

Institution: Bournemouth University
Unit of Assessment: UOA17 Geography, Environmental Studies and Archaeology
a. Overview

Our research addresses the global challenge of understanding past and present changes within natural, cultural and historic environments to develop sustainable solutions for their long term future. Identified as a centre of research excellence in Bournemouth University (BU), our UOA has undergone significant growth since our RAE 2008 submissions to UOAs 32 and 33. This joint submission reflects the connectivity of our research under one management and investment structure, with growth and investment across the UOA. Highlights include:

- **A 69% increase in submitted staff** from 17.5 to 29.5 FTE through investment of QR income in staffing and from core BU funds in recognition of the Unit's research excellence.
- **A 145% increase in PhD completion numbers** from 11 during 2002-07 to 27 during 2008-13 (54 currently registered) due to increased success at winning externally-funded studentships and attracting external funding to compete for BU's innovative match-funded PhD programme.
- **A 156% increase in average annual research income** from £342k during 2002-07 to £874k during 2008-2013, with 100% AHRC success (five bids over four years; > £2.5m) and six NERC awards (£800k), reflecting the strength and societal relevance of our research, and enabled by BU initiatives around bid writing training and stringent internal peer review.
- **Publications in leading international journals** including *Science*, *Proceedings of the National Academy of Sciences (PNAS)*, *Antiquity*, *ISME Journal*, *Philosophical Transactions / Proceedings of the Royal Society B* and *Proceedings of the Prehistoric Society*.
- **£2.4m investment** in state-of-the-art laboratories and equipment; £1.2m in 2013 alone.

Our submission comprises 26.9 FTE from the School of Applied Sciences, plus Bennett (Pro-Vice Chancellor), Zhang (Head of the Graduate School) and Klinkner (Business School), showing strengths across the breadth of the UOA17 remit:

- **Geography.** Geographical Information Sciences (Golicher, Hill); Geomorphology (Bennett, Slomp Esteves); Quaternary Science (Bennett, Slomp Esteves, Stewart); Biogeography (Gillingham, Golicher, Hill, Korstjens, Stewart).
- **Environmental Studies.** Conservation and Ecology (Andreou, Britton, Clarke, Diaz, Esteban, Franklin, Gozlan, Green, Hardouin, Herbert, Hodder, Korstjens, Newton, Stafford, Stillman, Zhang).
- **Archaeology.** Human Origins (Bennett, Coward, Korstjens, Stewart); Bioarchaeology (Schutkowski, Smith); Prehistoric Societies (Coward, Darvill, Hambleton, Jenkins, Maltby, Smith, Welham); Landscape and Environmental Archaeology (Coward, Darvill, Hambleton, Jenkins, Maltby, Stewart); Forensic Law (Klinkner); Archaeological Resource Management (Darvill, Parham).

BU organises research into cross-university research themes, with our research sitting within the Biodiversity, Environmental Change and Green Economy theme (led by Esteban and Newton), and the Communities, Culture and Conflicts theme (led by Schutkowski and Welham).

b. Research Strategy

Our strategy builds on the programmes of growth set out in our RAE 2008 submissions. Its success is evidenced by increased numbers of staff and PhD students, increased income in total and per FTE, high quality outputs and increased societal impact. RAE 2008 QR funding, circa £200k p.a. has supported our strategy through three strategically important appointments and an innovative School initiative, the R-Budget, to reward high quality research.

Strengthen existing and build embryonic research clusters. We have engaged in a major programme of growth across the UOA, with 14 staff (12.5 FTE) appointed through QR (Franklin, Jenkins, Stewart), and School/University funding (Andreou, Coward, Esteban, Gillingham, Golicher, Hardouin, Klinkner, Schutkowski, Slomp Esteves, Stafford, Zhang). Institutional funding has been targeted to the UOA in recognition of its research excellence. New staff have expertise in environmental change and its effects on humans (Coward, Jenkins, Schutkowski, Stewart) and biodiversity (Esteban, Franklin, Gillingham, Slomp Esteves, Stewart), and cross-cutting themes of

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genetics (Andreou, Hardouin, Zhang), law (Klinkner) and spatial analysis (Golicher, Stafford). BU initiatives have maximised productivity, and have increased the number and quality of external grant applications (Section 5c). Success is evidenced by increased FTE within our submission, the quality of outputs and increased research funding (Section 5d), a highlight being 100% success in AHRC bids since 2009 (> £2.5m). We have achieved 145% growth in PhD completion numbers to increase the quantity and quality of outputs, with student co-authored papers in high profile journals including American Journal of Physical Anthropology (Bennett), ISME Journal (Esteban), PLoS One (Bennett, Britton, Gozlan, Schutkowski) and PNAS (Newton).

