Institution: Durham University

Unit of Assessment: 17B (Geography)

a. OVERVIEW

Durham Geography is a large, integrated department with approximately equal numbers of staff across human and physical geography. We have an inclusive research environment that is reflected in our comprehensive submission. Research activity is organised by seven clusters: Politics-State-Space; Culture-Economy-Life; Urban Worlds; Geographies of Health and Well Being; Ice Sheets and Sea level; Catchments and Rivers; and Hazards and Surface Change. Our clusters act as ideas factories and as centres of gravity for existing areas of research expertise. They are central to capacity building, act as resources for impact networks, and form nodes in University-wide research activity.

We are an outward-facing department that is committed to interdisciplinary working. As such we play a key role in Durham University's (DU) interdisciplinary research institutes, particularly the Institute of Hazard, Risk and Resilience (IHRR), and make major contributions to cross-department research centres, notably the Centre for Social Justice and Community Action (CSJCA) and the Centre for Medical Humanities (CMH); our staff currently direct or co-direct these institutes and centres.

Research activity is reviewed annually, coordinated by cluster convenors and overseen by our Research Committee (RC). Convenors are three-year appointments, charged with promoting cluster research and the delivery of a balance of activity including events organised by and for early-career researchers (ECRs). External seminar series are organised by cluster convenors.

Operational matters are addressed by the Director of Research and RC. Research Away Days develop key elements of the Department's Research Strategy. RC monitors the external research landscape, advises and provides assurance to our Board of Studies and implements policy change. Research Postgraduate Committee manages postgraduate research, and the Director of Research Postgraduates sits on RC.

b. RESEARCH STRATEGY

Evaluation of strategies within RAE08 and subsequent changes

In RAE2008 we highlighted six strategies for maintaining excellence: (i) staff recruitment; (ii) improved support for younger staff; (iii) better integration of research-only staff; (iv) delivery of research wholes that are more than the sum of the parts; (v) raising research income; and (vi) continuing to enhance our research infrastructure. A root and branch review of research activity in 2011/12 formed the basis for a revised Research Strategy adopted formally in Autumn 2012.

Our research environment is designed to deliver sustained excellence. Our organisational structure seeks to avoid narrowly defined objectives whilst recognising that the key to delivery often lies with groups of researchers at varying career stages. We routinely reflect on our organisational structure and use the opportunities afforded by staffing change to renew and refresh activity. In the review period we have reduced the number of our human geography clusters and realigned activity across the department. Acknowledging existing strengths in urban geography and new strengths in health research, we reorganised activity into our Urban Worlds and Geographies of Health and Well Being (GoHWell) clusters. Following recruitment of expertise in cultural economy, we realigned our former Lived and Material Cultures cluster as Culture-Economy-Life. In physical geography, we recognised that the distinction between our former Quaternary Environmental Change (QEC) and Catchment, Rivers and Hillslopes (CRHS) groups was too restrictive and we reorganised into three clusters: Ice Sheets and Sea Level, Catchments and Rivers, and Hazards and Surface Change.

In all areas of activity we have delivered against our priority themes in RAE2008 (bold italics below) and have taken our work in new directions.

In ***climate-cryosphere-ocean interactions research*** we achieved our primary objective of integrating our field research with numerical modelling. We addressed the decadal-millennial scale

change of polar ice sheets, providing new insights into their evolution, dynamics, and forcing (submitted outputs *Lloyd, Bentley, Roberts, Cox*). We developed new glacial-isostatic adjustment models for Antarctica and Greenland (*Whitehouse, Long*) and estimates of ice sheet contribution to present-day sea level (*Bentley*). We provided important new insights on ice sheet extent (*Ó Cofaigh*), ice stream dynamics (*Evans, Jamieson*) and the ice-bed interface (*Stokes*). We pioneered new methods to reconstruct sea level (*Woodroffe*) and palaeo-seismicity (*Shennan*). Using novel geochemical and chronological approaches we explained the ocean's role in driving key Quaternary climatic transitions (*McClymont*) and helped deliver an improved chronological framework for the British Quaternary (*Bridgland*).

As planned, our ***catchment research*** addressed larger spatial and temporal scales, including new representations of hydrological connectivity at the hillslope scale (*Bracken*) and analysis of catchment-wide datasets for policy-relevant water quality recommendations (*Burt*). This was complemented by new techniques for high-resolution reach- or catchment-scale measurement of key parameters such as grain size (*Carbonneau, Warburton*) and topography (*Carbonneau*). We established the critical long-term roles of landslides in the carbon cycle (*Hilton*) and the mass balance of mountain ranges (*Rosser*). We proposed a new spatial and temporal framework for ecological dryland change (*Turnbull*), allowing us to document how vegetation shifts can enhance runoff and erosion (*Turnbull*). Concurrently, work at smaller spatial scales outlined new approaches to hillslope soil erosion (*Wainwright*) and showed how spatial sediment distributions govern transport in bedrock rivers (*Hodge*).

In human geography, we advanced ***new understandings of order, liberty and equity in a post-territorial world***. We reconceptualised territory as a product of relational networks (*Painter*) and in its relation to mobility (*Steinberg*). We examined the spatial orderings of security, war and code through mundane practices (*Amoore*). We identified how materialities in the global economy, including primary (*Bridge*) and recycled/recovered resources (*Gregson, Hudson*), configure opportunities and inequalities, and examined how new economic conditions shape geographies of mobility (*Crang, Rigg*). We produced new conceptions of geopolitics, from the impact of China's role on international development (*Power*) to the everyday geopolitics of fear (*Pain*). We investigated how climate change experiments reconfigure urban politics (*Bulkeley, Marvin*), examined how the political emerges in the city (*MacLeod*), and reconsidered the connections and spatialities between citizenship and community (*Closs-Stephens, Staeheli*).

