Altitudinal distribution of plant communities in the Faroe Islands

Hæddarútbreiðsla av plantusamfeløgum í Føroyum

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Úrtak

Greinin lýsir úrslit frá teirri fyrstu kvantitativu kanningini av vøkstri á heilum fjallasíðum í Føroyum. Fimm fjøll vórðu kannað til tess at kunna lýsa útbreiðsluna av plantusamfeløgum og broytingar niðan eftir fjøllum. Endamálið var at greina vøksturin í hæddarbeltir og at kanna skiftið millum tempereraðan og arktiskan fjallagróður. Tólv plantusamfeløg vóru greinað í fýra høvuðsgróðrarsløg: Graslendisgróður, grámosagróður, vátur graslendisgróður og lyngheiðagróður. Vøksturin kann býtast í trý ymisk hæddarøki: Tað tempereraða vakstrarbeltið (ovara mark 200 m hædd), lágfjallavakstrarbeltið (200-400 m hædd) og fjallavakstrarbeltið (oman fyri 400 m hædd). Tað tempereraða vakstrarbeltið er sermerkt av lyngheiðagróðri við tveimum plantusamfeløgum: *Empetrum nigrum-Calluna vulgaris*-samfelagið og *Calluna vulgaris-Nardus stricta*-samfelagið. Lágfjallavakstrarbeltið er sermerkt av vátum graslendisgróðri við trimum plantusamfeløgum: *Thymus praecox-Vaccinium myrtillus*-samfelagið, *Nardus stricta-Potentilla erecta*-samfelagið og *Galium saxatilis-Anthoxanthum odoratum*-samfelagið. Fjalla vakstrarbelti er sermerkt av tveimum høvusgróðrarsløgum: 1) grámosagróðri við trimum plantusamfeløgum: *Racomitrium lanuginosum*-samfelagið, *Racomitrium lanuginosum-Salix herbacea*-samfelagið og *Racomitrium fasciculare-Alchemilla alpina*-samfelagið, og 2) graslendisgróðri við fýra plantusamfeløgum: *Koenigia islandica*-samfelagið, *Festuca vivipara-Agrostis capillaris*-samfelagið, *Bistorta vivipara-Festuca vivipara*-samfelagið og *Deschampsia flexuosa-Rhytidiadelphus loreus*-samfelagið. Høvuðsniðurstøðan í hesi kanning er, at trý vakstrarbelti eru, eins og áður hevur verið hildið; men hesi øki eru væl lægri enn í eldri kanningum.

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Abstract

This paper presents the first quantitative vegetation analysis carried out along a continuous altitudinal gradient in the Faroe Islands. In order to describe the distribution of plant communities along altitudinal gradients, five mountains were studied. The aim was to define vegetation zones and to determine the transition boundary between temperate and arctic-alpine vegetation. The vegetation was classified into 12 plant communities belonging to four main vegetation types. These types are open grassland vegetation, *Racomitrium* vegetation, moist grassland vegetation, and moist dwarf shrub vegetation. Three significantly different altitudinal vegetation zones can be defined: a temperate zone (upper limit at 200 m a.s.l.); a low alpine zone (200-400 m a.s.l.); and an alpine zone (above 400 m a.s.l.). The temperate zone is characterized by moist dwarf-shrub heath vegetation with these two plant communities: *Empetrum nigrum-Calluna vulgaris* community and *Calluna vulgaris-Nardus stricta* community; the low alpine zone is characterized by moist grassland vegetation with these three plant communities: *Thymus praecox-Vaccinium myrtillus* community, *Nardus stricta-Potentilla erecta* community and *Galium saxatilis-Anthoxanthum odoratum* community; and the alpine zone is characterized by two types of vegetation: 1) *Racomitrium* vegetation with these three plant communities: *Racomitrium lanuginosum* community, *Racomitrium lanuginosum-Salix herbacea* community and *Racomitrium fasciculare-Alchemilla alpina* community; and 2) open grassland vegetation with these four plant communities: *Koenigia islandica* community, *Festuca vivipara-Agrostis capillaris* community, *Bistorta vivipara-Festuca vivipara* community and *Deschampsia flexuosa-Rhytidiadel-*

phus loreus community. I conclude from this study that the three vegetation zones are found at considerably lower altitudes than older studies demonstrated.

Introduction

In recent years, interest in studying the effects of global climate change on vegetation has increased (e.g. Woodward, 1987; Sykes *et al.*, 1996; Körner, 1998; Crawford, 2000). According to the IPCC (Intergovernmental Panel on Climate Change), the average global temperature will increase around 2-4°C in the 21st century (IPCC, 2001). A potential weakening of the North Atlantic Current, however, makes it uncertain whether the climate in the Faroe Islands will become warmer or colder (Hansen *et al.*, 2001).

The location of the Faroe Islands, directly in the path of the North Atlantic Current, makes it unique for studying the effects of global climate change, because these islands are the only land areas that are completely surrounded by the North Atlantic Current (Hansen *et al.* 2001; Christiansen and Mortensen, 2002).

Lower elevations in the islands belong to the temperate climate zone while the upper elevations belong to the arctic climate zone (Humlum and Christiansen, 1998; Christiansen and Mortensen, 2002). Therefore, it is possible to study the dynamics of temperate and arctic-alpine vegetation in the islands. These previous studies based on temperature and periglacial activity propose a low arctic zone from 200 m a.s.l. and an arctic zone from around 400 m a.s.l. (Humlum and Christiansen, 1998; Christiansen and Mortensen, 2002).

The predominant vegetation in the Faroe Islands is grassland; it occurs from sea level to mountaintop. Three vegetation zones have been previously defined in the Faroe Islands. The lowland vegetation zone (0-300 m a.s.l) has *Calluna vulgaris* heaths and *Nardus stricta* vegetation with *Hylocomium splendens* in the moss layer. At higher altitudes (300-500 m a.s.l.), *Nardus stricta* is still dominant, but the heath vegetation almost disappears. In the moss layer, both *Hylocomium splendens* and *Racomitrium* spp. dominate, with *Racomitrium lanuginosum* as the most frequent species. At the highest altitudes (500-882 m a.s.l.), *Racomitrium* spp. heaths are the characteristic vegetation, *Salix herbacea* is common and *Calluna* heaths are absent (Böcher, 1937)

The alpine zone has usually been defined as a zone that is delimited downwards by the mean isotherm of 10°C for the warmest month, also consistent with the tree line (Billings and Mooney, 1968; Troll, 1973; Körner, 1998; 1999; Mark *et al.*, 2001). This zone usually has a wide altitude range and a large diversity of plant communities composed of various dominant life-forms. On the basis of these differences, the alpine zone is usually subdivided into a lower alpine zone and an alpine zone (Ahti *et al.*, 1968).

This paper presents the first quantitative study of the vegetation in the Faroe Islands with systematic sampling along continuous altitudinal transects, from 100 m a.s.l. up to 856 m a.s.l. Five mountains in the northern part of the Faroe Islands are included (Fig. 1). The aim of this study is to describe the vegetation changes, based on plant communities, along these altitudinal transects in the Faroe Islands in order to define the boundary between temperate vegetation in the lowlands (temperate zone) and arctic-alpine vegetation in the highlands (low alpine and alpine zones), and, in addition, to further use these data as a basis for studying the effect of changes in climate and land use in the Faroe Islands. To place the vegetation in the Faroe Islands in a broader context, the plant communities are also discussed in relation to plant communities in other similar oceanic areas.

