Institution: Swansea University
Unit of Assessment: 17 - Geography, Environmental Studies and Archaeology
a. Overview

Our submission covers the Department of Geography, the largest of five constituent units of the College of Science (est. 2011). We conduct distinctive, cutting-edge, interdisciplinary research spanning the breadth of Geography. We are organized into the five research groups shown below.

RESEARCH GROUPS: KEY FOCI & COMPOSITION (as at 30/10/2013)
Environmental Dynamics – 12 academics, 6 PDRAs, 12 PhD students
We have expertise in dendroclimatology, tephrochronology, stable isotopes, biogeochemical fluxes (carbon, silicon), wildfire impacts, soil hydrology, and sediment tracing; covering atmospheric, cryospheric, terrestrial, and marine processes. Our key research foci include: • Reducing uncertainty in understanding past and contemporary climate dynamics. • The effects of natural and human disturbance on land-surface processes in regions particularly sensitive to perturbation: alpine, polar, Mediterranean, tropical and wildfire-prone. • Approaches to sustainable management and carbon capture in agricultural and forested land.
Glaciology – 5 academics, 4 PDRAs, 13 PhD students
We combine modelling, remote sensing, and geophysical/geological field methods in the Arctic, Antarctic, and most other glaciated regions to advance three key areas: • Processes regulating glacier dynamics and flow instabilities. • The role of the cryosphere in climate change. • Past and future cryospheric contribution to sea-level rise.
Global Environmental Modelling & Earth Observation – 5 academics, 4 PDRAs, 5 PhDs
We aim to advance understanding and prediction of land–atmosphere interaction through the assimilation of satellite and surface observations, with a particular focus on: • Developing enhanced global datasets of land and atmosphere from existing and new satellites through rigorous physical modelling. • Improving weather forecast and climate models by the assimilation of satellite observations. • Quantifying regional and global land–atmosphere fluxes of carbon, water, and radiation.
Migration, Boundaries & Identities – 4 academics, 6 PhD students
We lead Swansea's interdisciplinary *Centre for Migration Policy Research* (CMPR), focusing on: • Migration and mobility at local, national, and transnational scales. • The experiences of migrants and minorities. • The engagement of policy makers and practitioners.
Social Theory & Urban Space – 4 academics (1 not submitted), 5 PhD students
We lead the University's interdisciplinary *Centre for Urban Theory* (CUT), focusing on: • Poststructuralist, post-Marxist, and psychoanalytic urban theory. • Global cities, world cities, urban networks, and urban assemblages. • Urban imaginaries and utopias: visual culture, media geographies, embodiment, city space.

b. Research strategy

The **key drivers** of our research are *scientific and critical enquiry*, *policy relevance*, and *value to society*. Whilst capitalizing on commercial applications of the knowledge we produce, our **principal objective** is to contribute solutions to the world's most pressing environmental and societal challenges. Our **mission** is to produce research of the highest calibre and on this basis serve as one of the foremost international centres for research in Geography; in line with the University's mission to be a research-intensive Top 30 UK University by 2017.

Our strategy **empowers research groups** to develop and deliver cutting-edge research within a framework of *support and incentives* that reinforces clear *communication of expectations*. Research-group leaders act as line managers and, via our award-winning Performance Enabling Programme (Section C), ensure the *alignment of individual and group aims*. Best practice is shared via our Research Group Leaders' Forum. Group performance is *monitored and steered* by our

Geography Strategy Group. Our activity more broadly is configured within the sustainable business model provided by the College of Science, which delivers *transparent financial planning* and *economies of scale via pooled resources* within a *streamlined administrative/professional structure.*

Our strategy is aligned with the research process: (I) securing resources and infrastructure; (II) establishing the time, facilities, interaction, and engagement to facilitate research; and (III) ensuring the intrinsic quality of our contributions, their dissemination, and their wider impact.

I. **Maximizing grant capture**: internal peer-review of applications (including ESRC demand-management); research-incentives scheme (returning a portion of income to PIs and Co-Is and increasing research time); budgets for pump-priming and start-up funds for new staff.

II. **Facilitating research conduct**: comprehensive risk-assessment and ethics procedures; seminar series (Departmental, CMPR, CUT, Climate Change Consortium of Wales [C_3W]); vibrant cross-College and Research Centre interaction; technical staff and state-of-the-art laboratory facilities and fieldwork equipment; sustainable facilities and equipment budget.

