

# CLIMATES OF CHANGE

**The Shifting Environment of Archaeology**  
Proceedings of the 44th Annual Chacmool Conference  
Chacmool Archaeological Association, University of Calgary

Edited by  
Sheila Kulyk  
Cara G. Tremain  
Madeleine Sawyer



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## **In Memory of Dr. David H. Kelley**



One of the cornerstones of the University of Calgary's Archaeology Department, and a prominent participant in Chacmool conferences over the past forty years, passed away on May 19<sup>th</sup> 2011. David Humiston Kelley and his wife, Dr. Jane Kelley, arrived at the University of Calgary in 1968, and they became the heart and soul of Chacmool. The annual Kelley parties were epic, featuring abundant conversation and controversy. Dave Kelley was often at the center of spirited debates, holding forth from his lounge chair with colleagues and former students huddled at his feet. Dave was an amazing scholar with vast and diverse interests across academic disciplines and beyond, ever ready to tackle a topic with a twinkle in his eye.

David Kelley received his PhD from Harvard University in 1957, with a dissertation on linguistic evidence from trans-Pacific contact in pre-Columbian times. His profound knowledge of linguistics contributed to his fundamental insights that led to the decipherment of Maya hieroglyphic writing. His scholarly interests knew no bounds, and prominent publications covered such topics as archaeo-astronomy, world calendrical systems, and trans-oceanic contacts. He continued his research long after his retirement, and was regularly consulted by leading scholars in the field. Among his achievements, Dr. Kelley was the first recipient of the Tatiana Proskouriakoff Award from Harvard University for his contributions to Maya decipherment.

Chacmool warmly honours the memory of David Kelley.



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# The Human Experience of Social Change and Continuity: The Southwest and North Atlantic in “Interesting Times” ca. 1300

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*Archaeology is increasingly becoming a part of contemporary decision-making because of the insights that its long-term and comparative perspective can provide. As we enter that arena, we have a responsibility to bring with us an understanding of the lives of the people who experienced the past we study. Resilient societies persisted and rigid ones transformed, but what was it like to live in those societies? Was a “collapse” actually a welcome end to a difficult situation? Did persistence or resilience come at the cost of human suffering?*

*We are addressing these questions from a broad comparative perspective based on two multi-case projects. The Long Term Vulnerability and Transformation Project (LTVTP <http://ltvtp.shesc.asu.edu/>) focuses on the US Southwest and Northern Mexico, and the North Atlantic Biocultural Organization (NABO <http://www.nabohome.org/>) focuses on the North Atlantic. This is the first published account of our comparative work. So far, much of the work by both projects focused on major transformations – sometimes considered collapses – but we are also studying cases of continuity. In doing so, we address the usually implicit assumption that continuity is better than collapse by focusing specifically on the human and environmental costs of both.*

*Here we consider four cases – Zuni and Salinas in the Southwest and the Norse settlements in Greenland and Iceland in the North Atlantic – that maintained continuity during “interesting times” of major climatic and pan-regional social change, circa AD 1300. The inter-related goals are to (1) develop and apply a methodology to assess and compare the human experience in these very different cases; and (2) consider both the causes and consequences of continuity in these cases, with implications for today’s world.*

## Human Security in the Archaeologically Known Past

In developing a way to assess the human experience of the past, we considered numerous measures of health and well-being including, Sen's concept of freedoms (1999), numerous quality-of-life indices, and methods of comparatively assessing health in prehistoric skeletal remains (Steckel and Rose 2002). Best suited to our purpose is the United Nations Development Programme's comprehensive approach to what they call human securities, which, in contrast to national security, focus on what people actually experience physically, socially, and environmentally (UNDP 1994). This approach has also been applied to the study of global environmental change (Matthew et al. 2009). We chose it because the dimensions are applicable to our archaeologically known cases, but we expect that as this paradigm is advanced, other means of assessment will be developed and tailored to other kinds of cases.

The UNDP considers human security in terms of seven dimensions which can be assessed, directly or indirectly, in the archaeologically known past. (1) *Economic security* requires an assured basic income and may be reduced by income inequality. Although monetary income is not relevant to many of our prehistoric cases, we can assess economic security more generally by considering inequality, dependence on others, and control over the means of production. (2) *Food security* requires both physical and economic access to basic food; today about one in seven people world-wide are food insecure. We can consider it archaeologically with information on climatic and social changes that might limit such access, as well as bioarchaeological indications of food stress. (3) *Health security* refers primarily to disease, which can be assessed using bioarchaeological evidence. (4) *Environmental security* concerns threats to

resources through processes such as erosion, soil degradation, deforestation, and salinization, all of which can be studied through environmental archaeology. (5) *Personal security*, which relates to physical violence, such as warfare or domestic abuse, and also with dangerous activities, is also amenable to archaeological or bioarchaeological investigation. (6) *Community security* is a more complex concept. The UNDP notes that most people derive security from their membership in a group, but that communities can also be oppressive. Archaeologically, a change in community structure or membership may indicate a change in community security. We also consider changes in religious organization to be related to community security. (7) *Political security* concerns basic human rights and one of our cases has relevant textual evidence. We also consider changes in autonomy, resulting from changes in community structure (such as the creation of a walled village), as a component of political security.

