CHAPTER 4

ADAPTATION AND RESOURCES

4.1 COAST AND INLAND ADAPTATION

4.1.1 Inland economy:

As previously mentioned, most of the ruin-groups in the Eastern Settlement have a close connection with the shoreline.

But in the inner part of the Tunulliarfik (Eiriksfjord) and in the Vatnahverfi area quite a number of the ruin-groups are situated inland.

The scanty osseus material shows, however, that even typical inland farms based much of their economy on marine resources (Degerbøl 41 & 43, Møhl 82:289, McGovern 85b). If this apparent dependence on marine resources had a general relevance, they must have had good reasons indeed for choosing an inland farmsite.

Thus the marine element in the diet shows that the ecological adaptation of the inland farms did not fundamentally differ from that of the farms closer to the coast.

McGovern has presented the osseus material from 6 ruin-groups in the Eastern Settlement in a table, showing the relative percent of four major species (McGovern 85b:table 6). Fortunately three of the ruin groups, Ø-17a upper, Ø-17a lower, and Ø-149 are coastal groups, while the three other, Ø-71 N, Ø-71 S, (representing early and late settlements) and Ø-167 are inland groups. From his table, I have extracted the following figures: (Percentage based on TNB, i.e. Total Number of Bones).

Species:	Coast:	Inland:
Cattle	15,34	16,64
Caprine	21,78	40,18
Caribou	5,87	1,21
Seals	56,80	41,98

The greatest difference appears in the percentage of caprine material, showing nearly double the amount in the inland groups.

The percentage of caribou on the inland sites is surprisingly low, but the figures are too small for liable conclusions. The lower amount of seal bone inland is noticeable, but still virtually equal to that of the caprine.

The material is of course meager compared to the vast number of ruin-groups. The material may also hide chronological differences between the ruin-groups. The figures must therefore be taken with all possible reservations.

An analysis from the Western Settlement shows a somewhat similar picture, but with an even stronger representation of seal bones (McGovern & Jordan 82:75).

4.1.2 Inland ruin-groups:

The location of the inland ruin-groups tell us something about where resources were available.

The intensity of archaeological surveys in inland areas have varied, and ruins are easier to discover where sheep grazing has removed the high vegetation. It is therefore likely that the areas affected by modern sheep farming also have a higher percentage of discovered ruins.

In PLATE 14 (below) I have presented a map with iso-lines showing the two classes having the highest ruin-group density from PLATE 6. In addition I have plotted all inland ruin-groups in the Eastern Settlement.

I have defined "inland ruin-group" as a group situated more than 1 kilometer from the present shoreline, as marked on the survey maps of the National Museum. The maps had a scale of 1:250.000. From a total of 444, 119 ruin-groups, or 27 %, were located inland. A number of these are probably ‘saeters’ (i.e. shielings, see below, Section 4.2).

The map on PLATE 14 clearly shows how the inland groups correspond with the heaviest ruin-group concentrations, of which they are a part. Outside these concentrations, inland groups are found in the valley stretching from Ipatit Kuat near Søndre Sermilik to Itillissuaq in Tasermiut, and on the peninsula towards Tasiluk south of Igaliku fjord.

If we return to the grid system with 10 x 10 km squares, we find that 61 inland groups are located in 7 squares only, meaning that more than 50 % of the inland ruin-groups are concentrated in 6,25 % of the populated area.

This actually means that areas with inland farms also could support a higher settlement density than the shoreline areas. And contrarily, that settlement concentrations generally depend on the possibilities for inland habitation.

This probably also holds true even if we disregard the ‘saeters’, which will be discussed later.

It is logical to assume that the location of ruin-groups in inland areas reflect the presence of available resources. And as most of the ruin-groups lie in in good pasture areas, but rarely in typical hunting districts, it is likely that the possibilities for grazing and fodder collection have directed the choice.

Thus it may be argued that settlement concentrations depended primarily on availability of pastures and fodder. This is hardly controversial, and is quite in line with previous suggested theories.

The vegetational resources are discussed in Section 4.3 below.