Increase international profile. We have raised our profile by further engaging in international research and by organising and contributing to international conferences (Section 5e). This has been supported by funding initiatives for networking, including the School Staff Development Fund, R-Budget, Higher Education Innovation Fund (HEIF), Staff Mobility and Networking Fund, and Santander funding (Section 5c). We have an established record of leading and participating in international research, including five EU FP6/7 and INTERREG projects (Britton, Gozlan, Herbert, Newton) and three Marie Curie projects (Andreou, Britton, Gozlan, Stillman). Our fish biology research was identified as world leading by the Scopus bibliographic database in 2012. We have established formal collaborative relationships with many overseas research partners and international organisations including International Commission for Missing Persons (Hanson, Klinkner), International Union for Conservation of Nature (Newton), German Archaeological Institute (Darvill), Russian Academy of Sciences (Darvill) and European Commission (Britton, Gozlan) (Section 5e).

Prioritise policy- and practice-relevant research. We have targeted research towards key challenges of sustaining society and nature in the face of environmental change, understanding ancient peoples and places, connecting communities and managing heritage assets. We have won wide-ranging funding to support knowledge exchange, policy and practice including Heritage Lottery Fund (HLF) (Palma, Parham), AHRC Knowledge Transfer Partnership (KTP) (Staelens), KTP (Brisbane (retired from BU 2013), Esteban, Kneller, Newton), EU (Britton, Gozlan, Newton), NERC KTP (Stillman) and BU's PhD match-funding scheme (Sections 5c & d) establishes strong links with users via joint supervision. Our wide-ranging public engagement is detailed in Section 5ci. We have established two consultancies in the School (one archaeological and one environmental) to supplement income (Section 5d) and build strong user relationships.

Future research strategy

Our strategy will capitalise on our collective strengths and unique features. We will continue to:

Maximise our academic reputation. We will continue to prioritise global networking and research, and agenda setting outputs, building on existing high profile outputs (e.g. Clarke, Newton, Stewart), international projects (e.g. Darvill, Welham) and conferences (Section 5e). Maltby has recently won a large AHRC grant (£1.9m) with university partners throughout the UK. Darvill is co-investigator on two major archaeological projects within a six-year German Research Council programme. Britton, Gozlan and Newton are running large-scale international projects on rapid change within forest ecosystems and the threats posed by invasive fish. Support will be directed to hosting international conferences, knowledge exchange events and partnership development. We will further increase engagement with BU's International Task Force, which forges strategic links with international partners (e.g. Colombia (Bennett, Welham), China (Bennett, Gozlan, Zhang), USA (Schutkowski)). Success will be measured by the number of high-profile projects leading to international publications, agenda-setting and position papers.

Maximise our societal impact. Policy- and practice-relevant research is a collective strength across our UOA and REF3a details our strategy for maximising this. Gaining the best possible understanding of user needs through continued user engagement, performing the highest quality research to meet these needs, and communicating this research and how it can be adapted to promote societal impact are core principles of our strategy. We will continue to undertake horizon scanning with existing and potential users of our research to identify ways in which our research can meet current and emerging needs. We will continue to invest in and develop our consultancies as a means of establishing close links with fellow professionals, users and beneficiaries to better understand how research and its dissemination can be tailored to their needs.

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Capitalise on our breadth of expertise. Our research spans UOA17 with great potential to draw on individual strengths in collaborative ventures. We will continue to support interdisciplinary research, building on the success of existing projects. Brisbane (Archaeologist) and Herbert (Ecologist) won an EU INTERREG grant (£227k) to determine the archaeological and ecological importance of salt production in Europe. Interdisciplinary PhD projects are linking archaeology and remote sensing (Cheetham, Ford, Hill, Welham), ecology and social science (Diaz, Stafford), anthropology and forensic science (Schutkowski, Smith), and environmental science and psychology (Newton). Interdisciplinary research is central to BU's Strategic Plan, and is facilitated through cross-University research themes (Section 5a).

