Institution: University of Cambridge

Unit of Assessment: C17 Department of Geography

a. Overview

In RAE 2008, this Department was ranked joint first. Our core aim is to sustain this position by enabling some of the finest and most promising scholars in Geography to address challenging questions in innovative ways that make a difference. To that end, we have consolidated our claims to distinction, developing and supporting world-leading research (5b), building strong intellectual collaborations within and beyond the University (5e), and prioritising critical engagement with institutions outside the academy (REF3a). We have steered change strategically, building on existing strengths while matching new appointments to emergent research agendas (5c).

To achieve our strategic vision, we have thoroughly reviewed our research groupings, creating a porous structure in which diverse intellectual traditions combine to shape the cutting edge. Research active individuals, specialist smaller groups, and centres of excellence are now accommodated within 5 broad thematic groups: *Contested Political Economies*; *Population, Health and Histories*; *Natures, Cultures, Knowledges; Environmental Systems and Processes*; and *Glacial and Quaternary Science* (5b). As befits a large, flourishing Geography department, these groups embrace the full sweep of the social and environmental sciences.

We operate in a competitive research environment and a global academic labour market. High priority is attached to attracting and retaining staff, postdoctoral researchers, and graduates of the highest calibre (5c). We offer an inclusive management structure, first-rate infrastructural provision (5d), and a research strategy that nurtures creativity and promotes excellence (5b). All this, set within a leading international university, ensures the vitality and sustainability of our world-class research environment. Supported thus, our scholars make major contributions to the discipline, to interdisciplinary scholarship, and to the academy as a whole, as indicated in the award of honours and prizes, elections and other markers of distinction (5e).

b. Research strategy

The Department attaches high priority to the development and implementation of a strategic vision for research. This is advanced through the work of 5 thematic groups that are structured to consolidate and build from areas of historic strength; forge new connections through interdisciplinary dialogue; define and occupy the intellectual cutting edge; and increase the reach of our research into the worlds of policy, practice and lived experience. The groups' agendas and achievements (set out in 5b,vi) are shaped, managed and monitored through 6 key drivers:

i. An active Research Policy Committee (RPC) oversees the development and implementation of research strategy, allocates resources, identifies funding opportunities, and monitors progress. Chaired by the Director of Research, and including thematic group convenors, centre directors, the Head of Department, and research staff, RPC meets 6 times a year. It maintains, promotes and supports excellence at the highest level by cultivating a well-resourced, inclusive intellectual environment, which fosters the active engagement of researchers at all stages of their careers. Interacting with the Department's Management Group, which runs affairs on a day to day basis, and Planning and Resources Committee, dealing with longer-term priorities and needs, RPC influences cross-departmental activities and staffing decisions (5c), thereby strengthening leadership and adding momentum to thematic groups and centres.

ii. Managed evolution of thematic groupings. Since RAE 2008, a managed shift in the organisation of research agendas and practices has turned discrete clusters into more open thematic groups. In areas of historic strength and continued vibrancy, a priority was to carry momentum forward into the new structure: *Environmental Systems and Processes* (ESP) and *Glacial and Quaternary Science* (GQS) are cases in point. Elsewhere, a mix of evolving interests and strategic responses to staff turnover have inspired new combinations: *Natures, Cultures, Knowledges* (NCK) exploits synergies between an established focus on human-environment relations and new expertise on the cultures and politics of knowledge; *Population, Health and Histories* (PPH) brings contemporary insights on health, regulation and social control together with long-standing contributions to historical demography; and *Contested Political Economies* (CPE) combines research strengths in economic and political geography, transcending artificial analytical divides between the developed and developing worlds. The new structure embraces 3 centres of excellence: the Department's renowned Scott Polar Research Institute (SPRI), led by Dowdeswell

and conducting research on the polar regions within GQS and NCK; the Cambridge Group for the History of Population and Social Structure (CamPop), involving geographers and historians, with its distinctive demographic work fitting into PHH; and the University's Centre for Gender Studies, led by Browne within Geography, and contributing to CPE and PHH (see 5e). Restructuring our research effort has enabled us to realise the benefits of critical mass, maintain porosity through interdisciplinary work, advance shared agendas, and exploit the connectivity of Geography itself. No group was deemed *a priori* to be exclusively 'human' or 'physical'; several span the discipline. All members of the Department (including postdoctoral researchers and PhD students) belong to at least one thematic group, and about a dozen returned staff associate with more. Collaborative spirit and productivity are enhanced as a result.

iii. An energetic, internationally engaged, research environment. In addition to supportive structures for staff development (5c), steps taken to replenish intellectual energies and allow new ideas to flourish include:

- Devoting new resource to international connectivity. We typically host 10-15 academic visitors each year, as well as the Djerassi Visiting Professors in Gender Studies (eg Sara Ahmed, John Dupré, Cindi Katz, Catharine MacKinnon). We have also created a Distinguished International Fellows Programme, which will enable Professors Nick Blomley, Christopher Field, Diana Liverman and Paul Robbins to visit in 2014. A planned international symposium, *The Shrinking Commons* (September 2014), engages all five thematic groups and their international interdisciplinary networks.
- Stimulating reading/technical skills groups, using the University's online collaboration facility, to encourage synergies among staff, postdoctoral researchers, PhD students and external participants (themes have included Political Ecology, Risk and Resilience, 'Travelling Knowledges', Water, Geographic Information Science, Key Skills in Glaciology).
- Creating a fully *departmental* seminar series of broad intellectual appeal, attracting high-profile speakers who work at the interdisciplinary edge within and beyond Geography, including, in 2012 and 2013, John Agnew, Andrew Barry, Mike Hulme, John Urry and Sarah Whatmore.

