acidification monitoring has taken place since 2010 and gives an overview of how rapidly Norwegian marine areas are being acidified. The monitoring of water entering the sea, both from rivers and direct discharges into Norwegian coastal areas (the Riverine Inputs and Direct Discharges Programme), measures the input of nutrients and selected contaminants into Norwegian waters.

Wild salmon and trout

The Norwegian Institute of Marine Research has the ultimate national responsibility for monitoring the trend of the environment in the sea, and major programmes have been set up to monitor the aquaculture industry and the state of ecosystems in the coastal zone and the open sea. The institute also monitors stocks of commercial fish species. In the proposed BR, the institute's field station at Matre is an important platform for research on aquaculture and trials with fish, focusing particularly on fish behaviour and genetic and ecological interactions due to escaped farmed fish. The Norwegian Institute of Marine Research cooperates closely with the Norwegian Institute of Water Research, the Norwegian Environment Agency, the Department of Biological Sciences and Uni Research at the University of Bergen, with many research and management projects in Nordhordland.

The status of stocks of wild salmon and sea trout varies in the region, from rivers that are closed for fishing, with stocks that are thought to be critical or lost, to stocks that are reduced or require consideration. The two factors contributing most in a negative direction for the stocks of returning anadromous salmonids are fish farming and hydroelectricity generation. The River Frøyset is now being limed (by Norwegian Institute of Water Research and Uni Research) to benefit the salmon. The salmon in Modalen were lost in the 1970s due to acidification. Now, work is starting to release salmon in Modalen using roe from the River Vosso salmon stored in the gene bank, and liming began in 2017.

An example of cross-institutional cooperation on the management of wild salmon is the major rescue operation in the River Vosso since 2000. One measure is that the inner parts of Osterfjorden and Veafjorden have been given the status of national salmon fjords, where fish farming is forbidden. More than 100,000 migrating smolt have been released in the river. The hydrochemistry in the river and in brackish water, and numbers of escaped farmed salmon and rainbow trout, are being continually monitored to control threats. Moreover, comprehensive steps are being taken against sea lice in the aquaculture facilities along the migration route of the smolt.

As part of a national project in the Norwegian salmon fjords, the Norwegian Institute for Marine Research and UNI Research are following the trend of the Vosso salmon with regard to the impact of the sea lice on the survival of the smolt and their return to the river and other factors. Using the released smolt, the rescue operation has been successful in building up the spawning stock in recent years. The aim is that the population will become re-established and survive without such intervention measures.

Seabirds

The national monitoring programme for seabirds monitors variations over time in the breeding and wintering populations of key species of seabirds, and started up in 1988. This programme is

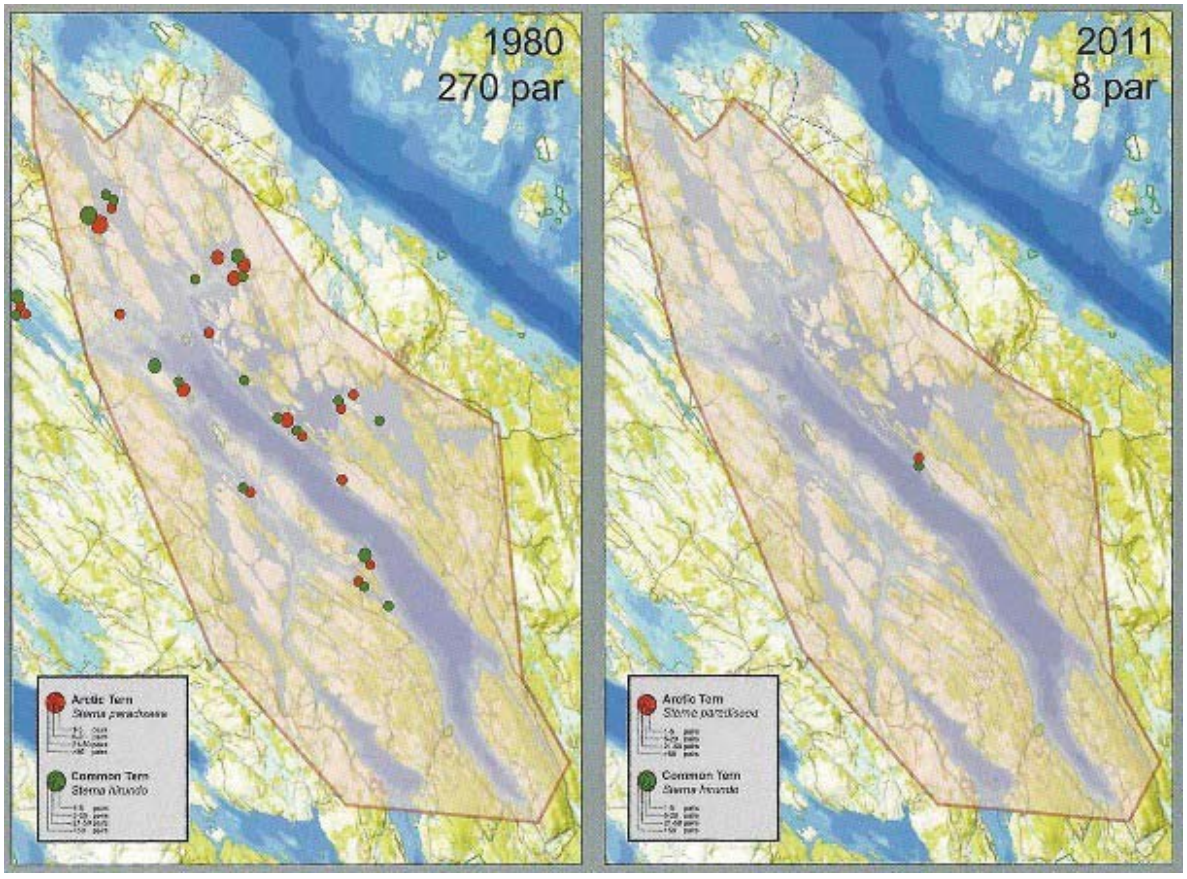


Figure 16.2: Breeding populations of arctic terns (Sterna paradisaea) (red dots) and common terns (Sterna hirundo) (green dots) in Lurefjorden in 1980 and 2011, showing a decline of 97% over 30 years. ©County Governor of Hordaland 2012/ Stein Byrkjeland.

funded by the Norwegian Environment Agency, while the Norwegian Institute for Nature Research has the scientific responsibility. To identify which negative factors are most important, research is undertaken in cooperation with SEAPOP (SEAbird POPulations)- a milestone for mapping and monitoring of seabirds in Norway, which maps and monitors seabirds to obtain fundamental knowledge in order to improve the management of the marine environments. SEATRACK aims to map the non-breeding distribution of seabirds breeding in colonies encircling the Barents, Norwegian and North Seas, which includes colonies in Russia, Norway incl. Svalbard and Jan Mayen, Iceland, the Faroe Islands and Great Britain. It is intended to supply knowledge about the marine areas to which seabirds migrate, and hence the environmental threats facing these vulnerable populations. Within the proposed BR, which includes 30 seabird sanctuaries, the environment departments at the County Governors' offices in Hordaland and Sogn & Fjordane perform the practical monitoring work. As on much of Norway's coast, a large decline in the numbers of many species of seabirds has been registered, including a huge drop in the breeding populations of terns in Lurefjorden from 1980 to 2011 (Figure 16.2). The massive fishing of herring in the North Sea (Figure 16.3) and brisling in the fjords of western Norway were major contributory factors to these declines. The herring population has now strongly increased, but the seabird populations have not increased yet.

Water areas in Nordhordland

The Ecosystem monitoring in fresh water (ØKOFERSK) programme monitors a large number of lakes each year. The River Series records the levels and any changes in the chemistry of Norwegian

watercourses, with a focus on the effects of long-transported pollution and climate changes. Monitoring the state of limed salmon watercourses in Norway documents the hydrochemistry and biological effects of liming in watercourses that contain salmon.

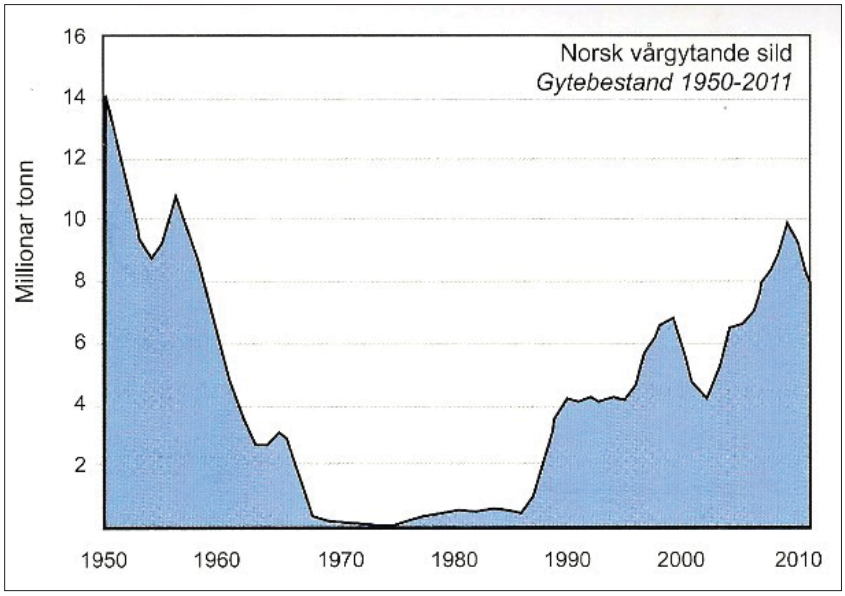


Figure 16.3: Changes in the spawning herring stock in Norway from 1950 to 2011. © County Governor of Hordaland, 2012.

Nordhordland is one of five areas in the Hordaland water region. Hordaland County Council is the water region authority. The monitoring programme for the Hordaland water region aims to provide the basis for future monitoring measures in this region. The programme also points to which water bodies need further investigation in order to attain the goals of the Water Framework Directive. The proposed basic monitoring of the water region is also given, and an overview of the obligatory and voluntary monitoring of the water bodies in the water region, including in Nordhordland. The County Governor of Hordaland has led the work of preparing this monitoring programme, in cooperation with other sectoral authorities, project managers in the water areas, and the water region authority. Water management in accordance with the Water Directive is intended to be holistic and to be coordinated across all sectors using and affecting the water. Fresh water and coastal waters must be considered in relation to one another. Nature's own limits should guide the limits for how the water in the water region is protected and utilised. Environmental targets have been stipulated for all water bodies. Water is now to be managed in keeping with these. This work is in accordance with the EU Water Framework Directive and part of a joint European effort to give a common framework for all water bodies in Europe, from the smallest streams to the largest lakes and the most extensive coastal areas.

The ecological state of all water bodies was mapped in 2012, and in 2013 suggestions to take action where there was a risk of the ecological state of the water being too poor were presented. All the data were entered into the www.vann-nett.no database, available for everyone. An analysis of steps taken for Nordhordland has now been prepared, based on proposals made by the local authorities and the sectoral authorities that are responsible. A sustainable management of water resources helps to make positive contributions to both regional and local development. The water resources must not be consumed, and manufacturing must not contaminate them so that their state becomes worse. Clean water is important for several commitments in the county. Good water quality is important for both industry and people. It is vital for the fisheries and the aquaculture industry. Industry is dependent on a good and reliable water supply. Water is also important for tourism, outdoor life, recreation and quality of life in general.

The monitoring programme for freshwater pearl mussel (Margaritifera margaritifera)
Rådgivende Biologer AS have been undertaking research since 2007 to determine the status of freshwater pearl mussels and to follow the trend of the population in Hordaland. This documents

the state of the populations and changes in the watercourses where they occur. The monitoring locations are widely spread and show great variation in the distribution and density of the mussels. The freshwater pearl mussel is identified on the Norwegian Red List as *Vulnerable* (VU), and on the IUCN Global Red List as *Critically Endangered*. Thirty per cent of the locations and 50% of the individuals of the species are found in Norway, but many populations are also declining in Norway. In the proposed BR, the River Mjåtveit in Meland, used to have a viable population. There is a small population in the River Lone on the island of Osterøy. Freshwater pearl mussels are vulnerable to impacts, and the population here has become smaller and smaller over time.

16.1.2 Summarize past research and monitoring activities related to the biosphere reserve management (please refer to variables in Annex 1)

Marine research

There has been an extremely high research activity in the marine area in the proposed BR, particularly the ecosystems linked to Masfjorden, Lurefjorden and Lindåsosane, in the past 50 years. More than 100 peer-reviewed scientific articles based on observations from these areas have been published since the 1970s. The research has mainly been conducted by the largest marine research institutions in the Norway, the University of Bergen and the Norwegian Institute of Marine Research in Bergen. Many scientific issues have been considered, particularly on the four major topics summarized below: 1) The herring strain in Lindåsosane, 2) Lindåsosane as a model for the sea, 3) The ocean grazing programme for cod, and 4) Light as a driver of ecosystems.

The herring strain in Lindåsosane (Lindåspollene)- Lindåsosane has a local, "fossilised" herring strain that can be traced back at least 6000-7000 years. The herring spawn grow up and live their entire life cycle without leaving Lindåsosane. The population is today about the same size as around 1960-1970, and local, small-scale, sustainable fishing has taken place using lines and nets. This herring population and the special environmental conditions in Lindåsosane have been the subject of studies of the population structure, migrations, growth, spawning behaviour, and recruitment of herring. These studies have brought new knowledge about the links between different populations of herring. For instance, it has been shown that Norwegian Spring-spawning Herring (NVG) enter Lindåsosane and spawn with the local herring. The environmental conditions in Lindåsosane have resulted in this ecosystem being a very widely used locality for research on fish populations and studies of factors that influence growth, recruitment and behaviour. In cold winters, there is ice on the surface in Lindåsosane that hinders boat traffic. Such periods can be ideal for studying underwater sound communication, as it has proved almost impossible to perform similar research in open water in fjords and the sea because of extraneous noise.

Lindåsosane as a model for the sea- Ever since research began in the proposed BR, and particularly in Lindåsosane, in the 1970s, scientists have been aware of the unique conditions that make these small fjord arms a miniature sea. The shallow thresholds reduce the exchange of water and make the system more or less enclosed. This creates good conditions for detailed observations of ecological processes and energy flow in the food chain. This is important for building models that simulate ecosystems, including, for example, concentrations of nutrients, uptake from algae, vertical transport of organic carbon, and grazing of zooplankton. The benchmark model for the ecosystem in the Norwegian Sea (NORWECOM), now used by the Norwegian Institute of Marine Research to advise the authorities on the use of resources and future effects of climate, was originally made and developed on the basis of knowledge from Lindåsosane.

Ocean grazing programme for cod- In the mid-1980s, when stocks of both the coastal cod and the North-east Arctic cod were greatly reduced, steps were taken to try to increase the local cod populations along the Norwegian coast. One of these projects took place in Masfjorden from 1985 to 1991 and focused on whether releasing cod fry might help to increase the population. Even though this proved to have very little effect, new knowledge was acquired about a number of components of the ecosystems – both generally and locally. For instance, primary production, food availability, carrying capacity, survival of cod fry, and competition and links between and within the various fish species were calculated, as well as how various environmental factors influence these.

Light as a driver of ecosystems- In the last 10-15 years, there has been a research focus on the role of light in structuring ecosystems. Some of the earliest work in a global context, on the role of light in the distribution of pelagic organisms in the water column, was done in Masfjorden in the 1980s. Recently, the differing environmental conditions found in Masfjorden (clear water) compared with Lurefjorden (darker water) have been used to increase our knowledge about the role of light for other topics than species distribution. For instance, it has been found that dark fjords are dominated by jellyfish whereas fjords with clear water have more fish (see Section 11.6). Light is also important for the kelp forests. A decline in kelp forests is reported from several parts of the coast, and can partly be explained by less access to light. This is a relevant problem because it seems that the coastal waters have become darker in the last 100 years. In addition, extrapolations of a warmer climate in the North indicate more precipitation and increased plant growth on land. This means that more and browner fresh water will flow out into the fjords, resulting in darker water along the coast. The dark Lurefjorden can therefore act as an example of what the future holds.

Ecosystems, climate and variation in a "mini-marine ecosystem": a west Norwegian fjord- Based on the marine tradition and the marine infrastructure available in the region through cooperation between the research vessel operated by the University of Bergen and the Norwegian Institute of Marine Research, the Institute of Bioscience offers students practical experience in marine subjects and courses that is held on the research vessel and at field stations. This is internationally unique, and marine subjects at the Department of Biological Sciences therefore attract students from countries that do not have such facilities.

Other mixed research

The Lindås project (1971-1977) was a major cross-disciplinary environmental project on the relationship between the historical development and the development of society in the coastal landscape up to the construction of the oil refinery at Mongstad. Nineteen science, social science and cultural history researchers took part in the project, which was funded by the Research Council of Norway and the University of Bergen. The project resulted in great knowledge about the value of the heathland landscape for farming in the coastal settlements from the Stone Age to modern times. The Lindås project was followed up by the opening of the Heathland Centre at Lygra and many subsequent botanical research projects in the area and along the west coast of Norway.

Atlantic heath (1987-1992) *Coastal heath in western Norway and Trøndelag*. *Habitat and vegetation at risk*. A project by Økoforsk (now the Norwegian Institute for Nature Research) to undertake a botanical inventory of heathland along the west coast of Norway. Fieldwork was carried out in 1987 in Hordaland and Sogn & Fjordane, and in 1988 in Møre & Romsdal with supplementary work in Hordaland, Sogn & Fjordane and the Trøndelag counties. 94 localities, including 27 in Hordaland, were described with respect to delimitation, type of heath, state, encroachments, etc. based on a total evaluation of their botanical qualities. The project was funded by the Ministry of the Environment.

The Norwegian Ornithological Society (2008-2012) carried out a nationwide project to map the occurrence of the eagle owl, partly as a follow-up of the national action plan for eagle owls launched in 2009. In 2012, the mapping project was replaced by eagle owl monitoring in selected regions. There are eagle owls in the proposed BR.

The HEATHCULT Project was an EU information project (in the Raphael programme) on the European heath landscape, in which 15 institutions from 8 countries participated. The project received broad exposure through a display on the outside of the wall of the Norwegian pavilion at EXPO 2000 in Hannover and an exhibition at the present Lüneburg Heath Nature Park. An international travelling exhibition was also made, and a book on the European heath landscape was published in four languages. The University of Bergen and the Heathland Centre organised the project.

The HeathGUARD Project (Conservation and management of North European Coastal Heathlands) was an EU project (European Heritage Laboratories/CULTURE 2000 Programme) in which the operation and management of four heathland reserves in Portugal, Germany, Scotland and Norway were compared. The project was run by the Heathland Centre.

The Wild sheep Project – A Research Council of Norway project in its Land use programme (2007-2010) "*Outwintered sheep in coastal heathland – local business development in a vulnerable cultural landscape*". The main objective was to acquire essential knowledge on ecology, economy, and animal health and welfare, in order to make the keeping of outwintered sheep along the Norwegian coast sustainable. The basic idea was that a combination of business activity and landscape management would be the most practical and cost-effective way of protecting Norwegian coastal heaths in the future.

Invaliens – A Research Council of Norway project in its ENVIRONMENT programme (2008-2011) "*How to prevent invasion of alien species into urban hills and coastal heathland ecosystems*" undertook research on how the introduced tree species, Sitka spruce (*Picea sitchensis*) and mountain pine (*Pinus mugo complex*) affect species diversity in the Norwegian countryside. Sitka spruce now figures on the Norwegian Black List of Alien Species. Studies of its life cycle (population dynamics) and ability to disperse show that it can become established in the same types of coastal heath as ordinary spruce, and that the risk of dispersal in an early succession phase, for instance following heather burning is particularly critical.

SeedClim – A Research Council of Norway project in its NORKLIMA programme (2008-2012) "*The role of seeds in a changing climate - linking germination ecophysiology to population and community ecology*". The general aim of SeedClim was to give a mechanistic understanding of how ongoing and future climate changes influence plants on landscape and regional scales. To achieve this, a new methodological framework was developed which makes it possible to investigate how climate changes act on the two major climate gradients – temperature and precipitation – and how these effects scale over organisation levels from individual people via populations to local communities. Some of the field sites are in Stølsheimen in the proposed BR.

The Institute of Geography, University of Bergen has undertaken a project linked with education and recruitment, entrepreneurship, innovations and regional business and industry development in the proposed BR. Health investigations, including some linked to the workplace environment in the petroleum industry and following the explosion in Sløvåg in 2007, have been undertaken in the business cluster surrounding the oil refinery at Mongstad. The importance of bringing this kind of

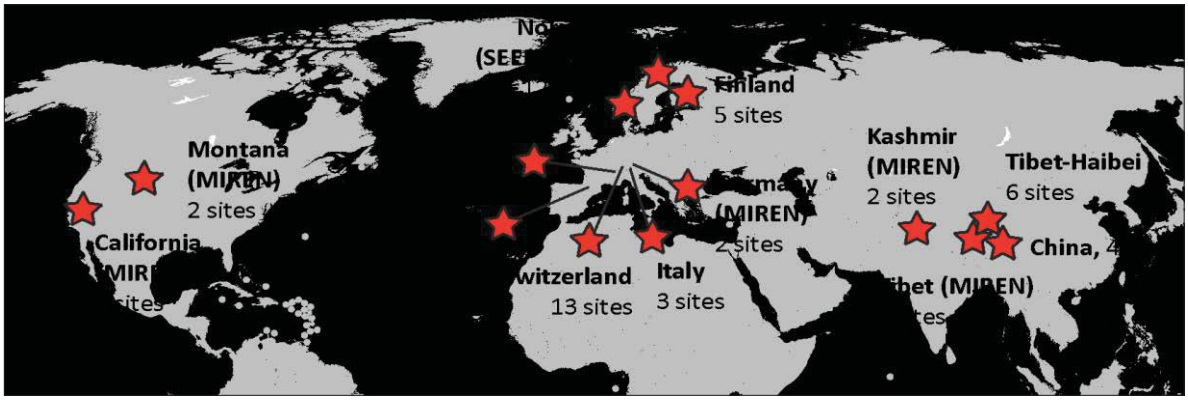


Figure 16.4: Map showing the TransPlant network of experiments on transplanting vegetation communities, including more than 60 sites spread over three continents. Map: Vigdis Vandvik.

knowledge in the region up-to-date and comparing it with projects elsewhere is useful for business and industry, the policy implementation system, and the authorities. Such knowledge is also used in education in regional development, social planning, and business development – as it is relevant for business decisions, strategic business planning, and work on regional development strategies. The research project "*Local authorities and large business concerns in interplay for business development and reorganisation*" (2014-2017), in cooperation with the University of Linkøping was concerned with the reorganisation of business and industry, and technological development at Mongstad, regional strategies and cooperation between industry and upper secondary schools in relation to training in vocational subjects, social innovations and regional development.

International cooperation on higher education that includes the proposed biosphere reserve
RECITE – A Research Council of Norway project in its INTPART programme (2018 – 2021). "*Research and Education Partnership in Climate Change Impacts on Terrestrial Ecosystems*". Recite is a follow-up of the two projects described below.

TransPlant – A Centre for Internationalisation of Education project (2014 – 2016), which was part of the Research Council of Norway UTFORSK programme. It aimed to strengthen the relationship between higher education and international research cooperation.

TraitTrain- A Centre for Internationalisation of Education project (2016 – 2018). "*Comparing climate change impacts on High North vs. Alpine ecosystems through research and training in trait-based approaches*" continued from TransPlant and is one of the High North programmes from the Centre for Internationalisation of Education. Its aim is to extend, strengthen and spread knowledge about, or relevant to, the High North.

16.1.3 Indicate what research infrastructure is available in the proposed biosphere reserve, and what role the reserve will play in supporting such infrastructure

The UNESCO Chair at the University of Bergen
The incumbent of **the UNESCO Chair** in *Sustainable Heritage and Environmental Management – Nature and Culture* (see Section 16.1) will focus on promoting the proposed BR in research, coordinating research cooperation, and implementing the UN Agenda 2030.

Infrastructure that advances research and its dissemination

The Heathland Centre at Lygra is an important location for research, teaching and disseminating knowledge about the coastal landscape, old ways of farming, and biological diversity. It has good facilities for research; many major projects on coastal vegetation and the Norwegian outwintered sheep ("wild sheep") have been undertaken here. Much research-based teaching on the environment has been carried out for pupils from primary, junior and secondary schools to university students. Walks for kindergarten children have also been organised, designed to let them experience small and large miracles in nature. Theoretical and practical courses on coastal heath management have been organised for farmers, including professional heather burning and handling of fires in heathland landscapes as important topics. There has also been wider interest in these courses, which have been held for farmers' associations in every coastal county and for fire services in various parts of the country, and even in Denmark. The activity at the centre shows how a local commitment in the proposed BR can be utilised in other parts of Norway and even in other countries. The Heathland Centre has close cooperation with the University of Bergen and a broad international network. It has been involved in several international conferences on sustainability, such as the UNESCO conference "*Using Natural and Cultural Heritage in Sustainable Development*" in 2014.

The Norwegian Institute of Marine Research field station at Matre

The research station at Matre in Nordhordland opened in 1971 and has been one of the pillars in the development of modern aquaculture ever since. Several methods developed there are now in use throughout the world. The station is an important platform for the research performed by the Norwegian Institute of Marine Research in aquaculture, fish experiments and marine research. This includes experiments with anadromous salmonids in all stages at sea and on land, marine species and wild fish caught in rivers. The facilities at the station and the skills of its staff are wide ranging. The fish laboratory can be adapted to many requirements, and the chemical laboratory can perform many analyses. The facilities are also suitable for trials on wild fish that have been caught, including mackerel, herring, Atlantic horse mackerel and similar species. Several important experiments have been made in recent years related to fisheries and fundamental biological understanding of such

Photo 16.3: Course participants training in professional heather burning to improve the pasture in coastal heathland. Photo: Mons Kvamme.

species. The opportunities available to control the water quality in tanks on land offer very many possibilities for studying the effects of climate change, acidification in the sea, effects of pollution, and so on. The station has a 50-foot catamaran aquaculture boat equipped with a crane, net and winch, which can be used for fieldwork.

16.2 Education for sustainable development and public awareness

Education on, and integration of, sustainability in every segment of society in Nordhordland follows two different tracks. One is the formal guidelines given by the Government to implement the **UN Sustainable Development Goals** (SDGs) of Agenda 2030 in every part of society. The other comprises the larger and smaller, formal and informal initiatives, in which municipality and county councils, schools, firms and special interest organisations are engaged.

In Report no. 24 (2016-2017) to the Storting, the Government indicates that the SDGs should be integrated into every part of Norwegian society (see Chapter 13). The Government placed priority on certain goals, particularly on those most relevant for Norwegian society or the ones where Norway can contribute skills and resources in a global context. At an operative level, individual Ministries are given responsibility to follow-up the goals that belong in their sphere of responsibility. Sustainability should be an element in the Government's budget proposal.

The report also states that sustainability should be part of the school's education plans at every level: "*As far as spreading knowledge about the SDGs is concerned, the recommendation by the Ministry of Education to include the SDGs as part of the curriculum in schools is valuable*". Knowledge and teaching sustainability will therefore be increasingly important in schools in the time to come.

In Nordhordland, both public circles and private interests show varying commitments to sustainable development. It is important that the inhabitants receive information about, and become involved in

Figure 16.5: The UN Sustainable Development Goals are important in the work of the proposed Nordhordland BR. Illustration: United Nations.

this work. Several local organisations have already built up much of their activity around sustainable development, such as 'Sustainable life' in Meland, a grassroots movement for developing and practising sustainable behaviour at the local level.

16.2.1 Describe existing and planned activities, indicating the target group(s) and numbers of people involved (as "teachers" and "students") and the area concerned

With education linked to sustainable development, the people of Nordhordland will become aware of the connections between action and environmental consequences. They will learn to understand the relationships between ecological, economic and social conditions in a sustainable context and extend these to their everyday life. Most of the teaching on sustainability is within the ordinary school system, from kindergartens to primary, junior and lower secondary schools and upper secondary schools. Nordhordland has a well-developed network of kindergartens and primary, junior and lower secondary schools, as well as three upper secondary schools offering a variety of courses. There are also two Folk High Schools that focus on tourism and music. Bergen has a broad offer of vocational training and education at the university level that directly concern sustainability. In addition, the region has many museums that have programmes which disseminate targeted information on sustainability.

Teaching in primary, junior and lower secondary schools and upper secondary schools
In 2016, the Norwegian Parliament determined that sustainable development must be a prioritised multidisciplinary topic in new curricula. In the school curriculum (primary, junior and lower secondary schools, upper secondary schools), teaching sustainable development is important and is adapted to various age levels. The United Nations Association of Norway is entitled to comment on this work. We refer to its comments, which propose different plans for primary, junior, lower secondary and upper secondary levels. These plans are developed together with teachers and pupils, and are up-to-date and of high quality. The teaching plan "Sustainability" (www.fn.no/undervisning/baerekraft) proposes cross-disciplinary teaching which is intended to make it easy to:

- show pupils how the world is connected
- get pupils committed to sustainable solutions
- stimulate critical thinking amongst pupils
- give pupils skills and tools to act in favour of sustainable development

The Ministry of Education and Research is responsible for two important school-related projects in which experiencing and learning about nature are central: The Nature Satchel (natursekken.no) and the *network for teaching about the environment* (miljolare.no). Both of these have a series of offers for every level in schools, about outdoor activities for learning about nature and sustainable development in practice. The school laboratory for scientific subjects at the University of Bergen coordinates this work in cooperation with the universities in Oslo and Trondheim.

We envisage that in Nordhordland, the BR organisation can help to supply more knowledge on teaching in this subject at a local level. We aim to get a teaching plan in place that is locally relevant and that can be combined with an overarching teaching plan for overall sustainable development.

Teaching at the university and college levels
The fjord and coastal systems in the proposed BR have had a foremost place in many topics taken up in the teaching of marine biodiversity, fishery biology and marine biology at the University of Bergen over the past 40 years. The unique contrasts in environmental conditions, and hence

ecosystems, between the various fjords have made this area a favourite location to take samples in connection with the teaching. For instance, samples taken in Masfjorden resemble those found in the open sea, whereas samples from the innermost part of Lindåsosane more closely resemble those from the Baltic Sea or the Black Sea. Today, most of the material from the proposed BR used in teaching is within the BIO325 Marine Research course (20 students per year); BIO102 Organism Biology 2, which focuses on marine and terrestrial ecology (100 students); and BIO250 Palaeo-ecology (20 students). In addition to these formal courses, higher-level education, and MSc and PhD degrees have used the proposed BR for observations, field localities and experiments for a long time. In addition to more than 200 research articles, some 80 MSc theses and 50 PhD theses have been based on scientific research in the proposed BR. International student exchange is another important activity which has used the proposed BR as a field area.

Other offers of education

There are several museums and cultural institutions in the region, and some have the environment, climate and sustainability as principal aspects of their dissemination activities.

