# MAEASaM

Mapping Africa's Endangered Archaeological Sites and Monuments

NEWSLETTER 3 | APRIL 2022

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Ile de Gorée, Senegal, UNESCO World Heritage Site. Photograph courtesy of the Zamani Project.

## EDITORIAL

"Knowledge is open if anyone is free to access, use, modify, and share it — subject, at most, to measures that preserve provenance and openness."
— Open Knowledge Foundation

In the past two decades terms such as Open Data, Open and Free Software and OpenTools have become increasingly popular. They are linked to the paradigm of open knowledge and are seen as the foundation of democratisation of information. They offer opportunities to promote transparency of government and institutions, participation and efficiency as well as to provide a sustainable ecosystem to accelerate innovation and generation of new knowledge. It is this innovation and knowledge that can help solve societal challenges, from climate mitigation to sustainable development. But what do these terms really mean?

As we reflect on what open data and technologies are and in particular on how open geospatial tools and data for heritage documentation and preservation are used in the MAEASaM project, we take an opportunity to share some of the core concepts of the Open Knowledge Foundation and Open Movement.

OPEN DATA

"Open data and content can be freely used, modified, and shared by anyone for any purpose."
— Open Definition

The full Open Definition offers precise details as to what 'open' means with respect to knowledge. In summary, in order for data to be classified as being 'open data', the data should be:

Available: under an open (data) licence that permits anyone freely to access data as a whole and in a convenient and modifiable form for all users.

Affordable: price should not be a barrier to entry and should only be used as a means to subsidise the cost of the data reproduction and dissemination channels.

Usable and re-usable: data should be

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## SNEAK PEEK


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• (p.4) Geospatial information in Africa today: an interview with Professor Serena Coetzee.

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in a format that enables even non-technical users to make effective use of the data.

The FAIR guiding principles for scientific data management and stewardship - Findability, Accessibility, Interoperability, and Reusability, published in 2016 and cited by Daniel Löwenborg in his article in this newsletter, have been inspired by Open Science, although they explicitly and deliberately do not address moral and ethical issues pertaining to the openness of data.

## FREE AND OPEN SOURCE SOFTWARE

Some software has source code that only the person, team, or organisation who created it and maintains exclusive control over it - can modify. People call this kind of software "proprietary" or "closed source" software. Examples are Microsoft Office, Google Earth Pro, ESRI ArcGIS.

Free and open source software (FOSS) is an umbrella term for software that is simultaneously considered both free software and open source software. In a broad sense FOSS allows the user to access and inspect the source code, which is openly shared and provides high levels of control of the software's function. Examples of FOSS are Open Office, QGIS and GRASS. Although the terms 'open source' and 'free software' stand for almost the same range of programs and licences, there are strong philosophical disagreements between the advocates of the two positions.
The term Open Source refers to software for which the source code is available under an open licence. The full definition, which extends beyond access to the source code, is published by the Open Source Initiative and contains ten criteria that regulate the compliance of the software. These include free redistribution; the requirement of the program to include source code; the guarantee of the integrity of the author's source code; and non discrimination against persons, groups or fields of endeavour, amongst others. Whilst the terms 'open source' and 'free software' stand for almost the same range of programs, Richard Stallman, founder of the Free Software Foundation in 1985, and other authors, have argued that the open source idea is mainly practical, whilst the free software movement campaigns for freedom of the users of computing. This is to be distinguished from the idea of free as free of charge. 'Free software' means software that respects users' freedom and community. Roughly, it means that the users have the freedom to run, copy, distribute, study, change and improve the software. Thus, 'free software' is a matter of liberty, not price. To understand the concept, you should think of 'free' as in 'free speech,' not as in 'free beer.' (https://www.gnu.org/philosophy/free-sw.en.html).

## CONTRIBUTIONS TO THIS ISSUE

We open the third issue of our newsletter with a contribution that summarises our first journal article published in January 2022 in the Open Access journal 'Remote Sensing'. In this research the Google Earth Engine platform (free of charge but not FOSS) and free remote sensing imagery from the Landsat series were used to assess Land Use Land Cover changes in an Eastern African semi-arid region and demonstrate how they have impacted pastoralist bio-cultural heritage preservation. The interview with Serena Coetzee and the article by Daniel Löwenborg offer respectively some reflections on the growth of spatial data accessibility. Both highlight the impacts of this availability in understanding near-real time phenomena in almost any area of application. The article by Daniel Löwenborg also provides an insight into cultural heritage informatics via a detailed description of the GeoPackage format. Security is an important aspect of sharing information and one of the main challenges of opening data. Our database developer Mahmoud Abdelrazek reflects on the technology behind our website www.maeasam.org. Lastly, two contributions are made by the MAEASaM social media team and by the Arches database development working group. All these contributions reflect the project's commitment to the dissemination of information on our project and on the diverse archaeological heritage of Africa, as openly as possible.