III. **Optimizing research output**: peer-review of pre-submission outputs to optimize quality; Departmental and University funding for page charges and open-access charges, and conference attendance; authorship policy ensuring all research-contributors are appropriately credited; PR and dissemination strategy utilizing College and University Press Office services.

Many mechanisms combine these elements: our **research-incentives scheme** rewards (with time and money) outputs, grant applications and capture, and competitive PGR studentships.

Performance since RAE 2008: Our RAE 2008 ambition was '*to undertake world-leading research in all areas with which we engage*.' Reaffirming the strategic direction set in 2008, we have retained our successful group structure and significantly intensified our activity. We have confidently met the ambitious targets presented in our RAE 2008 submission, having:

- Cemented a **world-leading reputation** in climate-change research through major programmes, including leadership and contributions to multi-million-pound projects: Those **completed** include Millennium: European Climate of the Last Millennium (€13M; EU), GLIMPSE (Greenland Ice Margin Prediction, Stability and Evolution, Leverhulme); **continuing** projects include SEARRP (South East Asia Rainforest Research Programme, Royal Society), C_3W (Welsh Government), TRACE (Tephra Constraints on Rapid Climate Events, European Research Council), Networks of Sensors in Extreme Environments (NERC). **New** ventures include: £10M Met Office National Centre for the Impact of Extreme Weather hosted by Geography and Engineering (Welsh Government's *Sêr Cymru*), and £2.4M (NERC, BBSRC, Royal Society Fellowship) on climate–soil hydrophobicity feedbacks. Significant global scientific contributions include lead authorship within the Intergovernmental Panel on Climate Change's (IPCC) 5th Assessment Report.
- Established **leading international roles** in relation to migration, changing international policy relating to age-disputed children and gender in the asylum process, and generating influential poststructuralist urban theory, establishing a world-leading reputation in Baudrillard studies.
- Formed a well-resourced **graduate school**, collaboratively securing an **ESRC Doctoral Training Centre (DTC Wales)** Human Geography pathway, and obtaining European Social Fund (ESF) Knowledge Economy Skills Scholarships (KESS).
- Acquired continued funding as part of NERC's **National Centre for Earth Observation** (NCEO) and forged strong collaborative links with the European Space Agency (ESA), NASA, Met Office and the European Centre for Medium-Range Weather Forecasting (ECMWF).
- Secured **£6.7M** funding, jointly with Biosciences at Swansea, for innovation and engagement activities through EU Convergence funding: Welsh Institute for Sustainable Environments 2 (WISE-2); Sustainable Expansion of Applied Coastal and Marine Sectors in Wales (SEACAMS).
- Developed a **staff complement** capable of delivering outstanding research.
- Created a **sustainable community of postdoctoral research assistants (PDRAs)** and Research Fellows capable of nurturing and developing individual careers.
- Enhanced an already **excellent research infrastructure** via laboratory and IT investment.

