Institution: University of Exeter

Unit of Assessment: 17a (Geography & Environmental Studies)

1. Overview. Exeter Geography, part of the College of Life & Environmental Sciences (CLES), is an intellectually vibrant, research-intensive community of academics, post-doctoral (PDRF) and post-graduate (PGR) researchers. Since RAE2008 we have expanded significantly (36 FTEs in 2008 to 58 in 2013), and now comprise one of the largest centres for Geography research in the UK. We have used this phase of expansion to strategically enhance the interdisciplinarity of our research and to strengthen our core research themes. Research data clearly documents a sustained upward trajectory since 2008: research awards have increased significantly (240 awards worth >£16.1M); research income has more than doubled; RCUK income has increased more than three-fold; and PGR numbers have increased more than three-fold. High-quality research outputs have resulted, exemplified by 47 papers published in the *Science*, *Nature*, *PNAS* and *Geology* journals (32 are submitted in REF2; representing 21% of our return); and authorship of eight of the 93 UK-authored globally top-cited papers in the field of human geography since 2000 (2012 International Benchmarking for Human Geography), which ranks us in the top two in the UK.

Exeter Geography research is focused around two Physical Geography groups: **Environmental Change** and **Landscape and Ecosystem Dynamics**; and four Human Geography groups: **Geographies of Creativity and Knowledge**; **Spatial Responsibilities**; **Natures, Materialities and Biopolitics**; and **Environment and Sustainability**. In Physical Geography, our research has advanced understanding of ice sheet dynamics; used new empirical data to enhance palaeoclimatic records; developed new understanding of tropical marine carbonate production and reef growth; developed new modelling approaches to explore fluvial morphodynamics; and significantly advanced understanding of terrestrial carbon cycling. In Human Geography our research has developed new geographical understandings of material cultures, landscapes, and creativity; reformulated understandings of contemporary political and ethical spaces; led intellectual and policy debates around questions of nature, technology, human/animal relations and biosecurity; and made important contributions to geographical understandings of sustainability, resilience theory, and energy policy. This UoA17a submission highlights the strategies underpinning our growth, our plans to sustain this, our wider disciplinary contributions, and showcases research undertaken across Exeter Geography since 2008.

2. Research strategy

2.1 Research developments since RAE2008: In RAE2008 Exeter Geography significantly improved its standing as a leading UK Geography Department (60% of research graded at 3* or above) and as a centre for agenda-setting international research. This was underpinned by: (1) improved research income; (2) strong research outputs; (3) increased staff numbers (from 22 FTEs in 2001 to 36 in 2008); (4) investment of >£1.2M to develop new research facilities on our Penryn campus; and (5) investment of >£5M in new research laboratories on our Exeter campus. We also identified a set of strategic objectives necessary to further enhance our research environment and to position our research at the forefront across the Geography discipline. These were:

Obj. 1 To increase staffing and to build interdisciplinary capacity: In 2008 Exeter Geography identified the need to increase staff numbers to develop new synergies across research groups; to enhance interdisciplinarity; and to tackle emerging, priority research themes more effectively. As a result, we have expanded significantly, from 36 FTE staff at RAE2008 to 58 in 2013. We have achieved this by appointing a combination of: (1) discipline-leading established academics; (2) early career academics with potential as future leaders; and (3) advancing high performing postdoctoral staff into academic positions (see Section 3.1). A number of these appointments have been specifically made with a view to enhancing research linkages across Geography, and other University research initiatives, as a means to develop flexible research teams with capacity to meet emerging research agendas. Integral to this has been our lead role in developing the new £30M interdisciplinary **Environment and Sustainability Institute** (ESI) on our Penryn campus, and the appointment of new staff through strategic funding from: (1) the ***Climate Change and Sustainable Futures*** (CCSF) initiative, under the University's science strategy; and (2) the ***Humanities and Social Sciences*** (HASS) strategy (collectively >£1.8M to Geography).

In addition, we have used these new appointments, and associated strategic funding streams, to

enhance cross-disciplinary research, locally within Exeter, as well as nationally and internationally. Within Exeter, examples include: (1) project pump-priming e.g., O'Neill's "Media and the cultural politics of climate change" project with Psychology, Biosciences, and Politics; (2) seminar series funding e.g. Hinchliffe's spatial study of contagion with epidemiologists and social media modellers; (3) joint PhD projects e.g., Barr with Winter (Politics) on community renewable energy; and (4) developing collaborative projects e.g., the €1.4M ERC Starting Grant *The past in its place*, involving Harvey (Co-I) with English and History. These strategies have underpinned >£1.9M of new collaborative external research funding into Geography since 2008. Nationally, we partner multiple organisations (see **REF 3a**), but have developed especially strong links to the Met Office. More than £1.3M of our research awards since 2010 have been in collaboration with the Met Office and the collaboration has included 21 co-authored papers since 2008 and Betts (0.2FTE) as a joint Geography-Met Office appointment. We also jointly coordinate a Global Carbon Cycle Forum and have on-going collaborative research e.g., Hartley with Burke/Jones on data-model integration of thawing permafrost impacts on greenhouse gases. Internationally, we work with numerous academic and non-academic partners, exemplified by our roles in coordinating and participating in multiple international research networks. One example is the ESPA project *SPACES*, involving human and physical Geographers from Exeter (Brown, Perry) in collaboration with HEIs from the UK, Sweden, Kenya, and Mozambique, to explore ecosystem service and community wellbeing links in coastal East Africa (see Section 5.1); and collaborative overseas PGR projects (e.g., Cook, on commodity chains and ethical spaces with Brown University; see Section 5.2). More than 50% of our research awards since 2008 have been for projects with international partners.

