

SAA Climate Change Strategies and Archaeological Resources Committee

Tom McGovern CUNY, Chair

thomas.h.mcgovern@gmail.com

Jan 28, 2016

Summary: This report is the first product of the newly formed SAA *Climate Change Strategies and Archaeological Resources Committee* (CCSAR). It presents the committee membership as now established, the charge to the committee from the SAA Board, and reports on the initial WebEx meeting of the committee held Dec. 21st 2015. Note that while not all the committee was able to attend the initial meeting the summary has been circulated to all current members for approval. This report both summarizes discussions among the committee thus far and documents some of the growing synergy between the CCSAR and other groups concerned with climate impacts upon heritage and the archaeological record, notably the *US National Park Service* and the international *IHOPE Threats to Heritage and the Distributed Observing Network of the Past* (many CCSAR members are also participants in the IHOPE team). This report also summarizes some of the many activities already ongoing by committee members and allies, and provides links to useful websites and a short bibliography of some key references. We welcome additional input and comment, and look forward to the April SAA session in Orlando as an opportunity to report to the wider SAA community and recruit more talented and interested participants.

Committee Membership January 2016:

Adam Markham	Amarkham@ucsusa.org
Alice Kelley	akelley@maine.edu
Amy Ollendorf	Amy.Ollendorf@gmail.com
Ana Steffen	ana_steffen@nps.gov
Anne Jensen	amjuics@gmail.com
Anne St. Amand	anne.st@maine.edu
Ben Vining	bvining@bu.edu
Carole Nash	nashcl@jmu.edu
Dan Sandweiss	Dan_Sandweiss@umit.maine.edu
David Anderson	dander19@utk.edu
George Hambrecht	ghambrecht@gmail.com
Heather Thakar	thakar@temple.edu
Heather Wholey	hwholey@wcupa.edu
Isabel Rivera-Collazo	isabel.rivera@gmail.com
Jago Cooper	JCooper@britishmuseum.org
Jason Bogstie	jason.bogstie@wyo.gov
Junko Habu	habu@berkeley.edu
Kevin Gibbons	gibbonsk@umd.edu
Marcy Rockman	Marcy_Rockman@nps.gov
Mike Newland	michael.newland@sonoma.edu
Peter Biehl	pbeihl@buffalo.edu

SAA CCSAR Committee Initial Report 1/28/16

Rachel Loehman	rloehman@usgs.gov
Sandi Copeland	scopeland@lanl.gov
Tanya Peres	Tanya.Peres@FSU.edu
Thomas Hanson	Thomas.Hanson@colorado.edu
Tim Kohler	tako@wsu.edu
Tom Dawson	tcd@st-andrews.ac.uk
Tom McGovern	thomas.h.mcgovern@gmail.com
Torrey Rick	RickT@si.edu
Luis Gomez-Gastelum	gastelum@cencar.udg.mx

Committee Establishment by SAA *“Motion 136/54.10B - The Board establishes the Committee on Climate Change Strategies and Archaeological Resources to monitor climate change as it relates to archaeology and to make recommendations to the Board concerning ways to enhance the Society’s effectiveness in addressing the multiple challenges posed by climate change to the archaeological record. In addition to a chair and 14-20 members, one committee member each will serve on GAC, IGAC, and the Committee on Museums, Collections, and Curation. The Board Liaison to the Committee is Daniel Sandweiss.”* (note: GAC= Government Affairs Committee, IGAC= International Governmental Affairs Committee)

Committee Charge: *“The Committee on Climate Change and Archaeological Resources makes recommendations to the Board concerning ways to enhance the society's effectiveness in addressing the multiple challenges to archaeological resources posed by climate change.”*

December 2015 initial meeting Introductions & Discussions:

- 1) Initial introductions, discussion of SAA charge to committee, and the circulated draft organizational plan
- 2) Mutual updates on state of engagement nationally and internationally.
- 3) Mileposts
- 4) Working group organization, chairs and participants

The December WebEx meeting began with a reading of the SAA charge to the committee and a brief discussion of the draft organizational plan distributed beforehand. All were positive about the overall outline and we welcomed our three Grad Student representatives (Ani St. Amand U Maine, Kevin Gibbons U Maryland, and Tom Hanson U Colorado) and new members representing other SAA Committees: Jason Bogstie (SAA GAC) and Heather Thakar (SAA Museums and Collections). We decided to move to mutual updates on the very active areas of climate change threats to heritage and the “distributed observing network of the past” (DONOP). We agreed that the combination of heritage (with established organizations like ICOMOS and many national heritage agencies) with the clear inclusion of indigenous heritage and social justice, and the attraction of DONOP and the “completed long term human ecodynamics experiments of the past” represented a useful framework for the committee’s work. The connection of heritage and DONOP was seen as positive for establishing and expanding our connection to global change scientists who still represent the leadership and dominant disciplinary influences in national and international global change initiatives. Our members include scholars with considerable expertise in both heritage and DONOP areas, and one important function of

SAA CCSAR Committee Initial Report 1/28/16

this committee was seen to be the expansion of cooperation among these specialties to draw in resources and experience.

There is also great interest in the committee in engaging with indigenous and local traditional knowledge holders and with communities most immediately impacted by heritage loss. We recognized that many Native American and First Nations organizations have taken lead positions in planning for climate change and many are actively engaged with local and regional adaptive management strategies and considerable interest was expressed in identifying and engaging with these initiatives.

There was also discussion around the importance of connecting the SAA climate response to international efforts, and it was observed that the initial SAA CCSAR team already over-lapped somewhat with the IHOPE threats to heritage and the distributed observing network of the past group (<http://ihopenet.org/global-environmental-change-threats-to-heritage-and-long-term-observing-networks-of-the-pas/>). As IHOPE provides a direct connection to the *Future Earth* international global change organization, we felt that it would be important to connect the work of the SAA CCSAR team to the global effort. We agreed to add the SAA CCSAR team and contact information to a revised IHOPE threats group website (now being re-posted Jan 2016).