Material and methods

Study area

The treeless Faroe Islands is usually placed in the temperate vegetation zone in the lowlands and into the arctic vegetation zone in the highlands (Ostenfeld, 1905-1908; Böcher, 1937). The highly oceanic climate in the Faroe Islands, with an annual mean temperature of 7°C and an annual mean precipitation of 1,500 mm (lowlands), yields measurable precipitation on 75% of the days in a year (Cappelen and Laursen, 1998). The climate is greatly influenced by the North Atlantic Current and by proximity to the common track of atmospheric low-pressure systems in the North Atlantic region. Consequently, the climate can be humid, variable, and windy. Using the eco-climatic-phytogeographical system, Tuhkanen (1987) included the Faroe Islands in the highly oceanic sector of the hemiborial sub-zone.

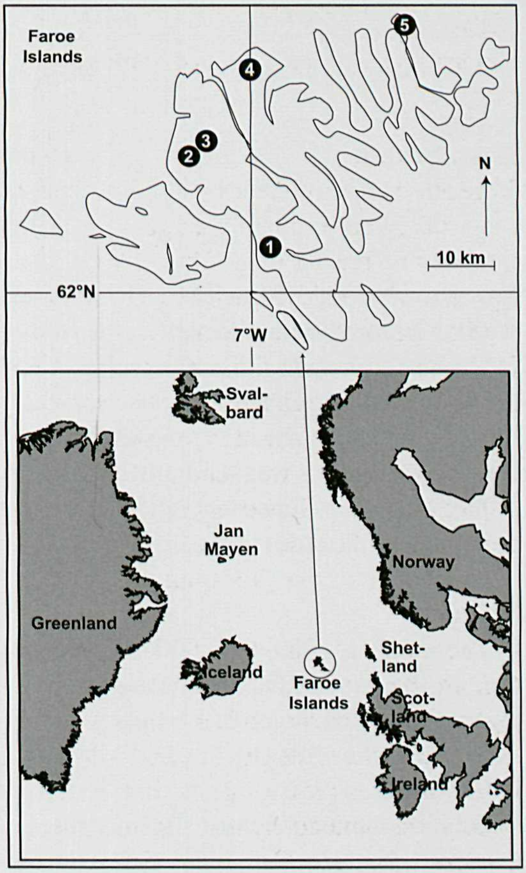

Fig. 1. Location of the Faroe Islands and location of the five studied mountains in the Faroe Islands: 1: Sornfelli; 2: Mosarøkur; 3: Ørvisfelli; 4: Gráfelli and 5: Villingardalsfjall.

Grazing has a profound impact on the vegetation in the area. Sheep are the most important herbivore, with an average number of around 44 sheep/km^2 (Thorsteinsson, 2001). The impact of geese and hares, however, cannot be ignored, and, in addition, there are larger herbivores like cows and horses.

The soil in the Faroe Islands is relatively nutrient poor (Olsen and Fosaa, 2002;

***Table 1**. Details of the five investigated transects.*

Name of locality	Latitude	Longitude	Length (km)	Altitude (m a.s.l.)	Aspect
1 Sornfelli	62°04´10´´ N	6°57´25´´W	3.7	749	N
2 Mosarøkur	62°11´05´´ N	7°10´52´´W	4.0	756	SW
3 Ørvisfelli	62°12´32´´N	7°09´17´´W	1.2	783	N
4 Gráfelli	62°18´41´´N	6°59´48´´W	2.9	856	SW
5 Villingardalsfjall	62°22´53´´N	6°33´13´´W	1.3	841	S

Lawesson *et al.*, 2003). The pH increases with altitude with a minimum value of 4.8 at low altitudes and a maximum value of 5.8 at high altitudes (Olsen and Fosaa, 2002). This is a result of a more humus-rich soil in the lowlands and a less acid mineral soil at higher altitudes. Vegetation cover also decreases with altitude (Fosaa, 2004).

Sampling

In July-August 1999 and 2000, the vegetation on five mountains in the Faroe Islands was investigated along five transects, from the highest elevation (856 m a.s.l.) down to an elevation of 150 m a.s.l. (Fig. 1). Two of the mountains have north-facing aspects, one has a south-facing aspect and two have southwest-facing aspects. Both the south-facing and southwest-facing aspects will be referred to as south-facing aspects in the text. Table 1 lists details about location, length of transect, altitude (m a.s.l.), and the aspects of the five transects. Here we can see that the length of the transects varies from a long transect (4.0 km) with a gentle slope to a short transect (1.2 km) with a steep slope along its whole length.

A total of 538 plots were sampled on the five mountains. The vegetation was sampled in 50 m altitudinal intervals from 100 m^2 quadrats (macro-plots). In each macro-plot, 8 smaller (0.25 m^2) quadrats (meso-plots) were placed randomly. The meso-plots were subdivided into 25 (0.01m^2) micro-plots and the presence/absence of each plant species was noted for each micro-plot. In this way, the abundance of species, ranging from 1 to 25, was determined for each meso-plot.

In each meso-plot, one soil core, 5 cm in diameter and 10 cm deep, was sampled after the top vegetation layer had been removed. The pH, measured with a Radiometer PHM 240, was determined after placing the soil sample in distilled water. The vegetation cover was estimated as percentage coverage for each meso-plot and the slope was measured in degrees.

The nomenclature of Jóhansen *et al.* (2000) was used for vascular plants; of Smith (1978) for bryophytes; and of Purveys *et al.* (1992) for lichens.

Data analysis

The vegetation data were analysed by the computer programme MVSP, using agglomerative hierarchical techniques (Kovach, 1986-1999). Minimum variance and squared Euclidean distance were adopted to calculate the variance between pairs. The analysis included 538 samples and 165 taxa of vascular plants, lichens and bryophytes.

Based on the results of the cluster analyses, the number of significantly different communities was determined. A cut level was found that gave the maximum number of communities that were statistically independent ($p<0.01$), using a t-test based on scores from axis 1 and axis 2 in the Detrended Correspondence Analysis (DCA) (Table 7). Syntaxonomic sorting of tables was performed to determine the vegetation types using the methods of Braun-Blanquet (1932); Mueller-Dombois and Ellenberg (1974); and Westhoff and van der Maarel (1978). The synoptic tables present taxa with their constancy class in each community, categorized in Roman numerals from I to V: V = 81-100%; IV = 61-80%; III = 41-60%; II = 21-40%; I = 1-20%. The abundances are given as a percentage for each species in the communities. Only taxa with a constancy class > II in at least one community are shown in the Tables. The abundance and the constancy class of species in the meso-plots were used to determine the communities. The indicator species used to name the plant communities were species with constancy class values between V and III and high abundances in the community.

Variation between vegetation and the environment was analysed using DCA. Following an ordination with all samples together, the main vegetation types were analysed separately in order to see more clearly the relationship between a specific part of the mountain and its communities.

The altitudinal zonation of the plant communities was determined by testing for a significant difference (t-test) in altitude between pairs of communities and then combining those that were not significantly different in altitude into zones.

We used the 25^{th} percentile and the 75^{th} percentile in a box plot to define lower and upper boundaries for the zones, respectively (Fig. 3). The boundary between the temperate and the low alpine zone was found to be at about 200 m a.s.l. The boundary between the low alpine and the alpine zone was found to be at about 400 m a.s.l.

Results

At the chosen cut level, the cluster analysis resulted in twelve communities (Fig. 2), ten of which were significantly different based on a t-test of the DCA scores. The remaining two communities, *Bistorta vivipara-Festuca vivipara* community and *Festuca vivipara-Agrostis capillaris* community, are similar to previously described communities (Böcher, 1937; Hansen, 1967; Hobbs and Averis, 1991) and are, therefore, kept as separate plant communities.