Table 16.1: Institutions in the proposed Nordhordland biosphere reserve that disseminate information focusing on sustainable development.

Institution	Teaching	Target group	Visitors in 2016
Heathland Centre	disseminates knowledge on sustainable resource utilisation linked to use of the traditional heathland landscape	Teaching: kindergartens, primary, junior and lower secondary schools, upper secondary schools and the university The general public: families	11,500 Teaching 1,640
Osterøy Museum	disseminates knowledge on regional cultural heritage and traditions	Teaching: kindergartens, primary, junior and lower secondary schools, upper secondary schools and the university The general public: families	3,000 Teaching 300
Coastal Museum in Øygarden	disseminates coastal culture from the perspective of the history of energy, where sustainability is a central element	Teaching: kindergartens, primary, junior and lower secondary schools, upper secondary schools and the university The general public: families	6,800 Teaching 2,290

16.2.2 What facilities and financial resources are (or will be) available for these activities?

Most of the funding will come through public grants and public subsidies, but the BR organisation envisages a great potential for increased private funding. An application to Sparebanken Vest for a project on sustainable development for children and young people in the region has already been sent. There is no concerted effort or central driver for information on sustainable development in the proposed BR today. This is why the BR organisation has placed information on, and activities linked to, the local follow-up of the SDGs as one of its most important tasks (see Section 13.1.1). The organisation will work closely together with local authorities in the region, regional authorities (Hordaland County Council and the County Governor of Hordaland), the business community, the museum sector, and societies and organisations to achieve this.

16.3 Contribution to the World Network of Biosphere Reserves

The Nordhordland BR organisation has international collaboration, particularly linked to the World Network, as one of its ten strategic goals (see Section 13.1.10). The organisation is already strongly involved in this network, and has at the same time taken on a role to help to develop proposals for more Norwegian BRs. The incumbent of the UNESCO Chair at the University of Bergen will continue this involvement in cooperation with existing projects and research groups in the region.

16.3.1 How will the proposed biosphere reserve contribute to the World Network of Biosphere Reserves, its regional and thematic networks?

The proposed Nordhordland BR is already active in the international MAB network. Representatives from the BR organisation have participated in all recent EuroMAB meetings. Even though Nordhordland is not yet formally established as a BR, it took part as one of few pilot BRs in the new MAB "branding process": a very beneficial experience.

The BR organisation is very active in NordMAB and hosted its annual meeting in 2016. Representatives of the proposed Nordhordland BR also took part in the MAB World Congress in Lima in 2016, where plans for the proposed BR were presented. Together with several other BRs, Nordhordland is involved in an EU funded project (SHAPE) to develop sustainable tourism (see Section 15.2).

Participation in these networks demonstrates our interest, but our ambitions are even greater. International work, both directly through the World Network and indirectly through our close cooperation with research and educational institutions, will be paramount for the activity of the BR. We believe the network of BRs will have fundamental significance for sustainable development around the world. We work closely together with the other Nordic BRs to develop strategies to ensure that the BR organisations are a central force for nations developing in a sustainable direction.

16.3.2 What are the expected benefits of international cooperation for the biosphere reserve?

Many business and industry in Nordhordland are international and have the whole world as their market. However, as a region, Nordhordland has a fairly limited international network. The establishment of the Nordhordland BR may therefore have great significance for the region. This is one of the most important reasons why the local authorities in Nordhordland support the commitment to the BR. Through the BR, they may be able to establish contacts, share and exchange knowledge, not just with other BRs, but indirectly with regions experiencing corresponding problems around the world.

Representatives for the local authorities in the region have already participated in several international gatherings arranged by MAB and have been on study trips to existing BRs. We have also received delegations from other BRs with specific challenges we have been able to help solve. This work will improve when the BR is officially established. The benefit in this context will be linked to the exchange and sharing of knowledge and experience, and showing pride for the distinctive character of the BR. We also expect more research cooperation with other BRs through the NordMAB network in the Nordic countries, the EuroMAB network in the rest of Europe and North America, and the UNESCO Chair/UNITWIN agreement between UNESCO and the University of Bergen. By using these networks actively, we can substantially increase research linked to the UN Agenda 2030.

16.4 Internal and external communication channels and media used by the biosphere reserve

The region has concentrated specially on communication in connection with the plans to establish a BR in Nordhordland. At the start of the project, a communication plan was drawn up, and this has been updated and extended as the project advanced. The plan is built around a great degree of openness and dialogue with, and involvement of, all interested parties. This has been fundamentally important for the development of the project. A person who is responsible for communication works part-time in the project.

16.4.1 Is (will) there (be) a biosphere reserve website? If yes, what is its URL?

The proposed Nordhordland BR has had an active website for several years. It has an editor, and the working committee for the BR function as an editorial council. The website URL is: http//www.nordhordlandbiosphere.no/.

16.4.2 Is (will) there (be) an electronic newsletter? If yes, how often will it be published?

It is not produced an electronic news letter from the BR. From the outset, all communication has been electronic and the website functions as a central communication hub where news is posted.

Photo 16.4: Tuition at the Heathland Centre. Photo: Mona Karstensen.

The BR organisation has produced targeted information for interested parties or in connection with particular commitments or projects. An annual report is also prepared and is publically available upon request. We have so far chosen to concentrate on electronic media, with existing media such as newspapers, radio and TV as channels for information on the BR.

16.4.3 Does (will) the biosphere reserve belong to a social network (Facebook, Twitter, etc.)?

Nordhordland is on Facebook, and the proposed BR has its own page. Instagram, Twitter and other social media platforms will eventually be used as they are important means of getting into contact with the younger generation.

Lygra, Lindås. Photo: Inger E. Måren.

17 GOVERNANCE, BIOSPHERE RESERVE MANAGEMENT AND COORDINATION

17.1 Management and coordination structure

The proposed Nordhordland BR is now a project organisation under Nordhordland Regional Council. The organisation is based on an agreement to collaborate signed in 2013 by Nordhordland Regional Council and the University of Bergen to prepare an application for BR status and for future research cooperation in the BR.

Nordhordland Region Council owns the project and its executive body. Nordhordland Development IKS, has had the responsibility as the project manager while the application is being prepared.

All the local authorities that are linked to Nordhordland Regional Council take part in the project. These are Austrheim, Fedje, Gulen, Lindås, Masfjorden, Meland, Modalen, Osterøy and Radøy. In addition to these, Øygarden, Vaksdal and parts of Askøy, Bergen, Voss, Vik and Høyanger will also be part of the BR.

The ultimate management and organisation structure will be decided in connection with the development of a strategy for the BR (Management plan). This will take place during 2018 and 2019. In the following, we describe the existing organisation structure, but stress that the steering committee for the project has given the following provisions for the ultimate organisation of the BR:

iv. The organisation of Nordhordland BR must be viewed in direct relation to the tasks and the function of the BR. Before the ultimate organisation form is adopted, the objectives and statutes of the organisation must be in place.
i. The organisation model must not bind us to an organisational structure from which we do not benefit over time. It should be dynamic so that it can be adjusted to differing future scenarios.
ii. It is important to have great openness and that all (particularly societies and organisations) are included in the management of the BR.

17.1.1 What is the legal status of the biosphere reserve?

The Nordhordland BR will embrace 11 entire municipalities and parts of 5 more municipalities in the counties of Hordaland and Sogn & Fjordane. The municipality councils in the 11 municipalities have formally debated and agreed to the application to become a BR.

Nordhordland BR has no statutory or legally binding status in relation to Norwegian law, because the designation is neither limiting nor excluding, except that the Statutory Framework for the World Network of Biosphere Reserves requires at least one legally protected core area and an attached buffer zone.

17.1.2 What is the legal status of the core area(s) and the buffer zone(s)

Core area and buffer zone complex 1: Lurefjorden and Lindåsosane
The Ministry of Climate and Environment has begun a procedure to protect this core area in accordance with the "*Act of 19 June 2009 No. 100 Relating to the Management of Biological, Geological and Landscape Diversity (Nature Diversity Act*)" § 39 (marine protected areas). A draft document has been drawn up for "*Regulations relating to the protection of Lurefjorden and Lindåsosane marine protected area in the municipalities of Lindås, Radøy and Austrheim, Hordaland*" pursuant to § 34 of the Nature Diversity Act. Following an extensive consultation, the County Governor of Hordaland has supported the protection of the fjord, including Lindåsosane. The protection procedure is expected to be completed in 2019.

The buffer zone: The intention is to limit pollution reaching Lurefjorden. In case 046/10, on 2 September 2010, Radøy Municipality Council adopted "*Local regulations concerning discharges from small sewage plants for the municipality of Radøy*". On 2 September 2015, Lindås Municipality Council adopted a "*Municipal subplan for Lindåsosane, Lygra and Lurefjorden*" pursuant to the Planning and Building Act §11-1, 3rd paragraph and § 11-5. The regulations, along with the map, are legally binding for future land use (cf. § 11-6 of the Planning and Building Act). The municipal subplan contains a series of environmental measures to protect outdoor life, agriculture and the natural environment (on land and in the sea).

Through the Nordhordland Regional Council and the County Governor of Hordaland, the local authorities are cooperating on measures to fulfil the EU Water Framework Directive. The intention is to issue a local regulation for the discharge of sanitary waste water from dwellings and leisure homes. It is planned to adopt this in 2019. The local authorities of Lindås, Radøy and Austrheim have areas that are within the Lurefjord catchment area. The new regulations will set strict demands for sewage plants which drain in to vulnerable water bodies, including the areas that drain to Lurefjorden.

The Directorate for Cultural Heritage began a project in 2013 to record "*Cultural historic landscapes of national interest*". Lurefjorden was chosen because the area has high cultural historic qualities due to Stone Age settlements beside the tidal currents, the heathland landscape at Lygra; the world's northernmost, self-generating beechwood at Vollom; and, not least, the safe water way along the west coast – the inner passage.

Core area and buffer zone complex 2: The national salmon fjords at Osterøy
The Government proposed the protection of the national salmon fjords at Osterøy in "*Proposition no. 32 (2006–2007) to the Storting on the protection of wild salmon and the commissioning of national salmon rivers and salmon fjords*" which was adopted by the Norwegian Parliament on 15 May 2007. On 22 June 2009, the Ministry of Trade and Fisheries issued, pursuant to the "*Act of 17 June 2005 no. 79 on aquaculture (the Aquaculture Act)*", the "*Regulations concerning special demands on aquaculture-related activity in or near national salmon rivers and national salmon fjords*" with numerous environmental demands regarding the operation of aquaculture plants.

The national salmon fjords constitute the core area. The focus for the core area is to ensure that the six threatened wild salmon populations will have sufficiently good living conditions that they can survive and form a basis for sustainable fishing, as had been the case for many thousands of years until the 1990s.

The buffer zones: The salmon fjords are narrow and deep (100 – 350 m b.s.l.) and are steep-sided, up to 600–800 m (see Figure 7.7 in Section 7.4). The steep sides form a natural, sharp, terrestrial buffer zone along the fjords. The marine buffer zone is meant to help the smolt migrate out of the fjords with as few as possible negative impacts from human activity. The main hazard in the buffer zone is serious infection by sea lice which kill the smolt. The population of lice has increased because the trout and salmon farms in the buffer zone provide an unnaturally high number of hosts for these parasites. The Regulations given in 2009 by the Ministry of Trade and Fisheries laid down stringent limitations on fish farming in and near the national salmon fjords. The Norwegian Food Safety Authority published 5th December 2012 regulation No 1140 strict requirements to limit the sea louse population (see Letter of 24.05.2018 in section 19.3: "*Regulations that protect wild salmon in Norway*"). All aquaculture plants along the route taken by the smolt swimming along the fjords and out into the sea are ordered to keep the sea lice concentration below a specific level, to protect the smolt in the migration period. This prescription seems to be having a positive effect, by helping to protect the emigrating smolt.

In addition, Osterøy Municipality Council has taken an initiative for a procedure that will limit the negative effects of fish farming for the marine environment, by introducing development concessions for aquaculture companies that want to try new ways of reducing the environmental load on the fjords in the buffer zone.

Core area and buffer zone complex 3: River Loneelvi

The River Loneelvi is protected pursuant to "*Proposition no. 4 1972-73 to the Storting Concerning the Protection Plan for Watercourses*", "*The Supplement to the Protection Plan for Watercourses*" (2005) and § 32 of the "*Act relating to Watercourses and Groundwater (The Water Resources Act)*" of 24 November 2000. The protection of the River Lone covers both the river course (the core area) and the catchment basin (the buffer zone). Under the terms of the Planning and Building Act, Osterøy Municipality Council has established a 50 m-wide core area for the River Lone and its tributary streams.

Core areas and buffer zone complex 4: Stølsheimen

Stølsheimen Landscape Protected Area was established on 21 December 1990 by a Royal Decree pursuant to the "*Nature Conservation Act of 19 June 1970*". "*Regulations concerning the protection of Stølsheimen Landscape Protected Area in the municipalities of Høyanger and Vik in the county of Sogn & Fjordane, and Modalen, Vaksdal and Voss in the county of Hordaland, dated 21.12.1990, no. 1087*", were issued pursuant to the Act of 19 June 1970 no. 63. The Landscape Protected Area forms the boundary of the buffer zone within which the core areas are located.

The core areas: There are 31 core areas:

- 6 cultural heritage sites in Askeladden database (Table 19.1) are protected by the Cultural Heritage Act of 9 June 1978 no. 50 because they predate the Reformation (AD 1537)
- 7 undated cultural heritage sites in Askeladden database: 5 house ruins (tofts) and 2 reindeer hunting pitfall traps which may predate the reformation.
- 18 additional undated house ruins (tofts) documented in the official ancient monument map in the management plan of 1998.

The "*Regulations concerning the protection of Stølsheimen Landscape Protected Area in the municipalities of Høyanger and Vik in the county of Sogn & Fjordane, and Modalen, Vaksdal and Voss in the county of Hordaland, dated 21. 12. 1990*" provide a series of prescriptions:

"All encroachments or activities that may alter the nature or character of the landscape are forbidden, such as erection of buildings, plant and permanent installations, removal of, or encroachments upon, fixed, post-Reformation, cultural heritage sites, such as buildings, roads and old livestock pens, erection of aerial cables, road building, land drainage and other means of making land dry, extraction, land filling, levelling and storage of earth and rock, mining and quarrying, watercourse regulation, dumping of rubbish, manuring and usage of chemical substances, and discharge of concentrated pollution, etc. The list is not exhaustive.".

The above paragraph states that "*encroachments upon, fixed, post-Reformation, cultural heritage sites, such as buildings, roads and old livestock pens*" are forbidden. Consequently, all 31 cultural heritage sites that are either recorded in the Askeladden database, or whose location are mapped in the "*The Management Plan for Stølsheimen Landscape Protected Area (1998)*" are legally protected.

The buffer zone: The Landscape Protected Area comprises the buffer zone for the core areas. The right of common access applies in the Landscape Protected Area, but many restrictions are stipulated.

17.1.3 Which administrative authorities have competence for each zone in the biosphere reserve (core area(s), buffer zone(s) and transition area(s))?

The core zones:

- The marine protected area in Lurefjorden: The County governor of Hordaland
- The national salmon fjords at Osterøy: Directorate for fisheries and The Norwegian Food Safety Authority
- River Lone: The Norwegian Water Resources and Energy Directorate, and Osterøy Municipality council
- Stølsheimen: The Directorate for Cultural Heritage pursuant to the Cultural Heritage Act, and The management board for Stølsheimen at the Norwegian Nature Inspectorate

The buffer zones:

- The marine protected area in Lurefjorden: The County governor of Hordaland ,and the municipality councils of Lindås, Radøy and Austrheim
- The national salmon fjords at Osterøy: Norwegian Food Safety Authority and the Directorate for fisheries
- River Loneelvi: Norwegian Environment Agency, Osterøy Municipality Council
- Stølsheimen Landscape Protected Area:Norwegian Environment Agency (The management board of Stølsheimen at the Norwegian Nature Inspectorate)

The transition zone:

- The county governor of Hordaland (13 local authorities), the county governor of Sogn & Fjordane (3 local authorities)

17.1.4 Clarify the respective competence of each of these authorities. Make a distinction between each zone if necessary and mention any decentralized authority

Ministry of Climate and Environment

The Ministry of Climate and Environment has the overarching responsibility for climate and environment policy and the management of the Norwegian countryside, cultural heritage sites, and the cultural environment. The Ministry has four agencies subject to it, two of which are relevant for the proposed BR:

- The Norwegian Environment Agency is the executive expert body for nature management and is responsible for ensuring that vulnerable habitats in protected areas are maintained intact so that they retain their regional, national and international values. Large protected areas, such as the Stølsheimen Landscape Protected Area, are managed by a management board that is appointed by the agency. The agency also gives advice to other sectors when they need to take decisions regarding, for example, hydroelectric power development, wind power development, and aquaculture. To maintain good local cooperation at the county level, environment departments have been set up in all the County Governors' offices throughout the country. The Norwegian Nature Inspectorate is part of the Norwegian Environment Agency and has the practical supervisory responsibility for, among other things, the protected areas. It has 60 local offices around the country.

- The Directorate for Cultural Heritage is the Ministry's advisory and executive expert body for the management of cultural heritage sites and cultural environments. At the regional level, cultural heritage management is the responsibility of the county councils, each of which has a separate section managed by a county curator.

Ministry of Agriculture and Food

The Ministry of Agriculture and Food has the overarching responsibility for agriculture and food policy from primary production to the consumers. The Ministry has six bodies subject to it, two of which are especially important for the proposed BR:

- The Norwegian Food Safety Authority is the supervisory authority responsible for plants, fish, land mammals, and foodstuffs. Its main task is to ensure safe food and drinking water, and the good health and welfare of marine and terrestrial animals and plants. Its head office in Oslo has a strategic role as a directorate, and there are also five regional offices. The department for fish and aquaculture has focus, among other things, on fish health and welfare, and the operation of aquaculture plants.

- The agricultural departments at the County Governor's offices have the task of ensuring the implementation of the national agricultural policy at the regional and local levels. Maintaining living agriculture that provides sufficiently safe and varied food of good quality is a political goal. In addition, it should contribute to environmental benefits such as the preservation of biodiversity, the cultural landscape, and the function of woodland and soil as carbon stores. Traditional knowledge and culture must be continued. The agricultural departments give local authorities assistance and advice on these tasks, at the same time as they have a verification function.

Local authorities

The local authorities have considerable management opportunities if they use the Planning and Building Act to set up municipal subplans to protect agriculture, outdoor life and the natural environment.

17.1.5 Indicate the main land tenure (ownership) for each zone

Core areas:

- The marine protected area of Lurefjorden and Lindåsosane. The protection extends from 2 m below the water surface and the area is therefore owned by three local authorities: Austrheim, Lindås and Radøy municipalities.

- The national salmon fjords at Osterøy. The local authorities own the property rights to all subsea ground that is lower than 2 m below the water surface: Osterøy, Vaksdal, Modalen, Lindås and Bergen municipalities.
- The River Loneelvi is mainly privately owned.
- Stølsheimen. The protected cultural heritage sites are on private property, but in accordance with the Cultural Heritage Act, the landowners do not have the right to perform any encroachment on, or in any other way damage, the cultural heritage sites.

Buffer zones:

- The marine protected area of Lurefjorden and Lindåsosane. The buffer zone embraces the catchment basin to Lurefjorden and its intention is to limit pollution down to the fjord. The area is partly privately owned, partly owned by the three local authorities, Austrheim, Lindås and Radøy municipalities.
- The national salmon fjords at Osterøy. The buffer zone is where the salmon swim along the fjords to the open sea. The sea is owned by six local authorities: Vaksdal, Osterøy, Bergen, Lindås, Meland and Askøy municipalities.
- Stølsheimen. The area is almost 100 % privately owned, but the regulations pertaining to the landscape protected area place clear restrictions on the landowners' right of disposition over their properties.

Transition zone:

The transition zone is mainly privately owned, but the local authorities also own relatively large areas. The Government owns the classified roads.

17.1.6 Is there a single manager / coordinator for the biosphere reserve or are several people in charge of managing it? If one manager / coordinator, who designates and employs him/her (national authorities, environmental administrative agency, local authorities)?

The day-to-day work of managing the proposed BR is done by a project manager employed by Nordhordland Development IKS. She works closely with a working committee comprised of five persons, including herself. The other three are two scientists (paid by the University of Bergen), a person with principal responsibility for project development (paid by Nordhordland Development IKS), and a person responsible for strategy and communication (paid by Nordhordland Development IKS). When the BR is established, the aim is to have at least three permanent, full-time employees. In addition, several project staff in full-time or part-time posts will be linked to the BR's administration. These will be employed by local authorities. The University of Bergen will organise its cooperation with the Nordhordland BR through the incumbent of the UNESCO Chair at the Institute of Bioscience.

17.1.7 Are there consultative advisory or decision-making bodies (e.g. scientific council, general assembly of inhabitants of the reserve) for each zone or for the whole biosphere reserve?

If yes, describe their composition, role and competence, and the frequency of their meetings

The highest formal body currently running the project to establish the BR is a broadly composed steering committee comprised of 10 members. The committee has representatives from the local authorities in the region (three mayors), Nordhordland Development IKS, the County Governor's

Office in Hordaland, Hordaland County Council, the University of Bergen, an environment organisation, and representation from business and industry.

The steering committee has the supreme economic and strategic responsibility for all activity in the proposed BR. It meets approximately 4 times each year.

The project manager reports to the chairperson of the steering committee who is one of the mayors in the region. Decisions in the steering committee are made by simple majority.

The steering committee has itself evaluated the present form of organisation and considers it to work well for the moment. Adjustments will come in due course.

17.1.8 Has a coordination structure been established specifically for the biosphere reserve?

If yes, describe in detail its functioning, composition and the relative proportion of each group in this structure, it's role and competence. Is this coordination structure autonomous or is it under the authority of local or central government, or of the manager / coordinator of the biosphere reserve?

The steering committee was established specifically for the purpose of establishing the BR. For its function and competence, see 17.1.7

Its members are appointed by Nordhordland Development IKS, administration for the Regional Council of Nordhordland, following proposals by project participants.

17.1.9 How is the management / coordination adapted to the local situation?

The local authorities in the Nordhordland region own the project to establish the BR. They are all represented in the Nordhordland Region Council and have an overarching responsibility for the project through Nordhordland Development IKS. The University of Bergen is the other formal partner in the project. Its responsibility and influence are regulated through the agreement to collaborate signed by the Regional Council and the University in 2013.

The other local authorities with territory within the proposed BR are continuously informed about the work taking place and plans and strategies. Suggestions are received from them in regular meetings. Local participation in the steering bodies of the BR will be determined when the designation is confirmed.

17.1.10 Is there a procedure for evaluating and monitoring the effectiveness of the management?

Administratively, the project to establish the BR is subject to Nordhordland Development IKS. Evaluation and quality control of routines and work in the project take place continuously in accordance with procedures decided by Nordhordland Development IKS. The project manager also reports regularly on plans and development to the owners of Nordhordland Development IKS, Nordhordland Region Council. In addition, the project manager prepares an annual report which is sent to all interested parties.

17.2 Conflicts within the biosphere reserve

17.2.1 Describe any important conflicts regarding the access to the use of natural resources in the area considered (and precise period if accurate). If the biosphere reserve has contributed to preventing or resolving some of these conflicts, explain what has been resolved or prevented, and how this was achieved for each zone

Nordhordland has had a strong industrial development and has tolerated strong development pressure. The region has been in a position to exploit the opportunities from the available resources, both renewable and non-renewable. In recent years, there has been more and more awareness in Nordhordland, as in the rest of the world, about how we consume our resources and how we should take wise choices for the future to ensure sustainable development. A continuous debate is taking place on these topics and most people have seen that the status as a BR can provide important tools to solve the local problems. This is probably an important reason why no special conflicts have been revealed in Nordhordland as a consequence of the effort to become a BR.

Beyond this, we can add that the general conflicts in Nordhordland are largely the same and probably reflect conflicts that are on the daily agenda in Norway in general: for instance, in relation to the generation of hydroelectricity and minimum environmental flow; aquaculture in relation to the wild salmon population; open landscape and the overgrowing problem; point emissions from industry; pollution from wrecked ships; fears that new protected areas may restrict land use; the use of non-renewable resources; and the consequences of CO_2 emissions.

17.2.2 If there are any conflicts in competence among the different administrative authorities in the management of the biosphere reserve, describe these

No conflicts between administrative authorities in the management of the BR have been revealed.

17.2.3 Explain the means used to resolve these conflicts, and their effectiveness

Since Nordhordland has no such conflicts, we cannot say which methods have been used.

17.3 Representation, participation and consultation of local communities

17.3.1 At what stages in the existence of a biosphere reserve has local people been, and / or are represented in the planning and management of the biosphere reserve (e.g. assembly of representatives, consultative groups)

A steering committee for the project has been in place since autumn 2013, consisting of local politicians and representatives from the county administration level, university, business and industry, and local societies and organisations. In addition, regular reports on the project have been sent to the Regional Council and the municipality councils. The project has also been a topic for debate at two Nordhordlandsting (a gathering where the executive committees of the nine local authorities meet) during the period.

Creating a BR in Nordhordland has been a long process. The initiative came from the University of Bergen, and Nordhordland Regional Council agreed to start the task of designated the area as a BR in June 2013. For a long time, Nordhordland did not know whether it would be allowed

to put forward its candidacy, but in December 2016, the Norwegian MAB committee gave the region the status of being the candidate to be the first BR in Norway. In view of this situation, the steering committee deliberately chose not to plan major information campaigns or meetings to get many people involved, because it was not desirable to build up expectations that would perhaps be impossible to fulfil. We have rather chosen to inform and involve interested parties who are included in the projects we have initiated through our work. These include tourism firms, food producers and specialist groups in agriculture, among others.

Throughout 2016, we held a photographic competition for the public. Its aim was to give information on the project and get good photographs of people in the proposed BR, utilising its resources in various ways. We selected the photo of the month and ultimately the year's best photo. The response was good, and the competition gave many good synergies in the projects referred to in Section 15.4.4.

The project has been presented in various societies and associations in the district to which we have been invited to hold talks. We have also taken part in some meetings organised by the local and county authorities, not always to hold presentations, but just to be there, talk to people and informally supply information.

A specific example is our involvement in the branding process which, among other things, led to the start of the photographic competition. Here, the steering committee initially worked together to get a strategy in place for the application work. It then became involved in the branding and communication work we did as a pilot area for the MAB Programme. At the end of this process, those employed by the various local authorities for business and social development were involved in influencing the final result. Since this took place at an early stage in our work (January 2015), it was not natural to involve the local community in general, but as mentioned earlier this was done through projects resulting from this process.

17.3.2 Describe how the local people (including women and indigenous communities) have been, and /or are represented in the planning and management of the biosphere reserve (e.g. assembly of representatives, consultative groups

The steering committee has placed emphasis on representativity for the community in Nordhordland and for having the specialist knowledge required in such a steering committee (see the representation in Section 17.1.7). §21 of the Equality and Anti-Discrimination Act states that "*When a public body appoints or selects a committee, board, council, tribunal, delegation, etc., both genders shall be [equally] represented*". We have also placed emphasis on broad representation in our various projects, with local people, the business community and the authorities being involved.

17.3.3 Describe the specific situation of young people in the proposed biosphere reserve (e.g. potential impacts of the biosphere reserve on youth, consideration of their interests and needs, incentives to encourage them to participate actively in the governance system of the biosphere reserve)

No particular focus has so far been placed on involving young people. Each local authority has a youth council, and these have also held some regional meetings. In the forthcoming preparation of the BR and the drawing up of the strategic management plan, the youth councils will be valuable associates for making suggestions about, and implementing, the plan.

17.3.4 What form does this representation take (e.g. companies, associations, environmental associations, trade unions)?

Societies, organisations and companies are represented in the steering committee. In addition, we have given many of them information. It will be natural and very desirable to achieve their broad involvement in, and interest for, the work to be done in the BR.

17.3.5 Are there procedures for integrating representative body of local communities (e.g. financial, election of representatives, traditional authorities)?

Good procedures exist. Nordhordland Regional Council appoints representatives and ensures a good representation in the steering committee. In the work planned to get a strategic management plan in place, we will pave the way for procedures to get subgroups and thematic groups represented.

17.3.6 How long-lived are consultation mechanisms (permanent assembly, consultative on specific projects)? Make a complete description of this consultation. What are the roles of involved stakeholders compared to the role of the biosphere reserve?

We have presented the main goal and the sub goals for the BR and will develop a strategic management plan though inclusive processes. This will state prioritised strategies and measures inside the BR, and the organisation of the work and the actual organisation will be determined on this basis. As is natural for all project organisations, the permanent processes for an annual general meeting (composition, tasks and authority) will be defined. The annual general meeting will have the supreme authority and will normally meet once a year.

17.3.7 What consultation mechanisms have been used, and who has been involved? Are they for specific purposes or long-term? What impacts have they had on decision-making processes (decisional, consultative or merely to inform population)?

In the planning phase, Nordhordland Regional Council has prepared reports and given guidance, and below that, the steering committee has been the permanent consultative body for the biosphere project. The Regional Council has the ultimate power of decision.

17.3.8 Do women participate in community organizations and decision-making processes? Are their interests and needs given equal consideration? What incentives or programmes are in place to encourage their representation and participation (e.g. was(were) a 'gender impact assessment (s)' carried out?

Women are involved and engaged on an equal footing with men in the planning work, the steering committee and the project groups.

17.4 The management/cooperation plan/policy

17.4.1 Is there a management/cooperation plan/policy for the biosphere reserve as a whole?

In the period UNESCO is considering our application, we will endeavour to get a strategic management plan for the BR in place before designation by the ICC. The plan will contain:

- a vision
- goal(s) and perhaps subgoals
- strategies
- actions

This will give some information about how we will work in the BR. It must be based on the work we have done in the planning phase and the opportunities we have identified for Nordhordland as a BR (see Sections 13.1 and 13.2).

This plan will be central for the work to be done and the priorities to be made. It is also central because it will lay the basis for how we will best organise our work. Here the owners of the project, the local authorities, will be the ones to apply the guidelines. We can employ different methods or processes to get such a plan in place. It may be based on a SWOT analysis, scenario work or some kind of background material.

17.4.2 Which actors are involved in preparing the management / cooperation plan?How are they involved?

The BR is based on broad engagement and involvement. The owners of the commitment to the BR, the municipalities, apply the directions for starting the work. In such a process, it is natural to involve municipal politicians and administrative staff, local businesses, and societies and organisations. In addition, Hordaland County Council and the County Governor of Hordaland should be invited to take part, as well as important partners at the University of Bergen and other research institutions.

To obtain suggestions for the plan, meetings with interested parties and the media will be organised as part of the process. A period for open consultation will be set apart before the plan is adopted.

