[Supplementary materials]

Climate change and the deteriorating archaeological and environmental archives of the Arctic

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Received: 4 July 2017; Revised: 28 November 2017; Accepted: 13 December 2017

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Supplementary materials 2. Methods used to estimate the number of sites in the Arctic

There is no official record on the total number of archaeological sites that exist in the Arctic. The number presented in this article (Table 1) was estimated the following way.

Alaska: The number (34,500) represents the number of archaeological sites in the Alaska Heritage Resource Survey database at the beginning of 2017. Information on population size is taken from United States Census Bureau.

Canada: The number (30,301) represents the total number of sites currently registered in northern Canada (Yukon, Northwest Territories, Nunavut, Labrador, and Nunavik (northern Quebec) and was collected directly from territorial and provincial archaeologists in these areas. Information on population size is taken from Statistics Canada.

Greenland: The number (5,538) represents the number of sites registered in the Greenlandic cultural heritage data base Nunniffiit (http://nunniffiit.natmus.gl/cbkort?#). Information on population size is taken from Statistics Greenland.

Norway: The number (108,000) represents the number of sites located north of the Arctic Circle listed in the Norwegian national heritage database, 'Askeladden'(https://askeladden.ra.no/; https://kulturminnesok.no/). Information on population size is taken from Statistics Norway.

Russia: There is no official record on the total number of sites in the Russian Arctic. The best estimate is approximately 1600 sites unevenly spread across the region: Kola peninsula – about 600, North-East of European Russia (Arkhangelsk region with Nenets Autonomous District) – about 250, northern West Siberia (Yamal Nenets Autonomous District) – about 200, Taimyr peninsula (Dolgan-Nenets Autonomous District of Krasnoyarsk region) – about 160, coastal lowlands of North-East Siberia from Anabar river in the west to Kolyma river in the east (Yakutia/Sakha Republic) – about 90, Western Chukotka and Russia (Chukchee Autonomous District) – about 300 (Provided by V. Pitulko, pers. comm., 2017). Information on population size is taken from Russian Federal State Statistics Service.

Supplementary materials 3. List of articles and publicly available reports that identify impacts of climate change on archaeological sites in the Arctic or that shed light on archaeology climate change has damaged

Coastal erosion

1. DARWENT, J., H. LANGE & G. LEMOINE. 2014. Falling into the Fjord: The loss of a high-latitude stratigraphic site in Northwest Greenland and issues surrounding mitigation of remote archaeological resources, in J. Bickersteth, N. Watson, M. Frisen & J. Hollesen (ed.) *International Polar Heritage Committee of ICOMOS Conference 2014: The future of polar heritage - programme and book of abstracts*: 39–43. Copenhagen: National Museum of Denmark.
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15. NILSEN, J.E.Ø., K. LARSEN, V.V. MARTENS, T. RAUKEN & K. HARVOLD. 2013. *Kulturminner og havnivåstigning (cultural heritage and sea level rise),* CIENS-rapport 1-2013. Oslo: Ciens.

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Supplementary materials 4. List of initiatives and research projects

The Pocantico Call to Action on Climate Impacts and Cultural Heritage was drafted by representatives of over twenty local, national, and international organizations who came together at a meeting organized by the Union of Concerned Scientists, the National Trust of Historic Preservation, SAA, and the J.M. Kaplan Fund at the Pocantico Center of the Rockefeller Brothers Fund, February 2 – 4, 2015, to consider strategies and develop an action agenda for preserving and continuing cultural heritage in a changing climate. In March 2014 the Society for American Archaeology board of directors formally endorsed the Pocantico Call to Action. This international call to action is now posted on multiple organizational websites and has a growing list of individual and organizational sponsors. http://saa.org/Portals/0/SAA/GovernmentAffairs/POCANTICO.pdf

IHOPE

The Integrated History and Future of People on Earth (IHOPE) is a global network of researchers and research projects using integrative frameworks to combine studies of human and Earth system history. IHOPE's long-term, human-scale perspective unites Earth system science with the social sciences, the humanities, and communities of practice. Part of IHOPE's work focus on Global Environmental Change Threats to Heritage and Long Term Observing Networks of the Past. http://ihopenet.org/global-environmental-change-threats-to-heritage-and-long-term-observing-networks-of-the-pas/

Arctic CHAR Project

Arctic CHAR is a multi-pronged program of research centered in the culturally unique Mackenzie Delta region, northwestern Canada, home to modern Inuvialuit communities. It is intended to investigate spatial patterns in the threats to the archaeological record in this region, and to begin to mitigate them through mapping and excavation of critically important sites. The project is a collaboration between the University of Toronto and the Inuvialuit Cultural Resource Centre.

REMAINS of Greenland

The project REMAINS of Greenland is initiated as a direct response to climate change and to the enormous challenge the National Museum of Greenland is currently facing, managing 5,500 sites in enormous land area. The purpose of the project is to advance the basic understanding of how climate change influences the preservation of archaeological sites and organic artefacts in the Nuuk region. Furthermore the project will develop research based cultural resource management tools for locating sites at risk and strategies for dealing with threatened sites in Greenland. The project is a co-operation between The National Museum of Denmark, The Greenland National Museum and Archives and Center for Permafrost (CENPERM) at University of Copenhagen. www.remains.eu

NABO

The North Atlantic Biocultural Organization (NABO) was formally founded in 1992 (after a key meeting in 1988 hosted by the Peary-MacMillan Arctic Museum at Bowdoin College in Maine) in an effort to improve communication and collaboration among the growing number of scholars interested in the North Atlantic region who shared common interests but lacked a common forum for regular meetings and exchange of ideas. Initially focused upon the archaeology and paleoecology of Viking Age colonization from Scandinavia and the British Isles, the NABO cooperative has progressively expanded in temporal and geographic extent (ranging from Prehistory through the Early Modern period and with participating projects spread from Labrador to Finnmark). NABO is strongly interdisciplinary as well as international and has aided scholars from a broad range of disciplines to set up wide ranging collaborative investigations of the interactions of humans, landscape, seascape, and climate change in the region. http://www.nabohome.org/

InSituFarms

The multidisciplinary InSituFarms research project has focused on sites with preserved archaeological deposits in northern Norway, independent of dating. Neolithic shell middens and Iron Age/Medieval farm mounds have been chosen as study objects with installed monitoring equipment, measuring soil temperature, soil humidity and redox parameters, to define if active degradation is taking place (Martens et al., 2016). Laboratory studies of degradation rates from the sites have been used to study possible effects of climate change on continued preservation (Hollesen et al., 2016 b). A series of tools

for cultural heritage management have been suggested, including site evaluation for prioritization, heritage management plans, threat evaluations and threshold levels have been defined to enable distinguishing between safe and threatened sites, and mitigation actions have been tested and suggested, particularly securing sections with clay (Martens 2016, 90-99). (https://www.forskningsradet.no/prosjektbanken/#!/project/212900/no)

SCHARP (Scotland's Coastal Heritage at Risk Project)

A citizen-science project in Scotland that has built upon two decades of coastal survey. Following a desk-based review of collected data, action at sites threatened by coastal processes was prioritized. All site and priority information was then made available to the public through web and mobile applications. Training sessions and other activities have led to a large number of individuals and groups around the Scottish coast updating information and reporting new discoveries. The collected data has been used to re-prioritize sites, taking into account current site condition and local threats. In addition, a range of interventions (both traditional and experimental) have been undertaken at sites nominated by local communities, thus saving data and increasing awareness about climate change. http://www.scharp.co.uk/