There was also interest expressed in continuing and strengthening links to regional research organizations and teams engaging in field, laboratory, and digital research in long term human ecodynamics (LTVTP, VEP, IHOPEMAYA, PESAS, NABO, etc.), and to museums (Smithsonian, British Museum, National Museum DK, Greenland National Museum and Archives etc.) as sources of expertise and allies.

We all recognized that the organization of an effective response to the multiple climate threats would require substantial new funding- significantly beyond what was likely to be available through conventional research- orientated funders like NSF. We discussed the need to coordinate lobbying efforts on the national and international scale (in close cooperation with other SAA committees and units) and to try to engage with donors interested in preserving heritage and contributing to responses to global change. SAA and other established organizations can potentially work with donors and development staff to target funding efforts at these challenges. Lobbying international funding consortia (Belmont Forum) was also seen as worthwhile application of a combined Heritage/DONOP approach.

Mutual Updates:

We all observed that the level of activity around the global threats to heritage and DONOP has been rapidly ramping up over the past 18 months, with very positive responses from heritage agencies and managers, hard science colleagues, *Future Earth*, *IPCC* representatives, and other global environmental change organizations. It is clear that there are a growing number of interested groups and active scholars engaging in the issues of climate change impacts and archaeological resources, and one important early goal for our team will be to develop a network map of active and potential collaborators nationally and internationally and make contact with potential allies and partners for the SAA climate effort. In light of the wide range of ecological and climatic information associated with archaeological material, we also discussed the importance of promoting and publicizing archeological contributions to our colleagues in the environmental sciences through targeted publications and active participation in

SAA CCSAR Committee Initial Report 1/28/16

workshops and meetings. Much of the rest of the on line meeting focused on mutual updating on meetings just completed or on the near horizon with direct relevance to the SAA CCSAR mission.

Meeting and connections updates:

Anne Jensen provided some very useful updates on her participation on in the recent Arctic Observing Network Open Science meeting in Seattle and the AGU in San Francisco. Ben Fitzhugh, Martin Callanan and Shelby Anderson (jointly) and Anne Jensen all gave papers, and Ben & Anne presented posters at AOOSM, so the issues were well covered. Ben's paper was in the *Marine Ecosystems* session and drew clear interest from several key people, including Sue Moore and Jackie Grebmeier, who are leads in the oceanographic Distributed Biological Observatories (DBOs), and Carin Ashjian of WHOI. The other papers were in *Human Dimensions*, where there was good attendance by natural scientists. The discussions included the relevance of archaeology to both other fields of research and to developing toolkits for sustainability. Several individuals approached Anne about possible collaborations and so far, two of them have started collaborations. Anne Jensen also attended the AGU meetings. She presented a poster co-authored with many team participants (currently being used as a handout on DONOP, see Appendix 1), and also was selected to give an oral presentation (most AGU sessions have limited oral presentations and lots of posters).

Tom Dawson and Marcy Rockman discussed the recent EAA session in Glasgow that brought together a wide international group concerned with coastal heritage and threats, and this gathering is rapidly moving towards publication as an edited volume (see Appendix 2 below). George Hambrecht discussed plans for a Heritage/DONOP session at WAC in Kyoto in late August, now approved as part of Marcy Rockman, Margo Swindon & Tom Dawson's session in an all-day offering with associated posters. Peter Biehl noted an important set of climate related sessions at the EAA in Latvia also in late August. We agreed to mutually report on relevant conferences and meetings and to pool presentation materials (handouts, ppt slides, web links etc.).

US National Park Service Initiatives:

Marcy Rockman provided an overview of USNPS climate framework and connections to IPCC (see also Appendix 3 below):

1. The US NPS *Climate Change Response Strategy* sets out 4 pillars of climate change response: science, adaptation, mitigation, and communication. In brief, these mean:
 - Science is about data, models, observations
 - Adaptation is about what do about and in response to data, models, and observations
 - Mitigation is reducing the overall carbon footprint of the NPS
 - Communication is connecting all these pieces and sharing them with the public and partners

The NPS approach for cultural resources and climate change builds on this. We've established a two-fold approach: there are climate change impacts ON cultural heritage and cultural heritage resources themselves also provide the opportunity to learn FROM them. This two-fold approach is now codified as NPS policy via a 2014 Director's Policy Memo, *Climate Change and the Stewardship of Cultural Resources*.

SAA CCSAR Committee Initial Report 1/28/16

Applying this two-fold approach to the four pillars of climate change response yields a 2x4 conceptual framework for cultural resources and climate change (see attached table in Appendix 3). What this means is there is a science of understanding the impacts of climate change on cultural resources and a science for learning from them, adaptation to address such impacts and learning from cultural resources to better inform modern efforts for adaptation, and so forth for mitigation and communication. The vision underlying this approach and the conceptual framework is not that any one organization, NPS or otherwise, will work on all the concepts. Rather that it sets out the size and scale of the effort necessary to address the needs and potentials of cultural resources in relation to climate change, and that collectively national and international partners working with their own expertise will come to address all or most of the concepts. The DONOP approach addresses concepts in the Science-Learning From and Adaptation-Learning From portions of the framework.

The 2x4 framework has been published in a George Wright Forum article by Marcy Rockman and is a core component of the NPS *Cultural Resources Climate Change Strategy*, currently in review. More info on the NPS approach is here: <http://www.nps.gov/subjects/climatechange/index.htm>. Policy memo is here: <http://www.nps.gov/policy/PolMemos/PM-14-02.htm>.