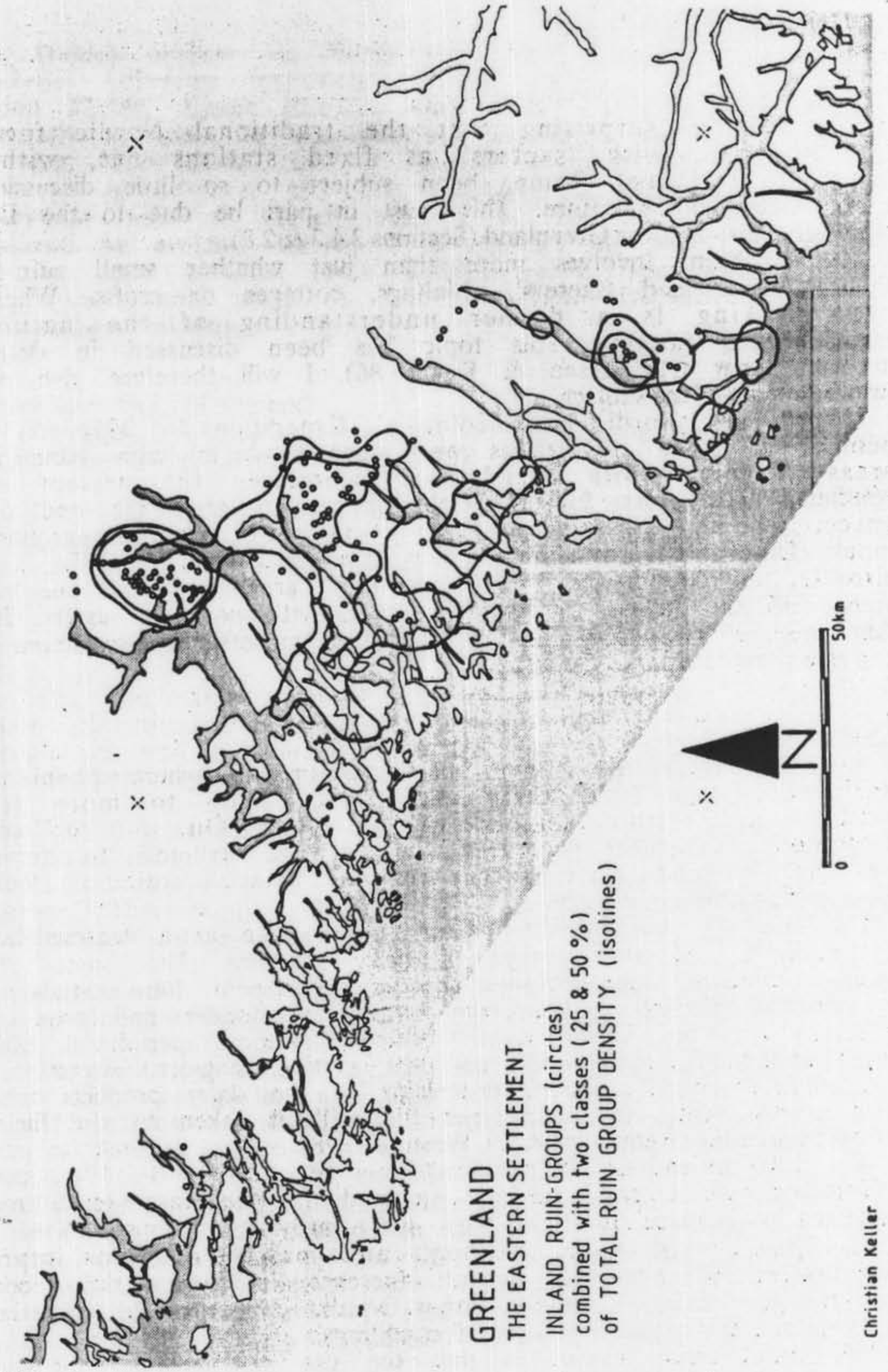


PLATE 14

Inland ruin-groups, marked together with the iso-lines showing the two classes of hatching marking the most densely populated areas, from PLATE 6.

4.2 TRANSHUMANCE

4.2.1 'Saeters':

It is perhaps surprising that the traditional Nordic form of transhumance, with 'saeters' as fixed stations has, with the exception of Daniel Bruun, been subject to so little discussion in Norse Greenland literature. This must in part be due to the Danish-Norwegian dispute over Greenland (Sections 2.4.7 & 2.8).

The problem involves more than just whether small ruin-groups should be termed 'saeters', shielings, cottages or crofts. What has been lacking is a deeper understanding of the nature of transhumance farming. This topic has been discussed in detail in another paper (Albrethsen & Keller 86). I will therefore give only a brief summary of the subject.

During the Nordic Archaeological Expedition in 1976 & 77 a number of small ruin-groups were discovered in high lying inland areas. Together with Svend Erik Albrethsen the present author continued field work for a couple of seasons after the end of the project. In all, 14 interesting ruin-groups were registered around the inner Tunulliarfik, and tentatively identified as 'saeters'. It must also be mentioned that relatively large areas between the settled areas and the inland ice were surveyed with negative results. It can therefore be reasonably argued that the 'saeters' in this area were as a rule situated close to the farms.

4.2.2 What is a 'saeter'?

The term refers to a type of transhumance where people from stationary farms herd their cattle and sheep to more remote pastures for certain seasons of the year. On one or several locations near these pastures, houses are erected to serve as "stations". These stations are called 'seter', 'støl' or 'sel' in Western Scandinavian dialects.

The chief purpose of the 'saeter' is to serve as a seasonal station for milking, and the storage of dairy products. The 'saeter' fulfills several functions, and includes for example, pens for animals, living quarters for people, and storage houses for fodder and produce. In addition, it often serves as a center for more peripheral activities like hunting, fishing, wood- or peat cutting, bog-ore extraction, etc. In certain types of 'saeter', processing of the dairy products is done at the spot, while in other types the milk is taken to the farm for further processing (Reinton 55 & 69, Westrheim 78).

Most literature on Norwegian 'saeters' deal with 19th century conditions, when the farmers engaged in the large-scale market production of dairy produce. This was partly a response to a price drop in cereals from Europe, and partly due to improved communications, and the overall increase in the market economy (Tveite 75:140-152). It is, in other words, dangerous to draw direct parallels from this material to medieval conditions.

The main point to us is that the use of 'saeters' represents a type of decentralized farming which makes exploitation of remote areas possible. As an example of extensive farming, it is well suited for areas with a low production potential per area.

As South West Greenland is indeed such an area, it would be surprising if this well known technique was not practiced by the settlers.

Some Danish authors on Norse Greenland have used the word 'sætergårde' (directly translated: "saeter farms") (Knuth 44:113, Andreasen 82:188, Krogh 82a:101, Gad 84:37). This is an invented term, totally unknown in Scandinavian ethnology. The same applies to the term "dairy farm" used by Roussell (41:228). The meaning of these words is obscure, and one suspects that the authors have misunderstood what a 'saeter' actually is. In my opinion, these terms should be avoided. Instead, I recommend the word 'saeter', or one of the more specified terms defined below. The Scottish word "shieling" has been used in some English literature, and is acceptable as a general term.

4.2.3 Three main types of 'saeters':

From Norwegian ethnological material, the following main types of 'saeters' are acknowledged (from Reinton 69:28):

1. The "**dairy saeter**" is primarily used for the milking of cows, goats and in older times probably sheep. These 'saeters' are usually located close to the farm, and the milk is transported to the farm for further processing. This type of 'saeter' therefore requires a minimum of permanent constructions.

2. The "**haymaking saeter**" has fodder collection as its main objective, and therefore requires housing for the people, as well as storage room for the hay. The distance from the farm may vary considerably.

3. The "**full saeter**" is a center for a variety of seasonal activities, including the milking of animals, processing of various dairy products, as well as fodder collection and storage. This requires housing for people as well as a wide range of storage rooms.

A variety of other types of 'saeters' are known, but these are generally regarded as subcategories of the types mentioned above.

It may of course be questioned whether these ethnological terms may be applied to archaeological material like that of Norse Greenland. The categories are first of all functional distinctions where differences in function should be detectable in the archaeological material.

Albrethsen tried to classify certain ruin-groups in Greenland on the basis of the characteristics of the three main types of 'saeters'.

His work was partially based on our own surveys, and partially on reports in the archives of the Danish National Museum, although a number of the older reports were insufficient in detail and hence not suitable for this kind of analysis. Thus for the Western Settlement and the Middle Settlement suitable reports were totally lacking.

Moreover, at the time of his writing, no reports from the roughly 100 ruin-groups surveyed in 1980 - 81 were available.

From the remaining material, he was able to compile a list of 43 ruin-groups from the Eastern Settlement. These were tentatively identified as belonging to the three main types of 'saeters'. This does not, of course, imply that the rest of the ruin-groups are farms.

As Albrethsen's classification was based on a selection of the best survey reports, and none of the ruin-groups in question have been excavated, the figures must be treated with care. Still, they suggest that 10 % of the ruin-groups in the Eastern Settlement may be interpreted as 'saeters'. Considering that many of the reports had to be omitted, the figure is probably too low.