From these twelve communities, it was possible to define three significantly different altitudinal zones ($p< 0.01$) (Fig. 3): the temperate vegetation zone (up to 200 m a.s.l.); the low alpine vegetation zone (200-400 m a.s.l.); and the alpine vegetation zone (above 400 m a.s.l.). The three defined altitudinal zones were found to be consistent with the grouping of the twelve communities into four main vegetation types. Definitions of the four main vegetation types were based upon species of high constancy shared among communities. In this way, vegetation in the three altitudinal zones was grouped into the four main veg-

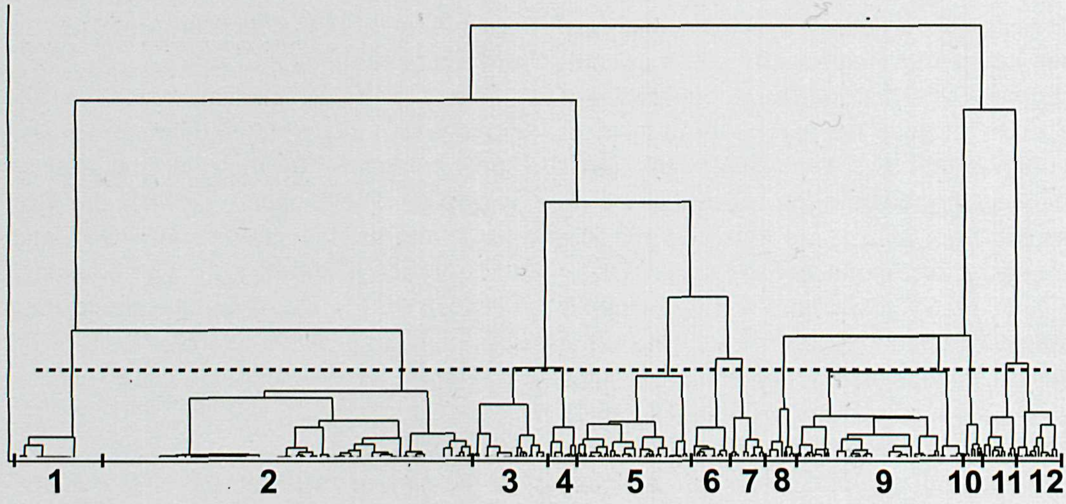

Fig 2. Classification dendrogram produced by minimum variance clustering, showing 12 clusters from 1-12. *1.* Koenigia islandica *community, 2.* Festuca vivipara-Agrostis capillaris *community, 3.* Racomitrium lanuginosum community, *4.* Thymus praecox-Vaccinium myrtillus *community, 5.* Nardus stricta-Potentilla erecta *community, 6.* Empetrum nigrum-Calluna vulgaris *community, 7.* Calluna vulgaris-Nardus stricta *community, 8.* Bistorta vivipara-Festuca vivipara *community, 9.* Racomitrium lanuginosum-Salix herbacea *community, 10.* Racomitrium fasciculare-Alcemilla alpina *community, 11.* Deschampsia flexuosa-Rhytidiadelphus loreus *community and 12.* Galium saxatilis-Anthoxanthum odoratum *community.*

***Table 2.** Altitudinal vegetation zones, main vegetation types and the twelve plant communities on the five mountains investigated in the Faroe Islands.*

Altitudinal vegetation zones	**Main vegetation types**	**Plant communities**
Alpine vegetation zone (above 400 m a.s.l.)	Open grassland vegetation	*Koenigia islandica* comm.
		Festuca vivipara-Agrostis capillaris comm.
		Bistorta vivipara-Festuca vivipara comm.
		Deschampsia flexuosa-Rhytidiadelphus loreus comm.
	Racomitrium vegetation	*Racomitrium lanuginosum* comm.
		Racomitrium lanuginosum-Salix herbacea comm.
		Racomitrium fasciculare-Alchemilla alpina comm.
Low alpine vegetation zone (200-400 m a.s.l.)	Moist grassland vegetation	*Thymus praecox-Vaccinium myrtillus* comm.
		Nardus stricta-Potentilla erecta comm.
		Galium saxatilis-Anthoxanthum odoratum comm.
Temperate vegetation zones (below 200 m a.s.l.)	Moist dwarf shrub vegetation	*Empetrum nigrum-Calluna vulgaris* comm.
		Calluna vulgaris-Nardus stricta comm.

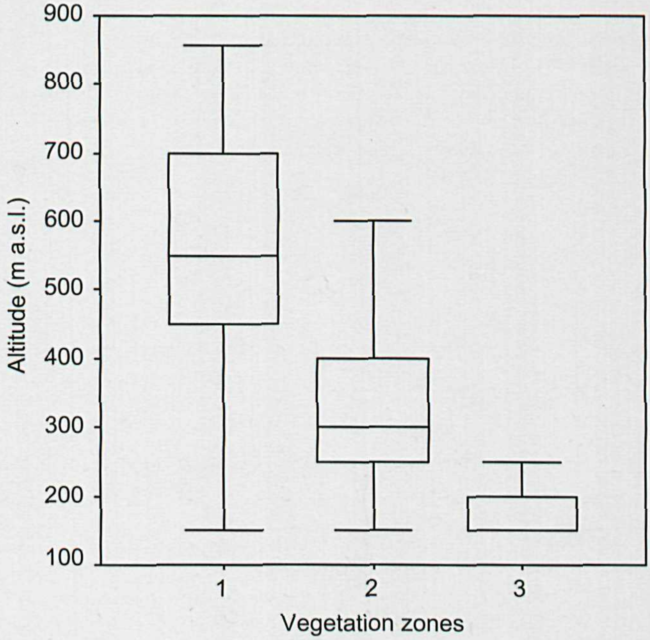

Fig. 3. *Box plot showing the distribution of the three altitudinal vegetation zones on the five mountains investigated:*
1. Alpine vegetation zone,
2. Low alpine vegetation zone,
3. Temperate vegetation zone.

etation types (Table 2): 1) open grassland vegetation; 2) *Racomitrium* vegetation; 3) moist grassland vegetation; and 4) moist dwarf shrub vegetation (Table 2, 3-6). The seven communities in the alpine vegetation zone were grouped into two main vegetation types: the three communities with the highest constancy level (V) of *Racomitrium lanuginosum* were grouped together into *Racomitrium* vegetation, while the other four communities with lesser amounts of *Racomitrium lanuginosum* were grouped into open grassland vegetation. The three communities from the low alpine vegetation zone differ from the two communities in the temperate zone due to: 1) the disapperance of *Calluna vulgaris*; and 2) generally fewer dwarf shrub species. The low alpine vegetation zone differs from the alpine vegetation zone based on the presence of *Nardus stricta* and more lowland species.

Open grassland vegetation (Table 3) contains almost half of the sample plots (275), classified into four communities. This vegetation occurred on more or less unstable soil with low to relatively high vegetation cover (10% to 89%), and with the highest pH values (5.3 to 5.8) of the four main vegetation types. Within this group, the graminoides, such as *Festuca vivipara* and *Agrostis capillaris*, were characteristic species with relatively high constancy, while dwarf shrub and *Racomitrium* species had relatively low abundance – except in the *Bistorta vivipara-Festuca vivipara* community. The lowest vegetation cover (10%) and the highest pH (5.8) were found in the *Koenigia islandica* community. This community also had relatively fewer species (41). In contrast, the *Deschampsia flexu-*

Table 3. *Details of the four communities belonging to open grassland vegetation. For each species in the communities, abundance and constancy are given: 1)* Koenigia islandica *community, 2)* Festuca vivipara-Agrostis capillaris *community, 8)* Bistorta vivipara-Festuca vivipara *community and 11)* Deschampsia flexuosa-Rhytidiadelphus loreus *community. Species in bold type are indicator species for the communities. Roman numerals from I-V indicate the constancy of species in the community. See text for further details.*