iv. Increasing the level and diversity of research funding. The scale and ambition of our research programme are underpinned by a flow of external grant funding. To ensure that this income stream continues to meet our needs, a key objective has been to increase its size and diversity; success on both counts is evidenced in 5d and REF4. The vitality of the funding effort has been boosted by: expanding the departmental research office; engaging in targeted dissemination of funding opportunities; improving mentoring and feedback to staff applying for grants; incentivising success (eg technical support, while available to all staff, is prioritised for grant holders and applicants); and drawing on expertise in University and School research offices. Institutional (University) sources have also contributed to the vitality and sustainability of our research (5d). High amongst our priorities for the next 5 years are increasing robustness by engaging with new funding sources and enhancing responsiveness to large-grant opportunities.

v. Planning for the future. We have identified priority development areas for the medium-to-long term with respect to the research agenda and its governance (5b), its human resource base (5c), and funding and infrastructure (5d). These are integral to the Department's rolling 5-year Strategic Plan. Our goal is to increase the international, interdisciplinary, and inter-sectoral reach of Cambridge geography (5e), whilst attending to the quality and dynamism of local research structures and culture (5b). This underpins the vitality and sustainability of our research agenda.

vi. Advancing the research agenda. Substantively and strategically the Department's research agenda is advanced in the work of the 5 thematic groups, each of which is actively convened and accountable to RPC. The groups are inclusive, and range in size from 13-21 academic staff and postdoctoral researchers, with associated research postgraduates.

1) Contested Political Economies **(CPE)** This group casts new light on the political economy of contemporary global change, fostering conceptual and methodological innovation at the boundaries of economic, political and development geographies. Informed by widespread regional expertise, and supported by c.£1m in grant income in the REF period (eg ESRC, Leverhulme, British Academy, DfID, DfES, Centre for Commonwealth Education, Nuffield, ERC, British Chamber of Commerce), CPE sustains excellence in 3 main areas:

a. *The heterodox economy of markets*. Complementing mainstream economics, this work applies heterodox approaches to various spheres of economic activity to account for the geographies of

markets. Ron Martin's pioneering work in evolutionary economics explains regional variations in resilience; S. Smith researches the role of emotional intelligence and 'welfare switching' in housing markets and mortgage debt; Strauss analyses labour market restructuring and its impact on un-free labour and welfare, forging new connections between political economy, behavioural economics, and feminist theory; and Bennett provides an institutional account of local markets, tracing chambers of commerce since the late C18th; this culminates in a major work (936pp), *Local Business Voice* (Bennett REF2).

b. *Rethinking the political economy of development*. CPE contributes much to the excellence of a field commended in ESRC's Benchmarking Review 2012. Mawdsley's pioneering research on rising powers in international development attracts growing attention (REF3a); Radcliffe's examination of social difference and power contributes substantially to the rethinking of postcolonial development geography; Vira's work on call-centres in India re-casts the developing/developed world distinction in relation to rapid transformations in economy and work; and *Living Terraces in Ethiopia* (Watson REF2) is an extended ethnographic exploration of how development enrols landscapes, livelihoods and culture.

c. *State formation and national recognition*. In this rapidly developing area of CPE research, Bravo draws on Inuit perspectives to rethink the nature of state power and geopolitics in the Arctic. Jeffrey, in his work on post-conflict Bosnia-Herzegovina (REF3a), links state formation with legal process, education for citizenship, and international geopolitics, while Wilcox shows how female suicide bombing challenges conceptions of bounded bodies and bounded states.

In all activities, CPE engages with *the politics of recognition and justice* (REF3a), developing a normative agenda through (eg) Amin's scholarship on the society of strangers, 'telescopic urbanism', and universal infrastructural rights; Browne's on gender inequalities and human rights; and Warrington's on access to education, as mediated by peer pressure, parenting, and location.

The above research and engagement priorities will continue, with planned CPE work focusing on advancing heterodox economic geography (S. Smith), the future city (Amin, Ron Martin), regional resilience and adaptation (Ron Martin), labour in postcolonial development (Radcliffe), international criminal law (Jeffrey), and sovereignty, occupancy and environmental regulation (Bravo).

2) Population, Health & Histories **(PHH)** asks how questions of fertility, mortality, health and disease connect with those of crime, social regulation and political economy. Supported by grants of c.£1.4m in the REF period, from (eg) AHRC, Anova Health Institute, British Academy, ESRC, Leverhulme and Wellcome, the group's research centres on 3 interrelated topics:

a. *Demographic transitions*. Conceptual, methodological and data innovations drive an energetic work programme on: population and economy pre- and post- industrial revolution; historical geographies of life expectancy; household formations and their social/economic correlates; marital fertility and celibacy; and changes in ageing and life extent. Reid, for example, has used advanced data linkage methods to examine the impacts of type/quality of birth provider, and regulation of attendants, on infant mortality in early 20thC Britain.

b. *Geographies of health, disease and mortality*. In this area, Bayliss-Smith links patterns of colonial depopulation in Melanesia to the cultural geography of sexually-transmitted infections; Beckingham documents the coercive medicalisation of drunkenness as physical and moral disease; and Howell examines the policing of venereal disease from domestic and colonial perspectives. Health research also contributes directly to impact: eg Cliff's models of infectious disease transmission in small communities will be applied in new work to refugee camps (Leverhulme) and his *Atlas of Epidemic Britain* (REF 2) was awarded the BMA 2013 Prize for books in Public Health; Tucker's innovative research on men who have sex with men in South African townships has already informed programmes to mitigate the spread of HIV (REF3b).

c. *Geographies of crime and social regulation* are an explicit focus of Nally's novel interpretation of the Great Irish Famine in his major work, *Human Encumbrances* (REF2), and Howell's and Beckingham's work on the interplay between behavioural regulation and stigmatisation of particular groups. Related concerns with demography and crime drive Haining's advanced modelling of spatial data (REF3a), and his collaboration with ESRC's Centre for Research Methods. PHH provides historical comparative work that offers innovative perspectives on contemporary and global concerns, for example, Beckingham's work informs policy debates around 'problem drinking'; he and Howell show how recent proposals for managed sex zones have Victorian parallels; and Nally brings historical research to bear on modern food politics and famine studies

(taken forward with a new Cambridge Humanities Grant).