RESEARCH-GROUP ACHIEVEMENTS SINCE RAE 2008
ENVIRONMENTAL DYNAMICS
• Produced the world's most robust and detailed reconstruction of Europe's climatic variability over last 1,000 years through the integration of proxy-based climate reconstructions. • Developed the capacity to test phase relations between ocean circulation and atmospheric dynamics via the novel use of cryptotephras and environmental proxies in ice/marine sediment. • Demonstrated the link between orbital forcing of African monsoons and the resultant climate change to global biogeochemical cycles using silicon stable isotopes in biogenic silica. • Developed stable-isotopic analyses in peat enabling us to reconstruct past hydro-climate and link this to ocean circulation for the Americas. • Quantified the effects of severe and extreme wildfire on soil erosion and flood risk, and on landscape carbon dynamics, including the potential of wildfires as long-term carbon sinks. • Elucidated the long-term response of rainforest hydrogeomorphology to logging and climate change, using novel sediment-fingerprinting and dendroclimatological approaches. • Determined the causes and implications of the superhydrophobic behaviour of soils.
GLACIOLOGY
• Created numerical models of ice-sheets, iceberg calving, ice-shelf stability and snow hydrology • Advanced satellite/airborne remote sensing of glacier/ice-shelf dynamics and volume changes. • Innovative applications of geophysical field techniques (radar, seismic, and electrical methods). • Enhanced understanding of critical glaciological process such as the influence of lake drainages on the Greenland ice-sheet; sensitivity of Greenland's SE glaciers to ocean influences; evolution and stability of Himalayan glacial lakes; dynamics/stability of Larsen C ice shelf; basal conditions of contemporary/palaeo ice streams. • Generated methodological advances from interdisciplinary collaborations with archaeologists, biologists, computer scientists, engineers, and historians.
GLOBAL ENVIRONMENTAL MODELLING & EARTH OBSERVATION
• Built global data products for numerical weather prediction in national-agency climate models. • Produced land-surface background albedo dataset used in the Met Office Model (MetUM) and High-resolution Global Environment Model (HiGEM) for weather prediction/climate forecasting. • Generated a ground-breaking global vegetation-height dataset to use in global climate models. • Advanced carbon-flux modelling and delivered global estimates by integrating carbon and water-surface fluxes supported by satellite data (FLUXNET, CASA, JULES, GENIE models). • Undertaken the code development for ESAs Sentinel-3 satellite mission (2014–30) to allow aerosol and surface-reflectance data to be collected for both land and atmosphere.
MIGRATION, BOUNDARIES & IDENTITIES
• Challenged dominant theoretical and policy understandings of home, border, boundaries, nation, and networks in the context of increased global mobility. • Foregrounded migrant experiences to increase public and policy understanding of the complexity and nuance of migration. • Connected academics, political leaders, policy makers, practitioners, and other stakeholders to ensure that up-to-date evidence informs policy and practice. • Influenced UK, European, and international policy debates on asylum, separated asylum-seeking children and socio-economic integration of migrants.
SOCIAL THEORY & URBAN SPACE
• Established radically new perspectives on the geographies of value, consumption, and excess through the integration of poststructuralist, post-Marxist, and psychoanalytic frameworks. • Advanced the theoretical basis and interpretative power of Media Geography by subjecting key media to rigorous poststructuralist and psychoanalytic analysis. • Pioneered a poststructuralist approach to global cities as networked assemblages. • Produced seminal work on the spatial implications of some of the most influential intellectuals and philosophers of our age: Jean Baudrillard, Gilles Deleuze, and Jacques Lacan.

Our **Strategic Plans, 2014–19**: (1) build on existing areas of excellence, targeting investment towards key global challenges in the areas of *climate change*, *international migration*, and

urbanization; (2) expand our research base with a specific focus on *extreme events* in the natural and social environments. We aim to achieve this over the next five years through:

1. Enhancing excellence in our existing research groups by:

- Empowering groups to set their own goals (below) to exploit core competences within the remit of our wider strategic plans, supported by targeted investment and incentives.
- Fostering our established integrated structure to amplify innovative cross-group collaboration via investment and appointments at the interface between research groups, beginning with the appointment of two FTE Human Geographers in January 2014.
- Optimizing our impact by increasing the range of academic staff adopting our proven approach of involving non-academic users in the research process from the outset.

2. Expanding our research base with a new core theme focused on extreme events by:

- Establishing, in 2014, the **£10M** Met Office *National Centre for the Impact of Extreme Weather*, bridging Geography and Engineering, and appointing 4 Professors, 2 Associate Professors, 4 Lecturers, 2 PDRAs, and 7 PhD students in Geography. This initiative will leverage additional staff and research income from sources including the EU, RCUK, and Government.
- Launching a new University Research Centre on *extreme geopolitical and geoeconomic events*, involving existing staff and the two new Human Geographers appointed in January 2014.