Research into the ***geographies of being human*** examined constructions of the self, body and life, and the connected forms of inequality and exclusion. We produced insights on the changing borders of human-material in the politics of affective life (*Anderson*), the biological-social in accounts of the subject and body (*Callard, Colls*), and the social-technical in assemblages of urban life (*McFarlane*). Our work on the human subject examined how forms of well-being are governed (*Atkinson*), how new medicalised practices discipline bodily appearance (*Colls*), identified the relations between magical and mental health (*Laws*), and deconstructed the figure of the active psychological self (*Harrison*). We advanced understanding of the material ecologies of raced citizenship in relation to memory and identity (*Tolia-Kelly*). We investigated how the future is problematized across different domains of life (*Anderson*), how efforts to secure life operate through risk devices for uncertain futures (*Langley*), and how perceptions of futurity in relation to nanotechnologies entail new forms of regulation (*Macnaghten*).

Cutting across human and physical geography, we explored novel ways of understanding ***hazard and risk***. We developed state-of-the-art techniques for monitoring Earth surface change (*Rosser*), leading both to unique monitoring of rockfalls (*Petley*) and their dependence on environmental conditions (*Rosser*), and to the first dynamic assessment of debris-flow hazard (*Rosser*). We re-conceptualised flooding and water pollution as distributed in space (*Reaney*), allowing us to tackle ecological issues (*Reaney*) and diffuse pollution (*Milledge*). We also showed how erosion modifies the topography above active faults (*Densmore*) and how that topography tracks fault growth and thus seismic hazard (*Densmore*). Our research has examined the risk technologies governing security systems and the commercial exploitation of state-defined security threats (*Amoore*). Finally, our work on risk governance and public engagement led to a deliberative methodology for articulating concerns about emerging technologies (*Macnaghten*).

Future strategic aims and goals and their relationship to the organisational structure of research: Our Research Strategy objectives are: (i) to further strengthen the quality of our

outputs, by emphasising quality over quantity; (ii) to increase external income generation by enhancing research proposal quality, diversifying funding streams, bidding for larger consortium grants, and increasing the number of independent postdoctoral fellows; (iii) opening up new areas of interdisciplinary collaboration within Durham University and with other HEIs; and (iv) further embracing Impact and the related importance of knowledge transfer/exchange activities.

The above objectives are **monitored** as follows: (a) output quality is supported by a REF Support Group whose remit is to help staff maximise output quality. Each member of Category A staff is assigned a research mentor, and they meet on a 6-monthly basis to discuss outputs and publication strategy (objective i). (b) Research grant capture is monitored monthly against annual planning round targets by the DoR and reviewed by RC (objective ii). (c) Interdisciplinary collaborations via institutes and centres are evaluated through University performance review mechanisms (objective iii). (iv) Impact is supported by the REF Support Group (objective iv).

Our clusters, and the networks of collaboration they enable, are the primary means of translating our research strategy into research deliverables. People (academics, RAs, PDRFs and PGRs) can be involved in more than one and they are the means by which individuals can trial ideas and build research collaborations, both internally – across and between clusters - and externally, including with international partners via our Distinguished International Visitor scheme. Cluster activity is supported by our Research Development Fund (~ £36k available per annum) and reviewed annually by RC. Clusters are charged with identifying research objectives, both collectively and singly. The following paragraphs outline the primary research objectives for our clusters over the next five years.

Politics- State-Space will advance understanding of emergent spatial forms of politics, working across diverse domains that include emergency governing and future scenarios, rising powers, climate change governance, border security and migration flows. We will focus on the techniques and practices through which political worlds are written, inscribed, and enacted. Our work will address: (1) the ways that geographic vocabularies of cartographic, linear and causal forms are challenged by different forms of assemblage, atmosphere, and network; (2) the techniques and devices though which political life is governed; (3) the capacities and potentialities of novel forms of identity, citizenship, nation, and neighbourhood; and (4) how the world of objects and things animate the space of the political.

Culture-Economy-Life will advance research at the intersection of the cultural and economic in life: from the routines and experiences of everyday life, to the liveliness of bodies and material things, the exhibitions and iconographies of previous lives, and developmental imaginaries of future lives. Our work will address: (1) how geographies of the body and corporeality operate in a range of domains; (2) how identities are enacted through imaginaries, technologies and artefacts in worlds of work and leisure; (3) how cultural economy explanations deepen geographical research into dynamic economic practices found in marketized spaces and beyond; and (4) how inventive conceptualisations and new methodologies pluralise the cultural and the economic, thereby opening-up political space to debate prevailing practices both within and between the global north and south.

Urban Worlds will develop new understandings of contemporary urbanism, particularly the techniques through which cities are governed and urban life is made. We will target specific domains that are critical to the nature of contemporary urbanism, including: the making of socio-technical and ecological infrastructures, the production and contestation of political economic architectures, and the experience of everyday life. Our work will: (1) explore the implications of urban spatialities as relational, i.e. as combinations of near and far or social and technical, for urban theory; (2) ask how relationalities are changing urban political economy, ecology, and sociality; and (3) examine how emerging forms of urban management, such as smart urbanism, impact urban governance, infrastructures, ecologies, and inequalities.

Geographies of Health and Well-being will develop a range of innovative spatial and scalar approaches to understanding health and well-being. Our central concerns will be to understand the determinants of health inequalities; the significance of power relations between social groups, market forces and environmental change for understanding health and wellbeing; the value of interdisciplinary approaches to understanding risk and health-environment relations; arts,

imagination and creativity in health and medicine; and the embodiment of (ill) health. Our work will address the following challenges: (1) understanding what it means to live, age and die well within the context of global health debates, including climate change; (2) interrogating how we understand, anticipate for and research the health of our future selves and health risks, in the global north and south; (3) exploring how social spaces and authority operate to exercise governance over human bodies; and (4) examining how the embodiment and performance of healthy lifestyles intersect with human flourishing and well-being.

