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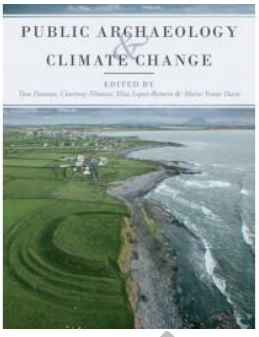
Coastal erosion and public archaeology in Brittany, France: recent experiences from the ALeRT project



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Chapter 9. Coastal erosion and public archaeology in Brittany, France: recent experiences from the ALeRT project

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Abstract

The ALeRT (*Archéologie, Littoral et Réchauffement Terrestre*) project has brought together researchers involved in coastal archaeology and aims to establish an interdisciplinary approach to assessing coastal archaeological vulnerability, site monitoring and heritage management. The scale of the problem and the need for improved field data collection and data management procedures led us to develop a web and mobile application for adding field data and administering users. This reduces the time of data collection in the field and widens the opportunities for collaboration between researchers, heritage managers and the wider community.

Recent extreme weather impacts on coastal archaeology in Brittany has led to a growing interest in public archaeology initiatives and resulted in a huge mobilisation of the local population. As a result of this, a specific training programme in coastal archaeology was developed for coastguards and local communities. The ALeRT network is formed of 30 active members who cover almost the whole coast of the region, and this network has been recently augmented through a partnership with the Conservatoire du Littoral, a public wildlife conservation organisation. In this paper we will focus on the results of the collaborative project undertaken in 2014 and 2015, when this citizen science approach was put to the test.

Introduction

Present climatic change and anthropogenic pressures are increasingly affecting the coastal zone across the globe. Hundreds of archaeological sites along the European Atlantic coast are currently threatened by accelerated relative sea level rise, erosion and various anthropogenic modifications to the environment.

The impact of coastal change upon coastal heritage and its vulnerability is now a major European issue, and there are several initiatives that have begun to deal with the problem. In the mid-1990s the heritage agencies of England, Scotland and Wales all independently started programmes of rapid coastal zone assessments (*e.g.* Fulford *et al.* 1997). Community monitoring programmes have developed from these projects and Shorewatch, launched by Scottish archaeologists in 1997, was one of the first projects to bring together individuals and groups from

local communities to save information about archaeological sites before they were lost to erosion (Fraser *et al.* 2003). This was followed by Arfordir and the work of the National Trust in Wales (see Chapter 6, this volume) and SCHARP in Scotland (Chapter 3, this volume). In 1997 English Heritage initiated the national Rapid Coastal Zone Assessment Surveys (Fulford *et al.* 1997), and this work has been followed by CITiZAN (Coastal and Intertidal Zone Archaeological Network), a new national network to monitor, record, and interpret coastal and intertidal sites in England (see Chapter 5, this volume). Some projects to record coastal sites have also been carried out in Ireland (Kelly & Stack 2009; Chapter 7, this volume) and in Spain (Chapter 8, this volume).

Since 2006, the ALeRT (Archéologie, Littoral et Réchauffement Terrestre) project, developed first in France under the coordination of the CReAAH research team (Centre de Recherche en Archéologie, Archéosciences, Histoire, Rennes) and then in Spain (Institute of Heritage Sciences, Santiago de Compostela), has brought together researchers involved in coastal archaeology and aims to establish an interdisciplinary approach to coastal archaeological vulnerability, site monitoring and heritage management (Daire *et al.* 2012; López-Romero *et al.* 2013; Olmos *et al.* 2014a).

The initial study area covers the West of France (Lower Normandy, Brittany and Pays de la Loire) and examines 2974 km of coastline (Fig. 9.1). Thanks to the active work of regional and local archaeology associations, groupings of professional archaeologists, and local volunteers over the last thirty years, more than 2500 archaeological sites in the study area within 100 m of the shoreline have been shown to be severely threatened. One of the objectives of the ALeRT project is to collaborate with local people and regional authorities to provide tools to assess coastal erosion at archaeological sites. Regular surveys are necessary in order to rank the sites at risk, after which rescue strategies are adapted that take into account regional issues, as the Brittany coastline possesses a great diversity of natural features. The geomorphological diversity of the region means that not all the areas appear to face the same erosion problems.

One important point that has been noted is the difficulty in setting up rescue excavation programmes in coastal areas in France. This is largely due to the division of administrative responsibility for projects between the Regional Archaeological Services, who manage terrestrial projects, and DRASSM (*Département des Recherches Archéologiques Subaquatiques et Sous-Marines*), which has a national responsibility for managing underwater projects, even though both divisions report to the Ministry of Culture. Recently, DRASSM established a fund for rescue excavations within the coastal area, but the amount of money available remains insufficient for addressing the scale of the problem.