Momentum will be maintained by new grants and grant applications (eg Wellcome Trust, long-run epidemiological consequences of urbanization, c.£1m, Sept 2013 [R. Smith]); a planned Professorial appointment (5c); and CamPop's 50th Anniversary Conference, planned for 2014.

3) Natures, Cultures, Knowledges **(NCK)** bridges conventional binaries (human/non-human, urban/rural, science/politics, scientific method/social theory), and generates impact through new models of responsibility and action. Its agenda spans historical, contemporary and future-oriented perspectives, embracing myriad material cultures and geographical locations. Supported by grants of c.£1.6m in the REF period (eg Defra, DfID, ESRC, Leverhulme, RGS/IBG, NERC, Royal Society), NCK research advances 3 interlinked programmes:

a. *Reciprocities of human beings, nature & environment*. NCK addresses environment questions by focusing on the interrelationships between human practices, institutions and nature. Adams, Leader-Williams and Vira unpick conservation conflicts, offering novel options for mitigation (REF3b). In Melanesia, Bayliss-Smith provides evidence for the cultural mediation of resource use from prehistoric times, while in Africa Watson explores the adaptivity of mobile livelihoods under stress. Amin on the technological city, Bravo on Arctic indigenous ontologies, and Donovan on volcanoes as geopolitical agents, each trace and analyse reciprocal links between environments and human subjects. The complexity of human/animal relations is likewise clear in Howell's work on animal geographies, and Vitebsky's on shamanism.

b. *Framings of risk, vulnerability and resilience*. NCK is concerned with pressures and adaptive strategies in widely differing habitats, ranging from Watson's work with pastoralists in African drylands, through Amin's and Thieme's reconceptualisations of resilient cities, to Möller's research (with Spencer, ESP) on ways in which salt marshes can reduce human vulnerabilities on low-lying coasts (REF3a). Historical and contemporary work on regulation (eg prostitution, drunkenness, labour markets, famines) positions the changing discourse around vulnerable versus resilient subjects as a technology of governance.

c. *Cultures of knowing and governing*. NCK exposes the epistemic, political and discursive conditions of environmental governance. It has successfully advanced understandings of scientific cultures in diverse contexts, including climate narratives in the Arctic (Bravo) and the governance of active volcanoes (Donovan). Owens' extended, in-depth, analysis of the Royal Commission on Environmental Pollution, drawing on a unique insider/outsider position, reconceptualises relations between expertise and policy-political processes. Increasingly dominant frames such as 'food security' and 'ecosystem services' are critically scrutinised by Nally and Vira, while the role of indigenous epistemologies in structuring governance is highlighted by Radcliffe for Latin America, and by Bravo and Vitebsky in the Arctic.

Much of the above research will be carried forward. New work is planned on synthetic biology (Adams), food security (Nally), conceptions of 'planetary limits' (Owens), and, if applications are successful, with CPE, the urban commons (Amin, ESRC) and, with PHH, governing the foreseeable future (Howell and Nally, AHRC).

4) Environmental Systems and Processes **(ESP)** focuses on 3 themes, reduced from 5 in 2008 to facilitate internal synergies. *Atmospheric and Volcanic Processes* addresses the controls of magmatic degassing; the chemistry and physics of volcanic plumes; and numerical simulation of atmospheric processes, from clouds to global circulation. *Terrestrial and Coastal Environments* focuses on water and sediment fluxes in such systems, and on ecosystem services in fluvial and coastal environments. *Biogeochemical Processes and Ecology* employs numerical modelling, from individual-based models of land cover dynamics, to global coupled models of plant physiology, ecosystem dynamics, the global carbon cycle and climate change; also field-based studies of plants, plant communities and ecosystem processes. In practice, ESP research cuts across these boundaries and is integrated with University Centres (eg Climate Science) and Strategic Initiatives (eg Cambridge Conservation Initiative). ESP research was supported by c.£1.3m grant income in the REF period, with sources including the EC, Royal Society and NERC. Significant scientific achievements since 2008 include:

- Innovative very high resolution modelling provided much improved understanding of formation of deep convective systems and the atmospheric impact of volcanic eruptions: aerosol micro-physics, plume chemical/physical dynamics, effects of super-volcanoes (Graf, Herzog, Oppenheimer, Rob Martin);

- The discovery of new modes of coupled variability of the ocean-atmosphere system, allowing for greatly improved understanding of climatic anomalies and connections, including the bi-decennial effects of big tropical eruptions on climate (Graf, Herzog);
- First demonstration of thresholds to wetland destruction by realistic storm waves over saltmarsh monoliths in world's longest (310m) wave flume (Hannover), informing debate on wetland loss linked to near-future storminess (Möller, Spencer in Coastal Research Unit);
- Novel research combining airborne and terrestrial laser scanning with vegetation modelling to map floodplain vegetation and estimate flow resistance of trees (Bithell, Richards);
- Multi-model comparison of atmosphere-biosphere interactions, with first quantitative estimates of impacts and uncertainties for different sectors, from multiple impacts (supporting IPCC WGII) (Friend).

Future work underpinned by grants or grant applications will include: computational frameworks for multi-scale environmental modelling (Herzog, NERC); the role of stratosphere/troposphere coupling on climate (Graf, Herzog, Royal Society); design of disaster risk reduction measures to increase shoreline resilience to extreme coastal events (Spencer, Möller, EC FAST, RISC-KIT); and global tree mortality rates as driven by atmospheric CO_2 and hydrological extremes (Friend, EC). Multi-disciplinary research will include modelling of high-risk floods (Herzog, EC), Nereus Programme on future of global fisheries (Spencer, Bithell; see 5e), and work on knowledge for environmental policy (Richards, ESRC-ORA), connecting with NCK.