Ice Sheets and Sea Level will explain and quantify the dynamic response of ice sheets to external and internal forcing and their contribution to past and future sea-level rise. We will integrate strengths in field and remote sensing with new expertise in numerical modelling to: (1) understand the decadal to millennial trajectory of the polar ice sheets to understand how they respond to climatic and oceanic forcing; (2) advance knowledge of how subglacial processes affect ice sheet dynamics, exploiting expertise in process-form relationships at the ice-bed interface; (3) develop understanding of sea-level change, especially during past glacials and interglacials, as an analogue for how sea level and ice sheets interact; (4) apply expertise in sea-level indicators of seismic activity to reconstruct earthquake recurrence and impacts in a range of settings; and (5) explain how oceans interact with ice sheets and other environments over major climate transitions, including the teleconnections between low and high latitudes, to understand better the fundamental processes that govern the role of the oceans in climate change.

Catchments and Rivers will monitor and model the interactions and feedbacks between geomorphology, hydrology, vegetation, and water chemistry in hillslope and river systems. We will focus on montane environments that are a dominant source of terrestrial sediment flux, with particular emphasis on two areas: (1) we will develop better process-based understanding of how water, nutrients and sediment move through catchments, with an emphasis on physical mechanisms that can cause societal impacts and on the integration of modelling with novel observational data at high spatial and temporal resolutions. This work will include rigorous theoretical approaches to defining and modelling connectivity across these systems, as well as quantification of flow and sediment transport in the mixed bedrock-alluvial channels that characterise mountain rivers; and; (2) we will build on existing numerical and analogue modelling expertise to investigate the interactions of vegetation with water flow and sediment transport, including the effects of vegetation on hillslope stability and dryland erosion, and the role of plants in modulating flow and flooding in river channels.

Hazards and Surface Change will advance holistic approaches to understanding hazards as the outcome of recurrent physical processes that occur within specific societal settings, rather than as one-off events. We will extend our existing strengths to focus on three interrelated challenges: (1) understanding the physical mechanisms of mass movements, coupling novel laboratory and field-based approaches with numerical modelling, to allow assessment of slope stability at societally-relevant scales; (2) quantitative estimation of the long-term and large-scale effects of mass movements on the sediment and terrestrial carbon cycles, including systematic assessment of how debris flows and earthquake-triggered landslides mobilise and transport sediment and organic carbon in montane environments; and (3) investigation of how scientific understanding of hazards – particularly around earthquakes, mass movements, and sea-level change – is used in decision-making and management processes, and how expert and local knowledge of hazards and surface change can coexist and inform policy and practice.

New and developing initiatives and priority developmental areas for the unit: We will explore the use of new research themes that cut across our clusters. Themes serve two purposes: to identify emerging research areas that may not map onto existing clusters; and to challenge cluster boundaries, ensuring that our research structures remain vital and appropriate. Priority areas for development are investing in new interdisciplinary initiatives and enhancing our research infrastructure. ***Strategic interdisciplinary priorities*** include the development of DU's new Climate Impact Research Centre, which we expect to involve collaborations by geographers with the Biological Sciences, Earth Sciences, Law, Maths and other departments; a review of our research units (the International Boundaries Research Unit and Nomis, National on-line manpower services) to be conducted in AY 2013/14; the further development of doctoral training networks, notably in physical geography; and continuing to ensure that our infrastructure is fit-for-purpose to support the research challenges identified above. ***Our goals for future infrastructure*** are to consolidate on

major investments completed in the current REF period, to use these resources effectively in the context of reduced capital income, and to ensure the alignment of our facilities to our developing research. Our IT, Laboratory and Equipment strategy identifies priority equipment to support RCUK-funded research across our physical geography research clusters. IT provision, including support staff, is an investment priority, and aligns with recent expansion of staff in numerical modelling (e.g. hydrology, hillslope process, ice sheet dynamics, sea level).

c. PEOPLE

i. STAFFING STRATEGY AND STAFF DEVELOPMENT

Our **staffing strategy** is allied to our research strategy which aims to develop and strengthen a faculty of staff that conduct and publish research which is of international quality. In that spirit we return all our Category A staff. Our staff complement has increased slightly since RAE2008. Of the 58 faculty submitted to that assessment two have retired but are still research active (Evans I, Ferguson), two left academia (Campbell, Casford), five moved to other UK universities (Amin, Bickerstaff, Elden, Graham, Smith), and three moved abroad (Lane, Vieli, Zong). Two RCUK fellows submitted to RAE2008 are now lecturers at DU (*Reaney*, *Rosser*) and one has moved abroad (Kearnes), as did the one independent PDRF (Leysinger-Vieli).

We used replacement positions and successful bids to DU's Academic Investment and Development Programme initiative to maintain strengths and add new skills or perspectives as part of the continuous review and renewal of our research. When replacing leavers we do not automatically seek those of equivalent status, but renew mindful of demographics, succession planning, and leadership considerations, sometimes replacing departing professors with more junior staff. In human geography we reinvigorated economic expertise (*Bridge*, *Gregson*, *Langley*), and opened up new areas of political (*Staeheli*, *Steinberg*, *Leshem*), environmental (*Baldwin*) and health (*Callard*) research, whilst recruiting staff with strong RCUK funding track records and experience of leading large teams of researchers across institutions (*Gregson*, *Marvin*, *Staeheli*). In physical geography we renewed our strengths in empirically-informed process modelling (*Wainwright*, *Hodge*) and recruited new expertise in biogeochemical cycles (*Hilton*) and palaeoceanography (*McClymont*).

We are committed to supporting and developing early-career researchers (ECRs) alongside established staff, as evidenced by our returning our only temporary lecturer (*Bagelman*) and nine independent ECRs funded by: NERC research fellowships (*Jamieson*, *Milledge, Whitehouse*); an ESRC future leaders fellowship (*Laws*); Marie Curie incoming research fellowships (*Ewertowski*, *Moreno*); a Leverhulme early career fellowship (*Harker*); and DU research fellowships (*Reznichenko*, *Turnbull*). Similarly, our emeriti continue to play an active role in the Department, working alongside new lecturers in research collaborations, publications and postgraduate research (PGR) supervision.

