

<p>Institution: Loughborough University</p> <p>Unit of Assessment: C17 Geography, Environmental Studies and Archaeology</p> <p>a. Overview Geography at Loughborough University (LU) has implemented an ambitious and sustainable strategy which has underpinned our innovative research and boosted our role in training future research leaders. We have pioneered new ways of thinking and working in two areas of physical geography: 'Hydrological and Ecosystem Science' and 'Polar and Alpine Research'. In human geography, we have led intellectual agendas in 'Children, Youth and Families' research, and have developed distinctive contributions to knowledge on 'Migration, Identity and the State'. Inter-disciplinarity, and a commitment to the co-production of knowledge with non-academic partners, are hallmarks of the Unit, giving geographical research at LU a meaningful role in contemporary debates about social and environmental futures.</p> <p>b. Research strategy</p> <p>1. Strategic Aims: Following RAE 2008, Loughborough Geography engaged in an open, inclusive and constructively self-critical review of its research. In intellectual terms, this resulted in the identification of four thematic research groups that built upon, but also extended, our expertise in dynamic and exciting ways (B3). To deliver our ambitious intellectual goals, we retained some elements of the underpinning research strategy highlighted in RAE2008, such as expanding the reach of our research through collaboration with UK-based and international partners, and increasing our engagement with policy-makers and stakeholders. Other elements of this strategy (B2) have been refined to embrace new opportunities and research contexts, allowing us to achieve our strategic aims for the current REF assessment period and beyond. These aims are to:</p> <ul style="list-style-type: none"> • Conduct original, rigorous research into: Hydrological and Ecosystem Science; Polar and Alpine Science; Children, Youth and Families; and Migration, Identity and the State; • Disseminate this research on an international stage and reshape disciplinary agendas in significant ways; • Use this research to promote social justice and environmental sustainability through engagement with academics, policy-makers and other stakeholders; • Engender a workplace and learning culture that facilitates excellence and promotes diversity and equality for postgraduate students and staff; • Sustain innovation in our research by training postgraduate students and supporting postdoctoral researchers so they become the research leaders of tomorrow. <p>2. Underpinning Research Strategy: To achieve these aims we pursued a coherent strategy designed to produce a vibrant, supportive research environment where individual and collective thought flourishes. This strategy, and evidence of its achievement, is to:</p> <p>i. Attract increased funding for original, significant and rigorous geographical research. Research income has increased year on year during the REF cycle to a total of £2.38M. Since RAE2008 our annual research grant and contract income has increased by 224% to £477k/yr. RCUK income, in particular, has risen from £83k/yr to £252k/yr (Section D and REF4).</p> <p>ii. Disseminate excellent research widely and reshape intellectual agendas through high-impact publications, conferences and leadership roles. We have published >450 refereed articles in high-quality journals including <i>Science</i> and <i>Transactions of the Institute of British Geographers (TIBG)</i>. The Unit hosted 7 international conferences in Loughborough, organised/co-organised 10 other international conferences and convened 80 conference sessions. Staff held editorial posts on 25 international journals and key leadership roles in the discipline (Section E).</p> <p>iii. Promote the social and environmental benefits of our work. We have collaborated with industry (e.g. Acclimatise, Anglian Water, EDF), charities (e.g. Leverhulme Trust, Nuffield Foundation, The Royal Society, WWF), local and national government (e.g. Home Office, Environment Agency, local authorities) and international agencies (e.g. EU, UN International Fund for Agricultural Development, World Bank), and our research has impacts on the environment; on</p>

Environment template (REF5)

practitioner activities and professional services; and on public policy (Section D and REF3).

iv. Develop the infrastructure required for world-class research. In the current REF cycle, the Unit benefitted from dedicated research laboratories funded by £1M from HEFCE SRIF/CIF, as well as new infrastructural developments including the installation of long-term scientific monitoring sites, and a digital laboratory for ground-breaking forms of qualitative analysis (Section D).

v. Provide an organisational environment that nurtures excellence. LU is a research-intensive institution and its research strategies, planning and support underpin our work (Section D). Within the Unit, the Research Committee co-ordinates research strategy, attainment monitoring, Personal Research Planning, the allocation of internal funding, postgraduate planning, and vibrant research seminars (Section C).

vi. Develop our human capital. Since 2008 the Unit has grown from 25.0 to 30.2 fte staff through strategic appointments; contract research staff numbers have also increased (from 2 to 8 fte). Staff development is underpinned by excellent probation arrangements, mentoring, support for funding applications, promotions and a robust approach to equality issues (Section C1). Our postgraduate training promotes sustainability by nurturing the next generation of research leaders (Section C2).

