

Environmental values in Norwegian agricultural landscapes

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Foreword

What role does the Norwegian agriculture play for the environment?

A large amount of research has been carried out internationally and in Norway on documenting and analyzing various environmental aspects and consequences of agriculture in the western industrialized countries. This report is an attempt to bring together, synthesize and analyse some important results of this enormous amount of scientific works within natural and social sciences.

This report is one of three subprojects carried out at the Centre for Rural Research for the Norwegian Ministry of Agriculture trying to answer the difficult question about what role Norwegian agriculture plays for the Norwegian society as a whole.

Dr. Gunilla Almered Olsson, Associated professor of the Department of Botany, Faculty of Chemistry and Biology, and Dr. Katrina Rønningen from the Centre for Rural Research, both at the Norwegian University of Science and Technology in Trondheim, carried out the work with this report. Olsson has mainly dealt with the issue of biodiversity in the agricultural landscape, while Rønningen has mainly focused on the cultural and humanistic aspects. Rønningen has been project leader.

In our original project description, we focused to a large extent on the connections between support systems, economy, farming practices and the landscape values produced. Since other research groups were to look upon various aspects of the economic dimension, the Ministry of Agriculture stressed it would prefer a main focus on to what extent Norwegian agriculture is producing environmental values. Therefore our main approach has been to focus on: what are these values, what is their importance; and how do they depend on the farming systems?

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1. Background and aims

Norwegian agriculture is facing difficult environmental conditions in large parts of the country. Only 3% of the country is used for arable cultivation which is scattered over a large country with wide geographical differences in terms of climate, topography and soil conditions. The combination of different environmental conditions and different agro-ecosystems as adaptations to the varying environments has led to a wide diversity of landscape types and farming adjustments.

A large part of these farmed areas are relatively marginal seen in an international economic context, although parallel to them exists also relatively fertile agricultural land with intensive farming practices.

In the Norwegian, as well as in the international debate on agriculture, it is often argued that agriculture is an important producer of collective goods in terms of environmental values. The environmental benefits or landscape values are usually defined as ecological, cultural, historical, aesthetic and recreational values. Scientists, as well as politicians and proponents of various environmental and agricultural interest groups are commonly referring to these values.

Agricultural support systems are under debate in Norway as they are internationally. The new round of negotiations within the World Trade Organisation starting in 1999 will have implications for national agricultural policies and support systems. Already, a large part of the Norwegian agricultural support has become partially decoupled from production. We know that agriculture world wide, particularly within industrialised countries, has many negative environmental effects, and since agricultural incentives have negative as well as positive environmental effects, it is timely to ask what role Norwegian agriculture does play for the environment

1.1 Aims

The main aim of this report is to analyse the importance of Norwegian agriculture for maintenance and reproduction of environmental values. The environmental values focused on are those related to biological diversity and the cultural landscape. In this context, the term reproduction refers to the continued production of the identified environmental values.

The questions addressed are:

- To what extent is Norwegian agriculture producing environmental values?
- What is the content of these values and what is their importance and relevance?
- How do these values depend on the farming systems?
- What conditions need to be attached to farming practices in order to secure future maintenance and reproduction of these environmental values?

Further, we will address a central but difficult issue related to the latter question;

- To what extent are these environmental qualities or landscape values dependent on active farming practices, in other words a 'living' agriculture. Might they be replaced instead by various management arrangements?

1.2 Structure of the report

Chapter 1.3 is an elaboration of the terms ‘cultural landscape’ and ‘biodiversity’. Chapter 2 is a discussion of the kinds of values biodiversity and the cultural landscape represent. Further we will critically examine some methods that are currently used for landscape evaluation. Chapter 3 is a survey of threats to the environmental values of the agricultural landscape in Norway. Chapter 4 contains a survey of current landscape classifications, and a description of selected examples of Norwegian agricultural landscapes. Chapter 5 contains discussion, analysis and conclusions.

1.3 The concepts of biodiversity and cultural landscape

The main issues dealt with in this report are the biological diversity in the agricultural landscape, and the historical, cultural, aesthetic and recreational values of the agricultural landscape, here termed cultural landscape.

The cultural landscape is a result of human interaction with their surroundings and has both cultural and ecological aspects. Regarding biodiversity, we will mainly focus on biodiversity related to vegetation and plant communities. Vegetation in general represents the main precondition for most groups of animals including insects, and thus for the overall biodiversity linked to both flora and fauna.

Biological diversity has been given numerous contents and interpretations. In this document we choose to use the official definition presented and used internationally in the United Nations Convention on Biological Diversity from 1992 (UNCEP 1992a):

‘Biological diversity means the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems’.

From this definition it is clear that the concept of biological diversity includes three levels of biological scales of organisation, the diversity of ecosystems and landscapes, the diversity of species, and the genetic diversity between and within species. The concept of biological diversity includes also both wild and cultivated or domesticated diversity. This implies that the diversity of crop species and their genetic constitution are covered, as well as e.g. domesticated livestock species. Landscapes little affected by humans, ‘wilderness’, as well as cultural landscapes, are included in the concept of biological diversity (Heywood *ed.* 1995, Sandlund *ed.* 1992).

Cultural diversity is a very wide concept; here it is restricted to be understood as the diversity of human use of biological resources and related techniques over the long period of human existence, and is closely linked to biological diversity. Mutual interrelationships between cultural and biological diversity have created a non-separable unit. The present biological diversity is more or less, in any ecosystem, in any place of the world, in some way or other, impacted by human culture (Heywood, *ed.* 1995). This is particularly evident for agricultural landscapes and their components of biodiversity (Nazarea 1998, Thrupp 1998).

The concept of cultural landscape goes back to the German *Kulturlandschaft* (Ratzel 1895, see Jones 1988) meaning ‘landscape formed or influenced by human activity.’ The term ‘cultural landscape’ is commonly used in German languages, although the term seems dominantly used for the rural cultural landscape. Within English speaking countries, ‘countryside’ is the term normally used for the agricultural landscape. However, recently it

seems that the term 'cultural landscape' has also become more frequently used within Britain.

Jones (1988) identified seven principal ways in which the concept has been used in Norwegian literature:

- as an area category;
- as a chronological stage;
- as human components in any landscape;
- as countryside;
- as cultural heritage;
- as scenery with aesthetic qualities, and
- as elements in the landscape with meaning for human activity.

From this, three broad categories of usage have been derived (Jones 1988, 1991, 1995):

- 1) The classical geographical definition: the cultural landscape defined as the landscape modified or influenced by human activity - in which the landscape provides a means or point of departure for analysing ecological and socio-economic processes.
- 2) The conservationist definition: the cultural landscape defined as valued features of the human landscape threatened by change or disappearance, in which the landscape is an object for planning and conservation.
- 3) The humanistic definition: the cultural landscape defined as elements in the landscape with meaning for a human group in a given cultural or socio-economic context, in which the landscape is seen as a manifestation of human values which will vary across different value judgements.

Within an economic scientific approach, cultural landscapes may be seen as an externality of agricultural production. Economic incentives may be used to reduce negative externalities or enhance positive externalities (Jones 1991). Typical examples are landscape management schemes which have been introduced within all Western European countries. Such schemes are in general based on voluntary agreements with farmers based on payments for specified management activities. The aim of these schemes is often to maintain specific biodiversity shaped by what is often termed 'traditional' or pre-industrial farming practices, and the cultural and historical structures and remnants of these. The landscape management schemes typically include mowing of hay meadows and maintenance of hedges, walls, buildings, historic pathways etc.

The terms 'landscape' and 'environment' are both very wide and complex. The environmental values referred to in this report are shaped by agriculture, and we focus mainly on the different aspects of biological diversity and the cultural dimension of the agricultural landscape. Within landscape geography, the term 'landscape resources' is commonly used.

Maintenance of biodiversity within the cultural landscape is facing the problem that ecosystems are dynamic. This is particularly valid for the agri-ecosystems shaped by agricultural activities. In the same way, the cultural and recreational values related to the landscape are dynamic and may change or disappear as a response to socio-economic, technological and political changes. Agricultural policies governing agricultural systems and food production are of critical importance for the development and maintenance of biodiversity and other landscape values and resources in the agricultural landscape.

2. Environmental resources and values attached to the agricultural landscape

‘A resource is a means of satisfying needs, both material and non-material. Landscape can be a resource in both senses’ (Jones 1991). Landscape resources are commonly divided into (Jones 1981, 1997):

- material/economic benefits and values
- scientific and educational value (for knowledge, research and education)
- ecological values in terms of biological diversity
- cultural and historical values
- identity or symbolic value
- aesthetic and recreational values

These values may be strongly interwoven. It should be stressed that scientific interest is related to most of these values, and there is a potential for economic benefits related to all of them. Examples are biological research which may lead to the use of certain plants or other species for medical or other industrial purposes; and aesthetic and recreational values are a common basis for development of tourism products.

The scientific, ecological, cultural, identity, aesthetic and recreational values may be termed amenity values or collective goods. They are the external effects of agricultural production of the farmed landscape that are not paid for through ordinary agricultural prices, and only during the last decade a limited extent through agricultural support systems. In this report, we will mainly be focusing upon this aspect of the agricultural landscape as provider of collective goods.

Several European countries have during the last decade carried out various types of landscape registration, often to serve as a basis for setting priorities for landscape management programmes or conservation legislation (see Rønningen 1994, 1995a,b). Although this report does not deal with conservation landscapes in particular, we will give a brief overview of the criteria used for some of these registrations in order to deepen understanding of landscape values.

In a report on landscape in land-use planning the Nordic Council of Ministers (Nordisk Ministerråd 1987) defined three main conservation interests: nature conservation, cultural heritage conservation and scenery. Special criteria for conservation were defined as rareness, representativeness, authenticity, diversity and intrinsic values.

A national inventory of valuable agricultural landscapes in Norway was published in 1994. One main purpose was to obtain a basis for management strategies for cultural landscapes. The registrations were based on biological/ecological and cultural/historical values. Registration and valuation were undertaken in accordance with the following main criteria: continuity, representativeness, distinctiveness, rareness, diversity, totality, and the extent to which the landscape is affected by various developments (Direktoratet for naturforvaltning 1994). Similar criteria have been used in a large Swedish landscape registration, and also resemble those used within British landscape designations (Rønningen 1995a,b).

The concept of ‘totality’ may be difficult to comprehend and operationalise (Krogh 1995). The report from the Nordic Council of Ministers stressed with regard to aesthetic values or the scenery, that the degree of totality is an important factor. ‘It [totality] is decisive for regional character of a landscape in relation to other areas and is an expression of the representativeness of the landscape. Thus, the focus is no longer only on the most

spectacular and generally acknowledged landscapes In the efforts to protect landscape resources, it is decisive to maintain the integrity in ordinary, vernacular landscapes' (Nordisk Ministerråd 1987:2).