17.4.3 Do local authorities formally adopt the management / cooperation plan? Are local authorities making reference to it in other policies and / or plans? If so, please provide details

The municipalities own the process for the planning work and the consultative rounds belonging to it. In any cases regarding the BR presented to the Nordhordland Regional Council, it will be extended with the Mayors of Øygarden and Vaksdal municipalities. Nordhordland Regional Council will adopt the final plan.

17.4.4 What is the duration of the management / cooperation plan? How often is it revised or renegotiated?

The strategic part of the plan will be valid for a long period – a 10-year perspective. The action part of the plan will be open for revision every other year.

Photo 17.1. The Nordhordland Regional Council and the University of Bergen signs their agreement in June 2013 to work for Nordhordland to be designated as as UNESCO Biosphere Reserve. Photo: Rune Heradstveit.

17.4.5 Describe the contents of the management / cooperation plan. Does it consist of detailed measures or detailed guidelines? Give some examples of measures or guidelines advocated by the plan? (Enclose a copy)

The plan will be founded on the basis outlined in Sections 13.1 and 13.2. See description for content in 17.4.1.

17.4.6 Indicate how this management / cooperation plan addresses the objectives of the proposed biosphere reserve (as described in section 13.1)

When the plan is completed, in spring 2019, it will be founded on the goals described in Section 13.1. and on the basis of the SDGs outlined in Section 13.2.

17.4.7 Is the plan binding? Is it based on a consensus?

The plan will be based on a consensus and be binding for the BR organisation. An annual report will be delivered to Nordhordland Regional Council, or an annual general meeting, depending on the form of organisation chosen.

17.4.8 Which authorities are in charge of the implementation of the plan, especially in the buffer zone(s) and the transition area(s)? Please provide evidence of the role of these authorities

The BR organisation will be responsible for implementing the plan. Since this must be done in close cooperation with very many participants, it is important that the central ones are involved in

drawing up the plan to ensure their interest in it and their ownership of it. Examples of important participants are the municipalities, the county council and the county governor, as well as the committee overseeing the protected areas, farming specialists, business and industry, and special interest organisations.

17.4.9 Which factors impede or help its implementation (e.g. reluctance of local people, conflicts between different levels of decision-making)

At present, we know of no factors that will impede the task of implementing a strategic management plan for the proposed BR. Three of the local authorities in the proposed BR are currently being merged, planned to take effect on 1 January 2020. This will obviously be a demanding process and require a great deal of work for those involved. We must take this into account in the work of the BR, but we do not know now whether it will delay the work.

17.4.10 Is the biosphere reserve integrated in regional / national strategies? Vice versa, how are the local/municipal plans integrated in the planning of the biosphere reserve?

If Nordhordland achieves the status of a BR, this will gradually be integrated in the revision of the individual municipal plans where it is relevant and of significance. The basis for the strategic management plan for the BR will be the municipal and intermunicipal plans that are in force.

17.4.11 Indicate the main source of the funding and the estimated yearly budget

The budget proposal must be viewed in connection with the goals described in Section 13.1, the suggested organisation of the commitment and the planned strategic management plan that has to be prepared and which will indicate activities and priorities relative to the goals.

As the Man and the Biosphere Programme is new in Norway, no experience is available to give guidelines for the economic commitment or its funding. Nevertheless, we envisage that the funding has to come from different sources depending on which tasks are to be solved.

- The BR involves all the municipalities in the region. The basic funding will come from these. This is a premise for acquiring money from other sources.

- The University of Bergen is a key participant in the project today, and has clearly signalled that this situation will continue in the years ahead.

- The budget presupposes that the BR organisation itself will acquire private and project funds. Major project commitments will also be able to contribute to the general running costs of the BR through some form of overhead.

- The budget includes a significant unpaid effort from the steering committee and the various tasks in which the local authorities are involved.

- In many other countries in Europe, the national authorities support BRs economically. It is anticipated that Government authorities in Norway will also economically support this new commitment to the UNESCO Man and the Biosphere Programme in the same way as they support the UNESCO World Heritage Programme.

The budget proposal sets up three man-years linked to the commitment to the BR. Expenses are also included for information work and meetings. An important part of the work involves helping to initiate and/or facilitate appropriate projects for the commitment to the BR. Projects that starts up in association with the BR must seek their funding elsewhere than in this budget.

Table 17.1. Proposed annual budget for 2019 – 2021 (Norwegian Kroner)

Expenses	
Project administration (3 man years)	2,350,000
Work by the steering committee and local authorities	250,000
External expertise	100,000
Meetings and seminars	150,000
Information work	100,000
Travel	100,000
Miscellaneous	50,000
Total expenses	**3,100,000**
Income	
Municipalities in the BR	600,000
Unpaid effort, steering committee, local authorities	250,000
University of Bergen	300,000
Hordaland County Council	200,000
Ministry of Climate and Environment/ Government programme funding	1,500,000
Business and industry / Sponsors	250,000
Total income	**3,100,000**

17.5 Conclusions

17.5.1 In your opinion, what will ensure that both the functioning of the biosphere reserve and the structures in place will be satisfactory? Explain why and how, especially regarding the fulfilment of the three functions of biosphere reserves (conservation, development, logistic) and the participation of local communities

Nordhordland is the first area Norway has proposed this century as a suitable BR. In this selection, and in the close follow-up made by local, regional and national authorities, a quality control is built in that ensures that Nordhordland fulfils all the requirements of such a status. Throughout the

process of establishing limits for the area and developing goals and strategies for the future BR, very thorough evaluations have been made using both national and international expertise to achieve this in the best possible way. This has also helped to create an understanding for the resources required to be able to run the commitment to the BR in the years ahead. We are therefore convinced that Nordhordland in an excellent way will fulfil the three functions of a BR: conservation, development and logistics.

The local support and enthusiasm for the commitment to the BR are just as important. The project began as a local initiative. During the four years spent in building up the content of the commitment and preparing this application, this platform has been extended and strengthened so that it now embraces all the local authorities and the most important interested parties in the region. This ensures the necessary basic funding of the project and that the future BR will become a valuable driving force so that the region will develop sustainably.

The third element is the close cooperation with important research and educational institutions. The proposed BR is a cooperative commitment between all the municipalities in the region and the University of Bergen. The university has supported the commitment by establishing a cross-disciplinary programme for sustainable development and a UNESCO Chair. Links have also been established between the future BR and a number of other research institutions in Norway and other countries to ensure that development in the region is knowledge based.

An efficient administration and an essential infrastructure have been built up to be able to run the BR. A good, flexible steering structure which makes the commitment to the BR resilient has been established, and projects have been started that will be able to develop further if the BR is formally established. Last, but not least, Nordhordland BR is already an active participant in the MAB Programme through formal positions on boards and committees and participation in conferences and projects. Through this, the way is paved for Nordhordland BR becoming a worthy and valuable participant in the World Network of BRs in the years to come.

From The Heathland Centre at Lygra. Photo: Inger E. Måren.

18. SPECIAL DESIGNATIONS

Special designations recognize the importance of particular sites in carrying out the functions important in a biosphere reserve, such as conservation, monitoring, experimental research and environmental education. These designations can help strengthen these functions where they exist or provide opportunities for developing them. Special designations can apply to an entire proposed biosphere reserve or to a site included within. They are therefor complementary and reinforcing of the designation as a biosphere reserve. Check each designation that applies to the proposed biosphere reserve and indicate its name.

UNESCO WORLD HERITAGE SITE
Nordhordland BR has no UNESCO World Heritage Sites.

RAMSAR WETLAND CONVENTION SITE
Nordhordland BR has no RAMSAR sites.

OTHER INTERNATIONAL OR REGIONAL CONSERVATION CONVENTIONS OR DIRECTIVES
Nordhordland BR has two regional landscape conservation areas:

- Stølsheimen Landscape Conservation Area
- Fedjemyrane Landscape Conservation Area, with preservation of animal life.

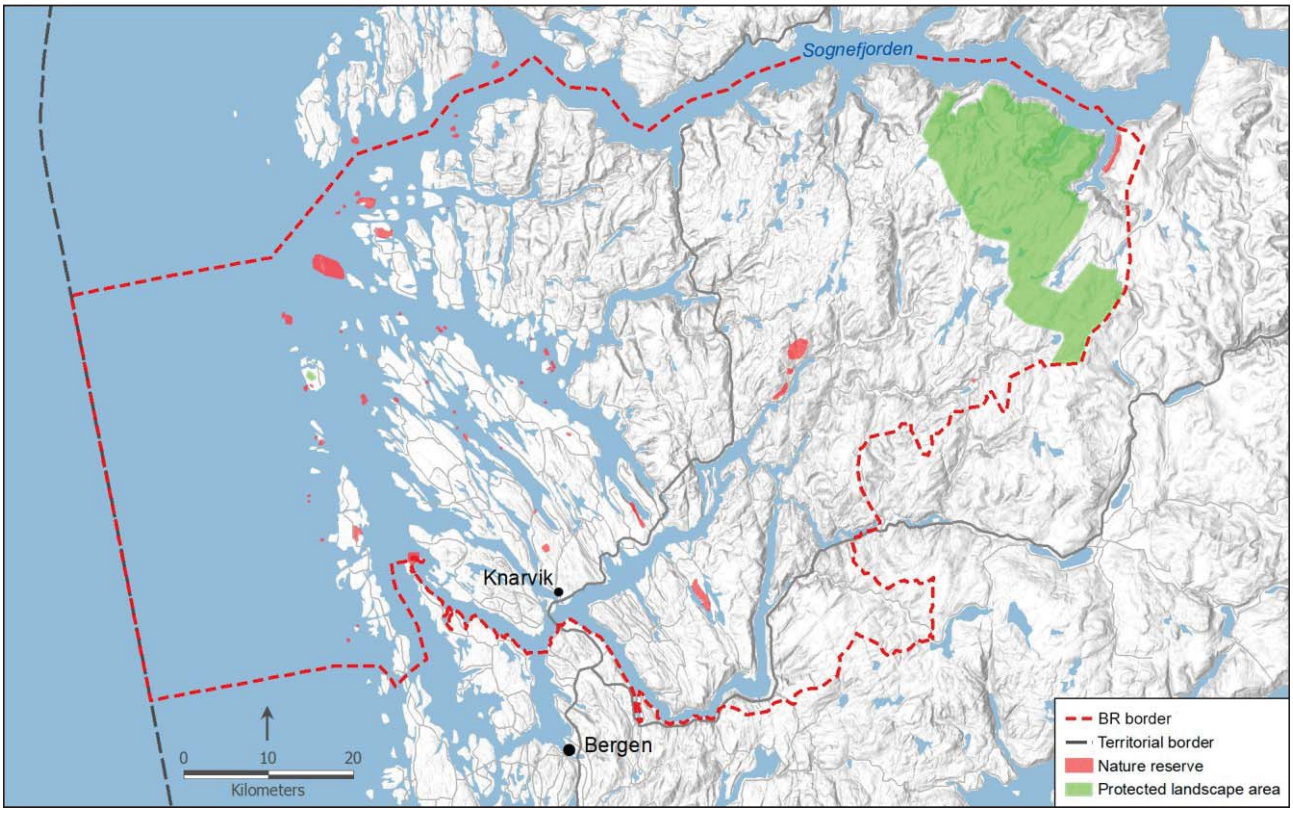


Figure 18.1: Overview of the 43 nature reserves and 2 landscape protection areas in the proposed BR. Map: Lina Haggard, Peter Emil Kaland.

LONG-TERM MONITORING SITE

- Wild salmon and trout. Responsible: Norwegian Institute of Marine Research (see Sections 16.1.1, p. 193)
- Seabirds. SEAPOP and SEATRACK programmes. Responsible: Norwegian Institute for Nature Research (see Section 16.1.1)
- Nordhordland Water Area. Responsible: Hordaland County Council (see Section 16.1.1)
- Freshwater pearl mussel. Responsible: Rådgivende Biologer (see Section 16.1.1)

LONG-TERM ECOLOGICAL RESEARCH (LTER SITES):
Lygra, Lindåsosane, Havrå, Masfjorden.

NATURE RESERVES
There are 43 nature reserves within the BR. See Table 18.1.

Table 18.1. Overview of the nature reserves and landscape protected areas in the biosphere reserve.

ID	MUNICIPALITY	OFFICIAL NAME	PROTECTION	CONSERVATION PLAN
VV00001057	Modalen	Flotaneset Nature Reserve	NR	Other conservation or conservation plan
VV00001059	Modalen	Hestabotn Nature Reserve	NR	Other conservation or conservation plan
VV00001806	Modalen	Stølsheimen Landscape Protected Area	LPA	Not assessed
VV00003112	Lindås	Heltveit-Bjørge Nature Reserve	NR	Woodland conservation
VV00001069	Modalen	Otterstadstølen Nature Reserve	NR	Woodland conservation
VV00001208	Lindås	Vollom Nature Reserve	NR	Conservation plan for broad-leaved and rich deciduous woodlands
VV00002818	Vik	Eiterstrondi Nature Reserve	NR	Conservation plan for broad-leaved and rich deciduous woodlands
VV00002281	Gulen	Grima Nature Reserve	NR	Conservation plan for mire
VV00000468	Lindås	Natås Nature Reserve	NR	Conservation plan for mire
VV00000467	Osterøy	Herlandsnesjane Nature Reserve	NR	Conservation plan for mire
VV00001767	Austrheim	Kuøyni, Skagøyni, Teistholmen and Teistholmskjeret Nature Reserve	NR	Conservation plan for seabirds
VV00001622	Austrheim	Låge Islendingen Nature Reserve	NR	Conservation plan for seabirds
VV00001655	Austrheim	Notholmen Nature Reserve	NR	Conservation plan for seabirds
VV00001760	Austrheim	Stridsholmen Nature Reserve	NR	Conservation plan for seabirds
VV00001625	Fedje	Hellisøy Nature Reserve	NR	Conservation plan for seabirds
VV00000588	Fedje	Litle Frilsøy, Hovden, Svarteskjeret and Innesøyane Nature Reserve	NR	Conservation plan for seabirds
VV00001374	Fedje	Sekkjedalstjørn Nature Reserve	NR	Conservation plan for seabirds
VV00001326	Gulen	Guleskjeret Nature Reserve	NR	Conservation plan for seabirds

VV00001290	Gulen	Kvernøyna Nature Reserve	NR	Conservation plan for seabirds
VV00001273	Gulen	Lihellene Nature Reserve	NR	Conservation plan for seabirds
VV00001324	Gulen	Ramsbarden Nature Reserve	NR	Conservation plan for seabirds
VV00001325	Gulen	Sogneoksen Nature Reserve	NR	Conservation plan for seabirds
VV00000485	Høyanger	Storholmen Nature Reserve	NR	Conservation plan for seabirds
VV00001762	Lindås	Grøningane Nature Reserve	NR	Conservation plan for seabirds
VV00001766	Lindås	Håvarden and Klubben Nature Reserve	NR	Conservation plan for seabirds
VV00001758	Lindås	Klammersholmen Nature Reserve	NR	Conservation plan for seabirds
VV00001656	Lindås	Lurekalven Nature Reserve	NR	Conservation plan for seabirds
VV00001761	Lindås	Vågsskjeret Nature Reserve	NR	Conservation plan for seabirds
VV00001763	Lindås	Ådnøy Nature Reserve	NR	Conservation plan for seabirds
VV00000587	Masfjorden	Dyrøysundskjeret Nature Reserve	NR	Conservation plan for seabirds
VV00001764	Masfjorden	Herøy Nature Reserve	NR	Conservation plan for seabirds
VV00001664	Masfjorden	Raunøy, Langøy, Skardholmen, Storholmen and Høgholmen Nature Reserve	NR	Conservation plan for seabirds
VV00001759	Radøy	Loddå Nature Reserve	NR	Conservation plan for seabirds
VV00001638	Radøy	Sandholmane, Ïysteinen and Hesjetå Nature Reserve	NR	Conservation plan for seabirds
VV00001765	Radøy	Synnøy Nature Reserve	NR	Conservation plan for seabirds
VV00001671	Øygarden	Bleikenøvlingen and Høgskjeret Nature Reserve	NR	Conservation plan for seabirds
VV00001756	Øygarden	Greipingen Nature Reserve	NR	Conservation plan for seabirds
VV00001649	Øygarden	Kortknappskjer and Horsøy Nature Reserve	NR	Conservation plan for seabirds
VV00001634	Øygarden	Teistholmen Nature Reserve	NR	Conservation plan for seabirds
VV00001757	Øygarden	Ullebroten Nature Reserve	NR	Conservation plan for seabirds
VV00001586	Fedje	Fedjedjemyrane Landscape Protected Area with protection of birdlife	LPAB	Conservation plan for wetland
VV00001291	Gulen	Vassøyane Nature Reserve	NR	Conservation plan for wetland
VV00000433	Lindås	Fossevatna Nature Reserve	NR	Conservation plan for wetland
VV00000958	Vaksdal	Nesheimvatnet Nature Reserve	NR	Conservation plan for wetland
VV00001074	Øygarden	Tjeldstø Nature Reserve	NR	Conservation plan for wetland

The luminous helmet jellyfish Pherifylla pherifylla, from Lurefjorden. Photo: Dag Hansen.

19. APPENDICES

19.1 Location and zonation map with coordinates

[Provide the biosphere reserve's standard geographical coordinates (all projected under WGS 84).

Provide a map on a topographic layer of the precise location and delimitation of the three zones of the biosphere reserve (Map(s) shall be provided in both paper and electronic copies). Shapefiles (also in WGS 84 projection system) used to produce the map must also be attached to the electronic copy of the form. If applicable, also provide a link to access this map on the internet (e.g. Google map, website).

The map and shapefiles (WSG 84) are available on : http://www.nordhordlandbiosphere.no/samarbeid-med-universitetet-i-bergen.365856.nn.html

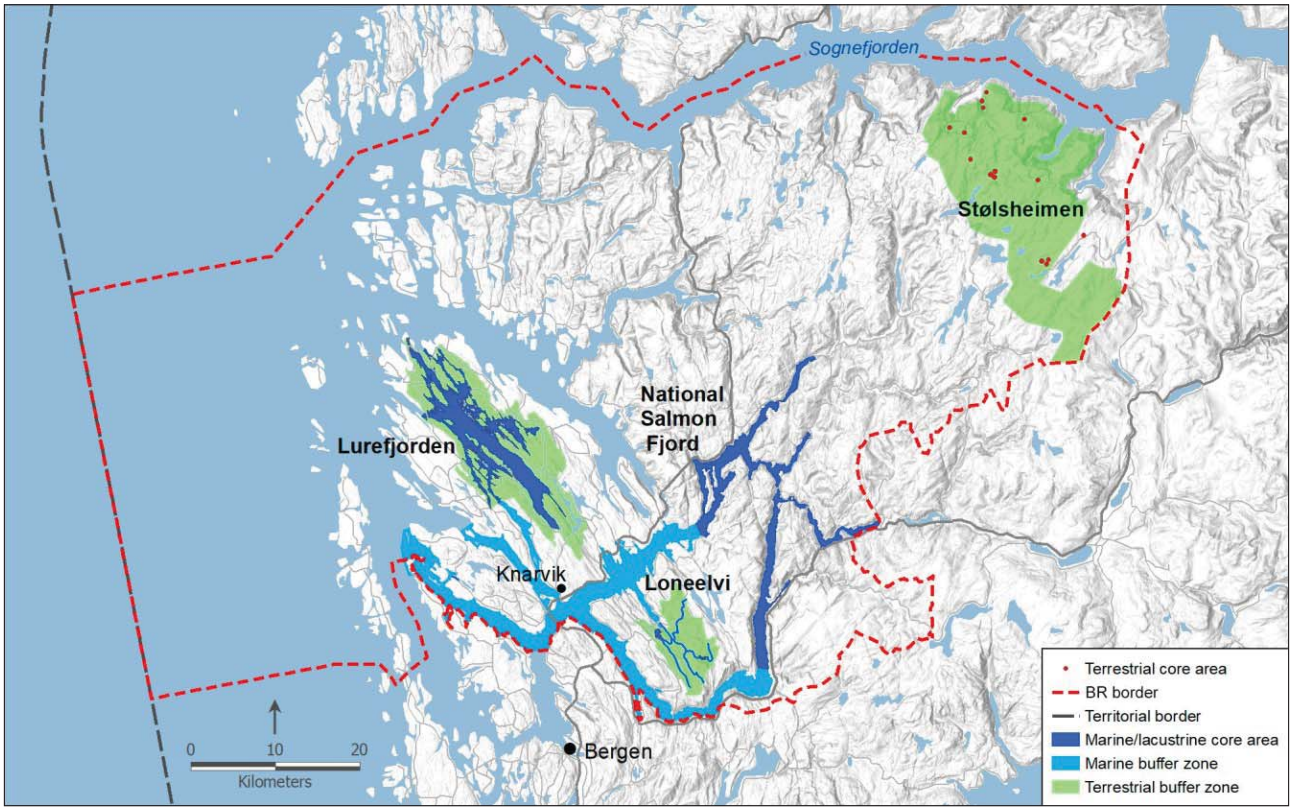


Figure 19.1 Map of Nordhordland BR showing core areas and buffer zones. The rest of the area within the BR boundary is the transition zone. Map: Lina Haggard, Peter Emil Kaland.

19.1.1 Detailed maps and descriptions of Core areas and Buffer zones

CORE/BUFFER COMPLEX 1: THE MARINE CORE AREA OF LUREFJORDEN AND LINDÅSOSANE (LINDÅSPOLLANE)

Lurefjorden is a marine "lake" linked to the coastal waters by narrow inlets through which the sea water enters with strong tidal currents. The fjord is up to 440m deep and is different from most other Norwegian fjords because its catchment is small and therefore does not receive large amounts of fresh water from mountain rivers. Lurefjorden is an important research locality where nature has created a series of natural "aquariums" with different ecological conditions. The threshold depths of only about 20-30 meters prevent heavier Atlantic sea water from entering Lurefjorden on a regular basis. The tidal currents carry with them rich zoological plankton which provide a good nutritional basis for fish, marine mammals, and birds. Lurefjorden is famous for its dense population of the luminous helmet jellyfish *Periphylla periphylla* and for the copepods *Calanus glacialis* and *Calanus finmarchius* which are today best known from arctic regions. In addition, the arctic Islandic scallop Clamys islandica is found here.

Lindåsosane are a row of three semi land-locked marine 'lakes' that receive their water supply through narrow straits with shallow thresholds from Lurefjorden. There is a strong salinity gradient. In the two outermost sea 'lakes', there is a semi-enclosed local herring population which can be traced back at least 6-7,000 years. These fish spawn, grow up and live their whole life cycle inside

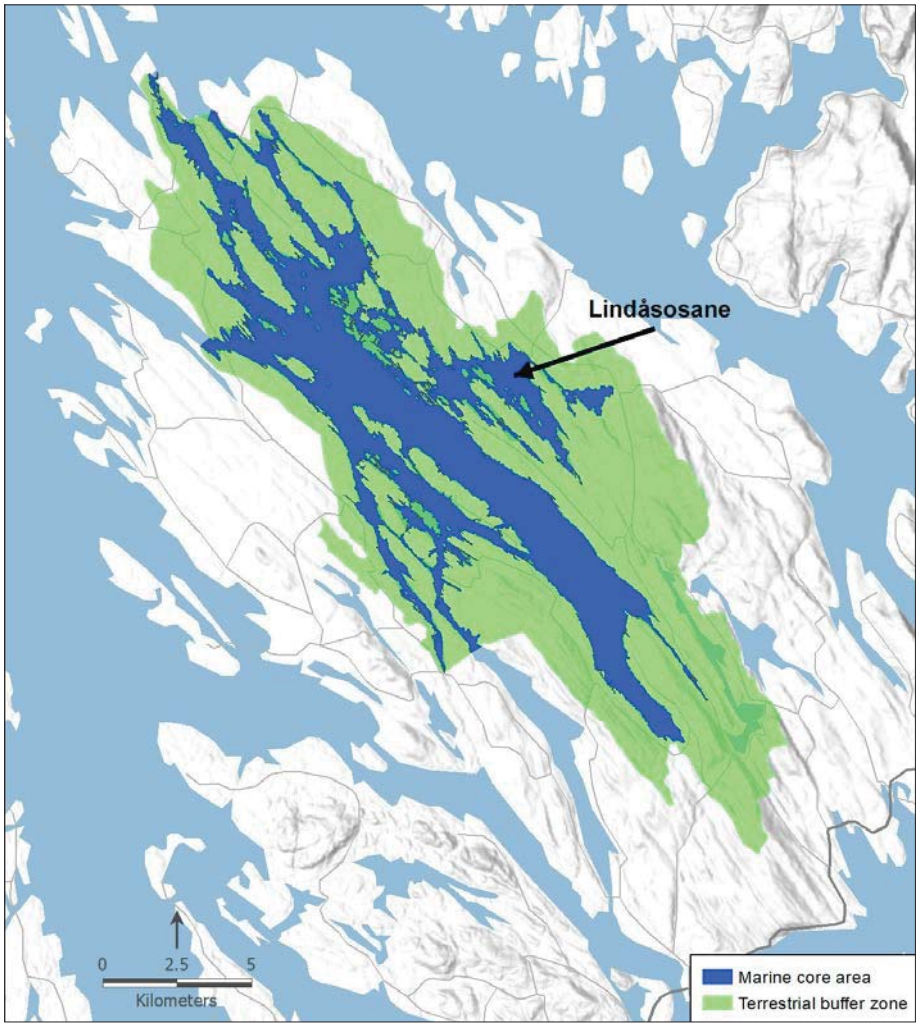


Figure 19.2 The marine core zone, Lurefjorden and Lindåsosane. The map shows the core zone (dark blue). The buffer zone (light green) is defined to prevent contamination of Lurefjorden and Lindåsosane. The buffer zone covers the total catchment area of these water bodies and is based on the EU Water Framework Directive. Map: Lina Haggard, Peter Emil Kaland.

Lindåsosane. The current herring population is about the same as during the 1960s-70s, with local, sustainable and small-scale fishing.

Zonation

The **core zone** (Figure 19.2) includes the entire Lurefjorden and Lindåsosane. In 2015, the Norwegian government started the process of protecting Lurefjorden and Lindåsosane, with a total area of c. 70km^2, under §39 (protected marine areas) of the Nature Diversity Act. The objective is to maintain the conservation values of the rare and vulnerable habitats in the fjord without substantial external impact. It is anticipated that this process will be concluded in 2019.

The **buffer zone** covers the total catchment area of Lurefjorden. Recognizing its rich but vulnerable marine environment, Lindås municipality passed regulations regarding sewage flow to the sea lake system in 1980. Since then, all sewage has been pumped over to Fensfjorden. In 2015, Lindås Municipality Council approved the "*Municipal Sub-plan for Lindåsosane, Lygra and Lurefjorden*" pursuant to § 11-1 (paragraph 3) and § 11-5 of the Planning and Building Act. The terms, together with the map in the sub-plan, are legally binding for future land use (see § 11-6 in the Planning and Building Act). In 2010, Radøy Municipal Council, in case 046/10, adopted a "*Local regulation relating to discharges from small sewage plants for the Municipality of Radøy*".

Nordhordland Regional Council and the County Governor of Hordaland are now working together to fulfil the EU Water Framework Directive. The intention is to put in place a local regulation for the discharge of sanitary effluent from houses and holiday homes in the entire Lurefjorden catchment area (see Figure 19.2 and Section 17.1.2), and to adopt this in 2019.

As part of Norway's commitment to the "*European Landscape Convention*", the Directorate for Cultural Heritage in 2016 designated the inner waterways of Lurefjorden and all the cultural monuments along the waterways as a "***Cultural Landscape of National interest***" (Figure 19.3). This includes the core area and a large part of the buffer zone including the National Centre for Heathlands at Lygra, the northernmost beech forest in Europe (nature reserve), and the many and the protected extremely rich Stone Age settlements along the tidal currents that lead in to Lurefjorden.

*Figure 19.3. In 2016, the Directorate for Cultural Heritage designated the waterways of Lurefjorden and all the cultural monuments and landscapes along the waterways as a "**Cultural Landscape of National Interest**". The area covers 196 km^2 and include the core area and a large part of the buffer zone. Map: Directorate for Cultural Heritage.*

CORE/BUFFER COMPLEX 2: FJORDS AROUND OSTERØY

Osterøy is Norway's largest inland island (330 km^2). It is surrounded by a narrow fjord system with water depths ranging from 100 to 350 m. The national salmon fjord includes the inner part of the fjord, with 700-850 m high mountains with steep hillsides down to the fjord. Settlements along the national salmon fjord are dispersed, and the population density is low.

Around Osterøy, there are six large rivers with substantial water flow, where each river has a total catchment area of over 20 km^2. In addition, there are about 50 smaller rivers with relatively low water flow. Most of the rivers in the area are regulated for hydropower production; only three of the main rivers – Loneelvi, Eikefetelvi, and Vosso – have permanent protection against hydroelectric power development. Vosso is additionally protected as a national salmon river. In the many rivers, there are numerous ecotypes of sea trout and salmon, including the Vosso salmon strain, internationally famous as the largest Atlantic salmon. Over the last 30 years, however, its population decreased dramatically, and a series of actions have been carried out to re-establish the population.