Stefania Merlo
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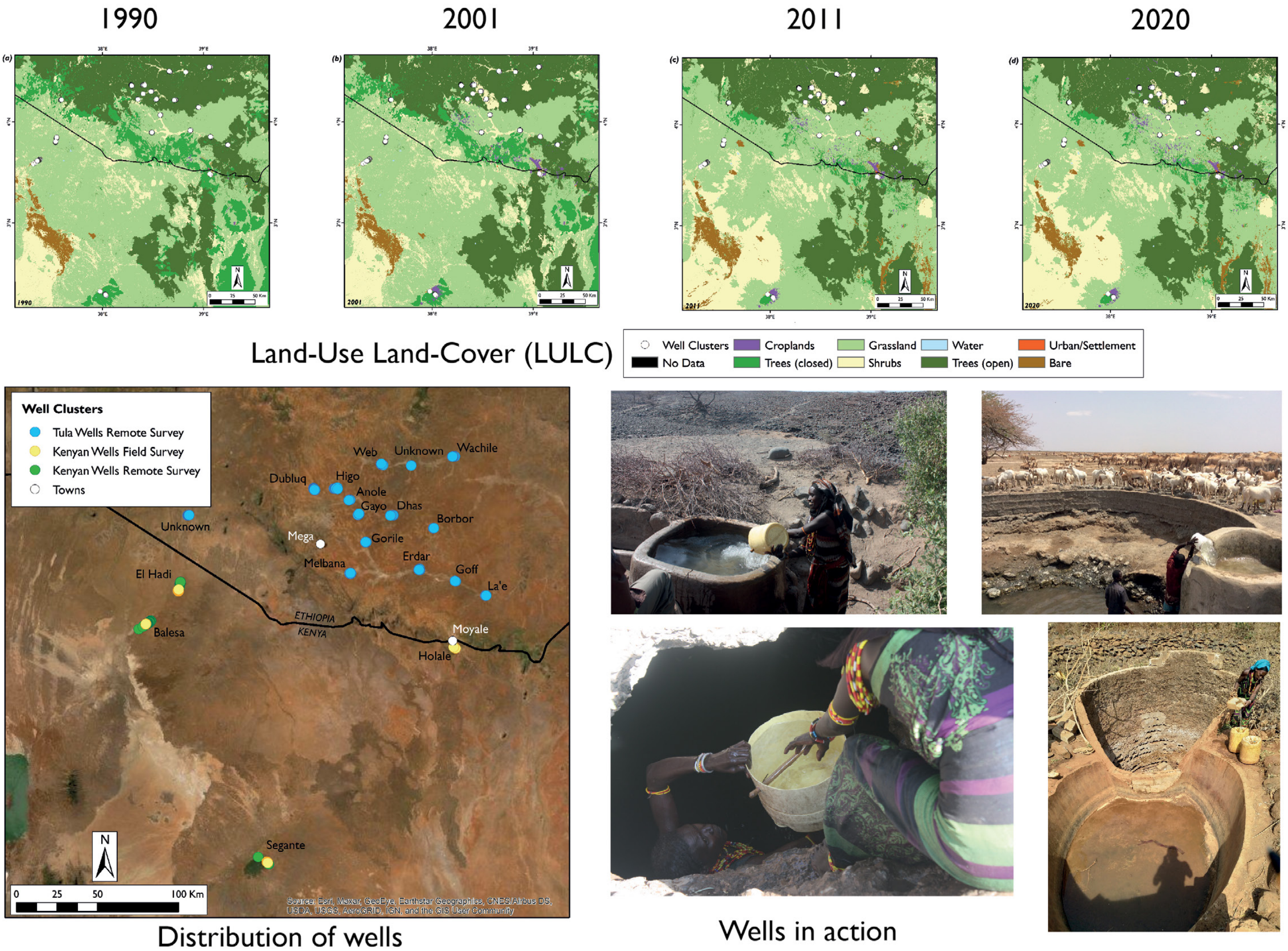
McDonald Institute for Archaeological Research, University of Cambridge.

Graphic by Faye Lander.




Graphical summary of the mapping of indigenous wells in Nothern Kenya and Southern Ethiopia from Ochungo et al. (2022).

## REMOTE SENSING FOR BIO-CULTURAL HERITAGE PRESERVATION IN AN AFRICAN SEMI-ARID REGION: A CASE STUDY OF INDIGENOUS WELLS IN NORTHERN KENYA AND SOUTHERN ETHIOPIA

A key component of the MAEASaM project is the use of Remote Sensing techniques to assess and monitor the preservation, conditions, and susceptibility of threats to new and known heritage sites, and to predict future threats for heritage management planning. As authors of a new paper in the open access journal MPDI, Pamela Ochungo and Nadia Khalaf, two of MAEASaM's Postdoctoral researchers, illuminate the role of remote sensing in mapping pastoralist biocultural heritage in Eastern Africa.

The use of remote sensing technologies for the detection of archaeological sites and monuments and other forms of tangible cultural heritage has increased significantly in recent decades, including on the African continent. A common application has been the use of freely available satellite imagery, such as that provided via the Google Earth platform, to locate previously undocumented sites in remote areas that have not been the focus of systematic, pedestrian surveys. In contrast, there has been less use of Remote Sensing technologies to map and monitor examples of extant 'biocultural heritage', except where such heritage are located within designated protected areas as in national parks and cultural landscapes that are subject to more formalised management regimes.