FIVE-YEAR GROUP AIMS
ENVIRONMENTAL DYNAMICS
(i) Use climate proxies to test/improve model performance across different temporal and spatial scales; (ii) determine why climate changed abruptly in the last 100,000 years using tephrochronology in a multiarchival approach; (iii) advance our leadership in understanding natural and human impacts on rainforest environments and their sustainable-management implications; (iv) develop geotechnical approaches for carbon sequestration through enhancing pyrogenic carbon generation in prescribed wildland fires and industrial production from waste biomass; (v) determine the role of microbes in superhydrophobicity to enable soil-management practices that improve crop production and reduce flood generation and erosion.
GLACIOLOGY
(i) Advance process-based understanding of glacier dynamics (Greenland outlet glaciers, Antarctic ice streams, palaeo ice masses); (ii) extend world-leading glaciological applications of geophysical field techniques; (iii) model key glacial processes (calving, subglacial and snow hydrology), constraining models with observations; (iv) consolidate our role in the Cryosphere community, leading major multi-disciplinary initiatives to advance understanding of ice masses in the global climate system and make major contributions to the climate-change policy debate.
GLOBAL ENVIRONMENTAL MODELLING & EARTH OBSERVATION
(i) Improve weather/climate models by assimilation of satellite and surface-flux data, focussing on extreme events within the Met Office *National Centre*; (ii) lead development of new climate-quality datasets for land-surface and atmospheric aerosols; (iii) improve global measurement of carbon and water fluxes by integrating spatial representation into the next generation of the global FLUXNET database; (iv) develop physically based methods for new satellite instruments, working with space agencies: ESA/GMES Sentinel-3 (2014–30) and NASA ICESat-2 (2015–).
MIGRATION, BOUNDARIES & IDENTITIES
(i) Interrogate how mobility produces new understandings of transnationality; (ii) capitalize on our leading role in evidence-based migration policy research via work on migrant/refugee identities involving policymakers and practitioners; (iii) set migration and integration policy agendas on age assessment, guardianship, and destitution, working with Government and other organizations; (iv) recast public understanding of migration through media and activist engagement.
SOCIAL THEORY & URBAN SPACE
(i) Mobilize our expertise in poststructuralism, post-Marxism, and psychoanalysis to critique financialized subjects; (ii) extend seminal research on the spatial implications of the work of key philosophers (Badiou; Sloterdijk), whilst expanding world-renowned expertise in Baudrillard and Deleuze studies; (iii) found innovative theoretical and empirical agenda on urban dominance to detail new geographies of command and control in global networks; (iv) forge new ecological understandings of cultural difference, visual technologies, and embodied practice.

c. People:
I. Staffing strategy and staff development

Our research groups represent vital hubs for our collective research endeavour and form the basis of a vibrant research culture. Their sustainability has been enhanced through the **appointment of six new early- and mid-career academic staff** since RAE 2008: Shubin as Senior Lecturer in 2011 (from Aberdeen); Evans as Lecturer in 2011 (from a Fellowship); Rogers as Lecturer in 2012 (from RHUL); Stanford as Lecturer in 2012 (from Southampton); Urbanek became a Royal Society Fellow in 2012, and Bevan was appointed as Lecturer in 2013 (from PDRA posts). Pump-priming funds are made available to all new staff. These **new appointments target key strategic areas**: *climate change* (Bevan, Stanford, Urbanek); and *mobilities and movement* (Evans, Rogers, Shubin). Our Human Geography appointments purposefully link our research groups. We have maintained a strong staff complement and plan to expand over the next five years (Section B).

Recognition of **excellent staff performance is reflected in the pattern of promotions** since RAE 2008, including five Personal Chairs (Crawley, 2009; Doerr, 2009; North, 2011; Davies, 2012; Luckman, 2013); five Readerships (Doerr, 2008; Davies, 2011; Halfacree, 2011; Kljun 2013; Robertson, 2013); and three Associate Professorships (Gagen, 2012; Hiemstra, 2012; Rutt, 2013). Davies and Doerr were promoted twice within the REF period. On completion of their Fellowships, Gagen (RCUK) and Loader (NERC Advanced) were appointed to permanent academic posts. In both cases, these prestigious awards provided the time and resources to develop high performance levels and delivered wider benefits as a consequence of interaction with established researchers. Urbanek will likewise be offered a permanent academic post on completion of her Royal Society Fellowship. Stanford's post results from Davies's European Research Council award. Of our 30 Category A staff, 28 are on permanent contracts, reflecting a commitment to providing security of tenure compatible with building long-term research trajectories.

Research staff are integral members of our research groups, with full representation on our research committees. Our commitment to sustaining our community of researchers and realizing individual potential is demonstrated by the fact that half of our PDRAs are common to RAE 2008 and REF 2014, now typically at higher grades. The University is committed to the implementation of the **2008 Concordat to Support the Career Development of Researchers**, being one of the second tranche of HEIs to be awarded the ***HR Excellence in Research Award*** from the European Commission, which we successfully retained in 2013. Our cross-institutional training unit, the Academic and Professional Enhancement Centre, Swansea (APECS), coordinates a comprehensive **skills development programme** aligned to the Vitae Research Development Framework. This represents a significant investment in building research-staff careers. Institutional support mechanisms combined with an inclusive Departmental culture ensure that the contribution of our research staff is fully recognized and rewarded.

The College has 22 **technical staff** plus a College Infrastructure Manager, including a seven-strong Laboratory team supporting our research laboratories, four being funded through external grants in the areas of isotope analysis, tephrochronology, water quality, catchment hydrology, and industrial liaison. Our IT team has five members maintaining our research computing facilities.

