

## LANDSCAPE CHANGE AS AN INTERFACE FOR DIFFERENT APPROACHES IN LANDSCAPE RESEARCH\*

With 6 figures, 2 tables and 6 photos

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*Keywords:* Cultural and ecological approaches to landscape, land cover, land use, mountains, Norway, perception, temporal and spatial dimensions

Bodenbedeckung, Gebirge, kulturelle und ökologische Forschungsansätze zur Landschaft, Landnutzung, Norwegen, Wahrnehmung, zeitliche und räumliche Dimensionen

*Zusammenfassung:* Landschaftsveränderung als Interface für verschiedene Ansätze der Landschaftsforschung

Für viele Disziplinen ist der Forschungsbereich Landschaft von großem Interesse. Die Bedeutung sich ergänzender Forschungsansätze ist von verschiedenen Seiten unterstrichen worden. Interdisziplinäre Arbeiten, die kulturelle und ökologische Ansätze anzuwenden versuchen, treffen auf Herausforderungen. Eine Möglichkeit diesen zu begegnen, liegt im Studium eines Interface (gemeinsames Interessensfeld, „Grenzfläche“), welches in diesem Artikel durch „Landschaftsveränderung“ repräsentiert wird. In der anthropogeographischen und landschaftsökologischen Literatur werden drei prinzipielle Betrachtungsweisen von Landschaftsveränderungen identifiziert. Diese umfassen zum Ersten eine Betrachtung der physischen Landschaftsveränderungen, zum Zweiten eine Untersuchung der Wahrnehmung und Bedeutung von, und Haltung gegenüber Landschaftsveränderungen und zum Dritten eine Konzentration auf die zeitlichen und räumlichen Dimensionen von Veränderungen. Anhand einer norwegischen Fallstudie wird gezeigt, wie die Anwendung dieser drei Betrachtungsweisen die Darstellung der Komplexität von Landschaftsveränderungen ermöglicht. Die Kenntnis dieser Komplexität kann bewusste Entscheidungen über die zukünftige Entwicklung von Landschaften und eine Abwägung unterschiedlicher Managementalternativen unterstützen.

*Summary:* Landscape is a topic of interest for many disciplines, and the importance of considering different approaches that may be complementary has been pointed out by several authors. However, interdisciplinary work applying both cultural and ecological approaches to landscape is challenging. One possible way to deal with these challenges is to study a common interest – an interface. The interface dealt with in this paper is landscape change. In the human-geographical and landscape-ecological literature, three broad perspectives on landscape change are identified. A first perspective deals with “natural” and human factors as causes of change. This perspective is mainly concerned with physical landscape changes. A second perspective concentrates on perception of, attitudes to, and meanings of landscape. The physical landscape plays a certain role, but more focus is placed on its perception. A third perspective focuses on the temporal and/or spatial dimensions of change. When applied to a Norwegian case study, the three perspectives on landscape change help to reveal the high complexity inherent in landscape change. Knowledge of this complexity can support conscious decisions about future development and a weighting of the consequences of different management alternatives.

### 1 Introduction

Landscape is a topic of interest for many disciplines. It is conceptualised in many ways, but one of the most marked distinctions in landscape research must be between the approaches of the social sciences and humanities on the one hand, and of the natural sciences on the other. This has been remarked on, for example, by PALANG and FRY (2003). Like COSGROVE (2003), they point out that ecological and cultural approaches to landscape may complement each other. BASTIAN (2001, 761) emphasises that it is important to consider both “natural and social components”. HEAD (2004) as well as HUGGET and PERKINS (2004) express comparable viewpoints concerning landscape research in human and physical geography.

COSGROVE (2003) contrasts an “ecological” and a “semiotic” landscape discourse, using VERA (2000) and OLWIG (2002) as examples. The ecological discourse deals with interactions of natural processes. Human beings are included through their interaction with these processes. The semiotic discourse focuses on cultural meanings and on how these create landscape through perception and representation.

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“Anyone seriously concerned with understanding and perhaps regulating the changing appearance of Europe’s landscapes and the natural and social processes that have shaped and sustain them needs to be attentive to both these discourses, and to hope for some kind of open dialogue between them” (COSGROVE 2003, 15).

Interdisciplinary research that attempts to incorporate different approaches to landscape is often perceived as difficult and challenging, and sometimes even as impossible. This may be caused by the expectations of the involved disciplines about what “the others” could or even should contribute, or expectations about what the outcome of collaboration could be. Is it, for example, the aim to come to a joint conclusion, or is it to show “different sides of the same thing”? Communication may be a problem (COSGROVE 2003, 16), especially when differing concepts are expressed in the same term, as in the case of landscape.

Moreover, because of their anchorage in different scientific roots, approaches to landscape show basic differences. A crucial one is, according to my understanding, the role of human beings. Although human beings are important for most approaches, they are included in different ways. JONES’s (1991) three approaches to landscape illustrate this. (COSGROVE’s (2003) discourses resemble the first two.) In the “humanistic” approach, “landscape is regarded as something subjective, a mental conception of reality. The underlying idea is that landscape is a ‘way of seeing’” (JONES 1991, 242). Human beings, their perception, the context that influences this perception, and representations are the core of this approach.<sup>1)</sup> In the “scientific” approach, “landscape is regarded as something objective, a set of physical forms which can be objectively registered. The underlying idea is that the landscape has an objective existence, the landscape ‘is’” (JONES 1991, 241). This can be seen as an underlying assumption for ecological landscape approaches, which, in general, regard landscape as a system that is organized hierarchically (e.g. FORMAN a. GODRON 1986; HABER 1990; LESER 1991; ZONNEVELD 1995; FARINA 2000; BASTIAN 2001; BUREL a. BAUDRY 2003). Human beings can play an important role but they are only one factor in the system. Ecological landscape approaches, especially “holistic” ones, incorporate humans and “natural features” into a system of interacting processes (NAVEH 1994; NAVEH a. LIEBERMAN 1994; BASTIAN 2001; TRESS a. TRESS 2001).

<sup>1)</sup> For a more extensive discussion see, for example, DANIELS and COSGROVE (1988), OLWIG (1996, 2002, 2004), COSGROVE (1998), SETTEN (2002, 2003).

Broad approaches to landscape are seen to supersede “the contradictions between natural science and humanities” (BASTIAN 2001, 761). On the one hand, humans are included as a dynamic factor through land use; on the other hand, the results of studying the “landscapes of the minds of groups and interests in society” should be included in landscape planning and management (BRANDT 1999, 25–26). In this applied approach, landscape may be “regarded as a value-laden reality, a reality consisting of objectively registrable physical forms, but where attention is focused on special natural or cultural elements which are considered as especially valuable” (JONES 1991, 241). LOSSAU (2005) argues for a comparable dissolution of the subject-object distinction in her discussion of HARD (2001) and FALTER and HASSE (2001).

Another possibility of dealing with different approaches or of bringing results together lies in the term “interface”, as used, among other authors, by PALANG and FRY (2003). The term expresses common interests or concerns between different approaches. In this paper, it is used to denote a “meeting place” of different disciplines’ approaches to landscape (cf. COWIE 1989; MERRIAM-WEBSTER 2006), and landscape change is chosen as such an interface (Fig. 1).