2. International Policy: NPS has been collaborating with US/ICOMOS and US State Dept. to incorporate cultural heritage into the outcomes of the COP21 climate negotiations and increase/incorporate information from cultural heritage into the next round of the IPCC reports.
 - a. For the climate negotiations, Small Island Developing States (SIDS) raised the issue of loss of their heritage as sea levels rise. They want the loss of places that hold their history and identity to be part of the implementation of the COP21 agreement. Loss of heritage is considered to be part of climate change non-economic loss and damage (NELD). US State Dept. is now considering recommending that cultural heritage be a focus of post-COP21 NELD development meetings throughout 2016. NPS is providing support to State in connecting cultural heritage to other major categories of NELD. SAA CCARC team will be asked for assistance.
 - b. For the IPCC, the US/ICOMOS Executive Director Andrew Potts met with several of the new IPCC co-chairs in Paris at COP21. They indicated they are aware that cultural heritage was not well incorporated into the last round of the IPCC reports and that it would be welcome in the next round. Apparently the next steps for creating a new chapter in an IPCC report is to set up a convening of the field to discuss major issues and approaches. This process is well enough established that a general price tag of \$100k has already been put forward. Marcy has checked with US State Dept. on this and they are coordinating to assist and find more information on next steps.

USGCRP Social Sciences Links

In January 2016 Dan Sandweiss and Tom McGovern had a very good conversation with Robert Winthrop and Carrie Hritz of the *US Global Change Research Program Social Sciences Coordinating Committee* about the potential contribution of SAA archaeology and related fields to a new USGCRP assessment upcoming. This conversation was an opportunity to formulate a sort of three level response to the broad question of "what can archaeology and other disciplines of the past contribute to current and future global change research?". Borrowing from IHOPE leader Carole Crumley, we can conceptualize a threefold response:

SAA CCSAR Committee Initial Report 1/28/16

1) Archaeology, paleoecology, environmental history together provide the unique ability to document and understand the "long term human ecodynamics experiments of the past" of human interactions with resources, climate, and other humans on a meaningful time scale. Critical junctures of variables, key pathway junctions, and long term outcomes of short term solutions are all subject to coordinated regional-scale investigations informed by shared perspectives on resilience, pathway dependency, robustness and vulnerability and sustainability on the century to millennial scale. We are now going far "beyond Jared Diamond" in mobilizing our case studies to expand the horizons of modern scenario builders attempting to fashion pathways to a sustainable future (Nelson et al. 2015). Forward planning requires a solid understanding of past interactions and outcomes. Since 2000, archaeologists have made real progress on getting the message out that archaeology is a global change science, and Historical Ecology approaches are spreading widely in the adaptive management community globally.

2) Scholars of the past connect with modern bearers of local and traditional knowledge in both documenting and demonstrating the effectiveness of local and traditional knowledge systems in managing resources sustainably on the long term. Examples include the Mývatn Iceland migratory waterfowl (Hicks et al 2016), and Clam Gardens of the Pacific NW (Lepofsky & Caldwell 2013). Similar approaches aid our understanding of what went wrong when LTK was overwhelmed by climate variability or globalization as in Norse Greenland (Dugmore et al. 2013). Together we can both expand the global adaptive tool kit by bringing in LTK from wider regions and help to open up the "black box" of local human cultural response that baffles hard science planners and creates "wicked problems" for designing responses to problems linking environment and society. Have a look at Steve Hartman's blog on *Future Earth* website for more: <http://www.futureearth.org/blog/2015-jun-3/unpacking-black-box-need-integrated-environmental-humanities-ieh>

3) We have new data sets urgently needed by environmental scientists, conservation biologists, resource managers, and global environmental change planners that are not available from any other source. These data are becoming increasingly available and valued (models and cyberinfrastructure playing key roles). Formal integration of history and archaeology with modern fisheries and marine resource management through ICES is now going ahead strongly through the EU-Funded **Oceans Past** program (<https://www.tcd.ie/history/opp/>). We are already making significant contributions to modern management and environmental science through our unique data sets, but these are endangered by climate change impacts worldwide (Englehard et al. 2015).

Mileposts

- Our initial milepost is this Committee report to SAA submitted **Jan 29th**.
- Our second major milepost is the SAA meeting in Orlando **April 6-10, 2016**: We have a reserved CCSAR meeting room on April 8th between 1:00-2:55 PM and the work of the committee will be prominently featured at the Presidential Forum 6:30- 8:30 PM. We will also have sessions organized by the *Island and Coastal* teams which will feature the CCSAR program.

The SAA meetings will thus be an opportunity to both reconvene for an in-person working meeting and to do some serious outreach to the rest of the SAA community, engaging with other SAA units and scholars. The CCSAR committee will be in contact prior to the meeting to work on agenda items and our collaborator network project and report progress by the working group teams.

Working Groups/ Task Clusters

1. **Networks and Collaborators:** (all hands) Need to connect widely to communities already involved in heritage, climate impacts, and integration of archaeology. Inform ourselves of key players and organizations (and connect to them if possible). Create “state of the field” overview of Climate Impact/ Heritage groups for SAA for Orlando meeting, begin large scale networking, recruit new participants. We agreed to work with the IHOPE Threats group and include the whole SAA committee in the revised IHOPE Threats web page.
 - Cultural Anthropology (AAA, Shirley Fiske, Mark Nuttall etc.)
 - Bioanthropology, Linguistics, Geography, Sociology
 - Other archaeology associations (SHA, EAA, AIA)
 - Native American/ First Nation/ Indigenous TLK & climate change initiatives: Note that this was a major discussion point.
 - Environmental History, Environmental Humanities (Oceans Past, Environmental History associations, Climate History associations, NIES....)
 - International and National Heritage Organizations
 - Archaeology- positive hard science groups (AGU, IMBER, etc.)
 - Regional research cooperatives (IHOPE MAYA, NABO, PESAS, VEP, ARCUS.....)
 - Existing research groups investigating long-term coupled natural-human systems in prehistory (e.g., VEP [<http://village.anth.wsu.edu>], FHiRE: Fire & Humans in Resilient Ecosystems, etc.)
 - Museums and cultural institutions (Smithsonian, British Museum, DK National Museum, Greenland National Museum and Archives?)