The term 'ordinary, vernacular landscapes' needs some elaboration. Within Nordic landscapes conservation and management, the following classification of landscape according to conservation value and relevant measures is commonly referred to (Nordisk Ministerråd 1992):

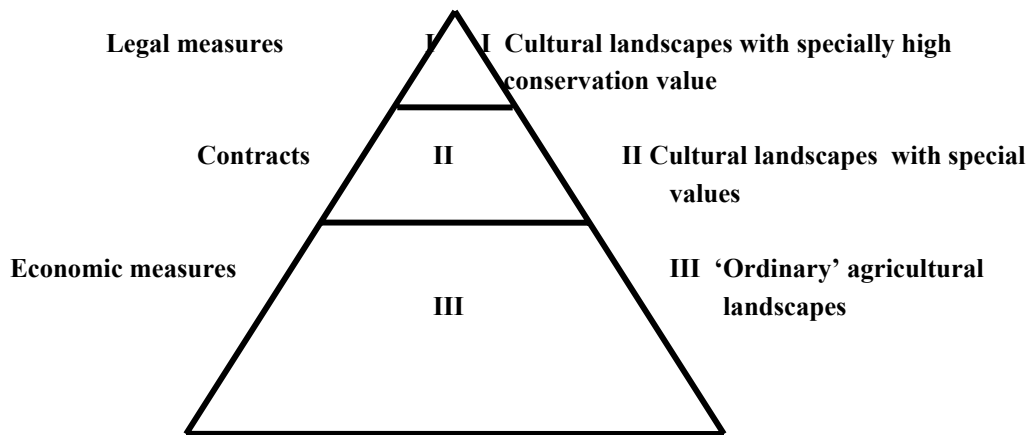


Figure 1: Classification of landscapes according to their varying conservation values, and their equivalent planning measures (Nordisk Ministerråd 1992)

According to this categorisation, the most valuable landscapes with strong 'museum' interest need protection and conservation through legislation. Then there are cultural landscapes of high value where special management arrangements are required, typically landscape management. Finally, there are 'ordinary' or 'everyday' agricultural production landscapes,

where general economic incentives are the most important instrument applied. General land- use planning instruments are also of importance for these areas.

This way of differentiating landscapes is, however, not unproblematic. The terms 'everyday landscape' or 'ordinary landscapes' have been criticised; unique panorama landscapes represent the ordinary, 'everyday' production landscape of the people living in these areas. Furthermore, many farm production systems are based on the utilisation of different landscape types, such as infield land for arable and outfields for fodder and pasture. This means that areas which according to this figure belong to category I (high conservation value) and III ('ordinary' agricultural landscapes) to a large extent may be strongly interwoven and dependent on each other as inseparable parts of a functional farming system.

2.1 Scientific and educational values

Norway covers some of the outermost areas for settlement in Europe. Here we find northernmost outposts in the world for growing fruit and grain and other types of agricultural production. The Norwegian cultural landscape with its yet remaining ecological and cultural values may offer reference areas and serve as a living history book (Direktoratet for naturforvaltning 1994).

Scientific and educational values are related to the interests of research institutions, universities and schools. The natural as well as the cultural landscapes can function both as outdoor classrooms, and as an archive, thus strong conservation interests are related. 'The value judgement is thus partly pedagogical and partly related to the wider

value seen in the pursuit of knowledge' (Jones 1997).

The agricultural landscape with its different components of habitats, biological communities, species and genetic diversity, domestic livestock species, crop species, as well as elements of cultural heritage such as grave mounds, remnants of former agriculture like fossil arable fields and field borders, archaeological finds, remnants of buildings as well as standing buildings representing former agricultural practices and older farming systems, are all examples of aspects of the agricultural landscape with significant scientific and educational values. The scientific aspect covers numerous disciplines from archaeology, history, geography, to plant and animal ecology, economics, art and architecture. Thus, scientific and educational interests are attached to the different values presented below in sections 2.3 - 2.5.

Another crucial aspect is the importance of maintaining knowledge related to traditional farming methods and the knowledge of how to utilise the existing landscape resources, which may partly be seen as a risk aversion strategy. This knowledge may represent a potential for economic utilisation and development.

2.2 Ecology and biological diversity in Norwegian cultural landscapes

The natural environment in Norway is characterised by steep topographical and climatic gradients and high natural landscape and habitat diversity. The development of pre-industrial agriculture has occurred within this environmental framework and the result has been an increase in biological diversity on the levels of landscape, habitats, and species (Olsson *et al.* In press). The major reason for this rise in ecological diversity is the use of subsistence agro-ecosystems where agricultural production was maintained by inputs from local and/or regional sources. This situation led to varied land uses which over time gave rise to diverse habitats. Among those the semi-natural grasslands have a particular position. By providing fodder for domestic livestock the semi-natural grasslands were the key to the function of the pre-industrial agroecosystems (Olsson 1991).

2.2.1 Semi-natural biological communities and Norwegian agricultural habitats

Semi-natural biological communities can be defined as plant and animal communities composed of species that are indigenous to the region, but where the development and maintenance of the communities requires direct or indirect human activities. Such human impact includes forest clearing, burning, grazing by domestic livestock, and/or mowing. The long-term persistence of these activities is essential; many European semi-natural grasslands have their origins in early prehistoric times, approximately 6.000 years ago (Bengtsson-Lindsjö *et al.* 1991; Berglund *et al.* 1991b) or even earlier (Bush and Flenley 1987). European examples of semi-natural vegetation include most lowland heathlands and grasslands, and many woodlands and shrublands that have been affected by burning, grazing and coppicing (Rackham 1980, 1986). By comparison, *natural* grasslands and heathlands in Europe are shaped mainly by climatic and edaphic factors; these include high-alpine grasslands and heathlands and communities affected by periodic flooding along freshwater and marine shores. The Atlantic heathlands characteristic of coastal areas in Western Europe (Gimingham and de Smidt 1983) were developed by Early Iron Age farmers, some 2000 years ago (Berglund 1969; Odgaard 1994). These heathlands and grasslands are today threatened European ecosystems that harbour a number of endangered plant and animal species and act as refuges of biodiversity (Oostermeijer *et al.* 1994). The threats are mainly changes in land management, cessation of grazing or mowing, or ploughing (Stevenson and Thompson 1993, Blackstock *et al.* 1995).

The Norwegian landscapes, from Finnmark in the very north to Jæren in the southwestern part of the country, are all shaped to varied degrees by agri-pastoral activities from pre-history until the present. The present

occurrence in some regions of large and numerous semi-natural habitats shaped by varying environmental conditions and agricultural practices is a feature that gives Norway an outstanding position in a European context.

2.2.2 Semi-natural grasslands in Norway

The reason is that those semi-natural habitats, among which the grasslands dominate, have high levels of biological diversity, and that such habitats - formerly common all over Europe - now have decreased or become extinct as a consequence of changes in agricultural practices (van Dijk 1991). This fact makes the Norwegian semi-natural grasslands shaped by long-term use in the agroecosystems, into invaluable treasuries of genetic diversity, in fact into living in-situ gene banks. Another valuable aspect of the high biological diversity of plant species in semi-natural grasslands to be emphasised here is the high nutritional quality of livestock fodder from semi-natural habitats. This is reflected in higher concentrations of vitamins, minerals etc. in the fodder plants here compared to the low-diversity or monospecific fodder crops (conventional cereal and ley crops) from conventional high-input cropping.

‘Semi-natural grassland’ is a broad concept that includes a variety of grassland habitats, e.g. dry and mesic grasslands in coastal and mountain environments, the wet and mesic saline grasslands or shore meadows (treated in greater detail in chapter 4. below), sub-alpine and alpine grasslands as well as wet meadows in the mountain summer farming landscape (treated in greater detail in 4.4. below).

2.2.3 Coastal heathlands in Norway

The Norwegian coastal heathlands constitute an ecological and cultural part of the extended West European belt of atlantic, coastal heathlands (Gimingham 1972). This habitat type is a pure product of agricultural activity dated back to early Iron Age, approx. 1500 years ago (Berglund 1986, Kaland 1979, 1986). The coastal heathlands were shaped by clearing of the trees, burning and by subsequent livestock grazing. Regular burning of the heathlands was performed in cycles of 15 years in order to promote fresh and young shoots of the heather (*Calluna vulgaris*) and to rejuvenate the heather vegetation (Kaland & Vandvik 1998). The young shoots have higher fodder values and are more palatable than the old ones for livestock (Gimingham 1972). The use of the heathlands provided summer fodder, sometimes also some winter fodder (heather was mown in some areas), the heather turf was also used as fertiliser, as fuel and for a variety of other needs. The heathlands were the major resource for agricultural production in coastal areas (Kaland 1986) The use and maintenance of the coastal heathlands in Norway as in other parts of western Europe was a major landscape-forming activity and the open *Calluna* heathlands have been a characteristic feature of Norwegian coastal areas for many centuries. Especially conspicuous were the coastal heathlands regions of western Rogaland, but coastal heathlands can be found all along the Norwegian coasts. Currently ongoing studies and experiments on combinations of traditional use, heathland conservation and economic analysis at local and regional landscape scales are being carried out in coastal heathlands in Rogaland (Kaland & Vandvik 1998).

Figure 2. The semi-natural grasslands shaped and maintained over millennium contain a large number of species of plants and animals – all more or less strictly connected to those habitats. This is an example of a such species – and indicator species for semi-natural grasslands in alpine and sub-alpine environment: *Genitana nivalis* (no. Snøsøte). (Photo July 1995. G.A. Olsson)

2.2.4 Other semi-natural agricultural habitats in Norway

There are a number of semi-natural habitats in the Norwegian agricultural landscape that have been shaped and maintained by long-term use within the pre-industrial agricultural systems in different parts of Norway. Their shape and ecological content are determined by local environmental conditions in combination with local cultural practice. Common to those habitats are that they have been used for long time periods and thereby developed specific ecological characteristics such as mutualistic inter-relationships (e.g. mycorrhiza, pollination relationships etc), specific biological communities (e.g. plants, insects etc), changed genetic constitution etc. They all contribute significantly to the biological diversity within the agricultural landscape. Examples of such semi-natural habitats are wooded meadows and pastures, coppiced and/or lopped trees, different elements like stone fences, open drainage channels, old field borders and earth walls, and pre-historic graves and fields. Thus, often historical and cultural heritage values coincide with biological diversity values.

Such elements, along with other patches and remnants of semi-natural vegetation and waterways, form *habitat networks*. Such networks of semi-natural patches are of immense importance for the survival of biological organisms, both plants and animals, especially within intensively farmed areas (Angelstam 1992; Andreassen and Ims 1998).

2.2.5 The concept of Agro-biodiversity

Along with the introduction of agriculture in Scandinavia some 6.000 years ago (Berglund *et al.* 1991) the build-up of agro-ecosystems started. Agro-ecosystems are subject to the same large-scale processes as natural systems since they are powered by solar energy for the production of biomass. Also, they are subject to the same physical processes of weathering, erosion and nutrient circulation. The major difference between natural and agroecosystems is that the latter are manipulated to various degrees to maximise the production of one aspect of plant biomass - the cultivated crops. The intention is to control both the biological and the physical processes,

but this is usually at the expense of the reduction of biological diversity. Cultivation seeks to reduce competition for limited resources for the crop plants. A larger part of the plant biomass can thereby be directed to human consumption, either indirectly via herbivores such as domestic livestock or through direct human consumption (Olsson 1991).

There is now a growing agreement among scientists that biological diversity is a fundamental basis for agricultural production and food security, as well as a valuable ingredient - or prerequisite? - for ecological stability (Thrupp 1998).

