

Institution: Staffordshire University
Unit of Assessment: UoA15 Archaeology
Note: Names that have submitted outputs in this UoA are bold. Names not bolded include individuals from other UoAs, non-eligible staff and practice-oriented staff supporting our research environment.
1. Unit context and structure, research and impact strategy

a. Overview

In line with our institutional commitment to building research capacity and capability, over the last seven years Staffordshire University (SU) has developed from having minimal provision in archaeology to being internationally recognised as a centre of excellence in archaeological research and practice. UoA15 combines three inter-connected disciplinary areas: archaeology, physical geography and forensic science. Together, they constitute a vibrant environment that has generated world-leading research on: (1) resolving the fate of missing persons, in particular individuals killed during the Holocaust and other genocides, (2) environmental change and (3) the archaeology of William Shakespeare's life and times.

We submit to UoA15 for the first time due to the unit's growth, sustainability, and substantial research footprint. Since 2014, the UoA has generated £772,405 of research funding (HESA reported) and an additional £415,492 for consultancy and research-informed teaching activity. It has responded to challenges across the academic, professional and public sectors by achieving a balanced portfolio of funding. The vigour of our research is evidenced by publication metrics and the delivery of conference papers and public engagement activities underpinned by innovative interdisciplinary research. During this REF cycle, UoA15 staff have published 154 outputs including 8 books and monographs, 84 refereed journal articles, 33 book chapters, 5 papers in conference proceedings and 24 other outputs, in addition to grey literature. In the sub-fields of forensic archaeology and Holocaust archaeology, we have had more publications than any other institution worldwide since 2015 (source: SciVal). Staff have presented at >170 conferences and public events, curated 4 exhibitions, received 17 awards, prizes and fellowships, and reached ~27 million viewers through TV documentaries. Impact is focused through a strong portfolio of social action projects, with the unit developing expertise in building sustainable relationships with volunteers, NGOs, civic bodies and governmental officials. We have established a vibrant community of 72 PhD and Masters students who contribute to our research themes. We have attracted 19 visiting researchers and interns. Our work is supported by cutting-edge facilities and equipment including a dedicated Centre of Archaeology (CoA) workspace hosting £85,000 of survey equipment, Forensic Science laboratories within SU's £30m Science Centre, a cartography laboratory, a Crime Scene House and Garden and a £1.3m Smart Zone with Virtual Reality (VR), laser scanning, photogrammetry and 3D printing equipment.

b. Unit context and structure

SU promotes interdisciplinary and impactful research through 9 interdisciplinary Research Centres and 8 Research Groups. **The Centre of Archaeology (CoA)** - one of these Research Centres - is the hub of UoA15. The CoA connects with our research on environmental change and burial studies, strengthening our interdisciplinary commitment and capacity. The CoA and forensic science researchers sit in the School of Law, Policing and Forensics (LPF), whilst physical geography researchers are based in the School of Life Sciences and Education (LSE). Unit staff are specialists in forensic and conflict archaeology, geophysical methods, archaeological excavation, photogrammetry, laser scanning, ethical approaches to genocide investigation, forensic science,

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landscape geography, environmental change, earth surface processes and anthropology. All unit researchers are committed to i) using cutting-edge techniques to investigate human interactions with the landscape and ii) finding novel ways to disseminate our research beyond academia through engaging and innovative community projects and participatory research.

The CoA was formed in October 2013 in recognition of the University's contribution to applied archaeology. It has become an international centre of research and knowledge exchange and emphasises engagement beyond academia. It is dedicated to developing research excellence and professional practice with a focus on using novel techniques to investigate recent and historic crimes while responding to the unique ethical challenges that these circumstances pose. International expert in conflict archaeology and genocide investigation **Caroline Sturdy Colls** leads the Centre. Much of her research focuses on landscapes connected to the Holocaust and Nazi persecution. **Kevin Colls** contributes high-profile research projects centred on uncovering Shakespeare's residences in Stratford-on-Avon and manages our portfolio of archaeological consultancy services. **Will Mitchell** provides expertise in field and community archaeology for the growing range of research and consultancy projects. **Rachel Bolton-King** (forensic science) undertakes primary research on forensic ballistics and its application to the investigation of military landscapes. Eight researchers and technical staff from other departments (geography, fine art, games design, and film and TV) also support the CoA's work e.g., Branthwaite (Fine Art, UoA32), Graham (Film and TV, UoA34), **Tweed** and **Swetnam** (below). An emerging community of postgraduates (n=72), and fellows, interns and research assistants (n=29) have contributed to the research environment (see below).

Since 2005, SU has supported research in human identification under the umbrella of the **Burial Research Group (BRG)**. Most BRG members work within LPF (**John Cassella, Kirsty Squires, Sturdy Colls, and Davidson**). **Cassella** is an expert in forensic pathology and taphonomy. **Squires** is an osteoarchaeologist with expertise in studying cremated human remains. BRG inquiry focuses on decomposition and associated detection of body fluids, laboratory analysis of skeletal remains, and funerary archaeology of the recent and distant past.

Research in environmental change is undertaken by internationally recognised experts in ecosystem services, glacial processes, natural hazards, pollution and landscape change. **Ruth Swetnam** applies her expertise in Geographic Information Systems (GIS) and associated skills to the management of natural field and farm resources through national and global-level assessments. **Fiona Tweed's** research focuses on increasing understanding of the processes and impacts of glacier outburst floods worldwide, particularly in the context of deglaciation. As a forensic scientist, **Claire Gwinnett** applies original, state-of-the-art forensic techniques to the investigation of microplastics as environmental pollutants. She manages the **Microplastic and Forensic Fibres Research Group** and, from 2021, the newly formed **Centre of Crime, Justice and Security**. Whilst **Tweed** and **Swetnam** maintain distinctive research profiles, they have developed collaborative research with international collaborators on the visual assessment of landscape quality. **Swetnam** has worked with **Sturdy Colls** to supervise and publish research on geospatial- and archaeologically derived data from sites of mass violence.

c. Research and impact strategy

Aligned with the University Research, Innovation and Impact Strategy, we have sought to develop a stronger, more focused research profile regionally, nationally and internationally (see REF5a). Since the creation of the CoA in 2013, we have focused on:

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- (1) building a world-leading, interdisciplinary staff base
- (2) acquiring research funding to increase capacity for research on Holocaust and genocide investigation and ethical approaches to archaeological practice
- (3) increasing the number of postgraduate students aligned to archaeology
- (4) delivering impact, building relationships with partners and research users within and beyond academia, and providing innovative public-focused dissemination of our research.