2. **Agency, Foundations and Policy Connections:** mobilize connections to national and international agencies, funding agencies and programs.
(Lead: Marcy Rockman, Anne Jensen, Jason Bogstie, Thomas Hanson, George Hambrecht, Ana Steffen, Heather Thakar.)
 - Connect and coordinate with SAA GAC, media and IGAC
 - Connect with existing and emerging GEC programs (Future Earth....) and funders (Belmont Forum, NSF, EU, Nordforsk, Green Donors)
 - Coordinate information delivery about Heritage/DONOP issues, get us on GEC response to do agendas.
 - Contribute to SAA policy & legislative outreach on national and international levels.
 - Connect to State, Agency, and local community programs and initiatives

3. **Outreach and Public Engagement:** Collaborate with other SAA committees and international best-practice examples on:
(Leads: Adam Markham, Jago Cooper, Alice Kelley, Tom Dawson)

SAA CCSAR Committee Initial Report 1/28/16

- Teaching and formal education
- Place based education
- Public engagement, crowdsourcing
- Digital media, new media, news and journalism

4. Distributed Observing Network Science

(Leads: Alice Kelley, George Hambrecht, Anne Jensen)

aDNA, stable isotopes, biomarkers etc.- ID archaeology friendly labs and participants

- identify immediate, oncoming, and long shot possibilities for DONOP contributions to GEC research.
- Connect labs and researchers with each other and potential consumers.
- Publicize success stories, engage with natural science and GEC planners.
- Data management expertise
- Models and integration

5. Prioritizing Responses

ALL HANDS ACTIVITY

- Identifying “good practice” local response programs.
- Pool international experience and expertise on response.
- Coordinate funding and planning efforts for enhanced effort.
- Create graphics (color coded?) for threat levels and response capabilities

6. Models and Data Management (Tim Kohler lead)

- Connecting archaeological/ paleoecological models to GEC research and response
- Aiding in identifying and prioritizing threats and vulnerabilities
- Providing guidance on data management issues.
- Connecting with groups like SKOPE (Synthesized Knowledge of Past Environments: <http://www.envirecon.org>) that aim to provide data useful to archaeologists for characterizing climate change

Upcoming Meetings:

- Smithsonian Arctic Crashes: Jan 15
- Arctic Horizons Portland Feb
- SAA April
- Keeping History Above Water April
- AEHA March
- AGU Dec
- WAC Japan Aug
- EAA Latvia Aug
- IUCN World Conservation Congress Sept

Grants:

SAA CCSAR Committee Initial Report 1/28/16

Discuss potentials for joint application with IHOPE and other groups to NSF /Belmont Forum for a 3-5 year RCN (Res. Coord. Network) grant aimed at extending the SAA committee remit, bringing in more resources, and getting fully global. Investigate Wenner-Gren and other workshop funders to provide mobility funds.

Links to Resources and Agencies:

<http://marineprotectedareas.noaa.gov/toolkit/>

<http://link.springer.com/journal/11852/16/2/page/1>

North Atlantic Biocultural Organization www.nabohome.org

Global Human Ecodynamics Alliance www.gheahome.org

US National Park Service <http://ncptt.nps.gov/articles/climate-change/>

[\(http://ncptt.nps.gov/blog/training-in-climate-change-and-cultural-resources/](http://ncptt.nps.gov/blog/training-in-climate-change-and-cultural-resources/)

Union of Concerned Scientists www.ucsusa.org/assets/documents/global_warming/National-Landmarks-at-Risk-Full-Report.pdf

Scottish Coastal Archaeology and the Problem of Erosion (SCAPE)

<http://www.scapetrust.org/index.html>

SCHARP – citizen science project to record eroding sites <http://www.ssharp.co.uk/>

Regan Alsup’s video of heritage impacts and community response to coastal erosion in Brora Scotland. <https://vimeo.com/90691169>

The Site Stewardship program at the Alutiiq Museum in Kodiak:

<http://alutiiqmuseum.org/research.html>

Collaboration with the USF&WS to reconstruct fragile island environments:

http://www.fws.gov/refuge/alaska_maritime/grazing.html

The Chirikof Island Project:

<http://www.bu.edu/today/2014/what-ancient-dinners-tell-us-about-climate-change/>

Recent News reports and blogs Featuring Threats to Archaeology and Heritage

<http://www.hakaimagazine.com/article-long/history-melting>

<http://www.smithsonianmag.com/science-nature/arctic-erodes-archaeologists-are-racing-protect-ancient-treasures-180957933/>

<http://www.hakaimagazine.com/article-long/what-history-gives-sea-steals>

Vimeo

<https://vimeo.com/90691169>

Selected Publications:

Ashmore, P. 1994. *Archaeology and the coastal zone: toward a Historic Scotland policy*. Edinburgh: Historic Scotland.

Blankholm, H.P. 2009. Long-Term Research and Cultural Resource Management Strategies in Light of Climate Change and Human Impact. *Arctic Anthropology* 46(1/2):17-24.

Braje TJ .2010. *Modern oceans, ancient sites: archaeology and marine conservation on San Miguel Island, California*. University of Utah Press, Salt Lake City

Brum, I., m. Cervetto, c. Chreties, j. Gorostiaga, I. Iriondo, e. Leicht, c. Roberto & I. Rodríguez. 2011. Plan piloto de manejo costero integrado en el área de oportunidad Punta Colorada-Punta Negra, Maldonado, in D. Conde (ed.) *Manejo costero integrado en Uruguay: ocho ensayos interdisciplinarios*: 153–86. Montevideo: UDELAR/CIDA.

Daire, M.-Y., E. López-Romero, J.N. Proust, H. Regnaud, S. Pian & B. Shi. 2012. Coastal changes and cultural heritage (1): assessment of the vulnerability of the coastal heritage in western France. *Journal of Island and Coastal Archaeology* 7: 168–82. <http://dx.doi.org/10.1080/15564894.2011.652340>

Dawson, T. 2013. Locating and prioritising action at eroding coastal sites, in M.-Y. Daire, C. Dupont, A. Baudry, C. Billard, J.M. Large, L. Lespez, E. Normand & C. Scarre (ed.) *Ancient maritime communities and the relationship between people and environment along the European Atlantic coasts / Anciens peuplements littoraux et relations Homme/Milieu sur les côtes de l'Europe atlantique. Proceedings of the Homer 2011 Conference, Vannes (France), 27/09–1/10 2011* (British Archaeological Reports international series 2570): 77–84. Oxford: Archaeopress.

