LLL Innis 7.
Holocene Climatic Changes –
the Medieval Warm Epoch
An exceptionally warm Arctic
Cave art – around 30,000-10,000 BP.
Early art – 60,000 to 70,000 BP
The causes of plant and animal domestication are unclear, but climate change appears to have been an important, perhaps critical, factor.

Domestication seems to have taken place independently in several places (hearth of domestication).

It is coincident with the climate shift called the Younger Dryas.
Perhaps the environmental disruption caused by the Younger Dryas forced people to modify their hunting and gathering economies to ensure a more dependable food supply.

Remember that the earliest domesticates were all grasses – weedy plants of open and disturbed environments, and that the first domestication appears to have happened in marginal situations.

Why?
Holocene climatic changes
So the domestication of plants and animals brought higher food production and created the **food surplus** that ultimately brought civilization. However, instead of reducing the impact of climatic vicissitudes on society, it increased vulnerability.
What is civilization and how does it contribute to its own demise?

- Material and institutional components;
- High population densities/urbanization
- Social stratification and elites
- Occupational specialization
- Centralized government
- State religion
- Monumental public buildings
- Language and art
- Math and other sciences
- Standing armies
- Trade
Some negative aspects;
- Patriarchal society and the subordination of women
- Coerced tribute
- Frequent warfare
- Slavery
- Epidemic disease
- Massive modification/deterioration of environment
In his book ‘Collapse: How Societies Choose to Succeed or Fail’, Jared Diamond suggests that most civilizations rise, shine and decline. He identifies a suite of characteristics that may predispose a society to failure;
- A. rapid population growth
- B. pressure from enemies/competition for resources
- C. unstable trade partners
- D. societal responses to the above
- E. environmental damage
- F. failure to respond to climate shifts and uncertainty

Often environmental damage and climatic shifts appear to be critical factors; the last straw.
Many have proposed that this susceptibility is reflected in the rise and fall of many civilizations – in the Americas (Moche, Nazca, Anasazi, Maya, etc.), in the Near East (Ur, Sumer, Akkad, etc.), the Far East (Indus civilization, the Chinese dynasties, etc.), in Africa and the Mediterranean (Sahelian societies, the Roman Empire, etc.).
TEMPERATURE CURVE LAST FIFTEEN THOUSAND YEARS

- Present temperature
- Holocene Warm Period
- Roman Warm Period
- Medieval Warm Period
- Little Ice Age
- Present global warming
- Gulf Stream shut down?
- Warming at end of Younger Dryas
- Younger Dryas cooling
- 8200 yr cooling

Temperature in central Greenland ice core

Date: 13,000 BC to 2000 AD
Climate change and the rise and fall of civilizations

More than coincidence?

The decline and fall of many civilizations coincided with periods of climate change, and there are also correlations between climate change, population size and the frequency of wars, as data from Europe shows (right).

Western Roman Empire
- ~250 to 500 AD
- Climate became extremely variable

Mycenaeans ~1100 BC
- Centuries-long dry period

Hittites ~1200 BC
- Centuries-long dry period

Tang Dynasty 907 AD
- Century-long dry period

Egyptian New Kingdom ~1100 BC
- Centuries-long dry period

Akkadian Empire ~2200 BC
- Centuries-long dry period

Khmer Empire ~1300 AD
- Floods and drought

Harrapans ~1800 BC
- Shift in monsoon rains

Maya ~900 AD
- Century-long dry period

Moche ~600 AD
- Floods and drought

Tiwanaku ~1100 AD
- Centuries-long dry period

(Data in normalised units to show relative amplitude)
Climatic shifts and the rise and fall of Near Eastern civilizations.
Dynastic changes in China and the monsoon.
Societal changes and solar activity in Northern China.