Since different societies have different standards of living and ways of life, some of these dimensions may be difficult to compare between cases. Therefore, our focus here is on assessing changes over time within each case, and comparing the cases based on the directionality of the changes.

### Interesting Times

The "interesting times" we are concerned with, ca. AD 1250-1400, saw major climatic, demographic, and socio-economic-cultural changes that enveloped the four cases in various ways. In each area, we draw on research that assesses the *magnitude*, *duration*, and *intensity* of climatic challenges (e.g., Dugmore et al. 2012; Ingram 2010). Analyses of the time since an event of equal or greater severity provide insights on the potential difficulties in coping with a given

challenge. Here we summarize the broad patterns in the Southwest and North Atlantic, and the next section considers how people responded and how their experiences can be considered in terms of the dimensions of human security.

### *The Southwest*

The decades just prior to AD 1300 saw major changes across the Southwest. These coincide temporally with what has become known as the “Great Drought” (AD 1276-1299). Although relatively severe in terms of the cumulative deficit, its intensity and magnitude were not unprecedented; thus farmers would have had well-established coping strategies. Probably more significant was an unprecedented increase in rainfall variability.

In the Southwest there were two rainfall regimes (**Figure 1**); the west normally received biannual (summer and winter) precipitation but only summer rains were common in the east. The 80-100 km boundary between the two areas shifts slightly from year to year (Cordell et al. 2007:387). Moisture that contributes to the two regimes comes from different sources and is differently affected by the jet stream and other macroclimatic processes. Thus, a good year in one area is not necessarily a good year in the other. Analyses of dendrochronological records reveal strong

clustering within each of these areas, suggesting the pattern extended back to at least the 7<sup>th</sup> century AD (Dean 1996). The pattern began to break down in the mid-20<sup>th</sup> century— due to global climate change. The pattern, especially the western bi-modal rainfall, also destabilized between 1239 and 1488.

A breakdown in these long-established climatic patterns starting in the early AD 1200s would have made things very difficult in those parts of the Southwest that experienced unprecedented weather patterns. However, Salinas and Zuni would have been relatively less affected. Salinas, in central New Mexico, is far from the unstable bi-modal area. Farmers at Salinas were also able to rely on a perched water table that would have provided water for their crops regardless of annual rainfall fluctuations

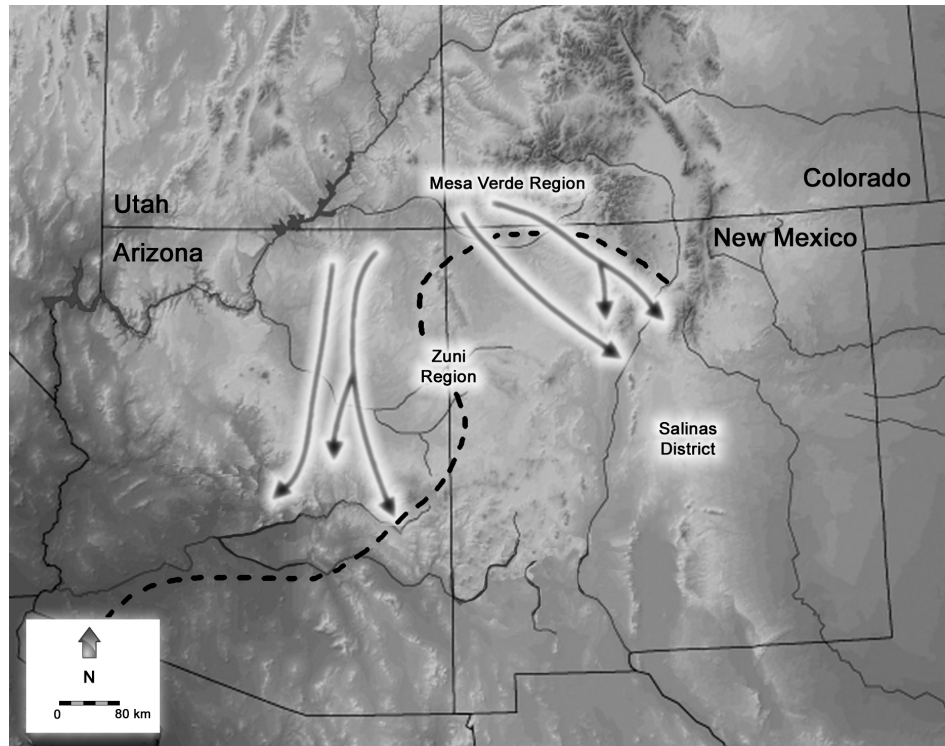


Figure 1. The US Southwest, showing the locations of the Zuni and Salinas regions in relation to the border of the rainfall regimes (indicated by the dotted line). Migration from the Mesa Verde region is indicated by the arrows.