A comprehensive cooperative project to rescue the Vosso salmon started in 2000, with many active partners: the local community, the national and the county environmental management authorities, the University of Bergen, Uni Research, salmon fish farming companies, and the major local company producing electric power (BKK). The goal is to find practical, operative means to ensure a vigorous and harvestable population of wild salmon that tolerates normal fishing. The most important actions are: the breeding of smolt from the national gene bank; new measures to prevent the escape of farmed salmon; and the establishment of synchronic delousing of the farmed salmon

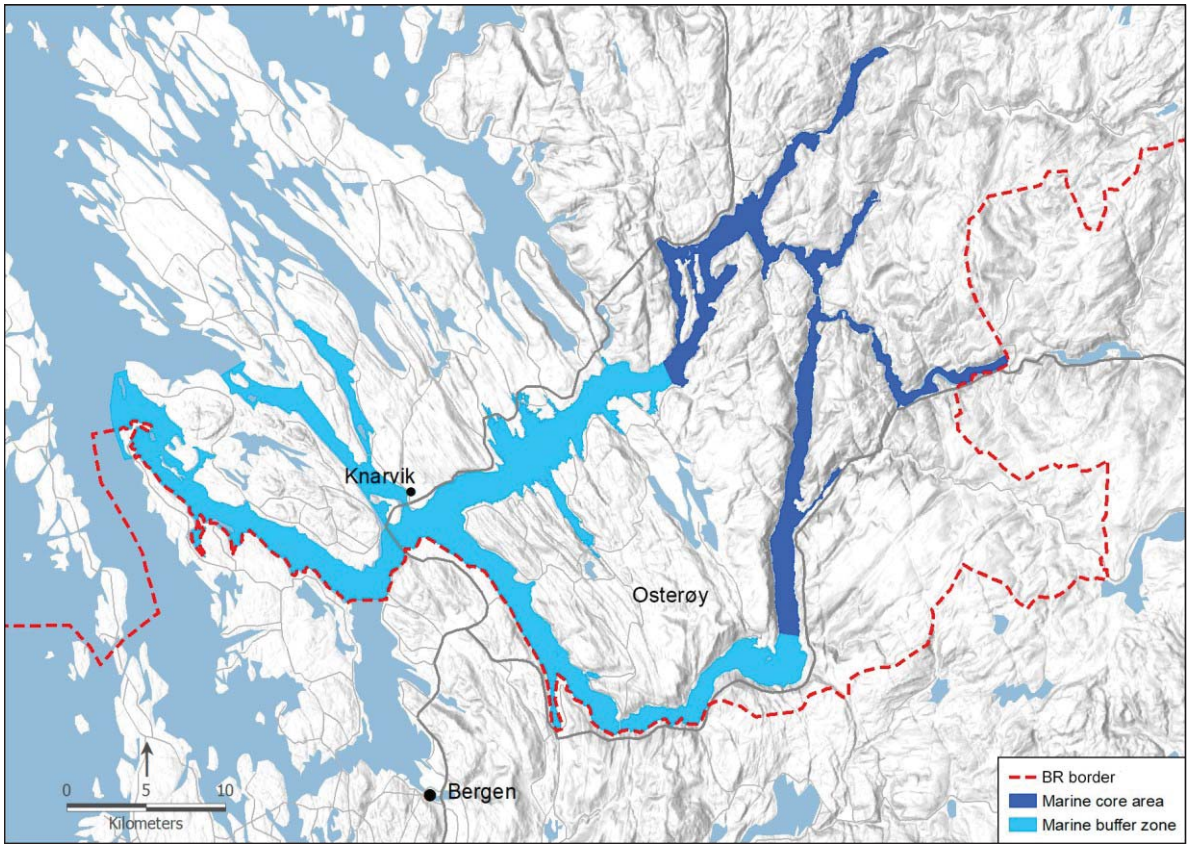


Figure 19.4. Map of the national protected salmon fjord by Osterøy island. Map: Lina Haggard, Peter Emil Kaland.

by all fish-farming operations outside the national salmon fjord. There have also been intensified efforts to capture escaped farm raised salmon and rainbow trout. Until 2016, Vosso salmon smolt were towed past the salmon farms out to sea in special crates, in order to reduce the time they were exposed to potential infection from sea lice. This method proved successful and resulted in the salmon returning to the river where they grew up, so that their population gradually increased. Since 2016, the population has been high enough, so that the managers have stopped using the artificial towing process. The smolt now swim by themselves from the Bolstad fjord, pass the many fish farms and out to the ocean. The success of this approach is being continuously monitored.

The management of rivers in the national salmon fjord and in the fjords out towards the ocean will continue and contribute to safeguard the life cycle of salmon both in the river and in the fjord.

Zonation

The **core area** is the national salmon fjord (29 km²), established under. «*The proposition to the Storting no. 32 (2006-2007) on the protection of wild salmon and the completion of national salmon rivers and salmon fjords*" adopted by the Storting on May 15, 2007. The water in the fjord has a high degree of variation in salinity, from fresh water near the mouths of the rivers, to brackish and salt fjord water. The large amount of water flowing through this system, especially through the spring and summer season, means that levels of pollution are low.

Buffer zones: both terrestrial and a marine buffer zones have been established.
Terrestrial buffer zone: The narrow and deep salmon fjords have steep hillsides up to 600-800 m above sea level (Photo 19.1). The steep hillsides above the fjord act as a natural buffer zone.

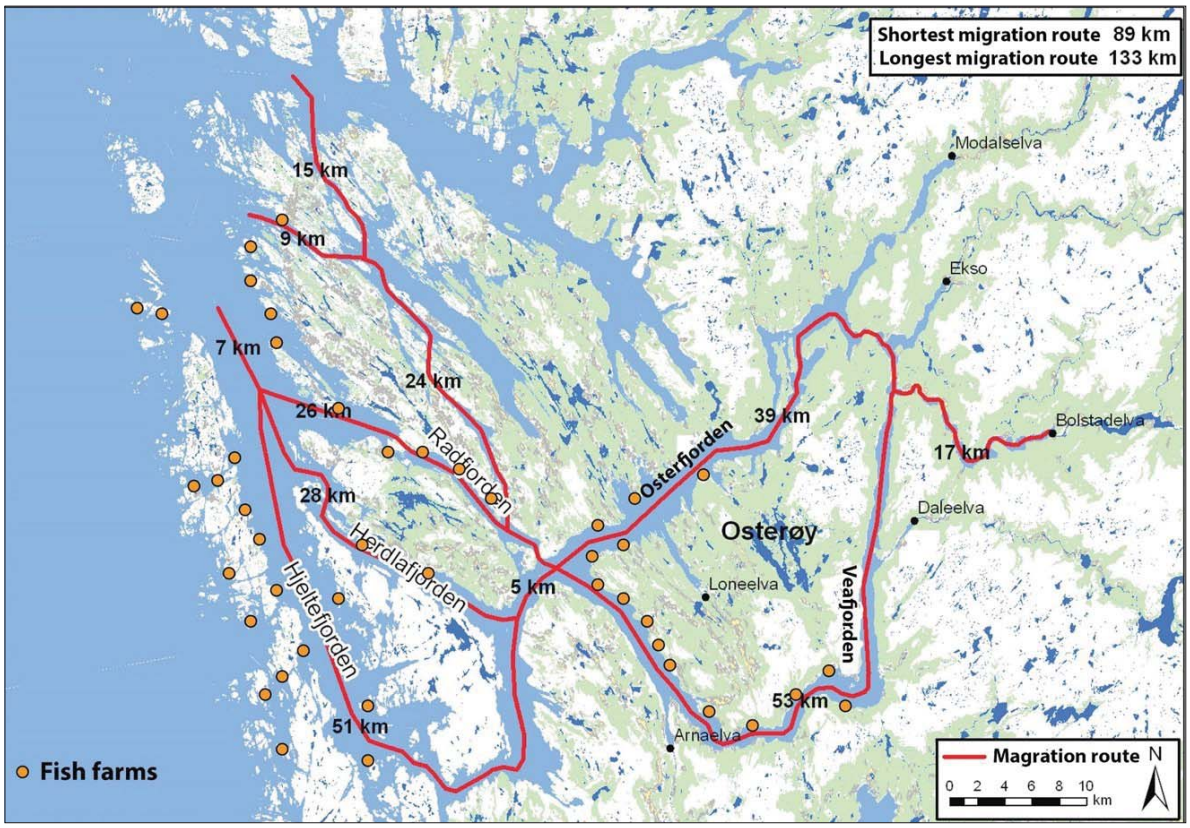


Figure 19.5. Map of the migration routes along the fjords for the salmon smolt from where the river Vosso enters the fjord at Bolstadøyri to the ocean. Map: Uni Research Environment

Photo 19.1. Photo of the Vea fjord seen from north (cfr. next map). The narrow fjord system has steep slopes up to the 700-800 m high mountains, making a natural terrestrial buffer zone. Photo: Bjørn Torgeir Barlaup.

Marine buffer zone: The objective of this buffer zone is to establish a safe migration route for the smolt from the core area through the fjords to the open ocean (Figure 19.3, 19.4). This is essential to sustain viable local salmon strains in the salmon fjords and rivers. Along the migration route, the smolt pass 15 salmon and sea trout farms. In order to reduce the risk of the smolt being mortally infected by sea lice from the fish farms, it is essential to keep the louse population beneath a specified level during the migration period during the spring (Statement from the Norwegian Food Safety Authority (Section 19.3)).

CORE/BUFFER COMPLEX 3: THE LONEELVI RIVER AND ITS WATERSHED

The relatively narrow and shallow Loneelvi river is permanently protected against hydroelectric power development. It has a large population of small salmon, which are probably not impacted by escaped farm salmon. Loneelvi has been selected as representative of the rivers with salmon and trout populations that drain into the fjord system surrounding Osterøy, its cultural and natural heritage values, and because its entire watershed is legally protected.

The **core area** corresponds to the course of the river, with an area of about 1 km^2. The river has high nature value and is representative for coastal river systems. The river is protected against Hydroelectric Power development under the terms of "*Royal Proposition no. 4 (1972-73) Concerning conservation plans for rivers*", "*Supplement to the conservation plans for rivers*" (2005) and §32 of the "*Act relating to watercourses and groundwater (The Water Resources Act)*" of November 24, 2000.

The **buffer zone** is the catchment surrounding the river basin (57 km^2), protected by the same law. The 1995 "*Regulations concerning national political guidelines for protected watercourses*" state: "*To achieve the goals, special emphasis must be placed on providing a basis (point 3d) for securing the value attached to parts of the catchment area of the protected watercourses which scientific investigations have shown are of significance for the conservation value of the watercourse*". The buffer zone (catchment area) is comparatively large for a coastal river, and the landscape has great value due to its cultural heritage monuments and cultural heritage landscapes. The buffer zone has three red listed plants, and several red listed bird species nest there. The buffer zone is used for outdoor recreation activities.

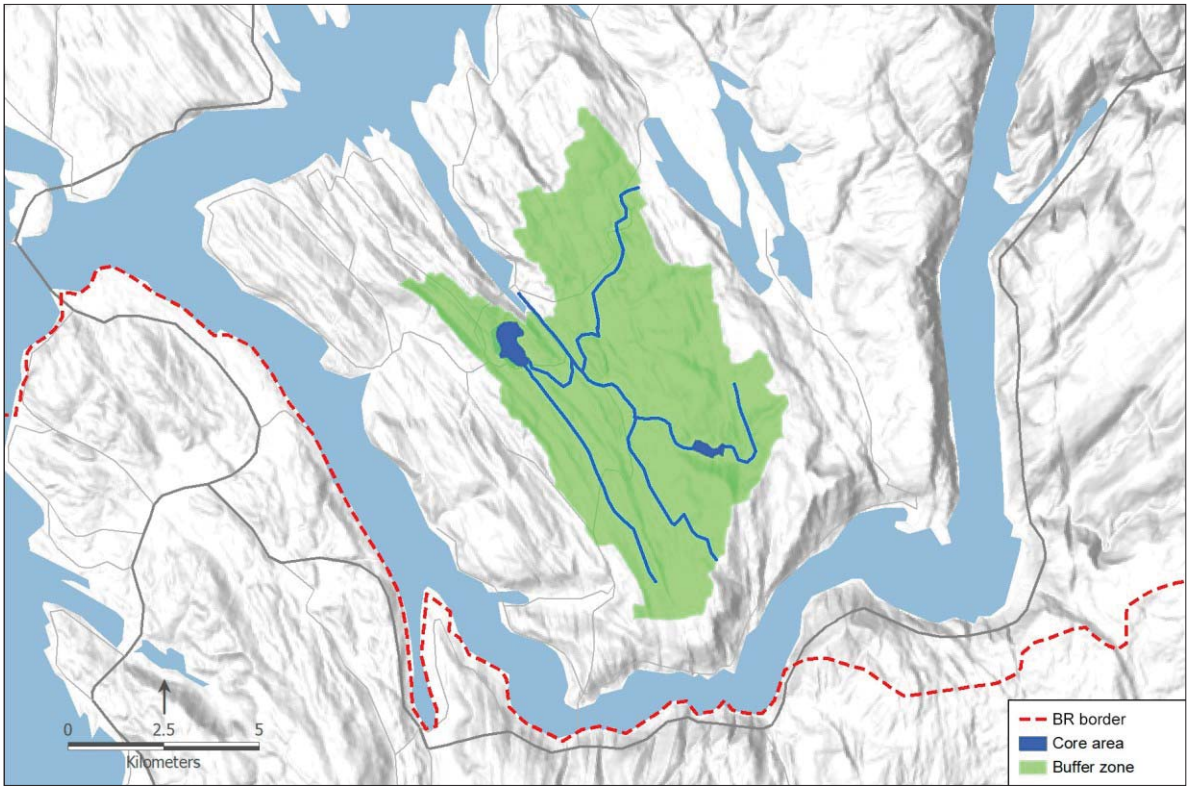


Figure 19.6 . Map of the Loneelvi river at the island of Osterøy. Core area: dark blue. The green area represents the protected catchment area as buffer zone. Map: Lina Haggard, Peter Emil Kaland.

CORE/BUFFER COMPLEX 4: STØLSHEIMEN

The Stølsheimen Landscape Protected Area (LPA, 377 km^2) is a mountain area with rich grazing. This, along with rich resources for hunting and fishing, has been an important reason why Stølsheimen, for millennia, has been an important meeting point for people in the municipalities belonging to Nordhordland, Voss and areas along the south side of the fjord Sognefjorden (Figure 19.7). Stølsheimen was declared a LPA in 1990, with the following justification: "*The intention behind making Stølsheimen a landscape protected area is to preserve a unique and beautiful western mountain- and fjord landscape, with its cultural heritage, cultural landscape and natural environment that have only to a small degree been affected by technological advancements, while at the same time, the area may be used for agriculture, outdoor recreation, hunting and fishing*." (Management plan for Stølsheimen landscape protected area (1998)).

The people of Nordhordland have a close kinship and affinity to Stølsheimen. The many summer farms, which are the origin of the name Stølsheimen (a "støl" is a mountain summer farm for grazing), are located both in the LPA and outside. Outside the LPA there are also several areas, each with numerous privately-owned modern cabins built for year-round recreational use. There are many opportunities for outdoor recreation in Nordhordland, but Stølsheimen has a special position in people's minds – not only for recreation, but because it has Norway's most westerly population of reindeer with about 600 animals, and also a large population of deer in the woodlands. The area has no large predators.

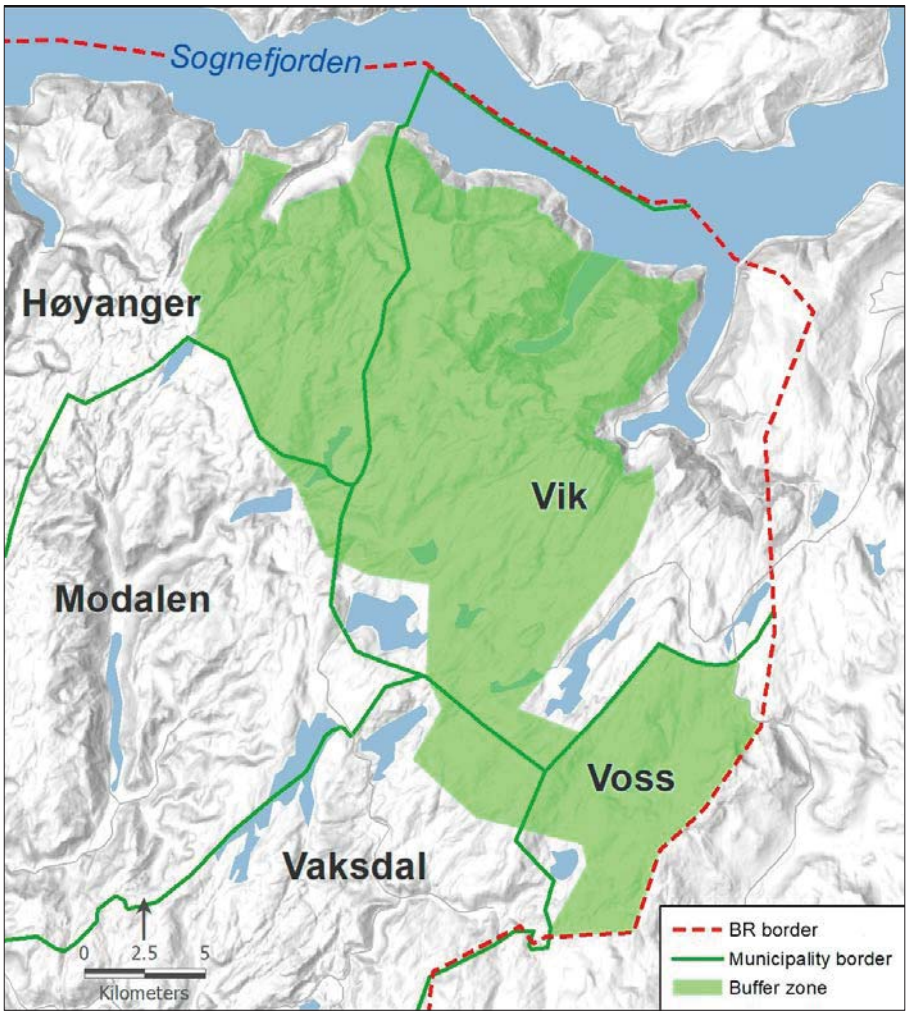


Figure 19.7: Stølsheimen Landscape Protected Area (green) includes parts of five municipalities. Map: Lina Haggard, Peter Emil Kaland.

Photo 19.2 Solrenningen summer farm is located beneath the alpine forest border, but intensive grazing and woodcutting over many centuries have removed the forest over a large area around the farm. The trees on the photo are the result of regrowth after the commercial use of the summer farming ended in 1972. Photo: Mons Kvamme.

Stølsheimen's cultural landscape is the result of long-term impacts on the natural ecosystems by farmers who have taken advantage of the area's natural resources for agricultural operations for more than 2,000 years. To carry out agricultural activities, hunting, and fishing, the farmers established summer farms and grazing areas. 56 summer farms or sites with the remains of summer farm houses have been identified within the LPA. Each summer farm has buildings for people and animals. The traditional system of using the summer farms ceased in 1972, but the area is still grazed by cows, sheep, and goats which are not milked. Thus, the intensive use of the area for grazing has been reduced, and the grazing pattern has changed, at the same time as the need for cutting trees has been reduced. The landscape is changing: the grassland is being overgrown by heathland, open forest is becoming denser, scrub is expanding in the open grazing areas, and the treeline is becoming higher.

Many of the buildings of the 56 summer farms are still maintained and used for the supervision of grazing animals, as well as hunting, fishing and outdoor activities. Stølsheimen LPA is an important recreational area for the people of the city of Bergen, Nordhordland, Voss, and for rural communities along the Sognefjord. Bergen Turlag (hiking organization) has marked 110 km of hiking trails and operates 7 lodges within the core area. In addition, there are about 100 km of unmarked paths associated with the summer farms. Along the fjord, there are several private accommodations.

Zonation

Stølsheimen's high nature and culture heritage qualities, together with the strong position stated by key local stakeholders, are the basis for the LPA to be an essential component of Nordhordland Biosphere Reserve. However, the process to find a solution that meets the criteria of the Statutory Framework for a core zone with a surrounding buffer zone took a long time. There are two reasons: first, there is extensive regulation of the rivers for the production of hydroelectric power to both

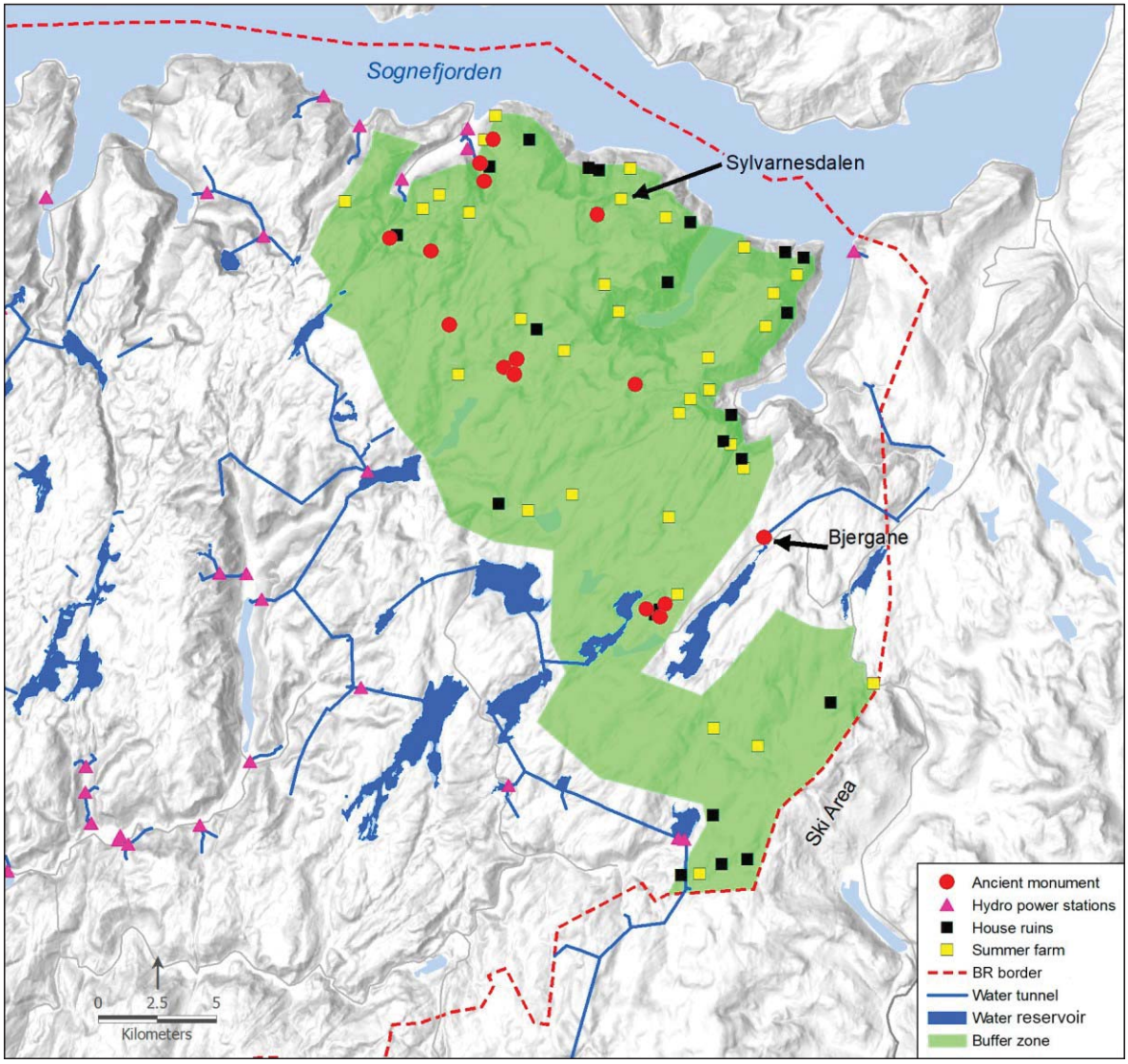


Figure 19.8 The Stølsheimen Protected Landscape Area (LPA: 377 km²) is located to the west and the east of major hydroelectric developments, and to the north of the area's largest ski centre. Biosphere reserve border: red dotted line. House ruins: In according to the official map in the managing plan of 1998 (Section 19.4.) Cultural Monuments: list in Askeladden database (Table 19.1). Hydro Power development: In according to map from The Norwegian Water Resources and Energy Directorate (NVE). Map: Lina Haggard, Peter Emil Kaland.

the west and the east of the LPA (Figure 19.8); second, Western Norway's largest ski resort has been built to its south (Figure 19.8). It is therefore not possible to treat the LPA as a core area and to establish a surrounding buffer zone for it. To satisfy the criteria of the Statutory Framework, the solution is to use legally protected cultural heritage sites as core areas (Figures 19.8 and Table 19.1), and the protected LPA as the buffer zone: the cultural landscape which is the context for – and protects – these significant sites.

Core areas: Stølsheimen is very rich in cultural heritage monuments. The buildings of the 56 summer farms (Figure 19.8, Photo 19.2) with infields (stølsvoll) and surrounding pastures are key manifestations of farming activities over countless generations. The infields and pastures are cultural ecosystems with a higher biodiversity than that of the landscape as a whole. In many locations, there have been buildings at the same place throughout the long history of summer farming, and these have been "modernized" by repair or reconstruction. The infields and pasture areas have been

used in the same traditional way throughout this long period so that, together with the buildings, this area represents a cultural landscape of high natural and cultural historical value.

However, archaeological investigations of Stølsheimen have been limited. The official database "Askeladden" of the Directorate for Cultural Heritage includes only 13 cultural heritage sites (Table 19.1.1). Dating from archaeological investigation has shown that six of the sites are older than the Reformation (1537 AD); these are automatically protected under the terms of the Cultural Heritage Act of 9 June 1978 no. 50, revised on 3 July 1992 no. 96. Seven monuments are most probably older than 1537, but not fully documented (as archaeological investigation has not been undertaken), and therefore their position in relation to the Cultural Heritage Act (Table 19.1.1)) is not definitive. Nevertheless, the " *Regulations for Protection of Stølsheimen Landscape Protection Area, Høyanger and Vik Municipality , Sogn & Fjordane, Modalen, Vaksdal and Voss municipalities, Hordaland of 21-12-1990*" state that "*disturbance of standing cultural heritage structures from recent times, such as buildings, roads, livestock pens, etc.*" is forbidden. This means that **all 13 cultural monuments listed in the database "*Askeladden*" (Table 19.1), with the addition of 18 house ruins (Black squares on Figure 19.8), which are mapped in the "*Management Plan of the Stølsheimen landscape protected area (1998)*", have legal protection. These are all core areas.**

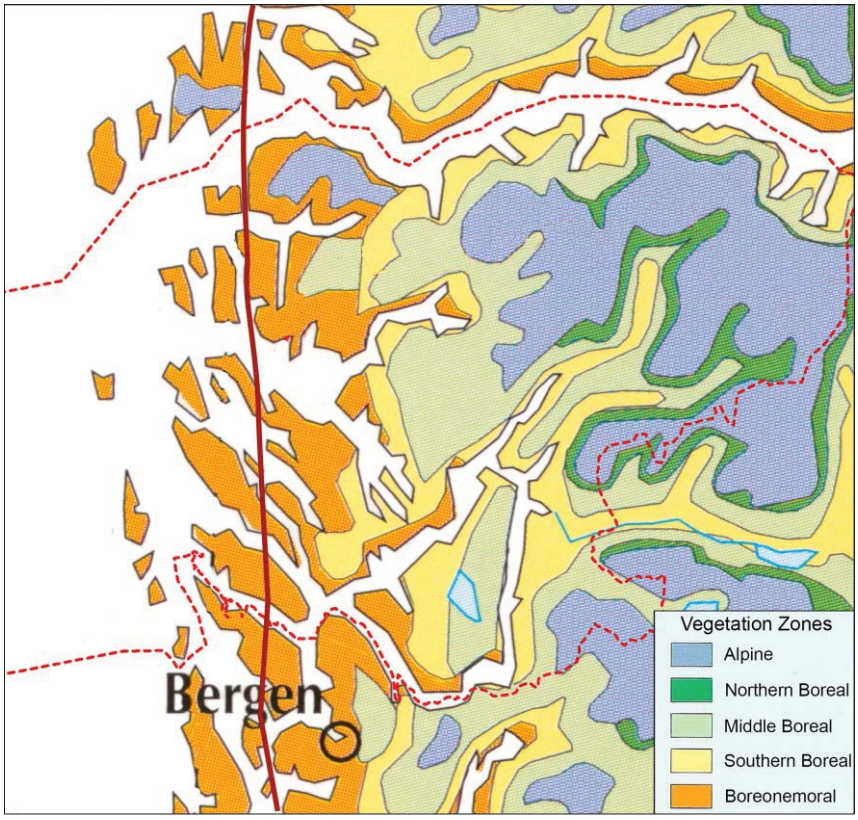
Table 19.1 Protection status in the database "Askeladden" of Directorate for Cultural Heritage. X and Y are map coordinates in UTM zone 32 Northern Hemisphere (WSG84).

ID	Ancient monument	Locality	Municipality	Protection status	X	Y
132270	Iron production site	Osland	Høyanger	Protected	23159.9	6805628.1
132233	3 building remains	Vassdalsvatn	Høyanger	Protected	23373.3	6805044.8
114884	Statite quarry	Fetts fk.nr. Fjellet F	Vik	Protected	33813.2	6790697.7
141992	Statite quarry	Gryteberget 1 og 2	Vik	Protected	28573.7	6785836.4
177701	Building remain	Alrekstølen	Vik	Protected	23937.5	6796687.1
177703	3 building remains	Alrekstølen	Vik	Protected	24073.1	6796893.1
132284	Building remain	Nedre Regndalsvatnet	Høyanger	Not definitive	20174.0	6802990.8
132277	Reindeer pitfall	Øksefjellvatn	Høyanger	Not definitive	20885.4	6801905.2
141956	Building remain	Tollknivbotn	Vik	Not definitive	28262.3	6796524.8
142000	2 building remains	Raudbergdalen	Vik	Not definitive	29237.9	6786098.9
141997	Building remain	Gryteberget	Vik	Not definitive	28822.4	6785681.9
177702	Building remain	Alreksttølen	Vik	Not definitive	24040.8	6796716.6
132331	Reindeer pitfall	Bjørnevatn	Høyanger	Not definitive	22915.5	6799202.2

Buffer zone: The Stølsheimen Landscape Protected Area (LPA) will act as a buffer zone, in line with the protection regulations stated in the Nature Conservation Act (cf. 9.3). In these regulations, §IV section 1 states that "*All intervention or renovation that may substantially alter the landscape character or character is prohibited*".

19.2 Vegetation map or land cover map

A vegetation map or land cover map showing the principal habitats and land cover types of the proposed biosphere reserve should be provided, if available.



Fgure 19.10 Vegetation zones in the proposed BR. Vertical red line: Boundary between the coastal heathland in the west and the wooded area in the east. Stippled red line: Boundary of the proposed BR. Map: Modified from map 70 in Moen 1999.