Peer Reviewed Study: Last 1,800 Years of N. China Temperatures & Precipitation

Significant historical Chinese events, with major solar activity periods identified

- Goryeo-Khitan Wars begin
- Mongol Invasion Song Dynasty collapse
- Yuan Dynasty collapse
- Mongols Capture Ming Emperor
- Little Ice Age Cooling
- Solar Max.
- Medieval Warming
- Medieval Solar Max.
- Movement Min.
- Medieval Warming
- Modern Warming

Temperature Anomaly (°C)

Precipitation Index


Events by www.climate.noc.com
Climatic changes would have involved nomadic societies too.
Clearly there are processes operating at different temporal and spatial scales;

A. those operating over centuries and millenia. These may be seen as climatic change.

B. those occurring at a decadal or smaller scales. These are perceived as climatic variability.

Some appear to be distinctly cyclical.
Climate Change & Variability Concepts

- Climate variability
  - Short term: (years) rises and falls about the trend line

- Climate change
  - Long term: multi-decadal to century trends

Reference period
The first includes the long-identified phases that include the **Younger Dryas**, the **Minoan**, **Roman** and **Medieval Warm Periods** and the **Little Ice Age**.

The second includes **ENSO (El Nino/Southern Oscillation)**, including **El Nino and La Nina**, the **North Atlantic Oscillation** and the **Pacific Decadal Oscillation**.
We need to remember that climatic shifts in the Holocene were small.
They often appear to be cyclical.
Most of our current focus is on global warming, but we recognize that there is a ‘package’. Hence the term climate change should be preferred.

For example, the package is likely to include – increase/decrease in the growing season, the number of frost-free days, changes in storminess, in maximum and minimum temperatures, increase/decrease in the number of rainy days, cloudiness, number of snow days, etc.

All of these may have economic, political and social consequences.
We need to recognize that climatic shifts at any scale operate through changes in the mechanics of the atmospheric and oceanic circulations – perhaps a temporary displacement of ocean currents, a change in the position of the jet stream, a change in the intensity of the general circulation, etc. They don’t require radical regime change.
Average length of the growing season (frost-free period). A 1°C reduction in mean temperature translates into 15 less days for crop growth.
Finally, we need to understand that there is a geography to climate change.
Back to Holocene climate shifts –
to century to millennial scale events

Let’s look at two of these;

A. The Medieval Warm Period/Epoch – a relatively warm period between about 900AD and 1350AD.

B. The Little Ice Age, 1350AD to 1850AD (next week).
The Medieval Warm Epoch.

This event may have had only regional rather than global impacts. It appears to be a North Atlantic phenomenon and likely a response to changes in the strength of the NA oceanic circulation and the behaviour of the NAO.
Some have suggested that the MWE was driven by changes in sunspot activity.
The MWE was marked by warmer summers with less frost risk and longer growing seasons. Hence crops could be grown further north and higher up in mountainous areas.

A largely ice free Atlantic allowed ease of movement and fostered the settlement of Iceland and Greenland and exploration of the eastern seaboard of North America.
The Vikings and Their Travels

- A neat example of the effects of climate on settlement can be seen in the Viking travels in Europe and across the Atlantic.
- In the North Atlantic, this meant colonization of first Iceland, then Greenland and (nearly!) North America.
- Their NA activities spanned the Medieval Warm Epoch and the early part of the LIA.
The Vikings were much more than pirates. They were farmers, traders, colonizers and explorers.

They spread out from Scandinavia about 800 AD. First across much of western and eastern Europe and the Mediterranean, then to the Faeroes and the British Isles, Iceland, Greenland and North America.

Much of what we know about their North Atlantic travels comes from the Sagas (Greenlanders’ Saga, Erik the Red’s Saga, etc.).
THE MEDIEVAL WARM PERIOD AND THE LITTLE ICE AGE

- ca. 1000: Vikings at L'Anse aux Meadows, Newfoundland
- ca. 1350: The "Western" Greenland Settlement abandoned
- ca. 985: The Viking Sagas

Timeline:
- Medieval Warm Period: 900-1400
- Little Ice Age: 1400-2000
A Viking longship. On long voyages and trade missions they often used stouter vessels (knarrs).
Tempers must have got frayed!
Viking settlement in the British Isles.