The aim of the paper is to show how the use of different approaches to landscape, cultural and ecological, can contribute to a more comprehensive understanding of landscape change as they take different, although, partly overlapping perspectives on change. As a first step, basic perspectives on landscape change have been identified in human-geographical and landscape-ecological literature including, with a few exceptions, case studies from Northern and Eastern Europe. The first perspective, which has an extensive literature, deals with different factors that lead to change. It ranges from a strong focus on “natural”<sup>2)</sup> factors to a strong focus on human activity as underlying causes. In between, many intermediate positions can be found which include both “natural” and human factors to a varying degree. Commonly, this perspective is mainly concerned with physical landscape changes. A second perspective deals with the perception, values and meanings of landscape. The physical landscape plays a certain role but more focus is put on its perception. A third perspective focuses on the temporal and/or spatial dimension of change,

<sup>2)</sup> The term natural is set in quotation marks to express awareness about the problematic distinction between human and natural as this may be understood as humans not being natural. ELLENBERG’s (1996) presentation of an ecosystem with humans both being part of the system and standing outside the system is a good illustration of this dualism.

for example, in making distinctions between large and small changes. This separation into different perspectives does not mean that there are clear divisions between them, but is concerned more with identifying the main focus of study.

These three perspectives are applied to a case study from a former mountain summer farming area in Norway which, due to its long use history, is a suitable area to investigate different perspectives on landscape change. The results are discussed against the literature reviewed for the identification of the perspectives on change. Moreover, in the discussion, the perspectives are related to cultural and ecological approaches to landscape. My own background is in landscape ecology, and the discussion will no doubt in places reflect this.

## 2 Study area

The study area, today known as Stølsheimen, is located in western Norway south of Sognefjord (Fig. 2). The area is characterised by steep slopes between the fjord and the main mountain plateau. The relief of the plateau ranges from about 600 m to over 1,300 m a.s.l. The climate is oceanic with a high annual precipitation. The low alpine belt, which covers the main part of the mountains, consists mainly of vegetation dominated by dwarf shrubs and grass that occur in a mosaic. Common species of the dwarf shrub heaths are *Empetrum hermaphroditum*, *Vaccinium myrtillus*, *V. uliginosum* and *V. vitis-idaea* (KNABEN 1950; HESJEDAL 1972; EITER et al. 2000). Their dominance varies according to factors such as moisture, wind exposure, and duration of snow

cover. The grass-dominated vegetation is characterised by *Nardus stricta*, but *Deschampsia flexuosa* and *Anthoxanthum odoratum* (ssp. *alpinum*) are also typical. Snow-bed vegetation is common, and *Salix herbacea* is typically a dominant species (KNABEN 1950; HESJEDAL 1972; EITER et al. 2000). In addition, mires of varying size, tall-perennial communities and, in the lower parts of the mountains, birch forest are common.

It is not known when mountain summer farming in the study area started. Archaeological investigations have dated the oldest structure of a site close to the present mountain summer farmstead of Bjergane to AD 140–380 (VALVIK 1998, 79–82; VALVIK a. ÅSTVEIT 1999, 44) (Fig. 2). Mountain summer farming in the area declined strongly from the beginning of the 20<sup>th</sup> century. The use of the last mountain summer farm – for about 30 years the only one in full use – was abandoned in 2004.<sup>3)</sup> Farming is now limited to livestock grazing on summer pastures; milking and processing of milk have ceased, and mountain summer farming is therefore considered as abandoned in this paper. The grazing animals are mainly sheep and some cattle. Other current uses of the area are new or have increased during recent decades, e.g. hydropower development and outdoor recreation.

## 3 Methods

The investigation of landscape changes takes its point of departure in 10 mountain summer farms (Fig. 2). All are located above the tree-line, except for two (Alrekstølen and Solrenningen), which lie in the present border zone between forested and alpine areas. The presentation of landscape changes in Stølsheimen in this paper draws upon results that are presented in more detail in POTTHOFF (2004, 2005a), POTTHOFF and EITER (2004), EITER and POTTHOFF (2005). Hence, methods will be presented only in brief. More detailed information on methods can be found in POTTHOFF (2004, 2005a).

Interviews and more informal conversations with owners and other people with knowledge about the mountain summer farms were used to obtain information about the cultural practices connected to mountain summer farming, changes in practices and the use history of the area. The interviews were semi-structured (DUNN 2000); informants' age from the mid 40s to the late 80s. The interviews included questions about the movement to and from the mountain summer

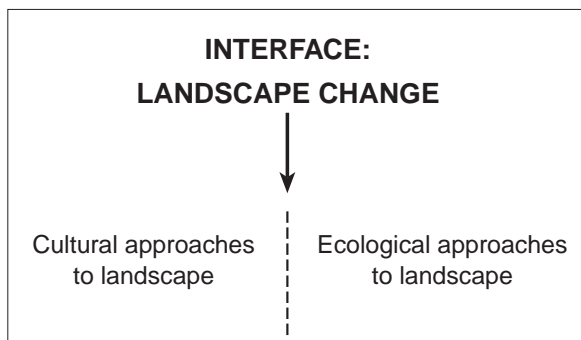


Fig. 1: Landscape change as an interface between cultural and ecological approaches to landscape

Landschaftsveränderung als Interface zwischen kulturellen und ökologischen Forschungsansätzen zur Landschaft

<sup>3)</sup> According to local informants, full use includes grazing and cheese production although not winter fodder production.