***5) Glacial and Quaternary Science* (GQS)** has critical mass in: a) the marine record of past ice-sheet growth & decay; b) modern ice-sheet mass balance, hydrology, flow and dynamic stability; c) Quaternary palaeo-environments at high- and mid-latitudes. It combines field and remotely-sensed data, laboratory experiments and numerical models to understand links between ice and environmental change. Novel techniques are important in ice-sheet and permafrost numerical modelling, and quantitative remote sensing (eg satellite radar and laser altimetry, SAR interferometry, ice-penetrating radar, LiDAR) is a particular specialism.

Prior to 2008, GQS research centred on the dimensions and flow of modern and past ice sheets, using airborne and satellite systems, and marine geological and geophysical methods respectively. It continues to use quantitative remote sensing tools, but with a distinctive focus on key basal boundary conditions in modern ice sheets, and to apply observations to modelling of modern and Quaternary ice sheets. Fulfilling a strategic aim, industrial funds of over £1m have been secured (out of £3.4m total research income) to develop understanding of the sedimentary evolution of high-latitude continental margins and past ice-sheet dynamics, an area in which SPRI leads internationally. Scientific achievements since 2008 include:

- First implementation of hydrologically coupled, time-varying basal properties in a high-order ice-sheet model, enabling prediction of ice-stream stagnation/reactivation (Christoffersen).
- First numerical models of supraglacial water flow, allowing simulation of time-dependent filling of lakes with implications for Greenland Ice Sheet dynamics (Arnold, Willis).
- Discovery of lakes beneath the Greenland Ice Sheet using ice-penetrating radar (Dowdeswell), and the first identification of a former subglacial lake in the geological record (Christoffersen).
- First recognition of a suite of submarine glacial landforms diagnostic of inter ice-stream settings in the geological record, a key tool in reconstructing past ice-sheet dynamics (Dowdeswell).
- Identifying the nature and rate of ice retreat across the West and East Greenland shelves after the Last Full-Glacial, providing a robust test for model predictions (Dowdeswell, Hogan).
- Long-term Quaternary fluvial, glacial and interglacial evolution in Western Europe (Gibbard).

Into the future, substantial NERC grants will continue on airborne geophysical measurements of the form, flow and basal properties of the Greenland Ice Sheet and Canadian Arctic ice caps; and on numerical modelling of the Greenland and West Antarctic ice sheets. New opportunities, funded by the University and NERC, will enable further ties to be built between SPRI and the British Antarctic Survey on glaciology and marine geology. Work will be ongoing with BP and Eni on the sedimentary architecture of polar continental margins (REF3b), as will field-calibration experiments for the CryoSat II radar altimeter, using neutron-probe methods developed at SPRI (fulfilling another strategic aim), with new ice-sheet altimetric datasets.

c. People

Our strategies for recruitment, staff development, and PhD students aim to attract world-class scholars in a global market, while sustaining the energies and commitment of those in situ.

i. Staffing strategy and staff development

1) Recruitment opportunities are used strategically to build research strengths, maintain a balanced demographic profile, support exceptional early-career researchers, and aid succession planning in research leadership. Assisted by proleptic arrangements, trust and donor funding, the collegiate context, and routine turnover (Devereux, Duncan, Grundy, Kearns, R. Smith & Trudgill retired or resigned in the REF period), our strategy has enabled us to make a number of outstanding appointments:

- Amin (2011) to 1931 Professorship of Geography, strengthening leadership in contemporary human geography and contributing to thematic groups CPE and NCK;
- Browne (2008) to Frankopan Directorship of Centre for Gender Studies and Lectureship (SL, 2011), adding sociological perspectives to CPE & crystallising cross-cluster interests in gender;
- Jeffrey (2012) to Lectureship, renewing the Department's commitment to political geography and adding novel perspectives to this dimension of CPE's research;
- Herzog (2012) to Lectureship (initially Moran funding), following five-year RCUK Fellowship, increasing the breadth of scholarship on atmospheric science within ESP;
- Leader-Williams (2009) to Directorship of Conservation Leadership Programme (Mava Foundation), enhancing impact through training and bringing ecological expertise to NCK;
- Strauss (2012) to Lectureship (initially Newton Trust funding), bringing novel cultural and behavioural perspectives to economic geography within CPE;
- Wilcox (2013) to Lectureship and Deputy Directorship of Centre for Gender Studies, adding new dimensions to gender scholarship, and bringing international relations expertise to CPE.

Three Professorial appointments are planned for 2014: to maintain leadership in physical geography following retirements; to support excellence in quantitative human geography; and to ensure the succession of leadership within PHH. We will also appoint to a proleptic Lectureship in physical geography in 2014, to increase critical mass in the successful Coastal Research Unit.

In addition to the above, fixed-term Lectureships play an important role in career development, while advancing our strategic objectives – adding connectivity, incubating new ideas, and enabling others to take up Fellowships and visiting positions. Among returned staff, Thieme and Tucker have benefited from this experience. Considerable mutual benefit also derives from full integration into the Department's research culture of outstanding individuals holding senior and early-career College positions, with important additions since 2008 including S. Smith, Mistress of Girton College and Honorary Professor of Social and Economic Geography; Beckingham (College Teaching Officer); Cutler and Mugford (CTOs); and Rob Martin (Junior Research Fellow). One CTO and 1 JRF moved to Lectureships in Birmingham and Newcastle respectively.

