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Endangered Archaeology in the Middle East and North Africa: Introducing the EAMENA Project

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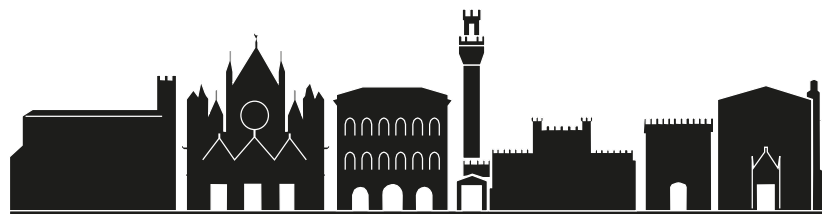
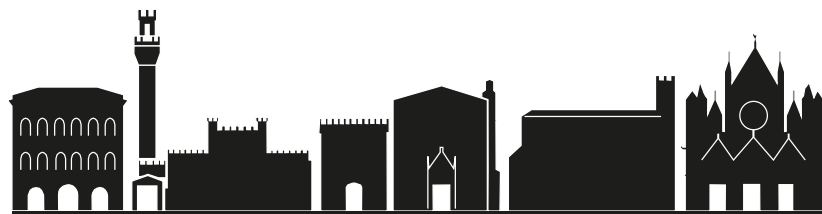
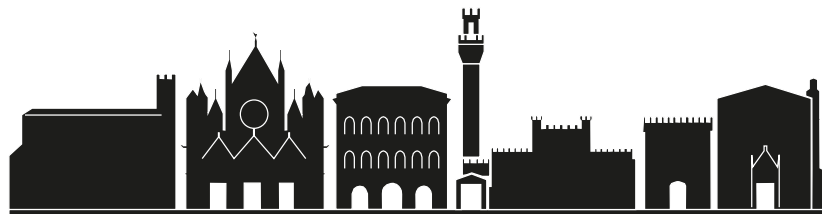
KEEP THE REVOLUTION GOING >>>

Proceedings of the 43rd Annual Conference on Computer Applications and Quantitative Methods In Archaeology

edited by

Stefano Campana, Roberto Scopigno,
Gabriella Carpentiero and Marianna Cirillo

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ON COMPUTER APPLICATIONS AND QUANTITATIVE
METHODS IN ARCHAEOLOGY

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Abstract: This project uses satellite imagery and historic aerial photographs to discover and interpret archaeological sites. It has created an open access database of archaeological records that provides basic information so that the sites can be better understood and preserved in the future. The threats to sites in the Middle East and North Africa are increasing and creating a record of previously unrecorded sites using this methodology may be our last chance before they are destroyed.

Keywords: Endangered archaeology, Satellite imagery, Middle East, North Africa

1 Background

Archaeological sites across the Middle East and North Africa are at risk from a range of threats: intensification of agriculture; population growth and the concomitant expansion of villages, towns, and cities; industrial developments, dam, and road building; looting and the illicit traffic of artefacts; warfare and deliberate and targeted destruction of heritage for religious or ideological reasons. Moreover, in many countries the pace of change is accelerating either because the economy is growing, or because there is conflict. These conflicts not only affect the individual countries where they are fought, but also neighbouring countries with the movement of refugees. This is happening in Iraq, Libya, Syria, Yemen and, to an extent, Egypt and Tunisia. The situation is fluid and is unlikely to improve in the short term, and may become worse unless the conflicts are resolved soon, which is unlikely.

Discussions about ‘endangered archaeology’ in the Middle East and North Africa have a long pedigree. In Jordan, Nelson Glueck lamented the growth of modern villages over ancient

ruins in the 1930s (Glueck 1939). Discussions to develop this project on ‘endangered archaeology’ began in 2014 and built on previous archaeological surveys in Jordan, especially by Kennedy and Bewley (2004) and a pilot-study in Saudi Arabia by Kennedy and Bishop (2011: 1284–93). Previous work demonstrated that the very rich archaeological resource of the Middle East was under enormous pressure, from a variety of agents (Kennedy and Bewley 2010).

Similarly fieldwork conducted in North Africa by Mattingly and colleagues at the University of Leicester demonstrated that the project should also include that region (Mattingly 2013; Mattingly and Sterry 2013; Mattingly *et al.* 2013).

The Endangered Archaeology in the Middle East and North Africa (EAMENA) project began in January 2015, generously supported by the Arcadia Fund (www.arcadiafund.org). The project is based in the School of Archaeology at Oxford University (with 10 staff) and has one core team member and an affiliated researcher in the School of Archaeology and Ancient History at the University of Leicester under the supervision of



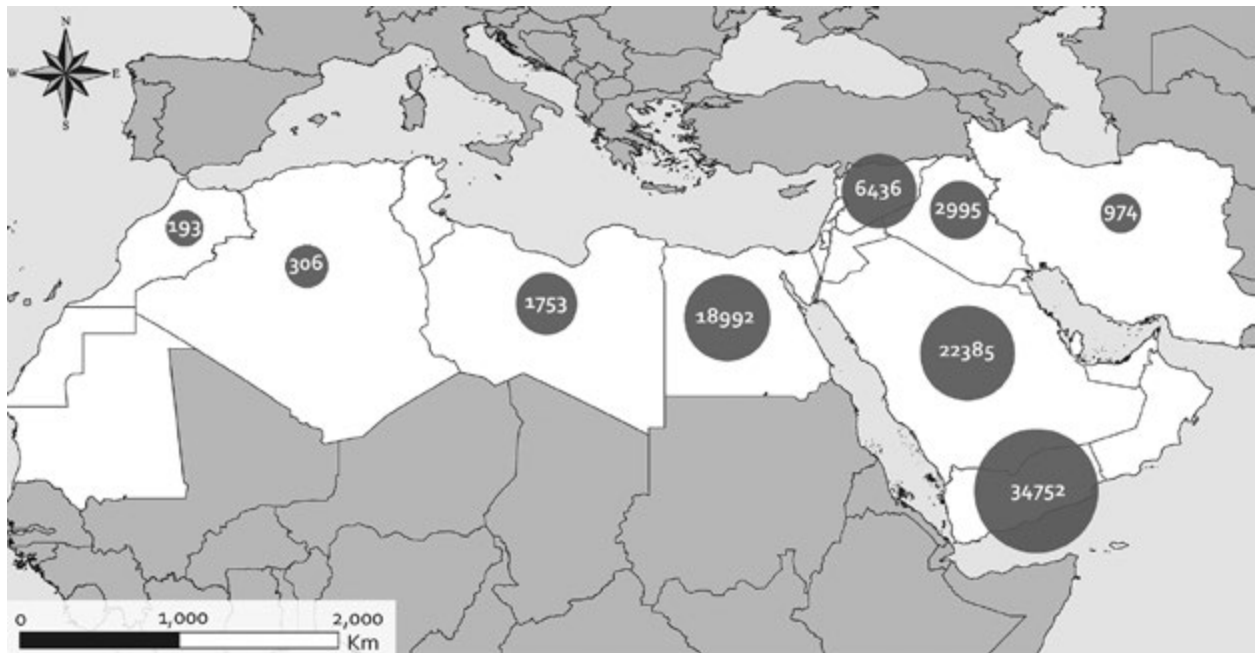


FIG. 1. THE REGION COVERED BY EAMENA AND THE NUMBER OF SITES RECORDED IN EACH COUNTRY (AS OF OCTOBER 2015).