Obj. 2 To enhance research management: Post-RAE2008 we have retained successful areas of our research structures, but also made a number of changes to enhance activity (both collectively and individually). The Geography Research Committee (GRC), comprising the Director of Research (DoR) and Research Group heads, continues to provide overall research leadership and to oversee the distribution of internal research funds to support conferences and group activities (e.g., research retreats) in line with our strategic priorities. However, we have also: (1) restructured our research groups to address new research priority areas (see Section 3.1.1) and aligned our staff recruitment strategies to these changes; (2) put in place clear pathways to link Departmental research management (guided by the GRC) to individual research planning through our annual Performance Development Review (PDR) processes, enhancing communication between research management, Academic Leads (ALs) and academics; (3) tasked Research Groups with a key role in PGR and Early Career staff mentoring through group activities; and (4) introduced a rigorous internal grant review system, the success of which is evident in significantly improved success rates since 2008 (now >25% across all funders, but even higher for the RCUK, >35%).

Obj. 3 To build PGR capacity: Our strategy following RAE2008 has been to grow PGR numbers substantially in order to establish Exeter Geography as a key **centre for RCUK-funded doctoral training** and to promote interdisciplinary PGR research and training. We have achieved these aims through: (1) successfully securing dedicated long-term RCUK investment through the ESRC SWDTC, AHRC BGP, EPSRC DTP, and NERC DTP; (2) by strategically investing in PGRs, e.g., match-funding of RCUK and industry-sponsored PhD research; and (3) by investing in, and supporting, interdisciplinary PGR research at Exeter, in particular through the University's CCSF and HASS strategies. The College has invested >£7.8M in PhD scholarships since 2008/09. Sustained year-on-year increases in PGR numbers (up >three-fold since 2007, and totalling 115 FTEs registered in 2013) are evidence of the success of these combined strategies.

Obj. 4 To enhance academic development: Since 2008, and following the key principles of the **RCUK Concordat to Support the Career Development of Researchers**, we have improved support mechanisms for researchers at all academic levels. New lecturers work, in a collaborative way, with an Academic Lead (AL) through a Professional Development Programme which identifies research, teaching, and administration targets and training opportunities. Lasting up to 5 years, this programme supports new staff into Senior Lectureships, with >40% achieving accelerated promotion. Established staff also work with ALs through an annual Performance Development Review (PDR) and are mentored in achieving and sustaining academic excellence.

2.2 Research strategy to 2019: Our aim for the next 5 years is to **continue developing and leading world-class research and defining intellectual agendas that have demonstrable**

benefit to key user groups, stakeholders and audiences. This ambition guides our strategic research planning. We thus identify our key objectives as: (1) enhancing research sustainability; (2) providing the highest quality training for emerging research staff; (3) creating an equitable and supportive working environment; and (4) maximising the benefits and impacts of our research.

2.2.1 Research sustainability and internationalisation: Exeter Geography aims to retain critical mass to support our world-leading and international-facing research by maintaining high quality research funding (e.g., RCUK, EU). We will do this through the following supported approaches: (1) through our newly established RCUK and funder specific University **Strategy Groups** we will enhance our pre-award strategies to maximise responsive and programme funding and to target prestigious Fellowships; (2) use our investment in **Early Career** academic staff, including new **Advanced Research Fellows**, to enhance interdisciplinary research opportunities; and (3) use our established **internal peer review system** not only to maximise grant success rates, but also to support early career staff development and to enhance opportunities for impact-relevant activities.

2.2.2 Training the next generation of researchers: Exeter Geography aims to maximise the research, training, and career development opportunities of early career staff, PDRFs, and PGRs to enhance our research environment and to train the next generation of researchers. Continuing to attract and support the best PGR students and PDRFs remains a priority, and thus our involvement in all four discipline-relevant **RCUK Doctoral Training Partnerships** is key. We will also use our **Early Career Network** to help mentor and train PGRs, PDRFs, and more junior academics. Additionally, we will focus on the recruitment of promising international students, capitalising on the University's Internationalisation Strategy and resources to achieve this.

2.2.3 Creating an equitable and supportive working environment: Exeter Geography is committed to implementing the key equality themes promoted through the **Athena SWAN** initiative to improve gender equality within STEM/M subjects, and across Geography generally. To support this we set up in 2012 a working group drawn from across the discipline (including new lecturers, PDRFs, PGRs, and established staff) to identify cultural and structural issues that could enhance career support, progression, and staff wellbeing. Following achievement of a **bronze award** at University level, Geography will be submitting a **silver award application in April 2014**.

2.2.4 Maximising the benefits of research: Exeter Geography aims to further enhance the benefits derived from our research by engaging with knowledge-users to deliver tangible outputs, including evidence-based policy and social and organisational change, following the **RCUK Concordat for Engaging the Public with Research**. Our activities already engage partners across regional and international scales, and across organisations, communities and individuals (see **REF3a**), and these engagements have brought co-produced research funding into Geography worth >£2.3M since 2008. We aim to expand this already successful portfolio by: (1) ensuring staff identify potential links with beneficiaries (through our PDR process); (2) financially supporting high quality engagement opportunities; and (3) providing rigorous internal reviewing of impact plans. Additionally, the University centrally supports gold and green **Open Access** publishing (via RCUK funding) and has established a dedicated open access repository (Open Research at Exeter).

3. People

3.1 Staffing strategy and staff development: Over the REF census period we have used staffing changes to facilitate the implementation of our strategic plans:

- 36 new staff have been appointed across all levels (a net increase of 22 FTE staff since 2008);
- Two RCUK Fellows have moved into permanent academic posts, two PDRFs have progressed into lectureships, and four Advanced Research Fellows will become lecturers from 2016.
- 14 staff returned in 2008 have left (three through retirement, seven to overseas HEIs, and four through promotion to other UK HEI's).

Our staff profile now comprises 2 FTE Proleptic Lecturers; 16.6 FTE Lecturers, 11.2 FTE Senior Lecturers, 8 FTE Associate Professors (equivalent to 'Reader') and 20.2 FTE Professors.