We pride ourselves on maintaining a highly **collegiate, mutually supportive, intellectually stimulating research environment**. This is reflected in a full range of activities, from a packed diary of seminar series events and conferences to a lively social calendar. Our approach to staff development owes much to our supportive and collegiate culture, which has long been a distinguishing feature of our Department. This dovetails with our formal **Performance Enabling Programme**, which, in 2012, won both a ***Times Higher Leadership and Management Award*** and a ***Universities Human Resources Excellence Award***. The programme provides all staff beyond probation with Key Performance Indicators relating to publications, grant applications and funding, and research-student supervision, informing biannual Professional Development Reviews (PDRs) with research-group leaders. PDRs establish mutually agreed research goals and training needs. New staff are supported by both a probationary supervisor and a mentor, our probation system merging seamlessly with our Performance Enabling Programme. APECS, our training unit, allocates resources and provision in an integrated and strategic manner, responding to training needs identified in PDRs. Additionally, a grass-roots collection of researchers, **Swansea**

University Research Forum (led by Murray), operates a highly successful **research coaching scheme** to enhance staff development at all career stages. We also participate in the all-Wales **Women in Universities Mentoring Scheme** (WUMS) for female academics.

Our research-leave scheme provides staff with full relief from teaching and administration for one semester plus contiguous out-of-term periods. All academic staff are eligible for research leave on average every five years, to pursue a strategic research or research-impact goal requiring an extended period of dedicated time. Since 2008, 20 staff have benefited from sabbaticals. Our success in creating research time is reflected in the data collected via the Time Allocation Survey, under the Transparent Approach to Costing framework. For 2008–12, Geography staff reported an average of over **58% of dedicated research time**. Our new **Academic Career Pathways** support both Research and Innovation & Engagement, as well as Teaching & Scholarship, the last releasing additional time for research-active staff.

Our commitment to **equality and diversity** is framed by the University's Strategic Equality Plan, which underpins a culture of inclusivity and values diversity in all areas of activity. In addition to characteristics covered by UK legislation, in Wales this also embraces Welsh-language issues. Our practice ranges from mandatory equality training for all staff to the provision of affordable nursery facilities and a family-friendly Flexible Working Policy. We run a College **Equality and Diversity Forum** to identify issues and deliver solutions (e.g. promoting gender representation on all committees). Our commitment to **gender equality** is evidenced by the fact that women comprise 32% of our Category A staff, 40% of our Research Group Leaders, and 36% of our Professoriate. Five of our six new academic appointees are women. The University successfully **retained its Athena SWAN Bronze Award** in 2013. The outcome of an application for a Departmental Bronze Award (led by Clarke) is pending. The University is also a member of Stonewall's Diversity Champions Programme, Britain's best-practice employers' forum on sexual orientation.

c. II. Research students

Research students play a vital role in our research culture and are integral members of our research groups. Our PhD completions over the REF period stand at 29 FTE, compared to 42 over the (longer) RAE 2008 period. However, a **comparative snapshot of the number of PhD students at the census dates of RAE 2008 and REF 2014 shows significant growth**, from 29 to 41. There has been a steady growth in the ratio of PhD students per academic FTE since 2008–09, rising from 0.6 to 1.3 in 2011/12. This approaches the sector's upper quartile figure of 1.4 for the same period. These figures demonstrate a thriving postgraduate community, which has been enhanced by a number of major developments. In terms of obtaining prestigious, competitive studentships, we have maintained our success in securing NERC studentships and have obtained EPSRC, NCEO, Royal Society, Commonwealth Commission and AXA studentships, and secured PhD funding through GLIMPSE (4), TRACE (1), and KESS (5), in addition to *Coleg Cymraeg Cenedlaethol* (3), and University and College scholarships (5). In collaboration with Aberystwyth and Cardiff, we have established an **ESRC DTC Wales Human Geography pathway** (launched in 2012), securing a sustainable flow of Human Geography studentships (3 to date, 2 more for 2014), working with partners including Countryside Council for Wales, National Botanic Garden of Wales, and obtaining an £80k package of support from Ordnance Survey for ESRC DTC studentships.