The term '*Agro-biodiversity*' encompasses diversity among plant and animal populations and genes, including soil organisms, insects, as well as diversity among elements of semi-natural habitats, in the agro-ecosystems. Agro-biodiversity thus includes both the diversity of organisms in the arable fields as well in e.g. the semi-natural grasslands shaped by long-term grazing and fodder collection. Agro-biodiversity makes it possible for farmers to recycle nutrients, reduce pest and disease problems, control weeds, maintain good soil and water conditions, and handle climatic stress, while producing agricultural products necessary for human health and survival (Thrupp 1998).

2.3 Cultural values

Agricultural development is by definition mutually linked with cultural development, expressed in the development of skills and knowledge related to the utilisation of the landscape resources, in handicrafts, buildings, music and stories (Blomquist 1997). We will here generally use the term 'cultural values', which includes historical, archaeological, orientational and identity values etc. Also factors such as ownership structures, land use regulations and laws represent a part of a country's or region's cultural heritage and identity.

We may make a division into material and non-material culture (Fellman *et al.* 1985). Material culture is defined as physical, visible things, or *the built environment*, including musical instruments, furniture, tools and buildings. Non-material culture may be expressed in oral traditions (songs, stories) and customary behaviour (mentifacts and sociofacts)(*ibid.*).

Although these many aspects may be seen separately, to a large extent they are interwoven. We will here elaborate some aspects of these values.

2.3.1 Orientational and identity values

Together, the physical and cultural traits of a place distinguish it from other places. 'Their attributes give character, potential and meaning to places that set them apart from other earth space' (Fellman *et al.* 1985).

The landscape is important as an element in the ability of people to orient themselves. Partly this can be seen in a very practical context; the importance of landscape elements as landmarks, but may also be seen in a more psychological sense. Further, the landscape has importance as an element in people's cultural identity and sense of place (Jones 1997). The European Council's environmental section states that cultural landscape is a cornerstone for our identity as Europeans and an irreplaceable part of European cultural heritage (Direktoratet for naturforvaltning 1994).

The World Heritage Committee (1992) predicts 'that quality of local landscape and culture makes one place different from another - looks set to become one of the great issues of the next decade, as political and economic forces drive us towards greater homogeneity'.

Increasing international attention is being paid within cultural monument conservation towards the cultural landscape and integrated natural and cultural environments (Daugstad *et al.* 1999).

The ability of experiencing the history in the landscape (here meaning historical events), as well as the landscape's historical development is of importance for our cultural identity, according to Widgren (1995). Thus, landscapes are part of our cultural heritage. Both cultural and natural landscapes may function as symbols of local, regional or national identity. Artists such as writers and landscape painters in the last century played an important role in the establishment of Norwegian national identity after centuries under Danish and Swedish domination. Paintings describing the agricultural landscape and the agrarian culture were important in this process. Particularly the mountain summer farm landscape became a central motif (Daugstad 1995).

The importance of the landscape may be connected to images and traditions at special locations. Historical memories and myths add to the landscape's symbol and identity values.

This is of particular relevance for cultures that make little or no use of written documentation, such as for example the Sami culture (Nystø 1991, 1992).

2.3.2 Archaeological values

The development of agriculture and the shaping of agricultural landscapes over the 6000 year long period of agricultural history in Scandinavia and Norway has yielded numerous cultural traces and remains of former agricultural activity. Since there generally has been an unbroken continuity from the first farmers until the present, at the same sites, the cultural landscape contains a large number of prehistoric remnants such as graves and tombs from Neolithic times and onwards. From Scandinavian Iron Age, approx. 500 BC to 1000 AD, there is a large number of finds of tombs as well as remains and foundations of farm settlements in all Norwegian landscape regions. (Inventory for the Norwegian Economic Map of Prehistoric and Medieval Monuments). Examples of other remains of former land-uses in the pre-industrial agro-ecosystems are ancient field boundaries, field dikes, field terraces, traces of ancient ploughing techniques, old stone fences, open ditches, coppiced or looped trees, foundations of ancient buildings related to agriculture etc. Those traces constitute significant building stones in our cultural heritage and are necessary elements for our understanding of the development of skills and experience in interactions between humans and their natural environment. The cultural landscapes shaped by farming and pastoral activities with prehistoric origins thus have an environmental-historical dimension which may be crucial in order to maintain knowledge for development of future sustainable food production.

2.3.3 Ownership structures and the built environment

Ownership structure is a main element in landscape design, and often represents ancient, historical structures. Further, boundary lines often consist of vegetation zones which represent valuable habitats. The small-scale structure is a dominant characteristic of Norwegian agricultural landscape, with a large number of small, self-owned units. Average farm size is

approximately 11 hectares today. However, forests and outfields often belong to the farm (farmers are often also foresters), and renting of additional farm land is common.

The physical structures of the farm and the production unit consist of areas for plant and livestock production, as well as different types of buildings for the agricultural production, and other types of buildings for production,

the dwelling house, and roads and tracks that connect the various elements together (Sevatdal 1998). Together, farm buildings and the farmed landscape make an entity in expressing the agricultural landscape. Traditional farm buildings are one of the defining characteristics of most rural landscapes, and a major feature of our most attractive landscapes.

Locally available building materials have to a large extent been the determining factor for building techniques and styles. The design and location of buildings in the terrain and in relation to each other has developed through centuries and may show great regional and local differences.

Place names and farm names often contain important keys to understanding environmental conditions and the historical development of settlements.

Approximately 855 of the country's 2500 protected buildings are located on farms (Direktoratet for naturforvaltning 1994). Further, there is a large number of old, unlisted buildings that are still in use, serving agricultural functions and therefore maintained. However, more 'ordinary' and recent vernacular architecture also gives the landscape its special identity, and farm buildings are 'central to the beauty of the farmed countryside' (Walshe in Gaskell and Tanner 1998). In spite of the large share of prefabricated, standardised buildings built in the post-war period, local and regional characteristics still exist and are important for identity.

Some of the most unique built environments are under protection and may receive some public support for their preservation. Some of these buildings may also survive as tourist attractions, second homes, or, when relatively centrally located, as dwellings. For the main part of our heritage of built agricultural environment, the continued need for and use of buildings is the main contributory factor for maintenance. When the functions vanish, the buildings deteriorate. Conversion of buildings to new purposes can to some extent contribute to their survival, however, in general, continued farming is the most important factor for the maintenance of buildings. In recent years, Norwegian agricultural authorities along with cultural heritage authorities have encouraged the adjustment and restoration of buildings on actively run farms for their continued, practical use, with particular respect to regional characteristics. This has been an important motivating factor for maintaining existing buildings. This measure has been welcomed by owners and has been made an important contribution to maintaining cultural values of the landscape.

Figure 3: Summer farming in Valdres, Oppland fylke; active use of mountain landscape and traditional buildings (Photo July 1994. G.A. Olsson)

2.4 Aesthetics and recreational values

Positive aesthetic and recreational experiences are commonly valued as important for mental and physical health (Jones 1997), and thus for general human welfare.

The landscape has a function as a source of inspiration for artists and others, and it is an important source for recreation, both non-commercial and related to tourism. However, economic interests related to the aesthetic and recreational value of the rural landscape are considerable. *Ecotourism*, defined as ‘the recreational use of the landscape and the flora and fauna that it contains’ (Kemp 1998), is generating millions of dollars every year world wide. Ecotourism may involve hunting and fishing, although it commonly is identified with activities such as bird-watching, wildlife safaris etc. (*ibid.*). In Europe, the related terms ‘soft tourism’ or ‘green tourism’ have been related to farm tourism and indigenous development of local resources in small communities for recreation and tourism (Messerli 1992; Rønningen 1994), but also to the general development of tourism products based on cultural landscapes as well as areas of more wilderness character. There is an increasing interest related to experiential tourism and in ‘traditional, authentic’ rural landscapes, often combined with an interest in local foods. Also, cultural heritage sites are increasingly gaining interest from the tourism sector. MacCannell (1992) has described *heritage tourism*, tourism seeking various types of cultural and historical memorials and places, as the modern ‘homeless’ human’s attempt to find meaning or some kind of identity. Thus, the cultural landscape represents an important value to modern people, as well as an economic potential.

The Norwegian general right of access to land should be mentioned because it is of vital importance for Norwegian recreation traditions. Systems of general access to and right to utilise various resources in the outfields are documented in written forms in the Acts of Frostating and Gulating dated as far back as the 10th century (Salmonsens 1920). These rights were of immense importance due to the limited arable resources (Kaltenborn & Vistad 1995). This right, termed *Allemannsretten*, is today secured by the Act of Open-air Recreation, which states the right of free access to outfields and agricultural land, whether public or private, and the right of picking wild berries, mushrooms etc. (Access to agricultural land is limited to the frost period or November 1st to April 1st). To some extent this makes privatisation and commercialisation of landscape goods difficult in Norway, although it is of course possible to develop various commercial tourist products related to the landscape. *Allemannsretten* is important for the exercise of outdoor recreation activities (rambling, cross country skiing, picking berries etc.) and thereby also for Norwegian culture and identity.

2.5 Can landscape values be evaluated?

We have referred to various national registrations of landscape and the criteria that have been used there. When the agricultural landscape is increasingly being seen as a collective good, the issue of landscape preferences may become relevant. Several academic disciplines have approached the issue of landscape preferences. Various methods for economic valuation of landscapes and for landscape perception studies have gained considerable attention within scientific quarters, particularly economics and psychology, in recent years. Central questions are; how do people experience the cultural landscape? How much are we willing to pay for maintaining certain aspects of the landscape? (See Jones 1998.)

2.5.1 Landscape perception and preference studies

To what extent can our landscape experience be generalised? Appleton (1975, 1996) suggested that landscapes preferences may be based on instincts genetically transferred from the first humans when 'prospect' - lookout for prey - and 'refuge' - escape from danger - were important qualities of the landscapes. However, various studies strongly indicate that landscape preferences are socially and culturally determined. Factors such as gender, age, ethnic group, education, profession, personal background and living place may influence people's landscape perception (see Jørgensen & Framke 1986; Burgess 1992; Krogh 1995b; Crouch 1990; Bourassa 1991).

Another aspect is the deep cultural foundation of the roots of people's landscape consciousness and preferences which in many cases may be traced back to the influence of literature, paintings and history (Olwig 1994). Value judgements or perceptions may be created, communicated or reproduced by different groups, such as artists, scientific works and through public management content and practice (Daugstad 1995). Further, peoples' interests and perceptions may not necessarily be stable, but change throughout time.

Within recreational research, landscape preferences have been a focus (see Søndergaard Jensen 1997, Aasetre 1995), and cognitive psychology studies have been carried out in order to identify landscape preferences (see for example Strumse 1996). Showing test groups sets of photos or paintings and letting them rank these pictures according to their liking is a common method. Some general results are that water and waterways, vegetation and variation in the landscape receive high scores (see Hoisl *et al.* 1987). Further, in a perception study from western Norway, Strumse (1996, 1998) found that traditional agricultural landscapes with natural elements and human-made elements identified with traditional farming were generally the best liked landscapes. The most favoured landscapes contained elements of old built structures.

A criticism of perception studies is the methodological weaknesses related to test groups and the limitations of using pictures selected by researchers. The pictures only represent a selected part of the landscape, and one that is neither 'objective' nor neutral. The implication of this is that one should be careful when using the results of perception studies for decision making.