(Spielmann et al. 2011). Zuni, on the other hand, lies near the boundary of the two rainfall regimes. Farmers there would have felt the de-stabilization, but because they were used to shifting patterns, it probably would not have been a major or novel disruption. Indeed, agricultural land-use in the Zuni region did not involve a single robust strategy, but instead comprised a flexible portfolio of strategies including a high degree of residential mobility (Dean 2007; Nelson et al. 2010).

In contrast, in the Mesa Verde region in the northern Southwest, both climatic events would have had major impacts. Tens of thousands of people migrated from the region, which was left virtually empty by 1300 (Kohler et al. 2010). Some migrating groups moved into Arizona and many thousands of people moved to northern New Mexico (Ortman 2012), an event unprecedented in the Southwest. Few, if any, of the migrating people moved into either Zuni or Salinas, but residents of those areas must have been aware of what was going on and possibly felt threatened by it.

The 14<sup>th</sup> century in the Southwest also saw the beginning of a new pan-Southwest religious movement that eventually became the Katsina religion. It involves new symbols, including masked figures, and extensive trade in new kinds of colorful polychrome ceramics. Rituals involved far more people than in earlier periods, and were held in large, often enclosed plazas. It is sometimes described as integrative or inclusive kind of ritual that helped build communities at a time of demographic flux (e.g., Adams 1991); others argue that the integration may also involve exclusion and preparation for conflict (Plog

and Solometo 1997). Ethnographically known Katsina rituals include whipping by Katsinas who serve as the protectors for dancers (whipping is seen as a means for ritual purification) and clowns who satirize and publicly ridicule improper behavior (Bunzel 1992). It is likely that some of these elements of social control were nascent in the religious developments in the 14<sup>th</sup> century.

#### *North Atlantic*

Cold temperatures and storminess are the most challenging conditions for people in the North Atlantic (**Figure 2**) because of the constraints they pose on biomass production, human and animal health, communication, and trade. A range of proxy measures of climate in this region are available, and these show great geographical variation because of the varied topography and distribution of ice; changing conditions based on current multi-proxy reconstructions are shown in **Figure 3**. After a comparatively warm, calm, and climatically stable period during the Viking Age (ca. AD 800-1050), the region experienced a series of climate changes involving increased inter-annual variability in temperature and storminess. It also witnessed overall regional declines in temperature from around 1250 and a dramatic increase in storminess after 1425. Additionally a threshold-crossing sea ice event ca. 1250-1300 saw summer drift ice from eastern Greenland appear for the first time in the Norse settlement areas in the southwest coast. (Ogilvie et al. 2009). Subsequently, there was also a very severe cold period in the mid-13<sup>th</sup> century (1250-1262), and severe cold periods continued to occur with increasing frequency in the mid-14<sup>th</sup> century.

