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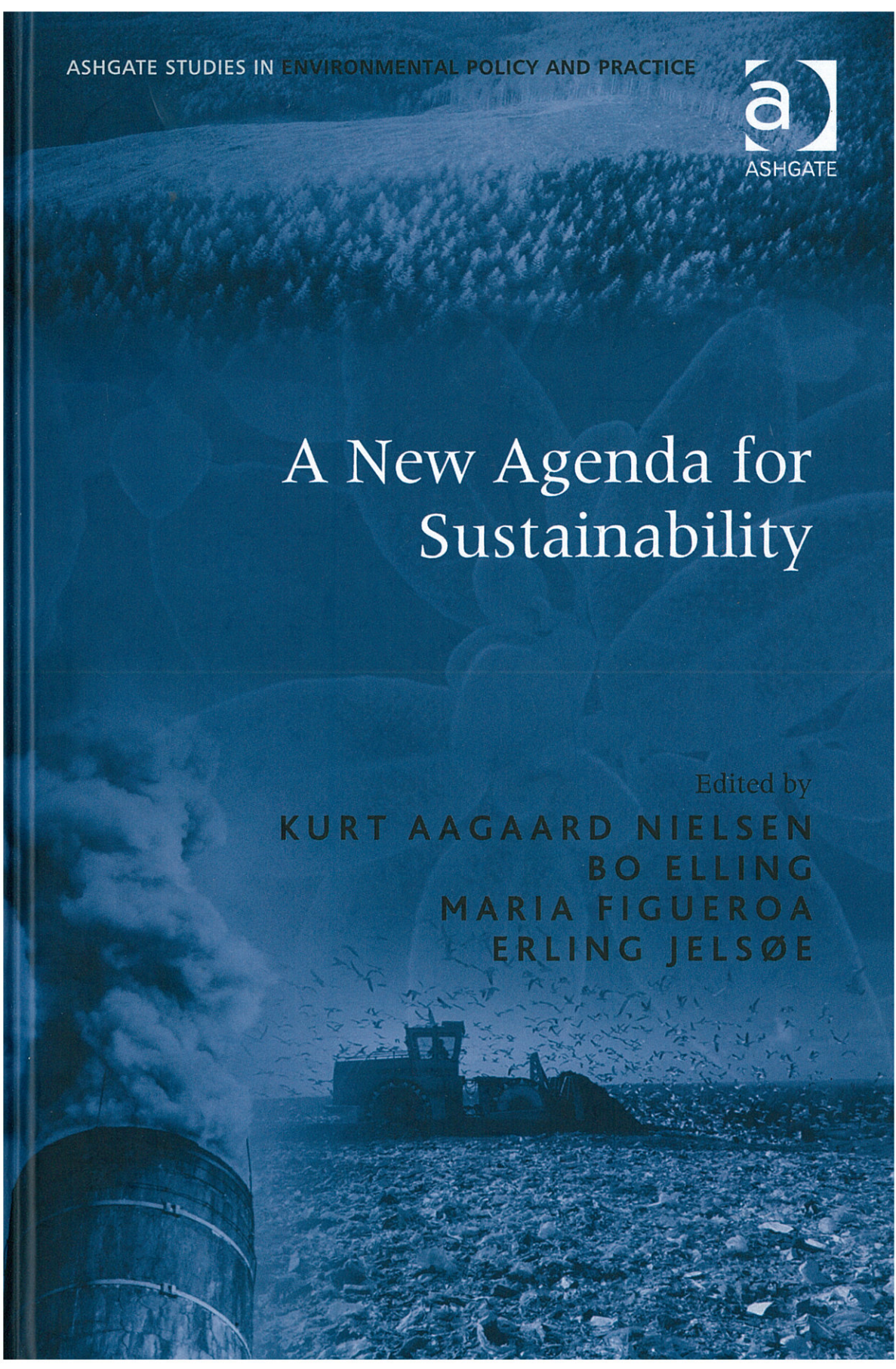

Chapter 3

Sustainability as a Tug of War Between Ecological Optimisation and Social Conflict Solution

Jesper Brandt

Introduction

A more sound ecological use of our landscapes has had a central role in landscape and physical planning since the environmental debate started in the 1970s. New dimensions have been added since the Brundtland Report announced the necessity of finding ways of ensuring sustainable development and emphasised changes in social institutions as an integrated part of sustainable development, since social institutions are the most important carriers of both obstacles and enabling factors for the transition process (World Commission on Environment and Development 1987).

From a narrow sociological point of view, social sustainability might be perceived as a system of social regulation mechanisms able to sustain the social coherence of a society or land use system. However, seen in a broader environmental perspective of 'sustainable development', the involvement of social institutions in the implementation of such a development can also be regarded as a question of putting ecology – care of the land – on the agenda for the structural development of the social institutions. They should have a basic interest in the identification and management of thresholds such as different kinds of carrying capacities in complex used cultural landscapes. Built-in structural mechanisms are expected to be the best way of keeping an institution's strategy on the right ecological track.

Many historical studies have been made during the last few decades to explore how past societies have dealt with problems of sustainability. A number of them have focused on the reasons behind the collapses of past civilisations (see, e.g. Tainter 1988) whereas during more recent years the trend has been the opposite: How do we explain that we are still here? Many societies seem to have an incredible ability to survive even long and severe crises (see, e.g. Diamond 2005) and a consensus seems to be developing around the concept of resilience as a framework for the study of the ability of a system to absorb disturbances without changing its structure (Gunderson and Holling 2002).

Since sustainable development is very often connected to the idea of a carrying capacity necessary to avoid environmental problems, historical studies of systems tied to the management of such a carrying capacity are of special interest. In the following, the description of a traditional Faeroese sheep grazing system will be used for a discussion on the relation between ecological sustainability and the regulation of related social conflicts.

