SASSA: an open source, Wiki soil based knowledge and decision support tool for archaeologists

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Abstract
Soils are an integral part of our cultural record and the importance of studying soils and sediments on archaeological sites in well established. However, many field archaeologists have had minimal or zero training in soil science and as a result feel overwhelmed by the specialist terminology and the complexity of the very medium that provides context to the archaeological artefacts and structures. SASSA (Soil Analysis Support System for Archaeologists) is a web-based knowledge base and decision support system that is designed for use both in the office as a reference and training tool, and also in the field, using a laptop or smart phone, to aid the description, sampling and interpretation of soils on-site. The architecture of SASSA, particularly with respect to the in-field support of students, provides a framework for other soil-education initiatives. The mobile technology and decision support tools of SASSA are also being explored as a possible basis for emergency response systems.

Key Words
Geoarchaeology, soils, decision support tool, web-based.

Introduction

Soils are historical entities that preserve legacies of their past formation, development and management, and hence are an integral part of our cultural sites and landscapes. On archaeological sites, soils provide context to archaeological structures and artefacts, determine processes of post-depositional alteration, and may even represent the degraded remains of archaeological materials. Field archaeologists recognise the importance of understanding the soils they routinely trowel away but most have little or no formal training in pedology or soil science. Traditionally, the interpretation and analysis of archaeological soils and sediments has fallen to specialist geoarchaeologists who may have entered into the subject via either archaeology or soil science. However, field archaeologists still need to make day to day decisions on the importance and meaning of the soils and sediments they encounter. They need to be able to effectively record and sample these soils, be able to recognise the potential information the soils may yield, and decide when specialist geoarchaeological help is required.

The problems specific to accessing and using geoarchaeological information that were identified by field archaeologists during an initial consultation prior to the development of SASSA were:

1. Geoarchaeology involves extensive field recording and sampling, which is time consuming and requires specialist input.
2. Soil analysis is expensive and time consuming and often provides little useful or new archaeological information.
3. Geoarchaeology involves dense terminology and scientific language making reports and books on the subject virtually unintelligible to the non-specialist.
4. There is a general lack of training in soil science that makes field interpretation and identification of key questions difficult for field archaeologists.

This consultation identified a need for an easily and freely accessible knowledge base aimed at supporting field archaeologists in the description, sampling and interpretation of soils.

The problem does not stem from a lack of literature on the subject. A number of very good books have been published in the last 20 years, including some aimed directly at field archaeologists (for example, English Heritage 2004; Goldberg and Macphail 2006). However, the pressures on field archaeologists to be conversant with a multitude of disciplines, and the specialist terminology involved in soil science, means they have had limited impact in the field. The Internet provides the opportunity to provide information in easily accessible bite-sized chunks and in a format that can evolve and change in line with user needs. The rapid rise of mobile technologies such as “tough-books”, PDAs and smart phones also now allow this

information to be accessed almost instantaneously in field situations, such as on-site during an excavation. This paper describes the development of a recently constructed web-based system (SASSA www.sassa.org.uk) that makes use of these technological developments to provide help and support on soils to archaeologists working both in the office and the field.

Development and consultation

In order to succeed in bridging the gap between archaeologists and soil scientists it was important that both groups would need to be included in the development process. To this end two advisory panels were formed: 1) an academic advisory panel to advise on and provide content and included members from archaeology, geoarchaeology and soil science; and 2) a user advisory panel that included field archaeologists from commercial, research and curatorial backgrounds. Both groups also aimed to have an international element with representatives from the UK, Europe, North America and Australia. These panels were involved in the consultation process and provided feedback on early versions of SASSA throughout its development. The academic group were also approached for material to populate the knowledge base, in particular case studies, whilst the user group were very helpful in providing field tests of both software and hardware. Additionally online archaeological discussion lists were used to elicit further ideas and feedback as well as to publicise SASSA, whilst early versions of the software were made available on-line alongside prominently featured feedback forms.

SASSA content and structure

The SASSA web system consists of two distinctive parts, each underpinned by different software.

