

# Chapter 4

## Cultural Heritage, or How Bad News Can Also Be Good



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**Abstract** The material cultural heritage of the High Arctic encompasses evidence of both indigenous and non-indigenous presence all over the area. Indeed, the term “Arctic wilderness” in the popularly-accepted understanding of areas that are untouched by humans, scarcely exists. Humans have left their mark all over the tundra in the form of unnatural stone arrangements that might have been a camping site from a few thousand years ago or a sign to show the way, mounds that indicate a collapsed dwelling site, or piles of animal and fish bones where a small group of families had their village long ago. In areas with no indigenous population, such as the archipelago of Norwegian Svalbard, humans first began their resource-exploiting activities in the early seventeenth century, and successive waves of hunters, explorers, prospectors, scientists and tourists have left behind the ruins and relics that we today consider to be heritage worthy of protection as sources of interest, appreciation and, not least, knowledge into the past.

Climate change is challenging the preservation of the Arctic cultural heritage as coastal erosion and milder, wetter and wilder weather conditions break down what was once protected by a dry and frozen climate. Work to protect and manage the heritage sites can seem as depressing as the stories of diminishing and threatened polar bear populations. However, also here there are several sides to the story and this chapter will present some of the positive results and implications of the climate change scenario on Arctic cultural heritage. These include enhanced understanding of the “population” of heritage sites and thereby of the whole history of the High Arctic, as well as increased international research and cooperation which has brought professionals in Arctic and Antarctic fields closer together.

**Keywords** Cultural heritage · Svalbard · Tourism · Threats · Positive developments

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## 4.1 Introduction – Cultural Heritage Attracts Travellers

A rather random and not very scientific glance through several websites advertising Arctic Cruises and Arctic Expedition Cruises indicates that polar bears and “untouched wilderness” dominate as bait to catch the eye of the expectant holiday planner. Surprisingly there is little immediate information about the wealth of historical sites that in practice often are the goals for many of the shore excursions that such cruises contain. One website describes the experience thus:

Each day is planned to take advantage of local ice and weather conditions. Svalbard is one of the few places on the planet to offer such a plethora of natural and historical extravaganzas [this author’s underlining]. Spend the next 9 days exploring the remote polar regions. Visit ice-sculpted fjords with breathtaking mountain scenery, and glaciers crashing into the sea. Spend time exploring pack ice edges in search of polar bears hunting seals. At one or more of the stops, it’s possible to encounter Svalbard’s Arctic fox and the region’s unique reindeer (*G-Adventures 2018*).

As we see it is mainly the plethora of natural extravaganzas that is meant to lure the tourists into the company’s net. However, with more experience of the Arctic it is possible to argue that the term “Arctic wilderness” in the popularly-accepted understanding of areas that are untouched by humans, scarcely exists and that those nature seekers who go ashore at various sites will almost inevitably also be exposed to cultural heritage. The Norwegian archipelago of Svalbard has been rapidly increasing as a cruise destination for many years now. The number of passengers who are put ashore at sites around the archipelago outside the main settlement areas increased from 29,340 in 1996 to 84,104 in 2015 (*MOSJ 2017*). The coastal areas are dotted with remains of human activities dating from the beginning of the seventeenth century when whalers — mainly Dutch and English — established land stations at suitable bays and beaches. They were followed in rapid succession by other temporary inhabitants in search of other resources for hunting and trapping or for mineral exploitation. Scientists and explorers have also left their mark and even World War II did not leave this once-remote archipelago alone. Further inland, in the areas that are not covered by glaciers, there are naturally enough fewer cultural heritage sites, but even so one can here and there find evidence that others have been there before, be it land surveyors’ cairns or remains from prospecting or scientific work.

In the larger areas of the Arctic that have had an indigenous population for thousands of years the tundra can be dotted with stone formations from paleo-Eskimo dwelling sites, cairns that point the way along ancient hunting or migration routes, mounds of turf, large bones and stones that indicate a collapsed dwelling, middens (historic ‘rubbish dumps’) of fish, bird and animal bones where a small group of families stayed for a longer time. Very often it takes a trained eye to spot and interpret these historical sites that cannot match the splendour of castles and cathedrals in other areas, but which are equally important and irreplaceable for their ability to help us understand and appreciate the past in this region.