The Faeroese village and the related regulation system can be seen as one of the few remnants of an agricultural infield-outfield system which was once the dominant land use system all over Europe up to modern times. A clear concept of sustainability has been a built-in characteristic of this system, which makes a study of its functionality relevant also in a modern context.

The Traditional Faeroese Land Use System

The Faeroe Islands are located in the North Atlantic, between Shetland and Iceland. Their origin is tertiary volcanic, consisting of several kilometres of thick almost horizontal layers of flood basalt lavas with intervening layers of ashes, later formed by ice and strong coastal erosion. This has given rise to a characteristic step-wise relief with marked glacial valleys and steep sea cliffs at exposed coastal positions. The total area is only 1,400 km^2, with a population of about 48,000 inhabitants, living on 17 islands. The largest, Streymoy, also comprises the capital, Tórshavn, where about one-third of the total population lives. Despite the smallness of the Islands, there are in fact about 90 small villages, in some areas amalgamated into larger settlements, along the coasts. Today, almost all of them are connected by an extensive infrastructural system of roads, tunnels, and ferry and helicopter routes. However, until the Second World War, the villages were rather isolated, due to the mountainous topography and difficult climatic and oceanographic conditions, making sea transport a necessary, but also risky way of communication due to very unstable weather conditions and strong tidal currents that exist between the Islands.

Today, the Faeroe Islands are a rich fishery nation, where agriculture contributes less than one per cent of the national product. But until the middle of the nineteenth century, agriculture was the dominant occupation. Although products from milking cows had a decisive role for the local nutrition, sheep breeding held a unique position as it produced an essential product for export and formed the main basis of taxation on the Islands, which for a long period was subject to different trade monopolies and substantial Crown estate. Since the increase in wool prices from the fourteenth century onwards, strong inducements have risen to increase the exploitation of the acreage available to the Faeroese communities, primarily by means of increased sheep breeding. Wool and its products thus amounted to approximately 90 per cent of exports during the entire eighteenth century.

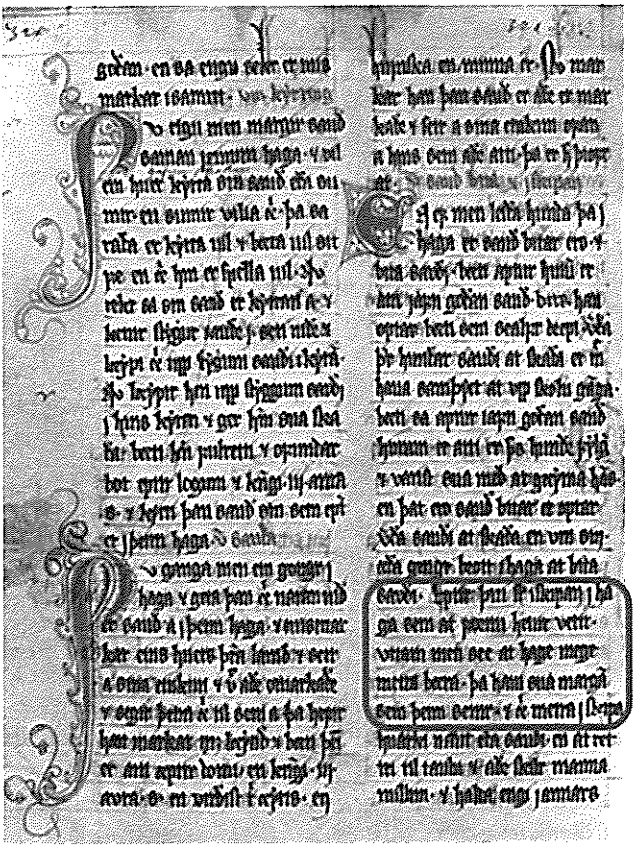

Figure 3.1 The Sheep Letter, 1298

Note: Version Lund 15, 133v (Matras, Poulsen et al. 1971), indicating that 'the number of sheep to be kept on an area of pasture land shall remain the same as it was in previous times. If they agree that it can accommodate more, then they can have as many (sheep) as they can agree upon, and every man can have as many sheep, as his share of the property can justify'.

The Sheep Letter

As early as 1298, a special law for the Faeroe Islands, Seyðabrevit (the Sheep Letter) was passed, which, among other things, stated that 'the number of sheep to be kept on an area of pasture land shall remain the same as it was in previous times' (Seydabrævid 1971: 49, see Figure 3.1). This number, in the Faeroese language called *skipan*, which may be historically related to the English word 'shipping', expressed the carrying capacity of each individual location, and to this day it is used as an

expression of the optimum carrying capacity for the various parts of the Islands. Additional skipans for cows, horses, dogs and geese were developed as well.

Each village existed as a typical infield-outfield agricultural system with a little infield located by the sea and surrounded by a one-metre high stone wall dividing the infield from the surrounding extensive outfields.

The most important farming activity was cattle and sheep rearing. There was a close relationship between these two stocks and the use of infield and outfield; in the summer the cows grazed the lower outfield, while the sheep were shepherded to the upper outfield. In winter, the cows were confined to the stable and fed on hay harvested the previous summer in the infield, while the sheep grazed the lower part of the outfield and some of them also the fields of the infield. There were no fences around the extensive outfields before the 1960s. Nevertheless the grazing depended on a very distinct but flexible territorial structure of pastures, each carrying between 12 and 90 ewes plus their lambs, living in flocks showing a very distinct territorial behaviour.

