**Institution: University of Gloucestershire**

**Unit of Assessment: C-17 Geography, Environmental Studies and Archaeology**

## a. Overview

For 30 years, geographical research has been an area of strength within the University and its precursor institutions and has been the focus of strategic investment since 1994. Bioscience started in the University in 2004 and has increased in scope and significance within the Faculty. In RAE2008, an embryonic joint Geography/Bioscience submission was made to UOA32 (Geography and Environmental Studies); our REF2014 submission integrates staff from these two areas, who are now co-located within the School of Natural and Social Sciences and are involved in joint research and teaching.

The University's Strategic Plan emphasises research-informed teaching and this has shaped research developments in the UOA. Successful phased introduction of new BSc degrees in Biology and Animal Biology leading up to RAE2008 has brought in research-active staff with ecological and biological expertise that complemented existing Geography researchers.

Within the UOA, a formal marque we have used successfully since 1995 for external promotion, grant applications and research publications in reconstructing past environments and contemporary/future environmental change is the **Centre for Environmental Change and Quaternary Research (CECQR)**. In 2013, recognising both our existing and developing research strengths, the University committed to additional research funding directed at increasing investment in '**Environmental Dynamics and Governance**' **(EDG)**, which spans Geography and Bioscience, including CECQR, and encompasses research in the Countryside and Community Research Institute (CCRI; submitted RAE2008 to UOA 31). This funding enriches and extends existing internal research partnerships, and facilitates greater external collaboration.

## b. Research strategy

Evaluation of strategies outlined in RAE2008

The UOA submitted for RAE2008 included geographers that were employed in the Centre for Active Learning (a HEFCE-designated pedagogic centre). During the REF assessment period, HEFCE funding for this centre ceased, which coincided with a well-publicised financial crisis within the University when Geography staff were formally put 'at risk' of redundancy—a situation that took 12 months to resolve, and disrupted applications for research funding. However, in keeping with University strategy, members of the UOA maintain a profile in pedagogic research, especially into the value and enhancement of biological and geographical field work. The UOA has three National Teaching Fellows (two awarded since RAE2008), two of which are predicated on the research activities of the staff involved (linking research and engagement (**Hart**) and involving undergraduates in research (**Goodenough**)). Members of the UOA have contributed to pedagogic research projects valued at approximately £200k (held in other UOAs) with considerable national and international collaboration and impact, for example with the UK National Coordinating Centre for Public Engagement and the US Carnegie Foundation for the Advancement of Teaching.

In the RAE2008 submission, three strategic priorities were identified: strengthening the research activities of staff and students; increasing collaboration between UOA researchers; and developing new research directions, based on the expansion of Bioscience. The UOA has successfully worked towards realising these goals: all but one member of the UOA is being submitted for REF2014; the

number and quality of outputs has increased during the REF period and includes collaborative outputs between staff and students; and the UOA has been so successful in increasing collaboration and developing new research directions that centralised funding for a new research initiative has been awarded. This initiative, 'Environmental Dynamics and Governance' (EDG), formally integrates the research activities of Bioscience, Geography, and the Centre for Environmental Change and Quaternary Research (CECQR) as well as linking across to the Countryside and Community Research Institute (CCRI). EDG will act as the strategic focus for the next five years of research activity in the UOA.

Research objectives and activities

(i) Interdisciplinary approaches

Researchers of the UOA that are brought together under the EDG initiative espouse an inter-disciplinary perspective on biological, geographical and environmental research questions, and adopt a problem-solving approach in applied research. For example, research will link infra-red thermal imaging techniques, parasite field biology, laboratory analysis, long-term bird breeding records, pollen analysis, palaeoenvironmental reconstruction and novel statistical methods in projects that integrate the varied interests of the UOA and provide solutions for external bodies engaged in conservation management. Other examples include **Patrick** (new appointment), a biologist, who will work with geographers within the UOA (and CCRI) to investigate biological implications of social policy; **Scott** (new, Human Geography appointment), who will contribute to US-funded network on global market of unskilled labor (*sic*); **Lynch**, who has investigated community resource management in urban and peri-urban agriculture in Sierra Leone, and will link zoonotic diseases and urbanisation in Kenya, and supervise a new PhD to study communities growing date palms in arid zones.

(ii) Making use of valuable datasets

The EDG strategic investment in research allows staff to make considerable advances with a number of existing projects in early stages that take advantage of exclusive access to internationally important datasets. The UOA (through **Goodenough** & **Wood**) has exclusive access to long-term datasets from Portland Bird Observatory (more than 50 years of extensive daily international bird migration records that are currently unanalysed and unstudied), from Skomer Island (seabird breeding & survival), and from an RSPB long-term bird nestbox study (**Goodenough**). With exclusive access to these datasets comes access to valuable field sites for interdisciplinary research by UOA staff. A feature of published research in this area has been the involvement of undergraduate students as research partners, facilitated by a rolling summer bursary scheme.