ALeRT deals with all cultural heritage, including remains or built structures of anthropogenic origin together with materials transformed by human activities, from the earliest settlements up to World War II structures. The sites examined as part of the ALeRT project are representative of this as they belong to a wide range of chronological periods, from the earliest Palaeolithic settlements up to recent coastal installations. Studying this diverse range of sites has shown that different site types do not face equal erosional pressures and other effects of climate changes, due to their form, the raw materials used in construction, etc.

Methodology

Specific methodologies were developed for the assessment of the vulnerability of coastal archaeological heritage and for engaging the public.

Assessing the vulnerability of coastal archaeological sites: the VEF tool

Very early on the research group moved towards using an interdisciplinary approach to construct a vulnerability model for coastal heritage, developing assessment and monitoring maps, and assessing the strategies for research and action which could be adapted to local and regional scales. This led to the development of a dedicated tool for the vulnerability assessment of coastal archaeological heritage: the Vulnerability Evaluation Form (VEF).

The VEF provides a standardised grid for recording information aimed at providing a snapshot of the state of preservation of coastal archaeological sites (Daire *et al.* 2012). It considers 10 variables that are measurable on site (see Table 9.1; impacts=A1–A6 and resilience=B1–B4). The impacts measured include: A1) human-made structures, A2) human activities, A3) traffic volume and frequency, A4) distance to the cliff, A5) biological erosion, and A6) weathering. The resilience measurements for each site include: B1) resistance of the remains, B2) local substrate and geomorphology, and existing B3) physical or B4) legal protection (such as nature reserves). Users provide scores based on factors such as distance (*e.g.* distance to the cliff) or intensity (*e.g.* intensity of biological erosion) relating to the hazards and the resilience of each archaeological site.

For each variable of the VEF, the field observation is transformed into a normalized value between 0.2 and 1. The vulnerability score (or index) can then be evaluated by the following method:

- Impacts (threats): A = A1+A2+A3+A4+A5+A6
- Resistance: B = B1+B2+B3+B4

- Vulnerability Score: VS = A-B (Daire *et al.* 2012, 179–80).

Resulting values fall between -2.8, which correspond to the lowest vulnerability, and 5.2, which correspond to the highest vulnerability. All of these observations are then integrated into a Geographical Information System**,** allowing sites to be mapped and ranked accordingly.

Data management: the ALeRT App as a participative approach

The results of the pilot project revealed a need to enhance field collection and data management procedures, leading us to develop a web application for administering users and adding field data. The ALeRT App is a web application accessible on a range of different devices (*e.g.* mobile phone, laptop) and connected to a central online database. The ALeRT App allows the user to type and transmit all relevant information (including the full set of variables considered in the VEF) for each site to a secure server (Barreau *et al.* 2013). It also standardises data collection in the field, improving its quality and widening the possibility of collaboration between researchers, heritage managers and the wider community. The ALeRT App and corresponding explanatory video are accessible online (https://alertarcheo.univ-rennes1.fr/; http://osur.univ-rennes1.fr/page.php?207).

Experiences of the ALeRT project in Western France and further afield

The VEF grid and the ALeRT App have been put to the test at a number of coastal archaeological areas in Western France (Shi *et al.* 2012) and also in Northwest Iberia (López-Romero *et al.* 2012; Ayán Vila & López-Romero 2014), demonstrating that it can be successfully used in geographical contexts other than the one for which it was initially created. The first tests of the vulnerability assessment were carried out along Vilaine Bay and the Rhuys Peninsula in southern Brittany. These areas were chosen because various databases contained information on both the geomorphology of the coast and the location of coastal heritage sites.

Assessments of coastal vulnerability were then tested in 2014 after an exceptional run of winter storms that severely affected the Atlantic and Channel coasts of Western Europe. Western France was lashed by a series of storms between December 2013 and March 2014, among which, Storms Xavier, Dirk and Ulla were of unusual intensity, leading to the highest amounts of rainfall since records began in 1910. The combination of heavy rain, strong winds, high waves and high tides caused damage to known coastal sites, but also resulted in the discovery of new archaeological sites and cultural remains. This was not the first time that storms had caused damage; similar weather episodes occurred in March 2008 and in February 2010 (storm Xynthia),

with catastrophic – but more localised – effects. Some rescue excavations were undertaken after these earlier storms in Brittany (Daire *et al.* 2011), thus giving us experience of understanding the importance of planning risk strategies prior to the destruction of sites. The winter storms of 2013–2014 were exceptional however, not only because of the intensity of some of the climatic episodes, but also due to the unprecedented scale of damage to archaeological heritage.