The Sheep Grazing System of the Outfields

Not only were the carrying capacities of the approximately 250 outfields of the Islands carefully stated and used for taxation, but also at the local level, within the single outfield, a detailed regulation of the number of sheep in each flock was maintained. As an example, the structure of the grazing around the mountain Stóra Fjallið, between the villages of Húsavík and Dalur at Sandoy, is shown in Figure 3.2. Here, about 500 ewes grazed in a very flexible manner, even around the outfield border between the villages. In a trial which took place in 1753 it was stated that:

> In Christian love it should be tolerated when sheep from Dalur are drifting into the outfield of Húsavík, and they should be left there freely, until they can escape again without any hazard. Also men from Dalur should accept, when sheep from Húsavík against their will are drifting into the outfield of Dalur, and both parts should take their sheep back in their own outfield at the first opportunity (Landbokommissionen 1911).

Obviously the concept of skipan could be regarded as a measure to regulate sustainability in the traditional Faeroese infield-outfield system, based on an intended ecological optimisation process behind the structure. This optimisation could partly be seen as a question of finding a balance between, on the one hand, land use and productivity of the infield and outfield and, on the other, the need for risk-minimisation as regards the availability of fodder for cows and sheep. Due to the agriculturally marginal position of the Faeroe Islands and the very limited amount of well-drained lowlands, the production of fodder was reserved exclusively for the cows, leaving sheep breeding as a more or less risky pursuit. The oceanic

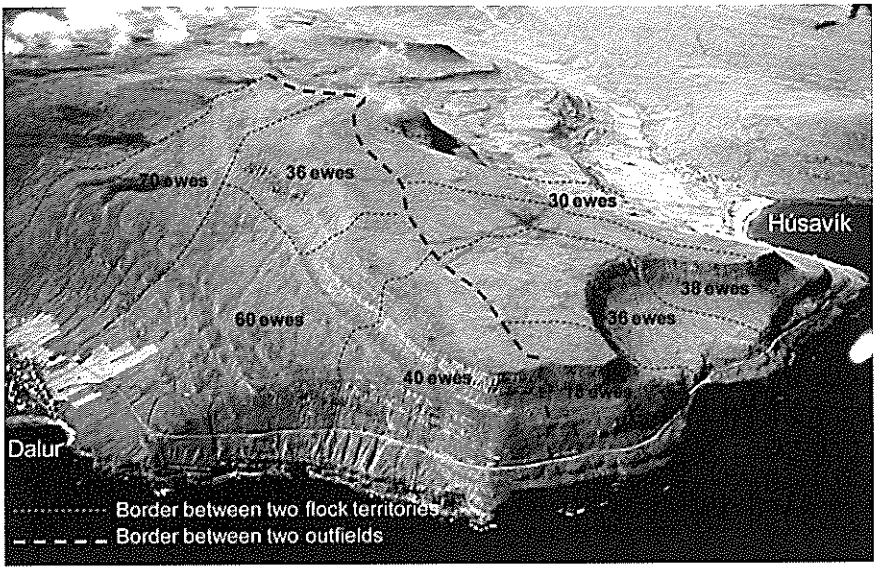

Figure 3.2 Sheep grazing around Stóra Fjall between the villages Húsavík and Dalur at Sandoy, Faeroe Islands

Source: Jesper Brandt.

position gives an average July temperature of only 11°C, but with mild winters of an average of 4°C in January, outdoor grazing was usually possible all year round. However, in some years a severe winter occurs in which frost and snow affect the pastures for a longer period. This could have disastrous consequences, especially after a summer period with modest vegetation growth. If more than one-third of the sheep population died as a result, it was called a *felli* (plural: *fellir*). According to a historical source from 1783, such a felli was expected to occur on average once every 14 years (Svabo 1959: 743).

The occurrence of felli certainly influenced the optimisation process that had to include this risk, since it took years before the size of the stock returned to the normal level.

The principle of risk minimisation is explained in Figure 3.3: On average only one lamb per ewe could be expected each year, giving a slaughter percentage of around 50 per cent. Thus, with a stock of 200 ewes producing 200 lambs per year in an outfield, one could expect to slaughter 200 sheep per year. For a period of 28 years as shown in Figure 3.3, it should potentially give a possible slaughter of, all in all, 5,600 sheep. But with an average of two felli in this period, the slaughter would be reduced considerably, in this scenario by 11 per cent, to 4,976. One might raise the skipan, e.g. to 225 ewes, giving a potential slaughter of 6,300, but due to the more dense grazing, the consequences of a felli would be much more severe and prolonged, here resulting in an overall reduction of the slaughter by

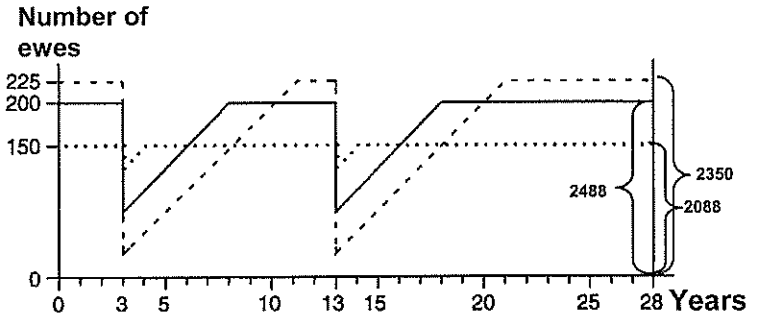

Figure 3.3 The principle of optimisation of the sheep carrying capacity ('skipan') in a time perspective

25 per cent (to 4,700) less than before. One might alternatively lower the skipan, e.g. to 150, thereby reducing the loss during a felli considerably, but also in this case one would end up with a lower result, showing that a skipan of around 200 represents a historically developed optimum carrying capacity.