In the Northern Kenya/Southern Ethiopia region, which is characterised by erratic rainfall, limited surface water, aridity and frequent droughts, sophisticated indigenous water management systems in the form of hand-dug wells have been developed to ensure equitable access to critical water resources. Well-digging has been attested among many pastoralist groups inhabiting areas of northern Kenya and southern Ethiopia. Examples include the 'singing wells' of the Kenyan Gabra, and the tula wells constructed by Borana communities in southern Ethiopia. By attributing socio-cultural and sacred values to water, pastoralists have managed to sustain access to water in this arid and semi-arid region for centuries. However, these systems are increasingly under threat from climate change and socio-economic development. This study therefore sought to apply Remote Sensing techniques for spatially explicit mapping of landscape structure around the wells, and to quantify the threats that face these wells through time.

Remote Sensing analysis was used to assess the scale, distribution, and intensity of these threats, by evaluating the land-use land-cover (LULC)

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Operational well at El Hadi, Kenya. Ochungo et al. (2022).

and precipitation changes in this landscape and their association with, and impact on, the preservation of traditional wells. Multitemporal Landsat 5, 7 and 8 satellite imagery covering the period 1990 to 2020, analysed at a temporal resolution of 10 years, were classified using supervised classification via the Random Forest machine learning method.

The results indicated that land cover change was mostly driven by increasing anthropogenic changes with resultant reduction in land cover classes. Furthermore, increased fragmentation has occurred within most of the selected buffer distances of the well clusters. The main drivers of change that have directly or indirectly impacted land degradation and the preservation of indigenous water management systems were identified through an analysis of land cover changes in the last 30 years, supporting insights from previous focused group discussions with communities in Kenya and Ethiopia. Our approach indicates that remote sensing methods can be used for the spatially explicit mapping of landscape structure around the wells, ultimately towards assessment of the preservation status of the indigenous wells.

For more insights on this study, visit https://www.mdpi.com/2072-4292/14/2/314 and https://stories.council.science/unlocking-science-history-water-scarcity-africa/

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## GEOSPATIAL INFORMATION IN AFRICA TODAY: AN INTERVIEW WITH PROFESSOR SERENA COETZEE

As the project continues to work closely with geospatial heritage site data, we took the opportunity to ask Professor Serena Coetzee, Head of the Department of Geography, Geoinformatics and Meteorology at the University of Pretoria (UP) in South Africa and advisor to the MAEASaM project, to give her perspectives on the importance of open source geospatial information and Spatial Data Infrastructures (SDIs) in Africa.

Q. Today, spatial data is produced at unprecedented pace and scale. What are the benefits of integrating these heterogeneous data?

It is very exciting that today ever more data includes a reference to location, be it as place names, as coordinates or as some kind of code. Location is a common reference through which data from different sources and contexts can be integrated, facilitating the geospatial analysis of diverse data sources. Together with recent technological advances in storage space, processing, and analytical capabilities, this allows novel geospatial insights in near real-time on almost any topic.

Q. Considerable achievements have been made in Spatial Data Infrastructures (SDIs). How are these infrastructures sustained and what might be some of the challenges facing them today?

SDIs are a special kind of digital data or information infrastructure. The concept of a digital infrastructure emerged in the second half of the twentieth century when digital data became commonplace. Early SDIs followed the model of large technical infrastructures of the day, such as those for electricity and telecommunication, with centralised bureaucratic operations subject to government regulation. However, the internet, open source software, open data and other technological advances have changed the way in which data is collected, made available and used today. For example, many new data sources (e.g., crowdsourced data or data collected via the Internet of Things) are not collected and regulated by governments, and users expect data that can be used seamlessly, without any conversion or