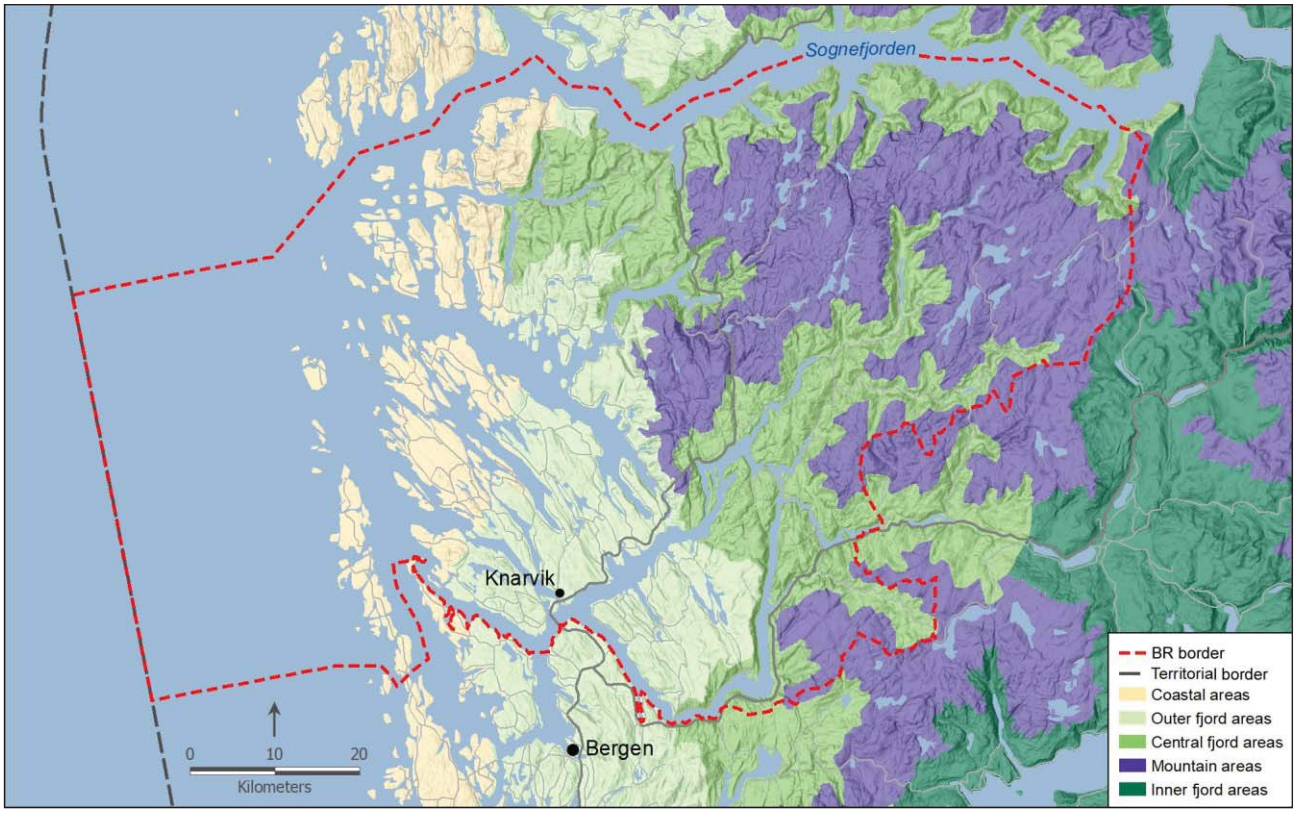


Figure 19.9: Landscape regions in Nordhordland (modified after NIJOS, 2011). Map: Lina Haggard.

19.3 List of legal documents

List the principal legal documents authorizing the establishment and governing use and management of the proposed biosphere reserve and any administrative area(s) they contain. Provide a copy of these documents.

The acts and regulations are available on: http://www.nordhordlandbiosphere.no/samarbeid-med-universitetet-i-bergen.365856.nn.html

See section 9.3 for short information on 4 central acts for land use and public recreation:

1. Act Relating to the Management of Biological, Geological and Landscape Diversity (Nature Diversity Act) (2009),
2. Act Concerning the Cultural Heritage (Cultural Heritage Act) (1978)
3. Act Relating to the Planning and Processing of Building Applications (Planning and Building Act) (2008)
4. Act Relating to Outdoor Recreation (Outdoor Recreation Act) (1957)

Core area and buffer zone complex 1: Lurefjorden and Lurosane

1. Act of 19 June 2009 No. 100 Relating to the Management of Biological, Geological and Landscape Diversity (Nature Diversity Act). (Lov om forvaltning av naturens mangfold (naturmangfoldsloven).)
2. Act of 27 June 2008 No 71 relating to Planning and the Processing of Building Applications (Planning and Building Act). Lov om planlegging og byggesaksbehandling (plan- og bygningsloven).
3. County Governor of Hordaland: Regulations relating to the protection of Lurefjorden and Lindåsosane marine protected area in the municipalities of Lindås, Radøy and Austrheim, Hordaland. (Forskrift om vern av Lurefjorden og Lindåsosane marine verneområde, Lindås, Radøy og Austrheim kommune, Hordaland.)
4. Lindås Municipal Council: Municipal plan 02.09.2015 for land use of Lindåsosane, Lygra and Lurefjorden 2011-2023. (Kommunedelplan 02.09.2015 for Lindåsosane, Lygra og Lurefjorden 2011-2023. Føresegner og retningsliner.
5. Radøy Municipal Council: Local regulation (case 046/10 of 01.09.2010) concerning discharges from small sewage plants for the municipality of Radøy. (Lokal forskrift om utslepp frå mindre avlaupsanlegg for Radøy kommune, datert 01.09.2010. Vedtatt i Radøy kommunestyre 30. september 2010, sak 046/10.)
6. EU Water Framework Directive: Ministry of Climate and Environment's approval of the regional water management plan in the water region Hordaland for the planning period 2016-2021. (Klima- og Miljødepartementet si godkjenning av regional plan for vassforvaltning i vassregion Hordaland for planperioden 2016-2021.)

Core area and buffer zone complex 2: The national salmon fjords at Osterøy

1. Proposition no. 32 2006-2007 to the Storting: About protection and completion of national salmon rivers and salmon fjords. (Om vern av villaksen og ferdigstilling av nasjonale laksevassdrag og laksefjorder.)
2. Act of 17 June 2005 no. 79 relating to aquaculture (Aquaculture Act). (Lov av 17 juni 2005 nr. 79 om akvakultur (Akvakulturloven).)
3. Food Safety Authority: Regulation of 22 June 2009 No 961 about special requirements for aquaculture related operations in or at national salmon fjords. (Forskrift av 22 juni 2009 nr. 961 om særskilte krav til akvakulturrelatert virksomhet i eller ved nasjonale laksevassdrag og nasjonale laksefjorder.) See: Statement of 24.05.2018 from Norwegian Food Safety Authority in section 19.3.

4. Food Safety Authority: Regulation of 5 December 2012 No. 1140 about control of sea lice in aquaculture plants. (Forskrift av 5 desember 2012 nr. 1140 om bekjempelse av lakselus I akvakulturanlegg.) See: Statement of 24.05.2018 from Norwegian Food Safety Authority in section 19.3.
5. Osterøy Municipal Council: Municipality intermediate plan for the sea and shore zone 2016-2016. (Kommunedelplan for sjø og strandsona 2016 – 2026. Arealplan etter PBL § 11-5. PlanID 125320140077)

Core area and buffer zone complex 3: River Loneelvi

1. Act No. 82 of 24 November 2000 relating to river systems and groundwater (Water Resources Act). (Lov 24 november 200 nr. 82 om vassdrag og grunnvann (vannressursloven).
2. Proposition no. 4 1972-73 to the Storting Concerning the Protection Plan for Watercourses.
3. Ministry of Local Government and Modernization: Regulations of 10 November 1994 on national policy guidelines for protected watercourses. (Forskrift om rikspolitiske retningslinjer for vernede vassdrag.
4. Osterøy Municipality Council: As part of the Municipality Area Plan (KPA) a consideration zone has been established to protect the environment of the main river and all side streams covering the catchment area of the watercourse.

Core area and buffer zone complex 4: Stølsheimen

1. Ministry of Climate and Environment: Official Norwegian Reports (NOU) 1986 No 13. New national plan for national parks. (Ny landsplan for nasjonalparker.)
2. Act of 9 June 1978 No 50 Concerning the Cultural Heritage (Cultural Heritage Act). (Lov om kulturminner (kulturminneloven).
3. Act of 28 June 1957 No. 16 Relating to Outdoor Recreation (Outdoor Recreation Act). (Lov om friluftslivet (friluftsloven).
4. County Governor of Sogn & Fjordane 1998: Management Plan for Stølsheimen landscape protected area. (Forvaltningsplan for Stølsheimen landskapsvernområde.)
5. County Governor of Sogn & Fjordane 2017: Revised management Plan for Stølsheimen landscape protected area. (Forvaltningsplan for Stølsheimen landskapsvernområde.) Approved by Norwegian Environment Agency.
6. Stølsheimen LPA was protected by the Crown Prince decree of 21.12.1990 on the basis of the Nature Conservation ct of June 1970 no.63. This Act was replaced by the Nature Diversity Act in 2009.

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Att. Peter Kaland

Norwegian Food Safety Authority

Mattilsynet

REGULATIONS THAT PROTECT WILD SALMON IN NORWAY

The Norwegian Food Safety Authority (NFSA) is a governmental body and the competent authority for promoting healthy aquaculture animals and environmentally friendly production. We draft and provide information on legislation related to the Food Act and the Animal Welfare Act.

Provisions to protect wild salmon from sea lice:
The following legislation is regulated by the NFSA and is intended to protect wild salmon stocks:

- Regulation of 22 June 2009 No 961 "*Forskrift om særskilte krav til akvakulturrelatert virksomhet i eller ved nasjonale laksevassdrag og nasjonale laksefjorder*" (relating to the protection of wild salmon stocks).
- Regulation of 5 December 2012 No. 1140 "*Forskrift om bekjempelse av lakselus i akvakulturanlegg*" (relating to the control of sea lice).
- The Diversity Act of 19 June 2009 No. 100.

Regulation 22 June 2009 No. 961 lays down provisions in order to give particular protection to the most important wild salmon stocks in Norway.
Included in this regulation are the river Vosso and the fjords near Osterøy - Molviki-Tysso and Skreaneset-Olsnessnipa. Any aquaculture related operations within national salmon fjords or within 5 km from national salmon rivers are strictly regulated. As a consequence there are no commercial aquaculture sites in the mentioned areas: The only location – 16122 Vosso – is a cultivation site strictly for the reestablishment of wild stocks in the area.

Regulation of 5 December 2012 No. 1140 aims amongst others to minimize damage from sea lice to wild salmon stocks.
Article 8 in this regulation states that aquaculture fish in the South West of Norway - including the area around Osterøy - shall have fewer sea lice than 0.2 adult females per fish from the start of week 16 to the end of week 21. This provision is intended to protect wild salmon from sea lice infestation during their yearly spring migration from the rivers to the sea. The rest of the year the legal limit of sea lice is 0.5 adult females per fish.

The Diversity Act articles 8 to 12 lays down general principles for applying rules and regulations in ways that protect the environment.

www.mattilsynet.no

Norwegian Food Safety Authority
Seksjon fisk og dyr Bergen og Omland

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Yours Sincerely

Trine Hellan
Head of Bergen Area Fish and Animal section
Norwegian Food Safety Authority

This document has been electronically approved, and sent without signature.
Documents that require a signature will also be sent as a paper copy.

19.4 List of land use and management/cooperation plans

All acts and regulations are available on http://www.nordhordlandbiosphere.no/samarbeid-med-universitetet-i-bergen.365856.nn.html

Core areas:

1. **Lurefjorden and Lindåsosane**:
   Regulations relating to the protection of Lurefjorden and Lindåsosane marine protected area in the municipalities of Lindås, Radøy and Austrheim, Hordaland. (Forskrift om vern av Lurefjorden og Lindåsosane marine verneområde, Lindås, Radøy og Austrheim kommune, Hordaland.)
2. **The national salmon fjords at Osterøy**:
   Proposition no. 32 2006-2007 to the Storting: About protection and completion of national salmon rivers and salmon fjords. (Om vern av villaksen og ferdigstilling av nasjonale laksevassdrag og laksefjorder.)
3. **River Loneelvi**:
   a. Proposition no. 4 1972-73 to the Storting Concerning the Protection Plan for Watercourses.
   b. Ministry of Local Government and Modernization: Regulations of 10 November 1994 on national policy guidelines for protected watercourses. (Forskrift om rikspolitiske retningslinjer for vernede vassdrag.
4. **Stølsheimen**:
   Act of 9 June 1978 No 50 Concerning the Cultural Heritage (Cultural Heritage Act). (Lov om kulturminner (kulturminneloven).

Buffer zones:

1. **Lurefjorden and Lindåsosane**:
   a. Lindås Municipal Council: Municipal plan 02.09.2015 for land use of Lindåsosane, Lygra and Lurefjorden 2011-2023. (Kommunedelplan 02.09.2015 for Lindåsosane, Lygra og Lurefjorden 2011-2023. Føresegner og retningsliner.
   b. Radøy Municipal Council: Local regulation (case 046/10 of 01.09.2010) concerning discharges from small sewage plants for the municipality of Radøy. (Lokal forskrift om utslepp frå mindre avlaupsanlegg for Radøy kommune, datert 01.09.2010. Vedtatt i Radøy kommunestyre 30. september 2010, sak 046/10.)
   c. Directorate for Cultural Heritage 2016: Cultural Landscapes of National Interest in Hordaland. Kulturhistoriske landskap av nasjonal interesse I Hordaland.

2. **The national salmon fjords at Osterøy**:
   a. Food Safety Authority: Regulation of 22 June 2009 No 961 about special requirements for aquaculture related operations in or at national salmon fjords. (Forskrift av 22 juni 2009 nr. 961 om særskilte krav til akvakulturrelatert virksomhet i eller ved nasjonale laksevassdrag og nasjonale laksefjorder.) See: Statement of 24.05.2018 from Norwegian Food Safety Authority in section 19.3.
   b. Food Safety Authority: Regulation of 5 December 2012 No. 1140 about control of sea lice in aquaculture plants. (Forskrift av 5 desember 2012 nr. 1140 om bekjempelse av lakselus I akvakulturanlegg.) See: Statement of 24.05.2018 from Norwegian Food Safety Authority in section 19.3.
   c. Osterøy Municipal Council: Municipality intermediate plan for the sea and shore zone 2016-2016. (Kommunedelplan for sjø og strandsona 2016 – 2026. Arealplan etter PBL § 11-5. PlanID 125320140077

3. **River Loneelvi**:
   a. Ministry of Local Government and Modernization: Regulations of 10 November 1994 on national policy guidelines for protected watercourses. (Forskrift om rikspolitiske retningslinjer for vernede vassdrag.
   b. Osterøy Municipality Council: As part of the Municipality Area Plan (KPA) a consideration zone has been established to protect the environment of the main river and all side streams covering the catchment area of the watercourse

4. **Stølsheimen**:
   a. County Governor of Sogn & Fjordane 1998: Management Plan for Stølsheimen landscape protected area. (Forvaltningsplan for Stølsheimen landskapsvernområde.)
   b. County Governor of Sogn & Fjordane 2017: Revised management Plan for Stølsheimen landscape protected area. (Forvaltningsplan for Stølsheimen landskapsvernområde.) Approved by Norwegian Environment Agency.

19.5 Species list

Provide a list of important species occurring within the proposed biosphere reserve, including common names, wherever possible.

Red listed species in the counties of Sogn & Fjordane and Hordaland within the categories Critically endangered (CR), Endangered (EN) and Vulnerable (VU) and Near threatened (NT). The proposed biosphere reserve covers only a small part of Sogn & Fjordane and part of Hordaland.

Redlist categories internationally (IUCN) and nationally	
CR (Critically endangered)	A species is Critically endangered when the best available documentation indicates that it meets one of the criteria A to E for Critically endangered, and is therefore regarded as being faced by an extremely high risk of dying out as a species in the wild.
EN (Endangered)	A species is Endangered when the best available documentation indicates that it meets one of the criteria A to E for Endangered, and is therefore regarded as being faced by a very high risk of dying out as a species in the wild.
VU (Vulnerable)	A species is Vulnerable when the best available documentation indicates that it meets one of the criteria A to E for Vulnerable, and is therefore regarded as being faced by a high risk of dying out as a species in the wild.
NT (Near threatened)	A species is Near threatened when it does not satisfy any of the criteria for CR, EN or VU, but is close to satisfying some of these criteria now, or in the near future.

Critically endangered (CR) species on the Natinal Red List occurring in the counties of Hordaland (H) and Sogn & Fjordane (S).

Species group	Scientific name	English name	County
Beetles	*Nitidula rufipes*		H
Beetles	*Panagaeus bipustulatus*		S
Birds	*Crex crex*	Corncrake	H+S
Birds	*Uria aalge*	Common guillemot	S
Bryophytes	*Jamesoniella undulifolia*	Marsh flapwort	H
Butterflies and moths	*Ethmia pusiella*	Striped ermel	S
Fish	*Dipturus batis*	Common skate	H+S
Hymenoptera	*Lestica subterranea*		S
Lichens	Bactrospora homalotropa		H
Lichens	Calicium quercinum	Spike lichen	H
Lichens	*Collema leptaleum*	Crumpled bat's wing lichen	S
Lichens	*Diploicia canescens*	Lobed button lichen	H
Lichens	*Enchylium limosum*	Lime-loving tarpaper lichen	H
Lichens	*Gomphillus calycioides*		H
Lichens	*Leptogium hibernicum*		H
Lichens	*Ramonia subsphaeroides*		H
Lichens	*Rinodina isidioides*		H
Lichens	*Rinodina stictica*		S
Lichens	*Scytinium fragrans*		S
Vascular plants	*Angelica archangelica var. maiorum*	Garden angelica	H
Vascular plants	*Botrychium matricariifolium*	Chamomile grape-fern	S
Vascular plants	*Centaurea phrygia subsp. pseudophrygia*	Wig knapweed	S
Vascular plants	*Rumex sanguineus*	Red-veiend dock	H

Endangered species (EN) on the Natinal Red List occurring in the counties of Hordaland (H) and Sogn & Fjordane (S).

Species group	Scientific name	Norwegian name	County
Algae	*Ceramium deslongchampsii*		H
Beetles	*Axinotarsus ruficollis*		H
Beetles	*Chrysolina latecincta*		H
Beetles	*Ctenicera cuprea*		H
Beetles	*Dytiscus semisulcatus*	Black-bellied great diving beetle	H
Beetles	*Elaphrus uliginosus*		H
Beetles	*Longitarsus apicalis*		S
Beetles	*Lyctus linearis*	European lyctus beetle	H+S
Beetles	*Melandrya caraboides*		H
Beetles	*Meloe proscarabaeus*	Black oil beetle	S
Beetles	*Onthophagus fracticornis*		S
Beetles	*Phyllodrepa salicis*		H
Beetles	*Plegaderus saucius*		S
Beetles	*Ptinus podolicus*		S
Beetles	*Rhacopus sahlbergi*		S
Beetles	*Sphaeriestes stockmanni*		H
Beetles	*Trypocopris vernalis*	Spring dor beetle	S
Birds	*Alca torda*	Razorbill	H+S
Birds	*Anas querquedula*	Garganey	H
Birds	*Bubo bubo*	Eagle owl	H+S
Birds	*Circus cyaneus*	Hen harrier	H
Birds	*Fulmarus glacialis*	Fulmar	S
Birds	*Philomachus pugnax*	Ruff	H
Birds	*Porzana porzana*	Spotted crake	H+S
Birds	*Rissa tridactyla*	Kittiwake	S
Birds	*Saxicola torquatus*	Stonechat	H+S
Birds	*Sterna hirundo*	Common tern	H+S
Birds	*Vanellus vanellus*	Lapwing	H+S
Bryophytes	*Anastrophyllum joergensenii*	Joergensen's notchwort	S
Bryophytes	*Atractylocarpus alpinus*	sylmose	H
Bryophytes	*Eucladium verticillatum*	Whorled tufa-moss	H
Bryophytes	*Habrodon perpusillus*	Lesser squirrel-tail moss	H
Bryophytes	*Hageniella micans*	Sparkling signal-moss	H
Bryophytes	*Hygrohypnum styriacum*	Snow brook-moss	H
Bryophytes	*Leptodontium flexifolium*	Bent-leaved beard-moss	H+S
Bryophytes	*Oxyrrhynchium pumilum*	Dwarf feather-moss	H
Bryophytes	*Plagiochila norvegica*		H
Bryophytes	*Pleuridium acuminatum*	Taper-leaved earth-moss	H+S
Bryophytes	*Porella obtusata*	Broad scalewort	H+S
Bryophytes	*Seligeria subimmersa*	Small limestone moss	H
Bryophytes	*Tortella flavovirens*	Yellow crisp-moss	H

Butterflies and moths	*Acasis appensata*		H+S
Butterflies and moths	*Acrolepiopsis betulella*	Durham tinea	H
Butterflies and moths	*Aporia crataegi*	Black-veined white	H+S
Butterflies and moths	*Athrips amoenella*		S
Butterflies and moths	*Diasemia reticularis*	Lettered China-mark	H+S
Butterflies and moths	*Digitivalva arnicella*		H
Butterflies and moths	*Epermenia profugella*	Little lance-wing	S
Butterflies and moths	*Falseuncaria ruficiliana*	Red-fringed conch	H
Butterflies and moths	*Metzneria aprilella*	Brilliant neb	S
Butterflies and moths	*Phyllonorycter tristrigella*	Elm midget	S
Butterflies and moths	*Pristerognatha penthinana*	Balsam marble	S
Butterflies and moths	*Pyrgus alveus*	Large grizzled skipper	S
Butterflies and moths	*Trifurcula eurema*	Field lotus pygmy	S
Butterflies and moths	*Zygaena lonicerae*	Narrow-bordered five-spot burnet	S
Butterflies and moths	*Zygaena osterodensis*	Woodland burnet	S
Caddisflies	*Wormaldia occipitalis*		H
Fish	*Cetorhinus maximus*	Basking shark	H+S
Fish	*Molva dypterygia*	Blue ling	H+S
Fish	*Sebastes norvegicus*	Redfish (Golden redfish)	H+S
Fish	*Squalus acanthias*	Spiny dogfish	H+S
Fungi	*Cantharellus friesii*	Orange chanterelle	H
Fungi	*Cortinarius balteatoalbus*		S
Fungi	*Cortinarius croceocoeruleus*		S
Fungi	*Cortinarius pseudoglaucopus*		S
Fungi	*Cortinarius splendens*	Splendid webcap	S
Fungi	*Cortinarius vesterholtii*		S
Fungi	*Geoglossum difforme*		H+S
Fungi	*Hygrocybe calyptriformis*	Pink waxcap	H+S
Fungi	*Hygrocybe canescens*		H+S
Fungi	*Hygrocybe citrinovirens*	Citrine waxcap	H
Fungi	*Hygrocybe spadicea*	Date waxcap	S
Fungi	*Hygrophorus calophyllus*		S
Fungi	*Inonotus hispidus*	Shaggy bracket	S
Fungi	*Leucopaxillus gentianeus*	Bitter false funnelcap	H
Fungi	*Porpoloma metapodium*	Mealy meadowcap	H+S
Fungi	*Ramaria fagetorum*		H
Fungi	*Rhodotus palmatus*	Wrinkled peach	H+S
Fungi	*Spongipellis spumea*		H+S
Fungi	*Strobilomyces strobilaceus*	Old man of the woods	H
Fungi	*Thujacorticium zurhausenii*		S
Fungi	*Trichoglossum variabile*		H
Fungi	*Tricholoma acerbum*	Bitter knight	H
Hymenoptera	*Andrena similis*	Red-backed mining-bee	H+S
Lichens	*Agonimia allobata*		S

Lichens	*Calicium abietinum*	Black stubble lichen	H
Lichens	*Calicium lenticulare*	Spike lichen	H
Lichens	*Calogaya biatorina*		S
Lichens	*Cladonia peziziformis*	Turban lichen	H
Lichens	*Coenogonium luteum*	Orange dimple lichen	S
Lichens	*Collema curtisporum*	Short-spored jelly lichen	S
Lichens	*Crutarndina petractoides*		H+S
Lichens	*Gyalecta derivata*		H+S
Lichens	*Heterodermia speciosa*	Powdered fringe lichen	S
Lichens	*Hypotrachyna sinuosa*	Sinuous imbricated lichen	H
Lichens	*Lecanora cinereofusca*	Bearded rim-lichen	H
Lichens	*Leptochidium crenatulum*		H
Lichens	*Megalospora pachycarpa*		H
Lichens	*Moelleropsis nebulosa*		H+S
Lichens	*Parmeliella testacea*		H
Lichens	*Pertusaria trachythallina*		S
Lichens	*Petractis clausa*	Eruptive lichen	H
Lichens	*Physcia leptalea*	Fringed rosette lichen	H
Lichens	*Placynthium lismorense*		H
Lichens	*Pyrenula macrospora*		H
Lichens	*Pyrenula nitida*		H
Lichens	*Scytinium callopismum*		H
Lichens	*Solenopsora vulturiensis*		H
Lichens	*Thelotrema macrosporum*		H
Lichens	*Usnea glabrata*	Lustrous beard licheny	H
Lichens	*Usnea longissima*	Methuselah's beard lichen	H+S
Mammals	*Gulo gulo*	Wolverine	H+S
Mammals	*Lynx lynx*	Lynx	H+S
Mammals	*Ursus arctos*	Brown bear	H+S
Spiders	*Maro lehtineni*		H
Spiders	*Robertus ungulatus*		H
Springtails	*Micranurida sensillata*		H
True bugs	*Aradus erosus*		H
True flies	*Brachyopa bicolor*		H
True flies	*Brachyopa obscura*		H+S
True flies	*Brachyopa pilosa*		H+S
True flies	*Eurygnathomyia bicolor*		H
True flies	*Mycomya simulans*		S
True flies	*Nemotelus notatus*	Flecked snout	S
True flies	*Pelecocera tricincta*		H
True flies	*Sphecomyia vespiformis*		H
Vascular plants	*Alchemilla xanthochlora*	Lady's mantle	H+S
Vascular plants	*Anisantha tectorum*	Drooping brome	H+S
Vascular plants	*Asperugo procumbens*	Madwort	H+S

Vascular plants	*Atriplex hastata*	Spear-leaved orache	S
Vascular plants	*Atriplex longipes*	Long-stalked orache	H+S
Vascular plants	*Baldellia repens*	Lesser water-plantain	H
Vascular plants	*Botrychium simplex*	Least grapefern (Least moonwort)	H
Vascular plants	*Calamistrum globuliferum*	Pillwort	H
Vascular plants	*Callitriche brutia*	Pedunculate water-starwort	S
Vascular plants	*Centaurea phrygia*	Wig knapweed	S
Vascular plants	*Cladium mariscus*	Great fen-sedge	H
Vascular plants	*Dactylorhiza majalis purpurella*	Northern marsh orchid	S
Vascular plants	*Draba cacuminum*		H
Vascular plants	*Draba cacuminum ssp. cacuminum*		H
Vascular plants	*Eriophorum gracile*	Slender cottongrass	H
Vascular plants	*Euphrasia confusa*	Eyebright	H
Vascular plants	*Galeopsis ladanum*	Broadleaf hemp nettle	H
Vascular plants	*Isolepis setacea*	Bristle club-rush	H
Vascular plants	*Leontodon hispidus*	Rough hawkbit	H
Vascular plants	*Pilosella moechiadia*		H+S
Vascular plants	*Potamogeton pusillus*	Lesser pondweed	S
Vascular plants	*Saxifraga hypnoides*	Mossy saxifrage	S
Vascular plants	*Tractema verna*	Spring squill	S
Vascular plants	*Zostera noltii*	Dwarf eelgrass	H

Vulnerable species (V) on the Natinal Red List occurring in the counties of Hordaland (H) and Sogn & Fjordane (S).