Our Category A staff have an average age of 44 years. Thirty academic staff have been promoted since RAE2008: 4 to SL (3 female, 1 male), 12 to Reader (7 f, 5 m), 14 to Professor (6 f, 8 m). There were 16 female and 14 male promotions. Six category A staff are on fixed term contracts. Our contract research staff has grown to 28 (17 f, 11 m). We have no joint appointments. Fixed term appointments provide cover for staff funded on work elsewhere, and are important ECR development opportunities. Our fixed-term Category A staff have identical roles to our other academics, mindful of career stage.

We use a medium-term (5-year) planning model to allocate major administrative roles and ensure succession planning. We provide staff with experience and skills appropriate to three stages of career: early career staff (<7 yrs from PhD) support research cluster/theme activities through reading and writing groups and ad hoc training events. They are aided by senior mentors and by the Annual Staff Review process. Consolidator staff (7-12 years from PhD) coordinate research themes and clusters (e.g. *McFarlane, Colls, Baldwin*) and are members of Research and Postgraduate Committee. Advanced researchers typically chair the Department Research and Postgraduate Committee, hold posts on other University research bodies (e.g. directorships of research institutes (*Curtis*) or centres (*Atkinson, Pain*), chair RCUK Liaison Groups (*Bentley,*

Gregson)) and are mentors for ECR staff and undertake Annual Staff Reviews. During the review period we ensured staff were supported with a minimum of one term's leave in seven, with 37 staff taking a total of 91 terms of research leave. In 2012 we moved to a research leave policy with a presumption in favour of a full year's leave, taken after 4 full years of teaching (3 terms in 15, equivalent to a 1:5 ratio). Our 5-year planning horizon enables us to allocate tasks strategically, recognising the needs of career development and providing the flexibility to react to research opportunities as they arise.

Equality of opportunity: A major achievement in the period has been to begin to tackle long-standing gender imbalances in staff fte, promotional status and research leadership. Of the 15 non-fixed term appointments made in the period, 9 were male and 6 female. Since RAE2008 the proportion of female fte staff rose from 28% to 35%, with 7.8 fte female Professors (29% of the Professoriate). Women currently play a prominent role in research leadership, as Directors of Research (*Gregson*) and Postgraduates (*Staeheli*), and as Chair of Research Ethics and Governance (*Pain*). Future strategic priorities include departmental Athena SWAN accreditation led by *McClymont*.

In order to ensure excellence is sustainable, we have adopted and developed a set of work-life balance principles. We support requests for flexible working, operating in an appropriate, fair and consistent manner. Interviews with the Department Head before and following periods of leave discuss the impact of life changes on research, agree research plans and consider relevant support. We have clearly defined expectations regarding publications and research grants that reflect part-time working.

Staff development: We recognise the primacy of staff development for enhancing individual and collective research. All staff are supported by a REF mentor. ECRs meet regularly with the Department Head as part of the probation process. They carry lighter teaching and administrative loads (70%, 80% and 90% in years 1-3) to maximise their research potential at an early stage. We encourage co-supervision of PGRs and provide bespoke training for all staff. We have adopted the Research Concordat and have improved our induction, given training for PIs to ensure uptake, clarified contract renewal procedures, established career development as a formal part of the annual review process for contract research staff, and now make research funds routinely available to all research staff. The effectiveness of this support programme is evidenced by 11 contract research staff making the transition to independent postdoctoral research positions and/or lectureships in the period, including at the Univ. North Carolina, UCL, Exeter, Sydney Univ., Sheffield and Edinburgh.

Mechanisms for maintaining research quality and integrity: Research Ethics and Governance Committee (REGS) is responsible for all matters of research quality and integrity, and is chaired by a senior member of staff (*Pain*). All staff, postgraduate and undergraduate research proposals must be submitted for clearance before research commences. REGS advises on a range of ethical issues, data protection, insurance, overseas working and intellectual property rights, with examples of good practice available to all applicants. For a number of years, Geography's ethics clearance process has led the way in DU in facilitating participatory research, allowing iterative staged clearance as methods are developed with research participants. DU provides operational and ethical review guidelines as well as a Statement on Values, Standards and Ethics; Guidance for Research Using Personal Information; policies on Data Protection and Ensuring Sound Conduct in Research; and various annexes covering specific guidance (e.g. working with children).

The role of Fellowships and their contribution*:* Within the review period staff have held a Leverhulme Early Career Fellowship, two Philip Leverhulme Prizes, and two ESRC Fellowships. These provide personal career and Departmental benefits, through publication, new collaborations and further grant capture. For example, in physical geography *Stokes*' Philip Leverhulme Prize (2009-10) led directly to a NERC Standard Grant and publications co-authored with other Department staff (e.g. *Cox, Jamieson***)**. In human geography, ***Bulkeley's*** SRC Climate Change Leadership Fellowship led to a new collaboration between the Department and UN-Habitat and the World Bank, and an ESRC International Research Network on Urban Low Carbon Transitions (2013 - 2016; PI Marvin, CI Bulkeley, with international partners from US, Australia, India, and South Africa).

A key priority is to maintain and grow the number of fixed-term **independent research fellows**. As well as enabling grant capture, capacity building and future international networks, we seek to attract ECRs whose interests align closely with, and enable the further development of, our research clusters and themes. In physical geography, many of these ECRs have strong modelling components within their work. They contribute significantly to our objective to more closely integrate modelling and field research, notably in our research on ice sheets and sea-level change, and the interaction between ecological and geomorphic processes.

c ii. RESEARCH STUDENTS

Our large, vibrant community of home and international postgraduates plays an integral role in our research environment. PGRs work with staff and alone to initiate new themes, organise events, publish in top-ranking journals, and contribute to our impact (see REF 3a). We currently supervise 107 research students, up 17 from 2008. The quality of our students is indicated by the award of 48 competitive RCUK studentships during the review period from ESRC, NERC and EPSRC. Within the quota allocated we have been awarded the highest number of ESRC awards of any department in the North East Doctoral Training Centre. We have also received 46 competitively awarded studentships from other sources (including, for international students, six Commonwealth Scholarships and 11 from the highly competitive Durham Doctoral Fellowship Scheme).