Support and supervision of our research students is undertaken within a framework ensuring effective induction into the University and Department, and incorporating a sustained programme of comprehensive training tailored to individual needs. Our robust **progression-monitoring procedures are cited by QAA as best practice**. PhD students meet frequently with supervisors (fortnightly in their first year) and have access to discipline-specific and generic professional modules. Physical Geographers select modules from our MSc Environmental Dynamics & Climate Change, MSc Geographic Information & Climate Change, and MSc High-Performance Computing schemes; Human Geographers from the Research Training element of our **ESRC 1+3 programme**: the MSc Social Research Methods scheme. This incorporates a collaborative annual Human Geography Postgraduate Conference and ESRC Theory School. We also run an annual Postgraduate Conference for all Swansea Physical and Human Geography research students. All research students access the comprehensive skills-development programme provided by our **Research Student Skills Division** (within APECS), which annually updates its curriculum in

response to training needs identified by research students and supervisors, and includes specialist employability-skills modules. We are also a major partner developing and delivering Welsh-medium postgraduate training across Wales through ***Coleg Cymraeg Cenedlaethol***, the national institution overseeing Welsh-medium education. The receipt of the 2013 ***Times Higher Education*** **Outstanding Student Services Team Award** evidences the calibre of our student support.

Our experience and dedication to postgraduate training is also reflected in contributions to international postgraduate training. Luckman is Adjunct Professor (2013–18) at the University Centre in Svalbard, where Murray (2006–12) and Rutt (2006–date) also serve as guest lecturers. Loader and Young were guest lecturers at the University of Gothenburg. Rutt taught at a Summer School jointly funded by the US National Science Foundation (NSF) and Scientific Committee on Antarctic Research (SCAR) (2009), and twice at UK Polar Network workshops (2009, 2012). Halfacree has been prominent in two Rural Sociology European Summer Schools (2008, 2010); Davies in a University of Iceland Summer School on Tephra Studies (2012); and Bevan at a joint ESA/CONAE (Argentinean National Space Activities Commission) Summer School (2010).

Our postgraduate community is valued as a major asset to our research environment. Postgraduates are not only ambassadors for Swansea, presenting their research at international conferences and publishing in international journals. They contribute enormously to the collegiality of our research culture and play an inestimable role animating a range of activities, including seminar series and reading groups. In addition to the dedication and commitment we show our own students and the vitality with which they repay us, we have hosted **visiting international research students** during the REF period, from locations as diverse as Brazil, China, Denmark, Fiji, The Netherlands, New Zealand, Norway, Portugal, Slovenia, Spain, Sweden, and the USA. Our commitment to generating high-quality PhDs is evident from **recent destinations** of our graduates, which include permanent academic posts and research posts in, e.g. the UK, Continental Europe, Canada and the USA.

d. Income, infrastructure and facilities

In consequence of our substantially increased grant-capture, our **research income for the REF period has been consistently greater than for the preceding RAE period**, amounting to over £1.8M in both 2008–09 and 2009–10, over £1.5M in 2010–11, £1.1M in 2011–12, and £1.1M in 2012–13. This amounts to *c*. **£7.4M in the five-year period 2008–13**, compared to the reported £4.7M (*c*. £5.3M present value) over the longer RAE period. HESA data record our ratio of research-grant and contract income per academic FTE in 2011–12 as £36,760, **significantly higher than the HEI-sector median** of £24,400 for the same period. This is complemented by in-kind support from RCUK and numerous other sources (e.g. Forest Research's additional in-kind contribution valued at £125k to a £291k NERC Partnership Grant; FP Innovations' (Canada) contribution of $160k to an EPSRC BTG grant). The REF period has witnessed substantial investment in infrastructure and facilities. We currently stand at the threshold of a major strategic investment at University level: our **new Science and Innovation Campus**. Based on a donated 100-acre seafront site, the development has secured £250M building investment, providing unprecedented opportunity to enhance the quality of our environment. Geography will expand from its present location via the Met Office National Centre for the Impact of Extreme Weather.

Grant-capture activity is supported by a robust institutional framework: our Department of Research and Innovation provides pre- and post-award support. Dedicated Funding Officers holding College-specific responsibilities advise on all aspects of research funding and proactively communicate opportunities to expand our research portfolio. Key funding sources include the Biotechnology and Biological Sciences Research Council (BBSRC), British Academy, EPSRC, ESRC, European Commission, European Research Council, EU Convergence Fund, Leverhulme Trust, NERC, NSF, Royal Society, and the Welsh and UK Governments.