Capitalise on our unique location. Based in central southern England, we are surrounded by one of the richest areas for biodiversity in the UK, close to globally important archaeological monuments and associated landscapes (e.g. the Stonehenge and Avebury World Heritage Site) and adjacent to the Jurassic Coast World Heritage Site. We will continue to research world-wide, but will also capitalise on our location, building on the success of ongoing projects. Newton has a NERC project on forest dynamics in the New Forest. Darvill and Welham have high-profile British Academy and AHRC projects to understand the history and cultural significance of Stonehenge. Parham has long-term English Heritage-funded projects on the recovery, interpretation and conservation of a 17th century shipwreck in Poole Harbour. We will focus on globally significant issues that can be addressed regionally including species range change linked to climate change, ecosystem tipping points, monumentality and materiality, and human/animal relationships. We will facilitate enhanced local links; for example, by building on existing partnerships with the Freshwater Biological Association River Laboratory and the Poole Maritime Trust.

c. People, including:**I. Staffing strategy and staff development**

Our staffing strategy supports our research and conforms to BU's Research Concordat Action Plan, which received the EC HR Excellence in Research Award 2013, for improving working conditions and providing staff and students with the facilities, funds, and training to enhance career development, income, networking, profile raising and outputs. We comprise 13.2 female FTE, 16.3 male and 7.5 ECRs. We are committed to a supportive research environment and careers of women in Science, Technology, Engineering and Mathematics (STEM) (BU is currently applying for Athena Swan Bronze Award). This is reflected in the demographic above, and our presence on BU's Research Concordat Steering Group (Esteban, Stillman), Women's Academic Network (Gillingham, Welham, Zhang) and Athena Swan Award Self-Assessment Panel (Esteban, Welham, Zhang (Chair)). The School's teaching was rationalised in 2010 to maximise research potential.

HR policies. Our HR policies permit flexible working and career breaks, and provide generous maternity/paternity/adoption leave. BU abides by the provisions of the Fixed-Term Employees (Prevention of Less Favourable Treatment) Regulations (2002) and is committed to ensuring the proper use of fixed-term contracts. Our *Code of Practice – Use of Fixed-Term Contracts* provides clear guidelines as to when it is appropriate to use a fixed-term contract.

Management. The School comprises three groups: Archaeology and Anthropology; Conservation Ecology and Environmental Science; Forensic and Biological Sciences. The professoriate and Heads of Group (Clarke, Darvill, Gozlan, Newton, Schutkowski, Stillman, Welham) are managed by the Dean, other staff by their group head. The Heads of Group meet monthly with the Dean and other senior academics at Executive Meetings to implement School management and strategy. The School research strategy is implemented through the School Research Committee comprising the professoriate and other senior academics. The institutional research strategy is implemented through the BU Research and Knowledge Exchange Committee (UOA members: Bennett (Chair), Esteban, Newton, Schutkowski, Stillman, Welham, Zhang).

Recruitment. A total of 14 academic staff have been appointed to our UOA since 2008, selected on the basis of research excellence, building our research strengths while reducing the staff to student ratios as set out in BU's Strategic Plan. Academic, support staff and research assistant appointments are made in accordance with BU's Equality and Diversity procedures. All staff and PGRs are required to complete online research ethics training.

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Succession planning. New staff are allocated lighter teaching and administrative loads in their first year to allow them to build their research profiles. Diverse career development opportunities (see below) allow all staff to build their research careers, enhancing staff retention, building collective strength, and reducing the reliance on a few individuals.

Career development. Staff can identify needs at any time, but this is formally addressed in their annual appraisal, which assesses performance against targets, identifies development needs and ensures appropriate balance of duties. All staff and PGRs have access to online databases such as Research Professional, Scopus and Web of Science. All staff have access to the following:

- **Bournemouth Researcher and Academic Development (BRAD).** BU scheme based on Vitae's Researcher Development Framework for training in all aspects of research. Runs through the year to provide networking opportunities and targeted development.
- **Grants Academy.** BU training initiative for bid writing, focusing on Research Councils, that culminates with three bid submissions. Our successful involvement is evidenced by an AHRC Early Career Grant recently won by Jenkins (£206k) from a bid prepared in the scheme.
- **EU Academic Development Scheme.** Annual BU initiative to develop a small group of researchers over 12 months to bid confidently and successfully for EU funds.
- **R-Budget.** School initiative to allocate RAE 2008 funds annually amongst staff on the basis of research performance. Support includes pump-priming, conference attendance, networking and training. Annual funding £40-50k, with individual staff receiving up to £3k.
- **Staff Development Budget.** School fund, annual budget of £50k, for development needs including training, and both national and international networking.
- **Fusion Fund.** BU revenue fund to support the Strategic Plan, £1.6m for 2012-13, for start-up projects, project support, international travel and study leave, with £3m available in 2013-14 and in subsequent years till 2018.
- **Research Study Leave.** Staff can apply for study leave through the Fusion Fund. Examples include: Newton - development of a computer modelling course, plus one year; Korstjens – six months to submit joint papers and bid with Oxford, Oxford Brookes and Liverpool John Moores Universities. Darvill – one year partly based at the University of Oxford.
- **University PhD Studentships.** BU fully- or match-funded studentships and scholarships with 100 opportunities each year with over £5m invested since 2008, proving an efficient way for staff to build research teams (Section 5d), with 26 awarded to the UOA.
- **Dissemination and peer review.** Career opportunities are broadcast by a research blog and email, and funding opportunities through Research Professional. Institutional peer review enhances bid quality and facilitates staff development.
- **Open Access.** BU has an Open Access fund for rapid publication and global access in online journals, open to all staff, with 16 papers funded in the UOA (£22.8k) since 2011.

