

# **‘Elegant failures’ and ‘clumsy solutions’ to climate change adaptation: and lessons in human security from the Viking settlement of the North Atlantic**

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## **Introduction**

In this paper we illustrate the utility of deeper time (century–scale) perspectives when assessing human security through an analysis of the contrasting fates of the Norse Settlement in the North Atlantic islands (Fig. 1). We explore the ideas of ‘clumsy solutions’ to complex problems and ‘elegant failures’ as an explanation for the impact of different choices in times of global change (Verweij et al. 2006). A ‘clumsy solution’ is one that includes many different viewpoints when making a decision or establishing policy (Shapiro, 1988). It may be viewed as a ‘fudge’ that muddles along through a series of compromises and the uneasy co-existence of incompatible (or inconsistent) goals. Clumsy solutions are the anathema of focused or ‘elegant’ solutions—that are based on a single vision of both the problem and the solution. Clumsy solutions have been advocated as an effective approach for complex problems (Verweij et al. 2006)- and so might have relevance for human security in times of global environmental change. Crucially, knowledge of how to avoid ‘elegant failure’ is most relevant to the promotion of human security.

## **The use of 'deeper time' when evaluating human security and global change.**

The past in general, and multi- century timescales of the past in particular, can offer illuminating case studies of human activities and the consequences of particular choices through the investigation of coupled natural and human systems, human ecodynamic modelling and the study of long-term human impacts (McGovern 2008). Indeed, a sustainable future maybe unobtainable without a well-understood past (Crumley 1994). Misleading short observational series of data can fatally undermine landscape and resource management strategies essential for human security. For example, unsuccessful managers of the North Atlantic cod fisheries began their data sets with 1903 A.D. as a pristine baseline, despite hundreds of years of prior human impact, with disastrous results both for cod and people (McGovern 2008).

Key advantages of 'deeper time-scales' include the multi-generational perspectives that enable us to see if people's choices can establish resilience and promote human security, over long time scales we can assess whether some measure of sustainability in terms of social practice or the natural environment can be achieved, and we can explore the circumstances under which changes occur. Some choices may create inherent instabilities that may not become apparent for decades or indeed centuries- examples of this include the 'over-optimistic pioneer fringe' (where initial settlement choices may be viable in the short term but have no long term future) and other types of non-sustainable practices (such as excessive grazing, over hunting and practices leading to reduced soil fertility). If we can identify practices that do establish a resilient, dynamic equilibria over longer timescales, it may be possible to evaluate reasons for instability or change, and identify triggers for change that may be both due to human factors (social, political and economic) or natural variation (climate and landscape changes).

The past does, however, have to be studied with care, as there are pitfalls that need to be avoided in order to gain the maximum advantage from the long time perspectives and rich data that are available. Notable issues relate to the changing nature of society and data resolution. There are, for example, fundamental differences between medieval and modern communities in terms of knowledge, beliefs and technology, social organisation and economic activities, socially-induced goals and measures of success. Indeed these sorts of contrasts are such that many choices in the past cannot be related to those of the present or future. Additional concerns related to the scale of environmental change; indeed one point of view is that likely future global changes are such that the last two millennia lack any examples of comparable magnitude. Temperature changes over the next century are indeed likely to be without precedent in terms of past civilisations, however the past does contain many examples of acute social stress and demographic shock that may be most instructive. When plague repeatedly killed 10-40% of entire societies (as in the Black Death and the Second Pandemic) (Herlihy, 1997),

when economic activities underwent fundamental change (as in the development of bulk commodity trading by merchants) when world views changed (as in the adoption of Christianity in northern Europe) and when migrations lead to new culture contacts (as in the Viking migration period and the spread of the Thule culture) Although future *environmental* change may be without precedent, the scale of future *social* change may not be.

We can, however, usefully consider general themes such as the nature of the decision making process (whether there is much discussion with many voices heard, or little discussion and few voices heard; local or distant decision making); we may also reflect on the consequences of specialisation versus generalisation, focus versus breadth, resilience and sustainability.

