

Institution: University College London (UCL)

Unit of Assessment: 14 (Geography and Environmental Studies)

1. Unit context and structure, research and impact strategy

1.1 Context

UCL Geography is distinguished by the diversity in breadth and scale of its research and the global scope of its expertise and collaborative links (Fig. 1). Our mission is to produce outstanding research and to translate this into impact beyond academia, framed by UCL's global perspective and commitment to the beneficial application of knowledge, and our vision of Geography as a discipline that cuts across the boundaries between the natural and social sciences and humanities.

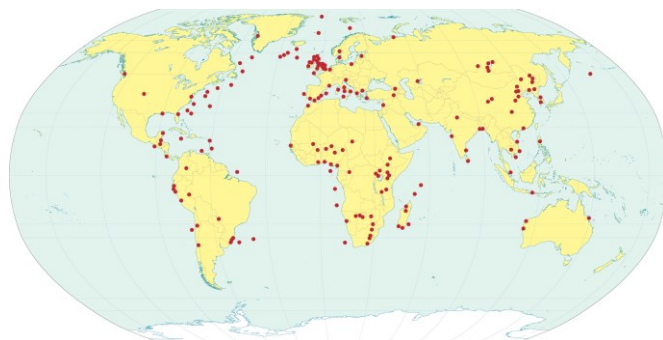


Fig. 1 UCL Geography research sites over the current REF cycle.

Over the REF cycle, we have undertaken research across six continents and four oceans, engaged in global partnerships, led international consortia, assumed key roles in interdisciplinary initiatives, increased our annual income by a factor of 2.4, won 4 ERC grants, published 27 books, 33 edited books, 1410 articles and book chapters, and delivered impact on environmental and societal issues.

Underpinning these achievements is a distinctive culture of inclusivity in people and subject matter and a commitment to

the integrity of the academic vocation as a genuine balance between research and teaching. To this end: (i) we support and encourage a diversity of styles and scales of research, from individual scholarship to large collaborative networks; (ii) we champion interdisciplinarity and open and engaged research from the local to the global scale; (iii) we have research strength throughout the Department, balanced across physical and human geography; (iv) we invest in our staff with open-ended research-teaching contracts, avoiding hierarchical workloads where teaching is allocated inequitably. Teaching-only contracts are only used to cover research fellowships, maternity leave or sickness; (v) we have embedded the values of Equality, Diversity and Inclusion to ensure best practice across the Department. This culture permeates a research environment that is stimulating and collegiate, providing a platform for outstanding achievement by all academic staff.

The UoA includes all 48 permanent academic staff and 6 independent researchers of UCL Geography, with *Roseneil* from the Institute of Advanced Studies (IAS) and *Kelman* from the Institute for Risk and Disaster Reduction. Unless otherwise stated, strategies and achievements discussed in this document refer to UCL Geography.

1.2 Structure

Research within the Department is organised around **seven thematic clusters** (Fig. 2):

The **Palaeoclimate** cluster combines reconstructions of marine and terrestrial environments with state-of-the-art climate modelling to explore climate changes and ecosystem responses on timescales from tectonic to historical, and to contribute towards a theoretical framework of long-term climate change. Work informs new perspectives on recent changes in Atlantic Ocean circulation, on carbon dynamics, on past warm periods as a basis for comparison with the present interglacial and its future evolution, and on the concept of the Anthropocene.

The **Environmental Change and Biodiversity** (ECB) cluster examines the drivers and impacts of environmental and biodiversity change. Work includes conducting long-term chemical and biological monitoring and using natural archives to reconstruct pressures and responses in both terrestrial and aquatic systems, informing policy and conservation practice. Members have been involved in the discovery of large previously unrecognised peatlands in central Africa and are central to the science behind the formal proposal for the Anthropocene Epoch.