These principles of optimisation had to be adapted to the local landscape conditions. This adaptation has been studied through a regional investigation of a larger area. Figure 3.4 shows the layout of the 87 pastures in the 15 outfields of the eastern part of Sandoy Island. The pastures around Stóra Fjallið are encircled. This information was gathered at the end of the 1970s through interviews with old shepherds having been active since the First World War. Although slightly modified, the pastures have, in principle, been rather constant for at least 500 years. The figures indicate the skipan of each pasture. In general, each flock should stick to its pasture the year around. Some flocks had, however, the right to graze the infield in wintertime and their pastures are indicated with a raster on the map.

The adaptation process was studied quantitatively through an 'up-side-down' landscape ecological analysis of the relation between vegetation productivity and carrying capacity: often an estimation of the carrying capacity in a grassland system is estimated by measuring the productivity (e.g. as digestive organic matter (DOM)) of the different vegetation types under different geo-ecological conditions, which are summed up based on a detailed vegetation survey. But instead of measuring the productivity of the vegetation directly, e.g. through the cutting of vegetation samples, the known historical data (gathered from taxation records or estimations given by old shepherds) of skipan were used to estimate the productivity of the vegetation. An optimisation modelling of the relation between the productivity of the sheep grazing system (based on the number of slaughtered sheep) and the basic vegetation production of the landscape was developed by using least-square method and linear programming. This permitted not only the estimation of the efficiency of the adaptation to the local

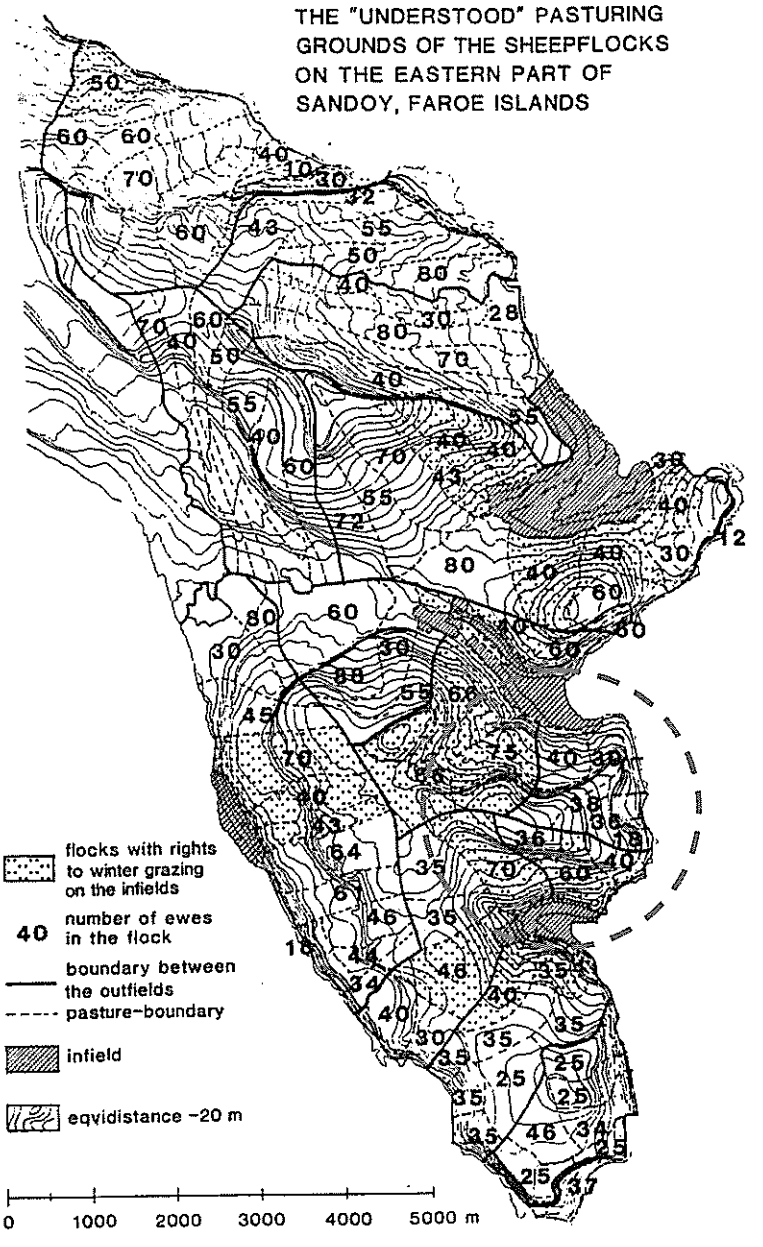

Figure 3.4 The pasturing grounds on the eastern part of Sandoy, Faeroe Island, including indication of their carrying capacity for sheep ('skipan')

Source: Survey based on interview with local shepherds in the late 1970s (Brandt 1984).