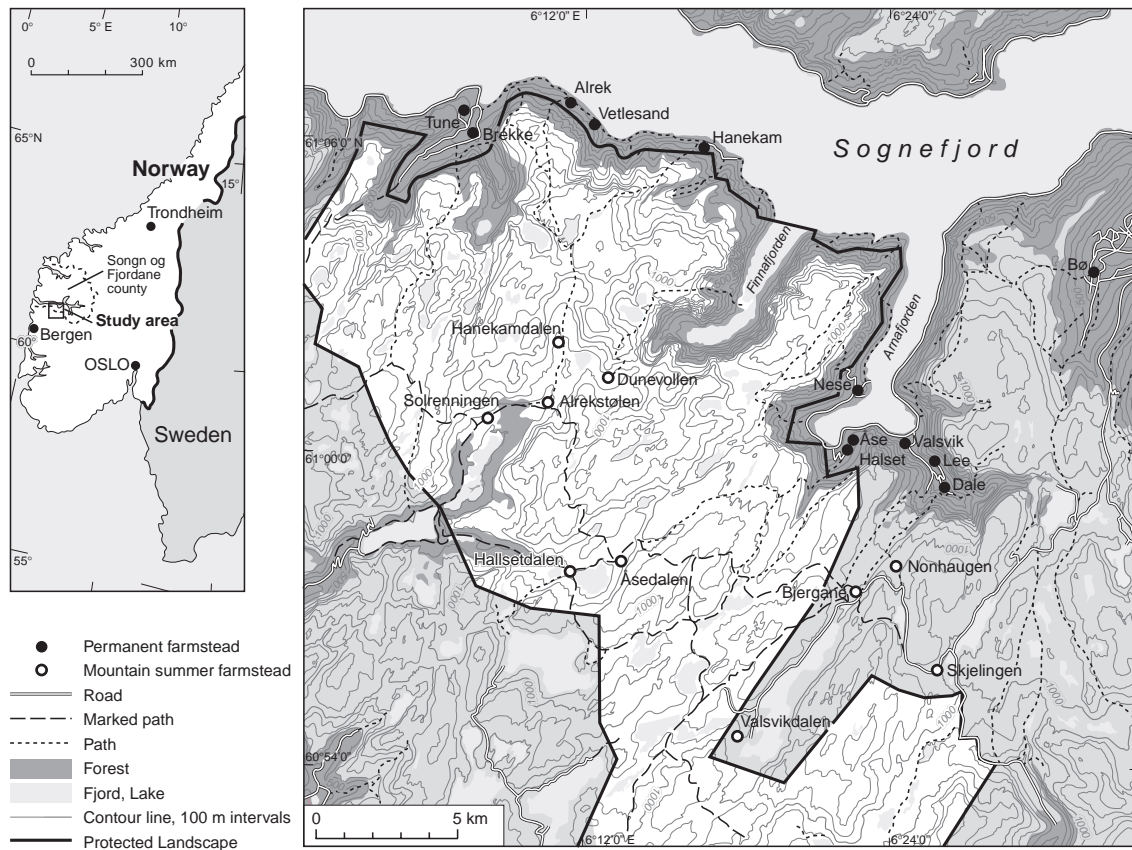


Fig. 2: The location of the study area and the 10 mountain summer farms investigated. (Detailed map adapted from: Statens kartverk, N50 Kartdata versjon 2002, partly updated)

Die Lage des Untersuchungsgebietes mit den 10 untersuchten Almen. (Detailkarte nach Statens kartverk, N50 Kartdata versjon 2002, teilweise aktualisiert)

farms, the abandonment of mountain summer farming, type of livestock used before and after abandonment and at present. Additionally, the diaries of two dairymaids contained information on mountain summer farming practices and very detailed information about the movements to and from the mountain summer farms.

Photographs from 1927–1965 were used to obtain a visual impression of the mountain summer farmsteads and their surroundings during the time of full mountain summer farming. Re-photographing was applied to detect vegetation changes since abandonment.

To investigate the present vegetation cover and the factors that control composition and structure of the vegetation, plant species coverage in percent and subplot frequencies (16 subplots) were recorded in 15 randomly placed quadrats of 1 x 1 m<sup>2</sup> on each curtilage<sup>4)</sup>.

Environmental factors were recorded. After preliminary testing, including significance tests, the following variables were included in multivariate analyses (Detrended Correspondence Analysis (DCA); Constrained Correspondence Analysis (CCA)): altitude, average vegetation height, amount of vegetation cover and of grazed vegetation (based on the prevalence of bitten leaves and shoots), P, Ca, Mg, K (all measured in soil samples), and years since abandonment. Quadrat data from the curtilages of Alrekstølen, Bjergane and Åsedalen from 1988 (AASTORP a. SKARPEN 1989) were compared with the author's own data to examine late vegetation changes.

<sup>4)</sup> Area directly around the mountain summer farmstead even if unfenced.



#### 4 Landscape changes in Stolsheimen during establishment and operation, and abandonment of mountain summer farming

##### 4.1 Perspective 1: Change in the physical landscape, and human and "natural" factors as causes of change

An important prerequisite for establishing mountain summer farming was probably, besides available pasture, a dwelling for the people who cared for the livestock. Material for the construction of buildings had to be transported from the lower-lying parts of the area. In some cases, existing buildings were dismantled, transported and rebuilt on the mountain summer farmsteads (interview data). The buildings are small in size and often difficult to see (Photo 1), and when compared with the size of the grazing area, their establishment altered the physical landscape little.

During the time of mountain summer farming, livestock grazing occurred over the whole area, but its influence on the landscape varied. The tree-line became lowered as a result of grazing combined with the cutting of firewood. This is inferred from the present increase in tree and shrub cover along the tree-line which is interpreted as re-growth due to reduced use intensity (Photos 2 and 3). Above the tree-line, low-intensity grazing appears to have had little influence on the vegetation in the greater part of the area (Photos 4 and 5). However, directly around the mountain summer farmsteads the vegetation was transformed as a result of defoliation, trampling and the concentration of nutrients in the soil. Several photographs (e.g. Photo 4) and general descriptions indicate that the vegetation was dominated by grass and herbaceous species in contrast to the surrounding dwarf shrub heaths.<sup>5)</sup>

Other physical changes during the time of mountain summer farming occurred in the form of altered buildings. Some have been rebuilt and extended, and in some cases the mountain summer farmsteads were moved to other locations close-by (BREKKE 1979, 22; VALVIK 1998; interview data). Thus, in contrast to the changes presented so far, where the implementation of a new land use (i.e. mountain summer farming) led to changes in land cover (construction of buildings, changes in vegetation), the alteration of the buildings is not necessarily accompanied by a change in land use.

Although full mountain summer farming has been abandoned, both buildings and paths are quite persistent, and are still important. Farmers use them when looking after the livestock on summer pasture or for leisure purposes (interview data). The importance of leisure use has increased, and the "majority of today's users – whether landowners or tourists – visit [...] the mountains for leisure purposes" (EITER 2004, 174).

Recent alterations of the buildings are now related to leisure use and, thus, represent a change in land use.

Vegetation changes caused by mountain summer farming around the buildings are quite persistent as well. The vegetation is still dominated by grass and herbaceous species, both in 1988 and 2001, but has become denser (Photos 4 and 5). Abundant and common species on the curtilages are *Agrostis capillaris*, *Cerastium cerastoides*, *Deschampsia cespitosa*, *Poa annua*, *Ranunculus repens* and *Rumex acetosa* in 1988 (3 curtilages), and *Agrostis capillaris*, *Anthoxanthum odoratum*, *Carex bigelowii*, *Carex brunnescens*, *Carex nigra*, *Cerastium cerastoides*, *Deschampsia cespitosa*, *Deschampsia flexuosa*, *Juncus filiformis*, *Nardus stricta*, *Poa annua*, *Ranunculus repens*, *Rumex acetosa*, *Rumex acetosella* and *Viola palustris* in 2001 (10 curtilages).<sup>6)</sup> The marked difference between vegetation directly around the mountain summer farmsteads and the adjoining vegetation is still visible where mountain summer farming has been abandoned, in some cases nearly 70 years ago. Thus, since the abandonment of mountain summer farming, no major transformation of the vegetation has occurred, only small alterations.

According to the analyses of factors controlling the structure and composition of the present vegetation (DCA and CCA), the present grazing pressure and altitude are crucial factors (Fig. 3). The CCA-results show additionally years since abandonment as an important factor. However, years since abandonment and altitude are correlated relatively highly ( $r = -0.780$ ). This correlation reflects the following relationship: mountain summer farms in lower elevation on gneiss were abandoned earliest. They were most difficult to reach because of long distances to the permanent farms and high ridges that had to be crossed. The last mountain summer farm that was abandoned is located on the

<sup>5)</sup> GRUDE (1891, 14; translated freely) describes the appearance of Western Norwegian mountain summer farms as follows: "There is [...] no boundary [made of fences] between the curtilage and the pasture. However, in general the mountain summer farmstead is distinguishable from a long distance because of the greener colour of the ground surrounding the buildings. This is because on areas where the overnight stays of the animals have heavily manured the terrain, lush grass species replace the naturally more pale grass species or herbaceous plants, or even replace the brown heather". Moreover, parts of the curtilage are bare because of trampling, especially when occurring in connection with rain (GRUDE 1891, 13).