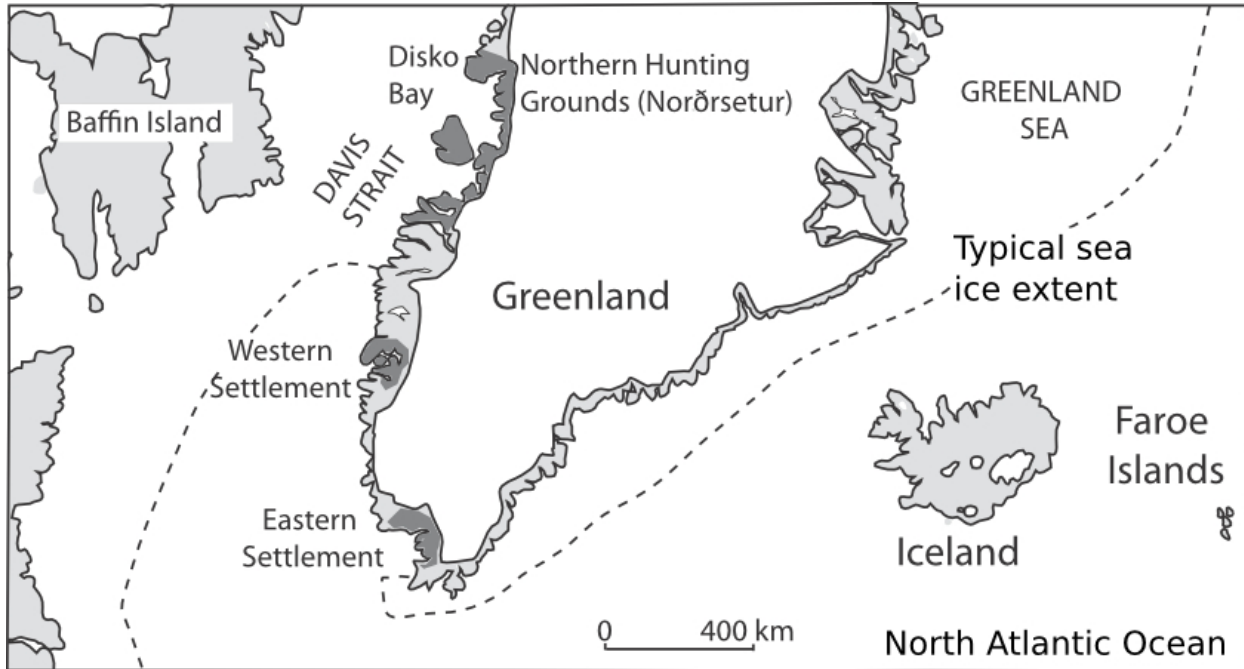


Figure 2. Greenland and Iceland in the North Atlantic, showing the location of the Norse Greenland settlements in relation to normal sea ice and the hunting grounds at Disko Bay.

At these times, there would have been snow on the ground in Greenland from September until June, making stock farming more difficult than before. Settlements in both Greenland and Iceland survived these challenges in part by intensifying marine hunting and fishing (Arneborg et al.2012). Inter-annual and inter-decadal variability may have been as much a challenge to North Atlantic farmers as overall cooling or even sudden, threshold-crossing events. Increasing variability in summer temperatures impacted the biological productivity of both in-field pastures and upland common grazing. It also affected both summer grazing and the critical hay harvest that had to carry stalled stock through winters of variable, but often increasing, length. Animals unexpectedly culled in late winter due to insufficient stored fodder made both human provisioning and herd management difficult, especially on small farms with limited pasture and smaller herds of sheep, goats, and cattle. These households would have had to borrow food,

fodder, and replacement stock from better off farmers and local chieftains.

The increased variability also brought warmer high productivity summers, but farmers ability to take advantage of these conditions would have been limited because their stock was reduced by starvation winters and unanticipated culling. Stock reduction would have had serious social as well as economic consequences, spreading poverty and indebtedness in societies where wealth was normally measured in cattle. In late medieval times, the great majority of farmers in Iceland, and probably in Greenland too, were tenants tied to a few large magnate holdings. Increased variability in growing season length in upland pastures may also have contributed to erosion and soil loss, especially in Iceland. Successful management of the upland commons depended as much on timing of removal of flocks from higher elevations as on total stock numbers, as models indicate that highland grazing past the (increasingly unpredictable) end of growing season would

be most likely to have exacerbated the widespread upland erosion seen in late medieval and early modern Iceland (Thomson and Simpson 2006). While the final demise of the Greenland settlements in the second half of the 15<sup>th</sup> century is associated with a conjuncture of severe cold and storminess (Dugmore et al. 2012), it is important to note that both Icelandic and Greenlandic communities were able to respond successfully to the shocks of the 13th-14th century.

People in Greenland and Iceland would also have been affected by major shifts in their larger socioeconomic environments (Dugmore et al. 2012; Streeter et al. 2012). These include changing relations with the kingdom of Norway, the migration of the Thule Inuit into the eastern Arctic after AD 1200, and Europe's changing interest in North Atlantic fish, wool, and walrus ivory. Since these affected Greenland and Iceland in different and quite specific ways, we discuss them in more detail below.

### **Assessing Human Securities in the Southwest and North Atlantic**

The UNDP dimensions of human security allow us to compare the human experience in these four very different cases. For each dimension we developed one or more archaeologically applicable variables, and then used these variables to assess change in that dimension during the interesting times circa AD 1300, when people experienced changes in their biophysical, cultural, and socioeconomic environments. Cross-case comparisons are based on changes within each case. The detailed results are presented in **Table 1**, which summarizes how the seven dimensions might have changed across the transitions. The discussion below summarizes

the changes in each case, referencing the table by row/archaeological variable (AV) number. Dimensions that show little or no change are not discussed in detail but are summarized in the table.

### *The Southwest*

Although they are more than 200 km distant, people in the Zuni and Salinas areas responded in similar ways to the demographic and climatic changes ca. 1300. In both areas, earlier settlements were loosely scattered clusters of small room blocks. In the Salinas area, the structures were built of wattle and daub and there does not appear to have been any communal architecture or formally designated space for community scale ceremonies. At Zuni there was often some shared public architecture that would have provided some degree of community integration. After 1300 people moved out of these settlements and into enclosed masonry pueblos (with from a few hundred to more than a thousand rooms) built around a central plaza (Chamberlin 2008; Peeples 2011). These nucleated villages often consist of long rows of rooms built at one time, suggesting that construction was organized at a super-household level. The total number of rooms changes little over time, suggesting that community membership remained stable. However, at Zuni the new large villages were often occupied for only a decade or so— after which people apparently constructed new villages, possibly in the same area (Kintigh 1985). In the Salinas District the new villages are defensibly situated and in both areas some rooms and sites were burned. Although there is clear evidence of violent death in some parts of the Southwest circa 1300, none is known from the core Zuni or Salinas areas.