Early Career Fellowships and Grants. Early Career Fellowship won by Britton (NERC; Impact of invasive fish; £98k) and Early Career Grant won by Jenkins (AHRC; Origins of agriculture and sedentism; £206k).

Public engagement and media. BU signed the National Coordinating Centre for Public Engagement's Manifesto for Public Engagement in 2012. We have dedicated public engagement officers, and staff actively engage with community projects. In 2013 BU initiated an annual Festival of Learning as a focus for public engagement and our free events included biological recording, a primate workshop, sessions themed on Alfred Wallace and archaeological excavations (attracting c. 650 people). Other events include Café Scientifique talks (Bennett, Diaz, Herbert, Schutkowski) and research outreach to schools (Darvill, Jenkins, Welham), including Science Family Fun Days (Esteban, Jenkins), and events with the Dorset Geographical Association (Hill; President). Our HLF funded project "MAD about the Wreck" has a major public engagement component in collaboration with Poole Museum. Media dissemination has included: newspapers / online (e.g. Darvill, Parham, Stewart, Welham); popular magazines (e.g. New Scientist (Bennett, Green, Stewart); National Geographic (Darvill, Korstjens, Welham)); TV (e.g. News (Bennett, Parham); BBC's One Show (Diaz, Parham); documentaries (e.g. Bennett, Darvill, Newton, Smith)); radio (e.g. Bennett, Darvill, Diaz, Herbert, Korstjens, Parham, Stewart); iUniversity lectures (Darvill).

c. II. Research students

The Graduate School is responsible for PGR experience and oversees the development, implementation and quality assurance of studentship provision. BU has invested over £5m in fully- and match-funded PhD studentships since 2008, and has committed to fund 50 per year to 2018 plus 50 doctoral (fee waive) scholarships per year. We have achieved 145% growth in PhD completions since RAE 2008 (54 currently registered), due to increased external and internal funding (Section 5d), derived from School and BU initiatives to maximise bid quantity and quality (Section 5ci). Our growth has been driven by increased success at winning competitive externally funded studentships from AHRC, NERC and the EU (including Erasmus Mundus) (Section 5d).

- **Recruitment.** Research studentships are advertised internationally via online systems, on the BU's website and through our research networks. Shortlisted applicants are interviewed by the supervisory team plus an independent Chair to maintain standards.
- **Supervision and monitoring.** Students have one primary supervisor and up to two secondary supervisors. To maintain quality, supervisory training is mandatory for all staff. A three-month review ensures the student has a clear understanding of their subject area and research plans. A 12-18 month transfer review, to progress from MPhil to PhD, confirms significant achievement and that the student has a clear plan for completion. These processes are overseen and monitored via the Graduate School, and its Academic Board and Research Degrees Committee where the UOA is represented by Schutkowski. BU has recently invested £290k in ResearchPAD, an online PGR monitoring system to streamline management, improve quality assurance and enhance student experience.
- **Development and funding.** Development events that run through the year (including a full induction) are offered by the Graduate School based on Vitae's Researcher Development Framework. Students have access to School and Graduate School funds to support research, conference attendance, fieldwork and public engagement. All BU-funded students are required to undertake at least two public engagement activities during their studies.
- **Research rooms for PhD students.** The School has three dedicated research rooms with high-specification computing facilities to facilitate ideas sharing and to create a community. These are adjacent to staff offices to maximise communication with the supervisory team.
- **Seminars and conferences.** Students run an annual School-wide PGR conference and contribute to the Graduate School's annual conference to showcase their research more widely. PhD student success includes winning the best presentation prize at the Remote Sensing and Photogrammetry Society (RSPSoc) Annual Conference 2013 (supervisors: Cheetham, Ford).
- **Student-led initiatives.** Students manage their own research-based meetings, debates and workshop with weekly events on specific research topics. Students are also active in conference organisation (including Theoretical Archaeology Group conference 2013, RSPSoc Annual Conference 2011, and Fisheries Society of the British Isles Conference 2011).
- **Examination.** Students are examined through a *viva voce* by an external and internal examiner, with an independent Chair present to ensure that procedures are adhered to.

d. Income, infrastructure and facilities

Income

Our annual income has increased from £342k p.a. during 2000-2007 to £874k p.a. during 2008-2013 (156%), more than twice the growth in FTE numbers (69%), enabled by good ideas and support from grant writing, peer-review and pump-priming initiatives (Section 5c). Our strategy for future income generation will continue to be based around these initiatives with a continued focus on diversifying our funding streams, including using our consultancies to exploit new knowledge exchange and enterprise funds, with profits reinvested in research.