3.1.1 Staffing strategy: Through our recent phase of staff expansion, our recruitment strategy has been guided by five principles: (1) to recruit the very highest calibre staff to enhance the reputation of Exeter Geography as a leading international centre of research excellence; (2) to ensure appropriate staff-student ratios for taught UG and PG courses; (3) to maintain a balance of junior and senior staff; (4) to maintain critical mass within research groups; and (5) to develop synergies

around established and emerging research themes, and to enhance interdisciplinarity:

- In **Human Geography**, we have appointed staff across all research areas, both to enhance long-established strengths (e.g., in Historical and Cultural Geography), and to lead on emerging theoretical, conceptual, and methodological debates. The appointments of Barnett, Gill, Lea, and Romanillos to the *Geographies of Creativity and Knowledge* Group and the *Spatial Responsibilities* Group, have further cemented Exeter's position as a field-leading centre for the development of new understandings of material cultures, landscapes and creativity, and of emerging ethical and political spaces. In addition, Davies, Hinchliffe, Johnson, Kinsley, Schrader and Srinivasan have been appointed to grow the *Nature*, *Materialities,* and *Biopolitics* Group into a key UK focus for the study of nature/society and human/nonhuman relations, extending established expertise in rural geography to lead investigations of human-animal relations as they relate to the food industry, disease, biosecurity, and postgenomic science. Established strengths in energy policy have also been significantly enhanced via appointments to the *Environment and Sustainability* Group (Abernethy, Adger, Bickerstaff, Brown, Devine-Wright, O'Neill), enabling major academic and policy contributions in sustainability and resilience theory, and two new Advanced Research Fellows (Butler and Evans, from January 2014), will further strengthen this group.

- In **Physical Geography** we have strategically developed our core research strengths to address emerging RCUK priority themes in environmental and climate change, and in carbon cycling. Within the *Landscape and Ecosystem Dynamics* Group, the appointments of Aragao, Feldpausch, Hartley, Meersmans, Mercado, and Sitch have allowed us to assemble a group with international expertise in terrestrial ecosystem dynamics, carbon cycling, and climate-ecosystem feedback modelling. Within the *Environmental Change* Group the appointments of Charman, Barrows, Gallego-Sala, Graham, Halloran, Le Brocq, Palmer, Perry, and Urrego, have allowed us to extend expertise in past and contemporary environmental change to global scales, and across multiple terrestrial and marine environments. Notable strengths exist in quantifying ice sheet dynamics, palaeoclimatic change, and marine carbonate production. We have also appointed leading physical scientists (Belcher, Betts, Lenton, Watson FRS) to the new cross-disciplinary *Earth System Science* group (returned to UoA7), to enhance expertise in modelling and experimental approaches to understanding the long-term dynamics of earth system change.

3.1.2 Staff development: Our staff development and promotion strategy recognises research, teaching, and administrative contributions, and our aim is to provide all staff with the resources, support, and time to achieve their research potential. External funding and workload adjustments are used to maximise research time, and a College-level scheme facilitates Research Leave. Multiple schemes also support and pump-prime research across all levels. Geography **research group funds** support conference attendance and networking, with priority for early career staff. At the University level, support is provided through: (1) an **annual fund** for project development initiatives (£200k/annum); (2) the **Science and HASS strategies** to initiate research across the themes (£400k/annum); (3) a College **Strategic Development Fund** to support equipment acquisition and research activity (£225k/annum); and (4) **Research and Knowledge Transfer** funds to support collaborative grant development and to pump-prime industry and user group activities. In addition, the **Exeter Science Exchange** (2010-13), supported by the **EPSRC's Bridging The Gaps** programme, has stimulated interdisciplinary work at the interface between science, technology, and policy. Funded projects coordinated by Geography include: *Engineering low carbon coasts* (Devine-Wright), *Climate and land use modelling* (Sitch), and *Contagion* (Hinchliffe), the latter leading to a successful ESRC Transformative Research Call bid (2013-15).

Early career staff: In addition to the Professional Development Programme (PDP, above) new lecturers are supported through reduced teaching loads (~25% over the first 2 years) and mentoring in grant and fellowship applications. As examples: (1) O'Neill was supported in writing a successful **ESRC Future Research Leader Fellowship** to work on visual methods for climate change engagement with international collaborations (Colorado, Melbourne); and (2) Meersmans was supported through the **EPSRC Bridging The Gaps** programme to organise a workshop on land use and soil degradation, promoting internal and external collaborations. Geography has also established an **Early Career Network** to support and mentor PGRs, PDRFs, and new lecturers. Consultation meetings identify career and intellectual development priorities for this cohort. The group has implemented formal events related to career development (e.g., publishing, Fellowships, research impact). Ten early career staff have progressed into Senior Lectureships since 2008, and

eleven PDRFs, who were based in Geography in this census period, are now in HEI Faculty posts.

Mid-career staff: We have supported mid-career staff in various ways. First, by selectively reducing teaching to support **strategic research activities** such as developing major grants or high quality outputs. An example is time allocated to Gill to develop two successful ESRC research grants and an ESRC Knowledge Exchange bid, enabling him to build a research team working on state theory and asylum migration. Second, we have supported staff (through workload adjustments) to take on roles, including as research group leads, to **gain experience relevant for promotion**. Third, mid-career staff have been supported through the **University Outward Mobility Awards** to enhance their international research (e.g., 2009-10: Barr, U. Washington; 2011-12: Thomas, UNC Chapel Hill). Six staff have been promoted from SL to Assoc. Prof level since 2008.

Senior staff: Disciplinary leadership has been supported by strategic development of research groups and through support in applying for prestigious Fellowships. Senior staff have received a number of such awards since 2008: **ESRC Professorial Fellowship** (Brown), **EPSRC Fellowship** (Mitchell), **ESRC Fellowship** (Davies), **Leverhulme Fellowships** (Perry, Harrison), and **DEFRA Fellowship** (Buller). Research excellence amongst senior staff is also celebrated through prestigious appointments: Fellow of the British Academy (Cloke); Academicians of the Academy of Social Sciences (Cloke, Goodwin, Hinchliffe); and Fellow of the Royal Society of New Zealand (Cloke). Staff with major managerial roles (Head, DoR, DoE) have post-tenure sabbaticals to support periods of renewed research focus, and where senior staff have been appointed to senior University roles, lecturers, PDRFs and technicians have been appointed to retain research continuity. Three staff have been promoted internally to Professorships since 2008, and three to senior University management roles: Goodwin, College Dean (2010-2013), now DVC (2013-); Charman, College Dean (2013-); Quine, College Assoc. Dean Education (2010-).