We have embedded SU's strategic goals of building capacity and capability, enhancing collaboration and enabling and facilitating impact into our internal structure. We prioritise opportunities for interdisciplinary research collaboration and for using co-working to develop staff research profiles, particularly for Early Career Researchers (ECRs). All unit researchers are supported in finding novel ways to disseminate our research beyond academia through engaging and innovative community projects and participatory research, a key strength across SU.

Our delivery of impact is best reflected in the two case studies we are submitting in 2021: *Global Impacts of Holocaust Archaeology* and *Searching for Shakespeare – Impact of Archaeology on Local, Regional and Global Communities*. The case studies reflect two of our flagship research programmes. Both programmes have informed new memorial and museum installations, contributed to the global development of professional practice across disciplines, delivered novel community archaeology and educational programmes around the world, and extended the reach of archaeologically derived knowledge via engagement with the media. We have benefitted from an institutional commitment to expanding impact in our area via internal Impact Acceleration Funding (totalling £10,451; 10% of SU's overall allocation over 2 years) and Global Challenges Research Funding (£7,660).

Achievements: 2014-2020

Since 2014, the CoA has won grants for 22 internationally significant research projects, leading to 52 associated publications. We have pioneered new research in the sub-field of Holocaust archaeology, which has led to the development of innovative methodological approaches that respond directly to, and highlight the necessity to engage with, the ethical challenges involved in investigating mass graves, camps and killing sites (**Sturdy Colls, Colls, Mitchell**). This research has furthered understanding about Holocaust landscapes and sites of Nazi persecution as well as about the experiences of victims, perpetrators and bystanders. It has resulted in the first archaeological investigations at sites including the Nazi-German extermination and labour camps in Treblinka (Poland), concentration and labour camps and cemeteries in Alderney (UK), Semlin concentration camp (Serbia) and killing sites in Ukraine and Poland. It has produced detailed and new surveys of camps in Germany, Norway, the Netherlands and the Czech Republic. The "Finding Treblinka" and HERA-funded "Accessing Campscapes" projects have led to new spatial understandings of extermination and internment sites as well as novel interdisciplinary understandings of cultural memory, identity, necropolitics and religion during and after genocide. The "Recording Cultural Genocide and Holocaust Killing Sites in Jewish Cemeteries" project, funded by the International Holocaust Remembrance Alliance, opened new research avenues on the causes and consequences of racial hatred and genocide, and the role the built environment played in the persecution of Jewish communities during World War II.

With our commitment to applying new technologies and interdisciplinary methods, we have produced publications that have increased knowledge about using non-invasive archaeological methods at Holocaust sites. Topics include the first uses of Light Detection and Ranging (LiDAR) in this context (**Sturdy Colls, Colls, Mitchell, Abate**), contested Holocaust and Nazi-era heritage (**Sturdy Colls, Mitchell, Weston**), Holocaust material culture (**Sturdy Colls**), digital Holocaust memory and 3D

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visualisation (**Sturdy Colls, Colls, Swetnam**, Kerti) and the role of art in widening engagement with Holocaust history and addressing difficult histories (**Sturdy Colls**, Branthwaite). Sturdy Colls' book *Holocaust Archaeologies* has been recognised as a seminal text in this field (see Impact Case Study, 5.8). Aside from work on the Holocaust, our theoretical and methodological contributions extend into forensic and conflict archaeology, archaeological practice, genocide studies, material culture studies, fine art, heritage and memory studies, professional ethics and visual effects. Our "Digital Forensic Archaeology Project" resulted in new methodological approaches to the investigation of crime scenes and socio-historic conflict sites (Abate, **Sturdy Colls**). Notably, it responded to falling clandestine burial detection rates in Cyprus via the application of remote sensing technologies and photogrammetric methods for recording crime scenes. Forensic scientists within the unit have generated new research regarding contemporary and historic firearms and ballistics (**Bolton-King**) and the detection of clandestine graves and geochemical dynamics within them (**Cassella**, Blom, Davidson).

Beyond our work on the recent past, researchers from the CoA have pioneered research into William Shakespeare's life and times (**Colls, Mitchell**). Since 2013, the research has revolutionised knowledge of Shakespeare's life. It has completed multiple innovative archaeological projects, including work at Shakespeare's family home, New Place, and at his grave site. At New Place, this research led to the search and subsequent excavation of this important residence. It discovered structural remains that revealed the property's form and function. Resulting from this success, the team was approached by Holy Trinity Church to undertake the first archaeological investigation of Shakespeare's tomb. By using bespoke Ground Penetrating Radar (GPR) equipment, this research demonstrated that, contrary to popular belief, Shakespeare was buried in a simple earth-cut grave. This cross-disciplinary approach to investigating the life of an individual and his immediate family has enlisted experts in archaeology, forensic investigation, geophysical survey, archive studies, Shakespearean studies, facial reconstruction, English studies, and building historians, teachers and educators representing universities and institutions from across Europe, community and school groups, and fundraising professionals

Our environmental change research emphasises methodological innovation. It develops new approaches to solve problems and investigate environmental processes. **Swetnam's** research expertise lies in land-use science, landscape ecology and conservation. It is underpinned by her high-level technical GIS skills. In 2014, **Swetnam** was finishing research on the Leverhulme-funded project "Valuing the Arc", which involved modelling ecosystem services in the mountains of Tanzania. This work resulted in highly cited outputs in *Conservation Letters*, *Global Environmental Change*, *Global Change Biology*, *World Development* and *Carbon Balance and Management*. **Swetnam's** current research focuses on landscape evaluation. She led a landscape workstream as part of the £6 million Glastir Monitoring and Evaluation Programme (GMEP), funded by the Welsh Government. Recent collaborative work between **Swetnam** and **Tweed** centres on developing methodologies for assessing landscape visual quality. It has produced article outputs in *Ecosystem Services*, *Land Use Policy* and *Landscape Ecology*. **Tweed's** research seeks to better understand the processes and impacts of glacier outburst floods, on which she is a leading expert. This research is timely because of the devastating impacts of such floods and the expectation of their shifting patterns due to climate change. Recent research with Carrivick (University of Leeds) has led to new insights into the development of proglacial lakes, ice-dammed lake drainage mechanisms and the socio-economic impacts of glacial outburst floods globally, with outputs in *Global and Planetary Change*, *Earth Surface Processes and Landforms*, *Quaternary Science Reviews* and *Geomorphology*. **Tweed's** research with colleagues at Lancaster University investigates subglacial drainage processes in Iceland. This work has i) identified temperate glacial methane production and release as a potential contributor of greenhouse gas to the atmosphere and ii) developed new