Species group	Scientific name	Norwegian name	County
Beetles	*Aspidapion radiolus*	Seed weevil	H
Beetles	*Atomaria rubida*		H
Beetles	*Bembidion dauricum*		H
Beetles	*Chaetocnema aerosa*		H
Beetles	*Chilomorpha longitarsis*		S
Beetles	*Corticeus longulus*		S
Beetles	*Cypha punctum*		H
Beetles	*Falagrioma thoracica*		S
Beetles	*Hylotrupes bajulus*	House longhorn	H+S
Beetles	*Hypera rumicis*		H+S
Beetles	*Margarinotus purpurascens*		S
Beetles	*Myrmecopora sulcata*		H
Beetles	*Opilo mollis*		H+S
Beetles	*Scopaeus pusillus*		S
Beetles	*Xylodromus concinnus*		H
Beetles	*Xylodromus depressus*		H+S
Birds	*Anas acuta*	Pintail	H+S
Birds	*Aythya marila*	Scaup	H+S
Birds	*Calcarius lapponicus*	Lapland bunting	H+S
Birds	*Carpodacus erythrinus*	Common rosefinch	H+S
Birds	*Cepphus grylle*	Black guillemot	H+S
Birds	*Chroicocephalus ridibundus*	Black-headed gull	H+S
Birds	*Fratercula arctica*	Puffin	S
Birds	*Fulica atra*	Coot	H
Birds	*Gallinula chloropus*	Common moorhen	H+S
Birds	*Melanitta fusca*	Velvet scoter	H+S
Birds	*Numenius arquata*	Curlew	H+S
Birds	*Phoenicurus ochruros*	Black redstart	H
Birds	*Rallus aquaticus*	Water rail	H+S
Birds	*Tachybaptus ruficollis*	Little grebe	H
Bryophytes	*Aplodon wormskioldii*	Carrion-moss	S
Bryophytes	*Brachydontium trichodes*	Bristle-leaf	S
Bryophytes	*Bryum riparium*	River thread-moss	H
Bryophytes	*Campylopus brevipilus*	Compact swan-neck moss	H+S
Bryophytes	*Campylopus pyriformis*	Dwarf swan-neck moss	H+S
Bryophytes	*Dicranum angustum*		H+S
Bryophytes	*Didymodon icmadophilus*	Slender beard-moss	H+S
Bryophytes	*Encalypta microstoma*	Candle snuffer moss	H
Bryophytes	*Encalypta vulgaris*	Common Extinguisher-moss	S
Bryophytes	*Fissidens pusillus*	Petty pocket-moss	H

Bryophytes	*Grimmia laevigata*	Hoary grimmia	S
Bryophytes	*Hamatocaulis vernicosus*	Slender green feathermoss	H
Bryophytes	*Hedwigia integrifolia*	Green hoar-moss	H+S
Bryophytes	*Herbertus stramineus*	Straw pringwort	S
Bryophytes	*Hygrohypnum cochlearifolium*	Hygrohypnum moss	H+S
Bryophytes	*Hygrohypnum montanum*	Montane hygrohypnum moss	H+S
Bryophytes	*Lophocolea fragrans*	Fragrant crestwort	H+S
Bryophytes	*Orthotrichum laevigatum*	Smooth bristle moss	S
Bryophytes	*Plagiochila spinulosa*	Prickly featherwort	H
Bryophytes	*Platyhypnidium lusitanicum*		H
Bryophytes	*Pohlia erecta*		H
Bryophytes	*Scapania apiculata*	Spruce pointed earwort	H+S
Bryophytes	*Syntrichia laevipila*	Twisted oak moss/Small hairy screw-moss	H
Bryophytes	*Syntrichia montana*	Tortula moss	H
Butterflies and moths	*Abraxas sylvata*	Clouded magpie	H+S
Butterflies and moths	*Canephora hirsuta*	Hairy sweep	H
Butterflies and moths	*Coleophora sylvaticella*	Hereford case-bearer	H
Butterflies and moths	*Depressaria daucella*	Dingy flat-body	H
Butterflies and moths	*Ectoedemia arcuatella*	Strawberry pygmy	H+S
Butterflies and moths	*Elachista bisulcella*	Yellow-tipped dwarf	S
Butterflies and moths	*Hypercallia citrinalis*	Lemon flat-body	H
Butterflies and moths	*Lampronia morosa*	Rose bright	H
Butterflies and moths	*Melitaea diamina*	False heath fritillary	S
Butterflies and moths	*Mompha terminella*	Enchanters cosmet	S
Butterflies and moths	*Nemophora minimella*	Small long-horn	H
Butterflies and moths	*Oncocera semirubella*	Rosy-striped knot-horn	S
Butterflies and moths	*Phyllonorycter nigrescentella*	Vetch midget	S
Butterflies and moths	*Phyllonorycter quinqueguttella*	Sandhill midget	H
Fish	*Anguilla anguilla*	Eel	H+S
Fish	*Lamna nasus*	Porbeagle	H+S
Fungi	*Antrodia mellita*		H+S
Fungi	*Boletopsis grisea*	Grey falsebolete	H
Fungi	*Camarophyllopsis foetens*		H
Fungi	*Clavaria amoenoides*		H+S
Fungi	*Clavaria flavipes*		H+S
Fungi	*Clavaria zollingeri*	Violet coral	H+S
Fungi	*Clavulinopsis fusiformis*	Golden spindles	H+S
Fungi	*Cortinarius adustorimosus*		S
Fungi	*Cortinarius argenteolilacinus*		H+S
Fungi	*Cortinarius cinnabarinus*	Cinnabar webcap	H+S
Fungi	*Cortinarius fragrantior*		H
Fungi	*Cortinarius lustratus*		H
Fungi	*Cortinarius olearioides*	Saffron stainer	H+S

Fungi	*Cortinarius populinus*		H+S
Fungi	*Cortinarius psammocephalus*		H
Fungi	*Cortinarius salor*		S
Fungi	*Cortinarius serratissimus*		H+S
Fungi	*Cortinarius tofaceus*		H
Fungi	*Crepidotus cinnabarinus*	Cinnabar oysterling	H
Fungi	*Entoloma aethiops*	Black pinkgill	H
Fungi	*Entoloma bloxamii*	Big blue pinkgill	H+S
Fungi	*Entoloma caeruleopolitum*		S
Fungi	*Entoloma cocles*		S
Fungi	*Entoloma cruentatum*		S
Fungi	*Entoloma kervernii*		S
Fungi	*Entoloma porphyrophaeum*	Lilac pinkgill	S
Fungi	*Entoloma pratulense*		H+S
Fungi	*Entoloma pseudocoelestinum*		S
Fungi	*Entoloma rhombisporum*		H+S
Fungi	*Entoloma sacchariolens*		S
Fungi	*Entoloma velenovskyi*		H+S
Fungi	*Geoglossum uliginosum*		H+S
Fungi	*Gloeopeniophorella convolvens*		S
Fungi	*Granulobasidium vellereum*		S
Fungi	*Grifola frondosa*	Hen of the woods/Maitake	H
Fungi	*Hapalopilus ochraceolateritius*		H+S
Fungi	*Haploporus odorus*	Diamond willow fungus	S
Fungi	*Hydnellum compactum*		H
Fungi	*Hygrocybe calciphila*	Limestone waxcap	H
Fungi	*Hygrocybe colemanniana*	Toasted waxcap	H+S
Fungi	*Hygrocybe ingrata*	Dingy waxcap	H+S
Fungi	*Hygrocybe intermedia*	Fibrous waxcap	H+S
Fungi	*Hygrocybe ovina*	Blushing waxcap	H+S
Fungi	*Hygrocybe roseascens*	stripevokssopp	S
Fungi	*Hygrocybe splendidissima*	Splendid waxcap	H+S
Fungi	*Hygrocybe subpapillata*		H
Fungi	*Hygrocybe turunda*		H+S
Fungi	*Hygrocybe vitellina*		H+S
Fungi	*Hymenochaete ulmicola*		H+S
Fungi	*Hyphoderma macedonicum*		H+S
Fungi	*Hyphoderma obtusum*		H
Fungi	*Hyphodermella corrugata*		H+S
Fungi	*Hyphodontia halonata*		S
Fungi	*Lactarius pterosporus*		H
Fungi	*Lepiota boudieri*	Girdled dapperling	S
Fungi	*Leucopaxillus rhodoleucus*		S
Fungi	*Lyophyllum transforme*		H

Fungi	*Microglossum atropurpureum*	Dark-purple earthtongue	H+S
Fungi	*Microglossum fuscorubens*		S
Fungi	*Microglossum olivaceum*	Olive earthtongue	H
Fungi	*Mutinus caninus*	Dog stinkhorn	H
Fungi	*Mycoacia uda*		H+S
Fungi	*Oxyporus obducens*		S
Fungi	*Perenniporia medulla-panis*	Pancake crust	H+S
Fungi	*Phlebia serialis*		H+S
Fungi	*Pleurotus calyptratus*	Oyster mushroom	H
Fungi	*Polyporus badius*	Black-footed polypore	S
Fungi	*Polyporus umbellatus*	Umbrella polypore	H
Fungi	*Porostereum spadiceum*		S
Fungi	*Ramariopsis crocea*	Orange coral	S
Fungi	*Rhodocybe stangliana*		S
Fungi	*Scytinostroma galactinum*	Ash root rot	H
Fungi	*Trichoglossum walteri*	Short-spored earthtongue	H+S
Fungi	*Tricholoma batschii*		H
Fungi	*Xenasma pulverulentum*		S
Fungi	*Xerocomus impolitus*	Iodine bolete	H
Hymenoptera	*Bombus quadricolor*		H+S
Hymenoptera	*Caenolyda reticulata*		S
Hymenoptera	*Caliadurgus fasciatellus*		H
Hymenoptera	*Nomada obtusifrons*	Flat-ridged nomad	H+S
Hymenoptera	*Sirex noctilio*	Sirex woodwasp	H+S
Hymenoptera	*Tenthredo fagi*		S
Lichens	*Alyxoria ochrocheila*	Scribble lichen	H
Lichens	*Arthonia cinnabarina*	Bloody comma lichens	H
Lichens	*Arthonia elegans*		H
Lichens	*Arthonia ilicina*		H
Lichens	*Arthonia lirellans*		H
Lichens	*Arthonia orbillifera*		H
Lichens	*Arthonia stellaris*		H
Lichens	*Bacidia biatorina*		H
Lichens	*Bryoria smithii*		H
Lichens	*Bryoria tenuis*	Pied horsehair lichen	S
Lichens	*Caloplaca demissa*		S
Lichens	*Caloplaca lucifuga*		H
Lichens	*Cetrelia olivetorum*	Speckled sea-storm lichen	H+S
Lichens	*Chaenotheca hispidula*	Lemon whiskers/Hispid needle lichen	S
Lichens	*Chaenotheca laevigata*	Lemon-twist whiskers/ Needle lichen	S
Lichens	*Cladonia glauca*	Glaucous cladonia	H
Lichens	*Cladonia humilis*		H

Lichens	*Cliostomum leprosum*		S
Lichens	*Cyphelium inquinans*	Cupped soot lichen	H+S
Lichens	*Graphis elegans*	Elegant script lichen	H+S
Lichens	*Gyalecta flotowii*	Dimple lichen	H+S
Lichens	*Gyalecta truncigena*	Dimple lichen	H+S
Lichens	*Hypotrachyna laevigata*	Smooth loop lichen/Even grey lichen	H+S
Lichens	*Lempholemma radiatum*	Lempholemma lichen	H
Lichens	*Leptochidium albociliatum*	Leptochidium lichen	S
Lichens	*Leptogium britannicum*		H
Lichens	*Leptogium burgessii*	"Frilly-fruited" jelly-skin lichen/ Crowned lichen	H+S
Lichens	*Leptogium cochleatum*		H+S
Lichens	*Melanohalea elegantula*	Elegant camouflage lichen	S
Lichens	*Menegazzia subsimilis*	Tree flute	H
Lichens	*Nevesia sampaiana*		H+S
Lichens	*Opegrapha vermicellifera*		H
Lichens	*Pachyphiale carneola*	Horny-cupped lichen	H+S
Lichens	*Parmotrema crinitum*	Salted-ruffle lichen	H+S
Lichens	*Pertusaria multipuncta*	Many-dotted lichen	H+S
Lichens	*Phlyctis agelaea*	Inelegant hollow-shielded lichen	H
Lichens	*Physcia magnussonii*	Magnusson's rosette lichen	S
Lichens	*Piccolia ochrophora*		S
Lichens	*Pilophorus cereolus*	Powdered matchstick	H+S
Lichens	*Porpidia hydrophila*		H+S
Lichens	*Protoblastenia terricola*	Protoblastenia lichen	H+S
Lichens	*Pseudocyphellaria crocata*	Yellow speckledbelly	H+S
Lichens	*Pseudocyphellaria intricata*		H+S
Lichens	*Pseudocyphellaria norvegica*	Norwegian speckledbelly	H+S
Lichens	*Punctelia stictica*	Rock speckled shield lichen	S
Lichens	*Ramalina thrausta*	Angel's hair	H+S
Lichens	*Rostania occultata*		S
Lichens	*Schismatomma pericleum*		S
Lichens	*Solorina octospora*	Chocolate chip lichen	H
Lichens	*Stereocaulon coniophyllum*	Powder foam lichen/Snow lichen	H+S
Lichens	*Stereocaulon delisei*		H+S
Lichens	*Sticta canariensis*	Spotted felt lichen	H+S
Lichens	*Thelopsis flaveola*		H+S
Lichens	*Thelopsis rubella*		H+S
Lichens	*Trapeliopsis wallrothii*	Scaly mottled-disc lichen	H+S
Lichens	*Usnea fragilescens*	Inflated beard lichen/Fragile beard	H+S
Lichens	*Variospora flavescens*		H
Mammals	*Lutra lutra*	Otter	H+S

Mammals	*Nyctalus noctula*	Noctule bat	H+S
Mammals	*Pipistrellus nathusii*	Nathusius' pipistrelle	H
Molluscs	*Margaritifera margaritifera*	Freshwater pearl mussel	H+S
Molluscs	*Mya arenaria*	Sand gaper	H+S
Spiders	*Cheiridium museorum*	Book scorpion	H+S
Springtails	*Anuridella marina*		H+S
Springtails	*Arrhopalites sericus*		H
True bugs	*Aradus brevicollis*		H
True bugs	*Berytinus signoreti*		H
True bugs	*Neides tipularius*		H
True bugs	*Stenodema virens*		S
True flies	*Callicera aurata*	Plain golden-hoverfly	H+S
True flies	*Criorhina ranunculi*	Large bear-hoverfly	H
True flies	*Eumerus flavitarsis*		H
True flies	*Exechiopsis grassatura*		S
True flies	*Monocentrota lundstroemi*		H
True flies	*Portevinia maculata*	Ramsons hoverfly	H+S
True flies	*Psychoda brevicornis*		H
True flies	*Sphaerophoria chongjini*		S
True flies	*Spilomyia manicata*		S
True flies	*Trichonta trivittata*		S
Vascular plants	*Aethusa cynapium elata*	Fool's parsley	H+S
Vascular plants	*Alchemilla subglobosa*		S
Vascular plants	*Antennaria lapponica*		H+S
Vascular plants	*Arnica montana*	Mountain arnica	H+S
Vascular plants	*Asplenium adulterinum*	Ladder spleenwort	H+S
Vascular plants	*Botrychium lanceolatum*	Lance-leaved moonwort	H+S
Vascular plants	*Botrychium multifidum*	Leathery moonwort	S
Vascular plants	*Carex paniculata*	Greater tussock-sedge	H+S
Vascular plants	*Carex quasibergrothii*	Small-fruited yellow sedge	H
Vascular plants	*Carex rufina*	Snowbed sedge/Red sedge	H+S
Vascular plants	*Circaea lutetiana*	Enchanter's-nightshade	H+S
Vascular plants	*Crassula aquatica*	Pigmyweed	H+S
Vascular plants	*Dryopteris expansa willeana*	Northern buckler-fern	S
Vascular plants	*Eleocharis parvula*	Dwarf spike-rush	S
Vascular plants	*Epipogium aphyllum*	Ghost orchid	S
Vascular plants	*Fraxinus excelsior*	Ash	H+S
Vascular plants	*Glyceria lithuanica*	Northern sweet-grass	S
Vascular plants	*Lysimachia minima*	Chaffweed	H+S
Vascular plants	*Malus sylvestris*	Crab apple	H+S
Vascular plants	*Meum athamanticum*	Spignel	H
Vascular plants	*Myosotis secunda*	Creeping forget-me-not	H
Vascular plants	*Ophioglossum vulgatum*	Adder's-tongue	H+S
Vascular plants	*Phippsia algida*	Ice grass	H+S

Vascular plants	*Phippsia concinna*	Snow grass	H
Vascular plants	*Polypodium interjectum*	Intermediate polypody	H
Vascular plants	*Rosa pimpinellifolia*	Burnet rose	H
Vascular plants	*Schoenus ferrugineus*	Brown bog-rush	H+S
Vascular plants	*Sorbus sognensis*	'Sognefjord' rowan	S
Vascular plants	*Taxus baccata*	Yew	H+S
Vascular plants	*Thalictrum minus*	Lesser meadow-rue	H
Vascular plants	*Thalictrum minus arenarium*	Lesser meadow-rue	H
Vascular plants	*Thymus praecox*	Wild thyme	S
Vascular plants	*Thymus praecox britannicus*	English wild thyme	S
Vascular plants	*Ulmus glabra*	Wych elm	H+S
Vascular plants	*Ulmus glabra glabra*	Wych elm	H+S
Vascular plants	*Ulmus glabra montana*	Wych elm	H+S
Vascular plants	*Urtica urens*	Small nettle	S
Vascular plants	*Zannichellia palustris*	Horned pondweed	H

Near threatened species (NT) on the Natinal Red List occurring in the counties of Hordaland (H) and Sogn & Fjordane (S).

Species group	Scientific name	Norwegian name	County
Algae	*Fucus cottonii*		H+S
Algae	*Nitella flexilis*	Smooth stonewort	H+S
Algae	*Rhodothamniella floridula*		H
Amphibians, reptiles	*Triturus cristatus*	Great crested newt	H
Beetles	*Ampedus nigroflavus*		S
Beetles	*Ancistronycha tigurina*		H
Beetles	*Aphodius sphacelatus*		S
Beetles	*Bythinus burrellii*		H
Beetles	*Calosoma inquisitor*	Caterpillar hunter/Lesser searcher	S
Beetles	*Carabus nitens*		H
Beetles	*Chrysolina hyperici*	St. John's-wort leaf beetle	H+S
Beetles	*Cionus alauda*		S
Beetles	*Cis quadridens*		H
Beetles	*Cryptocephalus distinguendus*		S
Beetles	*Enalodroma hepatica*		H
Beetles	*Fleutiauxellus algidus*		H
Beetles	*Holotrichapion aethiops*		H
Beetles	*Hydrosmecta delicatula*		H
Beetles	*Labidostomis humeralis*		S
Beetles	*Lesteva punctata*		H
Beetles	*Malthinus seriepunctatus*		H
Beetles	*Microrhagus lepidus*		S
Beetles	*Necydalis major*		S
Beetles	*Phloiotrya rufipes*		H
Beetles	*Prionocyphon serricornis*		H
Beetles	*Psylliodes cucullata*		S
Beetles	*Pterostichus quadrifoveolatus*		H
Beetles	*Quedius invreae*		H
Beetles	*Selatosomus cruciatus*		H
Beetles	*Stenus ater*		S
Beetles	*Taphrorychus bicolor*	Beech bark beetle	H
Birds	*Accipiter gentilis*	Goshawk	H+S
Birds	*Anas strepera*	Gadwall	H+S
Birds	*Carduelis flavirostris*	Twite	H+S
Birds	*Charadrius dubius*	Little ringed plover	H
Birds	*Coturnix coturnix*	Quail	H+S
Birds	*Delichon urbicum*	House martin	H+S
Birds	*Emberiza citrinella*	Yellowhammer	H+S
Birds	*Emberiza schoeniclus*	Reed bunting	H+S
Birds	*Falco rusticolus*	Gyrfalcon	H+S
Birds	*Gallinago media*	Great snipe	H

Birds	*Gavia adamsii*	Yellow-billed diver	H+S
Birds	*Lagopus lagopus*	Willow grouse	H+S
Birds	*Lagopus muta*	Ptarmigan	H+S
Birds	*Larus canus*	Common gull	H+S
Birds	*Locustella naevia*	Grasshopper warbler	H+S
Birds	*Luscinia svecica*	Bluethroat	H+S
Birds	*Melanitta nigra*	Common scoter	H+S
Birds	*Pandion haliaetus*	Osprey	S
Birds	*Riparia riparia*	Sand martin	H+S
Birds	*Somateria mollissima*	Common eider	H+S
Birds	*Stercorarius parasiticus*	Arctic skua	H+S
Birds	*Streptopelia decaocto*	Collared dove	H+S
Birds	*Sturnus vulgaris*	Starling	H+S
Bryophytes	*Anastrophyllum donnianum*	Donn’s notchwort	H+S
Bryophytes	*Archidium alternifolium*	Alternate leaf Archidium moss	H
Bryophytes	*Arctoa fulvella*	Arctic fork-moss	H+S
Bryophytes	*Bryum subapiculatum*	Lesser potato bryum	S
Bryophytes	*Buxbaumia viridis*	Green shield-moss	S
Bryophytes	*Campyliadelphus elodes*	snerpstjernemose	H
Bryophytes	*Dicranum viride*		H+S
Bryophytes	*Didymodon glaucus*	Green broom moss	H
Bryophytes	*Fissidens gracilifolius*	Narrow-leaved pocket-moss	H+S
Bryophytes	*Glyphomitrium daviesii*	Black-tufted moss	S
Bryophytes	*Grimmia fuscolutea*		S
Bryophytes	*Grimmia mollis*	Grimmia dry rock moss	H+S
Bryophytes	*Gyroweisia tenuis*	Slender stubble-moss	H
Bryophytes	*Herbertus hutchinsiae*		H
Bryophytes	*Heterocladium wulfsbergii*	Wulfsberg's Tamarisk-moss	H+S
Bryophytes	*Hygroamblystegium varium*	Willow feather-moss	H+S
Bryophytes	*Hyocomium armoricum*	Flagellate feather-moss	H+S
Bryophytes	*Isothecium holtii*	Holt's mouse-tail moss	H+S
Bryophytes	*Phaeoceros carolinianus*	Carolina hornwort	H
Bryophytes	*Physcomitrella patens*	Spreading earthmoss	S
Bryophytes	*Plagiochila exigua*	Petty featherwort	H+S
Bryophytes	*Rhabdoweisia crenulata*	Greater streak-moss	H
Bryophytes	*Rhynchostegiella tenella*	Tender feather-moss	H
Bryophytes	*Rhynchostegium confertum*	Clustered feather-moss	S
Bryophytes	*Tayloria tenuis*	Slender gland-moss	S
Bryophytes	*Tetrodontium ovatum*	Ovate tetrodontium moss	H+S
Bryophytes	*Tortella inclinata*	Bent crisp-moss	H
Bryophytes	*Trichostomum crispulum*	*Curly crisp-moss*	H
Bryophytes	*Weissia perssonii*	*Persson's stubble-moss*	H+S
Bryozoans	*Plumatella emarginata*	Robust bryozoan	H
Butterflies and moths	*Aporophyla lueneburgensis*	Northern deep-brown dart	H

Butterflies and moths	*Argyresthia ivella*	Gold-four argent	H+S
Butterflies and moths	*Bryotropha desertella*	Desert groundling	H
Butterflies and moths	*Caloptilia cuculipennella*	Feathered slender	H+S
Butterflies and moths	*Cerastis leucographa*	White-marked	S
Butterflies and moths	*Eupithecia expallidata*	Bleached pug	H
Butterflies and moths	*Paratalanta hyalinalis*	Translucent pearl	H+S
Butterflies and moths	*Parnassius mnemosyne*	*Clouded apollo*	S
Butterflies and moths	*Phyllonorycter hostis*	Red apple midget	H+S
Butterflies and moths	*Rhigognostis annulatella*	Ringed diamond-back /Annulated smudge	S
Butterflies and moths	*Stigmella pretiosa*	Water-avens pygmy	S
Caddisflies	*Beraea maura*		H
Caddisflies	*Stenophylax vibex*		H+S
Centipedes	*Allopauropus danicus*		H
Centipedes	*Lithobius macilentus*		H
Centipedes	*Strigamia crassipes*		H+S
Corals	*Anthomastus grandiflorus*		H+S
Corals	*Lophelia pertusa*	North Atlantic cold-water coral	H+S
Corals	*Paragorgia arborea*	Bubblegum coral	H+S
Crustacean	*Allomelita pellucida*		H
Fish	*Sprattus sprattus*	European sprat/Brisling	H+S
Fungi	*Abortiporus biennis*	Blushing rosette	H
Fungi	*Albatrellus subrubescens*		S
Fungi	*Amaurodon viridis*		S
Fungi	*Antrodia albobrunnea*		S
Fungi	*Antrodia pulvinascens*		S
Fungi	*Auricularia mesenterica*	Tripe fungus	H+S
Fungi	*Botryobasidium medium*		S
Fungi	*Camarophyllopsis schulzeri*	Matt fanvault	H+S
Fungi	*Cantharellus melanoxeros*	Blackening chanterelle	H+S
Fungi	*Ceriporia excelsa*		H
Fungi	*Chaetodermella luna*	Crescent crust	H+S
Fungi	*Clavaria fumosa*	Smoky spindles	H+S
Fungi	*Clavulinopsis umbrinella*	Beige coral	S
Fungi	*Clitocybe alexandri*	Alexander's funnel	H
Fungi	*Cortinarius aureofulvus*	Cortinar webcap	S
Fungi	*Cortinarius barbatus*		S
Fungi	*Cortinarius cagei*		H
Fungi	*Cortinarius cupreorufus*		S
Fungi	*Cortinarius ectypus*		H
Fungi	*Cortinarius mussivus*		S
Fungi	*Cortinarius praestans*	Goliath webcap	H+S
Fungi	*Cortinarius subporphyropus*		S
Fungi	*Cortinarius transiens*		H

Fungi	*Crinipellis scabella*	Hairy parachute	S
Fungi	*Crustoderma corneum*		H+S
Fungi	*Crustoderma tristis*		H+S
Fungi	*Dendrothele alliacea*		H+S
Fungi	*Entoloma ameides*		H+S
Fungi	*Entoloma atrocoeruleum*	Navy pinkgill	H+S
Fungi	*Entoloma chalybeum*	Indigo pinkgill	H+S
Fungi	*Entoloma corvinum*	Crow pinkgill	H+S
Fungi	*Entoloma euchroum*	*Stump pinkgill*	S
Fungi	*Entoloma griseocyaneum*	Felted pinkgill	H+S
Fungi	*Entoloma incanum*	Mousepee pinkgill	H+S
Fungi	*Entoloma mougeotii*		S
Fungi	*Entoloma prunuloides*	Mealy pinkgill	H+S
Fungi	*Entoloma strigosissimum*		S
Fungi	*Entoloma turci*		H+S
Fungi	*Fistulina hepatica*	Ox tongue/Beefsteak polypore	H+S
Fungi	*Geastrum minimum*	Tiny earthstar	S
Fungi	*Geastrum triplex*	Collared earthstar	S
Fungi	*Geoglossum cookeanum*		S
Fungi	*Geoglossum simile*		H+S
Fungi	*Gloiodon strigosus*		S
Fungi	*Hebeloma birrus*		H
Fungi	*Hericium coralloides*	Coral tooth	S
Fungi	*Hygrocybe aurantiosplendens*	Orange waxcap	H+S
Fungi	*Hygrocybe flavipes*	Yellow foot waxcap	H+S
Fungi	*Hygrocybe fornicata*	Earthy waxcap	H+S
Fungi	*Hygrocybe lacmus*	Grey waxcap	H+S
Fungi	*Hygrocybe nitrata*	Nitrous waxcap	H+S
Fungi	*Hygrocybe quieta*	Oily waxcap	H+S
Fungi	*Hygrocybe russocoriacea*	Cedarwood waxcap	H+S
Fungi	*Hygrophorus gliocyclus*		S
Fungi	*Hygrophorus nemoreus*	Oak woodwax	H+S
Fungi	*Hygrophorus persoonii*	*Olive wax cap*	H
Fungi	*Hygrophorus russula*	Pinknottle woodwax	H+S
Fungi	*Hyphoderma griseoflavescens*		H+S
Fungi	*Hyphodontia pruni*		S
Fungi	*Hypochnicium polonense*		S
Fungi	*Hypocrea alutacea*		H
Fungi	*Hypoxylon vogesiacum*		H+S
Fungi	*Infundibulicybe bresadolana*		H
Fungi	*Kavinia alboviridis*		H
Fungi	*Lactarius acris*	Raspberry milkcap	H
Fungi	*Lactarius citriolens*		H+S
Fungi	*Lactarius luridus*	Lurid milkcap	H+S

Fungi	*Lentaria byssiseda*		S
Fungi	*Lentaria epichnoa*	White wood coral	H+S
Fungi	*Lentinellus vulpinus*	Fox cockleshell	S
Fungi	*Meripilus giganteus*	Giant polypore	H
Fungi	*Metulodontia nivea*		H
Fungi	*Multiclavula mucida*	White green-algae coral	S
Fungi	*Mycena alba*	Ivory bonnet	H
Fungi	*Mycena arcangeliana*	Angel's bonnet	S
Fungi	*Mycena olida*	Rancid bonnet	S
Fungi	*Mycoacia aurea*		H+S
Fungi	*Mycoacia fuscoatra*		H+S
Fungi	*Pachykytospora tuberculosa*		H+S
Fungi	*Paullicorticium allantosporum*		S
Fungi	*Peniophorella guttulifera*		S
Fungi	*Phellinus nigrolimitatus*		S
Fungi	*Phlebia georgica*		S
Fungi	*Polyporus tuberaster*	Tuberous polypore	H+S
Fungi	*Ramaria botrytis*	Clustered coral/Rosso coral/ Pink-tipped coral	H
Fungi	*Ramaria flavobrunnescens*	Yellow-brown coral	H
Fungi	*Ramaria formosa*	Salmon coral/Yellow-tipped coral	S
Fungi	*Ramaria pallida*		S
Fungi	*Ramariopsis subtilis*	Slender coral	H+S
Fungi	*Rugosomyces onychinus*	Lilac domecap	S
Fungi	*Russula anthracina*	Coal brittlegill	H
Fungi	*Russula curtipes*		H+S
Fungi	*Sarcodon leucopus*		S
Fungi	*Sarcodon scabrosus*	Bitter tooth	H+S
Fungi	*Scytinostroma praestans*		S
Fungi	*Sidera lenis*		H+S
Fungi	*Tectella patellaris*	Veiled panus	H
Fungi	*Terana caerulea*	Cobalt crust	H+S
Fungi	*Trechispora kavinioides*		H+S
Fungi	*Tricholoma olivaceotinctum*		H
Fungi	*Tubulicrinis chaetophorus*		H
Fungi	*Tubulicrinis effugiens*		S
Fungi	*Tubulicrinis globisporus*		S
Fungi	*Tubulicrinis hirtellus*		S
Fungi	*Tubulicrinis inornatus*		S
Fungi	*Tyromyces kmetii*		H+S
Fungi	*Xenasma pruinosum*		S
Fungi	*Xylobolus frustulatus*	Ceramic fungus/Ceramic parchment	H+S
Hymenoptera	*Bombus muscorum*	Large carder bee	H
Hymenoptera	*Cladius grandis*	Poplar sawfly	H

Hymenoptera	*Dufourea dentiventris*		S
Lichens	*Alectoria sarmentosa*	Witch's hair	H+S
Lichens	*Bacidia absistens*		H+S
Lichens	*Bacidina inundata*		H+S
Lichens	*Biatora hypophaea*		H
Lichens	*Biatoridium monasteriense*		H+S
Lichens	*Bryoria bicolor*	Black & grey shrubby lichen	H+S
Lichens	*Bryoria nadvornikiana*	Spiny grey horsehair lichen	H+S
Lichens	*Bunodophoron melanocarpum*	Black-eyed Susan	H+S
Lichens	*Chaenotheca gracilenta*	Rat's whiskers	H+S
Lichens	*Cladonia callosa*		H+S
Lichens	*Cladonia parasitica*	Delicate spurious cup lichen	H
Lichens	*Cyphelium tigillare*	Yellow rail lichen	H+S
Lichens	*Elixia flexella*		H+S
Lichens	*Enchylium bachmanianum*		H+S
Lichens	*Evernia mesomorpha*		S
Lichens	*Flavoplaca havaasii*		H
Lichens	*Fuscopannaria ignobilis*	Caledonian pannaria	H+S
Lichens	*Fuscopannaria mediterranea*		H+S
Lichens	*Gyalecta friesii*	Dimple lichen	H+S
Lichens	*Gyalecta ulmi*	Elm gyalecta	H+S
Lichens	*Hyperphyscia adglutinata*	Grainy shadow-crust lichen	H
Lichens	*Lecanora impudens*		S
Lichens	*Leproplaca cirrochroa*		H
Lichens	*Lobothallia melanaspis*		H+S
Lichens	*Menegazzia terebrata*	Tree flute/Perforated lichen	H+S
Lichens	*Microcalicium ahlneri*	Ahlner's microcalicium lichen	H+S
Lichens	*Parmotrema chinense*	Palm ruffle lichen	H+S
Lichens	*Pectenia atlantica*		H+S
Lichens	*Pectenia cyanoloma*		H+S
Lichens	*Physcia dimidiata*	Rosette lichen	S
Lichens	*Protoparmelia oleagina*		H+S
Lichens	*Punctelia subrudecta*	Powdered speckled shield lichen/ Forest speckleback	H+S
Lichens	*Pyrenula occidentalis*	Wart lichen	S
Lichens	*Ramalina sinensis*	Fan ramalina/Burning bush	H+S
Lichens	*Rinodina flavosoralifera*		H+S
Lichens	*Rinodina sheardii*		H+S
Lichens	*Sclerophora coniophaea*		S
Lichens	*Sclerophora pallida*		H+S
Lichens	*Sclerophora peronella*		H+S
Lichens	*Scytinium magnussonii*		H
Lichens	*Squamarina scopulorum*		H
Lichens	*Stereocaulon leucophaeopsis*		H