3.2 Research students

3.2.1 PGR students: We recognise the importance of a vibrant PGR community to a Department's wider research culture and, since RAE2008, we have significantly grown our PGR community. PGR numbers have increased year-on-year, tripling since 2008 (2007/08: 33.5 to 2012/13: 115 registered), and PhD awards have also risen year-on-year (see **REF4a**). We have awarded 50 PhDs since 2008. This growth has more than matched staffing expansion (2007/08: 0.8 PGRs/FTE; 2012/13: 2.1 PGRs/FTE) and has been accompanied by a broadening of research supervision, with every established staff member involved in doctoral training. Since 2008 >50% of graduated PhDs have continued into academia and 15 of these are now in HEI Faculty positions. This provides evidence of our high quality training environment sustaining the discipline.

This phase of PGR growth has been underpinned by sustained strategic investment, especially via match-funding of public, private, and charity income sources, and by securing RCUK PGR funding. We are involved in all **four discipline relevant RCUK DTPs**. Reflecting key strengths in cultural and historical geography, Exeter was one of only four UK Geography departments to receive dedicated PhD funding via the **AHRC University's Block Grant Partnership**. Our leadership in this area is illustrated by 11 **AHRC Collaborative Doctoral Awards** since 2008, which also indicates a record of excellence in engaging with non-academic partners, including the Met Office, National Trust, and AXA. Our recent **AHRC DTP** award (to run 2014-19) will ensure research training continuity in this core research area. We are also key contributors to the **ESRC-funded South West DTC** (SWDTC), leading specialist research training in Human Geography and the interdisciplinary Environment, Energy, and Resilience pathway, and have received 14 1+3 and +3 studentships since 2010. Prior to the DTC system, Geography was awarded three **ESRC CASE studentships**, and through the **ESRC £1.5M capacity building cluster** on *Sport, Leisure, and Tourism* received six CASE awards (partners including Exmoor National Park and the National Social Marketing Centre). NERC studentships have followed NERC grant success (eleven algorithm, tied, and CASE), and we have now been awarded a new **NERC DTP** with Bristol, Cardiff, and Bath to run from 2014. Finally, through the recently awarded **EPSRC DTP** (2013-) Exeter Geography will be offering studentships in the key areas of energy policy and environmental modelling. Other notable PhD funders since 2008 include **The Great Western Research programme** (see 5.4), and cumulatively we have hosted 55 **Collaborative/CASE PhDs** with 38 public and private partners, including Rothamstead (North Wyke) Research (4); Dorset CC (4), Environment Agency (3), ADAS (3), AXA (2), Cornwall Council (2), and South West Water (2).

3.2.2 PGR Research Environment. Our aim is to sustain a vibrant PGR community in which our students progress to successful careers in academia, scientific and social research, and in the public and private sectors. Success in attracting external funding underpins this ambition; it provides the context for a high-quality doctoral research environment, both within Geography and more widely in the case of partnerships such as the RCUK DTPs. All Geography PGRs have dedicated workspaces and individual computing facilities, and the wider research environment has been enhanced by a £7.5M redevelopment of central library facilities. Our PGR environment is also characterised by student-led initiatives (e.g., an AHRC 'Connected Communities' workshop, 2010) and PGRs are fully embedded within the everyday research culture of Geography via research group seminars, research presentations, and reading groups. PGRs are further supported through access to a Research Enhancement Fund (£17.5k/annum) to support conference participation and to run workshops. Technical and academic support is provided through at least two supervisors and a research mentor. Each student completes a learning agreement in their first 8 weeks, has a review meeting at 6 months, and an MPhil-PhD upgrade (comprising a research presentation, written report, and viva) at 12 months. Student progress is facilitated via the University MyPGR online system which documents supervisory meetings, as well as supplying a one-point source for official processes. Research training and career development is also provided via: the Early Career Network (see Section 3.1.2) and the University's Researcher Development Programme.

4. Income, infrastructure and facilities

4.1 Research income, awards and outputs: Exeter Geography has increased its research income significantly since RAE2008, and this has sustained the quality of our research. Over the census period we have secured **240 individual research awards** (worth >£16.1M), including **77 Research Council Awards** (NERC 32; ESRC 13; AHRC 10; EPSRC 8) worth £10.7M, and **10 EU Awards** worth £1.6M, and benefitted from an additional £220k of **in-kind Research Council** support. Collectively this activity reflects a step-change in research performance. Research income metrics (**REF4b**) show that: (1) income has more than doubled since RAE2008; (2) the proportion from the Research Councils has increased from 38% at RAE2008 to 59% over this census period; and (3) income/FTE has increased year-on-year: 2008/09 £18.2k/FTE, 2012/13 £61.2k/FTE. This funding has supported world-leading research and underpinned high quality outputs. Geography staff have produced 861 peer-reviewed journal articles since 2008 (equivalent to 143/year or 2.7/FTE/year), along with 29 books and monographs; and 121 book chapters. We return 16% of these in **REF2**. The impact of these outputs is high, as evidenced by Scopus citation data (Oct 2013): 59% of all journal articles published since 2008 have been cited more than 5 times; 42% of staff have produced at least one output with >50 citations; and 16 papers have been cited >100 times. One web output (Cook #1) has had >26,000 visits. Funded research highlights and links to submitted research outputs are summarised below:

Geographies of Creativity and Knowledge (8 FTE staff, and currently 1 PDRF and 29 PGRs): The group have undertaken research at the leading edge of current geographical understandings of culture, matter, landscape, knowledge, and creativity, supported by the **AHRC**, **ESRC**, **ESF,** and **Leverhulme** (40 awards worth >£1.1M). **ERSC** and **FP7** funding has supported new investigations into the **geographies of environmental knowledge** by advancing insights into the role of memory and identity in perceptions of environmental change (Leyshon, C #2,3). Innovative **AHRC** and **Leverhulme**-funded work on **creative geographies** has broken new ground in exploring intersections between conceptual, critical and creative practices. In particular, the range of landscape geographies has been extended by new understandings of materiality, affectivity, spectrality, ruination, and creativity (DeSilvey #1,3; Harvey #3; Leyshon, C #1; Romanillos #1; Wylie #3, 68 citations & #1, 48 citations;), with this impressive body of work enhanced by two hosted **Leverhulme Artists in Residence**, poet Alyson Haylett, and fine artist Catrin Webster. Prestigious **AHRC React Hub Knowledge Exchange** funding has supported the development of innovative digital biography software app publishing (Thomas). In addition, the group have undertaken agenda-defining work, funded by the **AHRC** and **ESRC**, on **geographies of creativity**. This research has demonstrated how creative industries are implicated within, and constitutive of, spatial and place-based identities, especially regionality (Thomas #1,2), and inspired the first cultural geographical explorations of cultures of craft, mending, and making (Thomas #3; Ryan #2).