Communities	1	2	8	11
number of plots	34	208	16	17
aspect	N,S	N,S	N	N
vegetation cover (%)	10	35	83	89
pH	5.8	5.6	5.5	5.3
slope (degrees)	14	26	30	30
vegetation height (cm)	2	5	7	11
number of taxa	41	132	54	60
taxa/plot	5	9	13	16
Character species:				
Koenigia islandica	**49/V**	2/II	1/II	
Agrostis capillaris	3/II	**7/III**	2/IV	11/V
Festuca vivipara	4/II	**7/III**	**14/V**	3/III
Bistorta vivipara	1/II	7/II	**14/V**	3/IV
Deschampsia flexuosa	1/I	2/I	1/II	**19/V**
Rhytidiadelphus loreus	x/I	1/I	1/III	**12/V**
Carex bigelowii		1/I	1/II	8/V
Polytrichum spp.	1/I	3/II	5/III	11/V
Rhytidiadelphus squarrosus	x/I	1/I	2/II	4/V
Festuca rubra	2/II	6/III	3/IV	6/V
Agrostis canina	2/II	4/II	5/IV	4/IV
Racomitrium lanuginosum	4/II	5/II	12/IV	2/III
Salix herbacea	2/I	2/II	3/III	4/IV
Thalictrum alpinum		3/II	11/IV	1/II
Silene acaulis		1/I	5/IV	2/III
Luzula spicata	1/I	1/I	1/IV	x/II
Galium saxatile		1/I	2/II	3/III
Liverworth spp	6/I	3/II	2/III	1/III
Rumex acetosa	x/I	x/I		4/III
Ranunculus acris var. pumilus		x/I	1/III	x/II
Saxifraga stellaris	2/II	1/I	1/III	x/II
Hylocomium splendens		x/I		1/III

Additional species with constancy less than III: *Agrostis stolonifera, Alchemilla faroensis, Alchemilla alpina, Alchemilla filicaulis, Anthoxanthum odoratum, Armeria maritima, Aulacomnium turgidum, Bartramia ithyphylla, Blechnum spicant, Blindia acuta, Botrychium lunaria, Breutelia chrysocoma, Bryum sp., Calluna vulgaris, Campylopus atrovirens, Campylopus schwarzii, Campylopus sp., Cardaminopsis petraea, Carex binervis, Carex demissa, Carex echinata, Carex nigra, Carex panicea, Carex pilulifera, Carex pulicaris, Carex saxatilis, Cerastium alpinum, Cerastium arvense, Cerastium fontanum, Cetraria islandica, Cladonia cervicornis, Cladonia furcata, Cladonia portentosa, Cladonia uncialis, Cochlearia officinalis, Dactylorhiza maculata, Deschampsia alpina, Deschampsia cespitosa, Dicranella heteromalla, Dicranella sp., Dicranum scoparium, Diphasiastrum alpinum, Drepanocladus uncinatus, Epilobium alsinifolium, Epilobium anagallidifolium, Epilobium lactiflorum, Eriophorum angustifolium, Eriophorum vaginatum, Euphrasia arctica, Euphrasia frigida, Euphrasia micrantha, Euphrasia officinalis ,Euphrasia scottica, Hieracium officinalis, Huperzia selago, Hypericum pulchrum, Hypnum cupressiforme, Isopterygium elegans, Isopterygium pulchellum, Isothecium myosuroides, Juncus articulatus, Juncus biglumis, Juncus bufonius, Juncus bufonius, Juncus bulbosus, Juncus squarrosus, Linum catharticum, Listera cordata, Lotus corniculatus, Luzula arcuata, Luzula multiflora, Luzula sylvatica, Mnium hornum, Mnium stellare, Nardus stricta, Narthecium ossifragum, Omalotheca supina, Oxyria digyna, Peltigera cania, Pinguicula vulgaris, Plagiothecium undulatum, Plantago lanceolata, Plantago maritima, Pleurozium schreberi, Poa alpina, Poa glauca, Pogonatum urnigerum, Pohlia nutans, Polygala serpyllifolia, Polytrichum alpinum, Potentilla erecta, Prunella vulgaris, Racomitrium aciculare, Racomitrium canescens, Racomitrium fasciculare Racomitrium microcarpon, Ranunculus acris, Ranunculus glacialis, Ranunculus repens, Rhizomnium punctatum, Rhodiola rosea, Rhytidiadelphus triquetrus, Sagina procumbens, Sagina subulata, Saxifraga hypnoides, Saxifraga rosacea, Sedum villosum, Selaginella selaginoides, Sibbaldia procumbens, Solorina crocea, Sphagnum spp., Taraxacum officinalis coll.-, Thalictrum alpinum, Thuidium tamariscinum, Thymus praecox, Trichophorum cespitosum, Vaccinium myrtillus, Veronica officinalis, Viola canina, Viola palustris, Viola riviniana.*

Table 4. *Details of the three plant communities belonging to* Racomitrium *vegetation. For each species in the communities, abundance and constancy are given: 3)* Racomitrium lanuginosum *community, 9)* Racomitrium lanuginosum-Salix herbacea *community, 10)* Racomitrium fasciculare-Alchemilla alpina *community. Species in bold type are indicator species for the communities. Roman numerals from I-V indicate the constancy of species in the community. See text for further details.*

Communities	3	9	10
number of plots	36	84	9
aspect	N,S	N,S	S
vegetation cover	85	67	94
pH	5.3	5.5	5.4
slope (degrees)	11	17	14
vegetation height (cm)	8	4	6
number of taxa	83	88	40
taxa/plot	11	12	18
Character species:			
Racomitrium lanuginosum	**25/V**	**10/V**	2/V
Salix herbacea	4/III	**19/V**	3/IV
Bistorta vivipara	1/II	8/V	9/IV
Racomitrium fasciculare	x/I	7/III	**10/V**
Alchemilla alpina	x/I	1/I	**7/V**
Agrostis capillaris	3/II	6/IV	11/V
Festuca vivipara	5/III	5/IV	2/IV
Polytrichum spp.	4/III	4/III	4/V
Nardus stricta	5/III	x/I	4/III
Potentilla erecta	3/III	x/I	x/I
Agrostis canina	2/II	5/III	1/II
Festuca rubra	x/II	3/III	x/III
Carex panicea	6/III	x/I	
Deschampsia flexuosa	3/II	4/III	3/IV
Carex bigelowii	5/III	2/II	x/III
Thymus praecox	1/II	2/II	12/V
Galium saxatilis	1/II	2/II	2/IV
Anthoxanthum odoratum	1/II	1/II	1/III
Viola riviniana	1/I	1/I	1/III
Rhytidiadelphus squarrosus	1/II	1/II	4/V
Agrostis canina	2/II	2/V	1/III
Hylocomium splendens	1/I	1/I	1/III
Thalictrum alpinum	3/II	2/II	1/III
Viola palustris	1/I	3/IV	3/III
Liverworth spp.	2/I	2/II	2/III
Sibbaldia procumbens	x/I	1/II	6/IV
Selaginella selaginoides	1/I	1/IV	1/III
Dicranum scoparium		x/I	1/III
Euphrasia officinalis	1/I	1/IV	1/III
Hypnum cupressiforme	1/I	1/III	1/II
Luzula multiflora	x/I	x/I	1/III