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understanding of subglacial volcanic activity by using sulphate isotopes as a fingerprint of geothermal processes occurring beneath an ice cap. Key outputs include papers in *Nature Scientific Reports* and *Chemical Geology*. **Gwinnett** has led projects that employ interdisciplinary approaches to improve analysis and interpretation of particulates for environmental and forensic work. In the “Forensic Fibre Freshwater” project, **Gwinnett** applied forensic science methodologies to microplastics to improve characterisation and understanding of their source and prevalence in marine, freshwater and terrestrial systems. **Gwinnett’s** research with Woodall (University of Oxford) on the rapidly escalating global challenge of marine microplastic pollution has led to highly cited publications in *Nature Scientific Reports*, the *Marine Pollution Bulletin* and *PLoS ONE*.

d. Future strategic aims

We will enhance our current standing by continuing to lead and champion the development of interdisciplinary and cutting-edge research and methodologies to solve problems within and beyond the fields that we work in. In line with SU’s aims of being a Connected University, we will build on our successful record of innovative and impactful public engagement and outreach activities. We have developed a five-year strategic plan that defines the following research performance targets to:

- (1) focus on research connected to genocide, mass violence, and missing persons (within the CoA) and microplastics, the impacts of climate change and post-disaster responses (within the wider unit); then we will maintain our position as a centre of excellence in these fields, respond to contemporary societal challenges and broaden our impact within and beyond academia
- (2) shift the income strategy to the acquisition of larger UKRI and Horizon Europe grants and fellowships to build greater capacity, expand our research impact and ensure the continued professional development of our researchers, achieving a 230% increase from average REF2021 income per annum by year 5 for the unit
- (3) expand our postgraduate community incrementally over the next five years via four new courses and pathways relating to forensic archaeology, genocide investigation and environmental change
- (4) develop new collaborative research opportunities between the Schools of LPF and LSE
- (5) expand the unit’s staffing base with an additional five international researchers by 2025 to diversify our portfolio of specialisms.

All staff work under the SU Code of Practice for Research which sets out expectations in relation to research integrity. Accessibility of our research is essential to fulfilling both our impact aims and the requirements of the SU Open Access Mandate.

2. People

a. Staffing strategy and staff development

In keeping with institutional commitment to the Concordat to Support the Career Development of Researchers (REF5a), our staffing strategy aims to sustain and develop existing research excellence and diversity, and to be responsive to opportunities that strengthen interdisciplinary working and address contemporary societal challenges.

SU has clear career pathways that recognise and reward research success, and that support progression through co-working and mentoring (REF5a). The unit has strong academic staff capital for its size, with 5 Professors, 2 Associate Professors, a Senior Lecturer and a Lecturer. Several of these staff achieved promotion in the assessment period. Their career progression evidences our support for the development of their research profiles, expertise and external standing. Via an Annual Professorship Call, **Sturdy Colls** and **Swetnam** were promoted to Associate Professor in 2014 and were subsequently conferred Professor in 2017 and 2019 respectively; **Gwinnett** was promoted to Associate Professor in 2016 and Professor in 2019; **Bolton-King** and **Colls** were promoted to

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Associate Professor in 2017 and 2019 respectively. Appointed in 2016 to grow SU's provision in bioarchaeology and due to the expanding portfolio of grant funding acquired by the CoA, **Squires** was promoted Lecturer to Senior Lecturer in 2017. **Mitchell** (an ECR) was initially an Archaeological Project Officer. He was promoted to Lecturer in recognition of his research, integral role within the CoA team and teaching track record. Abate joined the CoA as an EU Marie Skłodowska-Curie Fellow researching digital forensic archaeology (2016-2019).

Supported by, and as part of our commitment to, SU's Equality, Diversity and Inclusion (EDI) Framework (REF5a), we seek to maintain a balance between career stage, subject expertise and gender within the unit, whilst supporting research development and employing individuals with long-term potential. Support for female researchers is notable. 6 of our staff are female, 3 are male. 70% of our submitted outputs are by women in our team. All researchers within the unit have benefited from e.g., SU's flexible approach to blended working arrangements in 2020 and **Sturdy Colls** undertook maternity leave during the REF period. As members of the Professorial Conferment Committee, our researchers have contributed to work to improve gender balance across SU and participated in mandatory organisational EDI Training.

As explained in REF5a, the unit has benefitted from several other University-wide initiatives and commitments that have enhanced our research culture. All staff have undertaken research ethics, leadership and development training as part of SU's Academic Development Framework. SU has a formal Performance and Development Review (PDR) system, with full staff participation. Workloading is established and reviewed using a workload planning model. Use of research time is monitored via reporting and the PDR system. All staff submitted to this UoA are given a minimum 20% of their time for research.

The CoA hosts a seminar series offering staff, PGRs and external speakers the opportunity to present their research in a supportive, rigorous environment. Other, School-level, seminar series enrich the research environment and facilitate cross-disciplinary networking. Staff and PGRs are encouraged to participate in SU's Annual Research Conference and in external meetings and conferences, with School-level funding available to support them. Our partnerships outlined in Section 4 have facilitated mutual external speaking opportunities, fellowships and CPD opportunities. Impact case study authors have worked closely with SU's Impact Manager, participated in training (e.g., for the VV Impact Tracker), delivered and attended central seminars focused on impact enhancement, accessed Impact Acceleration funding and benefited from Research Assistant placements to support impact literacy in PGRs.