2) Staff Development. The Department and University are committed to ensuring that all staff, at whatever stage, are fully enabled to develop all-round academic careers and maximise their potential for excellent, innovative research. This is secured by:

- a supportive, collegiate environment with open research groupings whose mission includes recognition, respect and accreditation for the ideas & achievements of scholars at every level;
- recognition of excellence and leadership through the University's annual Senior Academic Promotions exercise which, since 2008, has delivered Professorships for Bayliss-Smith, Oppenheimer and Radcliffe; Readerships for Friend and Spencer; and Senior Lectureships for Allen, Arnold, Bravo, Browne, Christoffersen, Mawdsley, Nally and Watson.
- mentoring of early-career researchers by more senior staff, advice for all staff on promotions, grant applications, publication strategies, and time management, and performance monitoring, including constructive appraisal (at least every two years);
- maximising time for research through regular reviews of teaching programmes, administrative commitments, and support-staff roles;
- well-established structures to monitor and advise on ethical and safety issues;
- sabbatical leave entitlement of 1 term for every 6 in service, used in REF period by almost all staff; flexible facilities for other forms of leave; and generous funding for conferences/travel, plus discretionary School and College Travel Funds;
- timing of seminars and key meetings to be as inclusive as possible for all staff.

Staff are encouraged to take up prestigious Fellowships and visiting positions, which offer concentrated periods for writing, new thinking, empirical work, and collaboration, as evidenced in the achievements of Christoffersen (Green Fellowship, Scripps Institution of Oceanography);

Haining (Erskine Fellowship, Canterbury NZ); Bayliss-Smith (de Carle Distinguished Lectureship, Otago); Ron Martin (Leverhulme Major Fellowship); and Owens (King Carl XVI Gustaf Professorship, Stockholm University & KTH). Twelve further Visiting Professorships/Fellowships have been held in 10 different countries abroad.

Equality and diversity are University-wide objectives, embraced, monitored and reinforced in the Department. Staff benefit from generous parental leave, a graduated return-to-work plan, flexible working arrangements, and a Returning Carers Scheme offering tailored assistance (eg research support, teaching buyout). There are regular CV mentoring and development workshops for women academics. In the Department we attach the highest priority to this ethic of equality (a measure of our success being that 43% of all staff promoted in the REF period were women), and we sustain momentum through service on the University's Equality and Diversity Committee (where Amin has led policy discussion on race) and Gender Equality Group (Browne).

3) Postdoctoral (including early career) researchers (PDRs). The success of our research strategy creates opportunities for a growing postdoctoral community. As of September 2013, we have around 20 such staff, including Research Associates, working independently or with PIs, and Research Fellows. The Department will have hosted 6 prestigious early-career Fellowships since 2008 (British Academy, ESRC, Leverhulme, Urban Studies Foundation, Marie Curie Intra-European (2)). Both Department and University attach great importance to the support of PDRs, and seek to contribute as effectively as possible to their careers. They are fully integrated into research thematic groups and departmental life, with some also having a well-supported college base. PDRs benefit from mentoring arrangements, have full access to our excellent facilities (5d), and are encouraged to gain teaching experience. Several of our REF-returned staff are independent, often early career, scholars, who have proved capable of outstanding research.

The University is strongly committed to the *Concordat to Support the Career Development of Researchers* and has received the European Commission's *HR Excellence in Research* badge for its work in this area. It provides comprehensive training/development programmes for postdoctoral researchers, including the successful *Emerging Research Leaders* Programme, and has created the new role of Director of Postdoctoral Affairs to coordinate strategy for the whole postdoctoral community. Recognising that accommodation is a critical issue in a high-cost city, the University has acted to ensure the provision of high-quality housing for over 600 postdoctoral researchers and their families in the first phase of its major new development in NW Cambridge.

ii. Research Students. The Department has a vibrant, cohesive and internationally diverse graduate community. Numbers and calibre remain high, despite pressures on funding. There have been 135 PhD starters since October 2008 (annual average c.23; figures include October 2013), of whom 29 have held RCUK Studentships (c.5 p.a.). We aim at least to maintain this volume through continuation of the University's ESRC DTC and a new NERC DTP. The fiercely competitive Gates and University Trusts supported a further 51 students, while 21 were funded by other sources including non-UK government and trust scholarships. In addition, we have successfully focused fund-raising activities on PhD studentships, raising over £250K to endow Debenham and Scott Polar Scholarships. Across all 5 thematic groups, these various sources support pathbreaking graduate research, which both fosters and thrives within a lively and non-hierarchical culture. Graduates are centrally involved in intellectual exchange in departmental and thematic seminars, reading groups, and other meetings (5b). They play a major role in seminar series run jointly with other departments (eg through African and Latin American Studies, Gender, Conservation), and have been closely involved in seminars and programmes at the University's Centre for Research in the Arts, Social Sciences and Humanities (5e).

Our Graduate School, with its dedicated Director and Administrator, delivers a Skills and Training Programme for all PhD students, covering a wide range of topics on diverse aspects of the PhD process, including research ethics, safety, career planning, and publishing. Students are encouraged to publish, and routinely do so, both individually and with supervisors. Many attend the cross-University Social Science Research Methods Course (embraced by the ESRC DTC), to which Geography staff contribute. All have office space, desktop computers, and access to departmental research facilities (5d). Valuable support for fieldwork, conferences and specialist training is available from University, DTC and departmental sources, including Trusts.