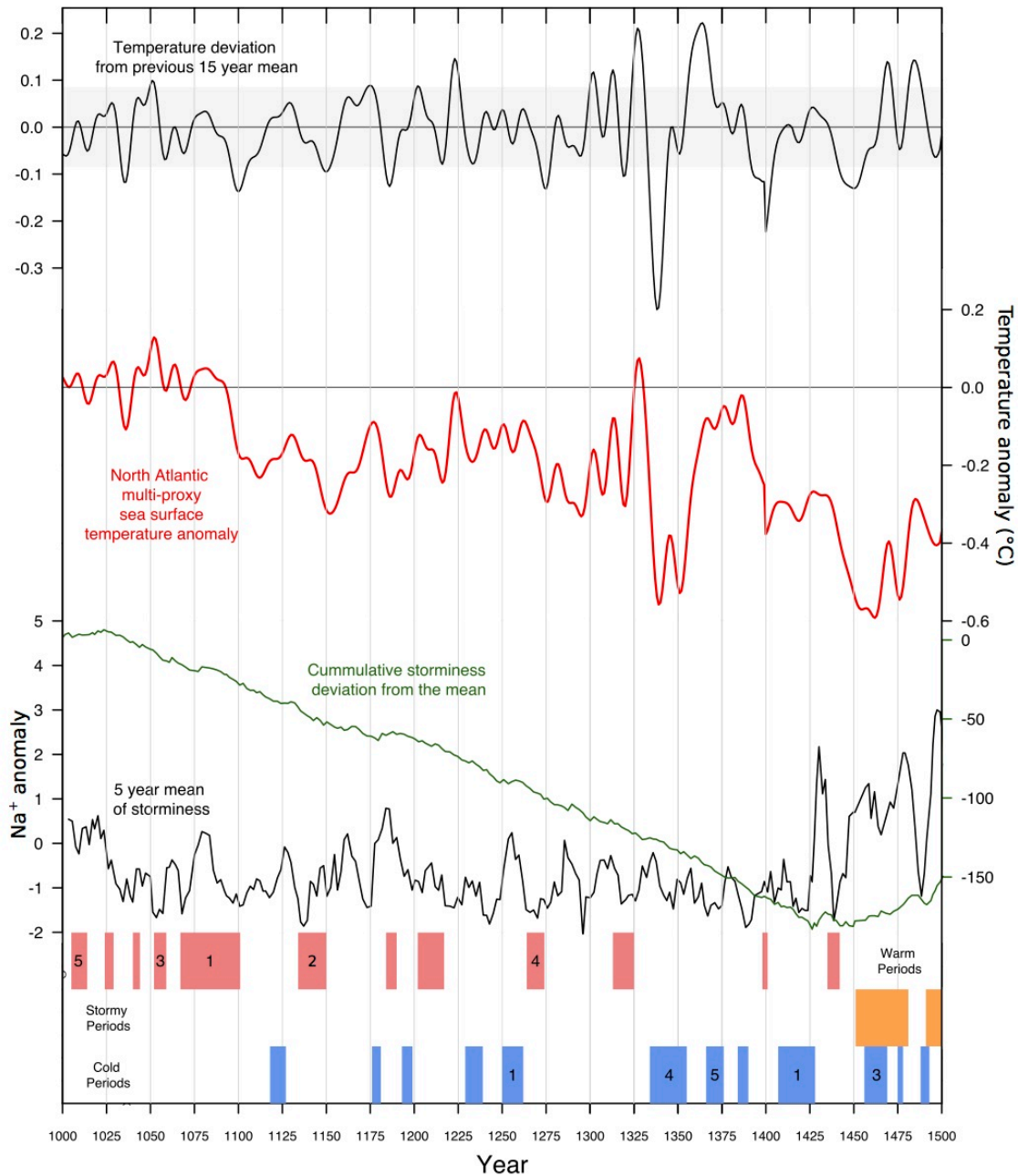


Figure 3. North Atlantic multi-proxy records of climate (Mann et al. 2009) indicate potential unpredictability gathering pace in the 14th century, shown here as the deviation of each year from the mean of the previous 15 (1). Proxy records of storminess from the Greenland Icecap show a step-wise change that contributes to the conjunctures of the 15th century (Meeker and Mayewski 2002) (2). An analysis of the intensity of modelled climate perturbations likely to have been experienced by the Norse settlements in SW Greenland indicates different periods of potential climate hazard. The intensity of change is defined as the duration of perturbation combined with the magnitude of deviation from the long term mean. Climate data for the Greenland settlements is derived from a GCM (Schurer et al. 2012), that has been calibrated to the local meteorological record (Carstensen et al. 2011). The five most intense temperature anomalies (Rank 1= most intense) are highlighted along with the unprecedented storminess of the 15<sup>th</sup> century; the Norse seem to have survived some of the coldest episodes of climate to have occurred during the settlement period but not the conjunctures of the 15<sup>th</sup> century.