Research staff have secured significant posts following the end of their work within UoA15. Abate went on to lead the 2D/3D Documentation and Multi-Spectral Imaging Laboratory at the APAC Laboratories of the Cyprus Institute (2019). Harrison-Curran became a GIS Consultant at ESRI UK (2015). Prochorskaite secured a research manager's position at Sheffield University (2019). Smith took a senior post at Public Health England (2017).

b. Research students

Postgraduate community and research culture:

The unit's postgraduate community has grown considerably over the last 7 years. Our PhD cohort rose from 4 PhD students in 2013/14 to 33 students across the REF period. Likewise, 39 students have completed our Masters' programmes and we have developed a successful research placement programme that has attracted 16 students to the CoA, whilst also facilitating several external internships.

Doctoral Students:

Recruitment of doctoral students has taken place through open calls, a University-level PhD scholarship scheme in 2017 (resulting in 3 of 15 scholarships being awarded to PGRs in archaeology and physical geography, 2 of which were international students) and annual School-level partial scholarship schemes since 2014. Between 2013-2020, 6 students supervised by UoA15 staff have completed PhDs and 27 are currently supervised by staff within the unit (20 as principal supervisors and 7 as secondary supervisors). This includes 3 University technical staff (1 complete, 2 ongoing), demonstrating our commitment to continued professional development and interdisciplinary working. One student has received a Young Scholars Fellowship from Yahad In-Unum, a French organisation working to record Holocaust killing sites. Another has worked with Skopje University during an extensive collaborative fieldwork programme. A further PhD researcher was awarded a grant from the Fund for Women Graduates (2019).

PGRs are integrated into our research teams via shared workspaces and alignment with our research themes. 6 students were/are jointly supervised by staff within the unit, often by scholars in different fields e.g., Kerti was supervised by **Sturdy Colls** (archaeology) and **Swetnam** (physical geography), and Kruszelnicki is supervised by **Gwinnett** (microplastics) and **Bolton-King** (ballistics). Students have benefitted from the unit's research and professional networks via collaborations with the United States Holocaust Memorial Museum, several Holocaust memorials across Europe, the Netherlands Forensic Institute, Staffordshire Police, Spheron and the Cyprus Institute. The CoA provides additional fieldwork opportunities on research projects for PGRs beyond those directly connected to data collection for their theses. These opportunities are led by Professors and Associate Professors within the unit, helping PGRs to develop their practical skills in landscape archaeology and their understanding of the challenges involved in working at ethically complex and contested sites. Our PGRs have published 24 peer-reviewed journal articles and book chapters and presented at >30 conferences during the REF period. Many have gone on to successful research careers within and beyond academia. Examples include a Lecturer at Liverpool John Moores University, a User Experience Researcher at Capita Education Software Solutions and several Senior Laboratory Specialists.

Support and Training:

The unit actively supports PGR training that upholds SU's expectations of research supervision. PhD students are supported by two supervisors and optional advisors, some of them external. Progress is recorded and monitored via (1) meeting records that are reviewed by SU's Graduate School, and (2) a clearly defined progress review in each of the three years of study. The progress review is accompanied by a skills appraisal via the Research Development Framework and interview. The Graduate School provides PGRs a year-round training programme that complements their subject-specific training. Students undertaking PhDs in Holocaust and forensic archaeology, and forensic science can study existing Masters' and undergraduate modules from across our forensics and policing programmes to acquire practical field and laboratory skills, and knowledge of ethical issues.

Masters' and undergraduate research:

We encourage research-informed curricula, and research-engaged co-learning permeates through our Masters' and undergraduate courses. The unit has extended its successful postgraduate community through a Masters' course in Applied Research. Students embark on unique research-engaged programmes of study which equip them with specialist knowledge and technical skills for careers in archaeology and heritage. These programmes draw upon and use the CoA's cutting-edge expertise, equipment and facilities.

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We integrate research Masters' students into our professional environment. Students undertaking the MSci Forensic Science have also completed research projects in forensic archaeology, forensic anthropology and decomposition studies, whilst 3 Masters' students have undertaken month-long placements at the CoA. In total, between 2014-2020, 39 students supervised by unit members have completed their studies on these programmes.

UG students in Forensic Investigation, History and Geography have also undertaken research placements at the CoA (ranging from 1 week to 1 year; 8 students). UG students in Forensic Science, Forensic Investigation and Policing have undertaken internships with Staffordshire Police and the Netherlands Forensic Institute connected to missing persons research and the documentation of outdoor crime scenes (commonly for 6 weeks). Since 2014, 5 UG students from Avans University (Netherlands) and 1 from Ghent University (Belgium) have undertaken research placements under the supervision of unit staff. The Geography Research Assistantship module, which enables final-year UG students to act as research assistants to staff and external collaborators, has been commended nationally as at the forefront of creative research-engaged curriculum development. It has generated publications in *The Journal of Geography in Higher Education*. Our commitment to these endeavours is reflected by several awards: Tweed (2016) and Bolton-King (2019) were awarded HEA/Advance HE National Teaching Fellowships for innovative approaches to incorporating undergraduate provision into research activity.

3. Income infrastructure and facilities

a. Income

Due to the rapid growth of SU's international reputation and a commitment to seeking grants to expand research activity, we have won funding totalling £1,187,897 between 2014 and 2020 for a total of 57 projects (£772,405 HESA returned and £415,492 non-HESA returned). Wins have included 2 Horizon 2020, 1 UKRI, 3 Heritage Lottery (HLF) and 3 UK Central Government grants and have led to the development of two Impact Case Studies. As described in detail in Section 4, these 57 projects have involved extensive international collaborations, including 8 institutions in QS's top 30 world-leading research universities.

The CoA's performance is measured using the acquisition of collaborative research funding and other income streams, research outputs, public engagement and impact metrics, all of which are regularly reviewed by the CoA's director, Archaeological Project Manager, the Dean of School and the Deputy Vice-Chancellor. Individuals in the unit are set income targets through the PDR process. These targets are linked to individual bidding strategies and associated support. They are designed to contribute to the CoA performance metrics.