Continued on next page

Table 4 continued

Additional species with constancy less than III: *Agrostis stolonifera, Alchemilla faroensis, Alchemilla filicaulis, Armeria maritima, Aulacomnium turgidum, Breutelia chrysocoma, Bryum sp., Calluna vulgaris, Campylopus schwarzi, Cardaminopsis petraea, Carex binervis, Carex demissa, Carex echinata, Carex nigra, Carex pulicaris, Carex saxatilis, Cerastium alpinum, Cerastium fontanum, Cerastium nigrescens, Cetraria islandica, Cladonia arbuscula, Cladonia cervicornis, Cladonia portentosa, Cladonia uncialis, Conostomum tetragonum, Dicranella sp., Dactylorhiza maculata, Deschampsia alpina, Deschampsia cespitosa, Dicranum bonjeanii, Dicranum sp., Drepanocladus uncinatus, Equisetum palustris, Eriophorum vaginatum, Euphrasia arctia, Euphrasia frigida, Euphrasia micrantha, , Euphrasia scottica, Huperzia selago, Hylocomium splendens, Hypericum pulchrum, Isopterygium pulchellum, Isothecium myosuroides, Juncus biglumis, Juncus bufonius, Juncus squarrosus, Juncus trifidus, Juncus triglumis, Koenigia islandica, Luzula arcuata, Luzula spicata, Carex pilulifera, Luzula sylvatica, Mnium hornum, Narthecium ossifragum, Peltigera canina, Plagiothecium undulatum, Plantago maritima, Pleurozium schreberi, Poa alpina, Poa glauca, Pogonatum urnigerum, Pohlia nutans, Polygala serpyllifolia, Polygala vulgaris, Prunella vulgaris, Pyrola minor, Racomitrium affine, Racomitrium canescens, Racomitrium microcarpon, Ranunculus acris ssp. pumilus, Ranunculus acris, Ranunculus repens, Rhinanthus minor, Rhodiola rosea, Rhytidiadelphus loreus, Rhytidiadelphus triquetrus, Rumex acetosa, Saxifraga hypnoides, Saxifraga rosacea, Saxifraga stellaris, Sedum villosum. Silene acaulis, Sphagnum spp., Taraxacum officinalis coll.-, Thuidium tamariscinum, Thymus praecox, Trichophorum cespitosum, Vaccinium myrtillus, Veronica officinalis, Viola riviniana*

osa-Rhytidiadelphus loreus community had the lowest pH in this vegetation group (5.3), the highest vegetation cover (89%), and a medium number of taxa (60). The last community in this vegetation type, the *Festuca vivipara-Agrostis capillaris* community, had a relatively high pH (5.6), low vegetation cover (35%), and was rich in species (132). The *Bistorta vivipara-Festuca vivipara* and *Deschampsia flexuosa-Rhytidiadelphus loreus* communities were found only on north-facing slopes.

Racomitrium vegetation (Table 4), found in about one quarter of all the sample plots (129), was classified into three communities. It differs from open grassland-vegetation due to a high abundance of *Racomitrium lanuginosum* and *Salix herbacea*. The vegetation cover parameter ranged from 67% to 94% and the pH varied from 5.3 to 5.5. The three communities are relatively rich in taxa, 83 taxa for the *Racomitrium lanuginosum* community, 88 taxa for the *Racomitrium lanuginosum-Salix herbacea* community, and 40 taxa for the *Racomitrium fasciculare-Alchemilla alpina* community. This last communitiy was found only on south-facing slopes.

The moist grassland vegetation (Table 5) was classified into three communities. The vegetation cover was high (87% to 98%) and the pH varied from 5.1 to 5.3. The number of sample plots was 95. Characteristic for this vegetation type is the dominance of *Nardus stricta* and the richness of bryophyte species, such as *Hylocomium splendens*, *Rhytidiadelphus loreus* and *R. squarrosus*. Bryophyte richness was especially characteristic of the *Galium saxatilis-Anthoxanthum odoratum* community, and, to a lesser degree, of the *Nardus stricta-Potentilla erecta* community. The moist grass heath vegetation is poor in dwarf shrub species although *Vaccinium myrtillus* is still frequent, and, to a lesser degree, *Empetrum nigrum* in the *Thymus praecox-Vaccinium myrtillus* community; however, *Calluna vulgaris* almost disappears.

In contrast to the moist grassland vegetation, the dwarf shrub heath vegetation (Table 6) has a dominance of species such as *Calluna vulgaris* and *Empetrum nigrum*. Two communities were defined: *Empetrum nigrum-Calluna vulgaris* community and *Calluna vulgaris-Nardus stricta* community. This vegetation type included 37 sample plots. The vegetation cover was high (94% to 98%) while the lowest pH values (5.2

Table 5. *Details from the three plant communities belonging to moist grassland vegetation. For each species in the communities, abundance and constancy are given: 4)* Thymus praecox-Vaccinium myrtillus *community, 5)* Nardus stricta-Potentilla erecta *community, 12)* Galium saxatilis-Anthoxanthum odoratum *community. Species in bold type are indicator species for the communities. Roman numerals from I-V indicate the constancy of species in the community. See text for further details.*

Communities	4	5	12
number of plots	16	57	22
aspect	S	N,S	N,S
vegetation cover	87	88	98
pH	5.3	5.1	5.3
slope (degrees)	32	13	29
vegetation height (cm)	6	13	8
number of taxa	54	86	58
taxa/plot	15	13	15
Character species:			
Thymus praecox	**13/V**	x/I	2/III
Vaccinium myrtillus	**6/V**	1/II	1/II
Nardus stricta	2/III	**8/V**	1/II
Potentilla erecta	2/III	**7/IV**	1/II
Galium saxatile	3/III	3/III	**7/V**
Anthoxanthum odoratum	2/IV	3/III	**6/V**
Agrostis capillaris	7/V	7/IV	15/V
Festuca vivipara	5/V	2/III	4/V
Viola riviniana	5/V	1/I	2/IV
Rhytidiadelphus loreus	1/III	5/III	11/V
Racomitrium lanuginosum	18/IV	2/II	x/I
Alchemilla alpina	3/III	1/I	x/I
Empetrum nigrum	9/IV	1/I	
Polytrichum spp.	3/III	3/III	5/V
Rhytidiadelphus squarrosus	1/II	3/III	6/V
Hylocomium splendens	1/I	4/III	6/V
Festuca rubra	1/III	1/II	3/IV
Viola palustris		2/II	5/V
Narthecium ossifragum		4/III	
Deschampsia flexuosa	1/II	x/I	1/III
Agrostis canina	2/III	3/III	2/III
Rumex acetosa		x/I	3/III
Euphrasia officinalis		1/I	2/III
Carex echinata		5/III	x/I
Dactylorhiza maculata	x/I	1/II	x/III
Cerastium fontanum		x/I	1/III
Carex demissa	1/III	x/I	x/I

Additional species with constancy less than III: *Agrostis stolonifera, Alchemilla filicaulis, Bistorta vivipara, Breutelia chrysocoma, Calluna vulgaris, Campylopus atrovirens, Campylopus schwarzii, Cardaminopsis petraea, Carex bigelowii, Carex nigra, Carex panicea, Carex pilulifera, Carex pulicaris, Cetraria islandica, Cladonia arbuscula, Cladonia furcata, Cladonia portentosa, Cladonia uncialis, Dicranella sp., Dicranum scoparium, Diphasiastrum alpinum, Drepanocladus uncinatus, Equisetum palustre, Eriophorum angustifolium, Eriophorum vaginatum, Euphrasia arctica, Euphrasia frigida, Euphrasia micrantha, Euphrasia scottica, Festuca vivipara, Huperzia selago, Hylocomium umbratum, Hypericum pulchrum, Hypnum cupressiforme, Isopterygium pulchellum, Isothecium myosuroides, Juncus bufonius, Juncus bulbosus, Juncus squarrosus, Juncus triglumis, Koenigia islandica, Liverworth spp., Lotus corniculatus, Luzula multiflora, Luzula spicata, Luzula sylvatica, Pinguicula vulgaris, Plagiothecium undulatum, Pleurozium schreberi, Poa pratensis, Polygala serpyllifolia, Prunella vulgaris, Pyrola minor, Racomitrium fasciculare, Racomitrium lanuginosum, Racomitrium microcarpon, Ranunculus acris, Ranunculus flammula, Rhizomnium pseudopunctatum, Rhytidiadelphus triquetrus, Salix herbacea, Saxifraga stellaris, Selaginella selaginoides, Sibbaldia procumbens, Silene acaulis, Sphagnum spp., Taraxacum officinalis, Thalictrum alpinum, Thuidium tamariscinum, Trichophorum cespitosum, Veronica officinalis, Viola canina.*