***Evidence of a strong and integrated research culture*:** PGRs play an important role in our research culture through collaborative activities with our research clusters (Section B) and by organising bespoke postgraduate symposia. PGRs are integrated within clusters through the annual planning of themes and events, running reading groups, organising events, and developing and presenting collaborative papers. Recent PGR-led cluster workshops that have developed new perspectives include those on performance (*Locating Performance and the Political*), resilience (*Narratives of Urban Resilience*), and the body (*Problematising Problematic Pregnancies*). These workshops have contributed to collaborative publications between PGRs and staff (e.g. the resilience event fed into a special issue *of Local Environment* in 2013 with UN Habitat, involving three PGRs and *Bulkeley*, *McEwan* and *Rigg*).

Beyond clusters, PGRs have organised major interdisciplinary postgraduate symposia, including the Postgraduate Medical Humanities Conference (with English and DU's Institute of Advanced Studies), the North East Quaternary Research Association (QRA) Postgraduate Symposium and the international QRA Postgraduate Symposium, the RGS-IBG Postgraduate Mid-Term Conference, bespoke PGR workshops at the International Medical Geography Symposium, and the North East Geosciences Postgraduate Symposium. They have also contributed centrally to funded seminar series, including the ESRC *Critical Perspectives on Public Engagement in Science and Environmental Risk*. These events have contributed to debates in our clusters, for example on well-being and public space. Taken together, through these activities our PGRs develop capacities in research leadership across multiple organisations, learn to forge and sustain networks, gain national and international recognition, and become immersed in conversations and ideas that enrich their own research and the collective work of the Department.

PGRs have been authors and/or co-authors of > 250 papers in the period (e.g. *Transactions of the IBG, Annals of the AAG, Nature, Nature Geoscience, Quaternary Science Reviews, Water Resources Research)*. They regularly present papers at national and international conferences. 129 students have had their work recognised in different ways, including through funded speaker invites (e.g. 3rd GCOE-SRC Summer School on Border Studies, Hokkaido University, Japan), and through prizes. The latter include awards for best paper at conferences (e.g. High-Performance Computing Conference, European Geosciences Union, Cultural Geography Specialty Group of the AAG), and from scholarly organisations (e.g. British Antarctic Survey Club's Laws Prize for the Outstanding Young Antarctic Scientist).

Support offered to PGRs: We provide supplemental funding for PGRs to attend conferences (to 49 students since 2010), and for research visits to other universities and for rapid response fieldwork. We develop presentation skills through our PGR conferences in first and third year and through informal presentations at cluster events, and a panel nominated by the student and supervisors provides feedback on both the first year progression report and literature review.

All PGRs receive a bespoke training programme in research philosophies and design, project specific skills and techniques, and professional development. We provide specialised skills seminars in Geography (e.g., ethics, publishing, PAR, Stata, and Matlab) and workshops in GIS and scientific writing. We detail specific infrastructure support to PGRs in Section D below. The Durham Centre for Academic Research and Training offers students additional skills and professional development seminars related to research management, research skills, personal effectiveness, IT training, and teaching in higher education, with >140 courses and workshops. The Centre received the *Times Higher Education* award for Outstanding Support for Early Career Researchers in 2009. The DU Learning and Teaching Award programme helps students earn teaching accreditation. Human geographers receive specialised research training through the NE ESRC DTC; bids for NERC and AHRC doctoral training programmes/centres are in process.

In the period, 20 PhD graduates moved to work as PDRAs and 17 to lectureships, including to Manchester, the Open University, Oxford, Sheffield, St. Andrews, and York in the UK and Amsterdam, Bangkok, Hong Kong, Melbourne, Peking, Penn State, Singapore, Stockholm, Sydney and Wageningen internationally. Other former students have moved into policy-facing roles, ranging from applied analysts for public sector bodies such as the Norwegian Mapping Authority or regional and local government in the UK, through to private bodies, such as the Economist Intelligence Unit and Chambers of Commerce. Others have returned to previous careers in more advanced roles such as the Director for Science and Innovation at the British Embassy in Brazil, or Minister for Health for Bahia (Brazil).

Contribution of submitted staff to doctoral programmes: All full-time, permanent staff are, or have been, supervisors during the review period and 23, including our research staff, have been involved in delivering modules, workshops, and administering the research postgraduate programme (See Section E). Two staff members (*McEwan, Rigg*) earned the Vice-Chancellor's award for excellence in doctoral supervision. We also play a central role in delivering postgraduate training in the university, where *Donoghue* has led bids to RCUK for doctoral training centres.

d. INCOME, INFRASTRUCTURE AND FACILITIES

Research income has averaged~ £3.5M per annum and is on an upward trend, with 43 awards (award value £7.7M) in 2012/2013. 43 (68%) of our returned staff have been PIs or CIs on 88 RCUK awards. We aim to sustain this level of funding in the immediate future and to grow this in the medium term.

The Department has been involved in 19 large ***research consortia*** (defined as grants > £1M involving three or more HEI partners) totalling ~ £52M. ***Major prestigious awards*** directed by staff include The Waste of the World (*Gregson*, *Hudson*, *Crang* - ESRC £2.9M); Tipping Points (*Curtis*, *Petley*, *Long* – Leverhulme £1.6M); Youth Experiences of Citizenship (*Staeheli* – ERC €2.4M); Earthquakes Without Frontiers (*Densmore*, *Petley*, *Rigg* – NERC/ESRC - £3M); GLANAM (*O'Cofaigh*, *Bentley, Evans D, Roberts, Lloyd, Long, Stokes, Whitehouse* - Marie Curie ITN - €4.4M), Hearing the Voice (*Callard* – Wellcome £1M) and *Amoore*'s ESRC Global Uncertainties Fellowship (2012-15). This blue chip funding supported 37% of our returned outputs including 53% of those in physical geography.