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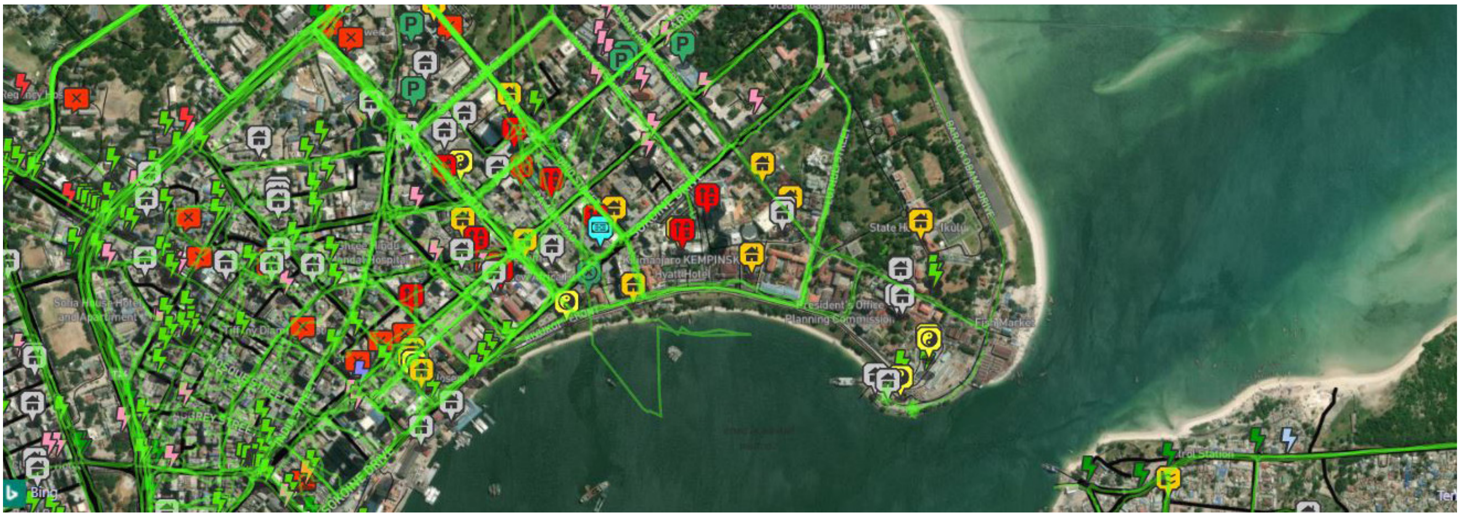
MORE ABOUT PROFESSOR SERENA COETZEE

Serena's research focuses on ever-increasing volumes of geographic information and challenges of making these available, accessible, and usable. Serena is actively involved in standardisation through ISO/TC 211, Geographic Information/Geomatics, chairs the Commission of SDIs and Standards of the International Cartographic Association (ICA) and is the African Regional Representative of the UN GGIM Academic Network.



OpenStreetMap view of the densely mapped city of Dar es Salaam, Tanzania.

transformation effort.

Therefore, 'traditional' SDIs will have to evolve: they will have to adapt to a much more diverse range of data providers, stakeholders and users. Instead of thinking of geospatial as something special that requires certain expertise, SDI implementers will have to consider how they can provide geospatial data so that it is usable by a much wider user base (i.e., how to make it 'not special'). For example, by involving a wider range of stakeholders in data governance, switching from a regulatory role to a coordinating role and actively engaging in data collaborations (for a comprehensive review of this topic see GGIM Committee: Towards a sustainable geospatial ecosystem beyond SDIs (2021)).

National SDIs are faced with the challenge of remaining relevant when there are so many other sources and providers of data. They will have to refocus their resources on datasets that cannot be provided by others, for example the data requires an authoritative stamp of approval, such as a cadastre or administrative boundaries. To regain relevance, they could also get involved in supporting e-government initiatives with their datasets and supporting municipalities or local authorities, who often struggle to collect and maintain geospatial data for addressing their urbanisation due to a general lack of resources and capacities (Siebritz et al. 2021).

Q. You have been involved in The OpenStreetMap (OSM) mapathon initiative in Africa. How has this shaped the way we interact, understand and work with maps?

OpenStreetMap has had a profound impact on the availability and use of geospatial data in many African countries, which is now readily available to anyone, whether they want to explore an area for tourism, development work, peace-keeping missions or an archaeological expedition. There are many success stories. For example, in Dar es Salaam, Tanzania, a community-based mapping project resulted in some parts of the city to now be among the most densely mapped areas in OpenStreetMap (https://wiki.openstreetmap.org/wiki/Dar_es_Salaam). Significant volumes of data have also been added through mapathons initiated by the Humanitarian OSM Team (HOT) in support of disaster response activities.

Q. In your view, what are the benefits of free and open-source geospatial software in capacity building?

Open source geospatial software facilitates geospatial data democratisation, because anyone can access geospatial data and analyse it with freely available open source geospatial software, such as QGIS. OpenStreetMap data, which anyone can download and use, together with QGIS, has removed all potential barriers to geospatial data access and analytics.

This presents many opportunities, not only in African countries, but also generally in lower-resourced environments, for example, academics at smaller universities or researchers on topics with funding constraints.

> "Open source geospatial software facilitates geospatial data democratisation, because anyone can access geospatial data and analyse it with freely available software, such as QGIS."
> — Prof. Serena Coetzee

# THE POWER OF FREE AND OPEN SOURCE GEOSPATIAL SOFTWARE FOR DIGITAL HERITAGE INFORMATION AND MANAGEMENT

Today there are far more free and open source softwares available to the global community compared with a couple of decades ago. Thanks to international consortia like the Open Geospatial Consortium (OGC) there are greater choices about how to conduct geospatial research without incurring heavy costs. As an expert in the field of Geographic Information Systems in heritage, and MAEASaM project's Co-Investigator for Zimbabwe, Dr Daniel Löwenborg writes about the powerful role of open and free geospatial software in research design, collaboration, and heritage management.

Using advanced and powerful technology for managing and analysing geospatial data does not have to be expensive. In fact, several leading software platforms are entirely built using Open Source solutions and are free to install and use for everyone. This opens many possibilities, ranging from personal use, with QGIS for spatial data editing and analysis, to enterprise level database management with PostgreSQL. Postgres is used in many industries all over the world, and the extension PostGIS adds functions for geospatial data.