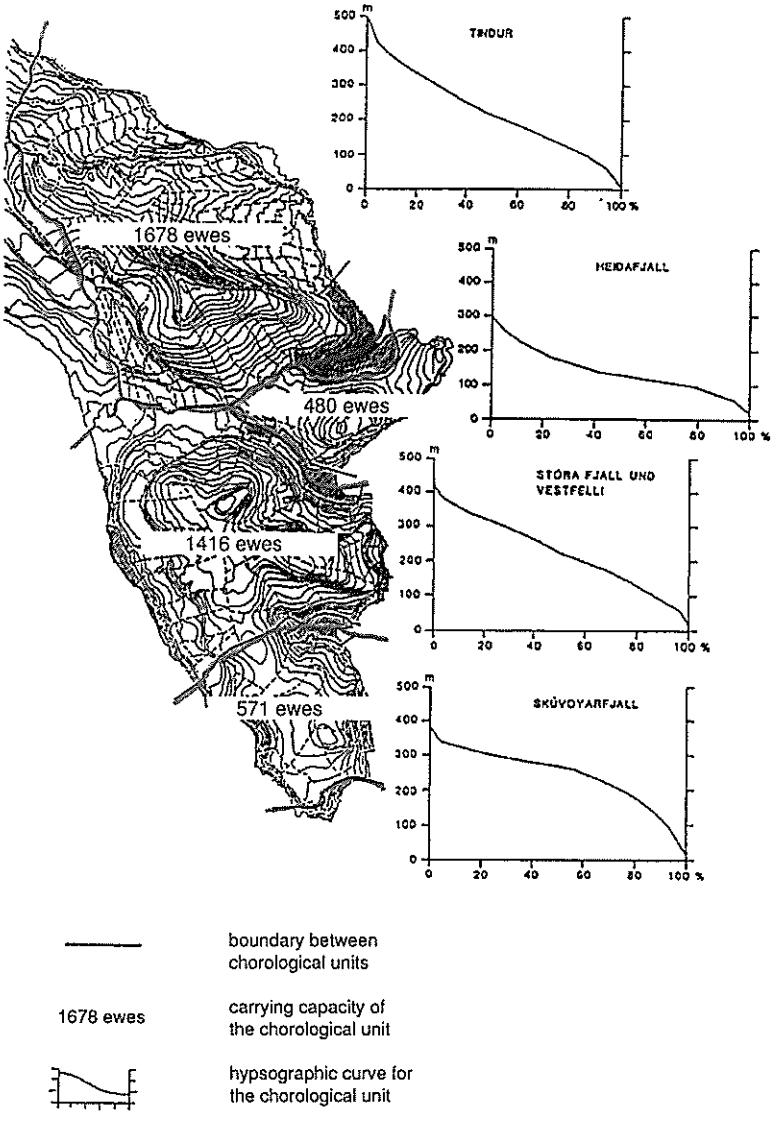

Figure 3.5 A layout of the basic principle of adaption to the local landscape

landscape conditions, but also to localise and evaluate important bottlenecks in the grazing system. For further details on the method see (Brandt 1984, Brandt 1992).

The basic principle of adaptation to the local landscape is outlined in Figure 3.5, showing how four main landscape units of the eastern part of Sandoy can be

Figure 3.6 The most northern outfield of the eastern part of Sandoy

distinguished, each of them showing a characteristic landscape chorology, decisive for the sheep grazing through its ability to deliver suitable pasture grounds for all seasons and all weather conditions. Each flock should preferably have different vegetation types at different heights at its disposal, which can be expressed through hypsographic curves that synthesise the local climatic and vegetation conditions to which the layout of pasturing grounds have been adapted.

A closer look at the two most contrasting landscape units can clarify the importance of the adaptation process.

In the northern part of the area around the peak of Tindur, see Figure 3.6, the composition of the landscape allows for a distribution of different grassland types giving bearable conditions under most weather conditions, and tolerable winter grazing during harsh weather conditions. The layout of the pastures has clearly been built up in strips running from the well-drained grass slopes good for summer grazing near the summits down to the harsh heather and moor vegetation near the sea or lowland areas of, e.g. the rush *Juncus Squarrosus*, which are not so attractive for the sheep, but on the other hand safe in most winter situations.

In the southern part around Skúvoyarfjall, see Figure 3.7, the topographical conditions are less favourable, since the heather and moor vegetation, constituting a safe winter grazing resource, are situated on the high plateau, and the luxuriant grass slopes, most suitable for summer grazing, are located down along the coast. Situations with felli in winter and early spring when alternating frost and thaw

Figure 3.7 The most southern outfield of the eastern part of Sandoy

might spoil the grass of the exposed slopes has obviously given rise to a more complicated pattern of pasture inhabited by rather small flocks which are easier to manage under these difficult conditions.

In general the system worked, but a felli in this area could be disastrous since no lowland winter pastures usable under harsh conditions were available. Therefore the skipan had to be kept at a rather low level.

Through the modelling of the adaptation of the territorial system to the landscape it could be estimated that the grazing system in the southern area was able to use only half of the outfields' mean annual production of DOM, whereas this percentage was raised to two-thirds in the northern outfield, thus showing a more straightforward adaptation of the grazing system to the landscape composition.

The Sheep Letter as Social Regulation

The foregoing analysis is founded on the basic assumption that social mechanisms of optimal and sustainable use of the grazing potential were built-in characteristics of the Faeroe sheep grazing system, legally grounded in the Sheep Letter of 1298. Serious reasons to question this assumption exist. Both an analysis of the development in legislation as well as historical studies of the development of

skipan indicate that a stable ecological sustainability is a too simple explanation for the functionality of the skipan.

In outline, the regulation of the Sheep Letter proved so stable over the centuries that it has been taken as a proof of an origin of the regulation system much older than thirteenth century (Bærentsen 1911). But, nevertheless, the Sheep Letter was renewed several times, especially concerning the ownership of sheep. Two main types of ownership have existed in parallel throughout history. Although an outfield with several owners was always a common, the sheep of the common could be individually owned in number according to the owner's share of the Marketal – this was called *kenning*. The sheep could also be collectively owned, and the ownership then expressed in the share of the total slaughter (including wool) equivalent to the owner's share of the Marketal – this was called *felag*. At the time of the Sheep Letter, kenning was absolutely dominant, which obviously influenced both language and rule-setting. But this changed, especially up to the eighteenth century, when the growing fragmentation of private property, obviously, in some areas, made it difficult to manage the grazing system. Smallholders could invest time in the isolated herding of their own sheep, which was in disfavour especially with the King's tenants, often clergymen and other official authorities, having the right to use about half of the total land of the Faeroes (Landbokommissionen 1911: addition, 76). Therefore kenning was forbidden in 1659 and felag forced through with the revisions of the Sheep Letter.

In connection with a revision in 1757, a report from the county mayors was produced to support the future legal administration. Figure 3.8 is based on this report. It shows that although felag was dominant, there was still a widespread use of kenning, especially in the more remote parts of the Islands. Not only were these under less influence of the central authorities, but these areas (like the southernmost Island Suduroy) were also historically characterised by a larger share of the land being owned by smallholders.