Table 6. *Details of the two communities in dwarf-shrub vegetation. For each species in the communities, abundance and constancy are given: 6)* Empetrum nigrum-Calluna vulgaris *community, 7)* Calluna vulgaris-Nardus stricta *community. Species in bold type are indicator species for the communities. Roman numerals from I-V indicate the constancy of species in the community. See text for further details.*

Communities	6	7
number of plots	19	18
aspect	S	S
vegetation cover	94	98
pH	5.2	4.9
slope (degrees)	23	9
vegetation height (cm)	15	12
number of taxa	58	45
taxa/plot	19	14
Character species:		
Empetrum nigrum	**11/V**	7/III
Calluna vulgaris	**9/V**	**13/V**
Nardus stricta	4/V	**12/V**
Narthecium ossifragum	x/I	10/V
Viola riviniana	4/V	
Thymus praecox	5/IV	
Potentilla erecta	10/V	11/V
Agrostis capillaris	6/V	3/IV
Vaccinium myrtillus	4/IV	4/IV
Festuca vivipara	5/V	1/II
Racomitrium lanuginosum	x/I	10/V
Polytrichum spp.	6/V	1/II
Rhytidiadelphus squarrosus	2/IV	1/II
Hylocomium splendens	6/IV	1/II
Juncus squarrosus	x/I	8/IV
Carex panicea	1/III	3/IV
Dactylorhiza maculata	1/II	1/IV
Carex pilulifera	1/III	2/III
Drepanocladus uncinatus	x/I	2/III
Cladonia uncialis	x/I	2/III
Hypericum pulchrum	2/III	
Thuidium tamariscinum	2/III	
Rhytidiadelphus loreus	1/II	2/III
Anthoxanthum odoratum	1/III	x/II
Agrostis canina	1/III	1/II
Polygala serpyllifolia	1/III	x/I
Viola palustris	1/III	
Alchemilla alpina	1/III	

Additional species with constancy less than III: *Blechnum spicant, Breutelia chrysocoma, Carex bigelowii, Carex demissa, Carex echinata, Carex nigra, Carex pulicaris, Cerastium fontanum, Cetraria islandica, Cladonia arbuscula, Cladonia cervicornis, Cladonia furcata, Cladonia portentosa, Deschampsia cespitosa, Dicranum scoparium, Eriophorum vaginatum, Euphrasia arctica, Euphrasia micrantha, Euphrasia officinalis, Euphrasia scottica, Festuca rubra, Galium saxatilis, Hypnum cupressiforme, Isopterygium elegans, Juncus bulbosus, Listera cordata, Liverworth spp., Lotus corniculatus, Luzula multiflora, Plagiothecium undulatum, Plantago lanceolata, Plantago maritima, Pleurozium schreberi, Prunella vulgaris, Ranunculus acris, Rhinanthus minor, Rhytidiadelphus triquetrus, Selaginella selaginoides, Sphagnum spp., Trichophorum cespitosus, Veronica officinalis, Viola canina.*

to 4.9) were found in this vegetation type. These two communities were not found on the north-facing slopes.

DCA ordination of the 538 meso-plots showed relatively high eigenvalues on axis 1 and axis 2 of 59% and 33%, respectively (Table 7). The twelve clusters are relatively well separated along axis 1, which seems to correspond to an altitudinal sequence with the *Koenigia islandica* community at one end and the two dwarf shrub communities at the other end of the diagram. Here is shown only the DCA diagram of the four main vegetation types separately, as the communities were distributed the same way along the two first ordination axes (Figs. 4-7).

Results from the DCA analysis of the open grassland vegetation (Fig. 4) shows that the *Koenigia islandica* community, the *Bistorta vivipara-Festuca vivipara* community, and the *Deschampsia flexuosa-Rhytidiadelphus loreus* community are separated along axis 1, which could be explained as an altitudinal sequence. The *Deschampsia flexuosa-Rhytidiadelphus loreus* community is also separated from the others along axis 2, reflecting the influence of other environmental variables on the distribution. The *Festuca vivipara-Agrostis capillaris* community is spread all over the diagram. This community is very diverse with numerous species and is distributed over an extended altitudinal range.

Results from the DCA (Fig. 5) of *Racomitrium* vegetation show that the *Racomitrium lanuginosum* community and the *Racomitrium lanuginosum-Salix herbacea* community are distributed along axis 1, while the *Racomitrium fasciculare-Al-*

Table 7. *Eigenvalues and cumulative percentages of variance for the DCA analysis of the four main vegetation types.*

Overall vegetation	Axis 1	Axis 2	Axis 3	Axis 4
Eigenvalue	0.594	0.326	0.275	0.248
Cum. Percentage	4.364	6.756	8.777	10.600
Open grassland	Axis 1	Axis 2	Axis 3	Axis 4
Eigenvalues	0.597	0.400	0.307	0.286
Cum. Percentage	4.642	7.752	10.137	12.360
Racomitrium heath	Axis 1	Axis 2	Axis 3	Axis 4
Eigenvalues	0.563	0.300	0.236	0.184
Cum. Percentage	8.785	13.458	17.137	20.007
Moist heath	Axis 1	Axis 2	Axis 3	Axis 4
Eigenvalues	0.551	0.257	0.200	0.174
Cum. Percentage	8.963	13.144	16.404	19.235
Moist dwarf shrub heath	Axis 1	Axis 2	Axis 3	Axis 4
Eigenvalue	0.453	0.137	0.104	0.069
Cum. percentage	18.921	24.654	28.977	31.854

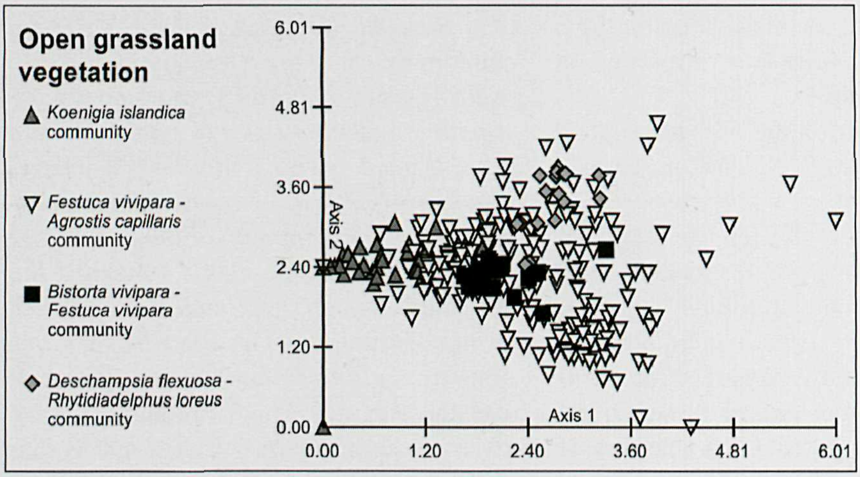

Fig. 4. *DCA ordination of the 275 meso-plots of the Faroe Islands' open grassland vegetation. The four communities result from a minimum variance clustering analysis.*

chemilla alpina community is distributed along axis 2. The distribution along axis 2 could represent a gradient of aspect.