Each student has a lead supervisor and an advisory committee of 3. We operate a rigorous system for monitoring progress, supported by the University's Board of Graduate Studies. A demanding

(and rewarding) First Year Review involves: a Forum at which all students present plans and receive feedback from staff and fellow students; a 10,000 word report submitted after 8 months; and a viva with the advisory committee at which the report must be approved. Third year students present their research after 7 terms, and receive valuable feedback on progress. Eighty PhDs have been approved in the REF period. Over ¾ of those graduating now hold academic or postdoctoral positions in the UK (eg Cambridge, Imperial, Oxford, Queen Mary, Royal Holloway), North America (eg Georgia Tech, Harvard, Waterloo) and other countries. Others work in government, industry, consultancy, or agencies (eg British and US Geological surveys). Some 40% are outside the UK, reflecting the global reach of our PhD graduates. In 2013, Batchelor received the *Outstanding Poster Award, European Geosciences Union, Division on Climate*.

d. Income, infrastructure and facilities

i. Growth and diversity in research income. Pursued strategically, as outlined in 5b, external grant income (excluding income in kind) has shown an upward trajectory, rising from £1.6m in 08/09 to an average of 2.0m pa between 10/11 and 12/13, while the sources of funding that underpin our expanding research programme have continued to diversify. Over the REF period, RCUK grants have represented c.45% of the annual total, reflecting our continued success in this highly competitive arena; income from charities has remained at c.12-19%; UK government and EC-funded research has risen from 13% in 2008-9 to c.20% in subsequent years; and industrial and commercial funding has accounted for between 10-13% of annual income. Around 100 grants have been awarded to 32 returned staff, distributed across all 5 thematic groups (from 11.4% of the total in CPE to 39.4% in GQS). Awards have ranged from >£500K (2 from NERC, 1 from ENI and 1 from ECFP7) to < £30K, the smaller amounts creating and expanding opportunities for staff whose research has not normally been grant-dependent. Individual and corporate benefactions have further enhanced and widened the reach of our research, through the funding of centres, posts, studentships, and distinguished visitors (eg £1.8m for redesign and refurbishment of SPRI's Polar Museum; >£2m to Centre for Gender Studies, from Staples Trust and Djerassi Foundation for Director's post, Administrator, Visiting Professorships and public events).

In addition to external sources, the institutional (University) context has been important for:

- *Ensuring sustainability*; eg Isaac Newton Trust provided core funding for CamPop, 'bridging' for postdoctoral researchers, individual awards for promising projects, match funding for external grants (Donovan, Hogan, Möller), and Lectureships (Strauss, Thieme) to fill strategic gaps;
- *Maintaining excellence* in underfunded areas; 6 geographers won awards from the Humanities Research Grants scheme, est. 2011 responding to reduced external availability of small grants;
- *Supporting innovation*; the Centre for Research in the Arts, Social Sciences and Humanities funds early-career fellowships (Nally 2010), conferences (eg, *Knowledge Politics*; Radcliffe, *Politics of Presence;* Vira, *Experiencing the State*), and seminar series (*Food and Drink Network, Taking Place, City*).

ii. Research Infrastructure. The Collegiate University provides a world-class intellectual and physical environment, supporting research at the highest level. The intellectual environment is described elsewhere (5b,e). Physical infrastructure, maintained at a high level, includes generous space for staff, PhD students, thematic groups and collaborations (5b,c,e). Significant investment has been made in our buildings, including extensive refurbishment of laboratories (£215K) and creation of tailored research environments for Gender Studies and Conservation Leadership. Growth of the Department in the medium-long term will be accommodated by a move to new premises, currently at University initial planning stage.

Laboratories and Field Equipment are central to most physical and some human geography research. Our infrastructure supports the needs of staff, PDRs and graduate students in projects on (eg): hydrodynamics; palaeoecology; glacial sedimentology; multi-proxy analysis of terrestrial and marine records of Quaternary environmental change. A particular focus has been on forging links between observation (eg remote sensing at a range of scales), laboratory experimentation, and environmental modelling (5b, ESP). The refurbished laboratories offer a wide range of instrumentation, including ion chromatograph (IC) and inductively coupled plasma (ICP) chemical analysers; a laser particle sizer; digital colour, high- and low-power microscopy/digital photography; and a tilting flume, recently completely re-built (£78K). Facilities allow for separate preparation and analysis for most procedures needed in physical geography, including optically stimulated luminescence dating. Field equipment includes Total Stations, dGPS and SmartNet RTK, MRBB drilling rig, and ground-penetrating radar for sub-surface surveys of sediments and glaciers, as well

as aids for human geography research, such as digital recorders. The Department's 4-wheel drive vehicle was replaced in 2013. Laboratories and equipment are overseen by a Senior Technical Officer, supported by a Laboratory Manager and Instrumentation and Environmental Science Technicians.

World-class library resources. The copyright Cambridge University Library (UL) is a global research resource. The Department maintains its own extremely well-used library, and SPRI has a world-renowned research library and archives on the history and environment of the polar regions; we also hold important collections of maps and aerial photographs, the latter with a new management structure. A central Journals Coordination Scheme has allowed the range of titles to be extended; it provides electronic-only subscriptions (it has financially-beneficial contracts with Elsevier, Wiley-Blackwell and Springer), and is building a collection of electronically-accessible backsets. The Department subscribes to the UL's "ebooks@Cambridge" project, and a growing proportion of the annual library budget is now allocated to the acquisition of such titles. The move to Open Access publishing is managed by a University Project Board (including senior academics), which provides an interactive web-based advisory service and resources to ensure that publication in the most intellectually-appropriate outlets is not inhibited. The Department is fully engaged with these arrangements.