Professor D. Mattingly. The project stretches from Mauretania to Iran (<http://eamena.arch.ox.ac.uk>) (Fig. 1).

The approach for the project is what might be termed ‘rapid archaeological survey’ involving the examination of satellite imagery, historical aerial photographs, and other sources to provide the location and brief description of each site and an assessment of threat. It is a first, but major, step in creating and then disseminating information about archaeology, which is at risk or ‘endangered’. The intention is that this will help those with the responsibility, or desire, in their respective countries, to preserve and conserve those archaeological sites that need better protection, so that future generations can study, enjoy, and profit from them.

Although the world’s media have recently focused on the shocking and headline-grabbing events in Iraq and Syria in 2015 (for example at Hatra and Nimrud in Iraq, and Palmyra in Syria), similar incidents of wanton destruction have also occurred much more widely across the MENA region. This includes the destruction of many Islamic monuments alongside the non-Islamic heritage; the latter has received more media attention in the West.

There are, however, other forces of destruction at work — as already listed — which are less dramatic but which, in aggregate pose an even greater threat to the cultural heritage of the MENA countries. Every day, through a range of destructive agencies archaeological sites are being lost. This loss is primarily through a lack of information and planning. Here we mean ‘planning’ as in the development sense of ‘town planning’ and the principle that any development, be it a road or a shopping centre, is only built after an archaeological investigation (or at least a proper evaluation of the archaeological implications of the development) has taken place. Even the rapid-approach employed by EAMENA can help to alleviate the worst damage, when it comes to understanding where archaeological sites are,

as it aims to create an initial record before many sites disappear completely.

2 Methodology

Unlike much of western Europe where many archaeological sites have been ploughed, and some of the remains are buried, largely invisible beneath the soil, in the arid or semi-arid regions of the Middle East and North Africa many sites remain visible on the surface and are made of stone or earth, rendering them detectable by means of aerial photography and satellite imagery. The vast majority of the sites we examine have not been recorded and are largely unknown to the relevant authorities in the countries concerned. The use of satellite and aerial imagery is especially important for those countries where access on the ground is either impossible or severely restricted.

The methodology for discovering and obtaining information about endangered sites consists of three elements:

1. the systematic analysis and interpretation of satellite and air-photo images utilizing established techniques and in conjunction with regional maps and archival data;
2. the creation of individual site records (using internationally recognized data standards) and building on work and procedures developed by the APAAME project (www.apaame.org) and others;
3. monitoring the condition of sites using a combination of remotely-sensed data and ground verification to provide appropriate documentation of the status of the visible remains so that their management can be improved.

The satellite imagery used is mainly that available on Google Earth and Bing Maps, although we have purchased some satellite imagery for specific sites in Syria, Libya, and Iraq,

which is currently being analysed. We also examine historic imagery where it is available and we have a programme of digitizing collections where we have permission, the most recent example being the Sir Aurel Stein collection, held at the British Academy which contains nearly 700 images: <https://www.flickr.com/photos/apaame/albums/72157652009016911>.

The approach is to look for sites in areas of high archaeological significance, where previous surveys may or may not have taken place, and assess these areas for the threats to the sites and landscapes. We have also worked in coordination and collaboration with authorities in certain countries, for example in Jordan to survey places in advance of infrastructure projects, such as the Madaba ring road (see Jordan below).

From the very beginning the project aimed to use the open source Arches software (www.archesproject.org) for a variety of reasons, not least because the MEGA-J archaeological database (for Jordan) was its prototype (funded by the Getty Conservation Institute and the World Monument Fund, <http://megajordan.org>). The Arches software has also been designed using agreed international data standards in a user-friendly way. The database now forms part of the EAMENA website and can be accessed via (<http://eamena.arch.ox.ac.uk>). At the time of writing the location of over 90,000 sites has been entered on the database and the full records are being created.

The information created, including both samples of the imagery and the database records, will be used to undertake or support fieldwork in those countries where this is possible. So far fieldwork has been possible in Jordan, Lebanon, and Morocco with plans in place for fieldwork on Iraq, and possibly Egypt, Iran, and Oman.

In association with the project we have developed a series of conferences and workshops, Protecting the Past (<http://www.protectingthepast.com/wordpress/>), which aims 'to highlight, and promote discussion of threats to cultural heritage sites as well as to develop strategies aimed at their preservation'. These workshops are aimed raising awareness of the EAMENA project information and for developing networks for on-the-ground monitoring of sites by local archaeologists.

The criteria for selecting areas to work in can be described as flexible and a judgement sample. Rather than allocate all the team to one country we needed to be able to respond to external needs as well as internal expertise. We also wanted to test the methodology in a variety of landscapes, so we began examining satellite imagery covering Saudi Arabia, Jordan, Iraq, and Libya and added in areas of Egypt (especially the Eastern Desert). The conflict in the Yemen also raised that country's needs up the agenda and we have worked there too. With staff joining the project with expertise in Syria's archaeology, we also started work there, especially in Halabiye and the coastal region. The rapidly changing political situation in North Africa altered initial plans for fieldwork in some countries, but through the Trans-Sahara project the Leicester-based personnel have been working in the field in Morocco.

3 Preliminary Results

The following section highlights examples of endangered archaeology in those countries where work has taken place so far. Although our focus has, by the nature of the project,

been on the archaeological and cultural heritage, there is no question that in those countries where there are conflicts the most important issue is the unfolding humanitarian crisis.

3.1 Jordan

The Aerial Archaeology in Jordan project and the archive (www.apaame.org) was one of the foundations and test beds for developing the EAMENA project. Using a combination of historical aerial imagery (the 1953 Hunting Aerial Survey in particular), Google Earth imagery, and an active aerial reconnaissance programme (for over 18 years, 1997 to 2015) thousands of sites have been photographed and recorded in Jordan; many are new discoveries. The overwhelming impression from this work has been the rapidly changing nature of the landscape. The pace of change is also accelerating, with a huge and recent rise in population in Jordan, the demand for more land for agriculture and for road and house building is having a direct and negative impact on important archaeological sites.