The 43 ruin-groups classified by Albrethsen are:

Full `saeter'	Ø-25(?), Ø-26(?), Ø-56, Ø-122(?), Ø-226, Ø-234.
Dairy `saeter'	Ø-2a, Ø-46, Ø-51(?), Ø-78b, Ø-83a, Ø-86a, Ø-111a, Ø-128a, Ø-210(?), Ø-215(?), Ø-221b, Ø-228, Ø-229, Ø-231, Ø-232, Ø-233, Ø-235.
Haymaking `saeter'	Ø-8, Ø-22(?), Ø-61, Ø-62, Ø-76a, Ø-85(?), Ø-90b Ø-128b, Ø-146(?), Ø-148, Ø-197a, Ø-211, Ø-218, Ø-219, Ø-220, Ø-221a, Ø-224(?), Ø-235.

(From Albrethsen in Albrethsen & Keller 86:101).

In PLATE 15 I have plotted the 43 suggested 'saeters' on a map, each type of 'saeter' being marked with a separate signature.
There is a marked concentration of 'saeters' in the most densely populated areas, even if the correspondence is not an exact one.

On the basis of Albrethsen's lists and the ruin-group maps, I have isolated the 'saeters' lying inland:

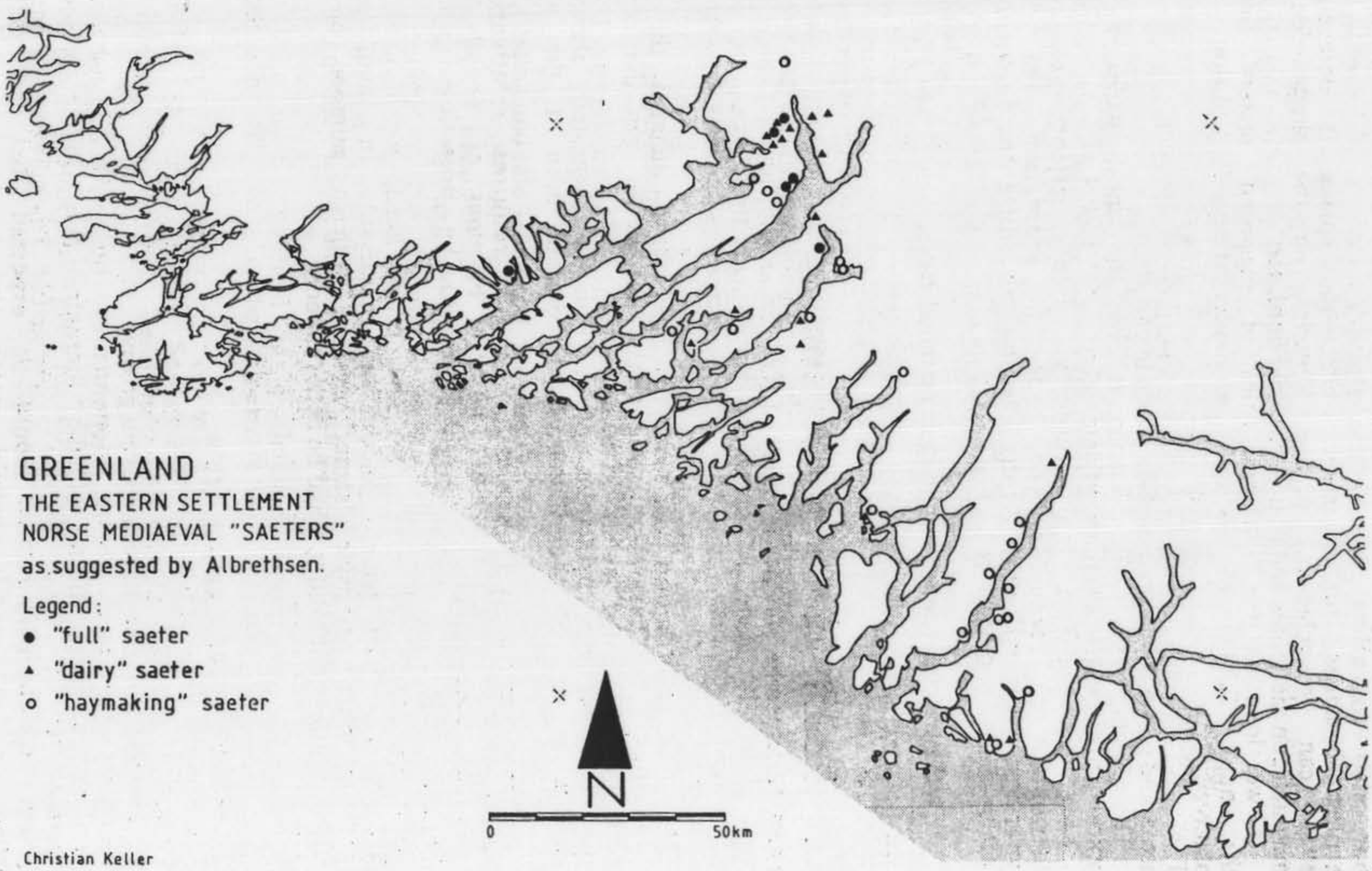
This classification gave the following figures.

Main types	Inland	Total
"Full saeters"	4	6
"Dairy saeters"	9	17
"Haymaking saeters"	4	20
SUM	17	43

17, or about 40 %, of the suggested 'saeter' ruins are located inland. This is higher than the percentage of inland groups in relation to the total ruin-group population (which was 27 %).

Still, most of the 'saeters' in Norway and Iceland are located in inland areas, (Reinton 69, Hizler 79), and the high percentage of coastal 'saeters' shown in Albrethsen's material represents a deviation from this pattern. The typical Norwegian 'saeter' lies at a higher elevation than the farm, although exceptions can be found.

PLATE 15


GREENLAND
THE EASTERN SETTLEMENT
NORSE MEDIAEVAL "SAETERS"
as suggested by Albrethsen.
Legend:
● "full" saeter
▲ "dairy" saeter
o "haymaking" saeter
N
0
50km
Christian Keller

This was not only to permit access to pastures far from the farm, but also to allow for the exploitation of a different set of ecological zones, for instance where the spring is delayed. This effect can be achieved in high altitudes, on the shady side of a mountain, on the shores and islands of a cold fjord, etc.

If we look at the different types of suggested 'saeters' found on the map, PLATE 15 (above), an interesting distribution can be observed:

The 'full saeters' seem to have the closest connection to inland areas, and to the most densely settled areas in particular.