(iii) Development of Citizen Science

Citizen Science approaches use non-scientists to collect data for scientific research. The UOA already has expertise, publications and continuing projects in this field (including a university funded PhD and a recently completed PhD) and such approaches have proved to be fruitful both scientifically and for wider impact. The 2012 and 2013 Flying Ant Survey conducted nationally by members of the group in collaboration with the Society of Biology stimulated considerable public interest, as did a similar joint project studying house spider phenology. The former has been selected in 2013 by RCUK as a case study to celebrate the third anniversary of the *Concordat for Engaging the Public with Research*. Investment in EDG will allow this type of research to develop

into a core strength and element of distinctiveness.

(iv) Strength in Quaternary Environmental Change: retrospective and prospective approaches

The Centre for Environmental Change and Quaternary Research (CECQR), established in 1995, is a long-established marque and is central to the development of EDG. CECQR will make use of the recently refurbished luminescence dating facility, palynology and microscopy laboratories (also used for nationally important forensic contracts by Research Associate Patricia Wiltshire with Hawksworth) and field equipment to continue its international work on pure and applied research into climate and environmental change. It is already cross-disciplinary, linking with Bioscience (e.g. through **Goodenough** and **Hart** on bird phenology; see RA2) and the CCRI, in which palaeodata are used to help formulate projections and assessments of environmental change. Palaeoecology is also used to inform future nature conservation practice (current research sponsorship to CECQR by Yorkshire Peat Partnership), while knowledge of palaeoclimate is used to advise on adaptation to climate change (recent National Trust, Wales, research contract: CCRI/CECQR).

Priority development areas

EDG has been designated as one of four priority research areas in the University. A guarantee of a minimum of two years of additional central funding has already allowed EDG to invest in three new research staff, a PhD studentship (linked to the luminescence dating facility), significant refurbishment of existing facilities and the purchase of new laboratory and field equipment. From this running start the EDG has identified four priority development areas:

1) Increasing successful bidding for external funds, especially for projects that link scientific understanding to policy and practice.

2) Increasing the impact of research and researchers with a view to REF2020.

3) Developing cross-disciplinary collaborations, with particular focus on 1) and 2) above.

4) Further strengthening the links between research and teaching (a University strategic priority), for example, by extending the summer bursary scheme allowing all UOA staff access to at least one funded summer research assistant.

**c. People, including:**

**i. Staffing strategy and staff development**

The UOA has seen a number of significant staffing developments since 2008. Academic staff members associated with the HEFCE-funded Centre for Active Learning have all, bar one, left the UOA, and the UOA has also lost two Human Geographers and two researchers associated with river and flooding research. However, new staff have been taken on to strengthen the academic portfolio and to help develop the EDG research initiative by building links between existing disciplines. These new appointments, most on permanent contracts, more than compensate for the loss of staff. They include a fluvial geomorphologist and GIS specialist [**Grenfell**], a population and disease ecologist [**Wood**], a spatial ecologist [**Patrick**], a human migration geographer [**Scott**], an environmental biologist [**Webb**], a microbiologist [**Rogers**], and the re-engagement of a fungal biologist and taxonomist [**Hawksworth**].

Succession planning has been a crucial consideration in appointments arising from staff losses. As part of the recruitment criteria since 2008, all new academic appointments to the School that

houses the UOA have the requirement for staff to be research active and to have a clear plan to ensure their REF submission. Now, all but one academic staff member within the whole of Geography and Bioscience is included in our REF submission.

Within the UOA, considerable attention has been directed towards developing staff as independent researchers (where staff are early-career) or in developing staff towards senior roles where appropriate. For example, during the assessment period, promotions have been made to Professor [**Hart**], Reader [**Goodenough**, **Lynch**], and Senior Lecturer [**Webb**, **Wood**]. Internal pump-prime funding (RAE QR funding) has been directed strategically to allow researchers to develop their research outputs and impact. Typically, this has included funding research assistants, mini-sabbaticals (through teaching buy-out), conference attendance (also funded through internal staff development allocation), equipment purchase and field expenses.

The existence of ample opportunity for staff development within the UOA is evidenced by the prestigious fellowships and awards held by members of the UOA. These include National Teaching Fellowships predicated on research (linking student and staff research [**Goodenough**], linking public engagement in science with academic research and teaching [**Hart**]), Fellowship of the Royal Entomological Society awarded for "substantial contribution to entomology through publications" [**Hart**], Fellowship of the Society of Biology for "a prominent contribution to the advancement of the biological sciences" [**Goodenough, Hart, Hawksworth**], CBE for Science [**Hawksworth**], Science Communicator of the Year [2010, **Hart**], Chartered Biologist [**Goodenough**], Professional Member of Forensic Science Society and the Josef Adolf von Arx Award (awarded by the Royal Netherlands Academy of Sciences on special occasions to an individual who has made an outstanding contribution to taxonomic research of fungal biodiversity) [**Hawksworth]**.