The trend towards felag changed again during the nineteenth century. Expansion of the infield following population growth from the beginning of the nineteenth century (at least partly related to an emergence of a growing class of smallholders and landless peoples involved in fishery) was difficult to handle due to the common property rights of the outfields. High prices on woollen products made it in principle possible for this new class to also make a living from knitting socks and sweaters. To maintain the labour supply for the bigger farms, legislation made it illegal to collect the necessary wool in the outfields, although it was often dropped by the sheep. Additional legislation was passed, forbidding young people to marry without having a legal occupation; knitting was not such an occupation! But in the end, the growing interests in keeping low reproduction costs for smallholders partly engaged in fishery took over and kenning, most suited for the smallholders, was legalised again in 1866.

The development of the legislation around felag shows that social affairs and conflicts had a considerable influence on the management of the skipan.

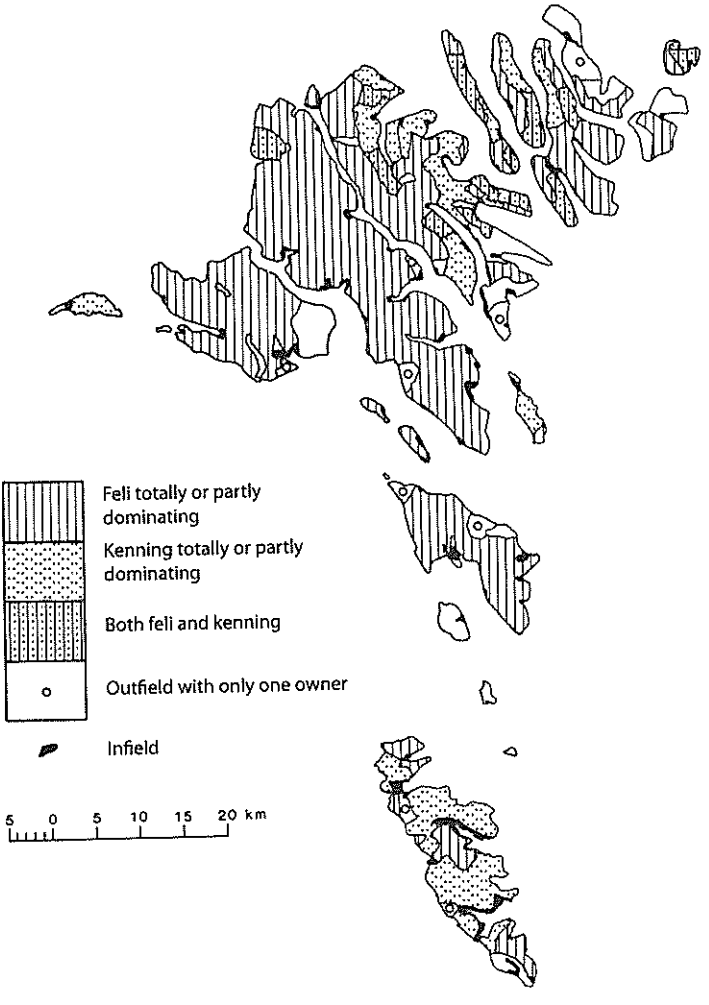

Figure 3.8 The distribution of separate ownership ('kenning') and common ownership ('feli') at the Faeroe Islands in 1758

Source: Reports from the regional governors. Føroys Landsskjalasavn, Tórshavn.

It could, of course, also be interpreted, ecologically, as a measure to ensure an optimal resource use, since joint management was based on the election of joint shepherds who had total control over the pasture, ensuring the necessary measures to sustain the productivity. Nobody, not even the owners, was allowed to cross the outfield without the permission of the shepherd. So, the shepherds were extremely important people in the village. In the past there was normally one shepherd per outfield, of which there could be several in a village. He was elected by the owners,

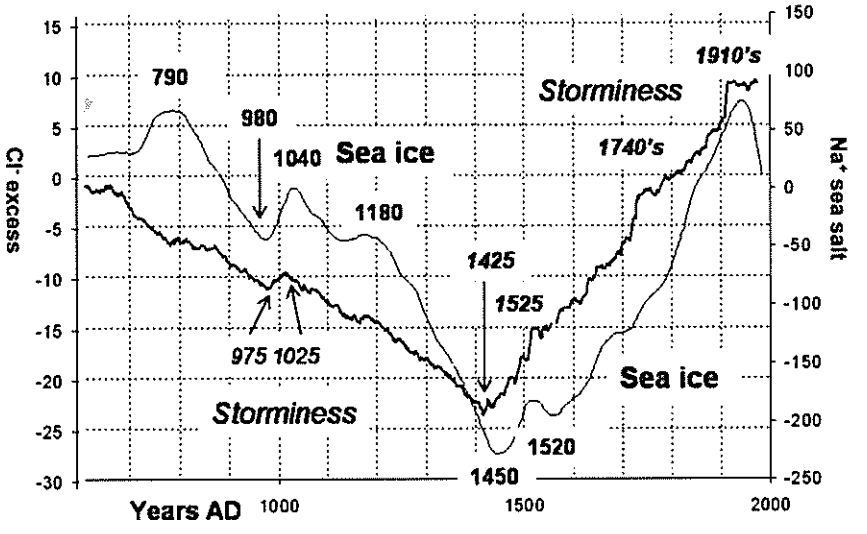

Figure 3.9 Climate diagram

Note: Cumulative records of annual deviation from the longterm mean of the time series for the proxy records of Greenland Sea/Davis Strait sea ice extent and North Atlantic storminess. The main interpretation of the curves are described by Dugmore, Borthwick et al. (2007) in the following way: 'Crucially, a shift in the direction of change can be used to mark the point at which prior change fails to predict future change and the gradient of the graph can be used to indicate a cumulative rate of change. Cultural stresses enhanced by climate (with potential impacts on landscape and settlement) may therefore be most likely where the gradient of the graph is steep, or where the slope changes direction'.