Our ***strategies for grant income capture*** rest on diversifying our income stream. To this end, we aim to: (i) maintain a bedrock of RCUK funding from both NERC and ESRC; (ii) grow grant capture in key interface areas, notably ESRC-EPSRC and ESRC-NERC; (iii) increase our recruitment of high quality independent post-doctoral fellows (NERC, ESRC Future Leaders, Leverhulme Early Career, Independent Marie Curie Fellowships); (iv) increase funding from the European Research Council; and (v) develop a distinct knowledge exchange funding stream for work with key users and partners. We aim to increase success rates through: i) rigorous demand management and internal peer review of applications, supported by Faculty-level peer review for large and/or complex bids and by review by an internal NERC Liaison Group for all NERC proposals; and (ii) supportive mentoring of early career and consolidator staff by experienced investigators as they develop ideas for grant proposals. A proactive process of call-monitoring and candidate selection occurs, supplemented by rigorous internal peer review and by mock-RCUK research panel review comprised of members of relevant peer review colleges. We also use mock interview panels.

Evidence of infrastructure and/or facilities supporting a vital and sustainable research environment: Our research is supported by an extensive technical infrastructure and a pool of 20 technicians and an Experimental Officer. A large expansion completed in mid-2008 (230 m^2 added), including state-of-the-art temperature- and humidity-controlled laboratories, has allowed us to develop advanced techniques in geotechnical testing and geochemical analysis. We run a suite of laboratories that support research within and across our research clusters. These comprise geotechnical apparatus for mass movement studies in the alumnus-funded Laithwaite Landslide Laboratory, including a range of shear-boxes and triaxial-cells, several developed in-house with industry partners; a clean laboratory with air and temperature control for high-resolution geochemical, biomarker and water quality analysis; a purpose-built environmental radioactivity laboratory that measures Cs-137 and Pb; and a sediment core laboratory including a Geotech multi-sensor core logger and three Coulter laser/particle size / shape instruments. Field research is supported by a wide range of sampling equipment (from land, lakes and the sea); extensive differential GPS and survey equipment that includes three terrestrial laser scanners and two Unmanned Aerial Vehicles; six vehicles (two off-road) and an inshore boat. Our modelling and remote sensing is supported by a GIS Laboratory, a distributed computing cluster, and access to high-performance computing.

A rolling 5-year IT, Laboratory and Equipment strategy identifies priority areas for replacement, refurbishment, and new investment. Department investment here amounted to ~£1M during the REF period. We supplemented this by winning major infrastructure funding (£1.1M) from DU's Strategic Capital (SCAP) equipment fund and Capital Infrastructure Fund (CIF), which we directed to large equipment items supporting strengths in slope stability and sediment/water geochemistry. We have also won investment from the University Green Fund to reduce energy and water use in the laboratories. To ensure sustainable equipment use we have integrated our departmental equipment database with a university-wide database, which will be extended to a shared resource amongst the N8 Universities in 2014. Our grant proposal procedures have been modified accordingly such that we can identify required equipment efficiently in the new RCUK capital funding regime.

Regardless of their funding, our PGRs have access to all departmental field and laboratory equipment, with benefits to their projects and research training. Similarly, we support unfunded pilot work by staff, including ECRs, to open up new areas of research. These policies have led directly to returned outputs (*Bracken, Lloyd, Petley, Shennan*) and funded NERC proposals (*McClymont NE/1027703/1, Rosser NE/G000050/1*).

We have expanded and enhanced the technical expertise of our support base through the recruitment and re-skilling of five (20%) technical staff. These staff support research in water and sediment chemistry, sediment dating, geotechnical testing and GPS processing. We have appointed a dedicated Research Computing Officer and two technical analysts as part of our strategic investment in numerical modelling and digital remote sensing.

We provide PGRs with space and IT facilities that are substantially in excess of RCUK guidelines. All 2nd and 3rd year PhD students have their own desk and dedicated PC with IT support; 1st year students have a dedicated laptop and share hot-desks, but in practice are often assigned a dedicated desk mid-way through the year depending on availability. We ensure that where possible PGRs in similar fields are grouped together to encourage synergy and sharing of ideas; for example, PGRs working in Hazards and Surface Change and Catchments and Rivers research share a dedicated space within the IHRR building.

DU infrastructure support for our research is provided by: (1) Computing and Information Services, which supports an Academic IT Team Leader in Geography who ensures that University IT support is appropriate to our research needs (e.g. physical geography (Ice Sheets and Sea Level; Catchments and Rivers) uses centrally provided High Performance Computing); (2) Geography has been awarded £97k in University research seed-corn funds for research and impact during the review period. This, combined with departmental seed corn funding allocated through the Geography Research Development Fund (£40k awarded during the period), has resulted in returned outputs (e.g. *Cox*; *Roberts*; *Ó Cofaigh; Rosser*) and successful RCUK grant applications by ECRs (e.g. *Whitehouse*; NE/K009958/1); (3) the Development and Alumni Relations Office

identify philanthropic supporters of research: since 2008 Geography has funded ~£500k of PGR studentships from alumni donations and; (4) a top-class library: all staff and research students have access to the recently extended (£11.5 million, 42% increase in floor area) University Library; offering access to 1.6 million printed items, 17,500 electronic journals, 290,000 e-books, 308 online databases, and 1300 technology-enhanced individual study spaces. We have maintained an extensive range of journal subscriptions through a Departmental library allocation of £0.75M during the review period. The library also manages the Durham Research Online and Durham E-Theses repositories, both of which manifest Durham's (and our) commitment to Open Access publication.

e. COLLABORATION AND CONTRIBUTION TO THE DISCIPLINE OR RESEARCH BASE

Our vision is to be a leading research node in a national and global network of geographical activity. As a large and diverse department, we are conscious of our role, collectively and as individuals, in advancing the discipline. We are strongly outward-facing; our aim is to help develop capacity and ideas within the discipline, but also to act as a conduit, with other disciplines. To this end we experiment with new forms of geographical thought which cross and disrupt conventional sub-disciplinary boundaries. In line with this vision, we endeavour to contribute to the discipline/research base in the UK and internationally through: (i) professional service that provides leadership and guides strategic developments; (ii) research collaborations leading to new research agendas and capacities; and (iii) inter-generational renewal via our activity with PGRs and ECRs.