3. Intellectual Research Strategy: This strategy underpinned the Unit's ability to pursue our innovative intellectual agendas in physical and human geography.

i. Physical Geography research has been reorganised into the *Centre for Hydrological and Ecosystem Science (CHES)* and *Polar and Alpine Research Centre (PARC)*. This was achieved by supporting the intellectual development of 5 early career researchers returned in RAE2008 (Evans, Graham, Millett, Ryves, Yu) and 3 strategic appointments (Hillier, K. Mills, Wilby).

CHES has its roots in the RAE2008 *Ecological and Hydrological Processes* research cluster and is now a multi-disciplinary centre with core interests in monitoring, modelling and managing hydrological and ecological systems. **CHES** advances understanding of: (a) hydroclimatic modelling and water management under changing climates (Dawson, Wilby, Yu); (b) ecological and hydrological processes involved in the maintenance and functioning of healthy ecosystems (K. Mills, Ryves, Wood); and (c) geomorphological processes that shape fluvial and terrestrial environments (Reid, Rendell, Rice). **CHES** has attracted funding from NERC, EPSRC, EUFP7 and Leverhulme Trust and its geographical reach includes temperate (UK, Canada), tropical (Uganda, Puerto Rico), and arid (Australia, Israel) environments. We have shaped the emerging field of ecohydraulics by hosting dedicated conferences, and through the publication of a special issue of *River Research and Applications* (Rice, Wood) and the first research-level edited text in the field (Wood). Intellectual debates in water management and environmental flows have been influenced by **CHES** articles in *Hydrological Processes*, *Journal of Hydrology*, *Sedimentology* and *Water Resources Research*, and by hosting British Hydrological Society meetings and the Peter Wolf Early Career Hydrologists' Conference (Section E3). Researchers in **CHES** (Wilby, Wood) have directly informed the development and implementation of EU Water Framework Directive standards for the abstraction of water and to protect in-stream flow needs (REF3b). **CHES** undertakes a substantial (>£250k) volume of research commissioned by and/or in collaboration with industrial, governmental and non-governmental partners (e.g. Defra, DfID, Environment Agency, Natural England, World Bank, WWF and water utility companies (Section E2)).

PARC is at the forefront of research into: (a) nutrient and sediment cycling (Anderson, Millett); (b) the hydrology, geomorphology and sedimentology of glaciers and glacierised catchments (Evans, Graham, Hodgkins); and (c) Holocene and Quaternary environmental change in polar and alpine regions (Anderson, Graham). Fieldwork is conducted in the Arctic (Iceland, Greenland, Svalbard), Antarctic and alpine areas (SW China). **PARC** has been instrumental in developing novel hypotheses concerning the drivers of ecological change in the Arctic, including the role of atmospheric reactive nitrogen deposition and the role of lakes in carbon sequestration (Anderson). It has also played a significant role quantifying the hydrological functioning of Arctic glacierised catchments, including its influence on biogeochemical cycling; this has revealed the first evidence of microbially-mediated processes in subglacial environments, with implications for the future exploration of ice-sheet subglacial lakes (Hodgkins). **PARC** research is sustained through awards from NERC and The Royal Society. Success in disseminating original research on the international

Environment template (REF5)

academic stage is evidenced by publications in *Journal of Geophysical Research*, *Journal of Hydrology*, *Nature Geoscience*, *Proceedings of the National Academy of Sciences (PNAS)*, *Quaternary Science Reviews* and *Science*. *PARC* also shapes intellectual research agendas through conference organisation and leadership roles; its researchers hosted the International Polar Network Workshop (2010) and International Glaciological Society British Conference (2013).

All physical geographers contribute to these two Centres; some also conduct research on other topics. These include aeolian processes and dune conservation management in temperate coastal and sub-tropical continental environments (Bullard, Millett, Rendell), submarine geomorphic processes (Evans, Hillier), and forest and plant ecology (Millett). This research has been funded by AHRC, British Academy, British Ecological Society, and National Geographic; hosted events associated with these interests include the INQUA North African Dust Workshop (2013).