<sup>6)</sup> Abundant and common are defined as follows: 1988, species occurred in at least 1 plot with  $1/8 - 1/4$  cover; 2001, species occurred either with at least subplot frequency 16 in 1 plot on 2 curtilages, or with at least 25% in 1 plot on 2 curtilages.

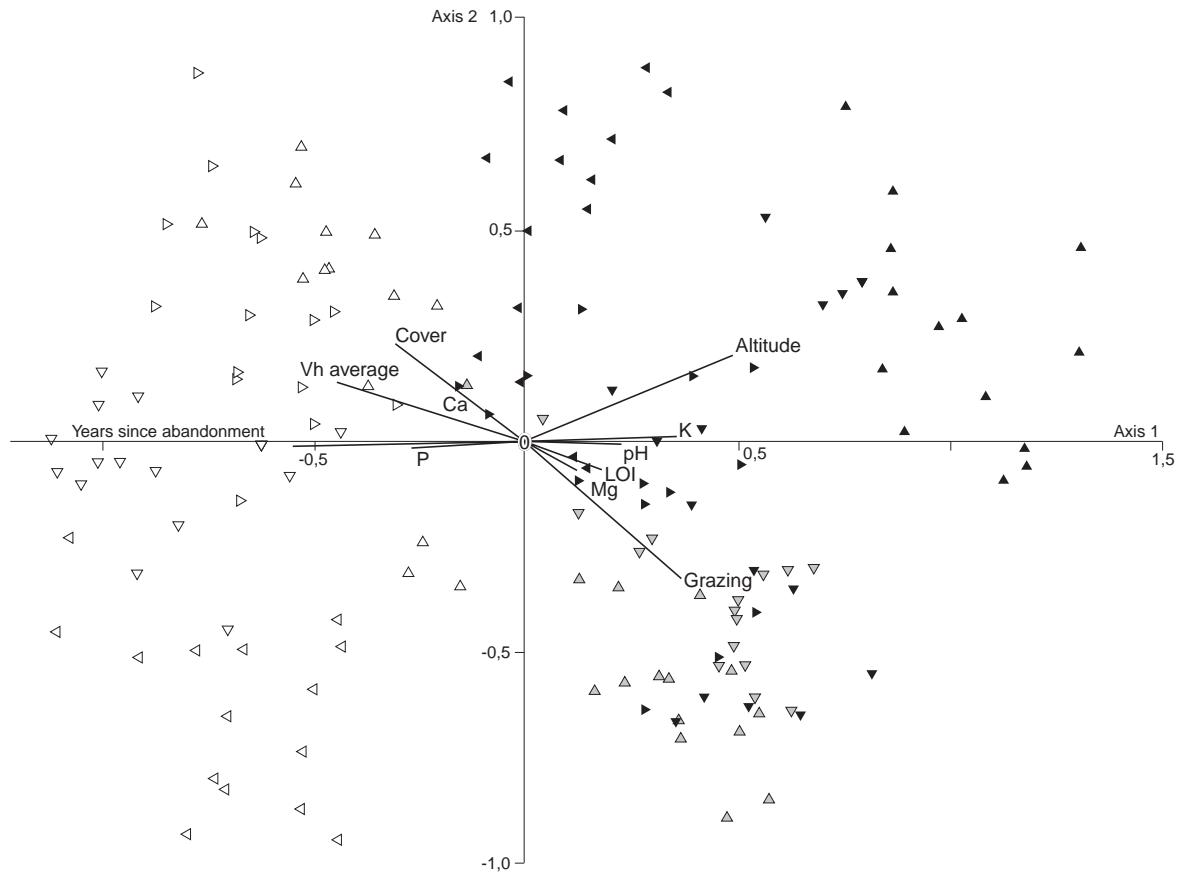


Fig. 3: Distribution of plots along CCA-axis 1 and 2. ◁ Solrenningen, △ Hanekamdalen, ▽ Alrekstølen, ▷ Dunevollen, ▼ Åsedalen, ▲ Hallsetdalen, ◀ Nonhaugen, ▲ Skjelingen, ▼ Bjergane, ► Valsvikdalen; open symbols: plots on gneiss; grey symbols: plots close to or at the bedrock border; filled symbols: plots on mica schist

Verteilung der Vegetationsaufnahmen entlang der CCA-Achsen 1 und 2. ◁ Solrenningen, △ Hanekamdalen, ▽ Alrekstølen, ▷ Dunevollen, ▼ Åsedalen, ▲ Hallsetdalen, ◀ Nonhaugen, ▲ Skjelingen, ▼ Bjergane, ► Valsvikdalen; weiße Symbole: Ausgangsgestein Gneis; graue Symbole: Aufnahmen nahe oder an der Gesteinsgrenze; schwarze Symbole: Ausgangsgestein Glimmerschiefer

mica schist and at high altitude. Further, the variable years since abandonment is relatively highly correlated with the present grazing intensity ( $r = -0.680$ ). This correlation represents a relationship between early abandoned mountain summer farms that at present are used for sheep grazing only (lower grazing intensity) while some of the later abandoned mountain summer farms are in use for cattle grazing (higher grazing intensity). Thus, years since abandonment is considered to be less important than altitude and grazing intensity (for a more detailed discussion see POTTHOFF 2005 a).

Reasons for the persistence of the distinctive vegetation around the mountain summer farmsteads can mainly be found in the high amount of nutrients, especially P, in the soil (POTTHOFF 2005a).<sup>7)</sup> The persistence

of buildings, paths and vegetation, though altered, shows that land cover may remain when land use changes. Major transformations of the physical landscape in recent times were brought about by hydropower development, including the construction of dams and roads (Photo 6).<sup>8)</sup>

#### 4.2 Perspective 2: Change in values and meaning

The establishment of mountain summer farms and the construction of buildings transformed the landscape significantly in terms of meaning. The buildings

<sup>7)</sup> Mean amounts of P on the 10 mountain summer farms vary between 978 and 2,353 ppm.



*Photo 1:* The mountain summer farm building of Dunevollen; relatively small in size, grazing area exceeds the photograph  
Die Alm Dunevollen: relativ kleines Gebäude; der zugehörige Weidebereich reicht über das Photo hinaus

were essential places for the production of dairy products for household consumption and sale. Together with the network of paths, the buildings and the adjoining vegetation can be seen as symbolising important values and meanings of the landscape for the farmers: the possibility to use the vegetation as a grazing resource and the resultant milk for butter, cheese and other products made farming and indeed existence itself viable along the fjords and in the lower-lying valleys. The area around the permanent farmsteads was usually too small to provide sufficient food, winter fodder and summer pasture. Thus, the mountain summer farms represented an essential economic value. Furthermore, the mountain summer farmsteads were important meeting places for youth and children, who once or twice during the season spent the weekend there (EITER 2004, 174), and people looked forward to these meetings (ØVREBØ 1999).