External competitive grants. We have won high-profile funding throughout the UOA:

- **RCUK.** 100% AHRC success (five bids over four years; > £2.5m) and six NERC awards (£800k). Lead partner of AHRC grant on the interaction between chickens and humans (Maltby; £1.94m; 2014-16); NERC grants on the evolution of human locomotion (Bennett; £316k; 2010-13), policy and practice of coastal bird conservation (Stillman; £150k; 2008-10) and ecosystem

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regime shift in forests (Newton; £150k; 2013-15); AHRC grants on Stonehenge Riverside Project (2006-10), Rapa Nui (2011-15) and Songo Mnara World Heritage Sites (2011-16) (Welham; total £313k); NERC grant to deliver short courses on aquatic ecology (Stafford; £47k; 2014-17).

- **EU.** FP6/7 grants on restoration of forest ecosystems (Newton; £1.15m; 2007-09), ecosystem management (Newton, Hodder; £147k; 2008-11), impacts of invasive fish on native ecosystems (Gozlan £13k; 2007-08; and £231k; 2011-13) (Britton; £172k; 2012-14) and quality of European freshwaters (Clarke; £63k; 2009-12); INTERREG grants on archaeology and ecology of salt pans (Brisbane, Herbert; £227k; 2010-13) and the impact of non-native species throughout Europe (Britton; £115k; 2012-14); Erasmus Mundus student and research exchange project with institutions in Asia (Gozlan, Andreou; £580k; TECHNO I AND II; 2011-16).
- **Fellowships.** NERC and AHRC Early Career Fellowships / Grants for Britton (£78k; 2009-13) and Jenkins (£156k; 2014-16) (Section 5c); Marie Curie Fellowships on ecology of trout and salmon (Gozlan, Britton), pheromone interactions of invasive and native fish (Gozlan, Britton) and disease emergence and biodiversity loss (Gozlan, Britton); Fyssen Foundation (France) Post-Doctorate on prehistoric pottery (Darvill; £25k, 2011-12).
- **PhDs.** AHRC Block Grant Partnership for capacity building (Welham; £250k; 2012-16); AHRC Collaborative Doctorate Award with English Heritage (Darvill; £60k; 2011-14); NERC Case (Britton; £70k; 2012-15) and NERC algorithm, derived from grant and fellowship awards (Bennett, Britton, Stillman; £72k; 2012-15); NERC Centre for Ecology and Hydrology (CEH) studentships (Hill; £23k; 2009-12) (Newton; £49k; 2010-14; and £23k; 2009-12) (Stillman; £21k; 2012-15); Fisheries Society of the British Isles studentship (Britton; £44k; 2012-15).
- **RCUK facilities.** Seven awards from NERC Airborne Research & Survey Facility (ARSF) for flights to monitor aquatic vegetation and forest structure, locate unknown archaeological and forensic remains (Ford, Hill, Welham); use of NERC Life Sciences Mass Spectrometry Facility (Britton; £35k; 2013-ongoing) to study non-native parasites.
- **Other competitive grants.** Esmée Fairbairn grant on colonisation of an artificial reef (Herbert; £40k; 2010-13); DEFRA Darwin Initiative grant on the conservation of globally important forests in Kyrgyzstan (Newton; £180k; 2009-12); British Academy grants on Stonehenge (Darvill; £7k; 2009-10) and diet in early medieval societies (Schutkowski; £4k; 2011-13); Polish Ministry for Science and Higher Education grant on human diet in the Near East from the Neolithic (Schutkowski; £20k; 2013-16); Brazilian Federal Agency grant for the Support and Evaluation of Graduate Education (Zhang; £142k; 2013-ongoing).

University fully- and match- funded PhD studentships. We have won 26 competitive studentships reflecting the strength of our blue-sky research (a priority for fully-funded studentships) and our ability to attract external match-funding. Match-funding organisations include Environment Agency, CEH, English Heritage, Poole Harbour Heritage Project, Natural England, National Trust, Forestry Commission, Kew Royal Botanic Gardens, Conservation International, New Forest National Park Authority and Scottish Association for Marine Science.