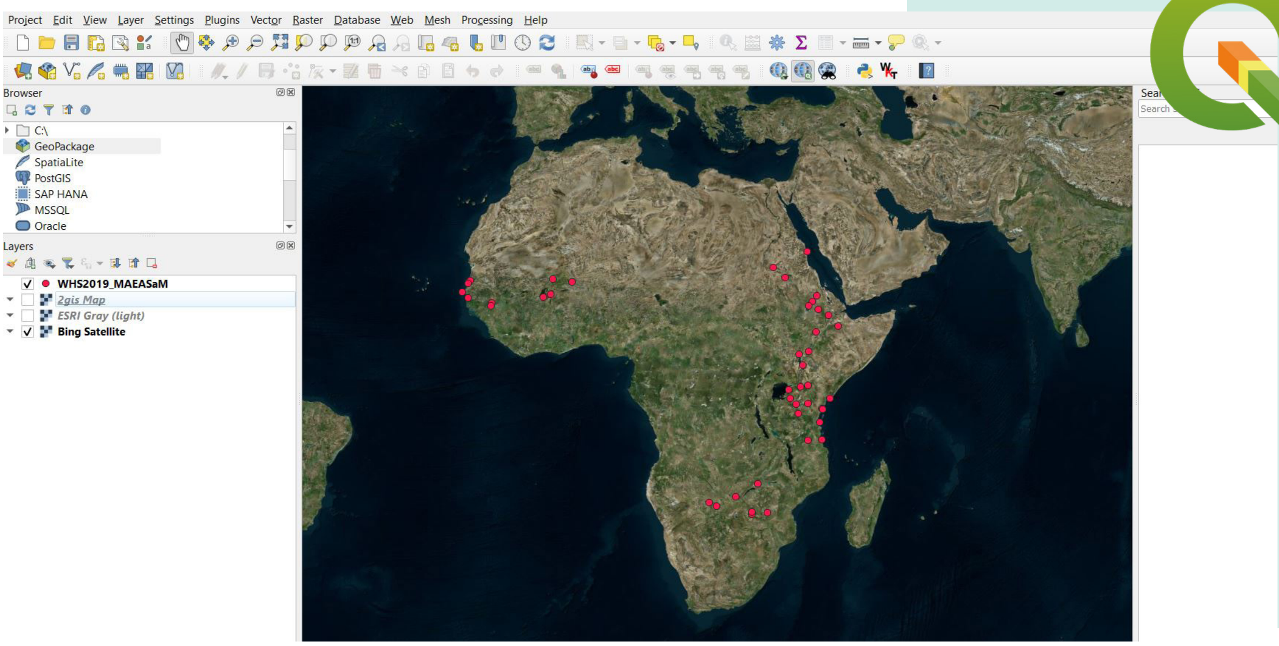
## THE USE OF A GEOPACKAGE (GPKG)

For a small organisation, a Postgres or PostGIS can still be a bit of work to install and manage. An easier way to get started started with a geospatial infrastructure could be to use the new GeoPackage (GPKG) format, developed by the Open Geospatial Consortium. GPKG is open format and well suited for archiving. It has resolved many of the limitations of the previous and informal standard for vector GIS data - the shapefile, developed by ESRI. Many GIS users are aware of some of the limitations of shapefiles, including the restricted number of characters that can be used in the naming of fields. GPKG takes this away and delivers your data in a single file that can combine multiple layers and tables. This makes it easier to store and share with others. Built on the SQLite architecture, the GPKG acts as a small, portable database which also means that it is possible to have many users accessing and editing data simultaneously, where the GPKG keeps track of the order of edits to avoid any conflicts or replications. All this makes the GPKG a very powerful format and a good way to get started for small organisations to establishing a structured way to work with geodata. GPKG is also the default format for vector data in QGIS, so they work very well together.

## HERITAGE INFORMATICS

Technical developments in recent years have brought a lot of hope for better and more accessible solutions that are free and open source. There are still several challenges for people involved with cultural heritage informatics, however. A major challenge is how to describe heritage information to make sure it will be understood by others and can be shared and reused. This is why there has been much talk about the FAIR principles since their introduction in 2016. FAIR (Findable, Accessible, Interoperable and Reusable) provides a set of guidelines on how to think about data sharing, as well as a set of formal requirements that you can test your data against. A key aspect to ensure that your data is FAIR is to use an established standard for describing the information. An example of a standard that is becoming increasingly used in cultural heritage is CIDOC CRM. CIDOC defines a set of terms to use with clear definitions so that both humans and machines can understand the data. Within the MAEASaM project, we are using the Open Source ARCHES platform which builds on the CIDOC CRM framework to make sure that the information produced will be sustainable both now and in the future, and can be incorporated in even larger infrastructure solutions for the future.

Daniel Löwenborg
MAEASaM Project Co-Investigator Zimbabwe,
Department of Archaeology and Ancient History, Uppsala University.




Open source QGIS for geospatial analysis.