Our flagship projects include:

- (1) for resolving the fate of missing persons, in particular individuals killed during episodes of genocide and conflict research: "Digital Forensic Archaeology" (**Sturdy Colls** and Abate, Horizon 2020 MCSA, EUR183, 454, 2016-2019), "Accessing Campscapes: Inclusive Strategies for Using European Conflicted Heritage" (**Sturdy Colls**, Humanities in the Research Area (HERA) EUR176,992 of a total of 1.2 Million Euro grant, 2016-2019), "Recording Cultural Genocide and Killing Sites in Jewish Cemeteries" (**Sturdy Colls**, International Holocaust Remembrance Alliance EUR67,089, 2016-2019), "Finding Treblinka" (**Sturdy Colls**, [text removed for publication], £59,344, 2014-2015).

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- (2) for environmental change research: “Glastir Monitoring and Evaluation Programme” (GMEP) (**Swetnam**, NERC, £247K of a £6 million grant), “European Forensic Education Network” (**Gwinnett**, Erasmus+ Strategic Partnerships, 96,000 Euros of a 325,901 Euros grant, 2014-17), “Forensic Fibre Freshwater” (**Gwinnett**, Aquacosm Transnational Access Fund 20,000 Euros of 60,000 Euros)
- (3) the life and properties connected to William Shakespeare: “Searching for Shakespeare” (**Colls** and **Mitchell**, £101,655 of a £560,000 grant, Shakespeare Birthplace Trust, HLF, Channel 4 and Arrow Media, 2013-2018)
- (4) for community archaeology research projects “St Giles Community Archaeology Project” (**Colls**, HLF, £48K, 2016), “The Lake District Holocaust Project Archaeological Dig” (**Sturdy Colls** and **Colls**, £20,000 of a £68,000 grant, HLF, 2019).

The unit has accessed funding from different sources for a further 46 research, staff-development, and impact projects. Notable examples include: two Winston Churchill Fellowships (**Gwinnett** and **Bolton-King**, both £9,000) and a fellowship from the United States Holocaust Memorial Museum (**Sturdy Colls**, \$15,200).

Gwinnett has achieved US and European patents in this REF cycle: ‘Apparatus and Methods for the Optical Examination of Birefringent Specimens’ (Patent no. US 8961727 B2, USA, 2015 and 10735037.3, European, 2014).

b. Infrastructure and facilities

The unit operates across SU’s campuses. It benefits from a range of infrastructure and facilities and the central technician support service. All new institutional facilities are subject to equality impact assessments and equipment/facilities can be booked through a centralised system, with extended open hours to facilitate flexible working.

Since 2013, CoA has received £85,000 of equipment, including GPR, GPS, Total Station, photogrammetry and drone technologies which have been deployed during our research on the Holocaust, missing persons and Shakespeare. We are supported by a £1.3m Smart Zone, which offers cutting-edge Virtual Reality (VR), laser scanning, photogrammetry and 3D printing equipment. The Smart Zone has empowered us to expand our research capabilities regarding the 3D visualisation of landscapes and objects, broaden collaborations with colleagues in Games and Visual Effects, and extend our impact.

Specialist laboratories enabling skeletal remains analysis, archaeological finds processing, decomposition studies and ballistics/firearms analysis are housed within our £30m Science Centre. The Forensics subject area also has its own dedicated Crime Scene House which has facilitated the creation of simulated graves and mock crime scenes, which have been investigated using geophysical technologies, laser scanning and photogrammetry.

Specialist IT facilities provide our staff and students with GIS and geophysical-processing capabilities. Research support for the unit is provided by SU’s centralised Research, Innovation and Impact Services covering bid development, impact, civic engagement, governance, ethics and post-award management. Our PGRs have access to centralised Graduate School resources. The Graduate School both fulfils an administrative role and provides PGRs access to SU’s broader research community.

4. Collaboration and contribution to the research base economy and society

Contribution to the Research Base

i. Interdisciplinary research and collaborations (including non-academic institutions)
 Since 2014, while a third of our publications [38%] have been in social sciences and humanities journals, we have published in leading environmental science, earth science, biological sciences, computer science, engineering and physics journals (Source: SciVal). We have co-authored papers with colleagues located in 17 different countries and from 35 UK universities, many of whom are specialists in fields beyond archaeology/landscape research. We have also collaborated with colleagues from NHS England, the Police Service, NERC, the RSPB, the World Wildlife Fund and the United Nations.

Since 2014, 89% of our outputs listed on SciVal have been published in Q1 journals, including some of the leading journals in our fields *e.g.*, *Current Anthropology*, *Antiquity*, *European Journal of Archaeology*, *Journal of Archaeological Prospection*, *Earth-Science Reviews*, *Marine Pollution Bulletin*, *Journal of Community Archaeology and Heritage*, and *Forensic Science International*.

Sturdy Colls, **Colls** and **Mitchell** have undertaken a range of research projects with world-leading experts from academic, public and private sector organisations across the world. The “Accessing Campscapes” project (2016-2019) brought together specialists in cultural memory studies from the University of Amsterdam, archaeologists and historians from the Norwegian University of Science and Technology, archaeologists from the University of West Bohemia, oral historians from Freie Universität Berlin, digital humanities specialists from University Pompeu Fabra Barcelona, historians and artists from the Vienna Wiesenthal Centre (Vienna, Austria) and memorial centres located in 7 different countries (also with Branthwaite from SU [UOA32]). Other projects have involved collaborations with The Cyprus Institute (MOU) (“Dig-for-Arch”); Jagellonian University and the International Holocaust Remembrance Alliance (“Recording Cultural Genocide”), Goldsmiths, University of London (The Living Death Camps and Forensic Architecture Advisory Board), the United Kingdom Holocaust Memorial Museum (“Bergen-Belsen Archaeological Project”), The Wiener Library (“Finding Treblinka”) and several television producers, including the Smithsonian Channel.