The haymaking 'saeters' seem to be the most widespread, and typical to areas with low settlement density.

This distribution may actually reflect differences in the distribution of resources, and hence in adaptation. The different types of 'saeters' may thus belong to different environments, roughly classified as follows:

1. Haymaking 'saeters' to the most marginal areas.

2. Dairy 'saeters' to average areas.

3. Full 'saeters' to areas rich in inland resources.

It must be remembered that the choice of a 'saeter' location and -type is largely made in order to supplement the farm, and thus in some ways dependent of the type of resources found on the farm itself.

Thus the distribution of resources may have dictated the choice of locations in Tasermiut, where the farms lie on the southern shore, and the suggested 'saeters' on the northern.

Nevertheless, the principles of distribution suggested above may work as a rule of the thumb in Greenland, even if the material evidence is incomplete.

The use of a full 'saeter' obviously requires relatively high productivity per area. To fulfill all the functions of a full 'saeter', pastures, fodder and fuel would have to be accessible from one location.

The most marginal areas, on the other hand, would have their resources scattered widely about the countryside in small patches. Here, a more extensive 'saeter' system, with a number of small stations in different locations would be better suited.

4.3 VEGETATIONAL RESOURCES

4.3.1 Distribution of vegetation and ruin-groups:

The Norse settlers' strong dependence on animal husbandry is described so many times in the literature that further presentation is unnecessary.

From this background it should be expected that the settlement distribution and density would match the present distribution of vegetational resources.

And contrarily, if significant discrepancies between ruin-group distribution and vegetational distribution was found, it would

require an explanation.
Such explanations could fall in four categories:

1. A deterioration of the top-soil may have occurred after the time of settlement, first of all caused by erosion.

2. The settlement in question may not have been solely based on vegetational resources. Settlements exploiting marine resources like fish and seals would illustrate this.

3. The settlement in question may have developed without direct dependence on vegetational resources. Trade centers and political centers would be typical examples.

4. An abundance of vegetation would lead to the suspicion that the area was unexploited, or that settlement was controlled.

During recent years, the mapping of vegetational resources in the Eastern Settlement has provided useful data for analyses on this subject (Thorsteinsson (ed.) 83). This, together with the extensive archaeological surveys of the area, has laid a useful foundation for comparative analyses of vegetation and settlement distribution.

But, such comparisons immediately raise a question: Is the modern-day vegetation representative of the vegetation during the Middle Ages? Or have there been considerable changes affecting the top-soil during or after the Norse period of settlement? These are important questions, but hard to answer.

In the following, I will present the analysis first, and pursue the question of vegetational change later.

4.3.2 Vegetation and ruin-group correlation:
A systematic evaluation of the pastures in modern Greenland was first made in 1925 (Bendixen 27).

Plans for the development of Greenland sheep farming led to an extensive survey of the vegetation during the years 1977 - 81 (see: Udviklingsprogram...80). The survey was a joint effort between Forsøgsstationen i Upernaviarsuk in Southern Greenland, and Rannsóknastofnun Landbúnadarins (Agricultural Research Institute) in Iceland.

The results were published in a detailed report, edited by Ingvi Thorsteinsson in 1983. The following is an extract from his report.

> The vegetational coverage, as well as the combination of species in the Eastern Settlement are subject to two variables; the altitude, and the distance from the outer coast.
>
> Vegetation is found up to 1200 meters above sea level, but the amount of ground coverage drops drastically within the altitudes 400 - 600 meters:
>
> 84 % of the covered area lies below 400 meters.
> 96 % of the covered area lies below 600 meters (Thorsteinsson 83:68).

The effects of the distance from the outer coast are harder to measure, as they can vary with the local conditions. Thorsteinsson has divided the area into three zones, called "the inland zone", "the mid zone", and the "coastal zone" (op.cit.:71, my translation and narration.).

The zones must not be interpreted in a strictly topographical sense, however. Thorsteinsson cites for instance Qaqortup ima (Hvalsey fjord), which lies in the mid zone, but has a typical inland zone type of vegetation (ibid).

In the report, the area of investigation is divided into 42 "natural grazing districts", which together cover most of the Eastern Settlement.

For the analysis (below), 10 of the districts had to be omitted due to incomplete data, leaving 32 districts for calculation.

From these districts, ruin-group distribution was correlated with the vegetational distribution.

The calculations were made in the following way, see the table in PLATE 16 below:

1. The analysis began by counting the number of ruin-groups in each of the grazing districts, **column no. 2.**

2. All suggested 'saeters' in each grazing district were counted, **column no. 3.** (As previously mentioned (Section 4.2.3), there are probably more 'saeters' among these ruin-groups, but they are not yet identified.)

3. The number of 'saeters' were then subtracted from the number of ruin-groups, giving a readjusted number of ruin-groups, **column no. 4.** These corrected figures are the basis for the calculations below.

4. The next step was to compare the number of ruin-groups with an appropriate value for the grazing potential. In the report, this is given as a "recommended number of ewes (sheep)" on summer pastures (Thorsteinsson 83: tables 90 & 91). These figures are listed in **column no. 5.** We are of course also interested in the potential for winter fodder, but this will be dealt with later.

5. The adjusted number of ruin-groups was then correlated with the recommended number of ewes (sheep) for the respective districts. The correlation ratio for all the districts was 0,64. (A full correlation would have given 1, and no correlation would have given 0. Full negative correlation would have given -1).

There is, in other words, a certain correlation between ruin-group distribution and the distribution of summer pastures, but it is not very high.