After the abandonment of mountain summer farming, the grazing resources have continued to be an economic value for at least some of the inhabitants in the adjoining valleys and along the fjord (interview data). However, mountain summer farming, including milking and processing of milk, has lost its central economic importance. Farmers can keep at least part of their live-

stock at the permanent farm throughout the whole year due to, for example, the improvement of pastures close to the permanent farms (interview data).<sup>8)</sup>

The remaining land cover created by mountain summer farming represents important amenity values. Its existence is one reason for the designation of part of the study area as a Protected landscape. Protection aims to “take care of a distinct and beautiful Western Norwegian mountain and fjord landscape with cultural monuments, cultural landscape and natural environment that is little influenced by technical encroachments, at the same time as the area should be able to be used for farming, outdoor recreation, hunting and fishing” (FYLKESMANNEN I SOGN OG FJORDANE 1998, 40, translated). Tourists, especially, appreciate buildings and the mountain summer farming character of the landscape as symbols of cultural history (EITER a. POTTHOFF 2005; EITER unpublished data). At least part of the values of tourists and conservation planners are rooted in persistence, i.e. more or less conscious “no change”. In the management plan for the Protected landscape, for instance, mountain summer farm buildings that are restored to their “original” conditions are mentioned as positive examples (FYLKESMANNEN I SOGN OG FJORDANE 1998, 17).

<sup>8)</sup> For more information about hydropower development in the study area and related demarcation of property boundaries see POTTHOFF (2005b).

<sup>9)</sup> General changes in the agricultural sector (ALMÅS 2002, 2004; GJERDÅKER 2002) can be seen as main reasons for this development, e.g. availability of fertilizers.

### 4.3 Perspective 3: Temporal and spatial dimensions of change

Change has a temporal and a spatial dimension, connected to its speed, frequency and duration, and the size of the area in which it occurs. To present landscape changes without at least implicitly including the spatial and/or temporal dimension of change appears to be

nearly impossible. As soon as changes are classified as large or small, major or minor, the dimensions of change are considered.

In this paper, the temporal and spatial dimensions of physical landscape changes are categorised according to a terminology based on speed and magnitude (POTTHOFF 2004). The term transformation is used for



*Photos 2 and 3:* The mountain summer farm of Alrekstølen (buildings in the centre), abandonment of mountain summer farming in 1936. Photo 2 was taken in 1927, Photo 3 in 2003. A number of birches and different types of shrubs have come up Die Alm Alrekstølen (Gebäude in der Bildmitte). Die Almnutzung wurde im Jahr 1936 aufgegeben. Photo 2 wurde 1927 aufgenommen, Photo 3 2003. In der Zwischenzeit sind Birken und unterschiedliche Sträucher gewachsen



change that affects a large area and occurs at high speed, which may lead to the perception of the change as large (Tab. 1). Slow changes over a large area are likely to be perceived as comparatively small. Similarly, changes affecting a small area at either high or low speed will probably be perceived as small. These two options are termed alterations. However, several subse-

quent alterations may be perceived as a transformation, a possibility not included in table 1. For a summary of the changes presented in section 4.1 see table 2.

Like physical landscape changes, changes in values and meaning have a temporal dimension as they occur at high or low speed, and have certain durations. Even if they lack a spatial dimension comparable to physical



*Photos 4 and 5:* The mountain summer farmstead of Bjergane, abandonment of mountain summer farming in 1973. Photo 4 was taken in the 1940s, Photo 5 in 2003. In the areas surrounding the curtilage, no significant changes appear to have happened while the vegetation on the curtilage has become higher and denser

Die Alm Bjergane. Der Almbetrieb wurde im Jahr 1973 aufgegeben. Photo 4 wurde in den 1940er Jahren aufgenommen, Photo 5 2003. Direkt um die Gebäude erscheint die Vegetation höher und dichter geworden, während außerhalb dieses Bereiches keine signifikanten Änderungen zu erkennen sind

Table 1: Terminology of physical landscape changes based on speed and magnitude

	Large area	Small area
High speed	Transformation	Alteration (2)
Low speed	Alteration (1)	Alteration (3)

landscape changes they are related to it, since the magnitude of physical landscape changes – in the same way as their speed – influences changes in meaning. The relationship between changes in the physical landscape and changes in perception and meaning is yet much more complex than a change in the physical landscape simply leading to a change in perception and meaning. The extent of physical landscape changes on the one hand, and the degree of change in perception and meaning on the other, may differ (Tab. 2).

The construction of small buildings in a large mountain area means only a (small) alteration in terms of physical landscape change, but represents a (large) transformation in terms of changes in meaning, as the area becomes significantly better accessible and, thus, more valuable for farming purposes. Subsequent alterations of the buildings during mountain summer farming can be also understood as alterations in meaning since the buildings kept their function. The alteration of

the buildings for leisure use, in contrast, can be seen as transformation in meaning. Moreover, values and meaning may change differently within a group of people, e.g. landowners. For those who still use the mountain pastures these represent an important economic value in the sense of use value. However, they have lost their essential importance when compared with the time of mountain summer farming, due to access to grazing resources close to the permanent farms (alteration). For those who have rented the mountain pastures to other farmers, the pastures gained new economic value in the sense of monetary value (transformation) (see Tab. 2).

Another aspect of the temporal dimension is seasonality. Winter snow cover and low temperatures during the major part of the year restrict the use of the mountains for grazing – with or without dairy production – to the summer season. This seasonality found its expression in the movements to and from the mountain summer farms which fluctuated due to annual differences in, for example, snow cover (Fig. 4). According to both interview data and diary records, the movements to the mountain summer farms could differ up to three weeks. The example of Åsedalen (Fig. 4) even presents a fluctuation of more than a month.

The movements were not only regulated by weather conditions but also by social norms. It was, for instance, uncommon to move on Sundays, while Saturday appears to have been a preferred day for the return from



Photo 6: Transformation of the physical landscape caused by hydropower development

Veränderung der physischen Landschaft durch Wasserkraftausbau

Table 2: Landscape changes in Stølsheimen as inferred from section 4.1 and 4.2. Physical landscape changes: numbers refer to the different types of alteration in table 1; changes in values and meaning: vegetation is adequate with grazing resources

Landschaftsveränderungen im Stølsheimen abgeleitet aus Kapitel 4.1 und 4.2. Die Zahlen zu den physischen Landschaftsveränderungen beziehen sich auf die unterschiedlichen Arten von Alteration in Tabelle 1; in der Spalte „Veränderung von Werten und Bedeutung“ wird Vegetation mit Beweidungsressource gleichgesetzt

		Physical changes		Changes in values and meaning <sup>1)</sup>	
		Transformation	Alteration	Transformation	Alteration
Establishment	Construction of buildings		2	X	
Operation	Vegetation in greater area above the treeline		1	no change	
	Vegetation on curtilages	X <sup>2)</sup>		no change	
	Modification of buildings		2		X
Abandonment	Modification of buildings		2	X	
	Vegetation on curtilages		3	X	X
	Hydropower development	X		no data	

<sup>1)</sup> The terminology used for physical landscape changes can be applied to changes in values and meaning in the sense of transformation denoting a large (significant) and alteration a small change.