Lichens	*Thelotrema suecicum*		H+S
Lichens	*Usnea cornuta*	Warty beard lichen	H
Lichens	*Usnea flammea*	Coastal bushy beard lichen	H+S
Lichens	*Xanthoparmelia verruculifera*		H+S
Mammals	*Lepus timidus*	Hare	H+S
Mammals	*Vespertilio murinus*	Parti-coloured bat	H+S
Molluscs	*Ostrea edulis*	European flat oyster	H+S
Molluscs	*Vertigo angustior*	Narrow-mouthed whorl snail	S
Segmented worms	*Hirudo medicinalis*	European medicinal leech	H+S
Spiders	*Syarinus strandi*	False scorpion	H
Sponges	*Racekiela ryderi*		H
Springtails	*Mesaphorura petterdassi*		H+S
Springtails	*Mesaphorura pongei*		H+S
Springtails	*Scutisotoma subarctica*		H+S
True bugs	*Micracanthia fennica*	*Harney hot spring shore bug*	H
True bugs	*Orthocephalus saltator*		H
True bugs	*Sehirus luctuosus*	Forget-me-not shieldbug	S
True flies	*Anatella aquila*		S
True flies	*Berkshiria hungarica*		S
True flies	*Bibio lautaretensis*		H
True flies	*Cheilosia fasciata*		H+S
True flies	*Epistrophe olgae*		H
True flies	*Exechia macula*		S
True flies	*Exodontha dubia*		H
True flies	*Gnoriste harcyniae*		S
True flies	*Heringia heringi*		H+S
True flies	*Macrorrhyncha flava*		H+S
True flies	*Melangyna ericarum*		H
True flies	*Mycomya disa*		S
True flies	*Myopa pellucida*	Pale-palped spring beegrabber	H
True flies	*Phronia obscura*		S
True flies	*Pipiza accola*		H+S
Vascular plants	*Allium scorodoprasum*	Sand leek	H
Vascular plants	*Anchusa arvensis*	Bugloss	H+S
Vascular plants	*Anchusa arvensis arvensis*	Bugloss	H+S
Vascular plants	*Androsace septentrionalis*	Northern rock jasmine	S
Vascular plants	*Artemisia norvegica*	*Norwegian mugwort*	H
Vascular plants	*Asplenium marinum*	Sea spleenwort	H+S
Vascular plants	*Asplenium scolopendrium*	Hart's-tongue	H+S
Vascular plants	*Blitum bonus-henricus*	Good-King-Henry	H+S
Vascular plants	*Campanula cervicaria*	Bristly bellflower	H+S
Vascular plants	*Carex lepidocarpa*	Long-stalked yellow sedge	S
Vascular plants	*Catabrosa aquatica*	Water whorl-grass	S
Vascular plants	*Cephalanthera longifolia*	Narrow-leaved helleborine	H+S

Vascular plants	*Cerastium nigrescens*	Shetland mouse-ear	H+S
Vascular plants	*Cinna latifolia*	Drooping woodreed	H+S
Vascular plants	*Comastoma tenellum*	Slender gentian	H+S
Vascular plants	*Draba alpina*	Alpine whitlow-grass	H
Vascular plants	*Draba lactea*	Milky whitlow-grass	S
Vascular plants	*Elatine hexandra*	Six-stamened waterwort	H+S
Vascular plants	*Elatine orthosperma*	Eight-stamened waterwort	H+S
Vascular plants	*Erigeron eriocephalus*	One-flowered fleabane	H+S
Vascular plants	*Euphrasia scottica*	Scottish eyebright	H+S
Vascular plants	*Filago arvensis*	Field cudweed	S
Vascular plants	*Gentianella campestris*	Field gentian	H+S
Vascular plants	*Gentianella campestris campestris*	Field gentian	H+S
Vascular plants	*Gentianella campestris islandica*	Icelandic field gentian	H+S
Vascular plants	*Geranium columbinum*	Long-stalked crane's-bill	H+S
Vascular plants	*Hammarbya paludosa*	Bog orchid	H+S
Vascular plants	*Hydrocotyle vulgaris*	Marsh pennywort	H+S
Vascular plants	*Koenigia islandica*	Iceland purslane	H+S
Vascular plants	*Lappula deflexa*	Deflexed bur forget-me-not	H+S
Vascular plants	*Lithospermum officinale*	Common gromwell	H+S
Vascular plants	*Lysimachia nemorum*	Yellow pimpernel	H+S
Vascular plants	*Micranthes tenuis*	Slender saxifrage	H+S
Vascular plants	*Monotropa hypopitys hypophegea*	Yellow bird’s-nest	H+S
Vascular plants	*Myosotis stricta*	Strict forget-me-not	S
Vascular plants	*Myricaria germanica*	German tamarisk	S
Vascular plants	*Osmunda regalis*	Royal fern	H+S
Vascular plants	*Peucedanum ostruthium*	Masterwort	H
Vascular plants	*Poa ×jemtlandica*	Swedish meadow-grass	H+S
Vascular plants	*Potentilla ×suberecta*	Tormentil	S
Vascular plants	*Potentilla tabernaemontani*	Spring cinquefoil	H+S
Vascular plants	*Pseudorchis albida*	Small white orchid	H+S
Vascular plants	*Ranunculus glacialis*	Glacier buttercup	H+S
Vascular plants	*Ranunculus nivalis*	Snow buttercup	H
Vascular plants	*Ranunculus polyanthemos*	Multi-flowered buttercup	S
Vascular plants	*Rhinanthus minor monticola*	Yellow-rattle	S
Vascular plants	*Rubus caesius*	Dewberry	H
Vascular plants	*Salix lanata glandulifera*	Woolly willow	S
Vascular plants	*Sorbus meinichii*		H+S
Vascular plants	*Sorbus subarranensis*		H+S
Vascular plants	*Spergula arvensis arvensis*	Corn spurry	H
Vascular plants	*Thalictrum simplex*	Small meadow-rue	S
Vascular plants	*Thalictrum simplex simplex*	Small meadow-rue	S
Vascular plants	*Trifolium campestre*	Hop trefoil	H
Vascular plants	*Veronica alpina pumila*	Alpine speedwell	H
Vascular plants	*Veronica verna*	Spring speedwell	S
Vascular plants	*Vicia orobus*	Wood bitter-vetch	H+S

[List existing land use and management/cooperation plans (with dates and reference numbers) for the administrative area(s) included within the proposed biosphere reserve. Provide a copy of these documents. It is recommended to produce English, French or Spanish synthesis of its contents and a translation of its most relevant provisions]

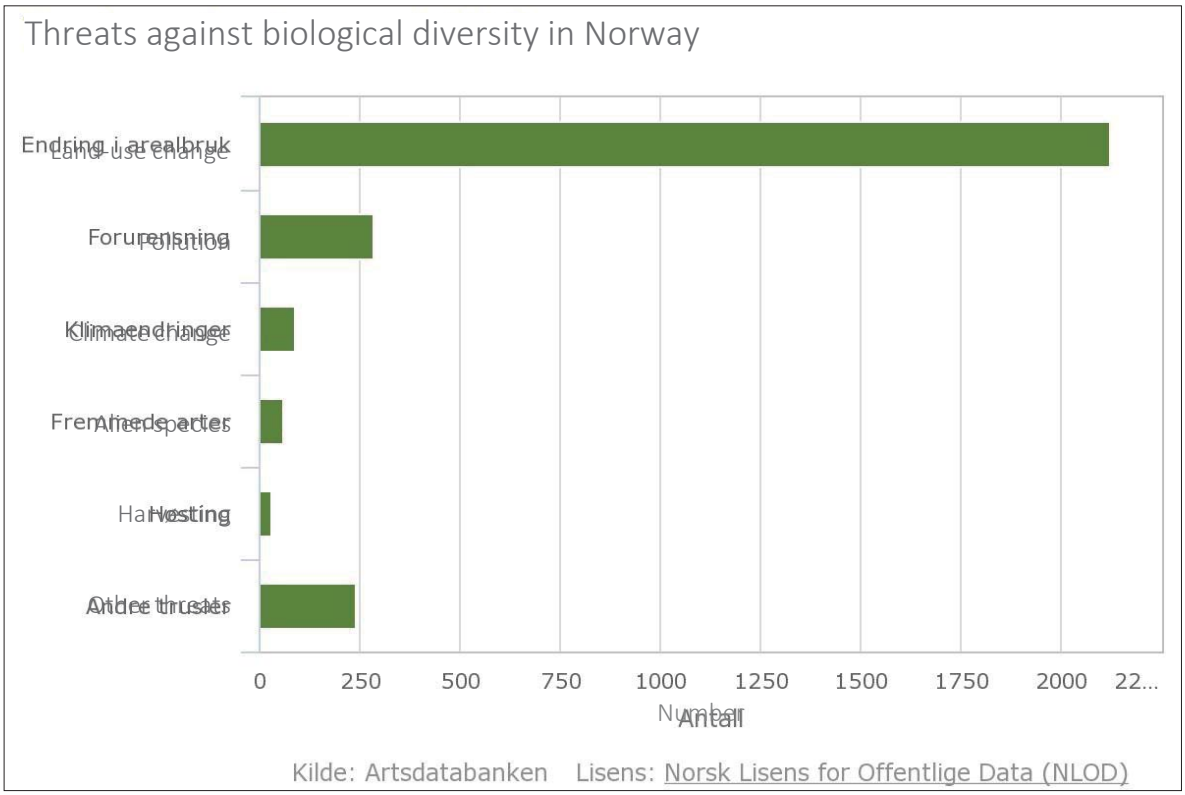


Figure: Threats against biological diversity in Norway. Source: Artsdatabanken.

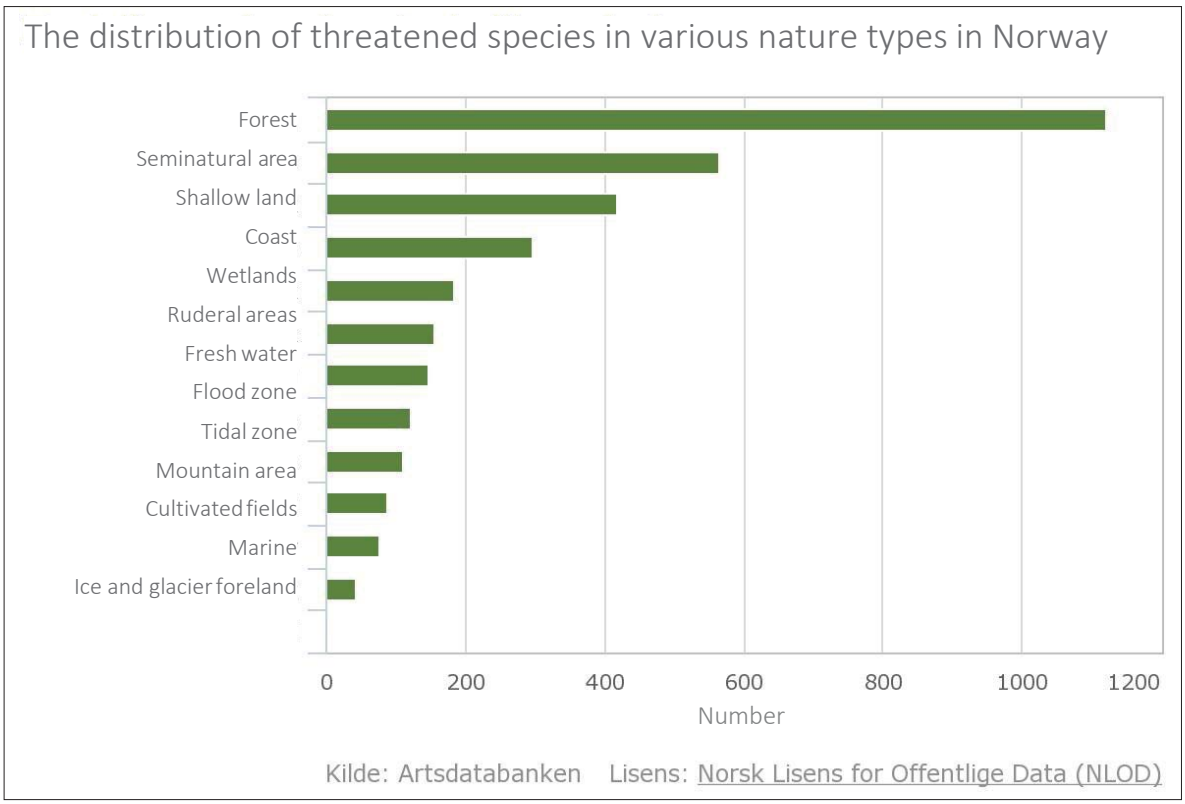


Figure: The distribution of threatened species in various nature types in Norway. Source: Artsdatabanken.

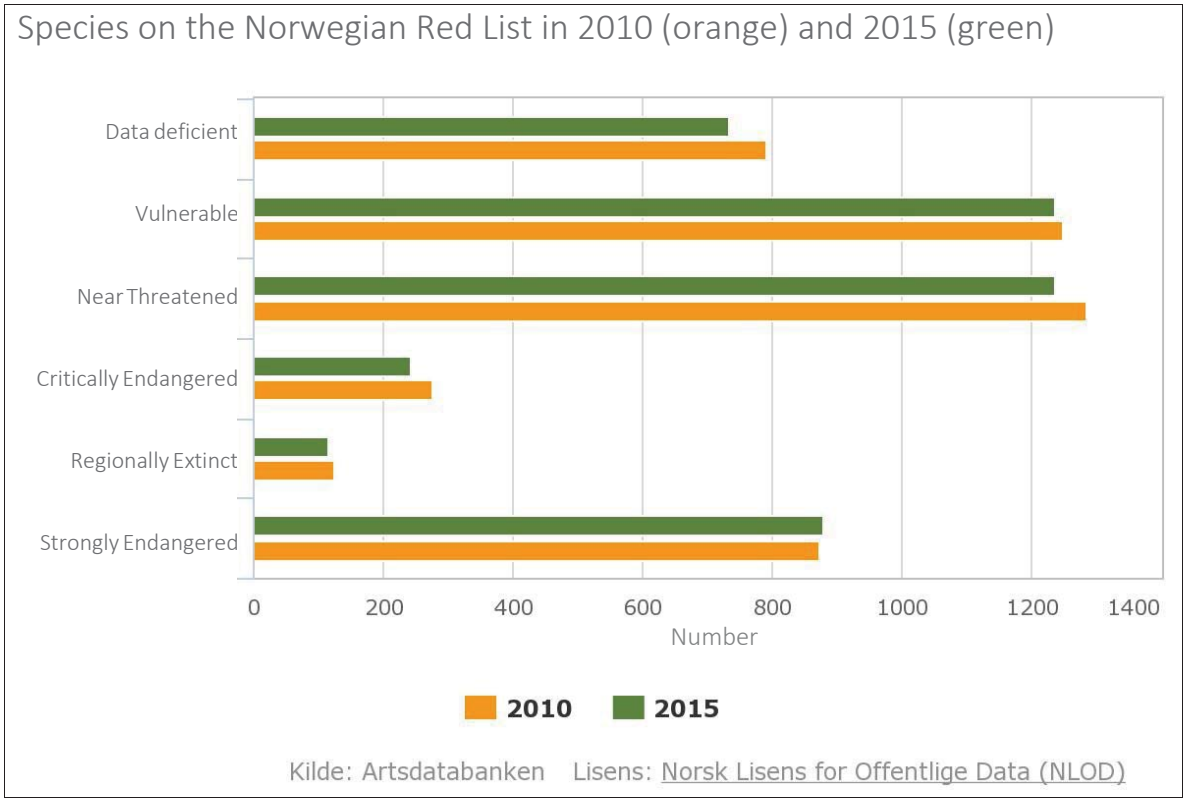
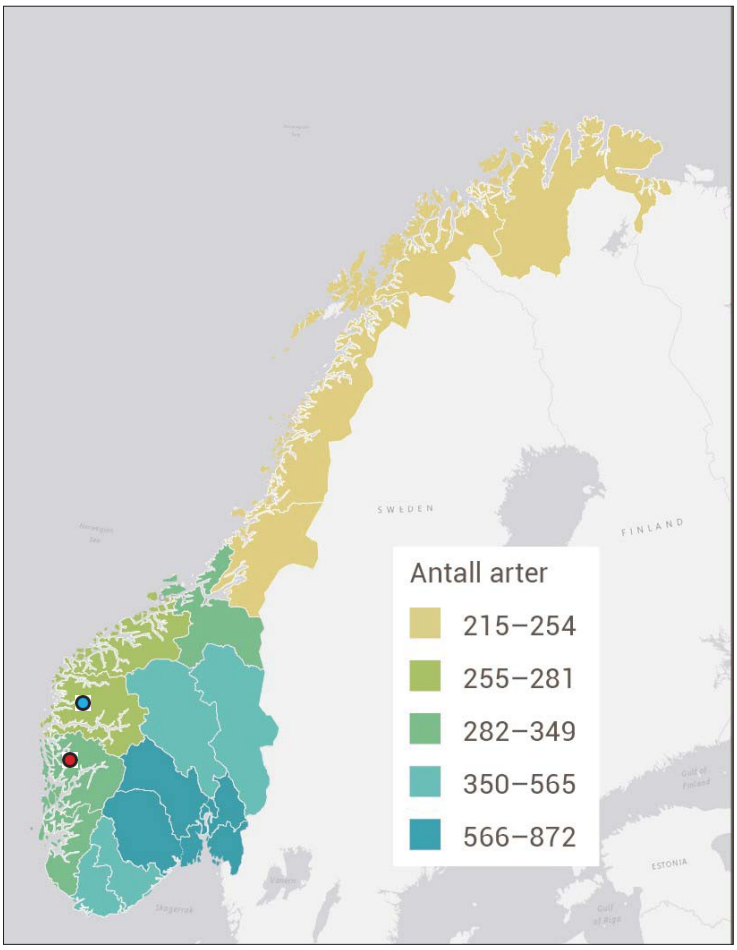
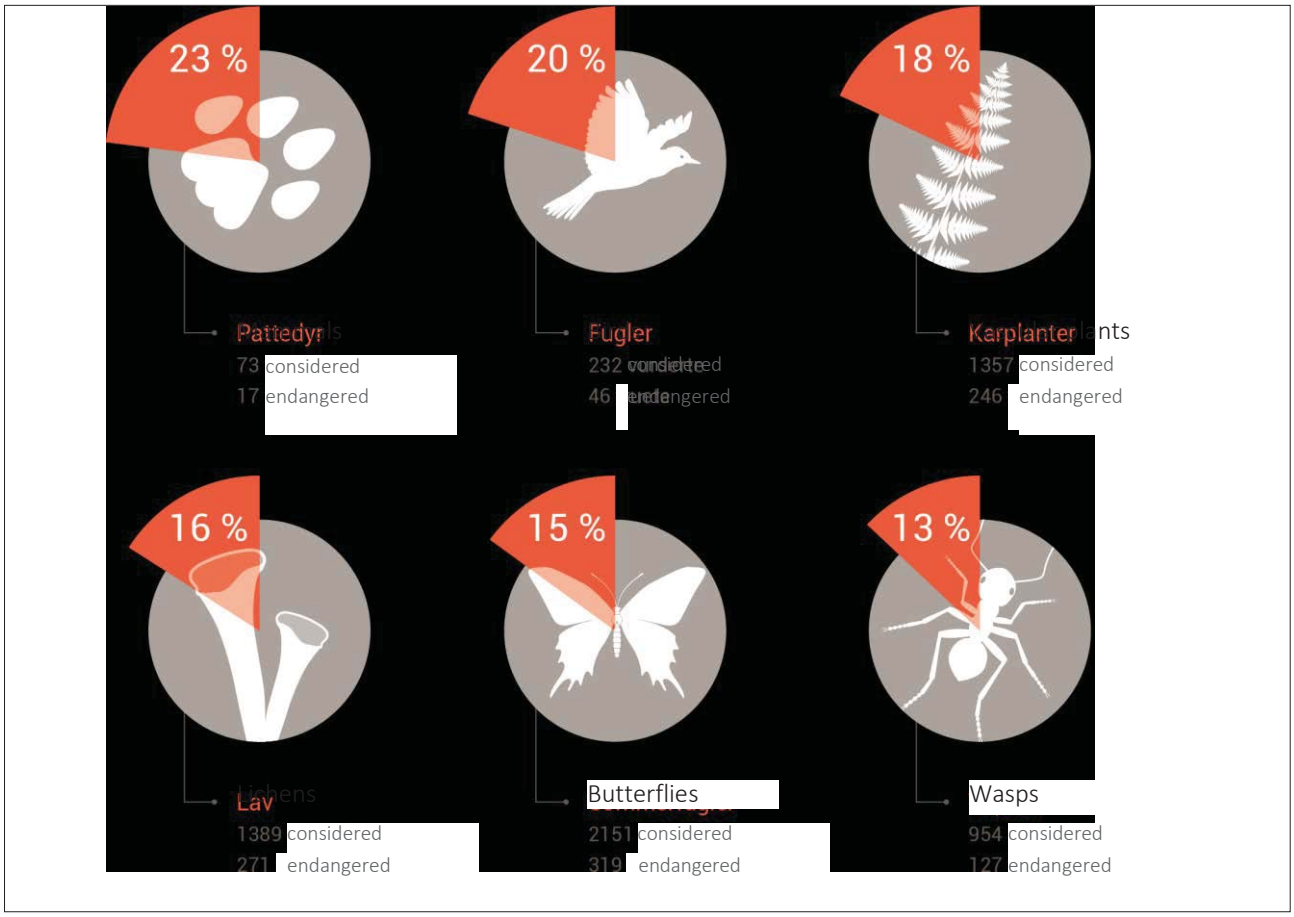


Figure: Species on the Norwegian Red List in 2010 (orange) and 2015 (green). Source: Artsdatabanken.



County distribution of the endangered species on Red List 2015. The number of endangered species is highest in the south-eastern parts of the country, with the most species in Oslo and Akershus (872 species), Telemark (698), Vestfold (675 species), Østfold (660 species) and Buskerud (647). Troms and Finnmark have fewest threatened species with 215 and 239 species, respectively. Source: Artsdatabanken. Red dot = Hordaland county, blue dot = Sogn og Fjordane county.



The largest proportion of endangered species in Norway is found in the species groups mammals, birds, vascular plants, lichens, butterflies and wasps. Source: Artsdatabanken.

19.6 List of main bibliographic references

Referenced literature

Aarrestad PA & Vandvik V (2000) Vegetation change in west-Norwegian coastal heathland – effects of the management methods fire and sheep grazing in rehabilitation of old heathland on Lurekalven in Hordaland. NINA Report 044: 1–60.

Aarrestad PA, Fremstad E & Skogen A (2001) Kystlyngheivegetasjon. I: Truete vegetasjonstyper i Norge Fremstad E & Moen A (red.). NTNU Botanisk rapport, 4, 99-105.

Andersen BG, Mangerud J, Sørensen R, Reite A, Sveian H, Thoresen M & Bergstrøm B (1995) Younger Dryas ice marginal deposits in Norway. Quaternary International. 28: 147-169.

Austad I & Hauge L (2014) Trær og tradisjon. Bruk av lauvtrær i kulturlandskapet. Fagbokforlaget. 169s. ISBN 978-82-11-01905-9

Barlaup BT & Vollset KW (red) (2015) Vosso Områdetilnærming. Sluttrapport. Laboratorium for ferskvannsøkologi og innlandsfiske (LFI). 73 s.

Barlaup BT (red) (2004) Bestandsutvikling, trusselfaktorer og tiltak. DN-utredning 2004-7

Barlaup BT (red) (2008) Nå eller aldri for Vossolaksen. DN-utredning 2008-9. 174 s.

Barlaup BT (red) (2013) Redningsaksjonen for Vossolaksen. DN-utredning 1-2013. 227 s.

Barlaup BT (red) (2018) Redningsaksjonen for Vossolaksen. Framdriftsrapport per 2017. Uni Research Miljø. LFI- rapport nr. 300.

Barlaup BT, Normann ES, Skoglund H, Vollset KW, Wiers T, Gabrielsen SE, Pulg U, Lehmann GB & Skår G (2016) Smoltslep som tiltak for å bygge opp gytebestanden av Vossolaks – Sammenstilling av fangster fra kile- og sittenotfiske. LFI-rapport nr. 269, 34 s.

Birkeland I. & Barlaup BT (2016) Prøvefiske etter rømt regnbueaure i Herdlefjorden ett år etterrømmingen ved Angelskår. LFI-rapport nr. 277, 28 s.

Birks HH, Aage P, Svendsen, JI, Alm T, Mangerud J, Landvik J (1994)Late Weichselian environmental change in Norway, including Svalbard. Journal of Quaternary Science. 9: 133-145.

Bolstad GH, Hindar K, Robertsen G, Jonsson B, Sægrov H, Diserud OH, Fiske P, Jensen AJ, Urdal K, Næsje TF, Barlaup BT, Florø-Larsen B, Lo H, Niemelä E, & Karlsson S (2017) Gene flow from domesticated escapes alters the life history of wild Atlantic salmon. Nature Ecology & Evolution, 1: 0124.

Bondevik S & Mangerud J (2002) The age of the maximum extent of the Younger Dryas re-advance in western Norway. Quaternary Science Reviews. 21: 1661-1676.

Bondevik S, Svendsen J-I, Johnsen G, Mangerud J, Kaland PE (1997) The Storegga tsunami along the Norwegian coast, its age and runup.Boreas. 26: 29-53.

Bouamrane M (ed) (2007) Dialogue I biosphere reserves. References, practices and experiences. Biosphere Reserves – Technical Notes 2. UNESCO, Paris.

Brekke NG (red) (1979) Stølar i Stølsheimen. Fylkeskonservatoren i Hordaland, Bergen

Christensen AL (1976) Sidl og pote. Daglegliv i ei strilebygd slik folk minnest. Lindås kommune. 160 s.

Engan LR (2004) Stølar i Vik. Skald forlag.

Ertresvaag E (2001) Strilesoga. Nord- og midthordland gjennom tidene frå 1914 til i dag. Eide forlag. 245 s.

Fægri K (1960) Maps of distributions of Norwegian vascular plants. I. The Coastal Plants. UiB Skr. 26.

Forseth T, Barlaup BT, Finstad B, Fiske P, Gjøsæter H, Falkegår M, Hindar A, Mo TA, Rikardsen AH, Thorstad EB, Vøllestad LA & Wennevik V (2017) The major threats to Atlantic salmon in Norway. ICES Journal of Marine Science.

Forseth T, Harby A, Ugedal O, Pulg U, Fjeldstad HP, Robertsen G, Barlaup BT, Alfredsen K, Sundt H, Saltveit SJ, Skoglund H, Kvingedal E, Sundt-Hansen L, Breivik E, Finstad A, Gravbrøt A, Einum

S & Arnekleiv JV (2013) Håndbok for miljødesign i regulerte laksevassdrag. Trondheim: Norsk institutt for naturforskning 2013 (ISBN 978-82-426-2589-2) 90 p. NINA temahefte 52.
Fossen AB (2007) Leia langs norskekysten. Den indre farleia fra Bergen til Mongstad. Bodoni forlag. 232s. ISBN 978-82-7128-442-8
Fremstad E, Aarrestad PA & Skogen A (1991) Kystlynghei på Vestlandet og i Trøndelag. Naturtype og vegetasjon i fare. NINA Utredn. 029: 1-172. Trondheim, Norway.
Gabrielsen SE, Barlaup BT, Halvorsen GA, Skoglund H, Sandven OR, Wiers T, Lehmann GB & Skår B (2013) «LIV – Livet i vassdragene»- Langsiktige undersøkelser av laks- og sjøaurebestander i seks regulerte elver i perioden 2006-2012. LFI-Rapport 194.
Gald R (2009) Stølar og stølsdrift i fortid og framtid i Hordaland og Sogn og Fjordane. FM Hordaland, FM Sogn og Fjordane, Hordaland fylkeskommune, Sogn og Fjordane fylkeskommune.
Gimingham CH (1972) Ecology of heathlands. Chapman and Hall, London, UK.
Gimingham CH (1975) An introduction to Heathland Ecology. Oliver and Boyle, Edinburgh.
Gimingham CH (1992) The Lowland Heathland Management Handbook. English Nature, Peterborough.
Haarstad H & Rusten G (2016) The challenges of greening energy: policy/industry dissonance at the Mongstad refinery, Norway. Environment and Planning: C Government and Policy. 34. 2, 340-355.
Halvorsen R, Bryn A & Erikstad L (2016) NiNs systemkjerne- teori, prinsipper og inndelingskriterier. Natur i Norge, Artikkel 1 (versjon 2.1.0): 1-358, Artsdatabanken, Trondheim (www.artsdatabanken.no).
Hauer C, Leitner C, Unfer G, Pulg U, Habersack H & Graf W (2018) The Role of Sediment and Sediment Dynamics in the Aquatic Environment. In Schmutz, S. & J. Sendzimir (red.) 2018: ”Riverine Ecosystem Management- Science for governing towards a sustainable future“. Springer. 572 s.
Hauer C, Pulg U, Gabrielsen S-E & Barlaup BT (2015) Application of step-backwater modelling for salmonid spawning habitat restoration in Western Norway. Ecohydrol., 8: 1239–1261.
Heinrup M & Schultz L (2017) Swedish Biosphere Reserves as Arenas for Implementing the 2030 Agenda. Analysis and practice. ISBN 978-91-620-6742-7.
Henriksen S & Hilmo O (2017) Den globale rødlista. Norsk rødliste for arter 2015. Artsdatabanken.
Hermelin B & Rusten G (2016) Lokal samverkan, tillväxt och omställning. – studier från industriregioner i Sverige och Norge. Linköpings Universitet: Centrum för Kommunstrategiska studier, 118 s.
Hermelin B & Rusten G (2018) How local context matters for social innovation. A place based approach to cases from Norway and Sweden. Journal and Local Economy.
Hobbs RJ, Jentsch A & Temperton VM (2007) Restoration as a Process of Assembly and Succession Mediated by Disturbance, In Linking Restoration and Ecological Succession. Walker L., Walker J & Hobbs R (Eds.) Springer Series on Environmental Management.
Hoelting K (2008) Vossolakksens betydning for kultur, livskvalitet og økonomi i fortid, nåtid og framtid. I: Barlaup BT (red.) Nå eller aldri for Vossolaksen. DN-utredning 2008-9.
IPCC (1992) Climate change (1992) The Supplementary Report to the Intergovernmental Panel on Climate Change Scientific Assessment (eds. J.T. Houghton, B.A. Callandar & S.K. Varney). Cambridge University Press, Cambridge.
IUCN (2001) IUCN Red List Categories and Criteria: Version 3.1. IUCN Species Survival Commission. IUCN, Gland, Switzerland and Cambridge, United Kingdom
Johannessen P, Sætre R, Kryvi H & Hjelle H (red) (2010) Bergensfjordene, Havforskningsinstituttet, Bergen, 191 s. Johansen, P.-O., Isaksen, T.E., Bye-Ingebrigtsen, E., Haave, M., Dahlgren, T.G., Kvalø, S.E., Greenacre, M., Durand, D., Rapp, H.T., 2018. Temporal changes in benthic macrofauna on the west coast of Norway resulting from human activities. Marine Pollution Bulletin 128, 483-495.

Kaland PE & Kvamme M (2013) Kystlyngheiene i Norge – kunnskapsstatus og beskrivelse av 23 referanseområder. Rapport M23-2013 Miljødirektoratet.

Kaland PE & Vandvik V (1998) Kystlynghei. Jordbrukets kulturlandskap (eds. E. Fremstad & I.B. Lid) pp. 50-60. Universitetsforlaget, Oslo.

Kaland PE (1979) Landskapsutvikling og bosetningshistorie i Nordhordalands lyngheiområder. På leiting etter den eldste garden (eds R. Fladby & J. Sandnes) pp. 41-47. Universitetsforlaget, Olso.