1	2	3	4	5	6	7	8	9	10
Grazing district no.	Number of ruin-groups	Number of suggested saeters	Corrected number of ruin-groups	Recommended number of sheep for summer	Summer sheep divided by ruin-groups	Recommended number of sheep for winter	Winter sheep divided by ruin-groups	Sum of sheep winter & summer	Sum of sheep divided by ruin-groups (Vegetation index)
1	18	3	15	3.914	261	3,903	260	7.817	521
2	8	4	4	6.244	251	5.983	206	12.227	422
3	28	3	25						
4	16	5	11	6.578	598	4.434	402	11.012	1.001
5	6	-	6	2.147	358	514	86	2.661	444
6	11	-	11	4.970	452	937	85	5.907	537
7	7	-	7	1.141	163	229	33	1.370	196
8	11	-	11	1.716	156	309	28	2.025	184
9	10	3	7	1.706	244	7.149	421	13.863	815
10	11	1	10	5.008	501				
11	8	1	7	844	121	486	69	913	130
12	5	-	5	857	171	709	142	999	200
13	6	1	5	1.291	258	577	115	1.868	374
14	7	-	7	1.229	176	--	--	--	--
15	7	1	6	1.487	248	589	98	2.076	346
16	1	1	0	188	--	86	--	274	--
17	3	-	3	677	226	314	105	991	330
18	3	-	3	1.107	369	29	10	1.136	379
19	4	-	4	1.337	334	229	57	1.156	289
20	7	-	7	2.402	343	760	109	3.162	452
21	9	1	8	2.204	276	1.040	130	3.244	406
22	13	2	11	1.852	168	2.314	210	4.166	379
23	14	-	14	4.276	305	4.971	355	9.247	661
24	23	-	23	4.761	207	1.337	58	6.098	265
25	7	-	7	3.150	450	1.166	167	4.316	617
26	11	-	11	2.152	196	1.549	141	3.701	336
27	3	-	3	390	130	57	19	447	149
28	18	1	17	2.452	144	1.046	62	3.498	206
29	13	2	11	1.263	115	366	33	1.629	148
30	12	2	10	3.257	326	4.000	400	7.257	726
31	2	-	2	--	--	--	--	--	--
32	16	3	13	--	--	--	--	--	--
33	8	1	7	1.320	189	777	111	2.097	300
34	10	2	8	1.613	202	1.800	225	3.413	427
35	6	-	6	1.758	293	886	148	2.644	441
36	8	-	8	765	96	--	--	--	--
37	10	3	7	--	--	--	--	--	--
38	4	1	3	603	201	86	29	689	230
SUM	364	41	323						

PLATE 16

We must assume that the potential supply of winter fodder was a more critical variable for the Norse settlers than the potential of summer pastures. Evidence of irrigation of infields at several farms (see Ingstad 59:109, Gad 67:84, Bak 70c: the list before page 68, no. 69, Fredskild 73:123, Krogh 74 & 75a:140, 82a:96-103, Archives of NAE, Albrethsen & Keller 86:99 & 105, Berglund 86:113), indicate that some of this fodder was produced on infields. We have, however, no direct figures to estimate this potential (see Albrethsen & Keller 86:101-105).

6. In Thorsteinsson's report estimates are given for the potential for production of winter fodder using modern cultivation techniques. This is presented as a "recommended number of winter sheep" (op.cit. table 92). Production techniques would, of course, be totally different in medieval times, but it may still be assumed that the figure has some relevance to Norse settlement variables. The recommended number of winter sheep is listed in **column no. 7.**

7. The correlation between the recommended number of winter sheep and the number of ruin-groups gave a ratio of 0,63, which is nearly the same as that for the summer pastures.

Both variables, i.e. the summer pastures and the possibilities for winter fodder must represent variables of relevance to the Norse settlers, even if the figures are not directly comparable to the medieval conditions.

8. Finally, the recommended numbers of summer and winter sheep were added together, column no. 9. The correlation between this sum and the number of ruin-groups was calculated. The result was indeed surprising:
   The correlation ratio rose to 0,73.

This is of course no perfect match, but if we consider that the vegetational estimates are based on modern and not medieval production techniques, the results must be considered significant.

In PLATE 17 (below) the results are presented in a correlation diagram. Districts with full correlation between ruin-groups and vegetation potential (summer + winter sheep) lie along the regression line.

Each district is represented with a point and an identification number, corresponding to those in column 1, PLATE 16.

Most of the districts are concentrated in the lower left hand corner, and most of them show a reasonably good correlation between the number of ruin-groups and the vegetational resources.

However, there are districts that deviate noticeably from the regression line:

Those above the regression line have a greater vegetational potential than their number of ruin-groups indicate, while those below the regression line have a dominance of ruin-groups compared to the vegetation potential.

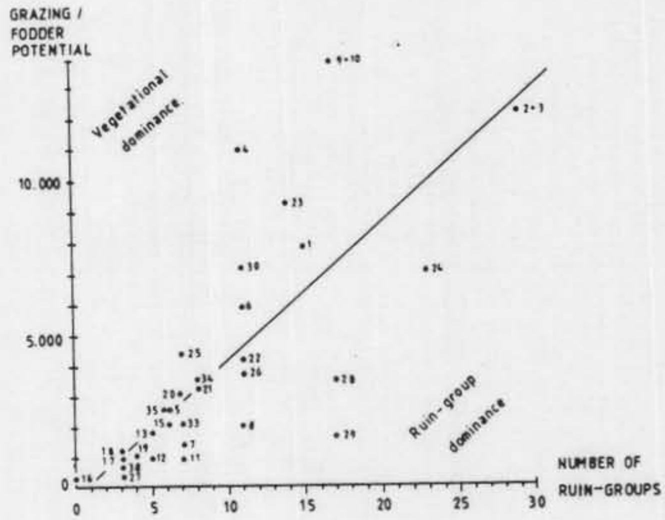


PLATE 17

Correlation diagram showing the relation between the grazing / fodder potential (on the vertical axis) and the ruin-group density (on the horizontal axis). Each dot represents a grazing district with an identification number. Correlation ratio 0,740.

9. To get a closer view of the different districts, the relation between the recommended number of sheep (summer + winter), and the number of ruin-groups was calculated. The results are presented in **column 10** in PLATE 16, and as a bar-graph, PLATE 18, below.

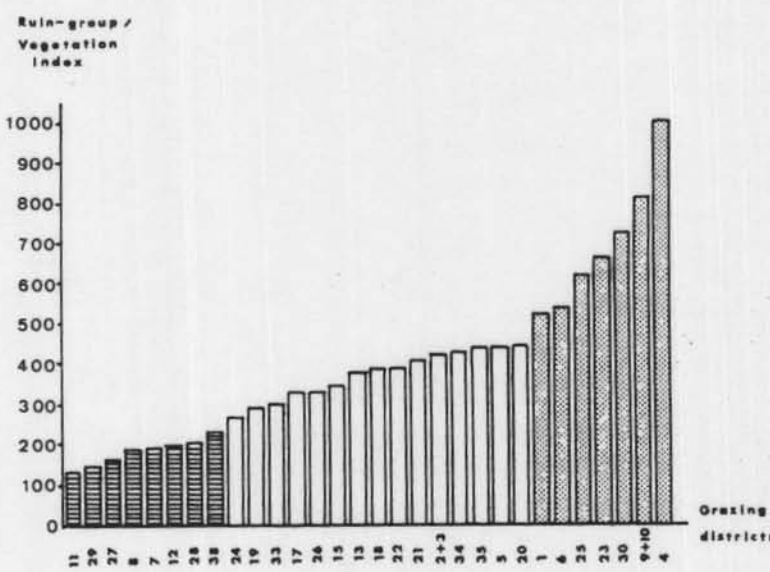


PLATE 18

Bar graph showing the ruin-group / vegetation index for the respective grazing districts.