<sup>2)</sup> This is a case where many alterations add up to a transformation.

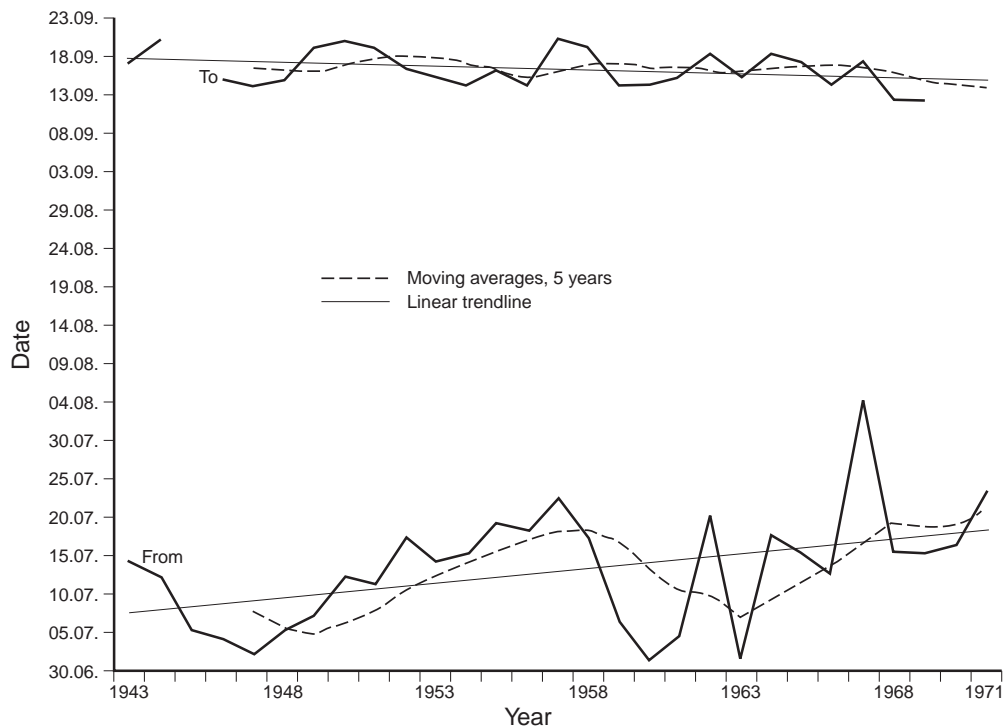


Fig. 4: Dates of movements for the mountain summer farm of Åsedalen (source: dairymaid's diary)  
Auf- und Abtriebsdaten für die Alm Åsedalen (Quelle: Tagebuch einer Sennerin)

the mountain summer farm (Fig. 5) (for an extended presentation and discussion of these data see POTTHOFF 2004).<sup>10)</sup>

## 5 Discussion

The case of Stølsheimen provides an example of how different perspectives on landscape change can be applied to one case study. In the following, the results will be discussed against the literature that has been used to extract the three perspectives on landscape change. Figure 6 presents an overview of the perspectives on change, approaches to and aspects of landscape, and their relationships.

### 5.1 Perspective 1: Land use and land cover change

The first perspective on change presented in the results is the analysis of physical landscape changes and the identification of their causal factors (see Fig. 6). In Stølsheimen, physical landscape changes caused by human use have mainly been in focus with mountain summer farming as an important causer. In the vegetation analyses, for example, altitude has been taken into account as “natural” factor. This factor did not turn out to be of importance for change but of relevance as controlling factor of, for example, vegetation composition.

In the literature, causal factors cover both “natural” conditions, human use and factors influencing human use, such as socio-economic factors. Some ecological studies focus exclusively on “natural” causes of change, such as wind or fire not caused by human activity. For example, FOSTER (1988) and FOSTER and BOOSE (1992) investigate the impact of a hurricane on a forest in New England, and BOOSE et al. (1994) extend these studies with a case from Costa Rica. However, even in these studies human activity may play a role, as in the first example, where the study site is a second-growth forest on former agricultural land and forest history was found to influence patterns of damage.

A possibility for considering both human and “natural” factors and their relevance for landscape change lies in the terms “land cover” and “land use”, which ANTROP (2001) identifies as key concepts for landscape ecologists and planners. Land cover “focuses on the

physical attributes of the surface and near-surface”, and both their condition and changes are included (TURNER a. MEYER 1991, 670). Land use “denotes the human employment of the land” (TURNER a. MEYER 1994, 5).

An extensive literature uses land use and land cover to analyse landscape changes. NÜSSER (2000, 2001) applies the land cover/land use approach to investigate landscape change in different parts of Pakistan. Based on re-photographing, partly supported by interviews with local people and investigation of historical sources, the author shows persistence and change of land cover and use, e.g. an increase in settled area and cultivated land due to population growth, and an increase in the number of irrigation channels with a resulting higher number of trees growing along these channels. In another region, NÜSSER shows persistence in the amount of dry forest which is used as additional winter fodder, and preserved due to local regulations.

KÜSTER (2004) shows the general importance of past land uses for present-day conditions, for example, change of nutrient contents in the soil. BUREL and BAUDRY (2003, 18–20) describe the relationship between agricultural improvements and the planting and removal of hedgerows in Brittany. LUNDBERG and HANDEGÅRD (1996) relate land use changes in a coastal area of Norway to changes in the physical landscape, e.g. development of drainage techniques and resulting drainage channels, which were new elements in the landscape and led to an improvement of the fields. Land use changes are the result of factors such as land

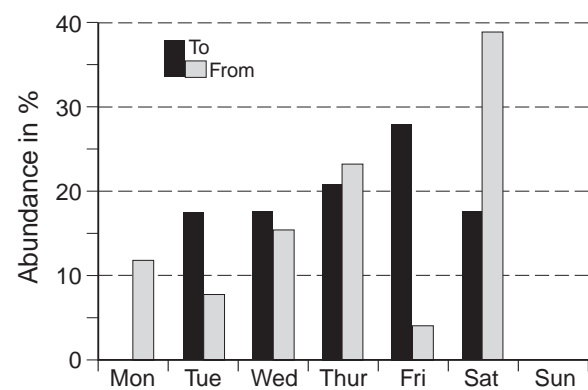


Fig. 5: Weekday movements for the mountain summer farm of Åsedalen (based on 29 (to) and 26 (from) movements, 1943–1971; source: dairymaid’s diary)

Wochentage der Auf- und Abtriebe der Alm Åsedalen (basiert auf 29 Auf- und 26 Abtriebtagen, 1943–1971; Quelle: Tagebuch einer Sennerin)

<sup>10)</sup> SOLHEIM (1952) points out that certain days of the week were regarded as unsuitable for the movements, for example, Sundays.

reallotment or the regulation of number of livestock. Similarly, SKOWRONEK et al. (2003), investigating landscape changes in the Polish-Ukrainian Borderland, interlink changes in factors that influence land use, land use change and changes in the physical landscape. For example, unemployment of village inhabitants in the early 1990s as a consequence of a decline in industry led to a depopulation of villages, resulting in a reduction of arable land and increase in forests.