Source: Data from Greenland Ice Sheet Project 2. http://www.gisp2.sr.unh.edu/ (Dugmore, Borthwick et al. 2007).

according to their share of the total number of marks. Thus, an owner or King's tenant having more than half the total value of an outfield (measured in mark=16 gylden=320 skind) could decide who should be the shepherds.

The reporting of widespread overgrazing and erosion as well as statistics on the development of skipan seems instantly to contradict such an interpretation.

Throughout history there are many reports on the lowering of carrying capacity and widespread soil erosion (Debes 1673: 117, Svabo 1959) (Landbokommissionen 1911: 69). But sheep and erosion have not necessarily been related to each other. Sheep have been such an integrated part of the Faeroese cultural landscape since the Celtic settlement in the sixth century, so it must have been difficult to judge how the geo-ecology would have developed without sheep: There have always been signs of erosion on the Faeroe Islands as well as sheep all over. Sheep have been so much a part of the cultural landscape that they have been considered a part of nature.

Table 3.1 The development of the total sheep flock on the Faeroe Islands 1600–1988

App. year	1600		1780		1870		1988	
		(Index)		(Index)		(Index)		(Index)
Suðuroy	17,578	(100)	15,600	(89)	11,949	(68)	10,111	(58)
Sandoy	12,412	(100)	10,375	(84)	7,760	(63)	7,738	(62)
Vágar	11,220	(100)	8,820	(79)	6,730	(60)	7,540	(67)
Streymoy	21,740	(100)	16,110	(74)	15,549	(72)	14,577	(67)
Eysturoy	19,840	(100)	13,703	(69)	13,824	(70)	14,155	(71)
Nordoy	13,759	(100)	10,931	(79)	8,296	(60)	10,026	(73)
Total	96,549	(100)	75,539	(78)	64,108	(66)	64,147	(66)

Note: The numbers are all based on the known skipan, not statistical counting. This is in reality also the case for 1988, although it should have been based on a counting.
Sources: (Brandt 1987) and Árbók fyri Føroyar 1991.

It is, however, a hard fact that, on average, skipan was reduced by one-third from the beginning of the seventeenth century to the end of the nineteenth century, although at different rates in the different parts of the Islands (see Table 3.1). The stabilisation within the last century probably implies continued overgrazing due to the introduction of modern medicine, winter shelters and a growing amount of imported winter fodder. Productivity has, in general, increased in terms of number of slaughtered sheep and an increase in slaughter weight. Decreases in the active sheepherding and maintenance of the outfields (especially drainage) paired with the use of winter fodder might have increased the pressure on low-laying pastures, and sub-optimal use of more remote areas. Such overgrazed 'feeding lots' are well-known in grazing systems.

Apparently the Sheep Letter only partly regulated an ecological carrying capacity and was primarily concerned with social conflicts at the local level of a single island due to uneven grazing pressure. The territorial system of grazing was upheld by the principle of the different flocks being deliberately 'shepherded against each other', that is, the grazing pressure of each flock had to be kept at the same level so that there was no reason for a systematic trespassing from one ground to another.

However, if the owners were able to agree on an over-exploitation of all the pastures, they were allowed to do it. In the short term this might have been seen as a sign of growing productivity, resulting in higher taxation revenue. Because the quotation from the Sheep Letter (see Figure 3.1), continues as follows: 'If the owners agree that it can accommodate more, then they can have as many (sheep) as they can agree upon, and every man can have as many sheep, as his share of the property can justify'.

This indicates that the Sheep Letter primarily was established to solve social conflict between land owners.

Emphasis on a social interpretation of the use of skipan is also supported by the fact that considerable differences in the weight and slaughter percentage exist between the different islands, thus indicating very different degrees of grazing pressure. These differences can at least partly also be linked to obvious variations in soil erosion between the different islands.

Skipan as Ecological Wisdom

Although the Sheep Letter has primarily to be seen as a form of social regulation, it does not necessarily mean that the concept of skipan did not express the endeavour of the local land use system to ensure a sustainable use of the natural resources.

The skipan was not just passed down through the centuries. In fact, marked departures from the general trend of a falling skipan did arise. In a very interesting report from 1783, a young student Johan Christian Svabo (1783) commented on the general decline of the skipan since the beginning of the seventeenth century, but added a handful of exceptions most notably the Island of Nolsoy, by the entrance to Tórshavn, 'where the old skipan was 900, but due to the skill, industry and good management of the inhabitants had been raised to 1,100' (Svabo 1959: 771). Ninety years later, however, the skipan of Nolsoy was registered at 920 (Taxation 1873).

Concrete measures to keep the skipan were also a known practice. In some villages it was a standard procedure to make an evaluation of the tallow weight of the sheep by the first collection of sheep in the autumn. If it was below a certain level, the number of sheep to be slaughtered by the second collection was increased to lower the number of sheep grazing the obviously less productive area (personal communication, Rolf Guttesen).

Thus, an active ecological wisdom concerning sustainability did exist, and was a part of the management practice of the shepherd. He was, of course, dependent on the owner, and it is conceivable that his experience could have difficulties in being acknowledged. But his knowledge was not just attached to the outfield he managed. He cooperated closely with all the other shepherds for many practical reasons, first of all to prevent all the troubles that could turn up if the grazing pressure of the different parts of an island was dissimilar. His education was closely related to this cooperation thus giving the shepherds a powerful voice provided they were able to cooperate. The historically developed ecological wisdom of the grazing system was born out of the cooperation of these shepherds. However, their experience could only be based on the past. If trends in nature changed, they might fail.