The focus of the EAMENA project in Jordan has, so far, been on recent road building; some years ago we photographed as much as we could of the planned southern by-pass of Amman (Kennedy and Bewley 2010). More recently we were alerted to the intended construction of a by-pass for the Azraq; and in 2014 we saw (by chance) the beginnings of a by-pass road for Irbid, and therefore made this a focus for our aerial reconnaissance in 2015 (see www.apaame.org).

For the EAMENA project, however, we wanted to try to begin surveys in advance of any construction work starting. After consultation with the Department of Antiquities we examined a corridor of land through which the Madaba ring road would be constructed. In total, 141 potential archaeological sites were recorded during this rapid investigation. Of these, 41 are site features or sub-sites, mostly of the city of Madaba (29) and Khirbet al-Mukhayyat (6). As many as eleven sites will be directly affected by the ring road and development in its immediate vicinity (within a buffer zone of 500 m on either side of it). Many of the sites are 'new' to the record; of the 141 sites examined, 86 do not have records in the MEGA-Jordan database (<http://megajordan.org>). We provided a report for the Jordanian Department of Antiquities to enable them to develop mitigation strategies in advance of the construction of this road (Fig. 2).

3.2 Syria

There is no question that the archaeological sites of Syria, many of them World Heritage sites (Burns 1999), are under the greatest threat because of the five-year long conflict there. At the time of writing, very important sites and individual temples and structures at Palmyra have been destroyed as part of the so-called Islamic State's publicity programme. In addition we have also seen many large, important sites, and other smaller sites, subject to systematic looting for artefacts (Stone 2015). More research is required on the timing and stimuli for the illicit trade in artefacts, but there can be no doubt that as state control diminishes, or is totally absent, looting of archaeological sites increases (but see <http://traffickingculture.org> for more information). We have seen significant changes to sites in connection with looting activities in Egypt, Iraq, and Yemen. In Syria the most often quoted example has been the



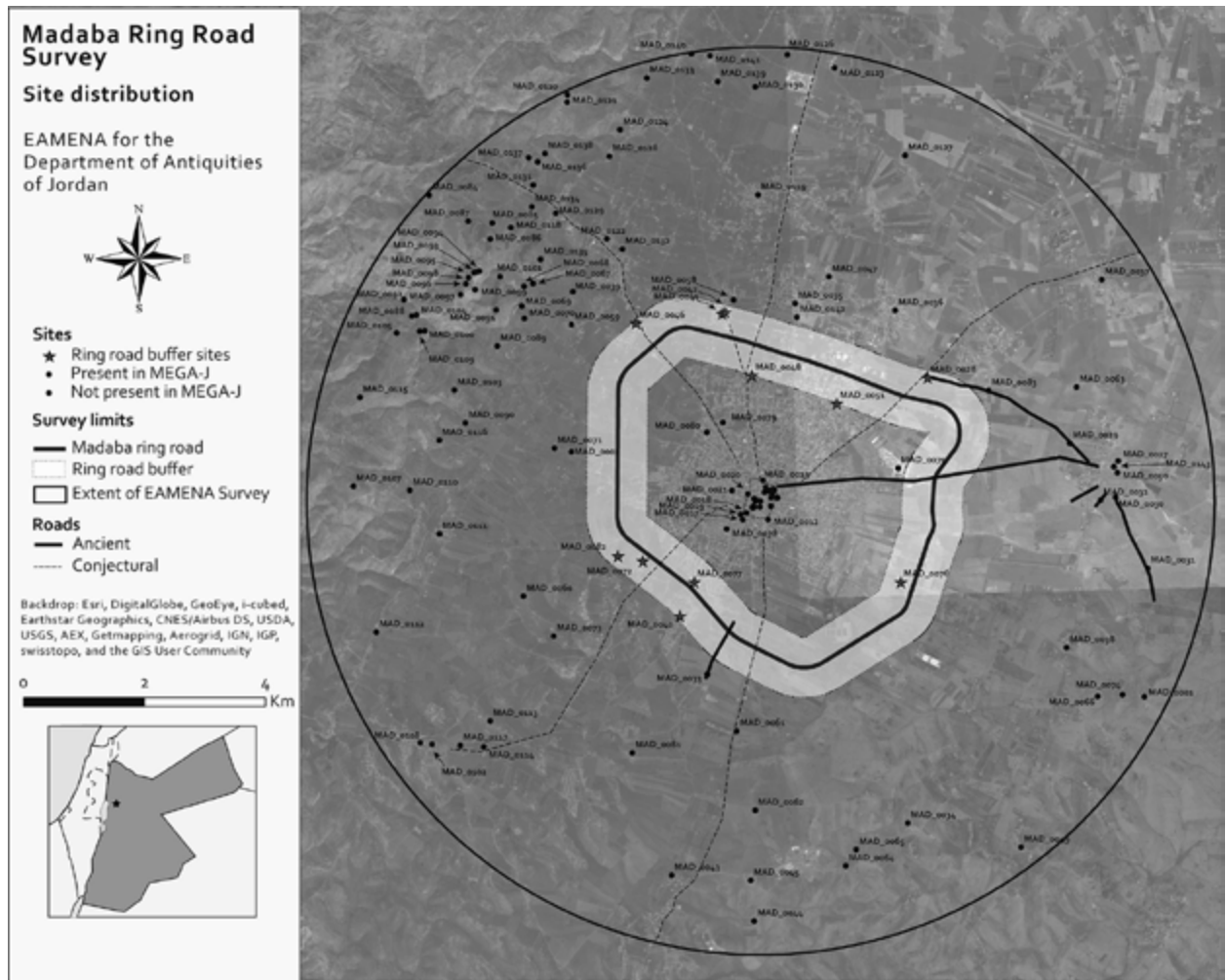


FIG. 2. THE HINTERLAND OF MADABA, JORDAN SHOWING THE DISTRIBUTION OF POTENTIAL CULTURAL ASSETS AND THE RING-ROAD BUFFER ZONE (SHADED).

illegal excavations at the Roman city of Apamea (see Casana 2015: fig. 8; Cunliffe 2014). Equally significant have been the changes at Dura Europos (see Casana 2015: fig. 2).

The project’s approach towards data collection in Syria has aimed at filling in existing gaps in knowledge, given the extent of previous surveys (e.g. Braemer *et al.* 2009; Casana and Wilkinson 2005; Castel 2007; Geyer 2001; Matthiae and Marchetti 2013; Meyer 2013; Poidebard 1934; Ur and Wilkinson 2008; Wilkinson 2003; Wilkinson *et al.* 2012, 2014). Two main areas have so far been targeted by the EAMENA project: the Halibye Plateau and the coastal strip, from the Turkish border in the north to the Lebanese border in the south.