Despite the glimpse into cruise websites mentioned above, experience shows that nature is not enough for many cruise operators to offer their guests. If an historical site is to be found on the way, it will inevitably become the event of the day. According to the reports on *TripAdvisor*, this can strike the tourists in quite different ways. For example from the ruined Norse stone church on Hvalsey, south Greenland, a selection of reviews (TripAdvisor [Undated](#)) tell us:

It is a cool place for history lovers. Viking era and viking trails. You will enjoy the scenery of the beautiful Greenland

The ruins are interesting if you are “into” that sort of thing. It is certainly not worth a trip to Greenland just to see these.

A trip to Hvalsey church is well worth the effort. The ruin itself may not be as impressive as buildings of similar age in Europe, but this is more than made up for by its stunning location at the end of a fjord.

What the wealth of websites offering cruises and other tourist visits to the Arctic *can* tell us is that the Arctic, and particularly the High Arctic, has been opened up to tourism in a way never known before. It is not necessary to delve deep into the climate statistics for most people to have gathered by now that the Arctic is warming and that there is less sea ice. As a result of this, cruise ships now sail where only ice-strengthened ships previously could go with any degree of safety and success. In 2010, Norwegian polar expeditioner Børge Ousland with three companions sailed a glass-fibre catamaran through both the Northern Sea Route and the Northwest Passages, thus circumnavigating the Arctic in one season (Amtrup 2010). At the same time the Russian sailing boat *Peter I*, with Captain Gavrilov and crew, also completed the circumnavigation (Dormer 2010). One hundred years earlier it would have taken the specially-designed and built ships such as Fridtjof Nansen’s *Fram* and Roald Amundsen’s *Maud* about 6 years to manage the same.

So now we are getting to the crux of the matter. Climate change and increasing tourism go hand in hand, and with them go the extra impacts on the cultural heritage in the Arctic today. Tourism to the Arctic is not new. Gentlemen travellers in their own or hired yachts were sailing to Jan Mayen and Svalbard at the end of the nineteenth century both for the travelling experience, for hunting (walrus and reindeer were popular trophies in addition to polar bears) and not least for the collecting of facts about the geography and nature of the areas; anything they could record was new information. Lord Dufferin’s “Letters from High Latitudes” describes just one example of such a trip and this travelogue achieved great and international success in its time (Dufferin 1857). “Package tourism” for the relatively wealthy without their own yachts rapidly followed, and not least spectacular exploration expeditions such as the Swedish balloon expedition led by S.A. Andrée which attempted to fly from Virgohamna in northwest Svalbard to the North Pole in 1896 and 1897 drew boatloads of tourists to the area both at this time and later. The same Virgohamna was the scene for American journalist Walter Wellman’s more or less serious attempts to fly to the North Pole by airship in 1906, ‘07 and ‘09. Remains of both Andrée’s and Wellman’s base camps litter the bay today and are since 1974

(Andrée's) and 1992 (Wellman's) protected by the cultural heritage law for Svalbard. The fixed and movable objects and artefacts shall neither be disturbed, damaged or removed. Norwegian Arctic scientist and leader of the Fram expedition across the Arctic Ocean in 1893–1896, Fridtjof Nansen, visited Virgohamna during a scientific cruise to Svalbard with his own yacht in 1920 and noted:

The most of useful and valuable objects, particularly of metal, had by now I presume been plundered, but there was still much left – trappers and tourists had not yet managed to get it all (p. 145). [...] And then the tourists come here and scratch their names everywhere, and help themselves to souvenirs (Own translation; Nansen 1920, p. 145, 146).