The Environmental Modelling and Observation (EMO) cluster combines modelling of present and future Earth System dynamics with observations and methods. EMO research has provided insights into the resilience of groundwater resources in the tropics, contributed to new international satellite missions and policy activities to monitor tropical forests and climate, led to award-winning crop yield forecasting tools, pioneered new understanding of tree structure and function, identified new atmospheric pollution sources and sinks, and underpinned models capturing the impacts of climate change on geomorphic, hydrological and ecological systems.

The **Global Urbanism** cluster has made leading contributions to global urban studies through developing novel comparative methodologies, as well as Global South and regionally-grounded approaches. Analyses of urban infrastructure, verticality, gender, smart cities and housing, the politics of large-scale urban developments, as well as sustainability politics and policy, across a range of different contexts (India, Mexico, Tanzania, South Africa, China, UK), demonstrate the benefits of a global perspective for urban studies.

The **Culture and Migration** cluster combines interests in socio-cultural and historical geographies with specialisms in international migration, refugee studies, diaspora culture and postcolonialism. Members are united by an interest in the meanings, practices and critical theorisations of culture, social justice and radical politics. It undertakes methodologically innovative and socially engaged analyses of southern humanitarianism, international education, transnational housing, creative citizenship, sonic and literary cultures, and the poetics and politics of belonging.

The **Environment, Politics and Society (EPS)** cluster focuses on government, policy and practice across diverse fields including climate, energy, health, marine ecosystems, cities, diplomacy, war and security, and major citizen science initiatives. Taking up defining geographical concerns with materialities, and with interrelations between nature, the environment and social and political life, the group has made theoretical advances in our understanding of the Anthropocene and 'the event', as well as policy impacts, notably in marine planning.

The **Geospatial Analytics and Computing (GSAC)** cluster focuses on the adoption, deployment and use of geographic information technologies to understand the form and functioning of society today. Through methodological innovations in data management and analysis, it leads initiatives in core computer science, applied spatial analysis and geovisualisation, with contributions to policy areas including consumer behaviour, demographic change and movement in cities.

Physical Geography clusters are associated with our Environmental Change Research Centre (ECRC), while the Culture and Migration cluster is linked to the Migration Research Unit (MRU). GSAC hosts the UCL-led part of the ESRC Consumer Data Research Centre (CDRC) consortium. The Department is involved in interdisciplinary UCL initiatives, including the UCL Urban Laboratory, the Environment Domain, the Global Governance Institute, and has led or contributed to a number of IAS initiatives: Refuge in a Moving World (RiMW), African Studies Research Centre (ASRC), Centre for the Study of South Asia and the Indian Ocean World (CSSAIOW), and the Sarah Parker Remond Centre for the Study of Racism and Racialisation (SPRC). The Department has close links with the Alan Turing Institute, (the national institute for data science) and has a central role in the UCL Anthropocene initiative (Fig. 2).

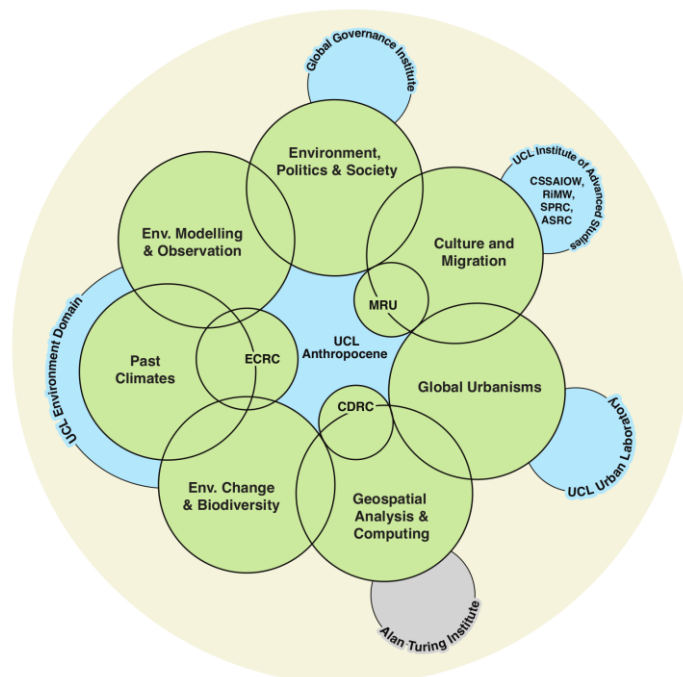


Fig. 2 UCL Geography clusters and research centres (green) and relation to initiatives at UCL and beyond.