A distinction may be made between participatory knowledge of the landscape, and the panoramic view of landscape on the part of the outsider, the first encompassing the observer, and the latter involving a physical distance between the observer and the object (K. Steinsholt 1992, Jones 1995). Krogh (1995a) has emphasised the link between landscape and social identity. Different social groups not only perceive the landscape in different ways, but through their perceptions, actions and participation in the life of an area actively become part of the landscape. Management based on strict conservation principles may easily come into conflict with the users of the landscape since the aim is to protect the landscape from those most actively taking part in and creating the landscape – for good and for bad.

2.5.2 Economic assessment of landscape values

Agriculture produces environmental values that are not paid for through the ordinary prices for agricultural products. They are external effects and a collective good for which there has been no incentive to produce an optimal amount. As cultural landscape has become a focus for agricultural policy, economists in recent years have been trying to make use of economic assessment methods for assessing the economic value of these environmental goods.

Contingent Valuation Methods (CVM) have been much used in recent years; this is a means of valuation based on statements made by consumers/the public about their hypothetical willingness to purchase, or receive compensation for, a change of circumstances. In a landscape context, it involves asking people about their willingness to pay

(WTP) for certain landscapes or environmental qualities, often aiming at finding the optimal payment willingness of a person for an environmental improvement. The goal is to find the critical payment level. Drawn scenarios, photos or videos are often used to concretise the various landscape situations. Structured interviews are often used (Randall 1994, Bergland 1994).

A Swedish study (Drake 1992) of the willingness to pay for the preservation of the agricultural landscape found that the more intensive the land use, the less the willingness to pay. A recent Norwegian study (Bergland 1998) investigated people's payment willingness for various landscape elements in a relatively intensively farmed arable area. Manipulated photos of the same landscape were presented to various groups of people. The landscape elements that were manipulated were zone vegetation, stream/ditch, fence, path, wooded land etc. Zone vegetation along with open streams and paths, in combination, were seen as the most important landscape elements. Payment willingness per household was NOK 175 for only stream; 225 for only zone vegetation; and NOK 625 for both.

Bergland (1998) stresses that agriculture's cultural landscape in many ways should be considered a complex, local environmental good; it exists in a local geographical, cultural and economic context. Thus, the results of payment willingness studies should be seen as partly specific for this particular study. The results are valid for one investigation at one given place and time, and thus difficult to generalise. For the cultural landscape and other local environmental goods, the payment willingness will be determined by the context of the environmental good, the access to other environmental goods, and by local conditions (*ibid.*). However, there seem to be certain general aspects of people's preferences. People seem to prefer varied agricultural landscapes characterised by natural landscape elements or traditional farming structures. Such qualities coincide with what ecologists identify as a desired design of the agricultural landscape (Jones 1998, p.184), in terms of what is positive for maintaining a high biological diversity.

Monetary values may give a reasonable indication of the public's preferences. However, there are several methodological problems connected with this approach. The fact that interviewees are confronted with an isolated feature to value seem to elicit a very generous bid from many. Some important problems are connected to: who evaluates, what is evaluated and how. A basic anxiety about this economic approach in decision making is that valuation, through the very process of condensing complex issues into a single index, actually hides potential environmental conflicts (Minter 1994). The limitations of evaluation studies mean that they cannot replace political decisions regarding complex and important environmental goods. In political processes moral and cultural relations are discussed which are difficult to quantify in monetary values. If quantitative evaluations of complex goods become a dominating premise for political decision making, there is risk that the importance of a complex good is reduced to a value which expresses the interests of articulate and leading groups (Krogh 1994).

2.5.3 'Scenery' and 'authenticity'

In addition to landscape perception studies and economic assessment of landscape values, the use of landscape analysis should be mentioned, as it has become an important instrument in providing a basis for landscape planning. The Nordic Council of Ministers has developed an approach for the description of the cultural landscape, based on the natural basis, land use historically and present, cultural elements such as buildings, and the total impression of the landscape (Nordisk Ministeråd 1987, also see criteria in Chapter 2). Some landscape analysis systems go far in the scientification of aesthetic criteria and symbolic values (see Hoisl *et al.* 1987).

Scenery becomes important in landscape analyses. A criticism has been that the landscape analysis takes the starting point of identifying landscape values understood as physical elements. This kind of understanding of the landscape leads to an objectification of the landscape, and alienation of the people living and working in the landscape. This may be seen in relation to Krogh's (1995a) argument that analyses of landscape forms and other

aesthetic typologies, as well as perception studies and payment willingness studies, do not catch what actions are seen as valuable by different groups in the landscape. ‘Silent knowledge’ may be knowledge derived from activities in the landscape (for example farming, fishing, recreational activities etc.), in other words participatory knowledge. It may also be derived from cultural knowledge (for example beliefs, myths, religious practices) and local knowledge related to certain landscape elements and landscapes.

However, one may argue that not only these ‘competent natives’, but also visitors and tourists have some legitimate demands or needs in the cultural landscape. Geelmuyden (1989) has argued that ‘sensible change’ in the landscape needs to strike a balance between the different perceptions of or meanings that the landscape has for different groups and at different times: production area, museum, recreational area, home place, tourist destination etc. (Geelmuyden 1997). These are the multiple functions of the landscape that need to be considered.

Olwig (1993) criticises aspects of the ideas behind landscape management and conservation because they deny what agricultural values actually are: culture is based on cultivation, and in this context loses its meaning if decoupled from food production and mainly becomes a preservation object through visual management. Olwig (*ibid.*) stresses that we need a living agricultural culture to maintain the agricultural landscape. In line with this, Messerli (1991) maintains that a reproduction of the Alpine cultural landscape cannot be achieved in a meaningful way through specialised landscape management. On the contrary, this can only happen through a link between production and reproduction (*ibid.*), in other words, an agricultural production for the purpose of producing food and fibre.

Landscape inventories and landscape evaluation are often related to the various landscape elements or objects. This raises the question of totality and landscape functions. We need to see the landscape in its historical context, the historical geographer Widgren (1997) argues; in what context has the landscape had its function? In what context does the landscape still have a function?

Widgren criticises the principles that many landscape management schemes are based on, with lists of point systems for the various landscape elements with prices on the management of a hedge, the cutting of a hay meadow and punctual treatment with herbicides etc., which is the logical consequence of the trend within agriculture towards paid scenery production. Widgren sees it as a paradox that what was supposed to protect the landscape history and promote the connections between man and the environment in its practical implementation leads to the opposite; a fragmented, formalistic and unhistoric view of the landscape. The landscape *form* is regarded as more important than its *content and function*.

3. Threats to values in Norwegian cultural landscapes

Agricultural conditions, and thereby the conditions for rural areas and rural cultures have varied throughout time. Yet, agriculture has been a part of an unbroken tradition related to the basic necessity to utilise the land, the forests and the outfields to produce food and a variety of other products for subsistence living.

The cultural landscape is dynamic, reflecting socio-economic, cultural and technical changes, as well as natural changes. Changes have always occurred in history, but the changes in the agricultural landscape that have taken place during the last decades are happening extremely rapidly, compared to the historic time scale (Olsson 1991). Changes are now accelerated by international political and economic decisions related to trade agreements. These changes all have environmental consequences, which causes severe concern both from an ecological, as well as social and cultural point of view. For example it can be mentioned that 50% of endangered species in Norway are dependent on agricultural ecosystems (Direktoratet for naturforvaltning 1992).

The current most important threats to biodiversity and other landscape values arising from agricultural activities in Norway are connected to:

- 1) *intensification of agricultural practices*;
- 2) *abandonment of traditional use* - leading to overgrowth and forest colonisation of semi-natural areas and decay of the built environment and other historical structures
- 3) *afforestation* of former semi-natural areas and farmlands

All three major activities have similar effects on biodiversity and landscape values: they create homogenous, low diversity landscapes and habitats.

3.1 Threats to ecological values

The introduction of agro-ecosystems means to a certain extent a shift from wild, indigenous communities to artificial communities where the cultivated species have exotic origins far from the present site of cultivation. The agro-ecosystems display a broad variety of conditions from inter-cultivation of indigenous and exotic species to pure monocultures of highly bred exotics in the industrialised agro-ecosystems of present times. Cultivation of arable fields often means that the soil is naked, uncovered by vegetation, for shorter or longer time periods due to agrarian activities; cultivation, fallowing, over-grazing. Such conditions facilitate the colonisation of opportunistic plants and animal species like annual weeds and many insect

herbivores etc. The invasion and outbreaks of pests and pathogens is facilitated by the maintenance of large-scale monocultures (Eijsackers and Quispel 1988).

The build-up of agro-ecosystems increased potential food production per unit area although at the same time decreased the degrees of freedom for the humans since their dependence on a small set of species increased (cf. Roberts 1989). The degree of impact on biodiversity in different agro-ecosystems must be related to the scale and the exploitation of systems used in the various agricultural activities. In general agriculture means a reduction in natural biodiversity in favour of a few crop species. However, exceptions can be found in many of the traditional agro-ecosystems which maintain a very high biological diversity where advanced intercropping systems (polycultures) are applied and where both wild and domesticated plant and animal species are involved (Altieri and Anderson 1992, Gliessman 1993, Teran and Rasmussen 1995). The current industrialised agro-ecosystems where monoculture is the guiding principle, are detrimental for biodiversity on all levels from

landscape, community and species, including the genetic diversity of the crop species.

Such types of industrialised agro-ecosystems are also present to some extent in Norway, typically in the fertile flatland areas in Trøndelag and around the Oslo fjord and on Jæren in the south-west (Direktoratet for naturforvaltning 1992). The main aim is to increase the agricultural production of the major cereal crops (barley and wheat) but also of ley crops. This is achieved at the expense of biological diversity in the agricultural landscapes by an attempt to expand the arable areas as much as possible and to obtain homogenous surfaces for simplifying the cultivation processes for large-scale machinery (Fry *et al.* 1998). Non-ploughed landscape elements like semi-natural grasslands, wetlands, stone fences, earth dikes, single trees and small woodlots, field edges bordering field tracks and paths, open drainage channels etc., are removed. In intensively-used agricultural landscapes such elements are refuge habitats for biological diversity of a very different kind compared to the mono-specific annual or biennial crop species in the cultivated fields. The removal of non-ploughed habitats is one of the main and most serious threats to ecological qualities in intensively used agricultural landscapes.

Below follows a summary of activities with highest impact on biodiversity and landscape values within three different agricultural landscapes in Norway.