## 4.2 A Pan-Arctic Population of Cultural Heritage Sites

The Arctic is full of history, stretching over thousands of years and leaving behind a wealth of cultural heritage sites that are current witnesses to the stories of the past. Despite their often extreme modesty in an overwhelming natural landscape, the sites are as important to the complete history of mankind as are more imposing sites such as the pyramids in north Africa and South America. Without the Arctic sites we would know far less about the spread of mankind from Asia, across the high north of Alaska and Canada, and down the coasts of Greenland. It would be difficult to piece together the history of the earliest peoples who appeared and disappeared as living conditions tipped back and forth from the barely possible to the impossible. It would in addition be difficult for us to imagine and understand how early entrepreneurs scraped their living in a climate that cost hundreds of explorers their lives (Barr et al. 2013).

Broadly speaking the cultural heritage of the Arctic has two main categories: indigenous heritage and the heritage which has its origins in cultures further south, usually from individuals or smaller groups which moved north mainly to exploit natural resources by hunting, trapping, fishing, whaling and mining, but also for other purposes such as exploration, research and social work. The many-faceted cultural sites and landscapes of the Arctic have values that are important to people, from the individual to the international level. They are our main source of knowledge of how humans interacted with the Arctic nature over time. They reflect the motives behind this interaction and the ways in which the Arctic has been understood and interpreted. They are the inspiration for stories of human endeavours and achievements. For indigenous peoples they are also associated with both the intangible heritage and contemporary living, thus forming a basis for self-definition and sense of place in an historical context that stretches into the future (Ibid., p. 6, 7).

Internationally significant Arctic sites have qualities that are different from many other sites around the world that are recognised as internationally important. They tend to be less recognisable as physical structures and they challenge the notion of

culture as being separate from nature. At the same time they are not hidden by the growth of higher vegetation and by later cultural layers, and the climatic conditions have up to recent time ensured a remarkable preservation of organic materials not seen further south. In addition, the sites that represent the early exploration of the Arctic have gained a mythical quality that has been disseminated in art and literature through many generations (Ibid., p. 7).

The high Arctic territories belong to five different nations: Russia, Norway, the Kingdom of Denmark (Greenland), Canada and USA. Each nation has its own laws and policies relating to cultural heritage. A complete inventory of the “population” of cultural heritage sites is as difficult to obtain as a scientific estimate of the total population of polar bears as explained by the Polar Bear Specialist Group (PBSG):

For the 14 subpopulations with scientific estimates, the sum of the mid-point estimates is 18,349 bears (...). The PBSG expects that the number of bears ranges from several hundreds to a few thousands [this author’s underlinings] in each of the subpopulations in Chukchi, Kara, Laptev and East Greenland, bringing the midpoint estimate to approximately 25,000 (PBSG 2014).

Fixed cultural heritage sites should reasonably be easier to count than wandering bears, but there can be differences of methodology, definition and access to information that make a total estimate difficult also here. The Law on Environmental Protection for the Norwegian archipelago of Svalbard (Norway 2001) sets 1.1.1946 as the cut-off date for automatic legal protection of all fixed and moveable cultural heritage regardless of provenience and condition (Ibid., § 39). Therefore, there can be protected rubbish dumps from activities during World War II or from international scientific activities pre-dating 1946 that have the same level of recognition and protection as the remains of early seventeenth century whaling stations or early nineteenth century hunters’ and trappers’ simple wintering cabins. This all-encompassing status of automatic legal protection with pre-1946 as the cut-off dating makes as a starting point a potentially uneven definition of cultural heritage in a pan-Arctic connection where other national cultural heritage regimes have their own definitions of cultural heritage worthy of legal protection. In Svalbard a total of 2684 legally-protected heritage sites and monuments have been registered in Askeladden, the national database of protected cultural heritage throughout Norway (Directorate for Cultural Heritage, Norway). This number includes two younger complexes: a large system from the 1950s to 1960s for coal transportation from the mines to the shipping quay and a scientific station from the International Geophysical Year 1957–1958 consisting of 10 separate buildings. It does, however, open for the question as to whether a site containing several monuments is to be counted as one or several. As an example, if a seventeenth century whalers’ graveyard is registered as one site, but contains 20 graves, how will the diminishing of the site through coastal erosion — i.e. separate graves being gradually washed into the sea — be registered? By not registering each grave separately it can be difficult to quantify the actual loss.