# MAEASaM.org is now on https

At MAEASaM we do our best to keep you safe while browsing our website and to keep your data private. HTTPS has been implemented on our public website (www.maeasam.org) and on each of our experimental databases. Mahmoud Abdelrazek, champion database developer for the project, explains what this means for strengthening the security of data on the web and in wider cyberspace.

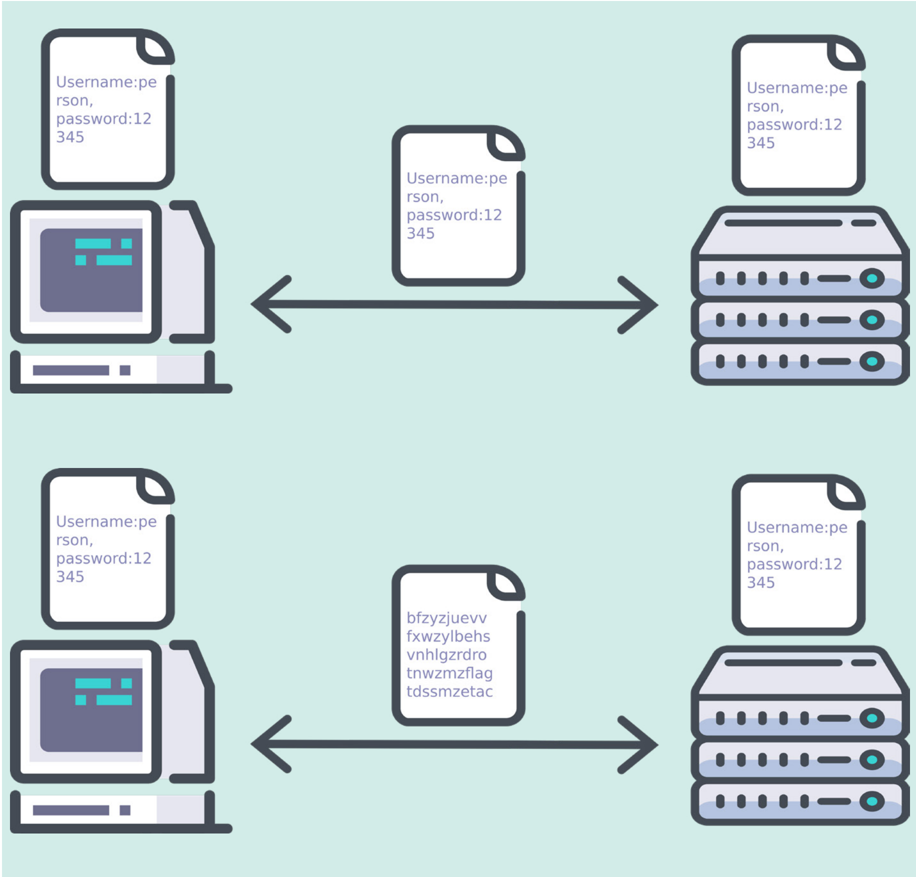



Illustration of the different encryption processes with http and https. Graphic by Mahmoud Abdelrazek.

In the few or long moments that your browser takes to load a website after you type the web address, some internet marvels take place. Your computer communicates with many other computers across the globe to find the exact computer hosting the website you are requesting access to and then collects the site and displays it on your screen. This process takes place in a few seconds or sometimes milliseconds, thanks to the robust infrastructure of the internet.

To examine this process, it helps to think about webpages in their original forms as text. When you visit a website, your browser receives a string of text and then translates it to the website you view on your screen. This text is transferred from a computer that hosts the website through HTTP Hypertext Transfer Protocol. HTTP is one of the most fundamental protocols that power the whole internet. It is used to transfer data back and forth between your browser and the server. This includes username and passwords during the authentication process when signing in. However, HTTP uses plain text, meaning that all the communications between your computer and the website server are sent without encryption. For anyone who has access to view the data travelling through the communication routes between you and the web server, this text is easily seen. Without the use of encryption your internet service provider can view the pages.

Resolving this issue requires the use of cryptography to protect your confidential information. Cryptography works in two steps: first your data is turned into a string of unintelligible text using a special algorithm; then the data is sent through the internet to the server which uses a similar special algorithm to turn your message back to readable text. The two steps are known as Encryption and Decryption, respectively.

For many decades symmetric cryptography was used as the main system for protecting information. Symmetric cryptography uses a common key shared between the sender and the receiver to perform both the encryption and the decryption, respectively. This common key can be agreed upon between the sender and the receiver before the start of the communication. Historically, the key could be anything from a line in a book to a random set of numbers and letters. The key must be kept secret at all costs and revealing it means that the encryption is broken. The result would be that anyone who has access to it will be able to decrypt the message and view its contents.

When your browser communicates with a server, it has no means to agree on a common key except using the same communication channel intended for the data transportation - the internet. If someone is monitoring this connection, they can view this negotiation on the key and use the key to view your data. Thus, this solution is incomplete, and a method to communicate the key securely between your browser and the server would still be needed.