The marked differences in the development of skipan at the regional and local levels between the sixteenth and nineteenth century might have been related to more basic ecological problems in the form of increased difficulties in risk assessment due to climatic changes.

Rather good documentation of the little ice age, approximately 1300–1870, as well as the preceding medieval warm period, approximately 800–1300, exists. It seems reasonable in some way to relate this development to the development in skipan.

In an historical assessment of climate impacts on settlement, it has been suggested that many complex societies have a marked resilience to droughts and other occasional events within a time span of some decades, but may also exhibit marked responses to events at a level of many decades to centuries (de Menocal 2001).

In a North Atlantic context (Dugmore, Borthwick et al. 2007) have drawn the attention to the necessary strategy behind this resilience, arguing that 'the ability of human systems to accommodate or adapt to bad seasons may be primarily constrained by their predictability on the decadal scale'. They especially focus on the identification of the validity of past experience concerning risk-benefit assessments of hazardous undertakings since the assessment of predictability might be just as critical for a land use system as the mere ability to adapt to periods of unfavourable conditions. They have used the cumulative deviations from the means of the Greenland ice core storm frequency proxy (GISP2 Na+) and sea ice proxy (GISP2 chloride excess) to identify episodes of unpredictable change in the storminess of the North Atlantic within the last 1,400 years, see Figure 3.9.

Most remarkable is a clear shift after 1425, but the authors also emphasise the fact that 'the rapid changes of the mid-eighteenth century coincide with one of the extreme periods of the last 1400 years'. They stress that 'In terms of predictability, another key climatic change is apparent in the storminess record after 1425 AD. Since the early fifteenth century the record has become more changeable with more extreme years'.

The relevance of these data for an evaluation of changes in the climatic conditions for the Faeroese sheep grazing, and especially for an assessment of possible changes in the occurrence of fellir as an important part of the determination of the skipan, can certainly be questioned: The length of the winter season and the productivity of the foregoing summer might be more important than storminess.

But their might very well be a relation between this storminess and Svabo's reference to a 'felli' on average every 14 years that was closely related to the long-termed valuation of the carrying capacity in the form of skipan. He describes it as a risk assessment, calculated by the tradition of 'the old men', adding that a calculation from the last 100 years confirms this assessment to be rather close. But he also adds that such a calculation cannot be made precisely. The little ice age might have passed outside the horizon of an experience-based hazard-inclusive assessment of the carrying capacity of the outfields for sheep breeding. Obviously, a late medieval shift in overall agricultural strategy took place on the Faeroes, replacing a former rather intensive dairy system, including shielings, or summer farms, using widespread tillage in the (later) outfields (Brandt and Guttesen 1981), with the later system of more contracted infield activities combined with extensive and exclusive sheep grazing in the outfield. Despite the apparent coincidence of this shift and the change in climate observed by Dugmore, Borthwick et al. (2007), the shift seems rather to be related to changing trade relations and growing wool prices, accentuating sheep farming at the expense of other types of agricultural activities. A less predictable impact

of the shift might, however, have been related to the changes in the circulation of nutrient. Adderley and Simpson (2005) argue that yields of cereals and fodder were optimised by the manuring strategies on the Faeroes around 1200 AD and Dugmore, Borthwick et al. (2007) suggest that the later changes in the climate record should be visible in the landscape of the later system due to the cessation of the widespread use of manure to compensate for yield loss.

Thus, one can imagine that the rapid climatic 'changes of the mid-eighteenth century' (Dugmore, Borthwick et al. 2007) might have represented a serious challenge to the authority of risk assessment based on former experiences, giving a defence for more short-termed interpretations of skipan related merely to social conflicts.

Conclusion

Diverging facts can give rise to different interpretations of the historical Faeroese sustainability concept of skipan. Basically, it has regulated a long-termed optimal use of the grazing potential of the Islands under shifting economic conditions. The variable weather conditions have made risk assessment of the grazing system through the judgement and constant evaluation of a long-termed sustainable level of skipan a crucial part of the regulation of the land use system. The shepherds of an island formed the expertise, developing a variety of indicators of grazing pressure and its relation to short-termed and long-termed regulations of the sheep stock at a local and regional level. Their cooperative effort based on a common experienced process of environmental learning was of utmost importance, especially for the minimisation of the consequences of extreme winter and spring situations, the so-called *fellir*. However, widespread soil erosion in combination with a notable decrease in the carrying capacity for the main grazing animal, sheep, during the last 400 years makes the historical efficiency of this way of sustainability regulation questionable. Also, the focus of the Sheep Letter (1298) on social conflict solution, admitting the right to raise the stock unlimited, if the owners could agree on it, makes the ecological interpretation of skipan less inevitable.

The long-termed changes in the climate since medieval time must have had a profound influence on the experience-based possibilities of risk assessment and optimal resource use based on a judgement of the local optimal level of skipan. This might have challenged the authority of the institution of the co-operating shepherds for an environmentally/ecologically-based regulation of skipan compared to the short-sighted advantages of a regulation strategy based solely on social conflict solution among the land owners. The land owners could be active shepherds too but, in general, and probably especially among the many officials being King's tenants on relatively big holdings this was not the case. More historical research in the socialisation and cooperation among shepherds as well as in the social relation between shepherds and land owners is, however, needed to shed light on the historical weighing of ecological and social sustainability. But if the thesis

of a shift towards a primarily social regulation of the skipan due to failing risk assessments eventually following climate changes is right, it will form a good example of 'The Pathology of Regional Resource and Ecosystem Management' described by Gunderson and Holling stating that 'mediation among stakeholders is irrelevant if it is based on ignorance of the integrated character of nature and people' (Gunderson and Holling 2002: 8).

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