Professional service**:* We have contributed leadership and service to core UK-based ***professional associations and learned societies in the discipline, including supporting emerging initiatives. Within the RGS-IBG, staff have served on RGS-IBG Council (*Petley, Painter*), acted as RGS-IBG Conference Chair (*Rigg*), chaired (*Dunn*, *Painter*) and served as committee members for RGS-IBG Research Groups (*Anderson*, *Horschelmann*). Our staff have played key developmental roles, by being founders and committee members of RGS-IBG working groups (*Bridge* – Chair, Energy Geographies Working Group; *Pain* – founder member and treasurer of the Geographies of Justice Working Group, committee member of Participatory Geographies Working Group). Similarly, we have played a key role in major UK geosciences professional associations Staff have been President of the Geologists' Association (*Bridgland*) and Vice President of the Quaternary Research Association (QRA) (*Evans D*), and have served as committee members for the British Society for Geomorphology Research (*Warburton*) and the QRA (*Long*, *McClymont*, *Roberts*).

We also play a key role in shaping UK research agendas by representing the discipline on major funding bodies. Within RCUK, staff have served on key committees for NERC, ESRC, AHRC and EPSRC. Physical geography staff have been members of NERC's Airborne Science Review Group (*Donoghue*), delivering a report for NERC Executive Board and the Director of Science on facility integration. They have served on the NERC Integrated Ocean Drilling Review Group (*O'Cofaigh*), providing an expert assessment of the benefits of ocean drilling to UK science; the Ice Sheet Stability Programme Ocean Forcing Group (*O'Cofaigh*); and on the Ice Sheets and Sea Level Expert Group (*Bentley*, *O'Cofaigh*), which framed NERC's large ice sheets research programme. They have provided expert assessment of UK marine science under the auspices of the UK Scientific Committee for Oceanic Research and the Challenger Society for Marine Science ('Prospectus for UK Marine Science', published by the Royal Society) (*O'Cofaigh*). They have Chaired the NERC Cosmogenic Isotope Facility Committee (*Long*) and been members of this and the NERC Radiocarbon Facility Committee (*Densmore*, *Long*, *O'Cofaigh*). Human geographers played key roles in the ESRC/AHRC International Benchmarking Review of Human Geography, with *Bulkeley* on the Steering Committee and a range of other staff providing advisory input (*Hudson*, *Painter*, *Rigg*). They have served on ESRC assessment panels, including Panel C (*Staeheli*), Professorial Fellowships (*Staeheli*), large grants (*Amoore*) and thematic programmes (*Atkinson*). Within EPSRC our staff have served on the Societal Issues Panel, the pan-RCUK EPSRC-led Nanotechnology Strategic Advisory Team and the EPSRC Strategic Advisory Network (*Macnaghten*), and within AHRC, they chaired the Connected Communities Large Grant Panel (*Staeheli*). More broadly, they worked on the European Commission group defining priorities for

Euratom Social Research & Training For Horizon 2020 (*Macnaghten*). At the grass roots level, we contribute via peer review to the allocation of the RCUK research budget with 26 staff refereeing for ESRC and 17 for NERC in the period.

Internationally, we perform similar professional service roles, both within Geography and beyond. *Petley* was Vice President of the Natural Hazards Division of the European Geosciences Union, whilst *Curtis* is an international expert member of the French CNRS National Scientific Council, and *Hudson* chaired the International Scientific Council of the Dutch Research Institute for Transitions. *O'Cofaigh* is Chair of the Palaeo-Arctic Spatial and Temporal Gateways (PAST-Gateways) programme, directed at promoting understanding of Arctic environmental change, whilst *Long* is European lead for PALeo constraints on SEA-level rise (PALSEA2), the lead international programme on using past changes in sea level and Earth's cryosphere to constrain future sea-level rise. *Densmore* was a member of the NSF Geomorphology and Land-Use Dynamics Panel, and other staff serve on science programme steering committees in the 50-nation Scientific Committee on Antarctic Research (*Whitehouse*, *Bentley*). At the grass roots level, more than three quarters of our staff have reviewed proposals for overseas funders, including one-third of staff reviewing for the US NSF. Our staff regularly provide reviews on promotion candidacies in the UK and abroad, and more publicly act as institutional reviewers (with seven staff reviewing research at three UK and five overseas institutions)

We also provide intellectual leadership and service through our ***contribution to journal editorship***. In the period staff (returned, as well as those who have left in the period) have held journal editorships for nine major geography-facing journals including *Transactions of the Institute of British Geographers* (*Bridge*), *Area* (*Bracken*), *Earth Surface Processes and Landforms* (Lane), *Journal of Geophysical Research – Earth Surface* (*Densmore*), *Environment and Planning D* (Elden) and *Journal of Quaternary Science* (*Long*). 32 staff have served on the editorial boards of 25 journals. We support schools-facing geography journals through our work with *Geography* (Lane) and *Geographical Review* (*Burt)*. We also seek to make a similar level of contribution to interdisciplinary journals, serving on the editorial boards of 30 journals including *Journal of Cultural Economy, New Political Economy, Global Environmental Politics* and *Urban Affairs Review*.