ii. New and Developing Initiatives in Physical Geography: Strategically important new initiatives in **CHES** include two long-term monitoring projects focusing on interactions among physical and biological systems (Section D). The first is the Loughborough University Temperature Network (LUTEN: Wilby) that will be used to develop ways of predicting spatial and temporal variations in the thermal regime of rivers from meteorological, riparian and catchment properties. LUTEN has generated £79k of support. It aligns with the Environment Agency's 'Keeping Rivers Cool' project and The Rivers Trust's focus on changing invertebrate phenology, and will enable the testing of practical solutions for adapting freshwater ecosystems to climate change. Second, in 2012 the University invested £42k to develop the Loughborough University Research Forest (LURF: Millett) that will be used to monitor the impacts of *Chalara fraxinea* (Ash) dieback in an established forest. The sustainability and vitality of the **CHES** and **PARC** units are supported by new RCUK grants (starting 2013) on the role of cyanobacterial crusts in landscape stability (£386k: Bullard) and organic carbon cycling in Arctic lakes (£151k: Anderson) and by the recent award of a NERC Doctoral Training Partnership to the CENTA consortium involving Loughborough. University support for interdisciplinary research is exemplified by a new collaboration with engineering to develop an autonomous unmanned aircraft system (UAS) for the collection of high-resolution topographic data; our first joint project will test the UAS in the Arctic in 2014 (Bullard, Graham). This collaboration with engineering will expand as part of a university-wide "Changing Environments and Infrastructure" research theme, one of six for LU from 2014.

iii. Priority Development Areas in Physical Geography: Aligned with the emerging projects detailed above, a priority development area for **CHES** is researching 'life and its landscape'. We will focus on: (a) ecosystem engineering in fluvial and terrestrial environments (e.g. using outputs from LUTEN); and (b) the importance of environmental flows for maintaining hydrological, geomorphological and ecological diversity. This research will contribute to issues of environmental sustainability and security with the outcomes of value to science, industry and wider communities. Within **PARC** the priority is inter-disciplinary research on biogeochemical and sediment transfer processes amongst terrestrial, marine, lacustrine, cryospheric and atmospheric systems. This will include: (a) integrated catchment scale research to improve understanding of the spatial and temporal variability of C, N and sediment fluxes in the Arctic; (b) the implications of altered terrestrial C and N fluxes for regional element budgets, their upscaling and feedback into the climate system; and (c) understanding ecological and environmental responses to stresses such as deglaciation, permafrost melting, shifting land cover and climate change at a range of spatial and temporal scales. Anticipated funding streams include building on recent RCUK successes and collaboration with industry and other users. Our on-going commitment to the co-production of knowledge with public, private and third sector partners will ensure that our research informs local to global scale environmental management.

iv. Human Geography: Research in human geography has been restructured into two groups: *Children, Youth and Families (CYF)* and *Migration, Identity and the State (MIS)*. This development in our research direction has been facilitated by the nurturing and academic development of scholars within the Unit, and targeted investment in outstanding new talent including 8 strategic appointments (compared with 2 retirements and 3 moves elsewhere).

CYF builds upon Loughborough's longstanding reputation for forging innovative research agendas in Children's Geographies (Holloway, Hoyer, Jöns). The group has been strengthened since 2008 through specialist appointments (Blazek, Gough, Holt, S. Mills, Pimlott-Wilson, Smith) to create the

Environment template (REF5)

leading international centre in this field. Our key contribution has been to forge new geographies of education informed by wider intellectual debates about children, youth and families. These geographies of education consider the importance of spatiality in the production, consumption and implications of formal education systems and of informal learning environments. Our theoretically-informed research demonstrates the importance of: (a) neoliberal policy localisation, social reproduction and difference in schools (Holloway, Holt, Pimlott-Wilson); (b) student and academic mobility in a globalising higher education system (Jöns, Holloway, Hoyler); (c) educational institutions' impacts on their environs through studentification (REF3b)(Smith); and (d) informal learning and public spaces' roles in the shaping of citizen-subjects (Blazek, Gough, S. Mills). This leadership in geographies of education is underpinned by our broader internationally-recognised contributions to research about children, youth and families, including debates on: (a) emotion, subjection and power (Blazek, Holt); and (b) employment, work-life balance and leisure practices (Blazek, Gough, Holloway, S. Mills, Pimlott-Wilson). Having this multiplicity of approaches adds vitality to our research environment, provides important synergies, and ensures the sustainability of our research agendas by stimulating new ideas. Together, we have shaped intellectual agendas by founding and hosting the 'Triennial International Conference on Geographies of Education' (2009, 2012) and through guest editing virtual/special issues of journals (e.g. 'Geographies of Education' *TIBG*; 'Student Geographies' *Environment and Planning A (EPA)*; 'Youth Mobilities' *Urban Studies*; 'Spatialities and Mobilities of Childhood and Youth Populations' *Population, Space and Place*).