Table 1. Some of the main agricultural activities threatening ecological qualities within three important types of agricultural landscapes

LANDSCAPES AND /OR ECOLOGICAL HABITAT	ACTIVITY – TYPE OF THREAT	ECOLOGICAL CONSEQUENCES
Fertile flatlands	Transfer of non-ploughed areas to plowed areas; this includes semi-natural grasslands, wetlands, stone fences, earth dikes, single trees and small woodlots, field edges, brooks and drainage channels, etc.	<ul style="list-style-type: none"> * Extinction of habitats and loss of biological diversity; * This might lead to greater susceptibility to insect pest attacks since the habitats for predator insects are lost. * Change of landscape scale and of landscape pattern by amalgamation of arable fields into larger units. * Loss and decrease of biodiversity due to larger distance between suitable habitats for non-arable plants and animals, incl. insects
Fertile flatlands	Abandonment of traditional use, or pollution by agri-chemicals (fertilisers and pesticides) of non-arable elements like semi-natural grasslands, wetlands, earth dikes, field edges, brooks and drainage channels, etc.	<ul style="list-style-type: none"> * Forest succession and subsequently change of vegetation and habitat loss. * Pollution leads also to habitat loss or complete change of vegetation and ecosystem. * This leads to decrease and loss of biological diversity for the organisms restricted to those habitats
Coastal areas: Coastal heathlands	Abandonment of traditional use: end of grazing, mowing, burning	<ul style="list-style-type: none"> * Forest succession, transfer from heathland to forest ecosystem. * Habitat loss and decrease and loss of biodiversity for the organisms restricted to those habitats.
Coastal areas: Coastal heathlands	Change of use: use of fertiliser, cultivation	<ul style="list-style-type: none"> * Change of habitat and vegetation. * Habitat loss and decrease and loss of biodiversity for the organisms restricted to those habitats.
Coastal areas: Coastal heathlands	Afforestation	<ul style="list-style-type: none"> * Change from heathland to forest ecosystem. * Habitat loss and decrease and loss of biodiversity for the organisms restricted to those habitats.
Coastal areas: Saline grasslands and shore meadows	Abandonment of traditional use: end of grazing and mowing	<ul style="list-style-type: none"> * Change of habitat and vegetation. * Habitat loss; Decrease and loss of biodiversity for organisms restricted to those habitats
Coastal areas: Saline grasslands and shore meadows	Change of traditional use: use of fertilizer, draining of shore meadows	<ul style="list-style-type: none"> * Change of habitat and vegetation. * Habitat loss; Decrease and loss of biodiversity for organisms restricted to those habitats
Mountain areas: summer farming landscapes	Abandonment of traditional use: end of grazing and mowing; decrease in harvest of fuel wood from the subalpine woodlands	<ul style="list-style-type: none"> * Forest succession, transfer from grassland dominated to forest ecosystem. * Habitat loss and decrease and loss of biodiversity for the organisms restricted to those habitats
Mountain areas: summer farming landscapes	Change of traditional use: use of fertiliser and cultivation of s-n grasslands	<ul style="list-style-type: none"> * Change of habitat and vegetation. * Habitat loss; Decrease and loss of biodiversity for organisms restricted to semi-natural grasslands

For the fertile flatlands in Norway, the threats to the environment to some extent are under control, partly due to

new regulations and measures to protect biological diversity and the cultural heritage, and the new regulations for control of pollution. reduced the environmental problems connecting to erosion and leakage. The Acreage and Agricultural Landscape Scheme which now makes up a considerable part of the Norwegian agricultural support system (28% of budgetary outlays), has prescriptions on the maintenance of the semi-natural landscape elements such as remnant road verges, streams, ditches between fields etc. This incentive system to some extent prevents environmentally negative changes in the agricultural landscape. However, large-scale changes had already occurred before this incentive system was introduced, and dispensations are still common. Many small-scale changes may contribute to a gradual deterioration of environmental values.

A new threat to the maintenance and use of the large commons in some mountain areas, is the increasing number of wild large carnivores, such as lynx, wolverine, bear and wolf, which are protected by law. Large sheep losses in certain regions in recent years due to predation by those animal species is threatening farmers, economically and psychologically. The conflict between wild animal biodiversity conservation and farmers' interests is a very complicated and difficult topic, which we will not penetrate here. However, it should be stressed that here we have also conflicts in conservation interests; the conservation interest related to wild animals and the conservation interest related to human-induced biological diversity – the maintenance of semi-natural ecosystems. As has already been mentioned above in Chapter 2, the biological diversity of semi-natural habitats stretches back some 4-5000 years (Olsson 1996). During recent times this conflict has been given great publicity in media. Sometimes surprising conclusions have been drawn, like the view that sheep grazing in mountains would be a threat *against* biological diversity (Hareide 1999). There are few documented examples of overgrazing in Norway (- overgrazing by reindeer on the Finnmarksvidda plateau is the most severe example). The greatest threat against biological diversity in Norway is the opposite – the abandonment of grazing in the mountain commons (Olsson 1999).

3.2 Threats to cultural values

Main threats to cultural values are related to loss of historical elements and landscape structures through abandonment of farming practices, intensification and construction works, and the loss of knowledge related to utilisation of landscape resources.

Further, there is a loss of aesthetic values when previously open and varied landscapes are becoming more monotonous, darker due to forest succession and less interesting due to loss of historical structures and elements.

Changes in farming and ownership structures have a powerful influence on the landscape. For example, it is difficult to maintain farm buildings that have lost their function in a changed agricultural system (Gaskell and Tanner 1998). During the last 50 years, the number of active farm units in Norway has been halved, from above 200,000 to below 100,000. However, the ownership units to a large extent still exist, much of the land is rented by neighbouring farms, and many of the dwelling houses are still inhabited.

The greatest threat to cultural historical values in the agricultural landscape is related to abandonment of farming practices including use of outfields/commons. Continuation of agricultural practices, for example continued grazing of commons by domestic livestock, is the main precondition for the maintenance of our physical cultural heritage (Direktoratet for naturforvaltning 1994).

The main problem in conserving the many landscape values of the countryside is that they are only by-products of food production. However, today it may be argued that in some areas, these collective goods are more valuable than the food, even in monetary terms. The tourism and recreation business is of significant and growing economic

importance. Many old buildings are now being converted and utilised for tourism purposes, and thus maintained. Yet, conservation or maintenance through tourism is only a realistic alternative for a very limited part of the cultural heritage, and may in some cases represent a contradiction in itself.

On the other hand, the deterioration of cultural landscape qualities may represent a threat to the tourist sector itself. The following example may illustrate this: Western Norway, with its fjords and mountains, represent one of the main destinations to foreign tourists. Now, the Association for the Tourism Businesses (*Reiselivsbedriftenes Landsforening*) in the district of Sogn and Fjordane is concerned regarding developments within the agricultural sector. Decay within agriculture has proven a very negative PR for the tourism business. The director of the Association for Tourism Businesses concludes that ‘tourism and agriculture are closely related. The tourist product in Sogn og Fjordane is mainly nature, a clean environment, culture and traditions. If agriculture goes away, also some of the basis for the tourism business goes away’ (Bondebladet April 1 1998).

Would a set of landscape management measures be sufficient in order to maintain what the tourism industry is afraid of losing?

Some of the main visual qualities of this landscape are related to grazing by sheep or goats and the maintenance of fruit trees. Regrowth of the pastures and hay meadows surrounding the fjords would have detrimental effects on the aesthetic qualities, further, the fruit trees are a major asset in the marketing of these fjord areas. Hay cutting in many of these extremely steep areas is unrealistic, so goats or sheep are required. Further, decaying buildings are detrimental to the landscape, so either they have to be taken down – or maintained. In principle, it would be possible to maintain some important landscape elements in certain areas through directed landscape management.

So far the tourism sector has enjoyed the unpaid collective goods resulting from an agriculture subsidised for food production, while at the same time suffering when these landscapes become less attractive for recreation due to restructuring in agriculture. An important issue is whether and to what extent the tourism business ought to take a share of responsibility, paying for landscape ‘services’.

In general, society as a whole is suffering when aesthetic and recreational qualities are being lost, and when places lose their regional and local character. The focus on place identity and cultural landscape values in many local development projects indicates very strongly that cultural and aesthetic factors are considered important for demographic and economic development in rural areas.

Another example of a threatened landscape type of great importance for recreation and tourism is the summer farm landscape (see Chapter 4). Along with ecological values, summer farm landscapes represent a rich cultural and historical heritage, and they are of great cultural, aesthetic and recreational importance. Having been a popular motif for painters and poets, these landscapes have also been important in the founding of a national identity (Daugstad 1999).

4. Agricultural landscapes in Norway

4.1 Regional variations and classification

The environmental conditions including climate and geological constitution set strong limits on agricultural production in Norway. Certain areas have relatively good conditions for farming, while large areas close to the North Atlantic Ocean and on the western islands and areas close to glaciers or alpine mountains are definitively limited by climatic conditions. However, even in most of the most productive agricultural areas, environmental conditions set barriers, for example the growing season is shorter than in most other European countries.

Compared to other European countries, Norway has an unusual regional diversity over relatively small distances in terms of vegetation and environmental conditions, which is also reflected in the composition of the cultural landscapes.

As in most other European countries the pre-industrial agro-ecosystems were based on the principle and use of the infield-outfield system (Olsson 1994, 1996). However, due to the rough topography in Norway with narrow sediment-bottom valleys and large montane areas the dependence on the vast outfields or commons was more evident here than in most other countries. The all-round utilisation of most of the available natural resources including fishing and hunting, as well as collection of wild berries etc. provided extra food supplies and products for sale. The use of a wide variety of fodder types, such as hay, leaves, lichens, twigs, bark, kelp, heather etc. made it possible to survive hard times of climatic fluctuation and poor harvests. Grazing and/or hay making were in some areas combined with coppicing of the tree layer, which created various kinds of characteristic wooded pastures or wooded hay meadows (Olsson *et al.* 1995). Thus, there was a flow of resources from the outfields to the infields (Olsson 1990, 1991, 1994, 1996, Losvik 1995;). To a large extent these farming practices have been abandoned post-war, but, commons/outfields are still important for many farmers in Norway, mainly for grazing, but also for hay production at the summer farms.

4.1.1 Classification of the Norwegian agricultural landscape

The Nordic Council of Ministers developed a method for regional classification of landscapes (1987). This work has later been carried on by The Norwegian Institute for Soil and Forest Mapping into a detailed classification of Norwegian agricultural landscape regions with ten main regions (NIJOS 1998, see map below).

Figure 4: Main types of Norwegian agricultural landscapes (Elgersma & Bruun 1998, NIJOS 1998)

4.1.2 National inventory of valuable landscapes

The project 'National inventory of valuable cultural landscapes' (DN 1994) made a division into three landscape classes, which is parallel to that of the Nordic Council of Ministers (see Chapter 2):

Class 1: Cultural landscapes with high conservation values (not necessarily protected areas)

Class 2: Cultural landscapes with special values

Class 3: Ordinary agricultural landscapes

The project prioritised 262 areas, of which 104 were selected for the final national selection of valuable cultural landscapes. Local and regional authorities are encouraged to use the inventory as a basis for setting priorities for cultural landscape payments.

4.2 Agricultural landscapes in Norway – regional examples

4.2.1. Criteria for selection of regional examples

Two main threats to cultural landscape values are, as mentioned, marginalisation and abandonment on the one hand, and further rationalisation and intensification on the other. In terms of marginalisation, the main threats to

Norwegian landscapes relate to coastal areas and summer farm areas. Further, the environmental problem in terms of pollution is most dominating within the fertile flatlands, often the most intensively farmed agricultural areas.