In contrast, the Greenlandic Cultural Heritage Law (Greenland 2010) sets 1900 as the cut-off date for automatic protection, which excludes the Danish and Norwegian hunter/trapper cabins from the 1920s to 1940s that are a large feature of the protected Svalbard heritage. These cabins in both areas were established by the same types of people in the same time period and using similar designs and materials. It must be mentioned, however, that the cabins in northeast Greenland are to a great extent restored in recent years by a private interest group and with the permission of the heritage authorities.

In other regions of the Arctic the component of indigenous heritage is naturally large and can consist not only of the remains of longer- or shorter-term dwelling sites, but also of hunting, burial sites and spiritual practices. These remains can date from as far back in time as several thousand years BC. Specific examples are the alpine ice patch sites in Yukon and Northwest Territories, Canada which are evidence of caribou hunting that has been radiocarbon dated to more than 9000 years ago (Hare et al. 2004), and the caribou-hunting driveline cairns (inuksuk) and tent rings dated to over 4000 years ago that cover a large area of the Agiak Lake district of Alaska (National Park Service 2018).

### 4.3 Threats to the Arctic's Cultural Heritage

The long-held axiom of the cultural heritage in the Arctic being 'frozen in time' is suffering badly now under the effects of climate change. The axiom became particularly famous in 1987 when a book was published about autopsies that were performed in 1984 and '86 on the corpses that had been buried on Beechey Island during Sir John Franklin's disastrous Northwest Passage expedition in 1845. One hundred and forty years after the burials it was still possible to recognise the corpses and their clothing and take samples of hair and soft tissues for analysis (Beattie and Geiger 1987). Negative effects relating to cultural heritage of the warmer, wilder and wetter Arctic climate are seen through the lack of sea ice causing more coastal erosion, the thawing permafrost that disturbs structure foundations and exposes buried organic material to degradation, more rot and mould destroying wood, more stormy weather that damages fragile structures, and more visitation as mentioned in the *Introduction* above.

A map of the 100 most prioritised legally protected cultural heritage sites in Svalbard shows that they without exception are located around the coast (Sandodden 2013, p. 8). Similarly, this applies to many of the Arctic sites. This was a result of logistical and geographical circumstances: access and appropriate resources were to be found near the coast and people found little reason to travel inland. However, as the increasing lack of sea ice, also in winter, removes the barrier against wave erosion that the land-fast ice edge previously could provide throughout much of the summer and certainly the winter, and as wave action itself increases due to more

stormy weather in the Arctic, so does the coastal area around the whole Arctic suffer from increased erosion (Parry 2011). Thus in turn the coastline moves closer and closer to the cultural heritage sites which ultimately erode into the sea. The erosion can be greatly accelerated in areas with larger ice layers or lenses within the permafrost when the exposed ice thaws and the bonding effect of the ice within the ground sediments is lost.

Away from the coast thawing permafrost can add to the stress on cultural heritage by destabilising the foundations of buildings and structures. Many of the simple, but historically important wooden buildings left by trappers, prospectors, explorers and others in the Arctic were established directly on the frozen ground. As the climate becomes relatively milder and wetter, the wood is exposed to deterioration from rot and mould. This is not necessarily a new situation, but an accelerated one in the new climatic conditions.

And again, sites and monuments that have rested in peace from visitation through decades and centuries are now increasingly becoming goals for individuals and groups as the barrier the sea ice once presented retreats. Most visitors do of course not intend to have a negative impact, but both the sites and the vegetation and terrain around them are often highly sensitive to even a few boots which can inadvertently dislodge small plants which have protected or stabilised the site, and crush already degrading wooden remains of structures or artefacts. In addition, some few visitors are quite obviously oblivious or indifferent to the damage they do, perhaps by applying graffiti or with careless handling of artefacts or even by taking away “souvenirs” from sites.