Dugmore, Andrew J., Thomas H. McGovern, Richard Streeter, Christian Koch Madsen, Konrad Smiarowski and Christian Keller, 2013. 'Clumsy solutions' and 'Elegant failures': Lessons on climate change adaptation from the settlement of the North Atlantic islands , chapter 38 in: *A Changing Environment for Human Security: Transformative Approaches to Research, Policy and Action*, Edited by Linda Sygna, Karen O'Brien and Johanna Wolf. Routledge UK London.

Doneus, M., G.J.J. Verhoeven, M. Fera, C. Briese, M. Kucera & W. Neubauer. 2011. From deposit to point cloud: a study of low-cost computer vision approaches for the straightforward documentation of archaeological excavations. *Geoinformatics FCE CTU 6* (XXIIIrd International CIPA Symposium): 81–88.

Elberling, B., Matthiesen, H., Jorgensen, C.J., Hansen, B.U., Gronnow, B., Meldgaard, M., Andreasen, C., Khan, S.A. ,2011. Paleo-Eskimo kitchen midden preservation in permafrost under future climate conditions at Qajaa, West Greenland, *Journal of Archaeological Science* 38, 1331-1339.

English Heritage. 1997. *England's coastal heritage: a statement on the management of coastal archaeology*. London: English Heritage.

SAA CCSAR Committee Initial Report 1/28/16

Engelhard, G. H., Thurstan, R. H., MacKenzie, B. R., Alleway, H. K., Bannister, R. C. A., Cardinale, M., Clarke, M. W., Currie, J. C., Fortibuoni, T., Holm, P., Holt, S. J., Mazzoldi, C., Pinnegar, J. K., Raicevich, S., Volckaert, F. A. M., Klein, E. S., and Lescrauward. A-K. , 2015. ICES meets marine historical ecology: placing the history of fish and fisheries in current policy context. *ICES Journal of Marine Science*, doi: 10.1093 /icesjms/fsv219.

Erlandson, J.M. 2008. Racing a rising tide: global warming, rising seas and the erosion of human history. *Journal of Island and Coastal Archaeology* 3: 167–69. <http://dx.doi.org/10.1080/15564890802436766>

Fitzpatrick SM, Kappers K, Kaye Q 2006. Coastal erosion and site destruction on Carriacou, West Indies. *Journal of Field Archaeology* 31:251–262

Gibson, J. ,2008. *Rising Tides: the loss of coastal heritage in Orkney*. Orkney College.

Gibson, J. 2014. Shaped by the Sea: The Endangered Archaeology of Orkney’s Maritime Communities in Harrison, R. and Maher, R. (eds.), *Human Ecodynamics in the North Atlantic*”. Lexington Books. , pp. 21-34

Harvey D. & Jim Perry (eds.) 2015. *The Future of Heritage as Climates Change: Loss, Adaptation and Creativity* (Key Issues in Cultural Heritage) Routledge UK.

Hicks Megan, Árni Einarsson, Kesara Anamthawat-Jónsson, Ágústa Edwald, Adolf Friðriksson, Ægir Þór Þórsson, Thomas H. McGovern, in press 2016. Community and Conservation: Documenting Millennial Scale Sustainable Resource Use at Lake Mývatn Iceland. in C. Isendahl & D. Stump (eds.) *Handbook of Historical Ecology and Applied Archaeology* Oxford University Press

Hollesen, J., Jensen, J.B., Matthiesen, H., Elberling, B., Lange, H., Meldgaard, M. ,2012. The Future Preservation of a Permanently Frozen Kitchen Midden in Western Greenland, *Conservation and mgmt of arch.* sites 14, 159-168.

Hollesen, J., Matthiesen, H., Moller, A.B., Elberling, B. ,2015. Permafrost thawing in organic Arctic soils accelerated by ground heat production, *Nature Clim. Change* advance online publication.

Hudson, M.J., M. Aoyama, K.C. Hoover and J. Uchiyama. 2012. *Prospects and challenges for an archaeology of global climate change*. Wiley Interdisciplinary Reviews: Climate Change 3(4):313-328.

Jackson J.B.C, Kirby M.X, Berger W H, Bjorndal K.A, Botsford LW, Bourque B J, Bradbury R. H, Cooke R, Erlandson J, Estes JA, Hughes TP, Kidwell S, Lange CB, Lenihan HS, Pandolfi JM, Peterson CH, Steneck RS, Tegner MJ, Warner RR. .2001. Historical overfishing and the recent collapse of coastal ecosystems. *Science* 293:629–637

Jordan, J.W. 1988. *Erosion characteristics and retreat rates along the north coast of Seward Peninsula*. The Bering Land Bridge National Preserve: an archaeological survey, edited by J. Schaaf, Vol. I. Anchorage, Alaska: National Park Service. pp. 322-362.

Lim, M., D.N. Petley, N.J. Rosser, R.J. Allison, A.J. Long & D. Pybus. 2005. Combined digital photogrammetry and time-of-flight laser scanning for monitoring cliff evolution. *The Photogrammetric Record* 20: 109–29. <http://dx.doi.org/10.1111/j.1477-9730.2005.00315.x>

Manley, W.F., O.K. Mason, J.W. Jordan, D.M. Sanzone, E.G. Parrish and L.R. Lestak. 2007. *Coastal Change since 1950 in the Southeast Chukchi Sea, Alaska, Based on GIS and Field Measurements*. Paper presented at the Arctic Coastal Zones at Risk workshop in Tromsø, Norway.

SAA CCSAR Committee Initial Report 1/28/16

Matthiesen, H., Jensen, J.B., Gregory, D., Hollesen, J., Elberling, B. 2014. Degradation of Archaeological Wood Under Freezing and Thawing Conditions—Effects of Permafrost and Climate Change, *Archaeometry*, 56, 3, 479–495.