Kaland PE (1986) The origin and management Norwegian coastal heaths as reflected by pollen analysis. In: Behre, K.E. (eds.) Anthropogenic indicators in pollen analysis, pp. 19-36. Balkema, Rotterdam, NL.

Kaland PE (2014) Heathlands: land-use, ecology and vegetation history as a source for archaeological interpretations. In: Gulløv HC (ed): Northern Worlds – Landscapes, interactions and dynamics. Publications from the National Museum. Studies in Archaeology & History Vol. 22.

Kolderup CF & Kolderup NH (1940) Geology of the Bergen arc system. Bergen Museums Skrifter, 20, 1-137.

Kvamme M (1988) Pollen analytical studies of mountain summer-farming in western Norway. In: Birks, H.H., Birks, H.J.B, Kaland, P.E. & Moe, D.(eds): The Cultural Landscape Past, Present and Future. Cambridge University Press.

Kvamme M, Eiter S, Potthoff K & Kvamme N (2011) Spor etter stølsdrift i Sølssheimen landskapsvernområde. Registrering av kulturlandskap, selbøar, bygningar og bygningsrestar. Fylkesmannen i Sogn og Fjordane. Rapport nr. 4-2011.

Kvamme M, Kaland PE, Brekke NG (2004) Conservation and management of North European coastal Heathlands. Case study: The Heathland Centre, Western Norway. European Heritage Laboratories /Culture 2000 Programme of European Union.

Marås O (2008) Strileliv – tida some in gong var. Folkeminne frå Radøy. Bodoni forlag. 166s. ISBN 978-82-7128-507-4

Meld. St. 14. 2015-2016. Natur for livet. Norsk handlingsplan for naturmangfold. Det kongelige klima- og miljødepartement.

Miles J (1979) Vegetation dynamics. Chapman and Hall, London, UK.

Millennium Ecosystem Assessment. (2005) Current state & trend assessment.

Moen A 1999. National Atlas of Norway: Vegetation. Norwegian Mapping Authority, Hønefoss.

Måren IE & Nilsen LS (2007) (Eds.) Threats, management and conservation of heathlands. 10th European Heathland Workshop, University of Bergen, Norway.

Måren IE & Vandvik V (2009) Fire and regeneration: the role of seed banks in the dynamics of northern heathlands. Journal of Vegetation Science, 20: 871–888.

Måren IE & Vandvik V (2009) Prescribed burning and the role of seed banks in post-fire succession of northern heathlands, Lygra and Lurekalven islands, Hordaland, Norway. Conservation Evidence 6: 48-56.

Måren IE (2009) Effects of Management on Heathland Vegetation in Western Norway. PhD Thesis, Department of Biology, University of Bergen, Norway.

Måren IE, Janovský Z, Spindelbock J, Daws MI, Kaland PE & Vandvik V (2010) Prescribed burning of northern heathlands: Calluna vulgaris germination cues and seed-bank dynamics. Plant Ecology 207: 245-256.

Måren IE, Vandvik V & Ekelund K (2008) Effectiveness of chemical and mechanical bracken Pteridium aquilinum control treatments in northern coastal heathlands on the island of Lygra, Hordaland, Norway. Conservation Evidence 5: 12-17.

Måren IE, Vandvik V & Ekelund K (2008) Restoration of bracken-invaded Calluna vulgaris heathlands: Effects on vegetation dynamics and non-target species. Biological Conservation 141: 1034-1044. Doi: 10.1016/j.biocon.2008.01.012

NOU (2013) Naturens goder- om verdier av økosystemtjenster. Norges offentlige utredninger 2013:10. 431 s.

Nybø S & Evju M (red) (2017) Fagsystem for fastsetting av god økologisk tilstand. Forslag fra et ekspertråd. Ekspertrådet for økologisk tilstand, 247 s.

Potthoff K (2005) Landscape change in a mountain summer farming area. A study of custom, practice and alpine vegetation in Stølsheimen, Western Norway. Doctoral thesis at NTNU 2005:233 ISBN 82-471-7347-6

Prøsch-Danielsen L & Simonsen A (2000) Palaeoecological investigations towards the reconstruction of the history of forest clearances and coastal heathlands in south-western Norway. Vegetation History and Archaebotany, 9: 189-204.

Pulg U, Barlaup BT, Skoglund H, Velle G, Gabrielsen S-E, Stranzl S, Olsen EE, Lehmann G, Wiers T, Skår B Nordmann E, Fjeldstad H-P (2017) Tiltakshåndbok for bedre fysisk vannmiljø: God praksis ved miljøforbedrende tiltak i elver og bekker. Uni Research Miljø LFI rapport 296. Uni Research Bergen.

Region Nordhordland (2016) Jordmassar frå problem til ressurs. Rettleiar for offentlig forvaltning.

Rødland K (2001) Modalen. Mennesket i naturen. Modalen kommune. ISBN 82-995277-2-4

Rødland K (2005) Modalen. Elva som fødde bygda. Modalen kommune. ISBN 82-995277-4-0

Rødland K (2010) Modalen. Den vesle kraftkaren. Modalen kommune. ISBN 978-82-7129-243-0

Rusten G & Hermelin B (2016) Regionale strategier og samarbeid om sosiale innovasjoner i fagopplæringen –eksempelet TAF i Nordhordland. I: Region og regionalisering. Perspektiv og Praksis. NOVUS Forlag, s 165-189.

Rusten G & Hermelin B (2017) Cross-sector collaboration in upper secondary school vocational education: experiences from two industrial towns in Sweden and Norway. Journal of Education and Work.

Scherr SJ & Templeton SR (2000) Impacts of population increase and economic change on mountain forests in developing countries. In Forest in sustainable mountain development: A state of knowledge report for 2000. Price MF & Butt N (Eds.), 90–97. CABI Publishing, New York.

Skoglund H, Wiers T, Normann ES, Barlaup BT, Lehmann GB, Landro Y, Pulg U, Velle G, Gabrielsen S-E & Stranzl S (2017) Gytefisktelling og uttak av rømt oppdrettslaks i elver på Vestlandet høsten 2016. LFI Uni Miljø-rapport nr. 292.

Skre BG (1994) Havråboka. Soga om ein gammal gard på Osterøy. Stiftinga Havrâtunet. ISBN 82-9933309-0-4

TEEB (2010) The Economics of Ecosystems and Biodiversity.- Earthscan, London & Washington. Thorstad EB, Todd CD, Uglem I, Bjørn PA, Gargan PG, Vollset KW, Halttunen E, Kålås S, Berg M, Finstad B. B (2015). Effects of salmon lice Lepeophtheirus salmonis on wild sea trout Salmo trutta—a literature review. Acuaculture Environment Interactions. 7: 91-113.

Thorstad EB, Todd CD, Uglem I, Bjørn PA, Gargan PG, Vollset KW, Halttunen E, Kålås S, Berg M & Finstad B (2016) Marine life of sea trout. Marine Biology (2016) 163:47

Udvardy M.D.F. (1975) A classification of the biogeographical provinces of the world. IUCN Occasional Paper no. 18. Morges, Switzerland: IUCN & ”World Biogeographical Provinces”. The CoEvolution Quarterly, Sausalito, California

UN General Assembly, Transforming our world: the 2030 Agenda for Sustainable Development (2015) A/RES/70/1

UNESCO (2017) A New Roadmap for the Man and the Biosphere (MAB) Programme and its World Network of Biosphere Reserves: MAB Strategy (2015-2025), Lima Action Plan (2016 – 2025), Lima Declaration

Vandvik V, Heegaard E, Måren IE & Aarrestad A (2005) Managing heterogeneity: the importance of grazing and environmental variation on post fire succession in heathlands. Journal of Applied Ecology, 42: 139–149.

Vandvik V, Töpper JP, Cook Z, Daws MI, Heegaard E, Måren IE & Velle LG (2014) Management-driven evolution in a domesticated ecosystem. Biology Letters, 10: 20131082.

Velle G, Gabrielsen-E & Stranzl S (2017) Gytefisktelling og uttak av rømt oppdrettslaks i elver på Vestlandet høsten 2016. LFI Uni Miljø-rapport nr. 292.

Vollset KW, Barlaup BT & Normann ES (2017) Release during night enhances survival of wild Atlantic salmon smolts." Fisheries Management and Ecology 24.3. 256-264.

Vollset KW, Barlaup BT, Mahlum S, Bjørn P A, & Skilbrei OT (2016) Estimating the temporal overlap between post-smolt migration of Atlantic salmon and salmon lice infestation pressure from fish farms. Aquaculture Environment Interactions, 8, 511–525.

Vollset KW, Dohoo I, Karlsen Ø, Halttunen E, Kvamme BO, Finstad B, Wennevik V, Diserud OH, Bateman A, Friedland KD, Mahlum S, Jørgensen C, Qviller L, Krkosek M, Aatland A & Barlaup BT (2017) Disentangling the role of sea lice on the marine survival of Atlantic salmon. ICES Journal of Marine Science.

Vollset KW, Krontveit RI, Jansen PA, Finstad B, Barlaup BT, Skilbrei OT, Krkošek M, Romunstad P, Aunsmo A, Jensen AJ & Dohoo I (2016) Impacts of parasites on marine survival of Atlantic salmon: a meta-analysis. Fish Fish, 17: 714–730. doi:10.1111/faf.12141

Vollset KW, Mahlum S, Davidsen JG, Skoglund H & Barlaup BT (2016) Interaction between migration behaviour and estuarine mortality in cultivated Atlantic salmon Salmo salar smolts. J Fish Biol, 89: 1974–1990. doi:10.1111/jfb.13097

Vollset KW, Skoglund H, Wiers T & Barlaup BT (2016) Effects of hydropeaking on the spawning behaviour of Atlantic salmon Salmo salar and brown trout Salmo trutta. J Fish Biol, 88: 2236–2250.

Internet links

Arbeidsledighet. Statistisk Sentralbyrå. https://www.ssb.no/akumnd

Agriculture (table 15.3.): https://www.ssb.no/jord-skog-jakt-og-fiskeri

Fiskeridirektoratets statistikkbank (2017) https://www.fiskeridir.no/Statistikk/Statistikkbank

Folketal. Statistisk Sentralbyrå. https://www.ssb.no/befolkning/statistikker/folkemengde/kvartal

Guest nights Hordaland (table 15.2.): http://www.statistikknett.no/reiseliv/ar/utv/utv_oversyn1.aspxInformation about the municipalities:

Austrheim. http://www.austrheim.kommune.no/om-kommunen.298240.nn.html

Fedje. http://www.fedje.kommune.no/fakta-om-fedje.5724227-308902.html

Gulen. http://www.gulen.kommune.no/velkomen-til-gulen.110236.nn.html

Lindås. https://www.lindas.kommune.no/fakta-om-lindaas-kommune.386712.nn.html

Masfjorden. http://www.masfjorden.kommune.no/om-kommunen.323052.nn.html

Meland. http://www.meland.kommune.no/om-kommunen.298728.nn.html

Modalen. http://www.modalen.kommune.no/om-kommunen.323053.nn.html

Osterøy. http://www.osteroy.kommune.no/om-kommunen.299044.no.html

Radøy. http://www.radoy.kommune.no/om-kommunen.299360.nn.html

Vaksdal. http://www.vaksdal.kommune.no/kommunen-vaar.316226.nn.html

Øygarden. https://www.oygarden.kommune.no/om-oygarden/

Hjorteviltregisteret. https://www.hjorteviltregisteret.no/Elg/Jaktstatistikk/TildelteOgFelteDyr

Immigration in Nordhordland: https://www.imdi.no/tall-og-statistikk/steder/N44/befolkning/

Millennium Ecosystem Assessment (2005) Current state & trend assessment. https://www.millenniumassessment.org/en/Condition.html

Naturindeks for Norge. http://www.miljodirektoratet.no/no/Tema/Arter-og-naturtyper/Naturindeks-for-Norge/

Nature Types in Norway classification system. https://www.biodiversity.no/Pages/135563

Norwegian Biodiversity Information Centre. https://www.biodiversity.no/

Norwegian Environment Agency. http://www.miljodirektoratet.no/en/

Norwegian Red List for Ecosystems and Habitat Types. https://www.biodiversity.no/Pages/135568
Number of Fishermen. https://www.fiskeridir.no/Yrkesfiske/Statistikk-yrkesfiske/Fiskere-fartoey-og-tillatelser/Fiskere-fra-fiskermanntallet
State of the Environment Norway. http://www.environment.no/
Swedish Biosphere Reserves and Agenda 2030. http://biosfaromrade.org/wp-content/uploads/2017/03/Biosphere-Reserves-and-the-2030-Agenda.pdf
The 2030 Agenda and the Sustainable Development Goals http://sustainabledevelopment.un.org/post2015/transformingourworld
The Biosphere Programme in Sweden. http://biosfaromrade.org/
The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES). https://www.ipbes.net/
UN General Assembly, Transforming our world: the 2030 Agenda for Sustainable Development (2015) A/RES/70/1, available at: http://www.refworld.org/docid/57b6e3e44.html
The Norwegian PRTR. https://www.norskeutslipp.no/en/Frontpage/
UNESCO Lima Action Plan (2016-2025). http://biosfaromrade.org/wp-content/uploads/2017/09/Vagledning_Lima_action_plan.pdf
UNESCO MAB http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/
UN Sustainable Development Goals. https://www.un.org/sustainabledevelopment/
Unemployment (table 10.2.): https://www.nav.no/no/NAV+og+samfunn/Statistikk/Arbeidssokere+og+stillinger+-+statistikk/Helt+ledige
Villrein Norefjella. http://www.villrein.no/nordfjella-1/

19.7 Acronyms

BR	Biosphere Reserve
WNBR	World Network of Biosphere Reserves
UiB	University of Bergen
LPA	Landscape Protected Area
NAO	North Atlantic Osciliation
NOU	Official Norwegian Reports
NiN	Nature in Norway
IPBES	The Intergovernmental Science-Policy Platform On Biodiversity and Ecosystem Services
ICT	Information and Communication technology
SHAPE	Sustainable Heritage Areas: Partnership for Ecotourism
SDG	Sustainable Development Goals (UN Agenda 2030)
R&D	Research and Development
LAP	Lima Action Plan for the MAB Programme
MAB	UNESCO Man and the Biosphere Programme

20. ADDRESSES

20.1 Contact address of the proposed biosphere reserve:

[Government agency, organization, or other entity (entities) to serve as the main contact and to whom all correspondence within the World Network of Biosphere Reserves should be addressed.]

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Signatures from the municipalities that have parts of their area within Nordhordland Biosphere Reserve:

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Annex I to the Biosphere Reserve Nomination Form
MABNET DIRECTORY OF BIOSPHERE RESERVES
Biosphere Reserve Description[1]

Administrative details
Country: Norway

Name of BR:
Nordhordland Biosphere Reserve

Year designated:
(to be completed by MAB Secretariat)

Administrative authorities: (17.1.3)
Nordhordland Utviklingsselskap IKS

Name Contact: (20.1)
Kari Evensen Natland

Contact address: (Including phone number, postal and email adresses) (20.1)
Address: Kvassnesvegen 23
5914 Isdalstø
Phone no: +47 48 07 09 72
E-mail: kari@nordhordland.net

Related links: (web sites)
www.nordhordlandbiosphere.no

Social networks: (16.4.3)
Facebook: Nordhordland Biosfæreområde

Description
General description: (Site characteristics in 11.1; human population in 10)

Approximately 25 lines
Nordhordland Biosphere Reserve is centrally located on the coast of western Norway and comprises the coastal landscape between Bergen and Sognefjorden. It stretches from the Atlantic Ocean in the west, covers the outer coastal archipelago, through hundreds of fjords and inlets and ends in the mountains 1300 m above the sea level in the east. Nordhordland BR covers an area of 669,800 ha and the total population is close to 55 000. Water is a central theme for the biosphere reserve because water has been important for shaping the natural features of the region, and because people in the region have always utilised the lakes, the rivers, the fjords and the open ocean for hunting and fishing, and for transport. But Nordhordland is also vital for the Norwegian economy with large resources of hydroelectric power, and vast quantities of oil and gas which are extracted from the seabed off the coast. The region holds a central position in the Norwegian aquaculture industry. Traditional culture is still very much alive in Nordhordland. The biosphere reserve is based on the best from the past and aims to pave the way for a future-oriented societal development that ensures the sustainable use of all types of resources for the benefit and pleasure of both the present inhabitants and future generations.
Major ecosystem type: (14.1)
Marine systems, fresh water systems, terrestrial systems

Major habitats & land cover types: (11.6)

Principal categories in the biosphere reserve application	Main ecosystem according to the Nature index for Norway	Main ecosystem according to the NOU report on ecosystem services	Division of types according to Nature in Norway (NiN)
Marine systems	Ocean and coastal zone	Ocean and coastal zone	Marine benthic system Marine water bodies
Freshwater systems	Fresh water	Fresh water	Freshwater benthic system Limnic water bodies
Terrestrial systems	Wetland	Wetland	Wetland system
Terrestrial systems	Woodland and forest	Woodland and forest	Non-wetland system
Terrestrial systems	Alpine	Alpine	Non-wetland system Snow and ice system
Terrestrial systems	Open lowland (non-agricultural area)	Open lowland and agricultural area (cultural landscape)	Non-wetland system
Terrestrial systems		Green areas in towns and built-up areas	

Bioclimatic zone (11.5)

Areas	Average annual rainfall/ mm	Aridity index		Core area(s)	Buffer zone(s)	Transition area(s)
		Penman	(UNEP index)			
Hyper-arid	P<100	<0.05	<0.05			
Arid	100-400	0.05-0.28	0.05-0.20			
Semi-arid	400-600	0.28-0.43	0.21-0.50			
Dry Sub-humid	600-800	0.43-0.60	0.51-0.65			
Moist Sub-humid	800-1200	0.60-0.90	>0.65			
Per-humid	P>1200	>0.90		x	x	x

Location (latitude & longitude): (6.1)

Cardinal points	Latitude	Longitude
Most central point	60.830486 N	5.325954 E
Northernmost point	61.11778 N	5.153265 E
Southernmost point	60.420683 N	5.528657 E
Westernmost point	60.833071 N	4.185495 E
Easternmost point	61.054069 N	6.493736 E

Total Area (ha): (7)
Core area(s): (7)
Buffer zone(s): (7)
Transition area(s): (7)

	Terrestrisk	Marint	Total
7.1 Area of the core areas	85 ha	13,540 ha	13,625 ha (2,0%)

7.2 Area of the buffer zones	43,360 ha	30,730 ha	74,090 ha (11,1%)
7.3 Area of the transition zone	379,285 ha	202,800 ha	582,085 ha (86,9%)
TOTAL:	**422,730 ha**	**247,070 ha**	**669,800 ha**

Different existing zonation: (7.4)
We have no other zonations.

Altitudinal range (metres above sea level): (11.2)

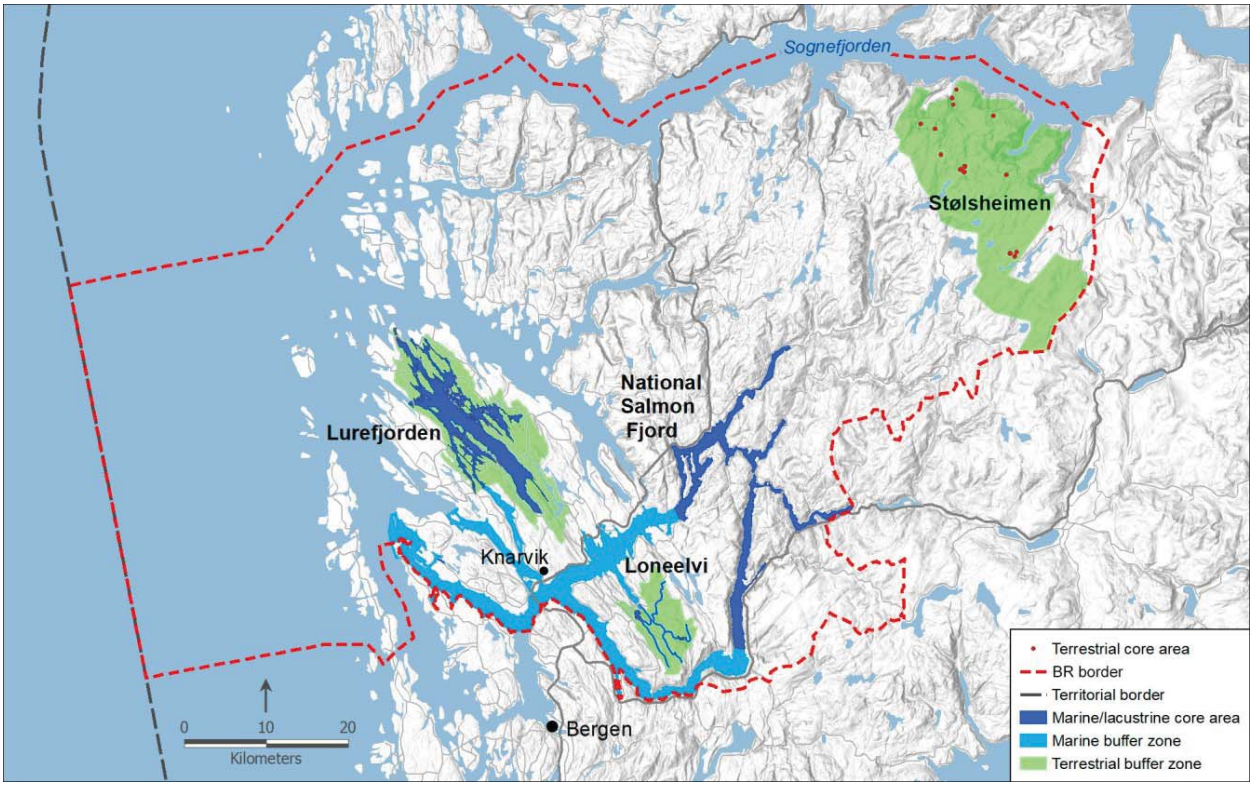
- The highest elevation above sea level is 1313 metres at Kleivfjellet in Stølsheimen
- The lowest elevation above sea level is 0 metres
- The maximum sea depth is 1308 metres below mean sea level in Sognefjord, off Åkrestrand in Høyanger municipality

Zonation map(s): (6.2)

Main objectives of the biosphere reserve
Brief description (13.1)

Approximately 5 lines
Nordhordland Biosphere Reserve will be based on the best from the past and will pave the way for a future-oriented societal development that ensures the sustainable use of all types of resources for the benefit and pleasure of both the present inhabitants and future generations.

Research



Brief description (16.1.1)

Approximately 5 lines
Research institutions in the region and abroad have and are using the proposed BR for research extensively, both within natural sciences (marine, limnic and terrestrial systems, geology, climate research, petroleum, hydroelectric power, renewable energy) and within social sciences (geography, innovation, economy, archaeology, history, sociology). The UNESCO Chair in "Sustainable Heritage and Environmental Management – Nature and Culture", University of Bergen, will be linked to work within the MAB Programme.

Monitoring
Brief description (16.1.1)

Approximately 5 lines
The Norwegian Environment Agency has the overarching national responsibility for monitoring and protecting the natural environment in Norway, also within the proposed BR. Extensive environmental monitoring is undertaken at sea, in rivers and lakes, at species and landscape levels and of air quality; e.g. the River delta database, Havmiljø.no, Encroachment-free natural environments, Environmental sample bank, Naturbase.no, Rovbase.no, Vannportalen.no, Arealis, and Norge.no.

Specific variables (fill in the table below and tick the relevant parameters)

Abiotic		Biodiversity	
Abiotic factors	V	Afforestation/Reforestation	V
Acidic deposition/Atmospheric factors	V	Algae	V
Air quality	V	Alien and/or invasive species	V
Air temperature		Amphibians	V
Climate, climatology	V	Arid and semi-arid systems	
Contaminants	V	Autoecology	V
Drought	V	Beach/soft bottom systems	V
Erosion	V	Benthos	V
Geology	V	Biodiversity aspects	V
Geomorphology	V	Biogeography	V
Geophysics	V	Biology	V
Glaciology	V	Biotechnology	V
Global change	V	Birds	V
Groundwater	V	Boreal forest systems	V
Habitat issues	V	Breeding	V
Heavy metals	V	Coastal/marine systems	V
Hydrology	V	Community studies	V
Indicators	V	Conservation	V
Meteorology	V	Coral reefs	V
Modeling	V	Degraded areas	V
Monitoring/methodologies	V	Desertification	
Nutrients	V	Dune systems	
Physical oceanography	V	Ecology	V
Pollution, pollutants	V	Ecosystem assessment	V
Siltation/sedimentation	V	Ecosystem functioning/structure	V
Soil	V	Ecosystem services	V
Speleology		Ecotones	V
Topography	V	Endemic species	
Toxicology	V	Ethology	V
UV radiation	V	Evapotranspiration	V
		Evolutionary studies/Palaeoecology	V
		Fauna	V
		Fires/fire ecology	V
		Fishes	V
		Flora	V
		Forest systems	V
		Freshwater systems	V
		Fungi	V
		Genetic resources	V
		Genetically modified organisms	
		Home gardens	V

		Indicators	V
		Invertebrates	V
		Island systems/studies	V
		Lagoon systems	V
		Lichens	V
		Mammals	V
		Mangrove systems	
		Mediterranean type systems	
		Microorganisms	V
		Migrating populations	V
		Modeling	V
		Monitoring/methodologies	V
		Mountain and highland systems	V
		Natural and other resources	V
		Natural medicinal products	V
		Perturbations and resilience	V
		Pests/Diseases	V
		Phenology	V
		Phytosociology/Succession	V
		Plankton	V
		Plants	V
		Polar systems	
		Pollination	V
		Population genetics/dynamics	V
		Productivity	V
		Rare/Endangered species	V
		Reptiles	V
		Restoration/Rehabilitation	V
		Species (re) introduction	V
		Species inventorying	V
		Sub-tropical and temperate rainforest systems	
		Taxonomy	V
		Temperate forest systems	V
		Temperate grassland systems	V
		Tropical dry forest systems	
		Tropical grassland and savannah systems	
		Tropical humid forest systems	
		Tundra systems	
		Vegetation studies	V
		Volcanic/Geothermal systems	
		Wetland systems	V
		Wildlife	V

Socio-economic		**Integrated monitoring**	
Agriculture/Other production systems	V	Biogeochemical studies	V
Agroforestry	V	Carrying capacity	V
Anthropological studies	V	Climate change	V
Aquaculture	V	Conflict analysis/resolution	
Archaeology	V	Ecosystem approach	V
Bioprospecting	V	Education and public awareness	V
Capacity building	V	Environmental changes	V
Cottage (home-based) industry	V	Geographic Information System (GIS)	V
Cultural aspects	V	Impact and risk studies	V
Demography	V	Indicators	V
Economic studies	V	Indicators of environmental quality	V
Economically important species	V	Infrastructure development	V
Energy production systems	V	Institutional and legal aspects	V
Ethnology/traditional practices/knowledge	V	Integrated studies	V
Firewood cutting	V	Interdisciplinary studies	V
Fishery	V	Land tenure	V
Forestry	V	Land use/Land cover	V
Human health	V	Landscape inventorying/monitoring	V
Human migration	V	Management issues	V
Hunting	V	Mapping	V
Indicators	V	Modelling	V
Indicators of sustainability	V	Monitoring/methodologies	V
Indigenous people's issues		Planning and zoning measures	V
Industry	V	Policy issues	V
Livelihood measures	V	Remote sensing	V
Livestock and related impacts	V	Rural systems	V
Local participation	V	Sustainable development/use	V
Micro-credits		Transboundary issues/measures	
Mining		Urban systems	V
Modelling	V	Watershed studies/monitoring	V
Monitoring/methodologies	V		
Natural hazards	V		
Non-timber forest products	V		
Pastoralism	V		
People-Nature relations	V		
Poverty			
Quality economies/marketing	V		
Recreation	V		
Resource use	V		
Role of women	V		
Sacred sites			
Small business initiatives	V		
Social/Socio-economic aspects	V		
Stakeholders' interests	V		
Tourism	V		
Transports	V		

Annex II to the Biosphere Reserve Nomination Form
Promotion and Communication Materials
For the Proposed Biosphere Reserve

Provide some promotional material regarding the proposed site, notably high quality photos, and/or short videos on the site so as to allow the Secretariat to prepare appropriate files for press events. To this end, a selection of photographs in high resolution (300 dpi), with photo credits and captions and video footage (rushes), without any comments or sub-titles, of professional quality – DV CAM or BETA only, will be needed.

In addition, return a signed copy of the following Agreement on Non-Exclusive Rights. A maximum of ten (10) minutes on each biosphere reserve will then be assembled in the audiovisual section of UNESCO and the final product, called a B-roll, will be sent to the press.

Photos will be sent electronic referring to this agreement below.

United Nations Educational, Scientific and Cultural Organization
Organisation des Nations Unies pour l'éducation, la science et la culture
Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura
Организация Объединенных Наций по вопросам образования, науки и культуры
منظمة الأمم المتحدة للتربية والعلم والثقافة
联合国教育、科学及文化组织

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Bureau of Public Information

Photothèque de l'UNESCO
Bureau de l'Information du Public

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3-Eivind Senneseth_Gulen_Nordhordland BR
4-Eivind Senneseth_Nordhordland BR
5- Eivind Senneseth_schoolband_Nordhordland BR
6- Hans Kristian Dolmen_Stolsheimen_Nordhordland BR
7- Inger Elisabeth Måren_old norwegian sheep_Nordhordland BR
8-Inger Elisabeth Måren_Stolsheimen_Nordhordland BR
9-Kjersti Isdal_Austrheim_Nordhordland BR
10-Kjersti Isdal_Fedje_Nordhordland BR
11- Kjersti Isdal_Modalen_Nordhordland BR
12- Kjersti Isdal_resourceprofile_Nordhordland BR
13-Kjersti Isdal_sheepfarming_Nordhordland BR
14-Linda Sæle Kjenes_coast_Nordhordland BR
15-Mons Kvamme_Nordhordland BR
16-Peter Emil Kaland_Nordhordland BR
17-Rita Sæle Langeland_Nordhordland BR
18-Svein Nord_Coast_Nordhordland BR

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b) These rights are granted to UNESCO for the legal term of copyright throughout the world.
c) The name of the photographer will be cited alongside UNESCO's whenever his/her work is used in any form.

2. I certify that:

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b) The photo(s) is/are in no way whatever a violation or an infringement of any existing copyright or licence, and contain(s) nothing obscene, libellous or defamatory.

Name and Address :
Nordhordland Utviklingsselskap IKS
Kvassnesvegen 23
5914 Isdalstø

Date : 11. sep 2018
Signature : Kari Eversen Vatland

(sign, return to UNESCO two copies of the Agreement and retain the original for yourself)

Mailing address: 7 Place Fontenoy, 75352 Paris 07 SP, Direct Telephone: 00331 – 45681687
Direct Fax: 00331 – 45685655; e-mail: photobank@unesco.org; m.ravassard@unesco.org

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