Equality of opportunity is central to the University's staffing strategy and is clearly evident in the UOA's appointments. For example, almost half of the REF-submitted staff are female and a third of the submitted candidates are relatively early in their career. A third of the submitted candidates are part-time staff and a quarter of staff had maternity leave during the assessment period.

Research quality and integrity are maintained through a combination of UOA, Faculty, and University policies and practices. The Faculty and University operate Ethics Panels, relevant for research undertaken within the UOA at undergraduate, post-graduate and staff level. These panels include external experts, and the Faculty panel scrutinises applications on a rolling schedule. Authorship policy within the UOA ensures (i) that all authors have made a significant contribution to research work; and (ii) that participating students are identified as named authors where appropriate.

### ii. Research students

It is published policy and established practice within the UOA that post-graduate research students are treated as staff. This leads to a vibrant PGR culture within the UOA, with strong linkage between the small PGR student cohort and academic staff. At the time of writing, more than half of the submitted staff are formally involved in PGR supervision, with plans to increase this proportion as EDG develops.

Several PhD students (current and completed) and two laboratory technicians would have been eligible for REF submission based on their publication outputs, which reflects the strong culture of engaged scholarship within the PGR cohort, technical and supervising staff.

PGR students have dedicated office space co-located with academic staff as well as dedicated laboratory facilities where appropriate. PGR students have the right to undertake, free of charge, the Post-Graduate Certificate in Academic Practice (PGCAP) during the course of their studentship. This teaching qualification provides opportunities to develop teaching skills during their studentship, which enhances their employability.

During the assessment period the UOA has been able to offer three concurrent competitive studentships as well as self-funded PGR students, and the development of EDG will continue this mixed pattern of PGR recruitment.

**d. Income, infrastructure and facilities**

Income

A strong feature of the UOA is the ability of its staff to lever maximal impact and return on relatively modest research income by ensuring peer-reviewed publications in international journals flow from both pure and applied/contract research and from University-funded research scholarship. Income for research has come from diverse sources, and external and internal (between-UOA) collaboration has meant that the UOA has not always been the accounting unit. Research income is an under-estimate of the wealth of research funding for this UoA because funding is accounted for at the first recipient institution or UOA.

To illustrate this point, research funding sources have included national Research Councils (for example, Co-PI **Chambers** on NERC £58k grant [to Evershed, Bristol] to develop temperature climate proxy from peatlands; NSF/QRA Workshop, via Universities of Wyoming and Plymouth; and NERC-QUEST Workshop, via the University of Bristol. These sources led directly to three of his REF-submitted publications); National Trust (£19k contract, via CCRI, involving **Chambers** of CECQR); British Ecological Society (**Goodenough, Wood, Hart**); Portland Bird Observatory (**Wood, Goodenough**); HEFCE (**Goodenough**); HEA Biosciences (**Goodenough, Hart**); HEA/NCCPE (£218k, involving **Lynch**); HEA-NTF awards (£198k, involving **Lynch**); Commonwealth Foundation (**Lynch**); and the Janet Trotter Trust (**Goodenough, Hart**).

Since 2008, the Luminescence dating laboratory has received £208k of external applied research income from UK and internationally. This income has been split ca 25:75 from industry and HEIs.

Infrastructure and facilities

Considerable infrastructure support for research exists within the UOA. Research facilities include a suite of laboratories that undertake research in general biology; invertebrate biology; microbiology; genetics; ecology**;** physical geography, including analysis of water, soils and sediments; pollen analysis, including forensic applications; and luminescence dating. The last-named has three laboratories housing some of the most up-to-date geochronology facilities in the UK. Laboratory facilities are run by five technicians—an increase from three in 2008. IT facilities include a specialist computer room and video conference facilities with updated software and dedicated GIS support.

University investment since 2008 has seen the refurbishment of luminescence dating equipment, the setting up of an approved category-2 microbiology laboratory and an additional dedicated molecular biology laboratory; the allocation of space and development funds for an invertebrate/ecology laboratory; the re-fitting of a large research and teaching laboratory for bioscience; and the refurbishment of a physical geography laboratory. Investment in the UOA has also seen the purchase of state-of-the-art thermal imaging equipment, low-light vision equipment, high-powered photographic microscopes and software to support this equipment.