The Halibye region (c.2500 km²), prior to the ongoing conflict in Syria, was marked for a dam project that was intended to affect more than 2000 km². This region is particularly rich in archaeological sites, with more than 4000 having been identified in the zone that is expected to be destroyed during construction. Mapping has focused on using Google Earth imagery, supported by the available imagery on Bing Maps and CORONA where necessary. Rescue excavations and surveys had been planned by the Syrian authorities for nine sites (some

of which were already recorded) and in the plateau area, but neither these investigations nor the dam project could be carried out once the conflict started.

The coastal strip, c.9000 km², in contrast, has been heavily developed since the mid-20th century. Our mapping here has focused on using a variety of different imagery and map sources (e.g. Corona and Google Earth) to explore the changes and threats to archaeological sites along this coastline since the 1950s. Detailed records currently exist for over 1600 potential archaeological sites from this region (Fig. 3).

Other sites in Syria have remained untouched, remarkably, and we are also investigating these further, so that a better record can be made of them, just in case they do become targets for looters. At this stage it is better not to name them in a publication until the current conflict has been resolved. In Syria 6094 sites have been recorded, in an area of c.11,200 km².

3.3 Yemen

Since March 2015, the beginning of the recent conflict, the monitoring of Yemen’s cultural landscape has become a





FIG. 3. DISTRIBUTION OF POTENTIAL ARCHAEOLOGICAL SITES IN THE EAMENA SURVEY AREA ALONG THE SYRIAN COAST.

priority for EAMENA (Fig. 4). The campaign of airstrikes has concentrated in the areas controlled by the Houthis, most importantly San'a and its hinterland, but also the northern and central highlands (from Sa'dah in the north to Ta'izz in the south). These regions were therefore the priority for our investigations.

Systematic investigation of over 61,885 km² resulted in the recording of 34,752 sites. While many of them appear to be in good condition, there have been some notable examples of destruction caused as a result of human action: conflict, agricultural development, construction, and looting, and there is also evidence of destruction by natural events (e.g. flash flooding).

Among the sites affected by the ongoing conflict, the Baraqish city wall, the Dhamar Regional Museum, the al-Qahira fortress in Ta'izz, and the Ma'rib dam deserve special mention. Damage to the city wall of Baraqish, a site occupied from the 13th to the 1st c. BCE as well as between the 13th and the 18th centuries CE (Schiettecatte 2011: 51–57 for a broad overview), were reported on 18 August 2015 and again on 14 October 2015.¹ Ground photos also appear to suggest that the temple of Nakrah, a site of worship in use from the 7th to the 1st c. BCE (de Maigret 2004) was severely affected by bombing.² The Dhamar Regional Museum, which contained more than 12,000 archaeological objects, was razed to the ground in

¹ Khabar News Agency 2015a, online; 2015b, online.

² Al Montasaf 2015, online.



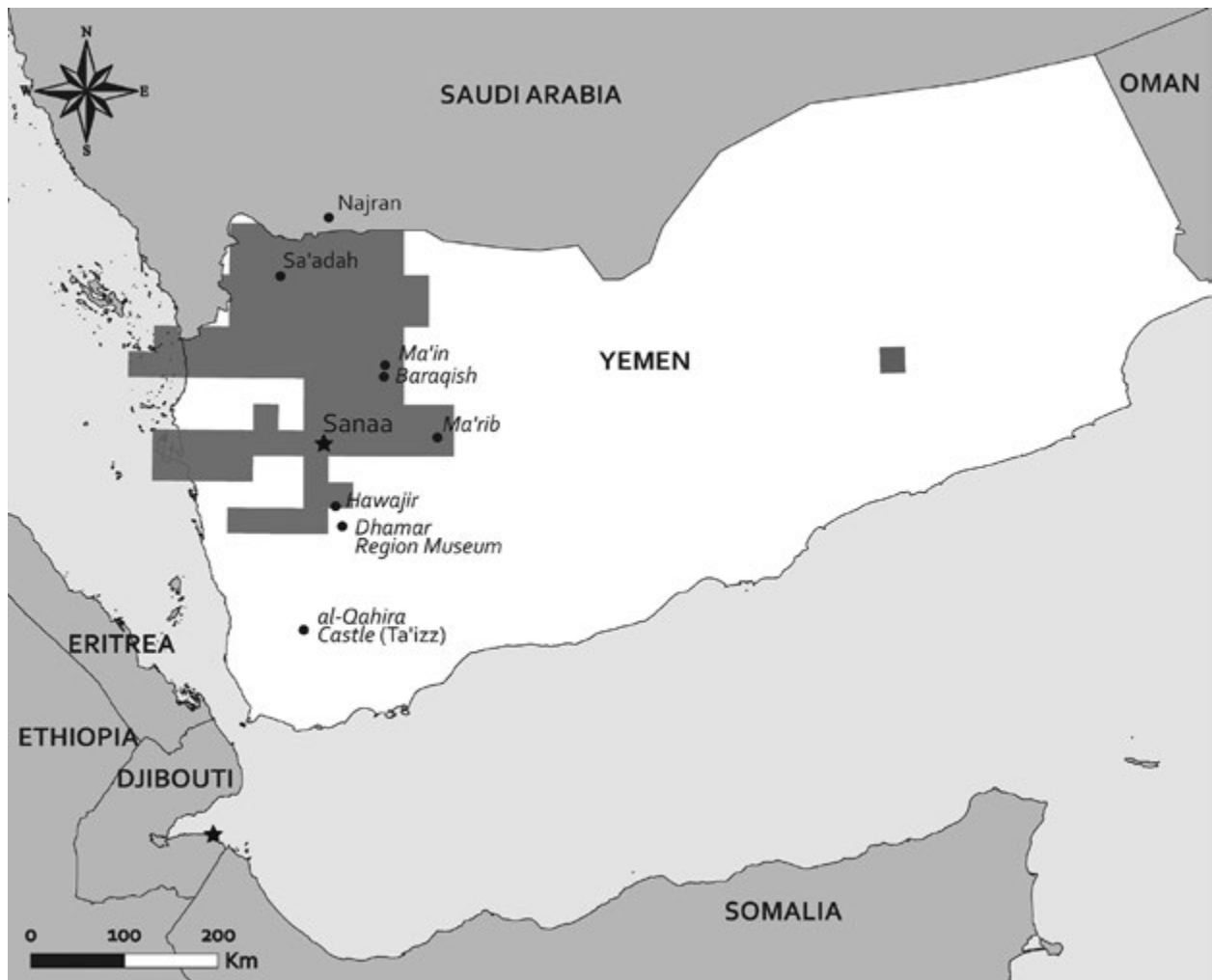


FIG. 4. EXTENT OF EAMENA COVERAGE IN YEMEN (AS OF OCTOBER 2015) AND LOCATION OF SITES.