Dimension UNDP meaning	Archaeological Variable	Salinas	Zuni	Greenland	Iceland
<b>Economic:</b> Assured Basic Income (may be reduced by inequality)	Interregional trade/interaction (uncontrollable) <b>1</b>	More imports (Glaze A).	Became even more insular; Zuni separates from larger region.	Declining European demand for walrus ivory.	Start of commercial fishing; importing barley; more reliance on foreign trade.
	Intraregional trade/interaction <b>2</b>	Contracting Chupadero network. More local, less regional interaction.	More local, less regional interaction.	Increasing diversity of land organization and management.	Increasing diversity of land organization and management.
	Inequality – general <b>3</b>	Non-material inequalities become entrenched.	Non-material inequalities become entrenched.	Emerging elite.	Elite become royal office holders. Mega-landowners emerge.
	Resource/capital owners are separate from users <b>4</b>	-	-	Elite increasingly own economic resources and control trade.	Elite increasingly own economic resources and control trade.
<b>Sum</b>		Slight decrease	Minimal decrease	Decrease	Slight decrease
<b>Food:</b> Physical and Economic Access to Basic Food	Climatic effects on productivity & reliability <b>5</b>	No change, perched water table.	Minimal change; used to changing regimes.	Farming/grazing more difficult; shift to hunting migratory seals.	Farming/grazing may have become more difficult; less diversity. More (risky) reliance on seafood..
	Social changes affecting productivity & reliability <b>6</b>	Conflict may have made farming more difficult/risky. Long distance to water.	Increased distance to fields may have made farming a little more difficult.	Church drives increase in productivity, but demands tithe.	Stabilizing parish organization increases security.
	Skeletal indicators <b>7</b>	NA / No change	No evidence	No change	No change
<b>Sum</b>		Minimal decrease	Minimal decrease	Decrease	Possible decrease
<b>Health:</b> Medical	Skeletal indicators <b>8</b>	No change	No change	No change	No change, at this point (Great Plague 1402-3)

Table 1. UNDP dimensions of human security, archaeological variables (AV 1-17) used to assess them, and evidence for the four cases.



<b>Dimension</b> UNDP meaning	Archaeological Variable	Salinas	Zuni	Greenland	Iceland
<b>Environment:</b> Threats to Resources (water, soil, vegetation)	Resource depletion (could be short term) <b>9</b>	No change. Large fauna depleted later.	No change.	Manage reindeer to minimize over-hunting; fuel depletion; localized erosion.	Management of waterbirds, non-migratory seals.
	Resource degradation (e.g., erosion) <b>10</b>	No change	No change	Unknown	Ongoing erosion; efforts to conserve woodlands.
<b>Sum</b>		No change	No change	Slight decrease	Increase
<b>Personal:</b> Physical Violence (warfare, abuse, dangerous activities)	Warfare <b>11</b>	Conflict, burned Villages.	Possible increased threat of violence; some evidence of violence along edges of Cibola region.	Possible Thule threat.	End of civil war; fighting mostly restricted to nobility.
	Dangerous occupation <b>12</b>	-	-	Yes, more so w/ sea ice.	Possibly more w/ fishing.
<b>Sum</b>		Decrease	Very slight decrease	Decrease	Increase
<b>Community:</b> Group/Religious continuity	Community continuity <b>13</b>	Yes	Yes, but frequent relocation	Yes	Yes. Parishes stabilize.
	Religious <b>14</b>	New practices	New practices	Decreased access to priests.	Church stronger, more centralized.
<b>Sum</b>		Little overall change	Little overall change	Decrease	Slight increase
<b>Political:</b> Human rights; Oppression, Autonomy	Political oppression <b>15</b>	-	-	-	Better justice system (theoretically).
	Inferred change in autonomy <b>16</b>	Decrease w/ aggregation.	Decrease w/ aggregation.	No change	Possibly more repressive.
	Religious oppression <b>17</b>	Unclear	Unclear	Unclear	Stronger church, more repressive.
<b>Sum</b>		Slight decrease	Slight decrease	No change	Mixed, overall increase

Table 1, continued. UNDP dimensions of human security, archaeological variables (AV 1-17) used to assess them, and evidence for the four cases.

glaze-painted ceramics that were part of new religious practices involving ceremonies held in the newly created plazas. Feasting activities may have occurred with increasing frequency and intensity beginning in the late 1200s and early 1300s (Spielmann 1998). These ceramics were used as serving vessels during public feasting events, and thus would have been highly visible. In both areas people produced vessels with a fundamental concern for how they would be viewed (Chamberlin 2008; Peeples 2011), suggesting that the identification of similarities and differences among individuals and social monitoring during public gatherings were key components of religious ceremonies. The new religious practices may have also been precursors of Katsina ceremonies, which emphasized both social integration and social control.