#### **4.4 A Dismal Picture or a Background to More Positive News?**

We could stop here now and state that the present situation for Arctic cultural heritage is gloomy and the future is probably disastrous. But would this be the whole truth? Happily, even though admitting that the description above is correct, it is still possible to add more details to the picture to make the story both more positive and more complete. The following are areas that can give encouragement to those who are concerned about the state of the Arctic cultural heritage population. Listed in random order they are:

- Increased attention to preserving the remaining cultural heritage
- Increased historical information
- Technological advances
- Natural sciences enhanced by the humanities
- More attention given to indigenous and local knowledge
- Arctic and Antarctic heritage professionals developing cooperation and exchanges

#### 4.4.1 *Increased Attention to Preserving the Remaining Cultural Heritage*

Joni Mitchell sang “Don’t it always seem to go / That you don’t know what you’ve got / Till it’s gone” (Mitchell 1970), lyrics that it might be tempting for Arctic cultural heritage managers to have as a daily reminder. Luckily the impacts of climate change that are described above have both heightened awareness of the risk of losing invaluable heritage monuments and sites, and also given impetus to actions to save as much as possible before it may be too late. This is not to say that little was done beforehand, but to highlight that the situation today encourages new and expanded action in addition to the steady work that has taken place over many years.

In the Norwegian Svalbard archipelago, where this author has worked for many years, discovering and registering heritage monuments and sites began in a small way in the late 1970s following the first legal protection act in 1974 of all cultural heritage pre-dating 1900. Gradual appreciation of the actual population of international cultural heritage around the islands led to the cut-off date being changed to 1946 in 1992 and to a steady expansion of resources both to continue registering around the islands and to set the political ambition of less than 0.1% annual loss of cultural heritage monuments (Sandodden et al. 2013, p. 50). Without knowing what you have to start with, you cannot measure the loss. So the work to complete registration of sites and improve the quality of the database has been prioritised and is steadily being refined. At a conference on research in Svalbard held outside Oslo, Norway, in November 6–8 2017, where 300 scientists from all over the world met, the recurring theme was the need for cooperation and coordination in order to address the current global challenges. Sharing of data and open access to databases was also a major theme along the same lines (Barr, personal observation). A hope for the future is that national databases of cultural heritage around the Arctic can be made available to give us a complete overview as a basis for combined efforts to protect a representative selection of monuments and sites in the best possible way.

As a step towards international agreement on the need for and methods of protecting the cultural heritage of the Arctic, this author suggested and ultimately led during 2010–2013 a project within the auspices of the Arctic Council’s Sustainable Development Working Group (SDWG). The project to assess internationally significant cultural heritage sites around the whole Arctic and to recommend best practice for site management was born as a result of the increasing High Arctic tourism and interest in visiting famous historical sites such as the Franklin Beechey Island graves mentioned above. The project group consisted of experts from Norway (including the Sámi cultural sphere), Greenland, USA, Canada and Russia with additional input from the Netherlands (which has important Arctic sites), Sweden, the Aleut International Association, Finland and the Faroe Islands (Barr et al. 2013).

The Arctic Council’s *Agreement on Enhancing International Arctic Scientific Cooperation*, which was signed at the Fairbanks Ministerial meeting on 11 May 2017 (Arctic Council 2017) will hopefully be able to enhance further cooperation directed towards acknowledging and protecting the cultural heritage of the Arctic in



addition to facilitating scientific cooperation in the disciplines which traditionally receive the most attention.

#### ***4.4.2 Increased Historical Information***

It follows naturally from the work of registering and considering the cultural heritage as mentioned in the examples of the previous paragraph, that the need arises to research further into the origins and meaning of the sites that are discovered or found worthy to be entered into national databases of Arctic monuments and sites. A pile of stones may be from an historical dwelling site or it may indicate a grave or a cache. There is also the challenge of dating many of the remains of human activity owing to the fact of a longer preservation time in the Arctic climate and the limited diversity of materials at hand. Expert analysis and historical research is needed to be able to categorise according to age, cultural type (for example the various early Inuit cultures in Greenland), provenience of sites from visiting cultures such as explorers and resource exploiters. A simple wooden cabin or a tent ring of stones can appear at first sight to be of a significant age for protection, but with investigation into historical accounts and archives can be shown to be relatively recent.