Enterprise and knowledge exchange. Diverse funding has underpinned our societal impact:

- **Archaeological and environmental consultancies.** Using HEIF funding we established archaeological (£45k) and environmental (£150k) consultancies in the School to maximise our enterprise earning potential. The archaeology consultancy (2 employees) was founded in 2010 earning over £50k per year since and over £75k in 2013. The environmental consultancy (2 employees) was founded in 2013, to capitalise on the contract earning potential of Britton, Gozlan, Herbert and Stillman, and has won over £200k in its first three months.
- **Knowledge Transfer Partnerships.** Our KTP projects have informed gallery redesign at Fishbourne Roman Palace and Gardens (Brisbane; £38k; 2010-11), optimised health and safety mechanisms with an SME (Kneller, Newton; £105k; 2011-12) and created folk maps and a touring exhibition from the works of Cecil Sharp (Staelens; £204k; 2008-10).
- **Heritage Lottery Fund.** Our HLF projects have facilitated community engagement within the Cranborne Chase and West Wiltshire Area of Outstanding Natural Beauty (Gale; £63k; 2013-16) and redesigned the Swash Channel wreck exhibition in Poole Museum (Palma, Parham; £140k; 2012-14).

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- **Other funders.** Our research on ecosystem services (Newton), freshwater ecology (Britton, Esteban, Franklin, Gozlan) and coastal birds (Herbert, Stillman) has attracted over £1.5m of enterprise funding since 2008 from sources including DEFRA, Environment Agency, Natural England and UK water companies. English Heritage has funded important archaeological projects in maritime archaeology (Palma, Parham; £541k) and the Archaeological Investigations Project (Darvill; £670k). The BBC funded investigations at Stonehenge (Darvill; £13k; 2008-09), and Google funded visualization of the development of Stonehenge (Welham; £14k; 2009-10). The UK Space Agency funded forest mapping from satellite imagery (Hill; £26k; 2011-13).

Infrastructure and facilities

We have invested heavily in our School infrastructure and facilities including £600k on capital equipment and £1.8m on laboratory facilities since 2008, including £1.2m on laboratories during 2013. Facilities and research are supported by a dedicated team of demonstrators/scientific officers (7 FTE). All staff, research assistants and students have high-end computing facilities, and access to a wide range of stored and on-line publications through the BU Library (£3m p.a. BU investment on staffing and information provision since 2008).

- **Investment in laboratories.** We have a modern molecular biology laboratory housing PCR, Real-Time PCR machines and Genetic Analysers, capable of DNA amplification and profiling, DNA sequencing, studying gene expression and molecular cloning. Analytical facilities include state-of-the-art instrumentation for chromatographic (HPLC, CG-MS/MS & IC), histology and spectroscopic analysis (ICP-OES, UV/VIS, FTIR). We have research-grade microscopy equipment including Scanning Electron, fluorescence, real-time, and X-ray facilities.
- **148 aquaria experimental facility.** Using DEFRA and EU funds we established a climate-controlled fish experimental facility, with Home Office accreditation to conduct regulated procedures, with automated video and electronic tag recording systems. It has been used as a unique platform to test the ecological impact of non-native invasive fish.
- **Dedicated forensic and anthropology laboratories.** We have invested heavily in extending our anthropology and zooarchaeology laboratory provision alongside growth in our extensive faunal and human reference collections.
- **Geophysical and remote sensing equipment.** Ground penetrating radar, electro-conductivity and tomography are key to our research on the detection of clandestine graves (Cheetham), understanding settlement patterns in Sub-Saharan Africa (Welham) and at Stonehenge, Skorba in Malta, and on Rapa Nui. Three-dimensional laser scanning has been fundamental to Bennett's NERC-funded work on human locomotion and Welham's AHRC-funded Rapa Nui research. These facilities are enhanced by survey grade global positioning systems and dedicated computer suites with the latest GIS and Earth observation software. Such facilities have enabled new ventures such as the Google funded 'Seeing Beneath Stonehenge' project. Cross-institution work supports processing of large remote sensing datasets, vital for our research using airborne laser scanning and multi/hyper-spectral data.
- **External facilities.** External facilities support our research including a field station to simulate mass graves and conduct field trials on the decomposition and detection of bodies. We have a bespoke Crime Scene Training Facility used to carry out full-scale simulated crime scene investigations, and access to Streetwise, a life-sized indoor village, owned by Dorset County Council, with street, beach and domestic scenes. The School leases laboratory space and experiment facilities at the Freshwater Biological Association River Laboratory.

e. Collaboration and contribution to the discipline or research base

Our collaboration and contribution has been supported by initiatives to fund networking, profile building and research strengths (Section 5b). Success is evidenced through awards, honorary / elected positions, collaborative income and outputs (Section 5d) and societal impact (REF3a).