Sturdy Colls has co-authored publications and edited volumes with colleagues from Cambridge University (Dr Gilly Carr), Harvard University (Dr Gabriel Pizzorno), San Jose State University (Dr Stephen Morewitz), California State University (Professor Eric Bartelink, Dr Colleen Milligan), and the United States Holocaust Memorial Museum (Dr Robert Ehrenreich, Dr Jane Klinger). She has worked with University College London (UCL) for six years, informing their Beacon Schools Programme for Holocaust Education. **Colls** and **Mitchell** have collaborated with Shakespearean scholar and president of the Shakespeare Birthplace Trust, Sir Stanley Wells, and scholars from the Folger Library in Washington DC, the University of Birmingham, UCL, University of Warwick, Historic England and University of Oxford as part of the “Searching for Shakespeare” project, and the Archaeology and Shakespeare Research Advisory Board. **Bolton-King** has collaborated with Aston University, the National Ballistics Intelligence Service, the Chartered Society of Forensic Sciences, the National Firearms Centre, the Netherlands Forensic Institute, Interpol and several police forces and forensic service providers globally, including in the USA, UK and South Africa. **Cassella** has long-standing research collaborations with Keele University, University of Huddersfield and the Potteries Museum and Art Gallery. **Squires** has undertaken research and published with scholars from Cranfield University (Dr David Eriksson, Dr Nicholas Márquez-Grant).

Tweed's international professional network includes scientists from Newcastle, Leeds, Lancaster, Sheffield, Aberystwyth, Reykjavík, Copenhagen, Potsdam and New York. **Tweed's** main collaborators comprise Dr Jonathan Carrivick and Dr Duncan Quincey (University of Leeds), Prof. Andrew Russell (University of Newcastle), Dr Matthew Roberts and Dr Tómas Jóhannesson (Icelandic Meteorological Office, Reykjavík) and Dr Peter Wynn and Dr Hugh Tuffen (Lancaster University). **Swetnam's** international professional network includes scientists from the universities of Cambridge, Newcastle, UEA, Leeds, York, Reykjavík, Skopje, Copenhagen and Dar es Salaam; from conservation bodies including the RSPB, the British Trust for Ornithology, and the WWF; from UK research institutes including the NERC Centre for Ecology and Hydrology, the British Geological Survey and the British Antarctic Survey; and from organisations including Natural Resource Wales, the NFU and Cadw. **Gwinnett's** network spans across Europe and North America and includes the Home Office's Centre for Applied Science and Technology, the Netherlands Institute of Ecology, Avans University, Lunz Mesocosm Infrastructure and the Rozalia Project.

ii. Awards

Sturdy Colls was awarded the European Archaeological Heritage Prize in 2016 for her pioneering contribution to the investigation of twentieth century conflict, with specific reference to Holocaust archaeology. In 2016, the "Digital Forensic Archaeology Project" (**Sturdy Colls**, Abate, **Colls**) received the O2 NextGen Digital Challenge Award for Novel Digital Application. This award was presented at the House of Lords. **Bolton-King**, **Cassella** and **Squires** received a Partnership Award in recognition of their School's contribution to the Staffordshire Police Partnership. Internally, the CoA and **Gwinnett** have been awarded SU's "Research with Impact Award" (2016, 2018 and 2019).

iii. Membership of professional bodies and learned societies

The CoA is a Registered Organisation (RO) (2014-2020), and **Sturdy Colls** and **Colls** have been Members of the Chartered Institute for Archaeologists for over 10 years. **Sturdy Colls** was a Committee Member of the Chartered Institute for Archaeologists Research and Impact Group (2011-2016) and a founding member of the UK Forensic Archaeology Expert Panel (2009-present), endorsed by the UK Home Office. Staff are long-term Members of the Chartered Society of Forensic Sciences (**Sturdy Colls**, **Cassella**, **Bolton-King**, **Squires**, **Gwinnett**) and hold posts with this organisation, e.g., Assessor for the University Accreditation Scheme (**Sturdy Colls**, **Bolton-King**, **Cassella**). **Tweed** is a Member of the Glacier and Permafrost Hazards in Mountains (GAPHAZ) Standing Group of the International Association of Cryospheric Sciences, a Member of International Permafrost Association (IPA) and a Fellow of the Royal Geographical Society (RGS). **Swetnam** is a Chartered Geographer (CGeogGIS) and an RGS Fellow; she is also one of few RGS Chartered GIS Specialists teaching in UK HE. **Bolton-King** is a Technical Advisor for the Association of Firearm and Tool Mark Examiners and an Associate Member of the Royal Society of Chemistry. **Gwinnett** is a Member of the UK Forensic Fibres Group and the UK Microplastics Network. **Squires** is a Member of the Society for American Archaeology, the British Association for Biological Anthropology and Osteoarchaeology, the Society for Medieval Archaeology and Student and Outreach Officer of the Society for the Study of Childhood in the Past. **Cassella** and **Squires** are Associate Members of Kenyon International Emergency Services.

iv. Fellowships and Visiting Positions

Sturdy Colls held the Fred and Maria Devinki Memorial Fellowship at the Jack, Joseph and Morton Mandel Center for Advanced Holocaust Studies at the United States Holocaust Memorial Museum (USHMM), Washington DC in 2016. She was the first archaeologist to be awarded a fellowship under this programme. Abate joined the CoA as a Marie Skłodowska-Curie Experienced Research Fellow (2016-2019) to work on the "Digital Forensic Archaeology" project. **Bolton-King** is a Visiting

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Research Fellow at the School of Engineering and Applied Science, Aston University and received a Winston Churchill Travelling Fellowship in 2019 to evaluate new technologies to improve the timeliness and outcomes of firearms investigations. Gwinnett received a Winston Churchill Travelling Fellowship for a project entitled “International Best Practice in Microplastics Pollution Sampling, Analysis and Removal” in 2018. **Cassella** is a Visiting Professor at Avans University and **Squires** is a Research Associate at the Observatory for the Mummified Heritage of Sicily.

v. Conferences, seminar series and keynote addresses

In 2014, the CoA organised and hosted the international conference *What Britain Knew* in partnership with the International Holocaust Remembrance Alliance (IHRA). The conference was delivered to >150 international delegates, including ministers and representatives from 28 countries.