Not least the fact that tourism to the High Arctic continues to increase leads heritage managers to act not only by introducing regulations and limitations, but to a large degree also by presenting the visitors and the tourism operators with as much information about the various historical sites as possible. Once a visitor is told or can read that this or that site was actually the very place where an important historical event took place, or is an amazingly preserved example of the will and the way to survive under far more severe climatic conditions than one meets today, then in almost all cases he/she will treat the sites with reverence and care, taking only away some photographs and a memory of a unique experience relating our own time to events long past.

In this situation of need-to-know and need-to-inform, the historical information around the various monuments and sites in the Arctic continues to grow and in turn provides material for more popular books about the history of the Arctic which hopefully in their turn increase serious interest in the region. An inspiring idea for the future would be a “David Attenborough type” documentary series that could be made about the treasures of Arctic heritage sites and the challenges facing them.

#### ***4.4.3 Technological Advances***

Television documentaries can perhaps be squeezed into the category of technological advances considering the revolutionary ways in which they now can portray their subjects. Regardless of this, new technology is also bringing advantages to

cultural heritage work in the Arctic. Repair and restoration are traditional methods of protecting and prolonging the life of buildings and structures. In seldom cases actual moving of a monument such as a small building threatened by erosion has also been used. In April 2015 a highly-prioritised trapping station from 1927 in Svalbard — *Fredheim* — consisting of a main house and two smaller buildings, was moved 37 m further in from the shoreline. Measurements of the rate of erosion started at the site in 1987, when the main house then stood 17.7 m from the edge. In 2011 the distance had shortened to 8.74 m (Sandodden et al. 2013, p. 71). Already in 2001, the oldest hut in the complex, which by then lay only 3 m from the erosion edge and was in obvious danger of falling into the sea, was moved 6 m back from the edge. While measurements in 2012 showed that the main house stood 8.5 m from the edge, in 2014 it was only 6 m away. The only alternative to letting the monument go was to move it.

Monitoring the effects of natural impacts such as erosion and degradation of wooden materials, and of human-caused impacts such as wear and tear on the heritage sites and surrounding vegetation, is an important method and such work will continue. Attention is increasingly being paid to the use of new technology in this respect. Drones can be sent to monitor sites and measure changes such as erosion increase without the operator having to set her own boots on the ground. *Historic England* describes the varied uses of drones thus:

Drones provide a useful low-level aerial platform for recording historic buildings, monuments, archaeological sites and landscapes. They can carry a wide variety of sensors including cameras, multi/hyperspectral imaging units, and even laser scanners. Drones can provide dramatic illustrative photographs of sites, but can also be used to create metrically accurate records for survey and conservation work (Historic England 2018).

In Cajamarquilla, the largest mud city on the Peruvian central coast dating back to 600 and 730 AD, drones are used to keep track of damage and invasions from human or natural causes, in order to gain a clearer understanding of the threats and develop prevention plans (livinginperu.com 2015). Many other examples exist around the globe, including from Arctic sites where erosion is particularly in focus (Geens 2016).

In addition, the development of monitoring satellites that cover the Arctic area opens a new and promising field of possibilities for remote information gathering. The European Union *Copernicus* Programme is exciting in this respect. It is aimed at developing European information services based on satellite earth observation and in situ (non-space) data (Copernicus Undated). The introduction of remote-sensing tools opens a whole new world of cultural heritage monitoring in remote environments and gives the opportunity for far more intensive studies of particular sites without the detrimental accompaniments that traditional expeditions to the areas unavoidably give, including air and sea transport emissions and direct human impact on the sites.