Moss, Madonna L., Dongya Y. Yang, Seth D. Newsome, Camilla F. Speller, Iain McKechnie, Alan D. McMillan, Robert J. Losey, and Paul L. Koch 2006. Historical Ecology and Biogeography of North Pacific Pinnipeds: Isotopes and Ancient DNA from Three Archaeological Assemblages, *Journal of Island & Coastal Archaeology*, 1:165–190, 2006 DOI:10.1080/15564890600934129

Murray, Maribeth, Anne M. Jensen, and Max Friesen 2011. Identifying Climate Change Threats to the Arctic Archaeological Record: Global Climate Change and the Polar Archaeological Record; Tromsø, Norway, 15-16 February 2011. *EOS* 91(21):180.

Nelson, Margaret C., Scott E. Ingram, Andrew J. Dugmore, Richard Streeter et al. 2016. Climate challenges, vulnerabilities, and food security. *PNAS* 113(2):298-303.

Pinnegar JK, Engelhard GH .2008. The ‘shifting baseline’ phenomenon: a global perspective. *Reviews in Fish Biology and Fisheries* 18:1–16

Reckin, R. 2013. *Ice Patch Archaeology in Global Perspective: Archaeological Discoveries from Alpine Ice Patches Worldwide and Their Relationship with Paleoclimates*. *Journal of World Prehistory* 26(4):323-385.

Reeder, L.A., T.C. Rick & J.M. Erlandson. 2012. Our disappearing past: a GIS analysis of the vulnerability of coastal archaeological resources in California's Santa Barbara Channel region. *Journal of Coastal Conservation* 16: 187–97. <http://dx.doi.org/10.1007/s11852-010-0131-2>

Reeder-Myers Leslie A. ,2015. Cultural Heritage at Risk in the Twenty-First Century: A Vulnerability Assessment of Coastal Archaeological Sites in the United States, *The Journal of Island and Coastal Archaeology*, 10:3, 436-445, DOI:10.1080/15564894.2015.1008074

Rick, Torben & Scott Fitzpatrick (ed.s) 2012. Special Issue: Archaeology and Coastal Conservation, *Journal of Coastal Conservation* Volume 16, Issue 2, June 2012

Rick Torben, Erlandson JM (ed.s) 2008. *Human impacts on ancient marine ecosystems: a global perspective*. University of California Press, Berkeley

Rockman, M. 2011. *The necessary roles of archaeology in climate change mitigation and adaptation*. In *Archaeology in Society: Its Relevance in the Modern World*, edited by M. Rockman and J. Flatman, New York: Springer. pp. 193-215.

Sandweiss, D. and Kelley, A.R., 2012. The Archaeological Record as a Paleoclimatic and Paleoenvironmental Archive, *Annual Review of Anthropology*, v. 21, pp.371-409.

Schwindt, D. M., R. K. Bocinsky, S. G. Ortman, D. M. Glowacki, M. D. Varien, and T. A. Kohler ,2016. The Social Consequences of Climate Change in the Central Mesa Verde Region. *American Antiquity* 81(1):1-23.

West, Catherine Foster 2009. Kodiak Island's Prehistoric Fisheries: Human Dietary Response to Climate Change and Resource Availability, *Journal of Island & Coastal Archaeology*, 4:223–239, 2009 DOI: 10.1080/15564890903178432

APPENDIX 1 Poster presented at AGU by Anne Jensen

Distributed Observing Networks of the Past: Using Archaeological Sites to Study Global Change

Anne M. Jensen (Bryn Mawr, USA), Ben Fitzhugh (U Washington), George Hambrecht (U MD), Tom Dawson (St Andrews), Andrew Dugmore (U Edinburgh), Ramona Harrison (U Bergen), Thomas H. McGovern (CUNY), and the members of the Initial Organizing Team

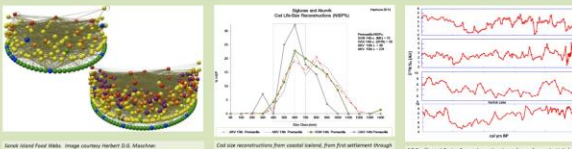
Driving Blind

The Arctic is changing rapidly, and there is much concern over what the effects of those changes might be. Although changes of considerable magnitude have happened in the past, current understanding of Arctic systems is not yet sufficient to enable predictions that are sufficient to guide planning and adaptation. Scientific observations span a limited period in the Arctic, and do not encompass even fairly recent (Little Ice Age, Medieval Climate Anomaly) periods of climate change. One way to address this would be to extend the period of observation, but the situation is urgent.

Proxies

As an alternative, various types of proxy data can serve a similar function. Archaeological sites with good organic preservation are not only sources of data on past human behavior and cultural organization, but also valuable resources for paleoenvironmental reconstruction, with potential similar to more familiar paleoenvironmental proxy records from ice sheets, bogs, lakes, and oceanic sediments. Such sites contain records of human subsistence, in stratified layers, meters deep and spanning millennia. The sites tend to be located at or near places that are still occupied today, thus providing locally relevant data. These samples from past ecosystems cannot be found in anything but archaeological sites, which form a Distributed Observing Network of the Past (DONOP).

Archaeological sites can contain many thousands of years of time-series data. With these records, it is possible not only to document human interactions with the environment, but also to see how those interactions changed through time, whether slowly or abruptly, and then correlate those changes with possible drivers, such as climate change, patterns of human exploitation, or natural catastrophes. The data can be used to address key questions in climatology, oceanography, ecology, social sciences and conservation biology. Our expanding ability to use organic remains for aDNA studies, stable isotope analysis, trace element analysis, and even sterchemical analysis make it possible for us to look at factors such as trophic levels, changes in stock structure, population bottlenecks, and movements of species, in addition to the more familiar paleoclimatic data on temperature and precipitation.




Small Island Food Webs. Image courtesy Herbert G. Marshall.

Core of pollen from a peat bog in the Scottish Highlands. Image courtesy of Ben Fitzhugh.

All Pacific, and being too extensive elsewhere (only for production). Image courtesy of Ben Fitzhugh.