While all these studies show physical landscape changes as a result of changes in use, the results from Stølsheimen illustrate that changes in land cover and land use do not necessarily occur at the same time and to the same extent. Alterations in land cover, in this case buildings, may occur without changes in land use, and changes in land use, in this case the abandonment of mountain summer farming, may happen with only minor alterations in land cover.

Two underlying conceptual models can be detected in this first perspective on landscape change which deals with “natural” and human factors as causes of change. These can loosely be linked to differences between ecological and cultural approaches to landscape (cf. Introduction; see Fig. 6). On the one hand, the natural conditions are taken as a kind of baseline. A certain area is “characterised by climatic, hydrological, lithological and pedological factors. They are regarded as natural in the sense of being non-anthropogenic” (KÜSTER 2004, 445). Land use changes these ecological

conditions or, as TURNER et al. (2001, 86) express it: “Patterns of land use can alter both the rate and direction of natural processes, and land-use patterns interact with the abiotic template to create the environment in which organisms must live, reproduce, and disperse.” Although land use and ecological conditions are presented as interacting in this second quotation, the term template reflects the idea of a pre-existing natural baseline. On the other hand, landscape is “a reflection of environmental and social conditions and processes in a society” (LUNDBERG a. HANDEGÅRD 1996, 168) or “[...] can be conceived as a nexus of community, justice, nature, and environmental equity [...]” (OLWIG 1996, 630–631).

These two conceptual models may seem to differ only slightly. However, they point to the different roles of human beings. Taking a “natural” landscape as a baseline that is changed and shaped by human beings means implicitly that, in line with the first distinction between cultural and natural landscapes, landscape does not necessarily require the occurrence of human beings. The view that landscape is created by “natural” and human factors together, regards the presence of human beings as essential for the shaping of the landscape. However, independently of the conceptual model, the examples presented in this section, including the Stølsheimen case, show that it is in many cases difficult to separate “natural” and human factors completely since they are complexly interrelated.

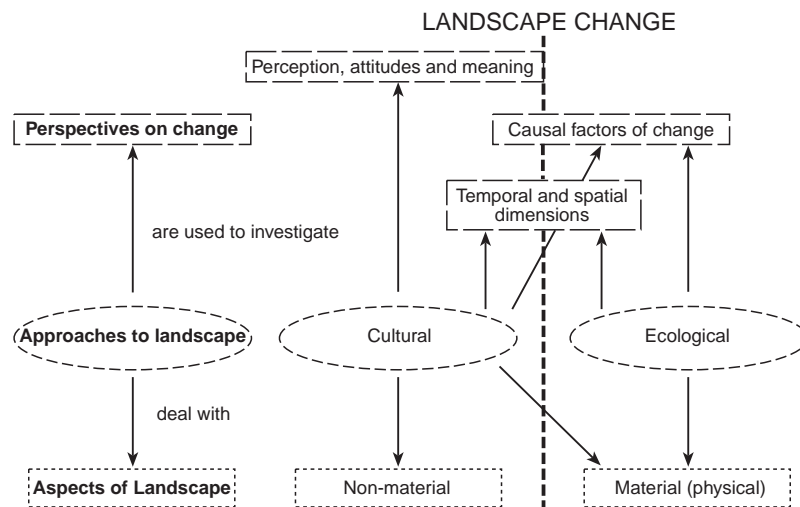


Fig. 6: Overview of the perspectives on change, approaches to and aspects of landscape, and their relationships

Überblick über die Zusammenhänge von Forschungsansätzen, Betrachtungsweisen von Veränderungen und Aspekten der Landschaft



### 5.2 *Perspective 2: Independence of changes in values and meaning from physical landscape changes*

The second perspective on change focuses on perception and related values and meanings. Questions dealt with in the literature are: how do people perceive a certain landscape? What does this tell about peoples' attitudes and the meaning of landscape for them? Changes in perceptions, attitudes and meaning are related to physical landscape changes and sometimes also causal factors for physical landscape changes. Although the degree of focus on the physical (material) aspect varies, the main emphasis is on people's perception, and thus these investigations belong to the domain of cultural approaches to landscape (Fig. 6).

As shown both in section 4.2 and 4.3, the extent of physical landscape changes and the degree of change in perception and meaning may differ. Moreover, changes in meaning may lead to changes of the physical landscape, e.g. collapse of buildings after their abandonment. The following two examples from the island of Saaremaa in Estonia show different aspects of this complex relationship. In the first case study by SOOVÄLI et al. (2003), there is a relatively large emphasis on changes in the physical landscape, such as the change of field sizes under different political systems, and changes in the extent of grasslands, forests and fields. These changes are compared with the perception of the landscape by different groups of people. Interestingly, perceptions of the landscape seem to have changed less than the physical conditions. The island is still perceived as an open landscape, although forest cover has increased significantly due to afforestation campaigns. Changes in meaning may occur although the physical landscape has changed little or not at all. PAE and KAUR (2004) investigate the changes of meanings connected to religious places on the island of Saaremaa without mentioning physical landscape changes. The authors show that the importance of churches as social centres has declined whereas their importance as tourist attractions has increased.

Continuity in perception despite changes in the physical landscape may be caused by expectations and wishes concerning what a certain landscape should look like. For example, in connection with Norwegian *seterlandskaper* (seasonally inhabited farming landscapes), DAUGSTAD (2000, 457) points out that administration, tourism, and even sciences have ideal landscapes, and that many ideals differ from the actual landscape. A study of perception of the West-Norwegian agricultural landscape shows that people have preferences for old buildings and constructions, such as stone bridges and stone fences, and for flowers and

colourful meadows with many species, in contrast to silos and other constructions associated with modern agriculture, which are not appreciated (STRUMSE 1998).

Preferences for certain landscapes mean that people attach values to them. JONES (1981, 1997) identifies economic, amenity and security values as three groups of landscape values. People's preference for elements representing "old" farming practices may be related to amenity values. However, it is not only certain physical elements that may represent values. As DAUGSTAD and JONES (1998) point out, terms such as cultural landscape, for example, may reflect values that differ among different groups of people, for example, between people belonging to the agricultural sector and those working with nature conservation.

Landscapes characterised by low-intensity farming are often valued because of high biodiversity and their cultural history. Changes in the Norwegian agricultural landscape during the last 50 years due to changes in agricultural practices have resulted in both a decline in the use of marginal areas and outfields, and intensification in other areas (FRAMSTAD 1998). The developments are perceived as leading to a loss of values, and point to a need for management. Successful management measures in turn are likely to be dependent on the knowledge of the causal factors of change. Stølsheimen is such a landscape that is characterised by low-intensity farming and where the use that gave the area its character is abandoned. However, the protection of the area is meant to keep this character (FYLKESMANNEN I SOGN OG FJORDANE 1998). Protection shows that the meaning of the study area has changed, as other user groups besides farmers attach values to the landscape, e.g. tourists and conservationists.