A further technological advancement that has been introduced to and embraced by heritage professionals is the use of scanning technology. Detailed measurements, photographs, scaled drawings and written descriptions have been the staple methods of documentation of monuments and sites. To enable this documentation to speak for itself, independent of the actual object in question, extreme care and accuracy are required which in turn means time and other resources spent in the field in gathering the documentation. By using 3D laser scanning, extremely complicated heritage sites can be captured in a short time by a pair of operators. Work on the data collected admittedly takes time, expertise and appropriate software and computer capacity in the aftermath for large collections, but this work is done back in the office and the actual field time is short and effective. This author has been involved in the total scanning of the complicated industrial and now deserted whaling stations on South Georgia in sub-Antarctica where two operators have used only a few days in the field to cover an entire station inside and out. One example can be found on *YouTube* (Geometria Ltd. 2015). Since the state of these derelict stations precludes normal visitation without special permission from the island authorities and special asbestos-protection clothing, the scanning results can be used not only for virtual visits and tours of the historical whaling stations, but also for a variety of research projects concerned for example with station layout and architecture, land use, more general whaling history and for examining details of buildings and structures perhaps with regard to possible protection of specific elements.

The technique has come to the High Arctic as well. In 2010 a laser scan was made of the historical site of Fort Conger at Lady Franklin Bay, Ellesmere Island, Canada. The paper written about the project explains that:

Fort Conger is currently at risk because of the effects of climate change, weather, wildlife, and human activity. In this paper, we show how 3D laser scanning was used to record cultural features rapidly and accurately despite the harsh conditions present at the site. We discuss how the future impacts of natural processes and human activities can be managed using 3D scanning data as a baseline, how conservation and restoration work can be planned from the resulting models, and how 3D models created from laser scanning data can be used to excite public interest in cultural stewardship and Arctic history (Dawson et al. 2013, p. 147).

The paper gives an excellent description of the use of this technology, which can be applied to all sizes and types of objects and sites.

#### ***4.4.4 Natural Sciences Enhanced by the Humanities***

Having just mentioned how the cultural heritage professionals can benefit from modern technology, it is also a fact that heritage work can benefit the natural sciences in various ways. The challenge is to get the natural scientists to become aware of this, but there is definitely a trend underway for funding agencies to insist on more cross-cutting between these traditionally too separate disciplinary worlds.

The fact of climate change in the Arctic lies behind much of what has already been written above, and the details of the changing climate have been collected through various natural science disciplines and spread to the general public through the Intergovernmental Panel on Climate Change and many other channels. However, in addition to this extensive work with observations and measurements by the natural science community, the humanities can also inform on and confirm the matter through our own disciplines of history, archaeology, historical archaeology and associated work with the material heritage.

History can tell us when a building or structure was first established and perhaps details of its situation with regard to the landscape at the time. This in turn may help to document coastal erosion. For example, it may be mentioned in the diary of a scientific expedition member how far the camp was established from the shore, or photographs of a prospecting or mining settlement may show the same. Diaries of others who used the buildings or structures afterwards may also give clues to the rate of erosion. One such example is the trapping station *Fredheim*, mentioned above. In other expedition reports and diaries there can be a wealth of information concerning meteorological conditions, sea ice, flora and fauna that can contribute to fill the picture of earlier climatic conditions where there are no long measurement and observation series. The historic state of sea ice in the Arctic has been pieced together with the help of logbooks and diaries from seafarers and whalers; in an article entitled *Piecing together the Arctic's sea ice history back to 1850* Florence Fetterer, principal investigator at the US National Snow and Ice Data Centre (NSIDC), states how sources such as whaling ship logbooks and mentions of the sea ice edge positions in the North Atlantic between 1850 and 1978 in various sources such as newspapers, ship observations, aircraft observations and diaries have helped to fill gaps and extend the Arctic sea ice record back to 1850 (Fetterer 2016).

Insight into permafrost changes have been gained through archaeology. Excavations of seventeenth century whalers' graves in northwest Svalbard carried out in 1980 showed corpses with traces of skin and hair, and with woollen clothes that could almost have been taken out and put on by the archaeologists. In 2016 and '17 similar graves in the same area were excavated and such finds were almost non-existent owing to the lowered state of the permafrost that no longer "froze the objects in time". Similarly, permafrost thawing is destroying organic material in middens in West Greenland that contain evidence of the three main Greenland cultures of up to 3500 years ago — Saqqaq, Dorset and Thule (Salomonsen 2015). The realisation that this unique archaeological material can be lost forever in 80–100 years has prompted targeted research by permafrost scientists in Denmark. Their studies show that the bacteria that normally eat away at organic materials (wood, bone, soft tissues, etc) lie dormant in permafrost, but once that thaws the bacteria become active again and in the process produce heat that in turn helps thaw more permafrost — an interesting study arising out of interaction between archaeologists and permafrost scientists.