MIS is a new development during the REF cycle, with strategic appointments (Antonsich, Matejskova, Smith) being made to complement existing expertise (Bell, Brown, Harrison, Holloway, Hoyler, Jöns, Mavroudi). The group builds on to **CYF** through its groundbreaking work on young people's and family migration, which highlights the importance of education, ethnicity, gender and urban/rural differentiation (Holloway, Gough, Jöns, Smith). More broadly, our research on migration demonstrates the interconnections between identity, citizenship and the changing role of the state in a post-national context (Antonsich, Matejskova; Mavroudi). States' responses to the challenges of reconfiguring boundaries in a hyper-mobile world have been explored through interdisciplinary work on aeromobiliites, disease and the state (Bell, with LU colleagues through the Health and Life Sciences Research School). Our innovative approach to state and non-state spatialities has advanced conceptual understandings of urban and regional geographies in globalisation (Harrison, Hoyler), and the role of institutional actors in shaping global space economies (Brown, Hoyler). **MIS** has led intellectual developments by: founding the Biennial British-Irish Population Geographies conference (2010, 2012); co/organising international conferences (e.g. *Rethorising Migration* (2009); *Britain on the Move* (2012); *Regional Studies Association* (2011-13)). Edited special issues include: 'Youth Migration' *Children's Geographies*; 'New State Spatialities' *Antipode*; 'City-Region Governance' *Urban Studies*. We host the Globalisation and World Cities (GaWC) network, the world-leading academic think-tank on cities in globalisation, whose website receives c. 35,000 hits per annum from >150 countries.

Research in **CYF** and **MIS** has been funded by the AHRC, British Academy, EPSRC, ESRC, ESRC/DFID, EUFP7, Institute of Historical Research, Leverhulme Trust, RGS-IBG and co-produced through engagement with stake-holders such as local and central government.

v. New and Developing Initiatives in Human Geography: Key developing initiatives in **CYF** include extending our research in geographies of education by analysing the links between family and community context, formal and informal learning, and the geographies of work. New ventures include current research into intergenerational work cultures in austerity Britain (£216k, BA, Pimlott-Wilson); European graduate employability (£50k, EU-FP7, Jöns); and mobility and poverty reduction in African livelihood strategies (£217k, EU-FP7, Gough). In **MIS**, state and non-state actors' roles in sustainable energy solutions are a crucial emerging area of interest. Developments have been led by Brown in his roles as Deputy Director of the LU Sustainability Research School and co-ordinator of the EPSRC/DECC-funded Low Carbon Energy for Development Network. This focus will be carried forward into the next REF through 3 recent EPSRC grants (£571k; starting 2013) on the impacts of decentralization on energy governance in Africa (Brown, Harrison), and the development of community-based solar nano-grids in Bangladesh and Kenya (Brown). These EPSRC grants include extensive engagement with African and Asian non-governmental organisations and the private sector (e.g. GAMOS Ltd; Grameen Shakti; INTASAVE Kenya). Developing work on state involvement in energy security also links human and physical geography

Environment template (REF5)

within the Unit (e.g. Wilby's work on climate risks and nuclear power infrastructure).

vi. Priority Development Areas in Human Geography: Building upon and extending the new initiatives, in **CYF** we will: (a) push the boundaries of research in geographies of education by analysing in/formal learning, employability and work cultures in the Global North and South; (b) examine new geographies of higher education, including its changing global formations, historical and contemporary regionalisation, and impacts on localities; and (c) explore the impact of state, business and third-sector intervention in young people's and families' lives, for example through a focus on childcare, enrichment activities, youth work, and parenting education. Taken together, these research foci will allow us to critique neoliberal policy debates about: the boundaries between family and state responsibilities for social reproduction; skills acquisition, employability and youth/adult independence; and, citizen-subjects, economic security, and societal engagement. **MIS** will forge new understandings of: (a) migration, citizenship and its impact on post-national identities and notions of belonging; (b) migration, state regulation (e.g. visas) and resources (e.g. land); and (c) new state/non-state formations, and their implications for social and environmental futures. **CYF** and **MIS** agendas will be resourced through the recently secured funding identified above and by our active grant acquisition strategy (Section D), and shaped by our commitment to the co-production of knowledge through our engagement with public, private and third sector organisations, which allows us to maximise the social and environmental benefits of our research. From 2014, LU's focus on six themes – including 'Culture, communication and citizenship' and 'Energy' – will direct institutional support towards our key research foci.

c. People:

1. Staffing strategy and staff development

i. Staffing strategy and profile: The appointment of excellent researchers to complement and extend existing expertise is at the core of our staffing strategy. During the assessment period we responded to retirements and other staff movements by making appointments in human geography at reader level (Gough, Smith) and at lecturer level (Antonsich, Holt, S. Mills, Pimlott-Wilson). We also took advantage of the British Academy fellowships (see below) to appoint Blazek and Matejskova. In physical geography the strategic appointment of a Chair (Wilby) and a lecturer (Hillier) further strengthened both **CHES** and **PARC**. Anderson's 2012-13 Chinese Academy of Sciences (CAS) Visiting Professorship in Nanjing facilitated the fixed-term appointment of K. Mills. In line with our strategic aims (Section B), the function of all these appointments has been to enhance dynamism, build capacity and provide for succession planning, ensuring that our research themes are sustainable and that the Unit's profile remains diverse in terms of age structure (age 25-34 = 7 fte; 35-44 = 10 fte; 45-54 = 10 fte; 55-65+ = 3.2 fte), gender (M = 18.2 fte; F = 12 fte) and country of origin (UK = 24.2 fte; non-UK = 6 fte). Internal promotions have included: Harrison, Holt, Hoyler and Jöns to senior lectureships; Wood to readership; Bullard, Gough, Holloway, Rice and Smith to professorships. Supporting these staff developments are full-time contract research staff (8 at the REF census date) and postgraduate research students (see C2).

ii. Prestigious/competitive personal research fellowships: The receipt of a Royal Society Wolfson Merit Award (2013-2018) by Anderson, in addition to his CAS Visiting Professorship, recognises his outstanding contribution to the understanding of global environmental change impacts on remote lakes. Holloway's British Academy Mid-Career Fellowship (2012) acknowledges her ground-breaking contribution to Geographies of Education, and has been designated an 'exemplary award' for leadership in the use of rigorous research methods. Holloway also became an Academician of the Social Sciences (2013). The award of a British Academy Postdoctoral Fellowship to Pimlott-Wilson (2012-2014), who was previously a PDRA in the Unit, reflects our commitment to nurturing research staff at the same time as it drives **CYF** forward.

iii. Staff equality, development and integrity: Equality of opportunity is embedded within the culture of LU. We implemented the *Concordat to support the Career Development of Researchers* in 2010 (e.g. introducing mentoring for post-doctoral researchers, ensuring 2 ESRC-funded PDRA's maternity leaves). Our early career researchers have benefited from the University's exemplary probationary training for new lecturers, with teaching loads reduced to the equivalent of 0.25 fte, 0.5 fte and 0.75 fte during the 3 years of probation. All staff benefit from study leave

Environment template (REF5)

arrangements. Leave is also accrued by part-time staff and is not affected by maternity leave. The expectation is for one semester's leave after every eight semesters and there have been 17 semesters of study leave during the REF cycle. Mentoring arrangements are put in place for all new staff and all staff produce annual Personal Research Plans (PRPs). The PRP process embeds research in the University's performance monitoring and reward systems. Health, safety and ethical standards are rigorously monitored; all research is subject to risk assessment and any research involving human participants is reviewed internally and subject to the approval of the University's Ethics Approvals Sub-Committee. Our authorship policy ensures that diverse contributions to research are recognised in written outputs and we are seeking to maximise our open access publications in journals and develop use of the institutional repository.

2. Research students

i. Growth in numbers: The vitality of our Postgraduate Research (PGR) community is evidenced by 35 successful PhD completions (compared with 18 in RAE2008) and a current (31/7/13) PGR cohort of 21 students. This growth has been underpinned by our strategic commitment to world-class infrastructure, with enhanced laboratory provision increasing opportunities for doctoral research, and by awards from HEA, NERC, EPSRC and pro-active engagement with state, commercial and third-sector stakeholders (e.g. Anglian Water, Environment Agency, Extreme World Racing, Paragon Law)(Sections B and D).

ii. Training and research environment: Core PGR student training and development is provided centrally by the LU Graduate School offering a comprehensive programme that is mapped onto the Joint Skills Statement and the Research Development Framework. The Loughborough Skills Matrix for PGRs, and the effective monitoring of students through it, was commended as good practice in our 2012 QAA Institutional Review. Discipline-specific training is provided by a formal collaborative Midlands Consortium Training Programme (with Geography at Nottingham and Leicester) for physical geographers and via a collaborative link with Leicester for human geographers. The Unit provides funding from its budget to support attendance at conferences and fieldwork/analytical costs. In addition, where appropriate, our PGR students are encouraged to apply to internal (e.g. LU Graduate School) and external funding sources. During the review period our PGR students were awarded £45k including £36k from external competitive sources such as the British Hydrological Society, Quaternary Research Association, RGS-IBG, Barbel Society, and National Maritime Museum. Both Geography sub-disciplines run regular research seminars with presentations by external visitors, Unit staff and PGR students, as well as discussions of papers, grant proposals and funding opportunities. In addition, there is an annual PGR Conference when first and final year PGR students present their work. Our PGR student group has been proactive in organising national conferences at Loughborough, including: 'All At Sea? - Synergies between past and present coastal processes and ecology' (2010); 'Polar and Alpine Research Conference' (2010); and 'POPFEST Conference' (2012). They have also competitively secured the right to host the next RGS-IBG mid-term conference (2014).