Collaborations

Global organisations. We have supported international policy and management of cultural and natural heritage sites of global importance. We have advised the International Union for Conservation of Nature (IUCN) and the United Nations Environment Program (UNEP) on the improvement of biodiversity Red Lists and assessment of conservation action (Newton). We aid

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understanding and preservation of World Heritage Sites in Tanzania, Rapa Nui (Welham), Malta (Darvill), Russia (Maltby) and England (Darvill, Welham). We improve best practice in investigating mass graves for International Commission for Missing Persons and International Criminal Tribunals (Cheetham, Hanson, Klinkner).

National and international governments. We have provided the evidence-base for UK government and departments (e.g. Welsh Assembly (Stillman), Joint Nature Conservation Committee (Herbert), Environment Agency (Britton), Ministry of Defense (Parham), Department for Transport (Clarke), Ministry of Justice (Schutkowski), British Foreign and Commonwealth Office (Schutkowski), Police Constabularies (Smith)), and international governments (e.g. Abu Dhabi Environment Agency, European Commission (Gozlan, Newton), Manx National Heritage (Darvill), Cultural Heritage Authority Baden-Württemberg, Germany (Schutkowski)).

Non-governmental Organisations. Examples include Wildlife Trusts (Diaz), British Trust for Ornithology (Stillman), Society for Ecological Restoration (Newton), National Trust (Darvill, Welham), English Heritage (Darvill, Parham), Malta Heritage (Darvill), Game and Wildlife Conservation Trust (Britton), Cotswold Archaeology (Darvill), British Museum and Natural History Museum (Stewart).

Industrial developers. Our applied research, channeled through our consultancies, provides the evidence-base for sustainable development. We have collaborated with port authorities, shellfishing companies, and road, housing, wind farm, nuclear power and tidal barrage developers to minimise their impacts on archaeology and biodiversity.

Universities and research institutes. Examples include CEH (Hill, Newton, Stillman), University of Oxford (Darvill, Korstjens), Universidad Autónoma de Madrid (Esteban), University of Rennes (Esteban), Liège University (Stewart), Institute of Archaeology in Moscow (Darvill), University of Hamburg (Darvill), German Archaeological Institute (Darvill), University of Malta (Darvill, Maltby), University of Warsaw (Schutkowski), St. Petersburg State University (Maltby), China Agriculture University (Zhang), Federal University of Rio Grande Do Sul in Porto Alegre Brazil (Zhang).

Contribution to the Discipline

Awards and honorary positions. Darvill was appointed OBE in the 2010 Queen's Birthday Honours list for services to archaeology; Esteban was "Highly-commended" for her public engagement activities in the national "Most Dedicated STEM Ambassador of the Year" award 2010; Invited professorship at Marseilles St. Charles University (Gozlan); Honorary Assistant Professor at University of Hong Kong (Stafford); Awarded fellowship of RSPSoc (Hill); Visiting Professor at China Agriculture University (Zhang).

Expert advisory roles. Vice-Chair IUCN Global Trees Specialist Group (Newton); Primate Specialist Group member of IUCN Species Survival Committee (Korstjens); Zooarchaeological advisor to Russian Academy of Sciences (Maltby); Expert member of EU Scientific, Technical and Economic Committee for Fisheries (Stafford); Expert panel members for European Food Safety Authority (Britton, Gozlan); UK Crown Court expert witness (Schutkowski); English Heritage Advisory Committee member (Darvill); Member of NERC ARSF Steering Committee (Hill); English Heritage Advisory Committee on Historic Wreck Sites (Parham); DEFRA advisor on emergence of infectious diseases (Gozlan); Chair Advisory Panel on Archaeology of Burials in England (Schutkowski); Environment Agency advisor on non-native parasites (Andreou).

Peer review panel memberships. AHRC Panel Member (Schutkowski); Members of NERC (Bennett, Franklin, Hill, Slomp Esteves) and AHRC (Darvill, Maltby, Schutkowski) Peer Review Colleges; Peer Review Panel Member for NASA Research Announcement and USA National Science Foundation (Hill); Member of funding panels for Mexican National Council for Science and Technology and Biodiversity (Golicher); Chair of FRIBIO panel of Norwegian Research Council (Gozlan); Chair of Fisheries Society of the British Isles (FSBI) Research grant (Gozlan) and Studentship (Britton) Panels; Member of British Ecological Society Small Ecological Project Grants and Undergraduate Ecological Support Grants review panels (Stafford).