Staff within UoA15 have convened 12 sessions at international conferences. Notable examples include the European Association of Archaeologists Conference in Maastricht 2017 (**Sturdy Colls** organised the first *Holocaust Archaeologies* session); the World Archaeological Congress in Kyoto 2016 (**Squires, Sturdy Colls**); and the European Geophysical Union General Assembly in Vienna in 2016 and 2017 (**Tweed**). Staff have delivered 36 keynote addresses and invited lectures, given in the USA, UK, Poland and the Netherlands. They have presented at >170 conferences in the USA, South Korea, Brazil, Canada, Japan, Australia, Egypt, Singapore, Poland, Lithuania, Germany, Italy, Spain, Croatia, the Netherlands, Norway, Iceland, the UK, France, Austria and the Czech Republic. This total includes several notable presentations relating to Holocaust Archaeology delivered by **Sturdy Colls**. These include the prestigious USHMM Joseph and Rebecca Annual Meyerhoff Lecture in 2020, recognizing ‘excellence in research’ relating to Holocaust studies (USA), the Material Culture and the Holocaust Symposium (USA), the British Association of Holocaust Studies and 3rd Annual Corpses of Mass Violence and Genocide Conferences (both UK). Our presentations on Shakespeare’s life include papers delivered to *New Place Revealed* at the Folger Library, the National Women’s Institute and the American Shakespeare Centre (all USA; **Colls**); the British Shakespeare Association Conference, Shakespeare Birthplace Trust’s Shakespeare Congress and *News from the Past*, Council for British Archaeology (all UK; **Mitchell**). **Swetnam** has presented at the RGS-IBG Annual International Conference. Notable presentations from **Tweed** include the Geological Society of America Fall Meeting, RGS-IBG Geography and Employability workshop, the Glaciological Society Nordic Branch Meeting, the RGS-IBG Annual International Conference and the IGS British Branch Meeting. **Tweed** has been invited to deliver the keynote ‘Frost Lecture’ at the British Society for Geomorphology Annual Meeting, 2021.

vi. Editorial positions

We serve on the editorial boards of 23 international peer-reviewed journals. These include the Icelandic geosciences journal *Jökull* (**Tweed**), *Landscape and Urban Planning* (**Swetnam**) and the *Journal of Forensic Social Sciences* (**Sturdy Colls**). **Bolton-King** is editor-in-chief of *Science & Justice* and an advisory board member for the *Journal of Forensic Science & Criminology*. In the assessment period, team members have been reviewers for >25 Q1 journals across archaeology, geography, forensic science and Holocaust and genocide studies.

vii. Membership of peer review groups, boards and steering committees

Swetnam was an invited member of the Steering Committee for a €75 million German Research Ministry programme on “Sustainable Land Management” in 2016. In 2017, she was an invited expert to the German Aerospace Center Project Management Agency on behalf of the German Federal Ministry of Education and Research, helping to shape research into ecosystems and biodiversity. **Sturdy Colls** is Archaeological Advisor to the Ministry of Housing, Communities and Local Government with regards to the UK Holocaust Memorial and Learning Centre development (2020+).

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As part of a commitment to enhancing knowledge beyond archaeology, she is a board member of the Forensic Architecture programme at Goldsmiths, a Founding Member of the Forensic Social Sciences Association and a member of the European Jewish Cemeteries Advisory Network (all 2016+). She has also held posts on the UK Holocaust Memorial Foundation Education Advisory Group (2015-2017) and as Scientific Advisor for Kamp Westerbork Archaeological Project in The Netherlands (2011+). **Colls** is a committee member of the Archaeology and Shakespeare Research Advisory Board, which brought together a group of cross-disciplinary experts to locate, evaluate and disseminate information about Shakespeare's New Place in Stratford-Upon-Avon (2010-2018). **Gwinnett** is an invited member of several global strategic groups including the Woods Hole Oceanographic Institute "Microplastics in the Ocean" initiative. **Cassella** sits on a Defence Science and Technology Laboratory group for Search Techniques Development and is work stream lead for 'rapid services and custody suites' for the Staffordshire Forensic Partnership.

viii. External supervision and examiner roles for research degrees

UoA15 staff have supervised and been advisors for external PhD and Masters' students at Keele (**Cassella**), Nottingham Trent (**Cassella**), Cranfield (**Bolton-King, Sturdy Colls**), and Leeds (**Tweed**) Universities. They have also examined research degrees at: Bournemouth University, York University and Institute of Technology, Sligo (**Sturdy Colls**); Dundee University (**Tweed**); Kings College London and Reading University (**Swetnam**); University of Huddersfield (**Bolton-King**); UCL, Glasgow-Caledonia University, University West of England, Nottingham Trent University and University of Technology, Jamaica (**Gwinnett**).

Contribution to the economy and society

In keeping with our commitment to being a Civic University, staff from across SU collaborate with the CoA to generate innovative interdisciplinary research-based public engagement outputs with societal impact locally, nationally and internationally.

i. Community engagement and public outreach

Sturdy Colls co-curated the "Finding Treblinka" exhibition, which has been permanently installed at the Museum of Struggle and Martyrdom in Treblinka since 2015 (which now receives >60,000 visitors per year) with an accompanying six-month exhibition at The Wiener Library in London in 2016. These exhibitions included historical and archaeological research at Treblinka alongside the work of five artists (including Branthwaite from SU [UoA32]). **Sturdy Colls** has delivered an average of 5 public lectures per year since 2014 for religious communities, local history groups and charities, including the Holocaust Educational Trust (annually reaching >400 young Ambassadors tasked with sharing information about the Holocaust with their peers), the Association of Jewish Refugees and the Auschwitz Jewish Center.