iii. Supervision, progress and employability: Students are allocated two supervisors with appropriate expertise, and a Director of Research Degree Programme who has an overview of the supervisory arrangements. All category A staff act as PGR supervisors and our system of having two supervisors allows for the induction of early career staff into the supervisory process. Progress is monitored through regular supervisory meetings (LU minimum 12 p.a.) and written records of these meetings are maintained by the Unit. A review is held at the end of each year and students must produce a significant piece of written work and undertake an interview with an independent assessor before being permitted to progress. Quality assurance of research degree programmes is provided, at the institutional level, by the Dean of the Graduate School, who is responsible for considering and approving a range of research student business from admissions to examinations, thereby ensuring consistent and equitable treatment. The University Careers and Employability Centre provides a specialist service for PGR students and also organises an annual event for doctoral students to meet and network with employers. Preparation for an academic career is enhanced through personalised guidance on: writing research bids and academic papers; and integration into professional networks (e.g. PGR student Balsdon is currently Chair of RGS-IBG Postgraduate Forum). PGR students are also offered training in teaching and, subsequently, opportunities to gain subject-specific experience of demonstrating on a number of modules with

Environment template (REF5)

practical components, including fieldclasses. Our PhD graduates during the REF period are authors on 113 journal papers; 56% of them have obtained posts in HEIs and 39% have found professional employment (e.g. Environment Agency, Wessex Archaeology, African/Asian NGOs).

d. Income, infrastructure and facilities

1. Research funding: Total research grant and contract income for the financial years 2008-9 to 2012-13 exceeds £2.38M and represents a 224% increase in the annual amount compared to the period of RAE2008. Despite financial constraints at the national level, our research income has continued to grow, vindicating our strategy for attracting research income and sustaining research successes. We have seen a significant increase in RCUK income (from £83k/yr to £252k/yr) and research support 'in kind' from NERC has risen from £13k to £375k. Examples of prestigious awards include: 3 NERC standard grants to Anderson for work on Arctic Lakes; NERC and EU grants to Rice for experimental work on gravel-bedded rivers; ESRC(&DFID) awards to Gough (urbanisation), Holloway (primary education), Holt (disability and education), and Hoyler (city connectivity); and three EPSRC grants to Brown/Harrison on sustainable energy solutions (see also prestigious research fellowships in Section C). This type of funding has led to high quality outputs, for example: Anderson in *PNAS* and *Nature Geosciences*, and Holloway in *TIBG*. Income from research with stakeholders has exceeded £304k during the review period and this too produces academically excellent outputs. Examples include: Smith in *EPA* and *TIBG*; Wilby in *Science of the Total Environment* and *Water Resources Research*. As a Unit we recognise that, in some instances, intellectually outstanding outputs can emerge without substantive funding. Examples include: Bell in *TIBG*; Bullard/Hodgkins in *Science*; and Ryves in *Science*.

2. Strategies for generating grant income: Staff are alerted to funding opportunities through weekly emails from the Associate Dean for Research (ADR-Wilby), with personalised information delivered via COS and searchable using ProQuest. The submission of funding proposals is encouraged and monitored through PRPs, with Research Committee, the ADR, and interdisciplinary research schools facilitating the development of consortia within the Unit and across the institution. Dedicated time for research is allocated via an equitable and transparent work-load model. Pump-priming monies are provided (>£250k since 2008), with preference given to early career researchers. Applications benefit from an internal review process within the Unit, which finesses applications, and from expertise provided by the Research Office. This collective approach to disseminating good practice is underpinned by Unit staffs' valuable experience as panel members (e.g. AHRC, NERC, NSF), and as reviewers for UK (e.g. AHRC, ESRC, Leverhulme Trust, NERC) and overseas funding bodies (e.g. Australia, Austria, Canada, Czech Republic, Finland, Germany, Israel, Norway, Portugal, USA). In addition, the Unit has a clear strategy and dedicated support mechanisms which underpin our growing income from enterprising scholarship (REF3a).

3. Infrastructure for a dynamic research environment: In 2007 we completed £1M of HEFCE SRIF/CIF-funded enhancements to our research facilities including new analytical and microscope laboratories, a cold room for core and sample storage and a major upgrade to our flume facilities. The impact of this enhancement has been evident during this REF cycle via increased RCUK income (8 NERC grants totalling £1.14 million) and 11 laboratory-based PhD awards. In addition to £258k of capital equipment purchased as part of these RCUK-funded successes, the Unit has ring-fenced £20k of its annual budget for competitive equipment bids to support field- and laboratory-based research. For example, £16k has been invested in portable spectroradiometry equipment for use in: tracking sediment plumes in glacier-fed fjords in Iceland and Svalbard; and examining the impact of local Nitrogen deposition on photosynthetic pigmentation in carnivorous plants. Successful additional capital equipment bids to the University include £79k for a Mobile Environmental Survey Unit, and £53k for Environmental Magnetics equipment. Support is underpinned by 3 laboratory technical staff and an IT/Cartographic technician.