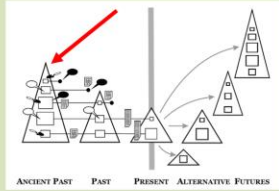
Critical problems

- 1) Loss of the rich paleoenvironmental records that are a long term "Distributed Observing Network of the Past"
- 2) Loss of key elements of cultural heritage to environmental change



Looking Back to Look Forward

- Reverse the 'shifting baseline' syndrome by broadening the understanding of ecosystem dynamics across time
- Use information about past climates and ecosystems to guide adaptive strategies (completed experiments in human adaptation) and for the strategic management of future ecosystems
- Archaeology can help with communicating with the public about the past, by putting people in the picture when it comes to climate change




ANCIENT PAST PAST PRESENT ALTERNATIVE FUTURES

Increased coastal erosion and the warming and thawing of permafrost are major and imminent threats to the archaeological and paleoecological record. We may well be the last generation to be able to recover a fraction of the record from the archaeological global recording network.

Response Strategies

The scale and urgency of the threat require a large scale response backed by sustained funding support. Archaeologists alone cannot do this. Projects involving partnerships across disciplines and with local communities are critical. We have no illusions about the scale and difficulty of the tasks before us, but history places this generation and the next in a crucial juncture with the survival of the basic record of the past. If we do not take up the challenge now we will irrevocably impoverish all future generations. **We need your help.**





Contact a member of the Organizing Team or visit our website for more information.



Initial Organizing Team

Anna Axmon, annaaxmon@gmail.com, University of Alaska Fairbanks, Fairbanks, Alaska, USA
 Ben Fitzhugh, bfitzhugh@uw.edu, University of Washington, Seattle, WA, USA
 George Hambrecht, ghambrecht@umd.edu, University of Maryland, USA
 Ramona Harrison, ramona.harrison@bergen.uio.no, University of Bergen, Norway
 Andrew Dugmore, andrew.dugmore@ed.ac.uk, Edinburgh University, Scotland, UK
 Thomas H. McGovern, tom.mcgovern@stjohns.cuny.edu, St. John's College, Suffolk, VA, USA
 Tom Dawson, tdawson@st-and.ac.uk, University of St Andrews, UK
 Ben Fitzhugh, bfitzhugh@uw.edu, University of Washington, USA
 Anna Axmon, annaaxmon@gmail.com, University of Alaska, Fairbanks, Alaska, USA
 George Hambrecht, ghambrecht@umd.edu, National Museum of Denmark, Copenhagen, Denmark
 Ramona Harrison, ramona.harrison@bergen.uio.no, University of Bergen, Norway
 Andrew Dugmore, andrew.dugmore@ed.ac.uk, Edinburgh University, Scotland, UK
 Thomas H. McGovern, tom.mcgovern@stjohns.cuny.edu, St. John's College, Suffolk, VA, USA
 Tom Dawson, tdawson@st-and.ac.uk, University of St Andrews, UK

<http://ihopenet.org/global-environmental-change-threats-to-heritage-and-long-term-observing-networks-of-the-pas/>

APPENDIX 2 Publication Information from EAA Session Glasgow 2015

Information for contributors *Public Archaeology and Climate Change*

Editors and contact details

- Tom Dawson, University of St Andrews: tcd@st-andrews.ac.uk

- Courtney Nimura, University of Oxford: courtney.nimura@arch.ox.ac.uk
- Elías López-Romero, University of Durham: lopezelias@hotmail.com
- Marie-Yvane Daire, University of Rennes 1: marie-yvane.daire@univ-rennes1.fr

Book description

This edited volume stems from a conference session that took place at the European Association of Archaeologists' Annual Meeting in Glasgow in 2015, but reaches beyond this by including a number of new contributions. The threats that climate change poses to heritage is gaining increased publicity, and several sessions at the recent COP21 meetings focussed on the problem. A key aim of this volume is to promote the new approaches employed by heritage managers and archaeologists globally at sites threatened by climate change, especially initiatives that engage communities or employ 'citizen science' techniques. The papers included will encompass current debates on the topic and propose novel solutions and approaches to managing heritage sites affected by climate change across the globe, making it a key reference in the field of climate change and heritage studies.

Heritage sites have the potential to inform us about past climates and to demonstrate how humans have adapted at times of change. Ironically, many of the sites that hold this information are now themselves vulnerable to changing climates. There is a long-established tradition of rescue archaeology at sites threatened by development, and the principle of the 'polluter pays' is referenced in the planning guidance of many countries. But what happens when there is no developer? Who should take action when natural processes put sites at risk? The threats are many, including flooding, erosion, desertification, sea level rise, thawing of permafrost, and the drying of waterlogged deposits. Worryingly, climate change predictions (e.g. IPCC Report 2013) suggest that the problem is likely to increase in the future. Though discussions on action in the face of climate change have been taking place amongst governmental policy makers for many years, it is only very recently that threatened heritage has been included. In fact, the words 'cultural heritage' appear only twice in the aforementioned 1550 page IPCC report.

Researchers and heritage managers around the world are facing severe challenges and developing innovative mechanisms for dealing with them. Increasingly archaeologists are engaging with practices learned from the natural heritage sector, which has long worked with the public in practical recording projects: citizen science projects involving communities are being now being further developed and adopted around the globe. These initiatives develop partnerships that include using mobile technology to collect data; sharing new digital recording techniques; undertaking a range of practical projects; and using innovative outputs to make information available to all. By involving the public in projects and making data accessible, archaeologists are engaging society in the debate on both threatened heritage and wider discussions on climate change. Community involvement is also key to climate change adaptation strategies, and citizen science projects can help to influence and inform policy makers. The very real threat to heritage is experienced around the world, and as this collection of papers will show, new partnerships and collaborations are crossing national boundaries.

With examples from a range of countries (see contributor list below), this book will bring together a selection of papers that detail the scale of the problem through a variety of case studies. Together they will demonstrate how heritage professionals, working in diverse environments and with distinctive archaeology, are engaging with the public to raise awareness of the threatened resource. The contributions in this volume will examine differing responses, proactive approaches and methodologies for the protection, preservation and recording of sites at risk from natural forces, as well as how new solutions can better engage people with the growing number of sites that are under increasing threat of destruction and contribute to its resilience.