The following two (A and B) major land use and landscape types were selected for illustration in this report on the basis of their past and present fundamental economical and ecological importance for Norwegian agriculture:

A. LARGE COMMONS/OUTLYINGS ('UTMARKER') mainly used for winter fodder collection and grazing;

A1: coastal areas: semi-natural grasslands: salt meadows and saline grasslands, mesic grasslands and coastal heathlands

A2: mountain commons: semi-natural grasslands, wooded pastures in sub-alpine regions, wet and mesic alpine heathlands

B. FLAT SEDIMENT AREAS WITH FERTILE SOILS, HIGHLY PRODUCTIVE ARABLE LANDS;

The flat areas on sand and clay marine sediments often with considerable content of calcium from deposited marine organisms, constitute the most favourable agricultural areas in Norway. They are located around the Oslo and Trondheim fjords, and at Jæren in the southwestern part of Norway. In those areas both climatic conditions and fertility of the agricultural soils contribute to a potential for high agrarian productivity.

4.2.2. Coastal areas

The coastal culture and its landscape are based on a mixed economy of trade and industry, agriculture and fisheries. The Nordic Ministerial Council (Nordisk Ministerråd 1989) pointed out that in particular the western and northern coastal areas of Norway still contain very large cultural values in terms of traditionally managed farm areas. The coastal culture and its landscapes have often been neglected within national conservation policies and in national and international coastal and sectoral policies (Nordisk Ministerråd 1996).

Norwegian coastal regions display a variety of habitats and vegetation due to the large environmental differences along the latitudinal climatic gradient. Conditions for agriculture thus vary significantly along this coastal gradient. However, there are several features in common irrespective of latitude. In the following section is briefly presented two of the main habitats shaped by agriculture and constituting characteristic landscape features in Norwegian coastal regions.

Salt meadows and saline grasslands

The shore meadows and coastal grasslands were the most important environmental resources in terms of useful vegetation from the very beginning of development of agriculture and husbandry in Norway and Scandinavia, approximately 6000 years ago (Welinder *et al* 1998). The shore meadows or shore marshes develop on flat sediment sea-shores along the Norwegian coast, both along the outer strandflat areas as well as along the inner fjord coasts (Kristiansen 1988a,b), and are regularly affected by salt water both from flooding and salt spray. They are characterised by specific plant communities composed of salt tolerant grass-, sedge- and herb species. Those plants have high mineral content and are palatable and healthy for grazing livestock. Other reasons for why the shore meadows have been important for agriculture from early on are that due to the salt water influence those habitats are naturally non-forested, and thus easy to use for grazing without previous forest clearing. Further, the shore meadows provide reliable fodder production irrespective of climatic variations, in contrast to terrestrial grasslands that are susceptible to drought (Olsson 1986). The shore meadows have been used for grazing for domestic livestock since prehistoric time, and - later - during the last 1000 years, also for mowing for winter fodder. The grazing and mowing contribute to the shaping of a dense grass sward and species-rich vegetation. Managed saline grasslands are also important habitats for a large number of wader birds

and insects that depend on those grasslands for nesting and foraging (Johansson *et al.* 1986). Saline grasslands are distributed along the whole Norwegian coast on sediment shores. However, the species composition differs between south and north due to large climatic differences.

Managed coastal grasslands are threatened habitats in all Europe and considered as valuable conservation objects worldwide (van Dijk 1991; Heywood ed. 1995). In Scandinavia, both Sweden and Denmark devote considerable conservation efforts to the maintenance of managed shore meadows. In a European perspective Norwegian shore meadows are unique and have high conservation values based on the existence of a number of plant and animal species with a northern coastal distribution. Currently the threat to the coastal grasslands in Norway, as well as in Europe in total, is of the abandonment of agricultural use, i.e. grazing and mowing. This leads to dominance of the grasslands by a small number of tall-statured plant species, an accumulation of litter and subsequently to a total change of the biological communities. The botanical diversity decreases as the dominance of a few tall graminoid species like *Elymus repens* (*kveke*), *Phalaris arundinacea* (*strandrøyr*), *Phragmites australis* (*takrøyr*), increases. The emergent plant communities inhibit survival of many of the characteristic - and endangered - bird and insect species (Johansson *et al.* 1986). Other threats to the ecology of the shore-meadows are use of fertiliser to increase herbage production for livestock fodder. Fertiliser will lead to changed dominance conditions and subsequently to decreased biodiversity of both plants and animals. Thus, the abandonment of traditional agricultural use has far-reaching ecological consequences for plant and animal species as well as for the properties of the ecosystem.

Other types of detrimental threats to the coastal grasslands are draining as well as building activities that lead to complete habitat destruction.

Coastal heathlands

Along the Norwegian western coasts the coastal heathlands form a characteristic zone. Those heathland areas are part of a larger European coastal cultural landscape encompassing the Atlantic coastal areas from southern Spain all along to Lofoten in northern Norway (Kaland and Vandvik 1998). Paleoecological datings have documented that those cultural landscapes were shaped by humans 4000-5000 years ago (Kaland 1986; Odgaard 1994). They were created by clearing of woodlands, and maintained by burning and livestock grazing. Also mowing of heather for use as fodder, fertiliser and/or fuel occurred (Kaland 1986). The vegetation is dominated by heather (*Calluna vulgaris*) with components of some other dwarf shrubs and several species of grasses and herbs. But it is the heather that is crucial for the ecosystem as offering the most valuable fodder plant for livestock and also influencing the function of the whole ecosystem. Those coastal heathlands were instrumental for the maintenance of agricultural production in the arable fields because the heathlands provided fodder areas for the livestock that produced the necessary manure for the maintenance of agrarian crop production. This is again an illustration of the mutual dependence and the close links between the different land-use areas within the infield-outfield system (Olsson 1991).

The most pressing threat to those areas today is abandonment of uses such as grazing, and burning and clearing of woody plants. Since the heathlands are pure products of agricultural practice they revert to forests and woodlands when this use is abandoned. The process of overgrowing of the coastal heathlands can be seen in many places along the long Norwegian coastline. Even if this is a natural process one must keep in mind that the coastal heathlands were in agricultural use for several thousand years and this is the age of the heathland ecosystems. Further, and even more important, the heathlands are still a huge agro-economic and ecological resource for the development of sustainable agriculture for the near and long-term future. This resource changes fundamentally if the heathlands are allowed to revert to woodlands.

Other important traditional habitats in coastal areas

A long list of habitats shaped by traditional, pre-industrial agriculture could be given. However, in this chapter we are dealing mainly with commons/outlyings in coastal areas and thereby focusing on large landscape forming habitats described above. But in coastal areas the significance of wooded meadows, enclosed areas of pollarded trees, coppice of hazel etc. have also been very important for the maintenance of the agro-ecosystems (Austad 1998).

Regional examples

The coastal areas in Rogaland, South- and North-Trøndelag districts are used as examples.

The Trondheim fjord with its side branches is one of the largest fjord systems in Norway and saline grasslands are abundant along its shores. Some of those grasslands are still used for grazing by domestic livestock (Kristiansen 1988). The coastal areas in this region are characterised by hilly topography, a mixture of small-scale sediment areas (marine sands and clays) suitable for cultivation, and of extensive coastal mountain areas with shallow soils. The climate is typically coastal, with mild winters, and humid summers. The traditional settlements have been based on combinations of fishery and agriculture. By the long-term use of the grasslands and coastal mountains as the basis for subsistence agriculture the semi-natural grasslands and coastal heathlands were shaped (Kaland & Vandvik 1998). The coastal grasslands and heathlands are the habitats that give the main traditional character to the coastal landscapes, but it must be underlined here that this feature is an entire product of long-term agricultural activity (Odgaard 1994; Kaland & Vandvik 1998).

Threats today are abandonment of use, in particular grazing by domestic herds. Without grazing those grasslands and heathlands revert to woodlands and shrublands. The saline shore meadows will not be colonised by woody species, but without grazing and mowing the present species-rich vegetation will be substituted by tussocky grass- and sedge-dominated vegetation of low species diversity. This transformation will also negatively affect the animal communities in those habitats, from insects to bird species, since those organisms are dependent upon a grazed or mown grass sward for their nesting and foraging (Johansson et al 1986; van Dijk 1991). Since the availability of areas suitable for large-scale arable fields is limited in those coastal areas, there is today an ongoing abandonment of farming based on cereal production. However, the opportunities for mixed farming based mainly on meat (cattle and sheep) production are numerous and promising. The extensive coastal heathlands constitute a valuable fodder resource for free ranging livestock which could be a prospect for future rural development. Currently ongoing studies and experiments on combinations of traditional use, heathland conservation and economic analysis at local and regional landscape scales are being carried out in coastal heathlands in Rogaland (Kaland & Vandvik 1998). Recent management plans for Smøla in Møre and Romsdal fylke (Melby 1997) include economic use as a conservation measure for coastal heathlands, as well as aspects of rural development.

Figure 5: Coastal saline grasslands and heathlands at the island Tarva, outer part of the Trondheim fjord. The area is grazed all the year round by an ancient breed of sheep and thus maintaining landscape values such as biodiversity of the grasslands, cultural and recreational values (Photo August 1994. G.A. Olsson)

Figure 6: Coastal areas at Sletvik, Agdenes, South Tøndelag. Grazed heathlands and semi-natural grasslands, arable fields and agricultural buildings. (Photo: June 1990. G.A.Olsson)

4.2.3 Mountain areas

The mountains in Norway have had a central role in subsistence agro-ecosystems by providing vast biological resources for humans and their livestock. The use of mountains in Norway for domestic livestock is dated back to the transition period of Late Neolithic and Bronze Age, 4000 - 3.500 BC, as indicated by paleoecological records of montane semi-natural grasslands (Paus and Jevne 1987, Kvamme *et al.* 1992). Much later, in the 16th century, the use of mountains was intensified by the development of summer farming systems (Paus and Jevne 1987, Reinton 1955, 1957, 1961), a form of mixed farming system (Price 1981, Allan *et al.* 1988) which included seasonal movement of livestock between the lowland valleys and the high mountains. The mountain areas in Norway were essential parts of the agro-ecosystems in pre-industrial society, and this situation was

enforced by the environmental and topographical conditions here which offered limited areas for agricultural activities in the narrow fissure of the lowland valleys (Olsson et al 1998).

This long-term use of the mountains has resulted in a montane cultural landscape where the present pattern of plant communities and habitats - and their content of organisms - reflects the human impact at different levels. Within the framework of mountain summer farming, the livestock grazing in combination with mowing for hay, and the collection of wood for fuel, have significantly increased the grassland areas at the expense of forested areas. Such grasslands and heathlands are typical semi-natural biological communities in the mountains too (Olsson 1996). They are habitats for specialised plant species of which many today have become vulnerable, which is a concern for conservation (Austrheim *et al.* 1999). Those semi-natural grasslands and heathlands with specific biological diversity have until recently dominated the mountains but are today decreasing due to forest invasion - which in turn is a result of changes in human land use. Also in regions where the summer farming activity still is relatively high, there are considerable landscape changes although in different directions. A measure of the intense use of the mountain areas in Norway - and the subsequent changes, is the decrease in number of summer farms, from 44.000 in 1907 (Reinton 1955) to 2.855 in 1997 (Agricultural statistics 1997). This traditional use of the mountains for farming was common in most parts of the world (Allen 1991), but today Norway has a unique position with a surviving tradition of summer farm use. Along with the built heritage which the summer farms contain, the summer farm landscape represents a landscape of great aesthetic and recreational importance (Daugstad 1999).