Before commenting on the bar-graph, it must be emphasized that the recommended number of sheep for summer and winter are added together, giving a figure nearly twice the recommended number of sheep. The number may of course be divided by 2, but as the recommended figure is based on modern farming methods, it has no direct relevance to medieval conditions. I have therefore considered the figure strictly as a relative expression for the vegetation potential, and not as an estimate of the carrying capacity as such.

In the following, it is therefore called "the vegetation potential", or "vegetation index" when correlated to the ruin-groups.

Looking at the bar-graph, PLATE 18 (above), it appears that most of the districts have a vegetation index falling between 300 - 400. The 7 tall bars to the right are most striking. Among these districts, Number 4 is the most extreme, with a vegetation index above 1000.

The districts in the left hand corner are also interesting. They do not deviate to the same extent, but 5 of the districts have indexes less than 200.

Where are these districts located, and how can the deviations be explained?

10. The different grazing districts are presented on the map, PLATE 19 below. Each district is identified with a number (Thorsteinsson 83:15).

    The districts with vegetational dominance (to the right in the bar graph) are shown with a dotted signature.

    The districts falling near the average are shown with open, vertical hatching.

    The districts with ruin-group dominance (to the left in the bar graph) are shown with dense horizontal hatching.

It appears from the map (PLATE 19) that the variation within the settlement area is great, and without any clear-cut tendencies. The most interesting districts will therefore be discussed in more detail below.

4.3.3 The Gardar area:

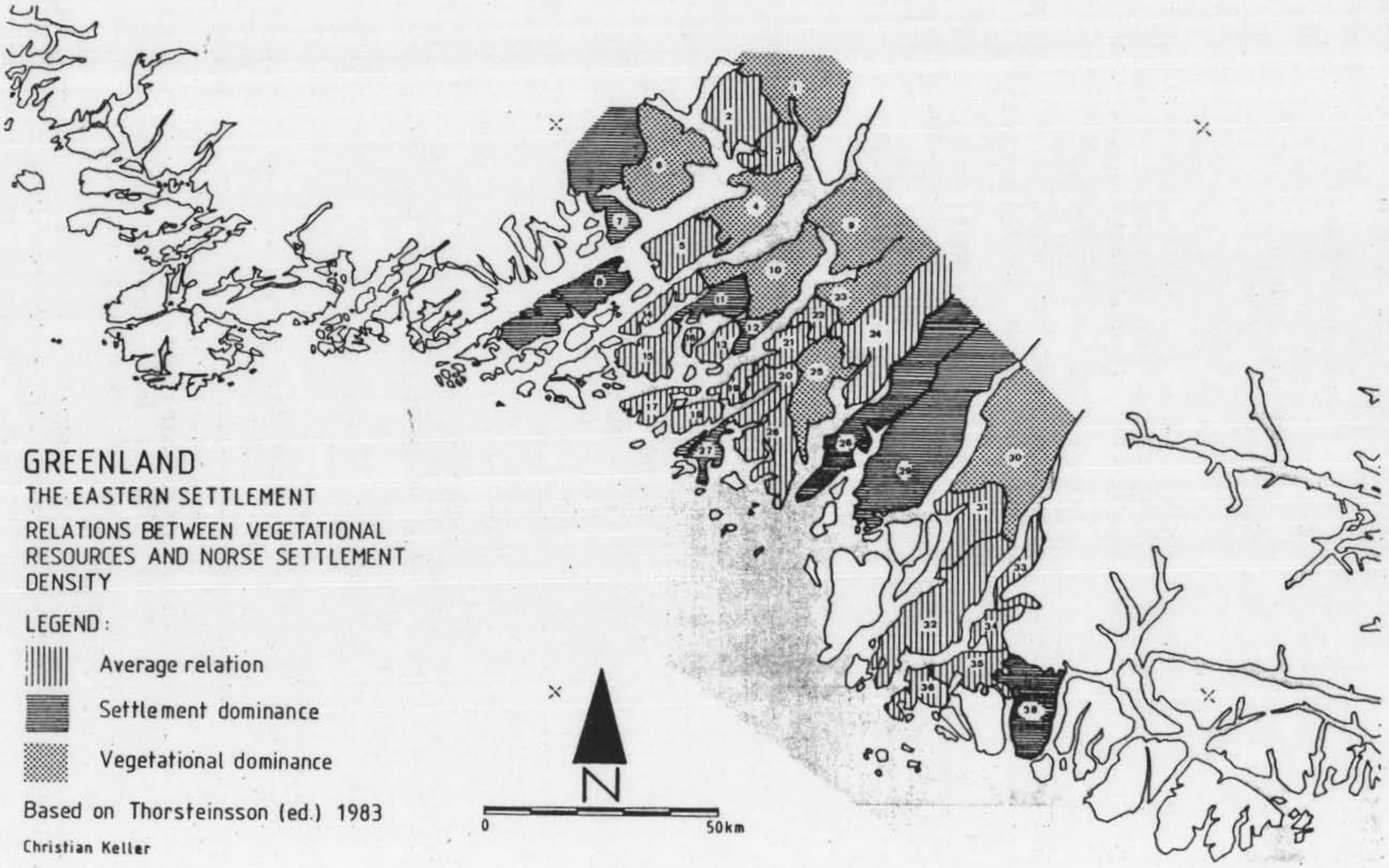
Studying the map on PLATE 19, the first thing that catches the eye is the apparently "unpopulated" areas around Igaliku (Gardar). These are Districts 4, 9, 10, and 23, with ruin-group / vegetation indexes ranging from 600 - 1000.

These areas are today heavily exploited by modern sheep farming from settlement centers at Qassiarsuk and Igaliku. It is therefore likely that most of the Norse sites in these areas are already discovered, with the possible exception of 'saeters'.

Also, if anywhere vegetation has been reduced by modern sheep farming, it is in these areas, where Nørlund cited local erosion as early as 1934 (Nørlund & Stenberger 34:106 & 109).

District 23, however, is the only one reported as showing signs of severe erosion (Thorsteinsson 83:158 - 159). Near Igaliku Kujalleq (Søndre Igaliku) an estimated loss of 10 square kilometers of top-soil has been reported due to wind erosion. And excavations of the ruin group Ø-64c, which was buried beneath dunes of aeolian sand, showed evidence of heavy erosion further inland, probably during the period of Norse settlement. It has been suggested that the farm was abandoned for this reason (Vebæk 43:55-59 & 81).