Chapter list and abstracts

1. Introduction by the editors
2. Socio-cultural implications of climate change for cultural heritage. *May Cassar, University College London*
3. Archaeology, art and coastal change in the UK, France, the Netherlands and Belgium. *Garry Momber, Maritime Archaeology Trust*
4. Communities and coastal heritage at risk in Scotland. *Tom Dawson, University of St Andrews*
5. Community recording and monitoring of vulnerable sites in England. *Nathalie Cohen, Elliott Wragg, Gustav Milne, Museum of London Archaeology; Courtney Nimura, University of Oxford*
6. Challenged by an archaeologically educated public in Wales. *Claudine Gerrard, National Trust*
7. The men and women behind the MASC Project (Monitoring the Archaeology of Sligo's Coastline): engaging local stakeholder groups to monitor vulnerable coastal archaeology in Ireland. *James Bonsall, Institute of Technology, Sligo*
8. Engaging the public with rescue information from eroding and destroyed coastal archaeological sites: the Guidoiro Areoso experience in NW Iberia. *Elias Lopez-Romero, University of Durham; Patricia Mañana-Borrazás, Incipit, CSIC; Alejandro Güimil-Fariña & Xosé Ignacio Vilaseco Vázquez, University of Santiago de Compostela*
9. Coastal erosion and public archaeology in Brittany, France: recent experiences from the Alert project. *Pau Olmos Benlloch, University of Rennes 1; Elias Lopez-Romero, University of Durham; Marie-Yvane Daire, University of Rennes 1*
10. Climate change and the preservation of archaeological sites in Greenland. *Jørgen Hollesen, National Museum of Denmark and Christian Madsen, National Museum of Greenland.*
11. Gufuskálar Iceland: an eroding fishing station. *Lilja Pálsdóttir, Institute of Archaeology, Iceland*
12. Finding and Sharing Climate Stories with Cultural Heritage (USA). *Marcy Rockman, US National Parks Service*
13. Racing against time: preparing for the impacts of climate change on California's archaeological resources. *Mike Newland^{1,2} & Sandra Pentney^{2,3}; ¹Sonoma State University; ²Climate Change and California Archaeology Committee, Society for California Archaeology; ³Atkins Global*
14. Threatened heritage and community archaeology on Alaska's North Slope. *Anne Jensen, Ukpeaġvik Iñupiat Corporation, Alaska*
15. Adaptation actions to preserve archaeological resources along eroding coastlines of Canada. *Trevor Bell & Christina Robinson, Memorial University of Newfoundland, Canada*
16. Cultural heritage under threat: the effects of climate change on the small island of Barbuda, Lesser Antilles. *Sophia Perdikaris, Allison Bain, Rebecca Boger, Sandrine Grouard, Anne Marie*

Faucher, Vincent Rousseau, Reaksha Persaud, Stephane Noel, & Mathew Brown; Brooklyn College, The City University of New York

- 17. Archaeological heritage at the tipping point: the Atlantic coast of Uruguay's state of the art biodiversity conservation policies and challenges for an integrated and sustainable management in a changing climate. *Camila Gianotti^{1, 2}; Laura del Puerto¹, Hugo Inda¹, Andrés Gascue¹ & Eugenia Villarmarzo², ¹Centro Universitario Regional del Este (CURE), Universidad de la República (UdelaR); ²Laboratorio de Arqueología del Paisaje y Patrimonio (LAPPU), Facultad de Humanidades y Ciencias de la Educación (FHCE), unidad asociada a CURE, UdelaR***
- 18. Indigenous and cultural change on the South Alligator River, Kakadu National Park, Northern Australia and Indigenous Ranger Groups' capacity for the management of climate change impacts on heritage sites in Australia. *Sally Brockwell & Bethune Carmichael, Australian National University***
- 19. Climate change in Japan and its impact on traditional wooden structures. *Peter Brimblecombe & Mikiko Hayashi, University of Hong Kong***
- 20. Climate change and archaeological heritage in Sri Lanka. *Chulani Rambukwella, Aruna Rajapakse & Mohamed Ariff Mohamed Isthikar, University of Peradeniya, Sri Lanka***

(Marcy Rockman, marcy_rockman@nps.gov)

SCIENCE		MITIGATION	
IMPACTS	INFORMATION	IMPACTS	INFORMATION
<ul style="list-style-type: none"> Climate science at cult. heritage-relevant scales Cultural resource (CR) vulnerability assessments CR inventory/monitoring techniques and protocols Integrated CR databases-GIS Preservation science Documentation science 	<ul style="list-style-type: none"> Paleoclimate Traditional ecological knowledge Social climatic thresholds Shifting baselines Past land use and human impacts on environments Paleogenetics 	<ul style="list-style-type: none"> Integration of historic buildings into energy efficiency plans Resource conservation through historic or native landscapes Reduce C footprint of CR management practices 	<ul style="list-style-type: none"> Past architectural and landscape techniques suited to local environments Cultural heritage to conserve/reestablish sense of place and community stewardship
ADAPTATION		COMMUNICATION	
IMPACTS	INFORMATION	IMPACTS	INFORMATION
<ul style="list-style-type: none"> Scenario planning Adaptation options Decision frameworks Policies and standards Contexts/theme studies to support decision frameworks 	<ul style="list-style-type: none"> Past social adaptability per env. Change Traditional ecological knowledge Relating past adaptability to current issues, methods, and decisions 	<ul style="list-style-type: none"> Cultural resources climate change (CR-CC) literacy Dialogue between impacts and information in all pillars Links between CR-CC managers (local-international) CR-CC links to public 	<p>Every Place has a Climate Story:</p> <ul style="list-style-type: none"> Change in material culture Change in experience and lifeways Lessons in change from past societies Origins of the modern climate situation

Caption: Draft U.S. National Park Service concept framework for cultural resources and climate change. This framework applies needs of resource managers to address the impacts of climate change on cultural resources (Impacts) and the capacity to learn about long-term human interactions with environmental and climatic change

APPENDIX 3 NPS framework figure

|