Excellent computing and IT services. The University provides vital central support (eg e-mail, graduate reporting systems, collaboration tools), as well as network support, site-wide WiFi, and software licenses. The Darwin High Performance Computing Facility has been significantly upgraded since 2008. Geography contributes to, and derives substantial benefits from, Darwin, notably in the modelling work of Bithell, Herzog and Friend (5b). The Department will also benefit from the £20m West Cambridge Data Centre, opening in 2014, to provide an energy-efficient home for the High Performance Computing Service. The Department's team of 5 IT staff (incl. Website Developer and Geomatics Technician) supports desktop computers, 3 major operating systems, laptop networking, and high performance local hardware for computational simulations. Machines connect to the University network via a 1Gb/s network backbone, linking to the UK-wide JANET network. Software, including mainstream packages such as ARCGIS, is available to cover specialist needs in human and physical geography. The Department has 40- and 16-seat computing suites accessible to staff and students, the latter being of particular use to graduates.

e. Collaboration or contribution to the discipline or research base

Across all thematic groups, members of the Department have made outstanding contributions to the discipline, to collaborative endeavours, and to the academy as a whole. They have done so through agenda-setting research; the building of interdisciplinary networks; participation in the work of national academies, learned societies and research councils; and major editorial and peer review activities. The following is a selection of achievements:

i. Leadership within interdisciplinary ventures in Cambridge. A strategic aim is to realise Geography's potential as a catalyst for interdisciplinarity. To that end, the Department supports CamPop, straddling Geography and History, and the Centre for Gender Studies, which champions a uniquely multi-disciplinary approach to research and graduate teaching (5b). Within the University more widely, Geographers also lead or substantially contribute to the:

- Cambridge Conservation Initiative, a University Strategic Research Initiative (SRI): 6 University departments with 9 external conservation organisations; key staff: Adams, Leader-Williams, Vira (Research Director 2013-);
- Cambridge Volcanology Group: 10 departments + external partners; involves 6 geographers;
- Centre for Climate Science: 5 departments with British Antarctic Survey; 5 geographers;
- Centre for Research in the Arts, Social Sciences and Humanities: Amin & Owens, Management Committee; Owens, Richards co-convened 2009-10 Sawyer Seminar, *Risk and Uncertainty* (Mellon Foundation, c.£90K; seminars, public lectures, international conference);
- Centre for Science and Policy (directed by Cambridge Geographer Dr Rob Doubleday): Owens, Associate Fellow; connects with NCK science/politics research, and significantly enhances impact (REF3a);
- Global Food Security, another SRI, Nally and Vira have taken lead on social science;
- Centres of African, Development, and Latin American Studies; Management Committees: AS, Watson; DS, Mawdsley, Vira; LAS, Radcliffe (Chair). In 2013-14, Geography is co-hosting with LAS the prestigious Simón Bolívar Professorship (Rosalva Aída Hernández).

ii. UK and international research collaborations All returned staff, regardless of subject or seniority, enjoy research collaborations with academic colleagues in the UK and/or abroad. Many also collaborate with governments, statutory agencies, NGOs, industry, and charities (REF3a). Supported by grants, fellowships and travel funds, this work includes:

- collaborations involving many UK partners, eg Leverhulme Interdisciplinary Group, *Seeing the Nation* (Radcliffe); NERC-BESS Symposium (Möller, Spencer); NERC-funded *Dynamical Response of Pine Island Glacier, West Antarctica* (Christoffersen);
- international collaborations with multiple partners, eg: Nereus Programme on future of the oceans (Nippon Foundation; Bithell, Co-I; Spencer); Glaciogenic Reservoir Analogue Studies Project (Gibbard); Greencycles II EU Marie Curie Initial Training Network (Friend, PI); International Polar Year Core Programme on Arctic Treeline (Rees, Joint Co-ordinator);
- broad alliances forged to respond to major funding opportunities eg i) *The Urban Commons* (ESRC £6.9m, shortlisted July 2013), led by Amin with 7 Cambridge geographers, 3 other departments, and 8 renowned urbanists elsewhere in UK and abroad; (ii) outline bid to AHRC's *Care for the Future* Programme (c.£2m: Amin, Howell, Nally, with several external partners);
- Oppenheimer's unprecedented collaboration on the seismology/volcanology of Mt Paektu, with partners in North Korea, as well as UK, US, and China, supported by Royal Society, NERC and American Association for the Advancement of Science (see also 5e).

Staff engage in further collaborative research with many more universities/institutes and non-academic institutions across 5 continents. Examples include: Amin, POEISIS Program (BMW Foundation) with NY University, and Urban Commons with Berkeley, Cape Town, Centre for Study of Developing Societies Delhi University, NY Stoneybrook, and University of South Australia; Bayliss-Smith with ANU on agricultural origins; Christoffersen with Scripps Institution, California, on Greenland Ice Sheet hydrology; Dowdeswell with NASA IceBridge team and Institute for Geophysics, University of Texas Austin, airborne radar investigations of Greenland Ice Sheet; Graf with Max Planck Institute, Hamburg, and Oxford on climate effects of massive volcanic eruptions; Co-ordinator, Radar-based Ash Monitoring & Forecasting (Marie Curie Intra-European Fellowships), with La Sapienza, Rome; Ron Martin with Utrecht on evolutionary economic geography; Oppenheimer with US NSF Antarctic Program on Mt. Erebus; Richards with CASS/CAS, China, TU Delft, Osnabruck on Global Water System Project; S. Smith with RMIT Melbourne on housing finance; Spencer with IPCC 5th Assessment Panel; Willis with University of Chicago on ice-sheet numerical modelling. There are many more bilateral and informal collaborations.

iii. High-level national and international committees. Staff have played central roles in the development of research agendas and capacities nationally and internationally. They have:

- served on: a) significant committees of national academies and professional organisations, eg British Academy (Amin, BASIS; Martin, Research); Royal Society (Owens, Science Policy Advisory Group); RGS/IBG (Owens, Council; Research Committee); Geological Society (Hogan, Marine Studies Group); b) the Councils of British Association for South Asian Studies (Mawdsley); British Society for Population Studies (Reid); and International Glaciological Society (Willis); c) the Steering Committee of the ESRC-funded Forced Labour Monitoring Group (Strauss); and d) REF 2014 sub-panel C17 (Richards, Chair).
- contributed to at least 14 international research-oriented committees or networks, often in key roles eg: Bravo, Dowdeswell, Rees, rapporteur/UK delegates to 4 different Arctic research organisations; Gibbard, President, Int. Quaternary Association Commission for Stratigraphy & Geochronology; Graf, Co-Chair, EU-COST Action network on Theory of Convection; Radcliffe, Chair, 'Transnationalism and Globalisation' Programme, Latin American Studies Association.
- served on the Science Advisory Councils of the Living Oceans Foundation (Spencer); Stockholm Environment Institute (Owens); and Bolin Centre for Climate Research, Stockholm University (Dowdeswell); and on 4 further international advisory boards for institutes or research centres/collaborative projects in Europe and North America.
- acted as external advisors for numerous professorial appointments in Geography and cognate disciplines, including, eg, Halford Mackinder Chair, Oxford (Amin); Senior Social Scientist, Stockholm Resilience Centre, (Adams); 2 chairs at Bartlett School, UCL (Owens).
- co-organised, or served on, steering committees for major international conferences, eg: *Arctic Frontiers* 2013 (Bravo); *World Climate Impacts* 2013 (Friend); *Geomed* 2009 (Haining); Royal

Society *Commonwealth Science Conference* 2014 (Owens).

iv. Invited keynotes, plenaries and public lectures. About 140 have been delivered, around two thirds of them abroad (in at least 14 European countries, Australia, Far East, New Zealand, North and South America). They have included prestigious named lectures eg: *Louis Agassiz* (EGU, Vienna, Dowdeswell); *Darwin Bicentenary* (RGS, Spencer); *De Carle* (series, Otago, Bayliss-Smith); *Doreen Massey* (Open University, S. Smith); *K. J. Gregory* (Southampton, Ron Martin); *Gordon Manley* (Durham, Dowdeswell); *T. B. Macaulay* (Aberdeen, Adams); *Roepke* (AAG, Ron Martin); *Tanner* (series, Cambridge, S. Smith); *Professor Sir Peter Hall* (UCL, Owens).

v. Editorial responsibilities Staff are senior, co- or consulting/associate editors for some 20 international journals (including *Bulletin of Volcanology*, *Cambridge Jl Economics*, *City*, *Environment and Planning C*, *Jl of Economic Geography*, *Jl of Geophysical Research*, *Oryx*, *Population Studies*, *Quarterly Jl of Royal Meteorological Society*), and serve on the editorial advisory boards of around 45. They also edit, or serve on advisory boards for, 8 book series or encyclopaedias/dictionaries/handbooks.

vi. Funding bodies and peer review As well as regular reviewing activities in the UK and abroad, members of the Department have made major contributions to:

- *The work of Research Councils and other funding bodies*, eg: AHRC (Bravo, Panel A, Peer Review College; Commissioning Panel, Researching Environmental Change); British Academy/Royal Society, Newton International Fellowships Panel (Watson); Darwin Initiative Expert Committee (Leader-Williams); DFID/NERC/ESRC Ecosystem Services for Poverty Alleviation (Bithell, Review Panel; Watson, Moderating Panel); ERC Advanced Grant Panel (Amin); ESRC (Ron Martin, Radcliffe, Richards, Peer Review College; Owens, member, Research Committee; Chair, Commissioning Panel, Rural Economy and Land Use); EC (Bayliss-Smith, Expert Evaluator [Soc. Sciences/Humanities], 7th Framework Prog); European Science Foundation (Ron Martin, Peer Review College); Finnish Academy for Atmospheric Sciences (Graf, Chair, External Review Committee); FNRS Belgium (Richards, External Expert Evaluator); Leverhulme (S. Smith, Assessment Panel, Prize Fellowships); NERC (Arnold, Dowdeswell, Friend, Graf, Herzog, Peer Review College; Dowdeswell, National Capability Action Group; Oppenheimer, International Opportunities Fund Assessment Panel; Steering Committees, Field Spectroscopy Facility and RESET Consortium Project).
- *National research assessments*: for example, Netherlands, Earth Sciences, Gibbard; Estonia, R&D Institutions (for Estonia Research Council/Archimedes Foundation), Richards.
- *University departmental reviews/research assessments*: Pacific Studies, ANU (Bayliss-Smith); Earth Sciences, Astronomy and Geography, Vienna (Bennett); Geography, Durham, Malaysia & National University of Singapore (Richards); Oxford (Amin, Richards); Geology, Innsbruck (Gibbard); Economics, Utrecht (Ron Martin).

vii. Medals, awards and prizes. *Founder's Gold Medal*, RGS/IBG: Dowdeswell 2008 (glaciology); Richards 2013 (physical geog & fluvial geomorphology); Baker (emeritus) 2009; *Agassiz Medal*, European Geosciences Union, Dowdeswell 2011 (for study of polar ice masses and sedimentation processes in glacimarine environments); *Carl O. Sauer Distinguished Scholarship Award*, Conference of Latin American Geographers, Radcliffe 2008; *Julian Minghi Outstanding Research Award*, AAG Political Geography Group, S. Smith 2009; *Stanley D. Brunn Young Scholars Award*, AAG Political Geography Group, Jeffrey 2012; *Philip Leverhulme Prize*, David Nally, 2013.

viii. Elections and honours S. Smith (2008), Owens (2011) elected to *British Academy*, bringing total in Department to 7 FBAs (Amin, Bennett, Cliff, Ron Martin, R. Smith); Haining (2011) to *Academy of Social Sciences*, joining Amin, Ron Martin, Owens, S. Smith; Dowdeswell (2013) to *Norwegian Scientific Academy for Polar Research*; Richards (2013) to Fellowship, British Society for Geomorphology. Honorary degrees: Gibbard, Univ. of Helsinki 2008; Owens, KTH Stockholm 2012; Owens, Lifetime Honorary Member RTPI, 2013; Browne, 2011 Woman of Achievement, Woman of the Year Committee UK.

These many and varied contributions and markers of esteem, involving a good number of early-mid career staff, provide a tangible indicator of the strength of our research at all academic levels.