This REF cycle has also seen strategic investment in four key infrastructural developments, two of which will sustain long-term monitoring projects (Section B). First, Wilby has established LUTEN, a dense array of air and water temperature monitoring sites in the English Peak District (£79k investment). Second, LURF has been founded and comprises 16 ha of woodlands owned by the University in which we have established 12 x 0.25 ha permanent plots that are regularly monitored

to examine changes in forest structure and the dynamics of the N- and C-cycles. Third, Loughborough Qualitative Digital Research Laboratory (LiQUiD Lab) has been launched. This collaborative project among Social Sciences, Geography, and Sport, Exercise and Health Sciences funded by £41k from the University supports engagement with the new wave of innovative approaches to qualitative research such as visual and sensory methodologies. Finally, the Unit has reorganised its cartographic and IT facilities to provide a dedicated Geospatial laboratory with high performance workstations and facilities for geospatial image analysis and digital photogrammetry. All staff and PGR students have an individual desk, PC with specialist software and library access.

e. Collaboration or contribution to the discipline or research base

1. National, international and interdisciplinary academic collaborations: Researchers in the Unit lead academic agendas on: 'Hydrological and Ecosystem Science'; 'Polar and Alpine Research'; 'Children Youth and Families'; and have a developing profile in 'Migration, Identity and the State' (Section B and REF3). We have contributed to the wider research base by collaborating at the local, national and international level, as exemplified by the publications submitted in REF2. Over 33% of these are jointly written with other UK authors, a further 17% are joint with both UK and international collaborators and an additional 20% joint with international collaborators (from Australia, Belgium, Brazil, Canada, Chile, China, Denmark, France, Germany, Iceland, Israel, Italy, Malaysia, Netherlands, Nicaragua, New Zealand, Sweden, South Africa, Uganda and USA). These collaborations are sustained by visiting fellowships (e.g. Bullard to Griffith University (Australia); Mavroudi to Australian National University (Australia); Reid to Ben-Gurion University (Israel); Smith to Peking University (China), Wilby to University of Melbourne (Australia) and the National Center for Atmospheric Research (USA)), by travel grants (e.g. Royal Society to Hodgkins) and by current joint research grants (e.g. EUFP7 awards with Copenhagen, Hull and Liverpool; Leverhulme awards with Belfast and Copenhagen). Many collaborations extend beyond disciplinary boundaries to include sociology, education (*CYF*), management, planning, urban studies (*MIS*), atmospheric sciences, biosciences, geosciences, science-based archaeology and engineering (*CHES*, *PARC*). Of our REF2 publications, 40% are co-authored with non-geographers.

2. Collaborations beyond academia which enrich our research environment: Our strategic commitment to engaging with stakeholders allows us to maximize the impact of our work (REF3). These collaborations also enhance our investigative capabilities and enrich our research environment by providing access to data, equipment, placements, professional introductions, training and practitioner/public perspectives on our research questions. In physical geography, collaborations with water authorities (Anglian, Wessex, Thames) have allowed access to proprietary data sets on water use and quality indicators in the UK (Wilby, Wood). We have 2 PGR students co-funded by the Environment Agency and have also benefitted from their technical support, equipment loans, data and training (Rice, Wood). Natural England have provided data sets and access to managed and protected sites (e.g. Ainsdale, Saltfleetby-Theddlethorpe, Rostherne and Tatton Meres)(Millett, Bullard, Ryves, Wood). A Natural England placement enabled a PGR student to experience how EU and government policy was implemented at the local and national scale. Overseas, we collaborate with the Israel Water Authority and Besor Shiqma Drainage Authority who maintain our research monitoring stations (Reid). Restricted datasets and equipment have also been provided by The Australian Nuclear Science and Technology Organisation (K. Mills), Geological Survey of Denmark and Greenland (Anderson, Ryves) and Global Safety Co. Ltd, China (Yu). In human geography, we have benefited from access to school census data, student addresses and accommodation details from Charnwood Borough Council, residents' groups and Unipol Student Homes (Smith). Collaboration with the Leicester Masaya Link Group has facilitated access local governments in Nicaragua which has enabled the development of projects such as the Energy Central EU/FCO-funded project on the role of local governments in promoting renewables in Central America (Brown). Other collaborations providing access to data and equipment include: Department of Transport (Olympic legacy data: Harrison); the European Playwork Association, Dynamo International and International Organization for Migration (Blazek).