These changes have implications for personal, community, and political security. The apparent stability of community membership (AV13) would have maintained community security, which might have been enhanced by the integrative aspects of the new religious developments (AV14), although at Zuni the short lifespans of the nucleated pueblos might indicate instability (Kintigh 1985). Although religious change might normally destabilize a community, we interpret the new ceremonial developments – with their emphasis on group ritual – as contributing to community security, thus we conclude there was little change in overall community security in both the Southwest cases. The newly aggregated sites, large-scale construction, and plaza-orientation would have increased the potential for surveillance and social control, which might also have been part of the new religion. These developments would have decreased the autonomy (AV16) of households in general, and especially of women whose corn-grinding labor was increasingly structured and subject to monitoring (Hegmon et al. 2000).

Actual or threatened violence would have decreased personal security (AV11).

The circa 1300 changes would have had a slight effect on economic and food security at Zuni and Salinas. In both areas interaction was more locally focused, other than Salinas's dependence on the importation of Glaze A ceramics (AV1and2), thus there would have been little dependence on outsiders. Material inequalities are minimal in most of the Southwest, although differences in power and knowledge can have serious economic implications, affecting access to both material and ceremonial resources. Such non-material inequalities are well-known ethnographically and may have solidified in the aggregated post-1300 villages (AV3). The newly aggregated settlement pattern and possible threat of violence may have made access to fields more difficult, thus decreasing food security (AV6).

#### *North Atlantic*

Iceland, which was colonized by Norse people in the late 9<sup>th</sup> century, had traditionally been governed by an oligarchic system of chieftains (Vésteinsson 2006). In the mid-1200s there was a bloody civil war in which a few mega-chieftains unsuccessfully battled for national supremacy; finally, in 1262-1264 they decided to recognize the overlordship of the Norwegian king. This affected peoples' lives and security in a number of ways.

Although chiefly competition continued under the ruling of the king, it mostly involved elites and spared the commoners, so personal security (AV11) increased. A new system of justice was established that (theoretically) guaranteed fair treatment for all, thus increasing political security (AV15). Communities were centered around parishes, and parish organization stabilized with the strengthening of the church (AV14), thus increasing community security (AV13).

However, these same changes would have increased the potential for repression within communities (AV16) and by the church (AV17).

Iceland became increasingly linked to foreign trade in the 14<sup>th</sup> century. The elite increasingly owned critical economic resources, such as coastal land and ships, as well as controlling trade. Dried fish replaced wool products as the principal export commodity, reflecting increased involvement with, and dependence on, foreign markets. These changes would have decreased economic and food security in a number of ways: they increased inequality (AV3), separated many people from their means of production (AV4), and made the local economy more reliant on foreign trade partners (AV1). The many unusually cold periods would have made farming and grazing more difficult, thus decreasing food security (AV5) on top of the economic changes.

Finally, although Iceland is known for terrible erosion, at this time people made efforts at conservation. Woodlands, which had already been degraded by charcoal production, were increasingly managed and preserved (Dugmore et al. 2007), and the harvest of many animal species was carefully controlled. Therefore environmental security, which was decreasing from climatic impacts, would have stabilized or increased, likely at the cost of increased human labor input and increasing social inequality.

In comparison, Greenland experienced very different conditions. Norse settlements were hard hit by the cold periods and by their increasing isolation from Europe. The settlements were established ca. AD 985-1000 as trading locales by hunters who provided walrus ivory and furs for the European markets; people subsisted on combination of agropastoralism and exploitation of marine

resources, but their livelihood depended on European trade (including the import of iron). Walrus hunting was concentrated in the Disko Bay area, which required long (up to 800 km) sea journeys in open boats. The tusks and portions of the dense skulls were then transported back to the settlements for extraction; fragments of walrus maxilla are found in nearly every archeofauna assemblage from this period.

For a number of reasons, the situation became more difficult beginning in the mid-1200s. Increasing sea ice on the west coast would have made the journeys to Disko Bay even more dangerous, decreasing personal security (AV12). European demand for walrus ivory declined because of changing art styles and new access to African elephants, thus dramatically decreasing economic security (AV1). This situation would have been exacerbated by increasing inequality (AV3), including elite efforts at controlling economic resources (AV4). The cold temperatures made farming and sheep-raising more difficult, thus decreasing food security (AV5). The sea ice also eliminated habitat for local populations of harbor seals, which had been an important resource, thus decreasing food security (AV5). At the same time, the sea ice brought with it large populations of migratory harp and hooded seals, which were hunted communally in the lean times of early spring. Isotopic studies indicate that the Greenlanders took advantage of these changing migrations and increased their consumption of marine resources at this time.