June 2015:³ only *c.*1500 objects could be retrieved from the rubble by the Yemeni General Organisation of Antiquities and Museums (GOAM).⁴ The al-Qahira fortress of Ta'izz, a site settled since pre-Islamic times, was a prominent fortress under the Ayyubids and, especially, the Rasulids (13th to 15th c. CE), who made Ta'izz their capital. Ta'izz was taken over by Houthi rebels in March 2015 and its fortress subsequently bombed by the Arab coalition in May 2015.⁵ Figure 5 clearly shows up to five impact craters (marked by dashed lines), which flattened several structures along the access ramp to the south of the castle, part of the rampart and the core of the castle building.

Ma'rib, the ancient capital of the kingdom of Saba, was continuously settled between the 7th c. BCE and the 7th c. CE (Schiettecatte 2011: 104–116). Water management infrastructure in Wadi Dhana is attested since the beginning of settlement in the area, although the standing features of the great dam of Ma'rib are probably no earlier than the 3rd century CE (Vogt 2004). The northern sluice of the dam was reportedly bombed on 31 May 2015.⁶ So far, only one ground

photograph of the damaged structure has appeared:⁷ the acquisition of satellite imagery post-dating the air raid, which is currently underway, will make it possible to clarify further the extent of damage.

While destruction and damage by conflict have been brought to the fore by hostilities in Yemen, a much more pervasive, and long-term factor of threat is that related to agricultural and infrastructural development (such as road building). For example a group of pendant burials, *c.*14 km SE of Baraqish, has been severely damaged by the construction of an 8 m wide dirt road. These structures, which are generally believed to have had a funerary function, have come under increasing scrutiny in recent years (Kennedy and Bishop 2011).

Agricultural intensification has caused the irreversible loss of a group of regularly spaced cairns located in the northernmost sector of the Hajjah province, only 5 km south of the Saudi border. These were still extant in August 2004, but have been subsequently bulldozed to establish a network of agricultural fields. A combination of ploughing and looting has severely increased damage, between 2004 and 2010, at the site of Hawajir in the Dhamar region, which was dated by ground surveys to

³ Khalidi 2015, online.

⁴ Antonini de Maigret and Gerlach 2015: 41.

⁵ Al Arabiya News 2015, online.

⁶ Romey 2015, online.

⁷ UNESCO 2015, online.



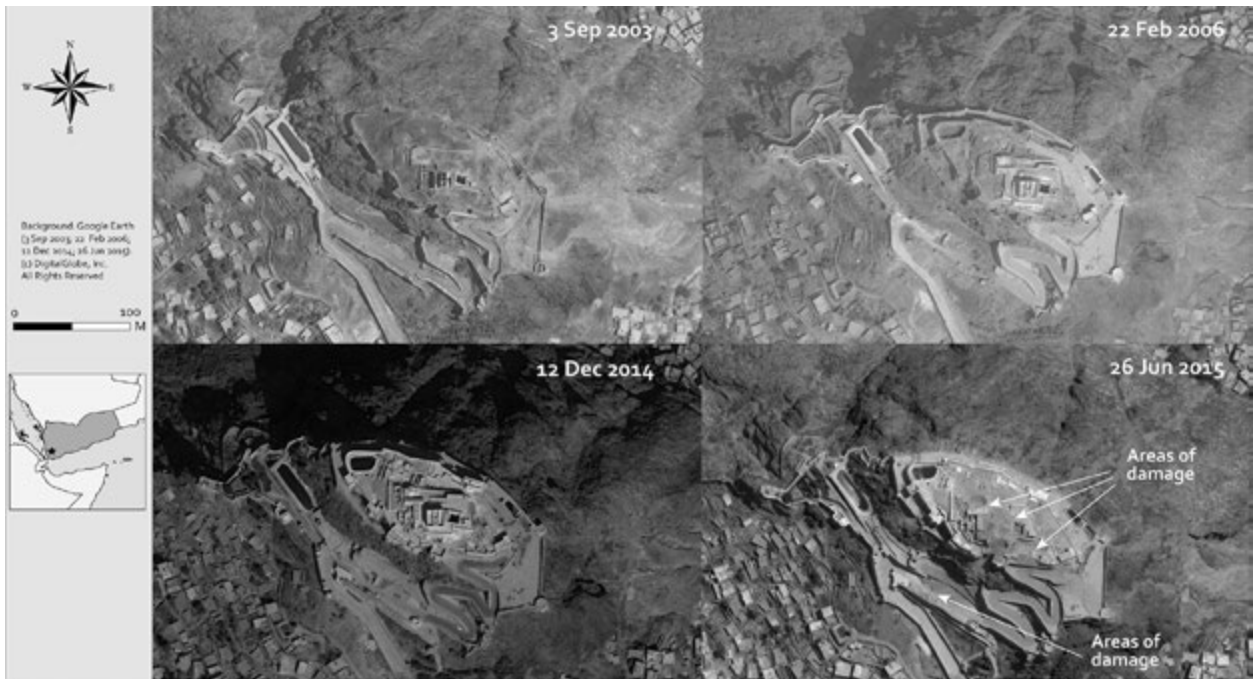


FIG. 5. TA'IZZ CASTLE. THE AL-QAHIRA CITADEL BETWEEN MARCH 2000 AND MAY 2015. IMAGERY FROM 2003, 2006, AND 2014 SHOWS THE PROGRESS OF RESTORATION WORKS, AND THE LAST IMAGE SHOWS THE IMPACT OF THE AIR STRIKES.

the second half of the 2nd millennium BCE (Wilkinson 1999–2000: 66–67). On the other hand, looting of large fortified structures and tell sites does not appear to have significantly increased over the last 10 years. For example, comparison of satellite imagery from August 2003 and September 2013 for the site of Ma'in (ancient Qarna in the Jawf region), an important centre between the 7th and 1st century BC (Breton 1994: 105–8; Tawfiq 1951), shows very little evidence of new looting activity during that decade.

Our work in Yemen has already produced the largest site inventory of cultural heritage sites for the country. Future work will be in the southern highlands and, more importantly, establishing partnerships with the GOAM, UNESCO, and archaeological teams with field experience in the country in order to add further details to our site records.

3.4 Saudi Arabia

The pilot study of high-resolution satellite imagery of a limited area near Jeddah, Saudi Arabia, was instrumental for this project in defining the scope and methodology. Despite the arid and daunting landscape, the results were dramatic. Within a randomly chosen survey area of 1240 km², which had high-resolution imagery, 1977 sites were recorded (Kennedy and Bishop 2011: 1284–1293). More recently a study of the Harret Khaybar area, relying solely on satellite imagery, from Google Earth and Bing has been published (Kennedy, Banks and Dalton 2015).