1. SASSA knowledge base
2. SASSA field tool

SASSA knowledge base (http://www.sassa.org.uk/index.php/Main_Page)

The knowledge base essentially contains tutorial type materials including an introduction to geoarchaeology (scope, scale and research questions), a soils and sediments tutorial (erosional and depositional processes, soil forming processes, post-burial processes and anthropogenic soils and sediments), information on field recording, sampling and interpretation of soils, information on post-excavation analytical methods, case studies and a glossary of soil science and geoarchaeological terms. This information is held within a wiki powered by MediaWiki free server-based software. This is the same software that is used by Wikipedia. This particular software package was chosen on the basis that users would already have some familiarity with using Wikipedia and it was hoped this would encourage user participation in the development of SASSA beyond the end of the original project.

SASSA field tool (http://www.sassa.org.uk/index.php/Field_Analysis:Field_Tool)

The field tool is accessed through the wiki site but is actually a separate system built using XML data format. As the field tool has a data storage capacity users have to register and obtain a unique user name in order to access the field tool. The field tool can be used in two different ways.

Soil description tool: this feature walks the user through the process of recording and describing their soil or sediment and saves data within a hierarchical site, section/trench, and context data structure. The system is flexible so that as much or as little information may be recorded as needed, and if the system is downloaded and used in a stand-alone mode the interface can be modified to suit the users individual needs, typically this might involve slimming down the recording options or incorporating aspects of an archaeological context recording sheet. Information links in the field tool link to the knowledge base and provide information on how and why they might record particular soil characteristics.

Soil interpretation tool: this feature uses decision support trees to walk the user through the process of answering some of the most commonly encountered soils-related questions. Including: “Is this a buried soil?”, “Has this deposit been affected by in-situ burning?”, and “Has this deposit been affected by waterlogging and iron movement (gleying)?”. The user is walked through a series of simple questions relating to the soil material and its local environment to produce a score on a scale of 0-100, 0 being a negative answer, 100 a positive answer, and 50 an inconclusive answer. Links are also provided to explain how the answer was reached, what the confounding factors and errors might be, and what follow-on analyses might be considered. An example of the interpretation tool interface is provided in Figure 1.