PLATE 19


GREENLAND
THE EASTERN SETTLEMENT
RELATIONS BETWEEN VEGETATIONAL RESOURCES AND NORSE SETTLEMENT DENSITY
LEGEND:
Average relation
Settlement dominance
Vegetational dominance
Based on Thorsteinsson (ed.) 1983
Christian Keller
N
0
50km

Ove Bak also reports erosion in the southern part of the Eastern Settlement, especially near the inland ice, but he does not specify where (Bak 70c:29, 33). One exception is Máukarneq (Sandhavn?) near Ikigaat, where he observed remnants of an eroded vegetational cover (op. cit.:41). It must be mentioned that the soils in the area Igaliku Kujalleq are originally aeolian, which makes this district especially vulnerable to erosion (Thorsteinsson 83:161, see also Sections 4.3.8 & 9.2.4).

It would probably be wrong to use this as an indication of similar deterioration of the more çommon moraine or lacustrine deposits of the Eastern Settlement. Thorsteinsson argues that the high contents of stone and gravel in the soil in such areas makes wind erosion less of a problem (op. cit.:73).

Possibly, one or two ruin-groups may have been lost in District 23 because of this process, but the effects on the vegetation as a whole must have been considerably more serious.

It is therefore all the more surprising that these were the districts showing the highest vegetation dominance.

Also, the areas in this group actually encompass the very center of the Eastern settlement, the bishop's farm at Gardar (Igaliku). Again, if the Norse settlers did permanent damage to the top-soil by over-exploitation, it should indeed be in these areas. This does not seem to have been the case.

Still, the fact that these areas are found around the bishop's residence may well be the explanation to the phenomenon.

The diocesan farm was extremely big, and housed a lot of people. The hall itself was 50 meters long, and the byres are estimated to have held 100 cows (Krogh 82a:148). This created quite a demand on the surrounding resources, and the bishop evidently had the means to secure a large enough area to supply his needs. It was obviously in his interest to prevent dense settlement in his vicinity. It is possible, therefore, that the Districts 4, 9, 10 and 23 actually mark the sphere of influence of the diocesan farm.

If this was the case, it means that traces of over-exploitation of the pastures must be sought outside the areas managed by the bishop.

Also, it raises questions about the function of two churches in this area, Ø-23 Sillisit and Ø-66 Igaliku Kujalleq. This will be discussed later (Chapter 7).

4.3.4 The Brattahlid area:

It is interesting, then, to compare the districts around the bishop's farm with the Districts 1, 2, 3, and 6, surrounding Brattahlid (Qassiarsuk). Brattahlid was mentioned by Ivar Baardson as being the residence of the 'laugmader' (Lawman) (Jónsson 30:28, GHM III:258).

Brattahlid also has been considered to be the secular administration center ('tingsted'), at least during the early part of the settlement period (Nørlund & Stenberger 34:113-117, Nørlund 67:22, Gad 67:136, Krogh 82a:149).

The Districts 1 and 6 have vegetation indexes of 521 and 537, while Districts 2 and 3 score very close to the average, with vegetation indexes of 422. (Of these, District 6 may be omitted. It lies on the ice-filled Sermilik Fjord, and is rather inhospitable even today). It would seem the people at Brattahlid did not have the same opportunity as the bishop to keep "squatters" from settling nearby.

Admittedly, Qassiarsuq is among the areas most heavily exploited by modern sheep farming, and modern grazing has probably reduced the vegetation potential somewhat. The vegetation survey gave some indication of this (Thorsteinsson 83:117). As noted above, signs of erosion in this area were also cited by Nørlund in 1934, and are visible in a photograph in Krogh 82a:23, and at ruin-group Ø-32 (personal observation).

Still, this can hardly compare with the serious erosion found in District 23 (described above).

We must therefore conclude that Brattahlid did not possess the same power as Gardar as far as land control was concerned, or alternatively, that they pursued a different economic strategy.

4.3.5 The Vatnahverfi area:

The Districts 24, 28, and 29 include Igalikup Kangerlua (Vatnahverfi), and especially the two latter appear to have a relatively marked ruin-group dominance, with vegetation indexes from as low as 265, 206 and 148. These are some of the best districts outside the administration centers, but still the settlement density is surprisingly high.

On the other hand, this is also the area where most of the recently reported ruin-groups are found, and until survey reports are available, we cannot make conjectures about the nature of these ruins. Until further details are known, the index may be considered highly uncertain.

As previously stated (Section 3.2.2) Knud J. Krogh has kindly informed that the new surveys largely confirm the picture of the older surveys. He also states that there are ruin-groups in between that appear too small to have been independent farms, but cautiously adds that this can only be confirmed through excavations (Letter to the author of Feb. 20. 1989).

4.3.6 The Tuttutooq island:

Another area with an apparent settlement dominance is the island Tuttutooq, District 8. This island is relatively barren today, and we may suggest three possible explanations:

1. Chronology: All the ruin-groups may not have been inhabited at the same time.

2. Alternative economy: The settlements on the island may have been based on non-vegetational resources, like seal hunting, fishing, cash-hunts etc.

3. Erosion: The vegetational conditions may have been better during the settlement period than today, indicating that severe erosion may have taken place.

Similar explanations may be forwarded for the Districts 11, 12 and 27.

4.3.7 Itilliarsuup Nunaa:

District 30 lies between the inner parts of Søndre Sermilik and Tasermiut, and has an index as high as 726.

This high index is difficult to explain, except that the area is not easily accessible. But whether this is an indication of low settlement density during the Middle Ages, or of less intensive archaeological survey, is hard to say. Ove Bak indicates that the local population avoids these areas, mainly because of superstition (Bak 70c:30). Thus the chances of accidental discovery of unknown ruins are low.

It is hard to imagine, however, that this district would have been overlooked by the Norse settlers, and even harder to believe that it could have been subject to similar socio-political forces as demonstrated around Gardar. The question must therefore remain open.

4.3.8 Top-soil destruction:

Bent Fredskild has demonstrated how the pre-landnám vegetation was dominated by betula and salix, and how this "forest" or scrub was quickly destroyed with the coming of the Norse settlers, to be replaced by grass and weed (Fredskild 73:133, 78:38, 82:192).

From the study of house ruins we know that grass turf was stripped off the ground to be used as building material.

Finally, we know that biomass was removed from the pastures and mountain-sides by grazing animals and fodder-collecting settlers.

These types of activity undoubtedly had severe effects on the vegetational environment.