Spatial Responsibilities (6.6 FTE staff, and currently 3 PDRFs and 17 PGRs): Through **ESRC** and **EU** funding (14 awards >£0.9M) the group have investigated the conditions for hope within so-

called 'neo-liberal' settings by challenging political and theoretical assumptions of neo-liberalism and by investigating the contours of ethical consumer practice. Agenda-setting research on the **politics and ethics of welfare** has included **ESRC-**funded research on the importance of Third Sector spaces of care in response to homelessness (Cloke #1) and, supported by **FP7**, the power for transformation and political resistance vested in faith-based organisations in postsecular initiatives (Cloke #2). **ESRC**-funded research on **asylum migration** has been used to establish the importance of attending to the everyday nature of state power experienced by both asylum seekers (Gill #2), and immigration decision makers (Gill #1). Through three **ESRC Seminar Series** awards, agenda-setting work has also been conducted that: conceptualises emergent forms of public action including the spatialities of urban and transnational democratisation (Barnett #2,3); questions the need for, and justice of, immigration detention (Gill #2); and explores the ethical spaces of fair trade (Cloke #3). The group have also produced agenda-setting outputs sparking innovation in the geographies of **ethical and political spaces of responsibility**, notably two monographs in the discipline-leading RGS-IBG Human Geography book series; *Swept Up Lives* (2010, Cloke, others #1) and *Globalising Responsibility* (2010, Barnett, others #1), and one major research website, *followthethings.com* (2011-, Cook #1). Other monographs underscore overlooked spaces of resistance, hope and generosity in the face of the exclusions caused by neoliberal restructuring: *Faith-based Organisations* (Cloke et al. 2012), *Rethinking the Public* (Barnett et al. 2009); *Giving Space, Taking Time* (Barnett et al. 2009); *Carceral Geographies* (Gill et al. 2013).

Nature, Materialities and Biopolitics (7 FTE staff, and currently 4 PDRFs and 6 PGRs): **ESRC** and **EU** funding (7 awards worth >£0.6M) has supported theoretically innovative and empirically interactive work with policy-makers, and the group has developed pioneering approaches to charting and intervening in the contemporary circulations of biological and technological life. Collaborative work on **geographical context in biosecurity** has challenged threat responses that rely on spatial segregation, to emphasise the topological practices vital to food safety and disease control (Hinchliffe #1). Pioneered through the **ESRC** 'Biosecurity Borderlands' project, this research is developing through **DEFRA** and **ESRC** funding for work on Bovine TB conflicts; **ESRC** funds for transformative research tracking contagion across domains; and a new **ESRC/FSA** food systems research programme. Work on **farm animal welfare** focuses on considering how the circulation of biological life has implications for productive animal lives, in both philosophical and policy debate, revealing the implications and intersecting dynamics of biodiversity policy, meat quality, animal husbandry and welfare policy (**ESRC** funding and a **DEFRA** Fellowship to Buller, 2012/13, Buller #2,4). In addition, ethnographic research on the **global geographies of laboratory animal science** (**ESRC Fellowship** to Davies) has explored how postgenomic and translational research are changing the way experimental animals and evidence are mobilised in biomedical contexts, developing new insights into the international practices of standardisation, emergence and care for animal models (Davies #2,3), and original art/science collaborations (e.g., micespace.org).

Environment and Sustainability (9 FTE staff, and currently 7 PDRFs and 24 PGRs)**:** Research has been supported by **ESRC**, **AHRC**, **EPSRC**, **Leverhulme**, and **British Academy** funding (49 awards worth >£5.6M). Highlights include research that has developed new understandings of **climate change adaptation limits** based on **NERC** (through Tyndall Centre) and **FP7** (CLICO) funding, and an **ESRC Future Leader Fellowship** to O'Neill. This has included work on the theoretical and empirical basis for identifying these limits (e.g., Adger's *Adapting to Climate Change*, CUP 2009), solving governance dilemmas (Adger #2, Runner-up for the 2013 Lloyds of London Science of Risk Prize), highly cited work identifying social limits to climate change adaptation (Adger #3; 202 citations) and avoiding maladaptation. This has underpinned new analysis for the IPCC's Fifth Assessment Report. Cross-disciplinary (**NERC/ESRC/DFID**) and theoretical work on resilience (e.g., Brown's **ESRC Professorial Fellowship**), has transformed the field of **ecosystem services** by uncovering processes constructing well-being and resilience. These have been tested globally in marine (Brown #1), coastal and delta (Adger #1) and forest environments (Brown #3), and highly cited work has demonstrated limits to neo-liberal construction of markets for ecosystem services (Brown #4). In addition, research funded through two **RCUK** strategic energy network initiatives on security and equity, the **Norwegian Research Council**, and **National Grid** studentships, have led agendas on the governance of **sustainable energy transitions**. These have revealed important equity, security and community acceptability dimensions of decarbonising energy systems in the UK and globally (Bickerstaff #3; Devine-Wright

#1,2; Mitchell #2). This research has again underpinned IPCC contributions. A major **EPSRC Fellowship** (Mitchell) is now addressing the international evolution of governance and innovation for sustainable energy systems. Research funded by the **ESRC**, **EPSRC-EDF/-Eon**, **AHRC**, **Leverhulme**, **AXA,** and **Coca Cola** has also shaped international debates on social and ethical dimensions of **sustainable consumption** (Barr #2), and demonstrated the role of materiality and responsibility in transforming home energy, travel and waste practices (Barr #1,3; Bickerstaff #2).