Outfields and summer farms still represent an essential resource base for agriculture in many regions, due to limited infield areas. A recent survey among Norwegian farmers with summer farms in operation, showed that to the majority the summer farm was considered a central part of their farming system; without the summer farm they would not have a sufficient basis for managing the farm itself (Norsk senter for seterkultur 1999). Thus, the summer farms constitute an important part of functional farming systems.

Regional examples

The mountain commons in Mid-Norway, in the districts of South-Trøndelag and Oppland, are used as examples. They belong to the landscape region termed Mountain and valley areas.

The Budalen valleys (Budalen and Endalen), Mitre-Gauldal commune, and Sjødalen, Vågå commune, central Norway are among the few mountain valleys in Scandinavia where the mountain summer farming is still practised. The Gauldalen mountains are characterised by low relief with shallow U-shaped valleys intersecting a relatively flat, plateau area. In Budal, the summer farms are located right below the present tree-limit consisting of *Betula pubescens* Ehrh., ranging from 600-900 m a s l. Below 650 m a s l also some spruce (*Picea abies* L. Karsten) and Scots pine (*Pinus sylvestris* L.) are growing - reduced in abundance by cutting for human use (Aas and Faarlund 1995). The vegetation in those areas is today a mosaic of open mesic grasslands, blanket bogs and fens, and wood-pastures with grass- and herb rich field layer vegetation (Austrheim *et al.* 1999). The Jotunheimen mountains have more dramatic topography with marked relief. The summer farms in Sjødal are found near, or below, the present tree-line (900-1100 m a s l) which here is composed of *Betula pubescens* Ehrh., and of *Pinus sylvestris* L. in the lowest parts of the valley. The soil layer in this area is shallow with low organic content. The vegetation is characterised by heathland communities dominated by Ericaceae species, e.g. *Calluna* and *Vaccinium* species with an abundance of lichens, mainly *Cladonia* and *Cetraria* species, in the bottom layer.

There are significant climatic differences between the two valleys. Budal has a slightly oceanic climate while Sjødal has a continental climate in rain shadow of the high mountains (Førland 1993; Aune 1993). Length of growth period is 140-160 days for Budal, and 110-120 days for Sjødal (Nordic Council of Ministers 1984).

The environmental resources in the mountain commons were a necessary prerequisite for the maintenance of the agroecosystems in the lowland valleys (Olsson *et al.* in press). The land use is traditionally divided between the main grazing areas (in essence the major part of the landscape) and the enclosed sites (no. 'setervoll') at the summer farming settlements. The enclosures were used for hay production with annual mowing and manuring. The enclosures at the summer farms in Budalen are relatively small, meaning below 0.5 ha, and there was a need for complementary fodder collection. The mountain slopes and river banks here are productive with a mosaic of fens and grass-dominated woodlands.

Figure 7: Parts of alpine and sub-alpine areas of Gauldalsvidda including parts of the new national park Forelhogna, South Trondelag. In the foreground the valley of Synnerdalen, part of Budalen, where mountain summer farming is practised (Photo July 1993. G.A.Olsson)

Up to the 1950s, huge areas, approx. 630 ha, of both fens and mesic grasslands, were mowed by scythe, every second year, for hay. Those semi-natural grasslands are now all grazed but there is dynamic forest succession in those areas.

In 1993 there were 136 summer farms registered in Budal of which 20 still had dairy herds. The use of the enclosures has changed from a primary use as hay-meadows into the present situation where the main part (56%) still is used for hay, 27% for grazing only, and 29% is not used for agricultural purposes (Grøntvedt 1997). Of the current hay-meadows some (12%) are managed as leys and are regularly ploughed and sown. During the period 1963-1993 further 12.6 ha of the mountain commons was also ploughed for new leys. The total number of grazing livestock in this area has increased during the last 100 years, and the composition of the stock has changed with a decrease in number of cattle and an increase in number of sheep (Olsson *et al.* 1995). Important for the landscape dynamics in this area is also that the need for fuel wood has decreased substantially during the 20th century. The energy and fuel consuming milk processing activities were moved from the summer farms to the dairy in the lowland valley successively from 1929-1963

The summer farms in Sjødal belong to the permanent farms in the lowland valley of Vågå at a distance of 50-70 km away. The enclosures at the summer farms are larger than in Budal, with a mean of approx. 4 ha. Due to environmental conditions the mountain commons in Sjødal did not offer any substantial areas for hay outside the enclosures. The need for supplementary winter fodder for the livestock had to be solved via local resources. Each year, large amounts of lichens (mainly *Cladonia* and *Cetraria* species) were harvested from rocks and ground in the mountain commons. Estimates from Reinton (1955) for the lichen harvest in Vågå around 1917

report some 8-10 tons annually per farm. Further, in Sjødal livestock was brought back to the mountains for a winter period - to consume the collected fodder reserves here - hay from the enclosures and the lichens from the commons. This habit also implied a large consumption of fuel wood for humans and livestock to survive the cold winter climate in this region. The winter use activity in Sjødal came to an end in the 1930s (Reinton 1955).

There are 27 summer farms in Sjødal, and in 1993 altogether 4 of the summer farms here had dairy production; 7 of the summer farms are used for cattle grazing in the enclosures, and 5 are used for sheep grazing only. New cultivation for ley production in the enclosures has occurred at 15 summer farms (Grenne 1998). An important difference between Sjødal and Budal is that even if livestock grazing still takes place at most summer farms, it is mainly restricted to the enclosures. Sheep are allowed to graze in the mountain commons here, but during summer they spend most of their time in the alpine zone and there is today little or no grazing pressure in the sub-alpine commons in Sjødal. This situation along with the abandonment of lichen harvest and reduced fuel wood collection has led to a vigorous forest succession and substantial rise of the tree line (Aas and Faarlund 1995). The total number of livestock in Sjødal has slightly increased from some 700 in the beginning of the 1960s to some 1000 in the 1990s. As in Budal the composition of the grazing stock has changed considerably during the past 30 year period. The number of sheep has increased five-fold since 1960, and goat keeping which was important in Sjødal disappeared here around 1965, but in 1963 a summer farm for joint goat keeping was established in a side valley to Sjødal (Griningsdalen). However, the goats are allowed to graze in the vicinity of this site only and thus having only geographically limited effects on the landscape in Sjødal (Grenne 1998). Tourism has become a substantial activity for several of the owners of the summer farms in Sjødal.

Fig. 8: The valley Sjødalen, with river Sjøa, eastern Jotunheimen mountain area. Oppland district. In the foreground view of the summer farm Stuttgongi – today used for sheep grazing during summer time. Some overgrowth of juniper in the grasslands and pine woodlands expanding in the surrounding commons. (Photo July 1996. G.A. Olsson)

The field layer vegetation of the semi-natural grasslands in the mountain commons and in the enclosures of Budalen and Sjødalen were investigated during 1993-95. It was found a very high plant species diversity of those grasslands with some 30 plant species per 0.25m² (Austrheim et al 1999, Olsson *et al* in prep.). The results from those studies indicate that alpine species intermingled in the semi-natural grasslands here seems to be favoured (larger populations) by the grassland management. In the grassland communities exist several plant populations which today are classified as endangered. Those species which also can be used as indicators for

semi-natural grasslands have generally decreased significantly all over Europe due to large scale changes in agricultural practises. They have refuge areas in semi-natural grasslands in the summer farming landscapes such as in Budalen and Sjodalen. Since this landscape earlier was common in large parts of the Norwegian mountains it is also relevant to conclude that the two selected examples from Budalen and Sjodalen are representative for the Norwegian summer farming mountains. The landscape pattern, the vegetation communities and also plant populations; all have developed during long-term human impact in this environment. Such areas have great national and international importance from different scientific, cultural and potential resource points of view. Continuous human impact and use is crucial for its maintenance (Olsson *et al.* 1998).

4.2.4 Fertile flatlands, highly productive agrarian areas

Fertile flatlands suitable for large-scale crop production are found in limited areas in Norway. The agricultural lands of highest production potential are located around the Trondheim and Oslo fjords and in the Jæren region in the south-western part of the country. A general trend here is production of a few species of grain (barley, wheat and oats) and leys. Dairy production exists, but mainly the cattle are kept indoors fed on ensilage. Mixed farming combining crop and livestock production with outdoor grazing is not very common.

This development has led to a general decrease of landscape and species diversity through the general efforts and measures taken to create large homogenous areas adapted for large-scale mechanised cultivation. This implies that most of the semi-natural habitats, non-ploughed areas, have been removed. This trend of simplifying the landscape and the general decrease of biological diversity is the most serious side effect of this type of agriculture. Other well-known ecological effects of large-scale mono-specific crop production are nitrogen losses to the water courses and ground water, dispersion of pesticides outside the crop fields, and soil erosion. Crop systems, crop management and soil organic matter management are considered as key factors influencing nitrogen losses from farmed fields (Vagstad *et al.* 1997).

These negative side effects with associated environmental problems are present but yet less serious in Norway than in most other countries with modern agricultures (Ministry of Agriculture 1998). Part of the explanation for this situation is that large-scale industrialised agricultural systems have limited distribution. Restrictions on use of chemicals, autumn ploughing etc, have had some positive effects for biological diversity in the agricultural landscape. Further, a new law regulating the keeping of livestock valid from 1997, prescribes outdoor grazing time for dairy cows to a minimum 6 weeks annually. This will probably successively lead to a greater demand and use of grazing land also in areas of intensive large-scale agriculture which also will have benign effects on the biodiversity of semi-natural habitats – see chapter 2 and 3.

In the fertile flatland areas where the intensive, ‘industrialised’ agriculture is predominating, very limited and fragmented patches of non-ploughed, or semi-natural vegetation, exist. However, the ecological as well as other values of those remnant habitats are very great. At the same time such areas are under severe threat from intensive agriculture, not so much any more from conversion to arable or chemical pollution, but due to abandonment of grazing or haymaking. In the absence of use such remnant habitats, often semi-natural grasslands, will lose their ecological and other values in the process of forest succession.

Regional example

As an illustration of the close connection between farming practice and landscape values which also exist in intensively farmed areas, we use the Høstad farms near Trondheim, belonging to the highly productive agricultural areas in the country within the landscape region of the ‘Trondheim fjord areas’. This area was

identified as a valuable agricultural landscape area in the National inventory of valuable cultural landscapes (Liavik 1996). Grain and dairy production are dominant. Characteristic features are the occurrence of prominent hills shaped by rock cores and covered by thin soil layers. The hills are protruding from the surrounding flat sediment areas and thus giving a significant character to the landscape. Several of the hills harbour pre-historic grave mounds (Liavik 1996), and also several of those hills are covered by semi-natural grasslands maintained by grazing livestock. Those grasslands probably have continued in use back to pre-history as indicated by the grave mounds. The present unfertilised grassland vegetation has high biological diversity and merit for conservation (Liavik 1996). Farmhouses and farm buildings of well preserved traditional style further contribute to a multidimensional agricultural landscape which has kept the historical and ecological qualities although participate in the development of modern agro-ecosystems. The area is used for teaching in Ecology at the University of Trondheim, NTNU, and also for recreational purposes.