### 5.3 *Perspective 3: Dimensions of change*

The third perspective on change is the consideration of the temporal and spatial dimensions of change (see Fig. 6). DELCOURT et al. (1983), for example, describe "short-term events" (e.g. fire, hurricanes) that are located in the "context of longer-term changes in environmental disturbance<sup>11)</sup> regimes and the evolutionary development of the biota". In comparison to these longer-term changes, short-term events typically cover a smaller area. A similar approach is used by BELL and WALKER (1992, 3), who distinguish between long-term, gradual processes (e.g. mountain building, climatic change) and sudden, frequent, catastrophic events (e.g. storms, volcanic eruptions). The temporal and spatial dimensions of change are often used to contrast small and large changes. ATKINS et al. (1998, 77), for example, refer to small-scale and localized change that oc-

curs gradually, and less frequent but more fundamental changes covering “whole landscapes”.

JONES (1988, 1998) links the temporal and spatial dimensions of change in studies of coastal landscapes in Norway and Finland. In Norway, he (1988) identifies changes in the proprietary system alongside industrialisation and rationalisation as the main reasons for change in fishing communities. The changes can be investigated on different geographic levels, i.e. micro-, meso- and macro-level, and can be related to varying time spans. In Finland, JONES (1998) adopted this approach to explain landscape changes caused by shore displacement due to land uplift and the succeeding use of the emerging land. The use was dependent on changing evaluation of resources and ownership conditions, among other factors.

In the Stølsheimen example, the temporal and spatial dimensions of physical landscape changes are considered, using a terminology that is helpful to compare different types of change. However, its application may be difficult because of the dissimilar perceptions of change by different researchers. Whether a change is denoted as short-term or long-term, small or large, is dependent on individual perception, experience, cultural and – in this case – scientific background (POTTHOFF 2004). Nevertheless, it may be the most promising perspective to apply individually in interdisciplinary research as it is of equal relevance for both the discussion of factors that lead to change and for changes in values and meaning.

A focus on one dimension of change – mainly the temporal – can be found in the literature. JONES (1979, 10), for example, distinguishes between short-term (seasonal and daily rhythms) and long-term changes (e.g. land uplift, changes in cultivation). Further, JONES (1981, 1997) relates landscape values to the temporal dimension. Short-term economic values may lead to rapid changes whereas educational values may depend on slow or no changes.

BRASSLEY (1998) discusses “ephemeral landscape”. This is defined by changes that occur at short intervals such as the movement of clouds, which may occur from minute to minute. It may also include seasonal changes. BRASSLEY (1998) contrasts ephemeral and permanent

changes, and ephemeral and permanent components of the landscape. Such a distinction only makes sense when the terms are contrasted; a permanent change may otherwise sound like a contradiction in terms. “Permanent” components are not really permanent but change on another time scale. BRASSLEY (1998, 123) describes ephemera connected to different harvesting methods, ephemeral landscapes that are representative for distinct historic periods. Paradoxically, these ephemeral landscapes reflect, at least for a certain time period, an occurring persistence.

Ephemeral landscape features are also the topic of HULL and MCCARTHY’s (1988) work on landscape change. The authors focus on wildlife and conclude that the presence of wildlife has an impact on the scenic quality of the landscape, i.e. its values, though it is influenced by, for example, the beauty of scenery itself. “[M]ore beautiful scenes tended to be less impacted by the presence of wildlife than less beautiful scenes” (HULL a. MCCARTHY 1988, 276). Even the expectation to see wildlife increased the positive evaluation of a scenery. This shows that ephemeral landscape features, which relate to the temporal dimension of landscape, may influence the perception and evaluation of landscape significantly. Like wildlife, the freely grazing livestock are an ephemeral landscape feature. This includes not only the possibility to see the livestock but also to hear them, for example, sheep bells. However, in the management plan (FYLKESMANNEN I SOGN OG FJORDANE 1998) the grazing livestock is not mentioned as a part of the cultural landscape, but as the most important means to manage it, i.e. keep it open.

Seasonality is an other important aspect of Stølsheimen. According to BRASSLEY (1998), it is an aspect of ephemerality.<sup>12)</sup> JONES (2004), in contrast, argues for a distinction between ephemeral and seasonal landscapes where ephemeral landscapes are related to changes that occur irregularly while seasonal landscapes are related to rhythmic changes occurring on an annual basis. He defines seasonal landscapes as “landscapes showing marked seasonal contrasts in their physical appearance or in activities occurring in them, as well as artistic and other representations of this” (JONES 2004, 13). The author presents different approaches to the study of seasonality. In this paper, seasonality as a natural-geographical phenomenon (e.g. marked climatic differences), and seasonal landscapes of different types of livelihood (e.g. of hunting, fishing, gathering, agricultural practices) have been considered for the Stølsheimen case. The seasonal changes and related ac-

<sup>11)</sup> The term disturbance is defined as “any relatively discrete event in time that disrupts ecosystem, community, or population structure and changes resources, substrate availability, or the physical environment” (WHITE a. PICKETT 1985, 7). As a consequence of disturbances, an ecosystem may be transformed; on the other hand disturbance may be necessary to keep a system in a certain condition (TURNER et al. 2001, 157).

<sup>12)</sup> For further discussions of landscape and seasonality see the theme issue of *Landscape Research* 30 (2).

tivities show the close relationship between the natural-geographical phenomenon of marked differences in snow cover and temperatures and the farming practices that are organised according to them.

There is no clear division between the three perspectives on landscape change, i.e. 1. “natural” and human factors as causes of change, 2. changes in perceptions, values and meanings, 3. temporal and spatial dimensions of change. JONES (1988, 1998), for example, focuses on temporal and spatial dimensions of change but includes also a presentation of factors that lead to change (perspectives 3 and 1). SOOVÄLI et al. (2003), for instance, discuss the relationship between causal factors of change, and the perception of the resulting physical changes (perspectives 1 and 2). Other publications by JONES (1981, 1997) show a connection between the temporal dimension and perceived landscape values (perspectives 3 and 2). These links between the perspectives point to the complexity of landscape change and the relevance of considering different perspectives on change.

## 6 Conclusion

Interdisciplinary research, especially where covering humanities, social and natural sciences, is challenging. Based on the experiences of the investigation of global environmental changes, TURNER (1991) asks how to integrate social and physical sciences without becoming superficial and at the same time taking care of the interests of both traditions. The author sees neither the mixing of different approaches nor the separation of the topics as satisfying solutions but suggests a focus on common problems and interests instead. This has the advantage of affording each science the possibility to apply its own approaches.

The present article has shown that the study of landscape change provides such a common interest or interface. A unification of cultural and ecological landscape approaches that have different scientific roots, influencing the perception of the role of human beings and thereby also research interests, perspectives, and, not least, the definition of landscape, does not seem most advantageous. By taking different perspectives the approaches have successfully elucidated different aspects of landscape change. For interdisciplinary research it seems to be more promising to focus on bringing the results of different approaches together by demonstrating the relationships between them than trying to unite different landscape approaches into one.

The complexity of landscape change is a reminder that decisions about allowing or preventing changes have far-reaching consequences for landscape develop-

ment. For example, the protection of parts of the study area has prevented certain developments, e.g. further hydropower development and road construction, while it is likely to have maintained its attraction for hiking tourists, and thereby supported another development. Knowledge of this complexity can support conscious decisions for successful future development and a weighting of the consequences of different alternatives.

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