The EAMENA team has scrutinized satellite imagery covering an area of 14,700 km² spread over three areas in the northern, central, and southern parts of the country. This had led to the identification of 22,385 archaeological sites or site components, including dense concentrations of prehistoric settlements and

burial evidence. These include cairns, pendants, desert kites, wheels, and settlement complexes, with exceptional levels of preservation occurring on the basalt lava fields in the west of the country. There is no primary threat so far identified to the archaeology of Saudi Arabia, in contrast with the situation in areas such as the Eastern Desert of Egypt, but there are localized threats such as large infrastructure projects, seismic exploration for oil, and centre-pivot field irrigation systems (Fig. 6).

3.5 Egypt

Our work on the Eastern Desert of Egypt has focused primarily in two areas, at risk in different ways: one from planned urban development that has not yet happened, and the other from uncontrolled looting and surface mining. In these two areas together we have recorded c.18,000 sites across more than 65,000 km².

The first lies just south-east of the Nile Delta in advance of a proposed eastward expansion of Cairo (*BBC News Online* 2015, online). While reported plans for the establishment of a 'New Cairo' in this area within the next few years seem to have been postponed, there is little doubt that future developments and expansion of the city eastwards will occur over the coming years and decades, posing a serious threat to any archaeological sites in the area.

The second region is an area of the Eastern Desert further to the south, where three major routes run from the Nile cities of Qift (*Coptos*) and Edfu (*Apollinopolis Magna*), connecting them to the Red Sea ports of Quseer (*Myos Hormos*), Marsa Nakari, and *Berenike*. This region is rich in natural resources, including gold, gems, and marble, and several previous archaeological projects have recorded abundant evidence of ancient mining

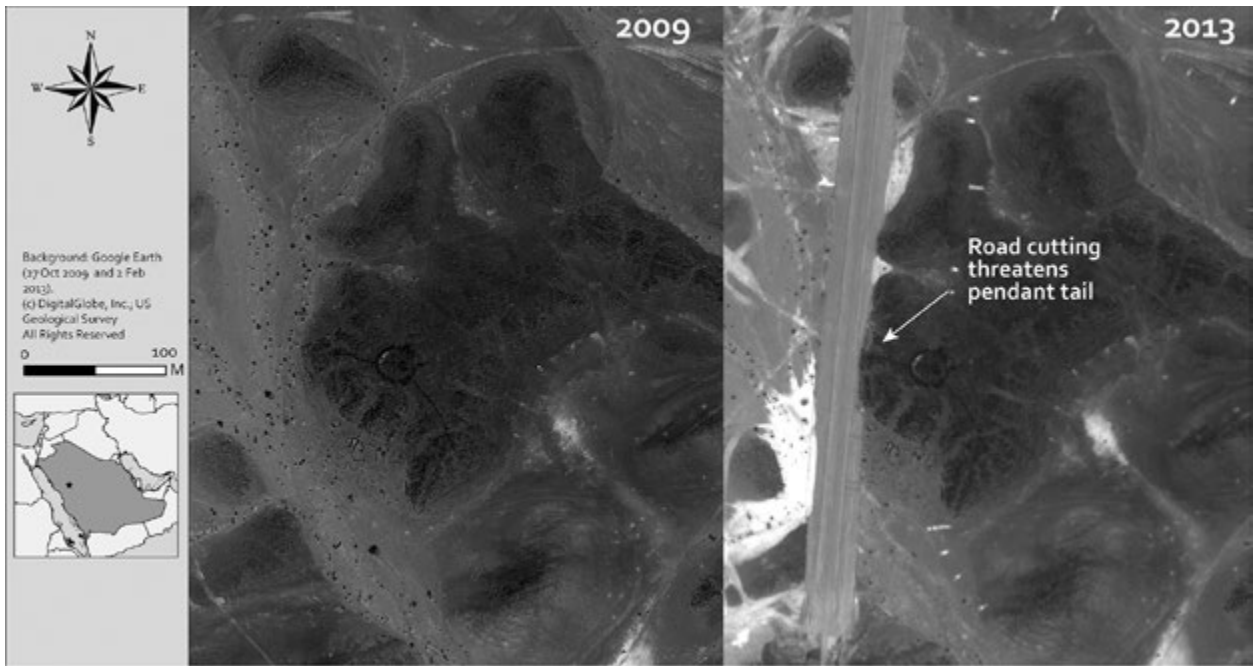


FIG. 6. SAUDI PENDANT. A PENDANT BURIAL IN 2009 (LEFT) AND 2013 (RIGHT), SHOWING DAMAGE BY ROAD CONSTRUCTION.



FIG. 7. BIR ABBAD: THE ROAD STATION OF BIR ABBAD IN 2010 (LEFT) AND 2014 (RIGHT).

settlements and activities. Furthermore, during Ptolemaic and Roman times, forts, road stations, fortified wells, and other military installations lined the routes through the region (Prickett 1979; Sidebotham and Wendrich 1995; 1996; 1998; 1999; 2000; 2006; Sidebotham and Zitterkopf 1998; Cuvigny 2003; Shaw 2007; Harrell and Storemyr 2009; Morrow and Cherry 2010; Klemm and Klemm 2011; Bragantini and Pirelli

2013, 2015). In addition to the many previously recorded sites, EAMENA has now identified several hundred previously unrecorded sites.

Many of these sites are now threatened with damage and destruction from modern mining activities. Before the Arab Spring foreign mining companies had begun large-scale