Pillaging the monastic settlement of Lindisfarne
Vikings in the North Atlantic.
By 950 AD, they had settled in southwestern Greenland (Western Settlement, Eastern Settlement), in part because of political intrigue in Iceland.

This extension of the Viking realm coincided with the Medieval Warm Epoch that made travel easier across the Atlantic and made agriculture less marginal in Greenland.

It’s doubtful that the total population of Greenland was ever more than 8000.

By 1430 AD, the settlement ceased.
Eastern Settlement centred on Brattahlid.
Viking house types
Why did the settlements fail?

- Overextended supply lines.
- **Over-use of resources.** There were major shortages of wood and iron.
- **Deteriorating climate.**
- Failure to adapt.
- **Increasing interactions** with Thule Inuit (Skraelings).
- ‘Forgotten’ small population, with few marketable resources.
- **Effects of the Black Death** (even though it did not reach Greenland).
The Lewis chessmen – Greenland walrus ivory.
Movement of Thule peoples across the Arctic
Leif Erikson and Vinland

Several trips were made from Greenland to North America.

Although there are Norse finds across the Canadian Arctic and many bogus Norse materials across North America, the only recognized Norse settlement is that at L’Anse aux Meadows, in northern Newfoundland.

What might have stimulated Norse interest in North America? Why didn’t they stay?
General map showing the Viking routes, including the Way West, the route from Norway to Iceland, to the Norse settlements in Greenland and hence to North America. Drawn by C. Fursund. After Canada Department of Mines and Technical Surveys.
The village of L’Anse aux Meadows
Epaves Bay in July
Figure 2. Plan of the L’Anse aux Meadows archaeological site. B. Gallant and B. Wallace, for Parks Canada.

Remains of sod huts at LAM
Reconstructions of the sod huts
Norse artifacts from LAM

1: stone lamp, indent for animal fat and wick
2: spindle whorl, carved soapstone used as small flywheel on spindles
3: carved wooden pieces, use unknown believed to be for ships
4: ship repair part
5: clothing pin used by men and women to fasten outer garments closed
LAM as a multicomponent site
Excavations on the seaward side of the site
The archeological finds show that LAM was a multi-component site with a settlement history of several thousand years.
Current landscape around LAM. The dearth of tall trees may be recent; the result of overcutting for fuel.
Stunted fir (tuckamore)
It is doubtful that LAM was occupied more than 2 or 3 times and only for short periods. It may have been a way station; a place for regrouping, boat repair, etc. There is no evidence for extended settlement (farming, etc.). There is some evidence that they did voyage further south, but no other equivalent to LAM.
Any evidence that they went elsewhere?

There are numerous Norse ‘finds’ across the Arctic, in eastern Canada and the central US.

Some of the materials are genuine, but their context is problematic.

These fakes include the Kensington Stone, Minnesota, and the genuine artifacts include the Beardmore relics from Thunder Bay. These are Norse, but the site was seeded.
In the Sagas, the area is referred to as ‘vinland’. Did that mean wild grapes? There is some reference to ‘grape trees’ possibly trees festooned with vines.

Distribution of *Vitis labrusca*.
A butternut (Juglans cinerea) found at the site implies that the Vikings went at least as far as Nova Scotia.
Vinland (?). These are proposed Norse voyages. None can be authenticated.
Kensington Stone and the Newport tower.
‘Viking’ mooring stones. Minnesota (below) and North Dakota (left).
The Beardmore relics were ‘discovered’ in 1930.
Although we focus on the Viking journeys cross the North Atlantic, it was likely that they were not the first European to settle the Faeroes or Iceland. Irish monks did.

It may be that St. Brendan had reached North America before the Norse.
St. Brendan’s stone, at St. Lunaire, is less than 20 km from LAM. Ogham script (below).
Around 530AD, St. Brendan and 14 other monks started an eight year voyage. It’s unclear where they went.
Next week we’ll look at the Little Ice Age, a cold episode that followed the MWE. It was a global phenomenon, although its effects were most pronounced in Europe.