Later in the settlement period, a deterioration of climate occurred. In the introduction to Ivar Baardson's Description, changes in the sailing routes to Greenland due to increasing drift ice is described (GHM III:250, Jónsson 30:2), and several of the Icelandic Annals record increasing drift ice and cold weather (Isl. Ann., Lauge Koch 45 in a (later criticized) compilation, see McGovern 81:419).

This, of course, marks the oncoming Little Ice Age, terminating the Little Optimum that had favored the colonization (Vibe 67, Lamb 77:99,189,437,451, Dansgaard 81, Weidick 82).

Several studies have been made on the consequences this climatic change had on pastures and wild game (Vibe 67, McGovern 81, McGovern et al. 85).

An observed increase of sand in the sediments of a small lake, Galium Kær near Qassiarsuq, led to the theory that the settlers destroyed the top-soil and thus accelerated the effects of climatic deterioration (Fredskild 73:123-128, and 82:192, Krogh 82a:179-183).

Thoughts along similar lines have been forwarded by other authors (Iversen 32 & 46, Roussell 41:9-10, Werenskiold 45, McGovern 81a, McGovern et al. 85, Keller 86).

Before, however, claiming that top-soil destruction was the cause of desertion, let us take a closer look at the processes in question.

1. Erosion.
Modern sheep grazing has left tell-tale signs of wind erosion in the most heavily exploited areas. The special climatic conditions in southeast Greenland, with strong foehn winds raging down from the ice cap, undoubtedly favor wind erosion in certain spots.

However, this problem mainly affects mineral soil of aeolian origin. Most soils in Greenland are moraine and shoreline deposits, with high contents of gravel and stones. Aeolian sands are found in Igaliku Kujalleq and in the eastern part of Igalikup Kangerlua (Vatnahverfi). Apart from these areas, wind erosion is limited to local patches because of the high content of course material.

For the same reasons, water erosion is not regarded as a serious problem. (From Thorsteinsson 83:73).

Admittedly, signs of erosion are visible at several locations, as noted above, but there seems to be little reason to generalize the conditions observed by Vebæk at Ø-64c.

2. Reduced vegetational productivity.
More important, but less visible, are the changes that may have taken place within the soil itself. To get a better understanding of this, a short description of the soil types is necessary (mainly taken from Thorsteinsson 83):

Mineral soil:
The dominating fractions of mineral soils are fine gravel, sand, and silt. Clay content is rare. This makes for good drainage, but also favors dilution of minerals and humus.

Generally, the content of humus in mineral soils is high, and the decomposition of organic material is slow due to the cold climate. (From Thorsteinsson 83:76-78).

pH:
The soil is very acidic, particularly in the coastal zone, where precipitation is highest. The average pH values ranges from 4,9 to 5,4. Some coastal areas show podsol profiles.

The highest pH is found in areas with scrub vegetation, and the lowest in areas with heather. (From Thorsteinsson 83:74-75 &78-79).

It has been suggested that a change towards a more acidic environment took place around 4.500 B.P. with the immigration of Betula glandulosa. At this time, acidophilic diatoms in the lakes increase (Fredskild 73:227).

Phosphates:
Generally, the soil is very low in phosphates.

The critical effects of grazing and fodder collection can be described as follows:

1. **Mechanical wear** by trampling feet ruin the root systems and causes loss of ground cover. The results are low productivity per area, increased evaporation, and less resistance to drought and erosion.

2. **Removal of biomass** from the ecosystem through grazing and fodder collection. With the plants go also protein, potassium, calcium, sodium, magnesium and phosphorus. Most of these substances end up in the vicinity of the farms, after having passed through animals and humans.
   The effects on the soil include increased acidity, decreased deposits of organic material, and a slow-down of mineral dissolution, all of which result in less productivity.

The cold climate of southwest Greenland slows down all chemical processes and the vegetation is vulnerable. Iceland, since the **landnám** 1100 years ago, has had a loss of vegetational resources calculated to 80-85 percent of the original potential (Thorsteinsson 83:97).

Present-day erosion in Iceland is, however, extremely severe, and much of the loss must have occurred in later times (personal observation). Some of this erosion may be attributed to the effects of the Little Ice Age.

Conditions in Greenland are, however, not directly comparable to those in Iceland, first of all due to the difference in geology. Analogies between the two countries are therefore difficult to make.

It is obvious that the Norse settlers in Greenland caused fundamental environmental changes. But it is likely that even moderate amounts of fertilizers, like manure, seaweed, or fish refuse, together with artificial irrigation, may have reduced the impact considerably, at least as far as the infields were concerned.

It is almost impossible, therefore, to estimate the degree of damage to the vegetation without the help of special investigations. Until such investigations are made, the environmental effects on the settlers' situation are hard to estimate.

4.3.9 Concluding remarks on vegetation and settlement:

The type of analyses employed are aimed at giving an over-all view, and not a detailed one.

I have already commented on the weaknesses of the archaeological material (above, Section 3.2). With these reservations, it should be possible to draw some conclusions from the analyses.

1. The possibilities for inland settlement seem to have strongly influenced settlement density. Analyses of the bone material in the middens of the inland farms show surprisingly little difference to that of the coastal settlements. It seems, in other words, as if the diet in coast and inland farms was much the same. It is therefore natural to assume that there was some kind of system for mutual exchange between coast and inland.

2. The distribution of different types of 'saeters' indicate a differentiated economic strategy, well adjusted to the distribution of resources in the different areas.

3. The ruin-group distribution seems, for most of the settlement, to agree reasonably well with the distribution of vegetational resources. An exception from this is the area around Gardar, where settlement seems to have been consciously restricted. Brattahlid, on the other hand, seems to lack corresponding evidence of such restrictions.

   A few areas contain inexplicably high ruin-group figures, indicating chronological differences, top-soil reduction or non-agrarian economies.

The picture which begins to appear is, with some exceptions, one of a normal, well adapted settlement, with a disappointing lack of dramatic features. This may indicate that if some kind of top-soil reduction occurred on a grand scale, it was not yet beyond the stage of recovery.

It must be emphasized, though, that the analysis does not tell us anything about the level of resource exploitation; i.e. whether the carrying capacity of the area was threatened or not (see Section 9.2.4).

Also, we must bear in mind that the basis for the analysis is the **number of ruin-groups**, and not the total amount of Norse ruins. A closer scrutiny of this material may reveal differences as to the size and number of houses within each ruin-group. There may, in other words, be systematic variations within the ruin-group material that are not uncovered in the present analysis.

Unfortunately, the survey reports available at present are not of sufficient quality to serve as a basis for such analysis, except for very small areas.

This must indeed be taken into account when the results of the present analysis is to be evaluated.