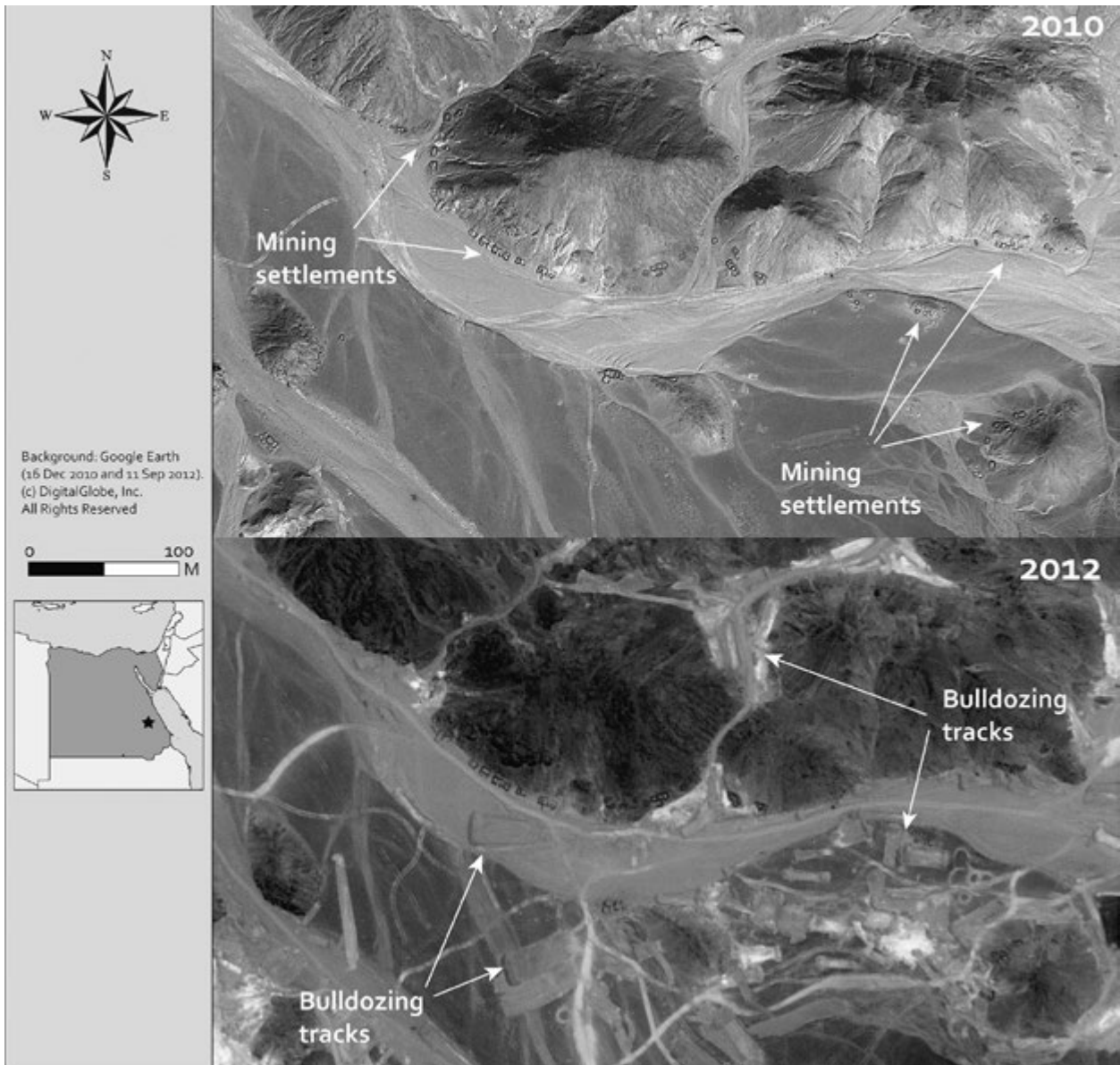


FIG. 8. A MINING SETTLEMENT IN THE EASTERN DESERT OF EGYPT IN 2010 (ABOVE) AND 2013 (BELOW).

industrial extraction of gold at a number of the sites (as, for example, Centamin at Sukari). Mining at some of those sites has continued or resumed since 2011. In addition, many sites appear to have been disturbed or destroyed by local people using metal detectors and bulldozers to search for the precious metals and probably also in some cases, archaeological artefacts to sell (illegally). One site that has suffered severe damage is Bir Abbad (c.20 km NE of Edfu), a road station, probably of the Roman period, where two outbuildings have been completely demolished by bulldozers (Fig. 7). In another example, a probable mining settlement of unknown date (c. 95 km E of Edfu) has also suffered extensive damage from bulldozers (Fig. 8).

3.6 Libya

The Leicester team has a long involvement in the mapping of archaeological sites in Libya, from the UNESCO Libyan

Valleys Survey of the pre-desert area (Barker *et al.* 1996a/b), to the Barrington Atlas sheets which underlie the Pleiades data (Mattingly 2000), to major surveys of desert sites in the region of Fazzan, south-west Libya (Mattingly 2003; 2007; 2010; 2013; Sterry and Mattingly 2011). The Trans-Sahara Project, with funding from the European Research Council, has extended the scope of this sort of work across a much wider geographical area (see e.g. Mattingly *et al.* 2013).

As well as consolidating the results of this work in a single database, the EAMENA project has been focusing on detailed mapping of a number of key case studies, where the archaeology has been identified as particularly understudied or under threat. To test the methodology, an initial study focused on the al-Jufra oasis group, to the south-west of the Gulf of Sirte. Three oasis towns of early modern date are known here — Sokna, Hun, and Waddan — but hitherto virtually nothing has been recorded of the long-term archaeological heritage of the oasis