Results from the DCA (Fig. 6) of the moist grass vegetation, including the *Thymus praecox-Vaccinium myrtillus* community, the *Nardus stricta-Potentilla erecta* community, and the *Galium saxatilis-Anthoxanthum odoratum* community are also separated from other communities along axis 1, which could represent a gradient of aspect, since communities 5 and 12 are found on both south- and north-facing transects, while community 4 is only found on the south-facing transects (Table 5).

Results from the DCA of moist dwarf-shrub heath vegetation (Fig. 7) show the *Empetrum nigrum-Calluna vulgaris* community and the *Calluna vulgaris-Nardus stricta* community distributed along axis 1. This distribution could be explained as a moisture gradient, with the *Calluna*

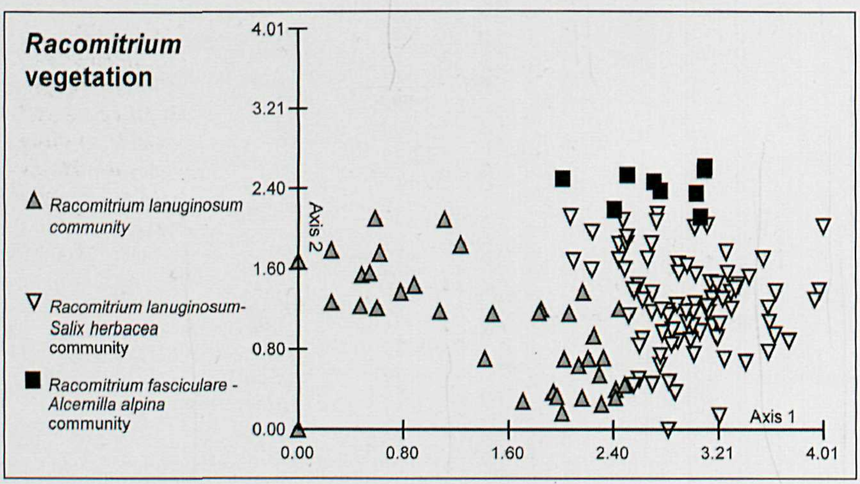

Fig 5. *DCA ordination of the 129 meso-plots of the Faroe Islands' Racomitrium vegetation. The three communities result from a minimum variance clustering analysis.*

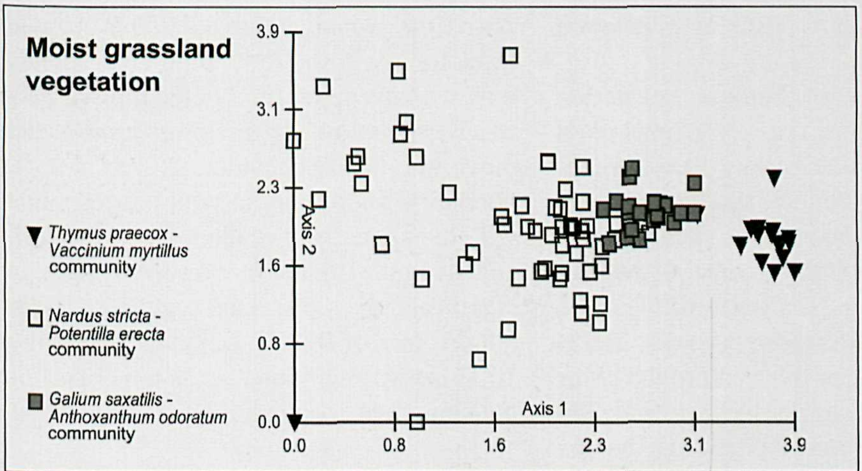

Fig. 6. DCA ordination of the 105 meso-plots of the Faroe Islands' moist grassland vegetation. The three communities result from a minimum variance clustering analysis.

vulgaris-Nardus stricta community at the wetter end of the gradient. This community contains a rich representation of species, which are common on wet areas, such as *Juncus squarrosus*, *Carex panicea* and *Narthecium ossifragum*.

Discussion

Patterns of spatial variation in community structure or zonation are common to all environments, aquatic and terrestrial (Smith and Smith, 1998). The vegetation zonation from lowland to highland is a good example of this kind of variation. This vegetation zonation pattern is controlled by major environmental variables. These environmental variables include topography, slope, aspect, moisture and temperature, among others. As my results demonstrate, these variations are marked by distinct plant communities that are distinguished by differing dominant plant species, differing diversity, and

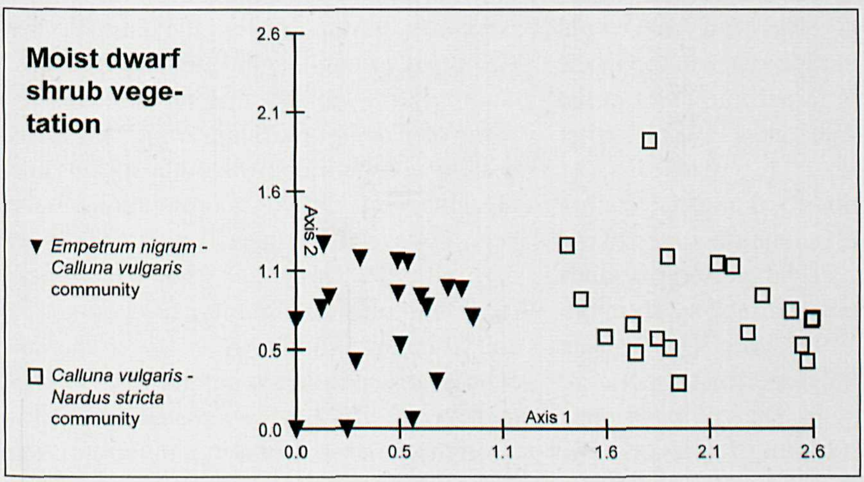

Fig. 7. DCA ordination of the 37 meso-plots of the Faroe Islands' moist dwarf shrub vegetation. The two communities result from a minimum variance clustering analysis.

by structural features such as vegetation height and density.

The uniformity of Faroese vegetation makes it difficult to classify it into plant communities and also makes the differences between communities small. The main reason for this is the extreme oceanic environment (0 on the Conrad scale: Crawford, 2000). This results in a uniformity of the composition of life-forms (Fosaa, 2003) due to the absence of trees and to the ubiquitous presence of species like *Racomitrium lanuginosum*, *Festuca vivpara* and *Agrostis capillaris*. The extreme oceanic environment and centuries of heavy grazing have modified the vegetation, giving it the tundra like appearance that it has today.

Despite a lack of trees, the islands are situated south of the limit of tree growth, since the mean temperature for the warmest month in the Faroe Islands is over 11°C, one degree higher than the mean July isotherm (10°C), which is usually used to define the limit for tree growth as well as the lower limit of the alpine zone in temperate areas (Billings and Mooney, 1968; Troll, 1973; Körner, 1998). Therefore, one would expect to find vegetation types in the Faroe Islands comparable to oceanic areas in the temperate zone (Tuhkanen, 1987), rather than the arctic zone.

The altitudinal distribution of vegetation into the three main vegetation zones found in this study (Fig. 3), largely corresponds with the climate zones defined by Humlum and Christiansen (1998) and Christiansen and Mortensen (2002) based on temperature and periglacial activity. They propose a low arctic zone from 200 m a.s.l. and an arctic zone from around 400 m a.s.l. This altitude level for the low arctic zone corresponds well with the upper limit of the moist dwarf shrub vegetation and the lower limit of the moist grassland vegetation. A 400 m a.s.l. boundary for the arctic zone corresponds with the upper limit of the moist grassland, and the lower limit of the *Racomitrium* vegetation and open grassland vegetation. With a lapse rate of 0.8°C (Köppen, 1920), the 10°C isotherm is found in the upper part of the temperate zone in the Faroe Islands.