Elected society memberships. American Association of Physical Anthropologists (Smith); Royal Anthropological Institute (Smith); Royal Society of Biology (Esteban, Herbert) and Chemistry (Welham); Fellow of Royal Anthropological Institute (Schutkowski); Primate Society of Great Britain

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(Korstjens); Institute for Archaeologists (Darvill, Maltby); Register of Professional Archaeologists (Darvill); Linnean Society of London (Green); Zoological Society of London (Esteban); Society of Antiquaries of London (Darvill, Maltby).

Council or committee memberships. President British Association for Biological Anthropology and Osteoarchaeology (BABAO) (Schutkowski; 2004-09); President Bristol and Gloucestershire Archaeological Society (Darvill 2013-); Chairman of Society of Low Temperature Biology (2005-08) and member of Board of Governors of Society of Cryobiology (Zhang; 2013-); Vice-president Society of Antiquaries of London (Darvill 2007-11) and Royal Archaeological Institute (Darvill 2010-); Chairman of Archaeology Data Service Management Committee (Darvill; 2007-); Independent Chairman of English Heritage / National Trust Avebury Museum Panel (Darvill; 2005-); Permanent Council Member of the Society for Post-Medieval Archaeology (Welham; 2006-); Council members of FSBI (Britton; 2006-10) and Primate Society of Great Britain (Korstjens; 2006-10); Founder member of British Ornithological Union's Records Committee for palaeontological and archaeological bird remains (Stewart; 2007-); Committee members of Global Soil Biodiversity Initiative (Esteban), Royal Anthropological Institute (Coward), Global Research Coordination Network for Biodiversity of Ciliates (Esteban), Association for Environmental Archaeology (Hambleton, Jenkins) and BABAO (Smith; 2004-10); Member of Technical Programme Committee for RSPSoc (Hill; 2009-); Scientific Committee of ForestSAT and Silvilaser international conference series (Hill); Coordinator of British Ecological Society (BES) Forest Ecology Special Interest Group (Newton; 2005-10).

Editorial positions. Editor in Chief Sediment Geology (Bennett; 2008-12); Associate editorships include Journal of Biogeography (Stewart; 2012-), Environmental Archaeology (Schutkowski; 2010-), American Journal of Physical Anthropology (Schutkowski; 2013-), Journal of the Royal Anthropological Institute (Coward; 2013-), North-Western Journal of Zoology (Andreou; 2008-), Annales de Limnologie (Britton) and Journal of Fish Biology (Gozlan). Guest editorships include International Journal of Remote Sensing (Hill; 2010), BABAO Annual Conference (Smith; 2008) and International Journal of Zoology (Stafford; 2012). Editorial board memberships include Protist (Esteban; 2007-), Antiquity (Darvill; 2007-12), International Journal of Heritage Studies (Darvill; 1994-2011), Time and Mind (Darvill; 2007-), Acta Protozoologica (Esteban), Ecological Informatics (Stafford; 2011-), Computational Ecology and Software (Stafford; 2011-), Quaternary Science Review (Stewart; 2011-), Journal of Aquaculture Research & Development (Zhang; 2010-), Journals of Animal Reproduction Science (Zhang; 2004-) and Cryo-Letters (Zhang; 2007-).

Conference organisation. Hosted and organised by the UOA: Annual conference of Fisheries Society of the British Isles 2011 (Gozlan, Britton); RSPSoc 2011 (Hill); 35th Annual meeting of Theoretical Archaeology Group 2013 (Darvill); BABAO annual conferences 2009 and 2012 (Smith, Schutkowski, Korstjens); Prehistoric Society Conferences (Darvill; 2008, 2011); Organised by the UOA: SilviLaser 2008, 8th international conference on LiDAR applications in forest assessment and inventory (Hill; co-Chair; 2008); ForestSAT (Hill; 2010-; Spain, USA); Primate Society of Great Britain Spring Conference 2009 (Korstjens); Society for Cryobiology Annual Conferences (Zhang; 2010-12).

Keynote lectures. Golson Lecture at Australia National University in Canberra (Darvill 2008); Keynote speakers include: Brazilian National Symposium on Coastal Vulnerability (Slomp Esteves 2013); 17th Conference of European Anthropological Association (Schutkowski 2010); British Ecological Society Forests and Global Change Symposium (Newton 2011); NordForsk Biotic Response to Climate Change in Cold Climates Network Workshop (Stewart 2011); European Platform for Biodiversity Research Strategy Evolution and Biodiversity e-conference (Stewart 2010); Bristol Conservation and Science Foundation / Primate Society of Great Britain Symposium (Korstjens 2011); 6th European Congress of Protistology (Esteban; Berlin 2011); National Conference of the Microbiology Society (Esteban); Cryo2011 Conference (Zhang; USA 2011).