Environmental Change (13 FTE staff, and currently 5 PDRFs and 13 PGRs): Significant funding from **NERC**, **EU**, **Leverhulme,** and **business** (Shell, BG Group) (61 awards worth >£3.1M) has supported research across three main areas. First, major advances have been made in understanding **global palaeoclimate change and impacts**, including **EU-funded** work on quantitative reconstructions of temperature change in the Arctic (Caseldine #1,2), the first demonstration of the biotic impact of rapid warming on the Antarctic Peninsula (**NERC Antarctic Funding Initiative,** Charman #4), and new understandings of ocean-atmosphere climate dynamics during super-interglacials (Jones #2). Highly cited work by Barrows (#1, 122 citations) has constrained ocean cooling during the Last Glacial Maximum, and links between Holocene climate change and fire cycles in low latitude settings have also been resolved (Urrego #1). **NERC** funding has also supported new quantitative research on global peatland carbon dynamics (Charman #2; Gallego-Sala #1). Major advances have also been made in understanding past, present and future **ice sheet dynamics** and their potential impact on global sea level. Marine geophysical techniques have enabled reconstruction of the complex past ice dynamics of the Amundsen Sea sector of the West Antarctic Ice Sheet (**NERC New Investigator**, Graham #1). Present ice sheet dynamics have also been investigated in the context of ice sheet hydrology. Observational evidence has been provided to support theories linking Greenland ice flow to rates of meltwater delivery (Palmer #1), and for channelised subglacial hydrology in Antarctica (**NERC Fellowship**, Le Brocq #3). Future sea level rise due to ice sheet instability in West Antarctica has also been quantified (Le Brocq #1,114 citations); the potential risk of collapse in the Institute/Moller catchment in West Antarctica highlighted (Le Brocq #2); and the links between climate and Patagonian glacial outbursts resolved (**Leverhulme Fellowship**, Harrison #1,2). The group have also undertaken ground-breaking work on **marine carbonate production and biogeochemistry**. New carbonate budget methodologies have been developed (**Leverhulme International Network**) that demonstrate significantly reduced reef growth across the Caribbean (Perry #1), and have underpinned modelling of reef growth under future climate change scenarios (Halloran #4). **NERC** and **Leverhulme Fellowship** (Perry) funding has allowed novel insights into Holocene reef turn-on and turn-off under natural forcing conditions in Eastern Australia (Perry #4), and **NERC** funding has supported climate-marine calcification research, including quantifying novel sources of marine carbonates (Perry #2), and highly cited work on marine phytoplankton responses to high CO_2 conditions (Halloran #1; 273 citations).

Landscape and Ecosystem Dynamics (10.2 FTE staff, and currently 14 PDRFs and 26 PGRs): The LED group has been funded by **NERC**, industry, and government (**DEFRA, DECC, South West Water**, **Technology Strategy Board (TSB)**, **EA**), charities (**Wildlife Trusts**, **National Trust**, **English Heritage**), and non-UK sources (**EU**, **NSF**) (65 awards worth >£4.4M). This has supported pioneering research on **upland landscape restoration**, leading to new holistic understandings of the benefits of creating landscapes resilient to land use and climate change. Long-term (2010-2020) **NERC/TSB**, **South West Water** and **HEIF Open Innovation Fund** support, is allowing real-time hydrology and carbon flux monitoring in UK upland environments, and has supported major methodological advances, integrating LiDAR and UAV laser scanning, to quantify peatland surfaces and ecology (Anderson #2). Soil and nutrient dynamics research, funded by **South West Water**, has re-assessed contributions of intensively-managed grasslands to erosion and water quality (Brazier #1), resulting in new funding from **DEFRA** to develop a national soil erosion monitoring capability. Major advances have been made in quantifying **tropical forest productivity and change**. Highly cited **NERC** funded research in Amazonia has shown the impacts of the 2005 drought on carbon emissions (Aragao #1; 294 citations), demonstrated increased fire events despite declining deforestation (Aragao #2; 54 citations), and that changed radiation from aerosol pollution stimulated global plant production and carbon sequestration (Mercado #1, 137 citations). **NERC** funded projects have also informed decision makers on forest degradation (Aragão #4, 56 citations), and resulted in ground-breaking, and very highly cited work on terrestrial carbon dynamics (Sitch #1, 459 citations, #2, 185 citations, #3, 287 citations). **Marie Curie** and **NERC** funded research on **soil**

carbon dynamics, has enhanced 3D modelling of soil organic carbon distributions at national scales (Meersmans #1), and in semi-arid deserts (Brazier #2), and shown that soil microbial community adaptations to temperature change, as well as increased plant growth, could increase C release rates in Arctic soils (Hartley #1 and #2; 51 citations). **NERC** and **NSF** funding has supported a fourth major LED theme on **large river dynamics**, involving studies of channel and floodplain functioning along globally-significant rivers (including the Ganges, Jamuna, Mekong, Paraná, and Fly-Strickland). Key outcomes include the first physics-based model able to simulate the full continuum of river channel patterns, leading to new insights into the morphodynamics and diversity of the world's largest rivers (Nicholas #1,2); and the first demonstration that fluvial carbon exports from Papua New Guinea exceed those from the Amazon (Aalto #1).

4.2 Research infrastructure and facilities: Geography research is directly supported by **twelve specialist research laboratories** across our two campuses; a large experimental hall; and access to high performance computing. 13.7 FTE **laboratory technicians** provide field and lab support; a specialist **cartographic unit** (2 FTEs) supports research dissemination; and a **workshop facility** (1 FTE) supports the manufacture of bespoke research equipment. Research is also supported by: digital media and audio facilities to support social science research; and to support physical geography field research, a wide range of coring, surveying (dGPS, Terrestrial Laser Scanner), soil and water analysis equipment, and a new unmanned aerial vehicles facility, including a droidworks AD8 octocopter and Quest-300 fixed wing aircraft, with thermal and optical imaging capability.