#### ***4.4.5 More Attention Given to Indigenous and Local Knowledge***

During the past few years, and particularly since the fourth International Polar Year (IPY-4) cooperation between scientists and local and indigenous residents has increased. The Framework document for IPY-4 stated that “IPY 2007–2008 must strengthen the dialogue and links between Arctic residents and the research community, and must engage Arctic residents in the design and implementation of IPY science, education and outreach programmes” (Barr and Lüdecke 2010, p. 310). Despite some scepticism from scientists, local and indigenous knowledge is receiving increasing attention in connection with the effects of climate change which are felt in force in the Arctic and which are changing the traditional way of life for many local societies. At an international conference organised in Paris by UNESCO in October 2017 the aim of the conference was promoted as:

Ahead of the 2017 United Nations Climate Change Conference (COP23), the UNESCO Local and Indigenous Knowledge Systems programme (LINKS) is inviting key partners and institutions to share their own successes and lessons learned in mobilizing local and indigenous knowledge for climate change (UNESCO [Undated](#)).

One spectacular result of bringing indigenous knowledge into the scientific sphere has been the discoveries of the exploration ships *Erebus* and *Terror* in the Canadian Arctic in 2014 and 2016 respectively. The two ships were commanded by Sir John Franklin who with 128 men set off from England in 1845 to find a navigable route through the Northwest Passage north of the Canadian mainland. The disappearance of the ships and men unleashed an extensive search in the following years and the story has remained the source of myths, books, poems, songs and projects to find the remains of men and vessels. Inuit have from the beginning been able to give information relating to what they or their ancestors had seen, but were often dismissed as unreliable or fantasy tellers. Luckily attitudes change, and the government agency Parks Canada reported in 2017 that: “The discovery of HMS *Erebus* and HMS *Terror* would not have been possible without Inuit knowledge” (Parks Canada 2017).

#### ***4.4.6 Arctic and Antarctic Heritage Professionals Developing Cooperation and Exchanges***

Finally it will be mentioned that the negative effects of climate change that are described above for the cultural heritage of the Arctic are also seen with respect to the Antarctic cultural heritage, even though the warming of the climate in the southern polar region is not as dramatic thus far as in the north. Again, in the Antarctic and sub-Antarctic the negative impacts have both natural and human causes. The wood of explorers’ huts is degrading more rapidly, changing precipitation patterns

of snow and rain add to the challenges, and increasing polar tourism and scientific activities cause additional wear and tear to monuments and sites. Recognising the similarities between cultural heritage work in both polar regions this author was instrumental in 1999–2000 in founding the International Polar Heritage Committee (IPHC) of the international cultural heritage organisation ICOMOS (International Council of Monuments and Sites). The IPHC brings together professionals working in one or both areas to exchange knowledge and discuss challenges and methods in order to enhance both their own work and the protection of polar cultural heritage in general.

## 4.5 Conclusion

There is no doubt that the cultural heritage of the Arctic is suffering under the current climate changes. Bad news is easy to find in this respect. However, we need not only concentrate on the negative. If we look beyond the immediate disastrous effects of the warmer, wetter, wilder Arctic climate we can see that there is also good news to be found. New technology, developing relationships across scientific disciplines and between scientists and indigenous and local people, increasing attention paid to Arctic heritage and an increase in the knowledge being gathered around the history both of individual monuments and sites and of the various cultures associated with such sites are on the plus side. Much of this could have developed without the threat of climate change hanging over us, but it is not certain that it all would have. There is nothing like a serious threat to bring out new and strengthened initiatives and effort.

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