The introduction of asymmetric cryptography was aimed to improve on symmetric cryptography and avoid some of its shortcomings. Asymmetric cryptography, also known as public key cryptography, uses a pair of keys, a private and a public key. As the name illustrates, private keys are kept secret and public keys are announced for everyone on the internet.

One of the main differences between symmetric and asymmetric cryptography is the reversibility of the encryption process. In symmetric cryptography, the steps taken by the encryption algorithm are performed

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in reverse by the decryption algorithm using the encryption key. While in asymmetric cryptography, reversing the encryption steps is not possible. Rather, the encryption is performed using the public key of the receiver and then the decryption takes place using the private key of the receiver. This design ensures that the information gets encrypted without access to the private key but cannot be decrypted without the private key.

Asymmetric cryptography sounds like an amazing solution to the internet communication problem. There is one downside, however. Performing the mathematics behind the asymmetric encryption takes a lot of computation, which translates into time delays in communication. Thus, a system that uses both symmetric and asymmetric cryptography was invented. The system uses asymmetric cryptography to communicate an encryption key for the symmetric cryptography in a process known as the handshake. Your browser reaches out to the server with a "Hello", message and the server responds by beginning the key exchange process. Once the key is communicated then your browser and the site can use it to encrypt the information and keep it safe from prying eyes. This system is commonly referred to as HTTPS. You can also read more about it in the amazing comics how https works. It is particularly important for the safety of your information to ensure your privacy on the internet. Although HTTPS solves a big problem, it is not a shield to all dangers online. We encourage you to read and learn more about the internet and cyber security.

Mahmoud Abdelrazek
MAEASaM Database Developer,
University of Cambridge.

Images from @maeasamproject instagram.

## THE ROLE OF SOCIAL MEDIA PLATFORMS FOR SPOTLIGHTING AFRICA'S DIVERSE ARCHAEOLOGICAL SITES AND MONUMENTS

RAISING THE PROFILE

Used for social good, social media can provide a space for more than just extraordinary content. Such platforms can be used not only to share and speak about the potential impacts on Africa's cultural heritage sites in changing global environments but to celebrate and raise the profile of the continent's archaeological sites and monuments, big or small, popularly known or less well understood.

WHAT @MAEASaMproject IS DOING

At the end of September 2021, MAEASaM's digital social media accounts on Instagram, Twitter and Facebook went live. Our objective is to raise awareness of Africa's archaeological sites and monuments, part of which includes sharing around the potential threats that many of these sites face today, such as the increasingly visible effects of global climate change. Two of our successful social media campaigns, which have attracted diverse audiences and online interactive engagement, are:

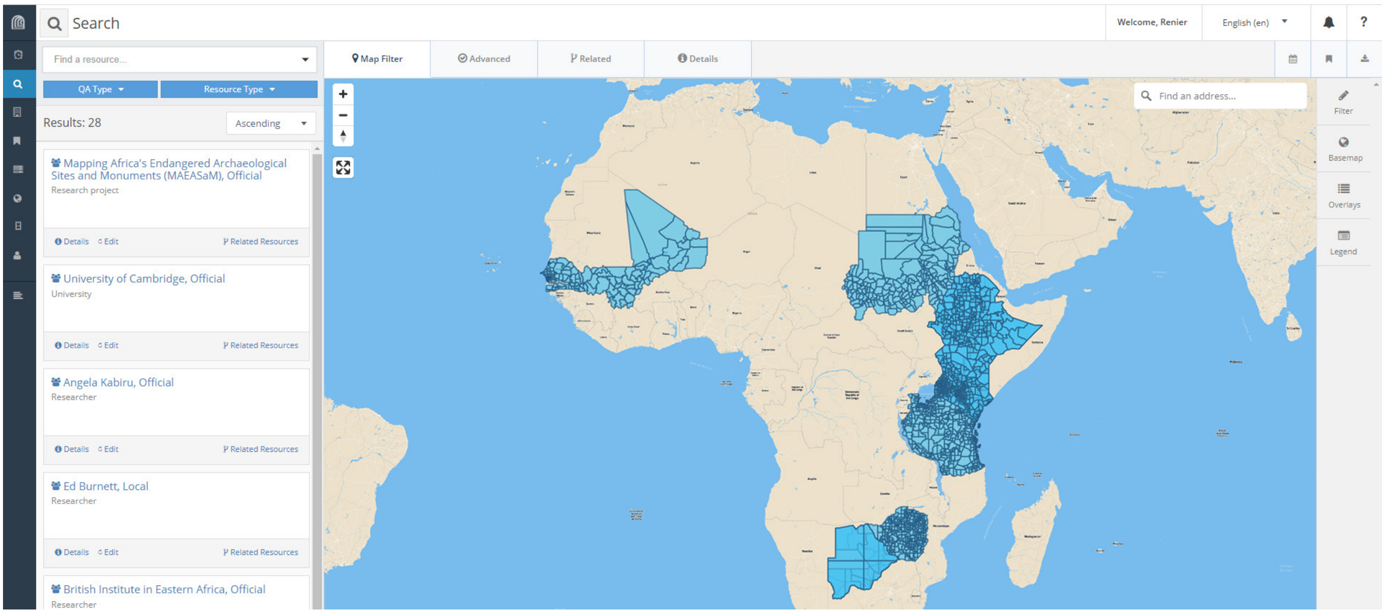
1) #heritagefromabove: These interactive weekly posts invite audiences to recognise sites and send their answers. Viewing heritage sites through remote satellite imagery allows followers to engage with these incredible sites and landscapes from afar, and to play an interactive role in highlighting their significance.