3. Making space for academic discussion: The Unit develops disciplinary agendas through conference organisation and editorial work. We have hosted 2 conferences on the Geographies of

Environment template (REF5)

Education (2009, 2012; 80 delegates from 16 countries and 10 disciplines in 2012), and we continue to lead and co-ordinate the International Conference on Children's Geographies. Geography hosted UK meetings of the British Hydrological Society in 2008 (>100 delegates from UK, Europe and North America) and 2013 (>65 delegates from >20 organisations), the 'Peter Wolf Early Career Hydrologists' Conference 2011 (60 delegates from 4 countries) and the International Glaciological Society British Meeting in 2013 (69 delegates from 9 countries). In total, the Unit's staff have organised/co-organised 17 international conferences during the review period, convened 80 themed conference sessions including 29 at the annual RGS-IBG Conference, 21 at the Association of American Geographers conferences and 11 at the European Geophysical Union; and given 50 keynote addresses. The Unit's PGR students also hosted 3 conferences at LU (C2).

Journal editorial responsibilities during the current REF cycle include: editor-in-chief of *Sedimentology*; associate/co-editor of: *Area*; *Climate Research*; *Earth Surface Processes and Landforms*; *European J. Phycology*; *Geografiska Annaler: Series A.*; *Hydrological Science J.*; *International Development Planning Review*; *International J. Climatology*; *Regional Studies*; *TIBG*; and roles on the editorial boards of both English-language and non-Anglophone journals: *Children's Geographies*; *Cave and Karst Science*; *Ecologyhydrology*; *Fennia: International J. Geography*; *Geomorphology*; *J. Global Entrepreneurship*; *J. Paleolimnology*; *J. Rural Studies*; *Limes: Rivista Italiana di Geopolitica*; *Raumforschung und Raumordnung*; *River Research and Applications*; *Singapore J. Tropical Geography*; *Social and Cultural Geography*; and *Social Geography*. Loughborough geographers have also guest edited 28 Special Journal Issues (e.g. in *Antipode*; *Earth Surface Processes and Landforms*; *River Research and Urban Studies*) and agenda-setting book series have been edited for Routledge (*Key Ideas in Geography*) and Wiley (*RGS-IBG Book Series*).

4. Learned societies and disciplinary initiatives: Since 2008 members of the Unit have served on the RGS-IBG Research Committee, and the Research Groups Sub-Committee, shaping disciplinary strategy and direction. We have played leading roles as Chairs, Treasurers and Secretaries of 6 RGS-IBG Research Group Committees (British Society for Geomorphology; Children, Youth and Families; History and Philosophy; Population Geography; Rural Geography; Social and Cultural Geography). Our contribution extends into cognate disciplinary organisations e.g. as chair/vice-chair/treasurer/secretary for: Committee of the International Conferences on Geographies of Children, Youth and Families; Cryospheric Sciences Division of the European Geosciences Union; EDF/British Energy Climate Change Working Group; International Society for Aeolian Research; International Glaciology Society British Branch; International Society for Diatom Research; IGU Commission for Population Studies; and Committees for International Population Geographies Conference and British-Irish Population Geographies Conference. In terms of wider disciplinary initiatives, human geographers were invited to participate in the ESRC International Benchmarking Review (Development and Population Geographies), while physical geographers participated in Palaeo50 (a discipline initiative designed to identify the 50 most pressing questions in palaeoecology). One early career researcher, K. Mills, benefited from a competitive PAGES (Past Global Changes) initiative designed to develop the skills and networks of young scientists.

5. PGR training and research-based continuing professional development (CPD): We co-operate with local HEIs for PGR training (Section C). The Unit also delivers research-based CPD to academics, PGR students and practitioners in the UK and overseas to disseminate the impact of our knowledge development and methodological innovations. Wilby and Dawson delivered training in the UK and overseas (Bangladesh, Canada, China, Tunisia) on using the Statistical Downscaling Model for assessing local climate change impacts (REF3b). PARC researchers ran workshops on glacier hydrological modeling, offshore fieldwork and marine geophysics and geology for the UK Polar Network (Hodgkins, Evans). Research-based CPD training has also been delivered on water and climate at the National Center for Atmospheric Research (Wilby). Rice and Bullard ran training sessions on authoring and reviewing scientific papers in Australia, China, Ireland and the UK. An international knowledge transfer event, chaired by Brown, on Sustainability Solutions for SMEs was attended by experts from across the world. Workshops on inter-city collaboration and networking were co-organised in Abu Dhabi (Harrison, Hoyler, Jöns) and Dublin (Hoyler) for politicians, public servants, business leaders and researchers. Blazek co-organised 3 European knowledge transfer workshops about youth, community research and development.