Alpine vegetation zone

Characteristic species for the alpine zone are species with their main distribution in the arctic area and in the mountain areas of the temperate zone. Examples are *Bistorta vivipara, Carex bigelowii, Salix herbacea, Sibbaldia procumbens*, and *Thalictrum alpinum* (Hultén and Fries, 1986). In this zone, two main vegetation types were found – open grassland vegetation and *Racomitrium* vegetation.

In the open grassland vegetation, there are four plant communities. The *Koenigia islandica* community is characteristic for two types of habitats, fellfields and screes. This reflects the fact that the annual life-form of *Koenigia islandica* favours areas with no competition from other species and unstable soil. Similar communities have been described for the Faroe Islands from high altitudes (*Koenigia islandica-Ranunculus glacialis* community: Böcher, 1937) and from low altitudes (*Koenigia islandica-Ranunculus ellipticum* community: Hobbs and Averis, 1991). *Koenigia islandica* has a circumpolar distribution, although the distribution is rather disjunct. It is also described from the southern hemisphere in Tierra del Fuego (Hultén and Fries, 1986).

The *Festuca vivipara-Agrostis capillaris* community is common on steep slopes with many species and low vegetation cover. Hansen (1967) and Hobbs and Averis (1991) have described similar communities (see Fosaa, 2001 for an overview). This community is similar to the *Festuca ovina-Agrostis capillaris-Alchemilla alpina* community (Rodwell, 1992-1995) in Scotland.

The *Bistorta vivipara-Festuca vivipara* community has species of high constancy like *Thalictrum alpinum, Silene acaulis* and *Racomitriun lanuginosum*. This community is similar to the British *Festuca ovina-Alchemilla alpina-Silene acaulis* community, which is found in the high alpine region of Scotland, seldom below 700 m a.s.l. (Rodwell, 1991-1995), and in Iceland in low alpine areas (Påhlsson, 1998). In the Faroe Islands, a *Bistorta vivipara-Racomitrium lanuginosum* community has been described in the alpine vegetation zone (Böcher, 1937).

The *Deschampsia flexuosa-Rhytidiadelphus loreus* community has constant species such as *Carex bigelowii*, *Agrostis capillaris* and *Festuca rubra*. This community is similar to the British *Carex bigelowii-Polytrichum alpinum* sedge heath (Rodwell, 1991-1995), although the British community is not as rich in species such as *Deschampsia flexuosa* and *Rhytidiadelphus loreus*. This vegetation is found in high mountain areas with a long duration of snow cover in Scotland, often on transects with north- or east-facing aspects. The *Deschampsia flexuosa-Anthoxanthum odoratum-Alchemilla alpina* community is distributed in the low and middle alpine area across the whole of Iceland, while it is restricted to the middle boreal area of Fennoscandia (Påhlsson, 1998). The Faroese version of this community does not have any *Anthoxanthum odoratum*, but is rich in *Carex bigelowii* and *Polytrichum* spp. This community has not been discussed in older literature from the Faroe Islands.

Racomitrium vegetation is widespread at all altitudes in the Faroe Islands. True *Racomitrium* vegetation without too many other species of high dominance, however, is restricted to high altitudes and mountain summits. An example is the *Racomitrium lanuginosum* community. In oceanic North Atlantic areas like Iceland (Gunlaugsdottir, 1985), Scotland (McVean and Ratcliffe, 1962), and the Faroe Islands (Ostenfeld, 1905-1908; Böcher, 1940), *Racomitrium* dominated communities often transition gradually into grassy moors, grassy heath land and dwarf shrub communities. This kind of community is equivalent to the moist heath and grassland vegetation classified in this study. *Racomitrium* heath, which is similar to the high mountain vegetation in the oceanic North Atlantic, is found on arctic islands like Jan Mayen and Bear Island, but the lowland transition type of grassy moor, grassy heath land, and dwarf shrub heath are not found on these arctic islands (Virtanen *et al*., 1997). The *Racomitrium lanuginosum* community is similar to the British *Carex bigelowii-Racomitrium lanuginosum* community, found in high alpine snow bed areas in Scotland (Rodwell, 1991-1995).

The *Racomitrium fasciculare-Alchemilla alpina* community is not mentioned as a community previously in the Faroe Islands, but, nevertheless, the species *Racomitrium fasciculare* is numerous in the vegetation found on boulder fields in the Faroe Islands (Hobbs and Averis, 1991). It is also numerous in two vegetation types in mountainous areas in Norway: *Salix herbacea* snow bed vegetation, and moss snow bed vegetation (Fremstad, 1997).

The *Racomitrium lanuginosum-Salix herbacea* community is mainly restricted to the arctic alpine region of Europe and N. America (Wielgolaski, 1997). The *Salix herbacea* community is distributed in the arctic area (Daniels, 1994) and also in Fennoscandia and Iceland; *Salix herbacea* is found in snow bed communities in high alpine zones (Wielgolaski, 1997).

Low alpine vegetation zone

A characteristic of this zone is that the lower limit is set where *Calluna vulgaris* disappears, but where *Vaccinium myrtillus* and *Empetrum nigrum* are still dominant in one of the three communities. The upper limit of this zone is found where *Vaccinium myrtillus* disappears. The same species is also used to define the upper limit of the low alpine zone in Fennoscandia (Dahl, 1997). This zone, as well as the temperate zone, is heavily grazed.

The three communities in moist grass vegetation: the *Thymus praecox-Vaccinium myrtillus* community, the *Nardus stricta-Potentilla erecta* community and the *Galium saxatilis-Anthoxanthum odoratum* community are all rich in moss species. These communities are similar to the *Festuca vivipara-Agrostis capillaris-Thymus praecox* community (Hansen, 1967; Hobbs and Averis, 1991), the *Nardus stricta* community, and the *Anthoxanthum odoratum-Agrostis capillaris* community (Ostenfeld, 1905-1908) described from the Faroe Islands.

Temperate vegetation zone

The characteristic species in this zone, such as *Calluna vulgaris, Polygala serpyllifolia, Hypericum pulcrum,* and *Juncus squarrosus*, are found in the cooler regions of the northern hemisphere.

Dwarf shrub vegetation (*Empetrum nigrum-Calluna vulgaris* community and *Calluna vulgaris-Nardus stricta* community) is restricted to south-facing transects. On the north-facing slopes, moist grassland vegetation penetrates down into the temperate vegetation zone. This indicates that these communities are at the limits of their northern distribution area, and are more common in warmer areas further south like the Shetland Islands (Roper-Lindsay and Say, 1986). The moist dwarf shrub heath, which is similar to the damp heath in Norway (Böcher, 1937), is distributed from boreo-nemoral to the middle boreal regions (Fremstad, 1997). The limited hours of sunshine in combination with heavy grazing could limit its distribution in the Faroe Islands. The moist heath vegetation type is similar to the moist alpine coastal heath in Norway, which is mostly distributed in the northern boreal to low alpine zones (Fremstad, 1997).

Conclusion

In this study, it was possible to define three significant vegetation zones in the Faroe Islands. Older studies have defined similar vegetation zones (Böcher, 1937; Hansen, 1972), but showed different altitudinal limitations. We find the temperate vegetation to have an upper limit at 200 m a.s.l., compared to 300 m a.s.l. in older studies, while the lower limit for the alpine zone in this study is found to be at 400 m a.s l., compared to 500 m a.s.l. in previous studies. This study has thus provided us with new information on the altitudinal distribution of vegetation in the Faroe Islands, which can be used as a framework for future study of climate change.

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