2) #meettheteam: Our weekly introductions of the MAEASaM core research members and their work behind the scenes, whether it be tailoring remote sensing models for site detection and monitoring or digitising legacy heritage datasets to be included in a unified African geodatabase, has provided a pathway to connect with the team and to get to know them.

In addition to these regularly scheduled posts, we share the ongoing work of our different project team members, offering a diverse array of content from all of our African partner countries. We also share content relevant to a variety of recognised international days, such as the International Day of Women and Girls in Science, and World Water Day, to keep our content varied and create links to wider social media (particularly regarding trending hashtags).

STAY CONNECTED AND FOLLOW OUR STORY

Twitter https://twitter.com/maeasamproject/
Instagram https://www.instagram.com/maeasamproject/
Facebook https://www.facebook.com/maeasamproject/




MAEASaM Arches database showing the Administration Boundaries.

## DEVELOPMENTS ON THE MAEASaM ARCHES DATABASE: THE ADMINISTRATION RESOURCE MODEL

MAEASaM has been working hard to modify and refine the Arches geospatial database for African archaeological sites and monuments. This is part of our continued efforts to develop a unified African geodatabase in collaboration with our national heritage stakeholders. As part of the modification process we have identified six different resource models that will cater for the large volumes of heterogeneous heritage site data types that derive from diverse geographical and information regions. These Resource Models currently include but are not limited to, (1) Site, (2) Actor, (3) Information, (4) Chronology, (5) Remote Sensing, and (6) Administration. To keep you updated, we take the opportunity to describe one of the resource models that has been finalised - the Administration Resource Model.

The function of the Administration Resource Model (ARM) is to provide the geopolitical context for each site entered into the database. Although history and past cultures transcend modern state boundaries, the administration and protection of these sites fall within the political and administrative origination of each nation. Therefore, a site that is added to the database needs to be placed within the administrative hierarchy of the country, which is done via the use of the ARM.

To develop the ARM, we balanced the technical aspect of the different administration systems with a straightforward user interface. This allows users to easily use the database, while simultaneously allowing improved system integration of the resource model into the database. The ARM is developed to include the first three levels of the administration system of each member nation, which makes it easy for users to locate heritage sites within a selected region. Similarly, a three-tiered level hierarchy will allow the national authorities to effectively manage and monitor their respective heritage sites. An additional benefit of the system is that it can help streamline future development projects as developers will know from the start which heritage sites are in the targeted area. This will not only help in preventing unnecessary delays but will reduce the risk of accidental damage to sites. Maintenance of the ARM is also easy to do, with two paths being available. For adding limited entries and/or modifications of already uploaded entries, the simple and straightforward Graphical User Interface (GUI) can be used. For the bulk upload of large quantities of entries, files need to be in a comma-separated value (CSV) format. With the streaming of the ARM, this process has been simplified to make it more user-friendly. Combining user-friendliness with straightforward coding principles has allowed us to develop the ARM into an intuitive, yet robust, model that can accommodate any nation that uses it. Similarly, should any nation require more than a three-tiered system, the ARM can easily be modified to accommodate this requirement.


Renier van der Merwe
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Mahmoud Abdelrazek
MAEASaM Database Developer, University of Cambridge.

Aerial photograph of Kua Stone Town, Tanzania courtesy of the Zamani Project.

## WHERE TO FIND US NEXT

In the upcoming months the MAEASaM project will be coordinating and participating in a number of activities. We will be attending both virtual and in-person conferences and presenting on some of the work we have done to date. Here is where to find us.

SOUTHERN AFRICA
Association of Southern African Professional Archaeologists (ASAPA) Biennial Meeting, 24-27 May 2022. Online Event. For more information: https://www.facebook.com/officialasapa/

EAST AFRICA
16th Congress of the Pan African Archaeological Association for Prehistory and the Related Studies, Zanzibar-Tanzania, 7-12 August 2022. MAEASaM will be running two sessions at the conference, including:

1. Remote Sensing and African Heritage Sites: New approaches and current research.

2. Learning from the past and looking to the future: reflections on digital African heritage management in a changing global environment.

UK
We will be joining our sister project Mapping Archaeological Heritage in South Asia (MAHSA) for a roundtable session (S16) at the Computer Applications in Archaeology (CAA) Conference in Oxford from 9 to 11 August 2022. The theme will be based on current challenges and future solutions towards digital equity in archaeology and heritage management, including discussants from different industries and geographic locations.

## STAY IN TOUCH!

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MAEASaM LOGO & NEWSLETTER TEMPLATE DESIGN
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MAEASaM
Mapping Africa's Endangered Archaeological Sites and Monuments

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