Notable successes range from **prestigious individual awards** (e.g. Davies's €1.4M ERC Independent Starting Grant, 2011–16 and Philip Leverhulme Prize, 2011) to **major cross-institutional consortia** (e.g. the £10M pan-Wales C_3W collaboration between Swansea, Aberystwyth, Bangor, and Cardiff Universities, 2009–2019), and a plethora of smaller awards that sustain the diversity of our research, from bodies such as AXA, the Diana, Princess of Wales Memorial Fund, European Foundation for the Improvement of Living and Working Conditions

(EuroFound), General Nursing Council for England and Wales, Humanitarian Innovation Fund, Kraszna-Krausz Foundation, Oxfam, Pharmacy Practice Research Trust, Refugee Council, Shelter Cymru, and UNICEF. This array of sponsors evidences the **diversity and resilience of our funding channels**. A significant measure is the EPSRC-funded Bringing People Together programme (Bridging the Gaps (BTG), £790k, 2010–13; Murray Co-I), to facilitate interdisciplinary research, and has provided Geography with seedcorn funding and supported grant development.

In relation to research infrastructure, an exceptionally strong resource base has been established through the development and support of state-of-the-art laboratory, fieldwork, and computing facilities. These include dedicated laboratories for (i) stable-isotope analysis (with three mass-spectrometers, including one of only two peripherals in the world for on-line equilibration); (ii) microscope/image analysis for tephrochronology and dendrochronology; (iii) biogeochemical analyses (including XRF, FTIR, GC-IRMS); (iv) soil and sediment analysis; (v) pollen analysis; (vi) climatic simulation (including a programmable climatic simulation chamber and rainfall simulator), and a multi-purpose positive-pressure clean laboratory. Our state-of-the-art high-performance-computing (HPC) facilities include the Mike Barnsley Centre for Climate Change Research's Blue Ice 2 supercomputer; an IBM System DataPlex (£500k); an IBM Analytics (£1M); and access to Wales's national HPC facility: a Fijitsu massive F cluster (£6M). The Met Office National Centre for the Impact of Extreme Weather will see the acquisition of a major HPC facility for Geography located at our new Science and Innovation campus.

We have invested in a wide range of field equipment for advanced research: (i) geophysical exploration instruments for surface and borehole applications (we are one of only three institutions worldwide with the capability to make multi-channel measurements of seismoelectric signals); (ii) sediment-fingerprinting tools (portable XRF and mineral magnetic sensors) enabling rapid site reconnaissance and assessment; (iii) CO_2-flux-measurement units (Li-Cor); (iv) a mobile fast-pyrolysis unit for biochar research, tailored for sites with invasive plant species; (v) over 100 autologging thermal sensors and a high-temperature thermal camera allowing *in situ* monitoring of wildfires and experimental burns; and (vi) an unmanned airborne vehicle.

e. Collaboration and contribution to the discipline or research base

Collaboration with scientists, artists, researchers, industry, policy makers, and research users is vital to our work: research is conducted across all continents and our research networks span the globe. The diversity of our co-researchers and co-authors demonstrates the **interdisciplinarity of our work**, from familiar interactions with bioscientists, computer scientists, and engineers on the part of Physical Geography, and demographers, cultural theorists, and sociologists in the case of Human Geography, to less expected interactions: the EU integrated project Millennium engaged historians and Latin scholars; Human Geographers have worked with paediatricians and pharmacists. Our College fosters interdisciplinarity and our two Research Centres – CMPR and CUT – forge connections across the social sciences, arts, and humanities.

We assume leading roles in significant **international academic collaborations**: for example, the Swansea-led Millennium project linked 42 institutional partners. We participate in networks such as the European Network of Cities for Local Integration Policies for Migrants, enabling over 30 European cities to share best practice; the International Atomic Energy Agency's Moisture Isotopes in the Biosphere and Atmosphere project; IPCC; IBiS (Isotopes in Biogenic Silica); North Greenland Ice Core Project and North Greenland Eemian Ice Drilling project; the Past Global Changes project of the International Geosphere–Biosphere Programme, and SEARRP. We play key UK and Welsh **national roles**, in BRITICE-CHRONO, C_3W, SEACAMS, Tephra in Quaternary Science group of the Quaternary Research Association, WISE-2, and WISERD (Wales Institute of Social and Economic Research, Data and Methods). Collaborative work generates **high-quality outputs**, exemplified in our submitted work and in McCarroll's co-authored paper (Ahmed et al, 2012): the top-ranked *Nature Geoscience* paper on the Altmetric scale, lying in the 99th percentile of all journal articles tracked for download activity.