Staff from UoA15 have been partners in 7 HLF projects demonstrating our commitment and reputation for community engagement and public outreach, with the communities themselves approaching us to participate in the work. One of the CoA's flagship projects at New Place, Stratford-Upon-Avon, saw 575 individuals (including 250 school children) assisting, and 223,500 visitors engaging, with the work over a five-year period (including 3,500 children from 40 schools in deprived areas). The re-telling of New Place's story based on the archaeological findings was enacted through a site transformation and the installation of a new permanent international exhibition in 2016/17. Visitor numbers to New Place increased by 40% to 142,000 in the exhibition's first year, followed by a 32% increase in 2018. New information boards at Holy Trinity Church provided access to the results of this project to 250,000 visitors annually. Two digital exhibitions were launched in 2018 ("Shakespeare Connected by SBT" with UoA team input) and 2019 ("Objects of Shakespeare's New

Unit-level environment template (REF5b)

Place 3D”, UoA team). Other community archaeology and participatory research projects have been undertaken at St Giles’ Church (Newcastle-under-Lyme, UK - 25 participants) (**Colls, Mitchell, Sturdy Colls, Squires**), the Calgarth Estate (Windermere, UK - 73 participants) (**Colls, Mitchell, Sturdy Colls**), Redfern Cottage (Uttoxeter, UK - 13 participants) (**Colls, Mitchell**) and various Jewish cemeteries (Oświęcim, Piaski and Wąwolnica, Poland; described more fully below) (**Sturdy Colls, Colls**, Weston). These projects have enabled new reflections on relationship-building, engagement and sustainability in community-led fieldwork, and engaging diverse audiences.

Swetnam was selected to be a speaker at “Soapbox Science Stoke-on-Trent” in July 2019, on the theme of “Valuing the View”. As part of the GMEP research project undertaken for the Welsh Government, **Swetnam** ran a stand at the Royal Welsh Show in 2015 and 2016, enabling visitors to engage with online landscape surveys (242,726 visitors in 2015; 236,758 in 2016). **Gwinnett** collaborated with artists and scientists in a public exhibition showcasing the ‘laundry monster’ and microfibre pollution at Keele University (2,000 visitors, 1-month 2019). **Tweed** co-led the Geological Society of America’s “Dynamic Iceland” GeoVenture in 2014 and 2015, alongside researchers from the State University of New York. For the last decade, **Tweed** has been a headline speaker at Hodder Education National ‘Tectonic Hazards’ Student Conferences, translating research for “A” Level audiences of up to 2500 people yearly. She is also one of the Geographical Association’s “Recommended Geography Speakers in the UK”. **Bolton-King** is Technical Advisor to the Association of Firearm and Tool Mark Examiners. She has also provided expert advice to the UK Government’s Chief Scientific Advisor in preparation for the Annual Report on Forensic Science.

Several staff have translated their research findings into articles to engage wider readership. **Gwinnett** and **Mitchell** have contributed articles to *The Conversation* with > 136,700 and >95,000 reads respectively (by December 2020). **Tweed’s** 2019 article in *Geography* won a Geographical Association Journal Excellence Award.

ii. Social action and regeneration projects

As part of the CoA’s shift towards projects with social impact in the present, “Recording Cultural Genocide and Killing Sites in Jewish Cemeteries” (**Sturdy Colls**) enhanced understanding of where racial hatred and intolerance can lead, increased engagement with Jewish heritage across 103 countries and raised awareness of the causes and consequences of cultural and physical genocide. The project reflected SU’s commitment to EDI, bringing together participants from a variety of different countries, age demographics and religious backgrounds. SU worked alongside our partners The Matzevah Foundation (USA), Fundacja Zapomniane (Poland) and Rohatyn Jewish Heritage (Ukraine) to develop and implement a unique interdisciplinary engagement methodology, using techniques from history, archaeology, digital humanities, games technology, conservation and community engagement. During “social-action projects” at four Jewish cemeteries, > 400 volunteers and 20 NGOs and museums worked together to locate unmarked killing sites, graves and tombstones, and to restore the sites. The project team built long-lasting relationships with political and educational decision-makers within the Polish, Ukrainian and British governments, mayors, civil servants, police, educators, and religious and community leaders to develop strategies to protect sites and develop further opportunities for sustainable education centred on Jewish heritage and social cohesion.

iii. Research with impacts on society (including memorialisation and commemoration), policy and practice

As outlined in our *Global Impacts of Holocaust Archaeology Case Study*, our work has led to the memorialisation and commemoration of Holocaust sites across Europe. The “Finding Treblinka”

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project marked and commemorated 6 unmarked mass graves at the Treblinka labour camp. Similarly, the “Protecting Memory Project” (**Sturdy Colls, Colls, Mitchell**) resulted in the identification of 16 mass graves, the erection of 10 memorials and information panels and 9 publications by our project partners. The “Adampol Archaeology Project” (Poland) led to the expansion of an extant memorial to more accurately reflect the location of Holocaust-era burials and generated new local educational initiatives for schoolchildren in the region (**Sturdy Colls**). Our collective work in this area has impacted upon family and community life across the world by providing survivors, descendants and religious communities with new information and commemorative opportunities. It has also led to collaborations with those working in the Arts (theatre, fine art, poetry, creative writing etc.) to produce new works about our research, reaching new audiences.

Across the unit, **Tweed**'s collaborative research on the societal impacts of glacier outburst floods was cited in the United Nations' Intergovernmental Panel on Climate Change report on “*The Ocean and Cryosphere in a Changing Climate*” (September 2019) and a *Scientific American* video and report. The Welsh government have applied **Swetnam**'s landscape evaluation research to evaluate their agri-environmental programme Glastir. This was the main programme through which tax-payer support was directed to landowners and a key policy instrument to maintain and enhance the Welsh environment.

iv. Media outputs: factual documentaries

The CoA has been involved in several high-profile media outputs. These include “Treblinka: Inside Hitler's Secret Death Camp” (Channel 5) and “Treblinka: Hitler's Killing Machine” (Smithsonian), both of which followed **Sturdy Colls**' pioneering archaeological investigations (reach: UK, 2014-2019 2.77 million; re-runs still reaching 1.39 million in the US in 2019, estimated global reach 2014-2019 10 million); “Shakespeare's Tomb” (Channel 4 and PBS), which followed **Colls**' examination of Shakespeare's grave (reach 2016-2019: UK 3.24 million, US 2.3 million); and ‘National Treasures Live’ (reach: UK 4.6 million) and ‘Time Team’ (reach: UK 2.1 million), which presented **Colls**' and **Mitchell**'s work at Shakespeare's final home. In 2019, the global Smithsonian Channel aired “Adolf Island”, which followed the CoA's search for a Nazi SS camp on the British Channel island of Alderney during World War II (reach 2019: US 3.35 million, UK 1.1 million).

CoA staff regularly appear on local and regional radio and TV, and national channels (e.g., BBC Crimewatch and BBC Breakfast News).