Finally, the Greenlanders were further affected by events in the larger world. Increasingly cut off from trade, they had less and less contact with Europe, including the Norwegian Archbishop, and thus less access to priests; the last ordained bishop living in Greenland died in 1378. For Christians who believed that an intact and functioning church

and priesthood were necessary for salvation, this would have been a dire situation. We classify this as a decrease in community/religious security (AV14). Also, around AD 1200 the Thule (Inuit) migrated to northern Greenland. Norse Greenlanders traded with the Thule, but there is also evidence of Thule-Norse conflict and thus a decrease in personal security (AV11). Such conflict is evident in an 1379 Icelandic source, which indicates that the “Skraelings” attacked and killed 18 Norse, though the location of the attack is unknown.

**Comparisons and Conclusions**

The goals of this research were to (1) develop and apply a methodology to assess and compare the human experience in these very different cases; and (2) consider both the causes and consequences of continuity in these cases, with implications for today’s world. Together these address the usually implicit assumption that continuity is better than collapse by focusing specifically on the human and environmental costs of both.

Our methodology (Goal 1) was developed based on the UNDP dimensions of human security, and changes in those dimensions through the interesting times (ca. AD 1300)

are summarized in **Table 2**. Greenland stands out from the other cases; people there experienced clear decreases in economic, food, personal, and community security. In a sense, these difficulties are beginning of the end. The Norse settlements did not survive the 16<sup>th</sup> century and the last settlers probably died of starvation. In this case continuity is a testament to the people’s amazing fortitude, but it should probably not be interpreted as a success story.

In contrast, Iceland, Zuni, and Salinas persisted in the long term; Zuni and Iceland are vibrant communities today, Salinas declined only after Spanish contact. In these three cases, people’s experience of the interesting times was, overall, much more benign. In Iceland human securities increased overall; in the two Southwest cases people experienced some, mostly minimal, decreases. These three cases illustrate that long-term continuity is – perhaps necessarily – associated with tradeoffs. Strategies that helped to maintain (or minimized decline in) food, economic, or personal security were associated with decreases in personal or household autonomy (AV16 in Table 1), and equality (AV3and4 in Table 1). For today’s world, this suggests the importance of

Dimension	Salinas	Zuni	Greenland	Iceland
Economic	Slight decrease	Minimal decrease	Decrease	Slight decrease
Food	Minimal decrease	Minimal decrease	Decrease	Possible decrease
Environment	No change	No change	Slight decrease	Increase
Personal	Decrease	Very slight decrease	Decrease	Increase
Community	Little overall change	Little overall change	Decrease	Slight increase
Political	Slight decrease	Slight decrease	No change	Mixed, overall increase

Table 2. Summary of changes in the dimensions of human security by case.

considering both the benefits and costs of any strategy, including strategies that promote social continuity. In these three cases – from an outsider’s hindsight perspective – the human costs do not appear to have been terribly high. NABO researchers are documenting a different situation in the Faroe Islands (Figure 2), which, in contrast to Greenland and Iceland, maintained social continuity with relatively little negative environmental impact. But the social and ecological stability of those settlements came at the cost of terrible repression of large sectors of society (Seth Brewington, personal communication, November 2011).

These comparisons and conclusions suggest several avenues for future research. More work is needed to develop and refine methods for assessing the human experience in the past, using the UNDP dimensions of human security or other means. A newly formed working group of the Global Human Ecosystems Alliance (<http://www.gheahome.org/>) is beginning to do just that. This methodology should be directed towards understanding the nature of tradeoffs in various situations. Is there, sometimes, a Rousseau-like social contract, in which the loss of some personal autonomy is compensated for by a well-functioning society that enables other kinds of freedoms? Conversely, why, at other times, is social and ecological stability associated with severe declines in human security? Answering these questions demands consideration of the different experiences of different sectors of society, a topic only hinted at in this brief paper. If there are tradeoffs, who benefits and who might suffer?

Finally, better tools for understanding the human experience will allow us to investigate factors that contribute to the vulnerability of human securities. Mike Davis (2001) recently explored the effects of the failure of the

monsoons in the late 19<sup>th</sup> century. In some cases, such as British controlled India, tens of millions of people starved to death; in other cases, such as the Chinese Confucian state, relief efforts worked fairly well and minimized human suffering. We need to understand if similar processes with starkly different consequences characterize the most distant past as well, and use our investigation to delve into the causes and how they can be changed.

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