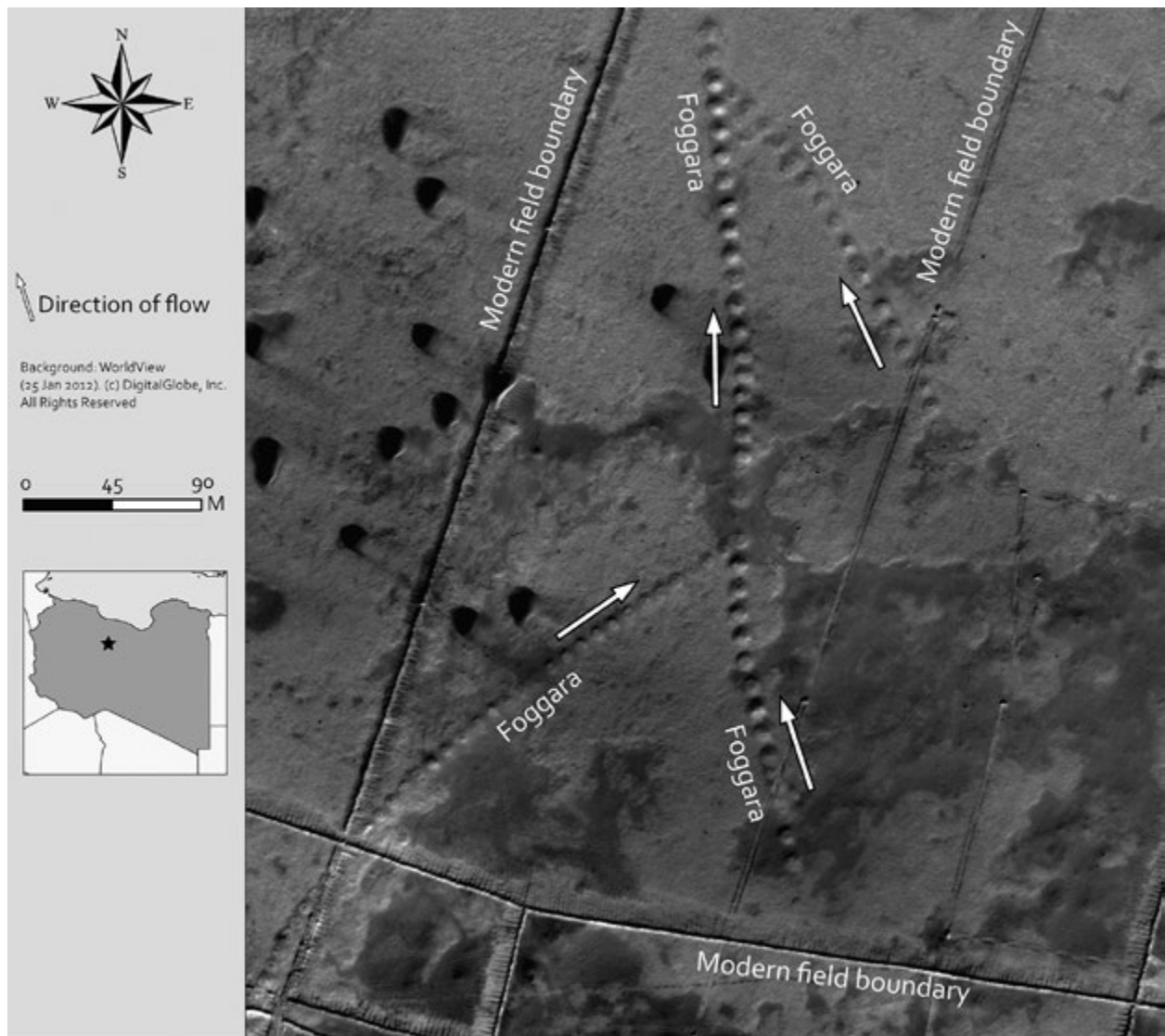


FIG. 9. FOGGARAS IN THE VICINITY OF WADDAN DAMAGED BY MODERN FIELD SYSTEMS.

(Scarín 1938). Our examination and interpretation of satellite imagery has enabled us to identify around twelve urban-scale sites, representing successive phases of the development of the three main oasis centres. Several of these sites have been damaged in recent years and others are under serious threat. We have also mapped extensive evidence of other settlement sites and pre-Islamic cemeteries as well as ancient irrigation systems (foggaras), which have been largely obliterated in the last decade.

Aerial photographs (Scarín 1938), WorldView, Corona images, and Google Earth were used to map sites and a classification of Landsat images was undertaken in order to quantify the impacts of cultivation intensification. The cultivated area increased by about 5400 ha between 1975 and 2011, supported by modern irrigation. Features including foggaras have been completely removed from some parts of al-Jufra by agricultural expansion since the 1930s aerial photographs and 1960s Corona images were collected. The more recent images show other areas of foggaras, which are at immediate risk of destruction due to the introduction of new fields (Fig. 9).

The resulting site map of the area's archaeology is thus completely transformed. These results have been communicated to the Libyan Department of Antiquities to enable them to enhance protection of the heritage before it is further degraded or lost.

A second case study involves the area around the UNESCO World Heritage Site (WHS) of Cyrene in eastern Libya. Despite its WHS status, the protection of this world-famous site is seriously compromised by the presence of a burgeoning urban settlement of Shahat, just outside the ancient city's walls (see Cherstich 2008). The main impact is on the suburban landscape of cemeteries, religious sanctuaries, suburban villas, and other productive buildings, the ancient roads and aqueducts.

3.7 Morocco

Our work in southern Morocco has been designed to tie in with the results of fieldwork undertaken by the Middle Draa Project of the University of Leicester. This is another Saharan oasis zone, where the archaeological record is poorly understood and



FIG. 10. THE HILLTOP SITE AND IRRIGATION SYSTEMS OF ZAGORA, MOROCCO.

even less well protected. The detailed recording of parts of the Draa Valley from the available Google Earth satellite imagery has already produced impressive results, with hundreds of hitherto unrecorded settlements identified, along with traces of many irrigation features and thousands of pre-Islamic burial monuments. The project is also closely collaborating here with the Moroccan antiquities service (Institut National des Sciences de l'Archéologie et du Patrimoine – INSAP).

The main modern oasis settlements and cultivation are located on the flat land adjacent to the river, irrigated partly by water management schemes constructed since the 1970s. In these

areas the earlier phases of activity are substantially masked or obliterated by the more recent cultivation and development. While damage is not apparent at some of the more remote hilltop sites, closer to the river the construction of new buildings and changes in irrigation and cultivation strategies have affected the preservation of sites. For example, areas of the hilltop site of Zagora have been bulldozed and some new structures built (Fig. 10). In areas where modern oasis cultivation is less intense, we have identified earlier phases of sites and irrigation systems. Although these have not, as yet, been closely dated, it is thought that the origin of oasis cultivation in Morocco dates to the pre-Islamic era. This area was selected as a detailed case

study because of the contrast between the good preservation of some sites and the impact of modern activity on others, all within the same region. Vehicle tracks are apparent across several sites and some cairns have been looted.

3.8 Iraq

As a trial exercise, the maps from two surveys for the heavily farmed alluvial plain of lower Mesopotamia, extending south-east of Baghdad were digitized (Adams and Nissen 1972; Adams 1981). Using this information the available satellite imagery for the area was assessed to see whether looting was visible. A total of 2995 records were created, with 397 sites showing definite signs of looting. This work also showed how much the landscape has changed, as 765 of the sites could not be reliably located as a result of the effects of agricultural development, water management, and sand movements that have occurred since the original surveys were done.

4 Conclusions

The philosophy underlying this project is that by discovering and recording archaeological sites the information thus created will provide for better conservation and protection of the region's heritage. The responsibility for protecting sites lies with the national or regional authorities in each country and we are working with as many of the Department of Antiquities as we can to target areas within each country, which may be under threat from planned infrastructure projects, so as to mitigate the possible damage. The majority of the sites we record have not been systematically recorded before; their destruction is irreversible. This project is therefore a once-in-a-generation opportunity. We are acutely aware that only a small sample of sites will be protected but we are, at least, improving the knowledge base so that informed decisions can be made. Only by knowing the nature of the threats to ancient sites can archaeologists advise national authorities to plan how to salvage a vital part of our shared human heritage. The preservation of the archaeological remains should not take priority over the lives of those having to live in areas of conflict. Once the conflicts do end, the destruction of the archaeological sites should diminish, and the preservation and conservation of those sites that have been affected can be improved. It is important that for the post-conflict era, however far in the future that is, the rebuilding phase does not destroy the fragile heritage any further. This is a key reason why the EAMENA project and others too (Casana 2015) have an important role to play in not only recording the archaeological sites as they are today, but also providing this information in a usable form for those with the responsibility for their future protection in each country.

Acknowledgements

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