We also need to beware of misinterpretations that may arise from a lack of data, limited data resolution, or stereotyping. Modern studies can generate very rich data but as we extend time horizons into the past data richness generally reduces; a simple lack of data on, for example, social organisation, economic activity or health may lead to mistaken conclusions as to the importance of climate change on human security. While we may have no doubt that large scale changes have occurred, such as economic recession (late 1200's A.D.), demographic collapse (the 'Black Death') or environmental disasters (the coldest decades of the 'Little Ice Age') (Aberth 2001, , if we focus at the resolution of individual households the effects of the large scale changes are often difficult, if not impossible to identify. The challenge is therefore to have case studies where there are sufficient long time scales to allow long term change, adaptation and sustainability to be considered, and yet which have a sufficient richness and granularity of interdisciplinary data to enable complex ideas to be explored. This can be done in the North Atlantic for the period of the Norse settlement; there are environmental archives of unparalleled quality from ice cores (Mayewski and White 2002) to palaeoecology and zooarchaeology (McGovern et al. 2007); there are exceptional dating controls that include high resolution tephrochronology (Thorarinsson 1981) and radiocarbon dating used in Bayesian analyses (e.g Church et al. 2007), a superb historical record (Jones 1986, Karlsson 2000 Vésteinsson 2000) and increasingly sophisticated landscape-scale archaeological studies (e.g McGovern et al. 2007). So it is to this arena we will turn our attention.

### **The Case of the North Atlantic: beginnings**

The Norse settled across the North Atlantic from their Scandinavian homelands from around 800 A.D., progressing from the British Islands and Ireland across to the Faroes (c. 825 A.D.), Iceland (from c. 870 A.D), and on to Greenland (c. 985 A.D.) – with short lived visits to North America around 1000 A.D. (Fitzhugh and Ward 2000). They took with them a remarkably flexible and durable settlement package of ideas, tools and domesticated animals that was adapted to local conditions and is clearly recognisable as a 'Viking settlement' (Keller 2009).

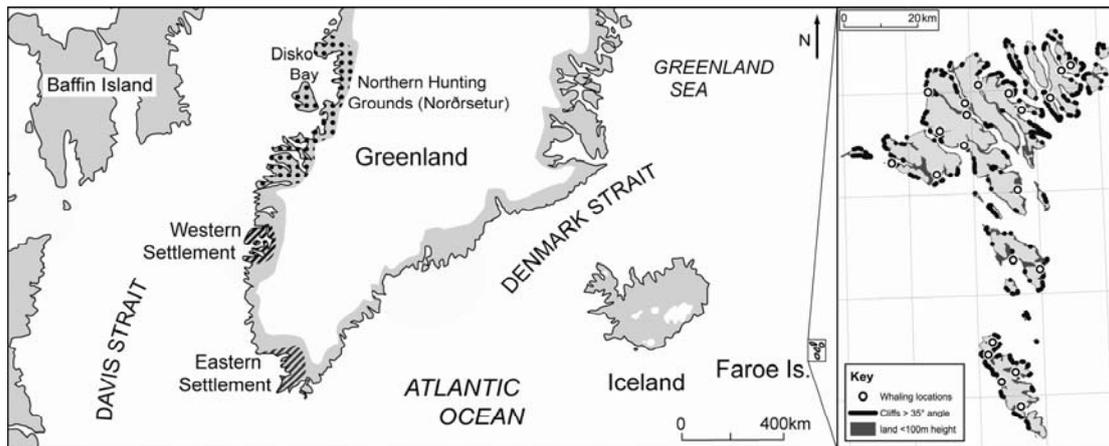


Figure 1. In the North Atlantic Viking settlement took place in the Faroe Islands, Iceland and Greenland. The Faroe Islands are hilly and no place is far from the sea, settlement is nucleated in villages. Further west medieval settlement was highly dispersed. In Iceland there are opportunities for extensive inland grazing. Greenland is affected by seasonal sea ice and is the most marginal area for pastoralism in the North Atlantic islands. Norse Greenland benefited from annual seal migrations, but the settled areas lay far from the northern hunting grounds for walrus whose ivory was a key export.

After gaining knowledge of a new island, settlement would proceed rapidly with the creation of a pastoral farming system based on a dwelling with associated byres and store houses, hayfields, domesticated livestock of horses, dogs, pigs, cattle sheep and goats, and a system for harvesting wild resources such as additional fodder, wood, birds, eggs, fish from both fresh water and the sea, shellfish, and marine mammals (McGovern et al. 2001). In favoured areas cultivation would take place ranging from cereal production in the eastern North Atlantic to small scale ('walled garden') cabbage and root crop production in the west (Keller 2009).

Travelling west of Bergen is to encounter essentially 'more polar' environments, and so, as the Norse established settlements across the North Atlantic, they crossed a series environmental thresholds - such as the limits to tree growth, cereal cultivation, ocean currents and sea ice. Each new island required different adaptations of the 'settlement package', different approaches to gathering wild resources, and offered different opportunities for trade and exchange. The consequences were varying opportunities and related travel costs depending on the local environment, the type of resource gathering, and, ultimately, the differing impacts on the environment and different outcomes in terms of community survival. This allows us to explore key themes of human security in times of global change.