At this farm grain cultivation is combined with livestock husbandry. Abandonment of livestock grazing represents the main threat to the biological, historical and aesthetic values of these characteristic hills. If the farming system here, including animal husbandry, should come to an end, we would face the deterioration of ecological and other landscape qualities. Further, the many traditional buildings would lose their function, and probably gradually deteriorate.

The Høstad example illustrates some major agricultural landscape management problems. In spite of the area being selected as a national valuable cultural landscape and also receiving landscape management payments, the continued maintenance of the area is fully dependent on continued mixed farming practices, both grain production and livestock husbandry, which again to a large extent depend on agricultural prices and policies.

Figure 9: The Høstad farm, Byneset, South Trøndelag district. Semi-natural, unfertilised grasslands of high species diversity, used for livestock grazing, and arable fields in the background. Traditional farm buildings complete a farm unit with many maintained landscape values (Photo May 1996, G.A. Olsson)

5. Analysis and conclusions

5.1. Important environmental qualities and main threats - summary

The previous survey and examples from the Norwegian agricultural landscapes were selected to give insights into the subtle intertwining between environmental conditions, agricultural practices applied, the long term perspective of Norwegian agriculture - 6000 years - and the resulting environmental features in today's landscape in terms of biological diversity and other cultural landscape values.

To sum up, the main environmental qualities are:

- **Biological diversity linked to semi-natural habitats:** grasslands, heathlands and single elements like old deciduous trees, grave mounds, etc. The greater part of such habitats exists in the outfields (or commons - 'utmarker'), both in coastal and mountain areas.
- **Ecological values linked to whole landscapes** with their content of ecological habitats, biological communities, species, species populations, and cultural elements.
- **Cultural heritage and historical values;** archaeological, built environment, identity etc.
- **Recreational and aesthetic values**
- **Scientific and educational values** linked to the issues listed above.

There are inseparable links and interdependence between these categories of values.

The main threats to those values in the Norwegian agricultural landscape can be summarised as:

- 1) **intensification of agricultural practices;**
- 2) **extensification and/or total abandonment of agricultural use - leading to overgrowth and forest colonisation on semi-natural areas**
- 3) **afforestation of former semi-natural areas and farmlands**

These ongoing processes are leading to a polarisation of land use with highly intensive and industrial agriculture in some areas, while other areas and semi-natural ecosystems are left to forest succession. All three major activities have similar effects on biodiversity and landscape values: they create homogenous, low diversity landscapes and habitats.

5.2 Some international obligations

What kind of agricultural development do we want? This is obviously an open question with numerous answers depending on political views, time perspective and whether or not we place Norway in an international context. However, there are some definite obligations that have to be considered. Norway has signed several international conventions and declarations related to sustainable use of biological resources, food production and agricultural landscapes.

The most important international agreements in this context are:

- The Convention on Biological Diversity (UNCED 1992a, Stortingsmelding nr. 13, 1993)
- The Rio Declaration (UNCED 1992b, Stortingsmelding nr. 13, 1993).
- The Agenda 21 (UNCED 1992c, Stortingsmelding nr. 13, 1993).
- The World Food Summit (FAO 1996) .

The key issues in all the above-mentioned documents are sustainable use of biological resources, conservation of biological diversity, including semi-natural habitats, cultural landscapes and domesticated species, and sustainable food production. Conservation by sustainable use of biological resources/biological diversity is explicit in the Convention of Biological Diversity.

With this in mind the logical question will be:

5.3 What type of agriculture is needed to maintain landscape values?

For maintaining biological diversity and ecological values four main conclusions may be drawn:

- 1) Continued agricultural use and preferably re-establishment of the use of outfields and grasslands into current agro-ecosystems
- 2) Maintenance and restoration of habitats within intensively farmed areas.
- 3) Development of agricultural systems where plant nutrients are used more effectively, and which lead to a decrease of inputs (including pesticides) and decreased losses from the agricultural systems.
- 4) Maintenance of knowledge related to traditional farming techniques.

For maintaining cultural heritage values:

- 1) Maintenance of buildings, and historical landscape structures and elements
- 2) Maintenance of knowledge related to the utilisation of landscape resources, building and construction techniques etc.

For maintaining recreational values:

- 1) Securing possibilities for access to the landscape through maintenance and development of habitat networks, maintenance of old access routes and integrating new ones.
- 2) Preventing forest succession, and preventing habitat destruction e.g. through ploughing.

How can this be obtained? Three main conclusions are that we need

- Better integration of livestock husbandry and cereal production. Farming units with livestock husbandry demand fodder areas for summer grazing, like the outfields;
- Transition from mono-cultures of cereal cropping to balanced cultivation systems with ley cultivation in order to obtain better nutrient circulation.

Among current farming systems, the principles dealt with above are best applied within organic farming systems. However, organic farming systems do not in general include conservation of biological diversity or maintenance of the cultural landscape as aims of their agricultural production.

The regionalisation of agricultural production has meant that Eastern Norway and Mid-Norway (Trøndelag) has the main part of grain production, while animal husbandry is mainly taking place in the west, north and in areas of high altitude, and in the south-west (Jæren). This has had negative environmental effects. In general, mixed farming systems are environmentally favourable, and more grazing animals are needed over most of the country to avoid forest regrowth. One main exception is in the most intensive animal husbandry areas in the south/south-west.

However, a situation must be avoided where arable in the fertile flatlands are used for fodder production and grazing at the expense of animal husbandry in less competitive regions (especially fjord, mountain and valley areas), which would have very unfortunate consequences for the environmental values in these regions. In that case, maintenance of the status quo is preferable.

5.4 Do we need a 'living' farming?

A central question for this study is whether these environmental qualities or landscape values are dependent on active, 'authentic' farming practices, in other words a living agriculture, or whether they may be replaced by various management arrangements.

The Nordic Council of Ministers (1992, see figure 1 p. 9 in this report) classifies the agricultural landscapes into three groups:

- 1) Especially valuable areas that are or ought to be protected through legal measures, such as the Nature Conservation Act or the Act on Cultural Monuments.
- 2) Other areas of great value, where formal protection is unrealistic. In such areas, landscape management schemes may be implemented.
- 3) The 'ordinary' landscape or the 'everyday' landscape, which includes most of the Norwegian cultural landscape. The landscape values are more scattered and not so dominating, and must be managed as a part of the general agricultural landscape. The 'management of these values is primarily maintained through agricultural policies, public planning and information' (Moen and Framstad 1998).

In order to maintain important environmental values in the agricultural landscape, we have to recognise that we are facing agricultural functional systems where the different components are essential for the overall functions of the system. It is not possible to select specific components, such as particular land-use categories, e.g. meadows only, without losing the function of the agro-ecosystem and also thereby many of the most essential environmental and other values discussed in this report. A large part of the Norwegian farms have areas that belong to two or all three landscape categories listed above. An agricultural incentive system with landscape

payments only directed towards the most valuable areas, will probably not be sustainable. It would mean the farming system losing connection with the other parts of the farming system, and finally lead to the loss of function of the agro-ecosystem.

One may argue that an important new function would be to maintain conservation, recreational and aesthetic values. For recreational and aesthetic purposes alone, this may perhaps to some extent be satisfactory, although, it also has some problems as described below. For the conservation of biological diversity values such an approach will not be satisfactory since biological communities often require large areas and/or a set of inter-linked areas in order to be viable.

Unless other land use alternatives are found for the rest of the farm land which is not qualifying for landscape management payments, farmers will finally have to close down. Although the majority of Norwegian farm households rely both on on-farm and off-farm income, the farm income in most cases cannot be fully replaced without moving out of the area. It is only to a very limited extent realistic to keep these areas managed through professional landscape managers.

Further, if we are to take the issue of authenticity and cultural values seriously, landscape production for its own sake is problematic. We may choose to accept and define landscape production or production of collective goods as a cultural project of our time. We then, however, are facing great practical problems which probably will make that cultural project a failure.

Cultural richness and identity is most of all linked to being able foresee a future for oneself, according to Jones (1998). One implication of this is that unless agriculture in general has a future, the maintenance of certain types of agricultural practices through landscape management payments may actually pave the way for a social deterioration, and thus also a cultural deterioration.

A prerequisite for the maintenance of landscape values is the presence of people in the landscape. Viable rural communities is thus a precondition. Farmers need a social environment to be able or willing to stay on their farms. The decreasing number of farmers is thus a threat.

The summer farms may serve as a good example illustrating many of the problems connected to landscape management per se, disconnected from a farming system: Management of mountain summer farming may easily come under various future landscape management schemes if they are to be introduced as a replacement for agricultural support. Mountain summer farms in active use are high priority areas for conservation, both in terms of biological diversity and cultural heritage, and their symbolic and identity value are unquestionable, as are their attractiveness for recreational purposes. However, the summer farm is part of a system of outfields, pastures and hay meadows, as well as buildings and fences etc. Further, the summer farm is an integral part of a system with the permanent farm often located in the lowland valley (Olsson *et al.* 1998, 1999).

A landscape management scheme would realistically be aimed at the summer farm including the buildings, fenced-in area and probably the nearest hay meadows and pastures. However, when the summer farm is taken out of its context, it becomes a 'landscape element', and we are dealing with conservation of cultural monuments – not conservation of the full landscape values – see above – which was the original intention. If areas around the summer farm itself are not maintained, other values like aesthetic and recreational qualities will also deteriorate.

Another threatening scenario is if the economic situation for agriculture were to make the permanent farm areas not viable, the summer farm would also lose its function. Unless other economic activities are found, it may be realistic to maintain the summer farm for tourism and recreation, and maintain a certain number of grazing

animals. If not, abandonment and woodland succession is the most realistic .

One important experience from landscape management programmes in Western Europe is polarisation of land use (Rønningen 1995,1999; Brandt 1995). Landscape management measures are implemented in certain designated areas, often at high administrative cost, and leaving the rest of the countryside for further intensification or forest regrowth. However, general restructuring effects cannot normally be met through these landscape management programmes, and a continued deterioration of landscape qualities is often still taking place, although at a somewhat slower pace (Rønningen 1999).

Management of certain cultural elements and monuments may to some extent be carried out through landscape management schemes, while landscape management in the true sense of the expression cannot be satisfactorily achieved. In other words, conserving biodiversity and protecting the other landscape values on a site-specific basis has some very important limitations. We have to recognise the need for integrated management of cohesive units (Selman 1994), in other words; a functional system approach.

Landscapes are dynamic phenomena and land-use changes, with often great environmental consequences, are inevitable. van der Straaten (1995) draws the following conclusions on economic processes, land-use changes and biodiversity: 'In the European countries a sharp degradation of biodiversity and landscape diversity is the result of common and 'normal' economic activities'. In other words, the dominant current agricultural systems are not sustainable.

We would like to conclude that in Norway, the main threat to the cultural landscapes is the abandonment of farming and extensification, leading to forest colonisation of agricultural land: arable fields as well as outfields and semi-natural pastures. Continued farming, maintenance and re-introduction of mixed farming systems, including use of the outfields for livestock grazing purposes and maintenance and careful development of buildings, are main preconditions for maintenance of biological and cultural values in large parts of the country.

The skills and knowledge in general developed for utilising the landscape and its resources for survival represent a source of great importance, not only seen in a cultural and historical perspective, but also as a source with a potential related to the development of more sustainable agricultural systems.

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