Research laboratories: Research is supported by, at Exeter, our **Experimental Landscapes Facility**, a £3.7M facility built in 2001 that houses: a rainfall simulator; a sedimentation basin for alluvial fan experiments; a tilting landscape simulator for modelling hillslope, river, and floodplain systems; an annular flume for sediment flocculation experiments; and an experimental plant-soil interactions facility with temperature-control capacity, and a LiCor infra-gas analyser for continuous CO_2 flux measurements. In addition we have eight research laboratories: (1) a **fallout radionuclide facility**, the largest academic facility in the world, with exceptional capacity (40 alpha spectrometers and 16 gamma spectrometers); (2) a **cosmogenic nuclide dating lab**, one of only two such facilities in England; (3) a **geochemistry lab**, including ICP, AAS, and C/N Analyser; (4) two **microscopy and palaeoenvironmental labs**, with high specification microscopy and imaging equipment; (5) an **environmental magnetism lab**, with low and high temperature magnetic susceptibility meters; (6) a **palaeofire lab**, a globally unique facility for exploring plant material flammability for fossil record applications; and (7) a **sediment properties lab**, with thin section preparation facilities. In Penryn we have: (1) a **micropalaeontology lab** with high specification microscopy facilities; (2) a **sediment processes lab** for textural and property analysis; and (3) an **IR dark room** with optical reflectance equipment for remote sensing analysis. We also utilise other world-class analytical infrastructure, managed by other Departments, including: Isotope Analysis (ESI); Electron Microscopy (Biosciences); and EDX, XRD, and Micro-CT (Engineering).

High performance computing: Numerical modelling work is supported by **Beowulf computing clusters** at both Streatham and Penryn campuses, by the University's £1.5M 2200 core **HPC facility "Zen"**, and by the Met Office supercomputer.

Field stations: Geography maintains **three long-term upland research catchments** (on Exmoor and Dartmoor), where meteorology, hydrology, soil and water quality, vegetation and greenhouse gas fluxes have been monitored since 2009. The sites comprise >£300k of equipment (monitoring, for example, water table responses to rainfall at >200 moorland locations) and provide unique data on UK upland ecohydrology. NERC/TSB/SWW funding secures these sites until at least 2020.

5. Collaboration or contribution to the discipline or research base

Geographers at Exeter have led, and contributed to, numerous national and international policy developments and reviews, demonstrating international recognition, including contributions across all three **IPCC Working Groups** and special reports, US National Academy of Sciences Inquiries, House of Commons Environment Audit Committee, ESRC-AHRC International Benchmarking of Human Geography; European Commission Directorate General: see **REF3a**. Here we document examples of major international research collaborations, and contributions to geography and cognate disciplines through participation in networks and organisations.

5.1 Research networks and collaborations: Exeter Geographers have contributed widely to high profile research networks that are a testimony to the international standing of staff. These include:

- Leadership in two significant **Leverhulme Trust International Networks**: Network Coordinator (Perry) of *ReefBudget* that developed coral reef carbonate budget assessment protocols; and as member (Charman) of a network studying uncertainty in palaeoclimate reconstructions.
- As lead members (Brown, Adger) of the **Resilience Alliance** (Exeter is the only UK node), with multiple activities, collaborative papers, joint funding (NERC, Belmont Forum) and organisation of three Resilience Congresses in Stockholm (2008), Arizona (2011) and Montpellier (2014).
- Through organisation (Davies) of the **Knowledge/Value Network**, an international collaboration of scholars from anthropology, science, technology, philosophy, sociology, and geography that explores the contemporary dynamics of knowledge production in the biosciences. The network has organised four interdisciplinary events in the USA and China since 2010.
- Through major contributions to the Working Groups of the **International Association of Geomorphologists**: Chair (Perry) of *REEForm: Reef and reef landform responses to environmental change*; member (Quine) *Geomorphology and Earth System Science*; and member (Perry) *Geomorphology and Global Environmental Change*.

We have also made major contributions to understanding earth system change: through involvement in developing the **Joint UK Land Environment Simulator** (JULES) and the **Hadley Centre Earth System model** (HadGEM2-ES; Sitch); **INQUA** project 0804: Peatland Archives of Holocene Climate Change (Charman); **EU FP7 ice2sea** (LeBrocq); the permafrost carbon cycling project **CYCLOPS** (Hartley); and **EU COST Action "Eurospec"** (Spectral Sampling for Vegetation Biophysical Parameters; Anderson); and collaborated in numerous **international funded programs** including: **NSF NEOTOMA** palaeoenvironmental database (Charman); **Christina River Basin Critical Zone Observatory** (NSF, Aalto); **NSF Sevilleta Long Term Ecological Research** (Brazier); and the 'Ruin memories' project (**Norwegian Research Council**, DeSilvey).

Since 2008 we have also hosted **international visitors** from 52 overseas Universities and research institutions, and this has not only underpinned extensive international research collaborative efforts and wider research knowledge exchange, but also significantly enhanced the training environment for our PDRF and PGR community, through international exposure.

5.2 Co-operation and collaboration in PGR training: Section 3.2 details our excellent track record in **ESRC, NERC, AHRC, and EPSRC DTC/P and Collaborative Awards** that support PGR training, and we submit this as evidence of the success of our PGR strategies. One other notable example has been the **Great Western Research (GWR) programme**, which promoted collaboration between the South West Universities and business. Geography hosted 13 GWR-CASE PhDs, including: *Sustainable lifestyles and energy conservation*, with Global Action Plan; *Robotics and future care for the elderly*, with OC Robotics; and *Policy and practice for sustainable carbon management of moorlands*, with Duchy of Cornwall and Dartmoor National Park. Our PGR-related collaborations also include numerous overseas partners, selected examples include: carbon cycling in Northern peatlands (**Univ. Québec**); quantifying Caribbean reef carbonate production (**Environmental Dept, Cayman Islands**); post-disaster management and the third sector (**Univ. South Florida**); assessing the fate of eroded soil carbon (**Indian Council for Agricultural Research**). Key partner contributions include, providing infrastructure, funding, site access, data and, for the student, enhanced international exposure and collaborative opportunities.