Our engagement with **research users**, typically as research partners, enhances the status of the discipline and drives our impact strategy. We have **established relationships with key policy-makers, senior civil servants, and Government ministers** in the UK and abroad. Our links with stakeholders and policy makers facilitate knowledge transfer. We provide **expert advice on**

climate change, wildfire impacts, carbon capture, sustainable forest management, and **migration policy** to influential bodies: UN Environment Programme (UNEP); US Department of Energy; Lloyds Global Insurance; Government and Parliamentary committees, Home Affairs Select Committee and Joint Committee on Human Rights; Government Office for Science; Welsh Government; Science Advisory Council for Wales; Earthwatch; the Immigration Law Practitioners Association; Oxfam; Refugee Council; and Shelter. Other key collaborators include the Council of Europe, Countryside Council for Wales, ESA, Met Office, NASA, National Botanic Garden, UN Refugee Agency, and UNICEF. A constantly broadening portfolio is evidenced by negotiation with the office of the Dalai Lama concerning future Tibetan refugee settlements. We have contributed significantly to the **public understanding of science** via outreach, e.g. at the Royal Society Summer Science Exhibition and National Eisteddfod of Wales, and helped to inform public attitudes, e.g. via work on migration involving RGS/IBG and Diana, Princess of Wales Memorial Fund, culminating in a public event with the Immigration Minister at the House of Commons.

We provide extensive service to the discipline and research community. We have hosted a range of **prestigious seminar series**, notably the ESRC *Understanding the Migrant Experience* series and a C_3W series on climate change. We contribute to the publication and dissemination of knowledge via **journal editorship** (*Geoscientific Model Development*, *International Journal of Wildland Fire*, *The Holocene*); **editorial board membership** (*Aether*, *Annals of Glaciology*, *Arctic*, *Antarctic and Alpine Research*, *Baudrillard Studies*, *Canadian Geographer*, *Journal of Geophysical Research*, *Journal of Rural Studies*, *Quaternary Science Reviews*, *Society and Space*, *Sociologia Ruralis*, *Transactions of the Institute of British Geographers*); and **guest editorship** (ACME, *Catena*, *Cultural Politics*, *Hydrological Processes*, *Journal of Quaternary Science*, *Quaternary Science Reviews*, *Quaternary International*, *Sedimentary and Chemical Geology*, *Society and Space*). We undertake **review work** for top-flight journals and publishers (e.g. CSIRO, Cambridge, Minnesota, Pearson, Policy Press, Prentice Hall, Routledge, Sage, Wiley). Works such as Smith's *Baudrillard Dictionary* evidence interdisciplinarity and provide invaluable scholarly resources.

We have convened **major international conferences**, associated, for example, with Millennium; **conference sessions** including the Association of American Geographers (AAG), American Geophysical Union (AGU), European Geosciences Union (EGU), International Association of Sedimentologists, International Union for Quaternary Science (INQUA); RGS/IBG; and contributed **keynote presentations** at major international meetings (e.g. AGU, EGU, European Society of Rural Sociology Congress, Euroscience Open Forum, EURODENDRO, EUROSOIL, INQUA, International Association of Hydrological Sciences, International Conference on Forest Fire Research, Integration of Ice-core Marine and Terrestrial Records (INTIMATE), International Focus Group on Tephrochronology, Quaternary Research Association (QRA) and RGS/IBG) and occasional conferences (e.g. the inaugural UNESCO's City of Film launch and international public events such as *Made in Kazan*, delivered to a live audience of over 2,000).

Our **contribution to professional associations and learned societies** includes service to the peer-review colleges and committees of key funding bodies, including ESRC (two staff) and NERC (six staff); Halfacree's involvement in ESRC's International Benchmarking Review of UK Human Geography; committee service to RGS/IBG research groups (Population Geography, Rural Geography, Social and Cultural Geography, Urban Geography) and numerous other organizations. We routinely review grant applications on behalf of major international funding organizations. Our contribution is evidenced through awards, prizes, and learned society membership: an MBE to Reynolds for services to Tropical Rainforest Research (2011); Doerr's (2011) Philippe Duchaufour Medal (European Geophysical Union); Crawley's election to the Academy of the Social Sciences (2012), Murray's Fellowship of the Learned Society of Wales (2012), and Davies's Philip Leverhulme Prize (2011), and Lyell Fund of the Geological Society of London Prize (2013).

We invest substantial effort via our engagement in **co-operative postgraduate training** on four key fronts: extensive international collaboration (Section C); external supervision for key international institutions; the pan-Wales ESRC DTC; a vital capacity-building role in national-level Welsh-medium research training through our key role in *Coleg Cymraeg Cenedlaethol*. Our commitment to expanding our collaborative engagement lies at the heart of our strategy as we look towards our centenary in 2020.