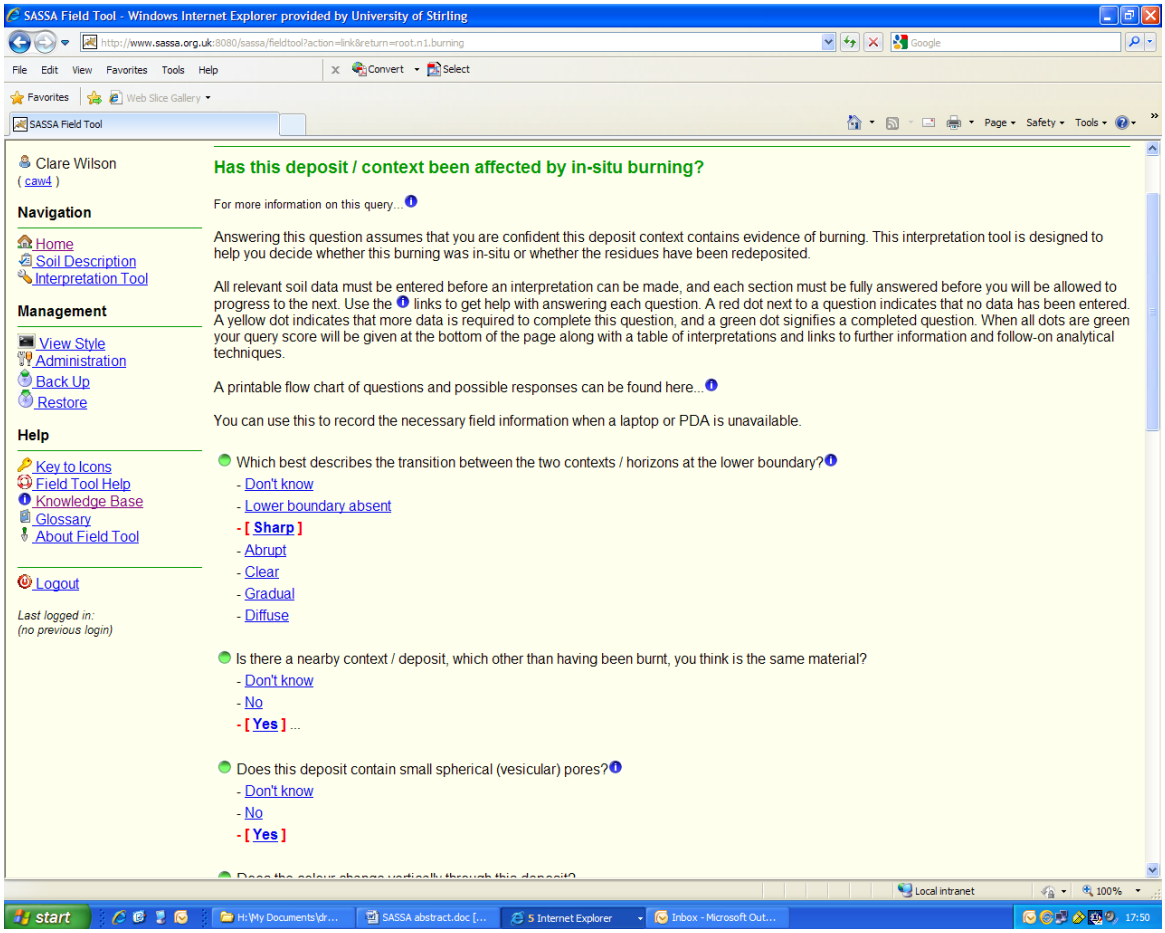

Figure 1. The user interface and question structure in the SASSA interpretation tool.

Design features

The SASSA field tool incorporates a range of features that support its use in field conditions.

Multi-user recording

If the system is to work as a recording or interpretation tool on complex archaeological sites it must be capable of building a single, logical 'site archive' of soil descriptions from the work of multiple users. Users could of course log into a single 'site' account but this risks data corruption as multiple users try to access and edit data entries. The compromise reached was to insist that each user has an individual account, and to provide a multi-user function that allows periodic importation and collation of data by a single designated user.

Mobile decision support

Decision support systems typically involve considerable computational and processing power limiting their use to desktop systems; however, the new generation of compact, mobile technologies is changing this. Mobile technology is rapidly developing and encompasses a considerable number of devices, from small personal digital assistants (PDAs), to laptops and tablet PCs (Derballa and Pousttch 2004). Mobile devices include the laptop computer, handheld devices, telephones, hybrids (e.g., 'smart phone' PDA/telephone), and vehicle mounted devices with enabling technologies such as GPS and Blue Tooth. While all such devices can provide decision support benefits and, in a general sense, be considered mobile, devices in the form of PDAs and Smart Phones are of most relevance and are becoming increasingly popular with general users (Burstein *et al.* 2004; Carlsson *et al.* 2005)

SASSA has been designed primarily as an internet resource that will also run over a wireless connection. A 'light weight', low-image version is available for use over mobile phone networks in order to reduce costs and to provide an interface appropriate to small screened devices. SASSA automatically identifies most currently available devices and presents the lightweight version, but in cases of non-recognition the view style can easily be changed via a link in the management toolbar. A downloadable version of SASSA is also available which can be installed as a stand-alone on a laptop or tablet PC, or can be loaded onto a USB memory stick for use as a plug and play device.

Uptake and usage of SASSA

The SASSA development project ended in January 2008 and since this time the site has continued to run with minimal maintenance. Although web usage figures are a crude measure of success there are now 95 registered users of the wiki knowledge base and 228 user accounts for the field tool. The field tool and tutorial pages have been the most popular parts of the site, although all the core components of the knowledge base have had in excess of 2000 views. The site is being accessed and used and as administrator for the site, I have been receiving regular e-mail communications from users typically requesting help and advice or offering case study material for the knowledge base. However, to date no users have actually added to or edited the wiki web pages, and efforts to encourage direct participation have largely failed. Users are happy to send data for inclusion on the site but appear not to be confident in adding these themselves. This raises issues for the future maintenance and development of SASSA that were neither foreseen nor budgeted for.

Conclusion

The SASSA project has been driven by a real need for soil information and support as identified by members of the archaeological community. Their involvement in the design and development of the system has been vital to its success. The site is now being routinely accessed by the community of users it was designed to support, and the feedback has been overwhelmingly supportive. The Achilles heel for the project so far has been in encouraging the user community to participate fully in the on-going development and evolution of the website. Since the end of the development project the site content has been static reflecting a lack of confidence by users in contributing to the wiki database. If SASSA is to become a site for discussion, debate and support, this is one problem that remains to be solved.

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