5.3 Contributions to editorships, conferences and research-based CPD: We recognise the critical role of supporting the discipline through editorial roles and conference organisation and, in addition to journal reviewing, most Geographers at Exeter contribute key roles in **journal editing**.

- ***Global Environmental Change***, the flagship interdisciplinary journal (top ranked of 70 Geography journals), is co-edited in Exeter Geography (Adger, Brown); ***Cultural Geographies*** is co-edited by Wylie; ***Sociologia Ruralis*** is edited by Buller; ***Coral Reefs*** is co-edited by Perry (Geosciences Editor). Until 2010 Caseldine was Chief Editor of ***J. Quaternary Science***, and until 2012 Cloke was Editor of ***J. Rural Studies***. Staff have also served on numerous **journal editorial boards** in this census period: *Annals of Assoc. Amer. Geographers*, *Geographical Journal*, *Trans. Inst. British Geographers*, *J. Historical Geography*, *Cultural Geographies*, *Landscape Research*, *Political Geography*, *Environment and Planning A*, *Ecology and Society*; *Geoforum*, *J. Rural Studies*, *Frontiers in Ecology and Environment*, and *Sedimentology*; and **guest edited >25 special issues** across the social and natural sciences.
- Exeter Geographers have organized **>50 academic conferences and workshops** and **>100**

thematic conference sessions since 2008. The following examples highlight some of the meetings that have been either interdisciplinary in nature and/or specifically engaged with research beneficiaries: (1) Adger's 2008 **RGS** conference on *Limits to Adaptation to Climate Change*; (2) the 2010 **AHRC-funded** '*Creativity and Place*' conference, which drew together academics, and policy and creative makers around issues of place and identity; (3) Brown's 2011 **ESRC-DFID** *Poverty and Environment Network* conference at the Royal Society on global forests and resource dependence; (4) the 2011 *Making it Big* event on international science infrastructures funded by the **ESRC Genomics Forum**; and (5) the 2011 **DEFRA** workshop Chaired and organised by Brazier on '*Developing a cost-effective framework to monitor soil erosion in England and Wales'*.

5.4 Contributions to associations and the discipline: Disciplinary contributions are essential for a Department claiming a role in discipline leadership and to be a centre for agenda-setting thinking. We cite four areas of activity to illustrate the scale and significance of our contributions since 2008.

First, Exeter Geographers have made strong contributions to the research committees of the **RGS-IBG** (the discipline's main UK professional association): Historical Geography (Secretary & Chair, Thomas; Web, Leyshon, C); Women and Geography (Secretary, Thomas); History and Philosophy of Geography (Treasurer, Wylie & Kinsley); Social and Cultural Geography (Chair & Secretary, Davies; Social Media, Kinsley); Political Geography (Chair, Carter; Secretary & Communications, Gill); Planning and Environment (Barr); Participatory Geographies (Committee, M Leyshon); Energy Geographies (Treasurer, Barr); the SW Regional committee (Thomas, Barr, Le-Brocq); RGS-IBG Research committee (Davies, Little, Thomas), and RGS-IBG Council (Little).

Second, our staff contribute widely to learned societies: **Landscape Research Group** (Director, Leyshon, C); **European Landscape Forum** (Wylie); **Centre for Environmental Arts and Humanities** (Co-Director, DeSilvey); **International Association of Critical Heritage Studies** (Committee member, Harvey); **Society for Landscape Studies** (Hon. Secretary, Harvey); **Quaternary Research Association** (President, Charman 2011-2014); **British Institute of Energy Economics** (Chair 2009, Mitchell); and **European Society for Rural Sociology** (President, Little).

Third, we make high level contributions as advisors and reviewers: e.g., Deputy Chair – **UoA24** REF2014 Panel (Brown); **UoA17a** REF2014 Assessor (Adger); Steering Group member **ESRC/AHRC International Benchmarking Review of Human Geography** (Cloke); Lead Author **UK National Ecosystem Assessment** (Quine) and Expert Panel member, Phase 2 (DeSilvey); Expert reviewer **Flemish Government's** Nature rapport NARA-T (Meersmans); Chair **NERC-ESRC-DFID** Ecosystem Services for Poverty Alleviation International Advisory Committee (Brown); Expert advisor on the **ESRC's Global Uncertainty programme** (Hinchliffe).

Fourth, Exeter researchers have made significant contributions across all relevant **UK Research Councils** and to other **grant awarding bodies** – as Peer Review College members of **NERC** (11 staff); **ESRC** (9); **MRC** (1); **EPSRC** (1); and **AHRC** (3); and committees: **ESRC International Advisory Committee** (Brown); **NERC Radiocarbon Laboratory Steering Committee** (Caseldine, Charman); **Airborne Research and Survey Facility** (Anderson); **AHRC Strategic Review Group** (Leyshon, C); **NERC UK Ocean Acidification Programme** Advisory Group (Halloran); **AHRC/EPSRC CDA Panel on** 'Heritage Science' (Harvey); **ESRC Centres and Large Grants Panel** (Barnett, Buller, Hinchliffe); Commissioning Panel **ESRC Future Research Leaders** (Devine-Wright); **RCUK/MRC Ecology, Environmental & Social Ecology of Human Infectious Diseases** panel (Hinchliffe); and other funders: **European Research Council** Environment, Space and Population Panel (Adger; and Chair from 2014); **Food Standards Agency Food Systems** grant call (Hinchliffe, Chair); **DEFRA Evaluation of Farm Animal Welfare Programme** (Buller); and **Big Lottery Fund Research Grants** (Leyshon, M).

REF2014 Summary: This submission demonstrates a sustained upward trajectory in the research performance of Exeter Geography since RAE2008. We base this claim on: income and PGR data; the quality and relevance (as indicated by citation metrics) of our research outputs; the success of our research strategies that have enhanced, and will sustain, our environment; and the significant contributions made to the discipline and to relevant user groups and policymakers. The breadth and calibre of our staff means we are exceptionally well placed to help address many future social and scientific challenges, and to continue producing agenda-setting research. As at 1st November 2013 Exeter Geography holds £10.7M of active grants, with >70% staff involved in PI or Co-I roles. This provides the underpinning for a vibrant and sustainable research environment into the future.