### **Discussion: differing outcomes**

In a pan-Atlantic context the Faroe Islands are perhaps most instructive in terms of what has not happened in comparison to the Norse settlement further west. Norse colonisation of the Faroe Islands did not result in a great overall change in the land cover; the islands had few trees before settlement, grazing

was maintained, and there has been no large-scale increase in erosion. Although some destruction of lowland soils and peat has occurred, this is relatively limited and because there were so few trees present before settlement, 'deforestation' has little practical consequence. Upland areas have been destabilised with the introduction and long term activities of grazing mammals, but the overall impact of these changes has been limited (Mairs 2007). The Faroese diet included a significant proportion of birds and fish (Church et al. 2005), and whale meat gathered in the *grind*, communal hunts of pods of pilot whales, *Globicephala melas* (Bloch 1996). In common with Iceland and Greenland early settlement included the pig. These animals were closely managed, but were later extirpated, presumably when the costs of rearing exceeded the benefits gained from their consumption. Outfield grazing was also closely controlled and subject to regulation (for example, the *Sauðabrævið*, 'Sheep letter' rules of the late 13<sup>th</sup> century); there was a shieling system to manage summer time grazing. Key trade items included both fish and wool.

There has been long-term settlement continuity in the Faroe Islands and a number of factors have helped to promote this; at the centre is the Norse concept of the farm, a focus for organisation that has proved to be of great utility (Keller 2009). Farms provided cereals, meat, dairy and textiles, and the wild resources exploited from the base of the farm provided much else;- birds for meat, eggs and feathers, fish for subsistence and trade, and marine mammals, in particular the pilot whale, for food and a basis for a community cohesion (Dugmore et al. 2007). Farms were run in relation to rules that aided the management of resources, and these resources were generally found in close proximity. Cereal production in the Faroe Islands has been maintained despite the significant labour required. The impacts of climate change, while significant have not crossed key thresholds and trade links have proved robust (Mairs, 2007). Crucially Faroese settlement is nucleated into hamlets or villages, and this may have promoted community based 'clumsy' approaches. In Faroese communities contact between people is forced on a daily basis because of the settlement pattern- this contrasts with the islands to the west where medieval settlement was characterised by dispersed homesteads, which dramatically reduced daily interactions.

The long-term outcomes of Norse settlement in Iceland have proved to be both similar to those of the Faroe Islands, and different from them. The Icelandic farms are scattered and mostly land-locked, meaning that there is a more significant mobility cost in Iceland than in the Faroes. In Iceland there is an emphasis on travel by horse and on foot, rather than boat, but there is also convincing evidence for the early development of long-distance intra-island trade and exchange (for example, processed sea fish (stockfish), marine mammal bones and sea birds eggs found at inland sites). This allowed for potentially enhanced specialisation from the scattered farms and a more complex associated trade network. Resource management was enshrined in early laws (*Grágás*) and in later times laws acted as a constraint on specialisation; for example, the requirement for those who fished to also have farms. Limited cereal cultivation occurred in Iceland from settlement through to the 16<sup>th</sup> century, but then the practise died out, probably as a result of some

combination of climate, economic, soil limitations or social change (reduced beer-making?)( Einarrson, 1963, Simpson et al 2002, Sveinbjarnardottir et al 2007), and cultivation became focused on providing winter fodder for animals, to enable them to utilize the extensive grazing of inland areas only available in summer months. Iron production flourished in 10<sup>th</sup>-14 century Iceland (Espelund 2007), but it declining as essential woodland resources were degraded through non-sustainable charcoal production. With changing climate, mismatches between the timing of grazing and plant growth provide a ready means to increase soil erosion despite the presence of otherwise effective stock management (Simpson, et al., 2001). In Iceland wool production and stockfish trade was established early. . These provided the pillars of the later Icelandic economy (Karlsson 2000).

The oligarchic Commonwealth period (from Settlement to 1261 AD) may, at least initially, have been characterised by 'clumsiness' in so much as the 'Godi' or chieftains all had a voice in decision making. Power became more concentrated, and in the aftermath of the loss of independence the silencing of the many voices of the early settlement period was typified by the new Law Codes imposed from Norway and lacking the local nuance and granularity of the old.

In Greenland Norse settlement came to an end after about 450 years. The farm was still the focus of Norse settlement, but in Greenland the long-term successes of the Faroes and Iceland were not to be repeated. The Norse population in Greenland was probably similar in number to that of the Faroe Islands and perhaps an order of magnitude less than Iceland. In contrast to the Faroe Islands settlement patterns were characterised by scattered farms. Despite geographical isolation Norse Greenland came to be characterised by communal efforts to utilise marine mammals for both trade and subsistence. A major focus of the economy was the hunting of walrus in the northern hunting grounds (*Norðrsetur*) which involved journeys of many hundred of kilometres through perilous waters north of the settled areas (Fig. 1). This, allied to the time and distance costs involved in harvesting the food resources such as the spring seal migration in a big, sparsely-populated area lead to very large distance costs, with associated labour demands.