Due to the impossibility of physically preserving all of the threatened sites, our methodology is based on a 'preservation-by-record' strategy. In this, the role of the public, local authorities and coastal managers is essential in order to alert us to the erosion of coastal heritage. Local volunteers and ALeRT reporters quickly reported damage to archaeological sites in the spring of 2014, and subsequently initial assessments of the erosion to coastal sites were undertaken (Olmos *et al.* 2014b).

An intensive fieldwork campaign was carried out in February and March 2014, right after the major winter storms. Work was mainly done in Brittany and fieldwork was systematically prepared in close partnership with local groups. Archaeological surveys were concentrated in different coastal zones depending upon local configurations and the presence of active participants in the area. After each report of damage was received, a detailed documentary study of existing archaeological data concerning each site was carried out. The main data sources used were the:

- *AMARAI* database (*Association Manche Atlantique pour la Recherche Archéologique dans les Îles*, Université de Rennes 1)
- Archives of the *Archéosciences* laboratory (Rennes 1 University)
- *Atlas des Patrimoines* database (Ministry of Culture, France)
- ADRAMAR *Atlas Ponant* underwater archaeology database (Association pour le Développement de la Recherche en Archéologie Maritime).

All the sites within the same geographical sub-area (e.g. island, peninsula) were the object of detailed analysis, but only 46 within the whole region were fully investigated, based on their vulnerability and accessibility.

The ALeRT network of coastal monitoring

After the positive experience in Western France and Northwest Iberia, the aim of the next phase of the ALeRT project was to increase collaborative work and build awareness of the consequences of heritage loss as a result of climate change and human pressure among coastal communities. Publicity about the effects of recent extreme weather events on cultural heritage has led to a growing interest in public archaeology in Brittany. As mentioned above, this has resulted in the development of the ALeRT network, consisting of about 30 active members led by

archaeologists from the Rennes Department of Archaeology and formed of local volunteers (mainly retired people); local and regional historical and archaeological societies; museums; and regional and national authorities.

A specific training course in coastal archaeology was developed, in partnership with the *Conservatoire du Littoral*, for coastguards in the winter of 2015 (Fig. 9.2). This course aimed to strengthen the ALeRT network and to improve the quality of vulnerability monitoring of coastal heritage. The partnership is part of a mid- to long-term strategy of collaboration, as coastguards can alert archaeologists about damage to archaeological sites located within *Conservatoire du Littoral* properties. The outputs of this collaboration can be re-evaluated, especially after subsequent episodes of extreme weather events.

Recently, a survey of volunteers and members of the ALeRT network was launched by Thibaut Peres, a student at Rennes. The sample consisted of 38 respondents, most of whom were experienced volunteers in coastal archaeological survey. The objective of the survey was to identify the behaviour of our volunteers, for example, where they work and what their interests are. Two types of participant were identified: 1) those who undertake coastal surveys in groups for an academic purpose (mainly men who have received a higher education, e.g. BA or MA); and 2) amateurs with a long experience of coastal survey, but who work alone or in small groups (mostly retired people with elementary or secondary education). In general, most people visited sites in their local area (up to 50 km away), and most of them complete surveys after every storm. These demographic results have been integrated into our project Geographic Information System and the information will be used as a management tool, allowing us to quickly contact surveyors at times when potential damage may be caused, directing them to survey areas at risk. The review also highlighted some areas where there were no active surveyors, but where coastal features suggest potential damage may be caused, especially in southwest Brittany.

Case study: Roc'h Santec Island (Santec, northern Brittany)

After an evaluation of its vulnerability, the small island Roc'h Santec in northern Brittany was selected for an in-depth study. The island has evidence of occupation from the Middle Palaeolithic to the Iron Age and work here demonstrates the role that non-professionals can play in monitoring coastal vulnerability. The area and islands surrounding the Île de Batz, including the island Roc'h Santec, were surveyed and photographed in depth by two locals working in collaboration with regional authorities and archaeologists from the French National Research Centre (CNRS) and the University of Rennes Department of Archaeology (Le Goff & Roué

1999). As the area has a flat coast that is exposed to the northwest, the storms of winter 2014 caused damage to known sites and led to the discovery of new sites and cultural remains.