**e. Collaboration and contribution to the discipline or research base**

Examples of international collaborative research

The vast bulk of the research conducted by the UOA is collaborative, and especially so at the international level. For example, research on palaeoclimates in CECQR has built on earlier Scientific Co-ordination by **Chambers** of an EC RTD project (€1.4M: ACCROTELM, 2003–6), involving 11 universities across Europe. Subsequent participation in NSF/QRA-sponsored international Workshops, involving researchers from Europe, US, Canada and India, led to research protocols being developed from ACCROTELM and adopted internationally (published in *Mires and Peat*, vol. 7, 2010–11). Collaborative international research has developed and refined proxy-climate indicators from bogs (see RA2: Chambers *et al*., 2012), and produced a synthesis of peat–carbon data, published in *Biogeosciences* (see **Chambers**' output 1, RA2).

Publications flowing from **Chambers'** contract research from two national statutory agencies, formerly named Countryside Council for Wales and English Nature, showed how, internationally, palaeoecology can inform nature conservation (see RA2: **Chambers** *et al*., 2013; and RA3 Case Study 2). The Luminescence Dating facility, run by **Toms**, has been contracted by numerous research organisations collaboratively, resulting in publication of twelve REF-able articles, co-authored by **Toms** and researchers from a range of HEIs.

Staff within the UOA are involved in numerous national and international research collaborations resulting in publications over the REF period.

Active collaborations include: fluvial geomorphology with Universities of Aberystwyth, Exeter, Swansea, and Rhodes (South Africa) (**Grenfell**); fungal biology, with Royal Botanic Gardens Kew, The Natural History Museum London, Birkbeck, and Universidad Complutense de Madrid (**Hawksworth**); urban and peri-urban agriculture, with University of Sierra Leone, the African Studies Association, the Commonwealth Foundation, Aston Business School, University of Bath, and Coventry University (**Lynch)**; insect ecology, with Universidade Federal de Viçosa (Brazil), Society of Biology, and BBC (**Hart**); population & disease ecology (**Wood**) with Edward Grey Institute University of Oxford, Institute of Zoology ZSL London, University of Sheffield, Lund University (Sweden), University of Cambridge, National Oceanographic Centre, Southampton, Natural Resources Wales, and the Wildlife Trust of South and West Wales (**Wood)**; bird ecology, with Centre d'Ecologie Fonctionnelle et Evolutive (France), University of Lund (Sweden) (**Rogers**), Universidade Federal de Viçosa (Brazil), and Universitat de València (Spain), Ecotricity (**Goodenough**); CEBC CNRS (France), University of Oxford, University of Exeter and Deakin University, (Australia) (**Patrick**); microbial ecology, with British Trust for Ornithology, Cambridge University, and Gloucestershire NHS Trust Pathology Department (**Rogers**); palaeoclimates from peatlands, with Universiteit van Amsterdam, and the Universities of Aberdeen, Bristol, Helsinki, MacQuarie, Newcastle, and Southampton (**Chambers, Webb**); forced labour monitoring with Universities of Cambridge, Dundee, Durham, and Liverpool (**Scott**); Quaternary geochronology, with Universities of Bristol, MacQuarie, Nottingham, Queen Mary University of London, Royal Holloway University of London, University College London, and Museum of London Archaeological Services (**Toms**); geochemical analysis, with University of Exeter, University of Portsmouth and Dustscan Ltd (**Webb**).

Contributions to research journals, learned societies and research associations

Staff are active within learned societies and research associations, including: Honorary President of the International Mycological Association and a Member of General Nomenclature Committee, International Association for Plant Taxonomy (**Hawksworth)**; Member of the West and South

Wales RGS Committee; co-organiser of the 2011 Annual QRA Field Meeting on the Quaternary of the Exe Valley and Adjoining Areas and co-editor of associated field guide (**Toms**); member of the Association for the Study of Animal Behaviour Education Committee and the Society of Biology's Public Engagement Committee (**Hart**); CROS/PIRLS Steering Group (**Chambers**); Steering Group of Living with Environmental Change project (zoonotic disease in Kenya) funded by the MRC (**Lynch**).

Senior staff in the UOA hold editorships of international research journals, including: *Biodiversity and Conservation*: **Hawksworth**, Editor-in-Chief, with **Chambers**, Editor; *The Holocene*: **Chambers**, Associate Editor; *Mires and Peat*: **Chambers**, Associate Editor; *IMA Fungus* (International Mycological Association): **Hawksworth**, Editor-in-Chief; *Fungal Diversity*: **Hawksworth**, Associate Editor; *Medical Mycology*: **Hawksworth**, Associate Editor; *Mycology*: **Hawksworth**, Associate Editor; *Ecological Entomology*: **Hart**, Editor-in-Chief (2009-2012) and Associate Editor (2012-); *Microbial Ecology*: **Goodenough**, Editorial Board; *International Journal of Zoology*: **Hart** and **Goodenough**, Guest Editors.