The walrus tusks collected in the northern hunting grounds were brought back to the settlements still embedded in skull bone. The frequency of small chips of tusk ivory accidentally flaked off during tusk extraction drops with time and the numbers of bone fragments increase (McGovern et al. 1996). The implication is that over time and with experience the Norse improved both quality control in ivory production and the volume of ivory collected.

The zooarchaeological and isotopic records also suggest that, through time, the Norse in Greenland developed a remarkably high consumption of marine resources - up to 80% of the diet (Arneborg et al. 1999, Dugmore et al. 2007), and this indicates a developing a focus on the sea. Furthermore, as fish bones are very rare in the known archaeological record two further conclusions may be drawn; either fishing was undertaken and the remains

were disposed of in such ways as not to become part of the archaeological records investigated to date, or the marine emphasis developed a specialised, if not single minded focus on marine mammals, namely seals. If we follow the latter line of argument then at this western limit of Norse settlement the local adaptation of the farm-based settlement model became focussed on marine mammals for both subsistence (seals) and trade (walrus). The adaptation seems to have served the Norse well for a significant period as the settlement did endure for some 450 years. Sustainable subsistence practices of land management and the exploitation of both caribou and potentially vulnerable populations on non-migratory common seals (*Phoca vitulina*) were insulated from the impacts of cash-generating activities as those involved distant walrus colonies. The distance of the walrus hunt also imposed sustainability on cash generating activity because of the limits imposed by travel time and the hazards of the journey. This situation contrasts with Iceland where there were no effective limits on cash generating activity; Icelandic walrus were wiped out and Icelandic iron and wool production both led to extensive environmental degradation.

In the 15<sup>th</sup> century, however, an unexpected series of events occurred; economic change swept Europe in the aftermath of the Black Death (Herlihy, 1997), climates deteriorated (Meeker and Maywsky, 2002) with storms and sea ice disrupting communication and travel, declining populations in Greenland may have reached a critical threshold in terms of social coherence, just as the Norse were having to manage a new set of relations with the incoming Thule peoples. In a modern context there is a useful concept of 'double exposure'; exposure to both climate change and the impacts of globalisation (Leichenko and O'Brien 2008). . In Medieval Greenland the Norse faced a triple exposure; to climate change, to the economic transformations sweeping Europe in the aftermath of the Black Death, and to culture contacts brought about by the migration of the Thule Peoples, a phenomenon unrelated to the other two. In the face of these pressures it is possible that settlement collapse occurred because of the resilience lost from the farming system; specialisation and an apparently 'elegant' solution to 14<sup>th</sup> century climate and economic changes may have quite suddenly lost its utility.

## **Conclusions**

In the North Atlantic we can evaluate contrasting adaptations of the Norse settlement. In the Faroe Islands with their closely placed resources and comparatively benign climates, the chosen balance of terrestrial and marine subsistence allowed great stability. They were favoured both by close proximity to key resources and the continued viability of cereal cultivation (abet with significant labour demands) throughout the climate changes of the Little Ice Age. Communal approaches and a strongly nucleated settlement may have helped 'clumsy solutions' to be found.

In Iceland, the early development of bulk trade in wool and stockfish also underpinned settlement continuity and the maintenance of the settlement despite more limited options (such as the initial lack and later absence of cereal cultivation). 'Clumsy' approaches (such as the insistence of combined

farming and fishery, rather than allowing for more specialist activities) promoted resilience. Scattered settlement and the imposition of foreign rule were probably associated with a loss of 'clumsiness' in decision making; settlement endured but it was related to extensive land degradation. Sustainable practices are associated with subsistence while cash-generating activities such as iron and wool production draw down resources.

In Greenland, the chosen solution to climate change was elegant, a greater utilisation of marine resources (seal) for subsistence and a more refined production of ivory for export. This adaptation proved unable to withstand the stresses of the mid 15<sup>th</sup> century: landscapes were not degraded as they were utilised for subsistence, potentially vulnerable subsistence resources such as the caribou of the Eastern Settlement areas and the harbour seals of the Western Settlement areas seem not to have been drawn down and yet the settlement failed. The economic focus involving long and hazardous journey times to harvest seals, walrus, furs (and wood?) ensured an element of sustainability because of limited accessibility but proved vulnerable to disruption, placing such pressure on the small community, it could not ultimately survive. Perhaps a less focussed, 'clumsier' solution may have proved of greater utility.

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