Thanks to the photos taken by the volunteers of Roc'h Santec between 1995 and 2010, we were able to evaluate its vulnerability. An assessment completed in 2014 provided evidence of major damage to some sites, especially in the centre of the island, which had been flooded by high waves. Our survey, when compared with old photographs, showed that a shell-midden had been almost completely destroyed. Due to the interesting archaeological potential on the island – with stratigraphy surviving to more than one and a half metres, which is rare in this region – a rescue strategy was developed. This strategy was adapted to the conditions on the island, where access is difficult and fieldwork can only be undertaken during low tide and is limited to four hours per day. Fieldwork consisted of excavating a coastal section, more than 7 m long, in order to understand site formation (Fig. 9.3). The excavation identified four periods of occupation, the oldest dating to the Middle Palaeolithic, followed by Upper Palaeolithic, Early Mesolithic and a late phase dated to the Iron Age. During fieldwork, and in order to provide an estimation of erosion rates, a 3D recording project of the island was undertaken. Three-dimensional scans and photogrammetric models can be used to measure the rate of loss at a site with great accuracy (López-Romero *et al.* 2016; Chapter 8, this volume) and can also reconstruct the original extent of prehistoric occupation before sea level rise. Repeated surveys of the site over the coming years will allow analysis of the effects of winter storms.

Discussion

Coastal archaeological sites are facing dangers from violent storm surges and anthropogenic pressure. The threats are not new, but there is mounting evidence that climate change is causing an increase in the frequency and intensity of storm events, with harmful consequences for vulnerable heritage (World Heritage Centre 2009).

In Brittany, tests of the assessment of coastal archaeological vulnerability confirmed that the VEF is an appropriate tool for monitoring the coastal record in different contexts. Although the analysis is currently limited to 46 locations, representing a small sample of coastal sites in Brittany, the widespread distribution of these sites along the shore of the region and the diversity of geomorphological contexts allows us to present some conclusions. These will be supplemented by periodic repeat archaeological surveys in order to increase the variability and accuracy of the results.

For each of the 46 sites, a vulnerability score has been calculated, based on values relating to the threat, resistance and vulnerability of each site, as determined from the individual observation sheet database (Table 9.2). The vulnerability score (A minus B) ranges from -0.8 to 4.8 points with an average value of 2.49. The analysis of the vulnerability scores of these 46 sites enabled us to determine three ranks of sites/scores: low vulnerability (-0.8 to 1.1), medium vulnerability (1.2 to 3.1) and high vulnerability (3.2 to 4.8). These results have been integrated into a graduated symbol vulnerability map (Fig. 9.4). Such a vulnerability rank can be helpful in the creation of cultural heritage management policies (thus integrating administrators, local entities, associations, land owners and others), so it is essential to ensure that the output is visually striking and simple to understand. The spatial distribution of dots on the vulnerability map shows that the majority of high-vulnerability values are in western Brittany (Finistère), and 17 of the 27 sites recorded here score higher than the average value. All are located on the shoreline and they score high values for weathering, low values for resistance, and none are legally protected. These high score values are partly the result of a significant retreat of the coastline in this area, and Finistère was the area of Brittany where the impact of the winter storms in 2013–14 was strongest.

The factors threatening coastal heritage mainly result from natural processes. Although the study region features different types of shoreline environments, the most significant damage to archaeological heritage corresponds to sites located along or embedded within soft coastal cliffs and sandy dunes. Winds, waves and salt spray strongly affect the remains, and the structures are destabilized by accelerated cliff retreat due to sea level rise and erosion.

Conclusion

Recent interest in the erosion of coastal archaeology in Northwest and Western Europe (France, Ireland, UK, Norway and Spain) demonstrates the potential for international collaborative programmes and the development of common strategies. To date, questions about the effects of coastal erosion on archaeological heritage in France have been delegated to regional authorities. The development of a rescue strategy for coastal archaeology should be an important priority at a national level. We hope that discussion with the Ministry of Culture will lead to new strategies in the future.

Public response to coastal heritage loss has been very positive, but the use of the ALeRT App by the public should be further developed. More training in using the technology has to be undertaken to enhance citizen involvement in coastal heritage conservation issues, and also to

integrate young students in vulnerability assessment. It should be noted that the public response to the collaborative project was not always positive, and some experienced volunteers were worried that publicising sites may lead to looting, and therefore preferred not to share their discoveries. This means that new communication campaigns are necessary. During the pilot project we started to lay the foundations for long-term collaboration between archaeologists and non-professionals. Similar experiences in France (*e.g.* LITAQ project, Université de Bordeaux, http://litaq.huma-num.fr/) have shown that deeper collaborations between teams working with coastal environments are necessary in order to alert national authorities to the importance of developing a national strategy with dedicated funding.

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