Research collaborations: Our contribution to national and international academic research collaborations is at the heart of what we do. Success is evidenced by the outputs returned to REF2014, which involve a total of 347 external collaborators, based in 184 institutions. 42 of our returned staff (68%) have returned outputs co-authored with international collaborators, and our total outputs involve 178 international collaborators, drawn from 127 institutions in 28 countries. Beyond our returned outputs, staff have collaborated to edit 31 books or proceedings, 44 theme issues of journals, and six research reference works. This level of activity is underpinned by our contribution to ***conferences***, ***networks*** **and scholarly exchange**, which has helped to shape disciplinary agendas. In the review period two-thirds of staff have collectively delivered > 280 keynotes across > 30 countries; 18 staff have organised ~ 50 sessions at RGS-IBG conferences in the period, 20 staff have organised 60 sessions at the AAG, nine staff have organised 26 sessions at European Geophysical Union conferences and 14 have organised 27 sessions at American Geophysical Union Fall Meetings.

Our networking activity positions us as a key hub in global flows of geographical debate. So, we act as hosts for national and international conferences, workshops and symposia and bring individual scholars to Durham via our Distinguished International Visitors Scheme (DIVs). We also leveraged the resources of the University Institute for Advanced Studies, partly supported by Marie Curie match funding, sponsoring seven visiting fellows for a term each with three of our staff also seconded there for long-term collaborations. In the period we have organised 30 such events and brought 23 DIVs to the department. In addition, our ***seminar-based activity*** has brought 83 externally funded international visitors to Durham, whilst our British Council-funded Inspire developmental programme has brought 10 Bangladeshi geographers to Durham in 18 months. As well as bringing researchers here, we forge, facilitate and contribute to externally-facing networks. Examples include *Bulkeley'*s Leverhulme-funded work on climate change transitions and ESRC-funded research on low carbon transitions, *Baldwin*'s COST-action on climate change and migration, and contributions to an ESF-funded workshop on self-organised ecogeomorphic systems (*Turnbull, Wainwright*). A third of our staff have held visiting positions or fellowships at

overseas universities during the period among which *McFarlane* was awarded the Irmgard Coninx Research Fellowship, Social Science Research Centre and Humboldt University, Berlin and *Macnaghten* a two-year Visiting Professorship in the Department of Science and Technology at the University of Campinas.

We discuss our ***collaborations with industry, the third sector and other users*** in REF3a.

We support ***interdisciplinary research*** at the local level through our work with DU research institutes and centres. Over the period, three staff have acted as institute directors and five as deputy directors. The Institute of Hazard, Risk and Resilience (IHRR) is a core part of our activity, and engages an interest group of >100 academics drawn from 15 DU departments. The Centre for Medical Humanities (funded by the Wellcome Trust to build a new interdisciplinary 'discipline' across health, philosophy, social studies and geography) is aligned to the Wolfson Institute for Health and Well Being and has *Atkinson* as an associate director and *Callard* and *Laws* as associated staff. The Durham Energy Institute was also launched in the period. Geography staff have developed the social science facing aspect of its work, with five staff working on its energy-society agenda, receiving funding for six seed-corn projects.

Inter-generational renewal: We see inter-generational renewal as critical to the vitality of the discipline base. 42 of our staff have external examined > 200 PhDs in the period, including >55 overseas exams in 18 countries, and we promote ***co-operative and collaborative PGR training*** activities as a core part of what we do. One third of our staff have contributed to PGR training programmes in 11 countries in the period. In line with our research strategy, we see Marie Curie ITNs as a means to grow income, strengthen our European networks and provide opportunities for PGRs to come to the Department, potentially returning as future post docs. The Glaciated North Atlantic Margins (GLANAM) project is a prime example (*O'Cofaigh, Bentley, Evans, Long, Roberts, Stokes, Whitehouse* and *Lloyd*). It aims to improve the career prospects and development of young researchers in the public and private sector. Involving ten partner institutions, GLANAM is training eleven Early Stage Researchers (ESRs) and four Experienced Researchers (ERs) – a total of nine researchers will come to DU for periods of three months to three years. Other major current grants include PGR training as core components; e.g. a NERC International Opportunities Fund grant, on which *Densmore* is CI, supported an interdisciplinary summer school for PGRs focused on training in earthquake hazard assessment and mitigation in the Alpine-Himalayan Belt and Central Asia. Closer to home, our long established partnership with Newcastle University has been at the core of our North east ESRC DTC, and staff now co-supervise PGRs with Newcastle. We are bid partners with Newcastle for both the AHRC and NERC DTPs; organised, with Newcastle, an AHRC-funded PGR/ECR event 'Engaging with Communities: arts and performance-based collaborative training' (held up as exemplary by ARHC); and play a major role in postgraduate activities organised under the auspices of the NE Quaternary Research Association.

Indicators of wider influence. A measure of the reach and significance of our work to the international research base is that nearly one third of our staff have had their work translated into a total of 12 other languages in the period. A further indication of our influence is in the award of 10 medals and/or research recognition awards to nine staff, and two prestigious visiting fellowships. Our staff were awarded the Bigsby Medal (*Densmore*) and the Lyell Fund (*O'Cofaigh*) of the Geological Society of London. *Donoghue* was awarded the President's Prize of The Remote Sensing and Photogrammetry Society and *Bentley* the Polar Medal by the Queen. Three staff have been awarded RGS-IBG prizes: the Gill Memorial Award, recognising early career success (*McFarlane*, *Pain*) and the Cuthbert Peek Award (*Dunn*). *Stokes* was awarded the Gordon Warwick Medal from the British Society for Geomorphology and *Pain* the Julian Minghi Outstanding Researcher Award of the AAG Political Geography Speciality Group. *Burt* was elected as a Fellow of the American Geophysical Union, and *Painter* and *Rigg* as Fellows of the Academy of Social Sciences. Three of our physical geographers (*Burt*, *Evans I*, *Ferguson*) have become founding Fellows of the British Society for Geomorphology. Pratt (IBRU Director) was awarded the 2010 Michael Barrett Award of the Royal Institution of Chartered Surveyors and *Bulkeley* the King Carl XVI Gustaf Professorship in Environmental Science by the Swedish Academy of Sciences.