Research oversight: Departmental research structures are coordinated by the Research Committee, chaired by the Director of Research, and comprising the Head of Department, the Departmental Manager, the Impact Coordinator and cluster leads. The Committee articulates the overall Departmental research strategy and supports impact activities emerging from research clusters. Within our Faculty of Social & Historical Sciences (SHS), we collaborate closely with the Dean (*Roseneil*) and Vice-Dean for Research (*Burningham*), the Joint Faculties Research Office (JFRO) and the Office of the Vice-Provost for Research (OVPR). Our doctoral programme is overseen by the Departmental Graduate Tutor and supported by the UCL Doctoral School.

1.3 Research strategy

Our strategic aims are to be internationally pre-eminent in geographical research, to cross boundaries between disciplines, and to deliver impact for public benefit. UCL's Research Strategy empowers Faculties and Departments to develop their own research agendas, while fully exploiting the advantages of institutional support and extensive interdisciplinary initiatives.

In our REF2014 submission, we set the following objectives:

Develop a long-term research strategy: (i) near the start of the REF cycle, we invested in early career academics of exceptional talent (*Thornalley, Fiddian-Qasmiyeh, Cheshire*), whom we have subsequently promoted internally (section 2.1). Their work has been recognised by individual awards and prizes (section 4.6); (ii) we focused staffing and resources on areas of research with significant scope for success in funding and research impact (Big Data [GSAC cluster], Citizen Science [EPS cluster], Earth Observation [EMO cluster]).

Boost research income and infrastructure: (i) we enhanced mechanisms for generating research income by rigorously planning and peer reviewing applications, providing in-house expert administrative assistance, exploiting UCL pump-priming funding, and placing a strong emphasis on European and strategic funding, in addition to blue-skies research (sections 3.1, 4.1); (ii) UCL made a substantial investment (£800K) in our state-of-the-art laboratories and high-performance computing facilities (section 3.3).

Strengthen research student recruitment: (i) we expanded UKRI studentships: UCL Geography set up and leads the London NERC DTP (Director *Maslin*, Deputy Director *Thornalley*) a ten-year collaboration between nine institutions (UCL, Birkbeck, Brunel, Kew, Kings, IOZ, NHM, Queen Mary, Royal Holloway) and 180 external stake-holder partners. The DTP has currently supported over 255 four-years PhD studentships of which 24 have been hosted by the Department. We are on the board of the UCL, Bloomsbury and East London ESRC DTP, leading the Human Geography pathway; (ii) we developed PhD-student pipelines via our undergraduate and MSc courses. Our intense undergraduate research training has led to 27 national dissertation prizes, with 13 of our undergraduates going directly to a PhD in the Department. Our MSc courses, aligned with research cluster agendas, have provided an important pathway for 69 students to pursue a PhD in the Department during the census period.

Promote a thriving research environment: (i) we expanded our interdisciplinary research by assuming key roles in new UCL initiatives (section 1.5); (ii) we strengthened the role of research clusters to review grant proposals and manuscripts, and to discuss research plans in termly meetings; (iii) we provided £1000 annual allocation per staff member to facilitate research activities and conference attendance; (iv) we expanded our lectures and seminars series. A pervasive culture of seminars adds to the vitality of our research community: we host weekly seminars in **Physical Geography**, in **Human Geography**, in **Palaeoclimate**, and in **Remote Sensing**. UCL Geography co-leads, with the Institute of Historical Research, the **Metropolitan History Seminars**. We play an active role in the **London Ocean Group** and the **London Urban Salon**, organising meetings across London institutions. We have established and funded **two annual public lectures**, inviting leading scientists to UCL: (i) the **Rick Battarbee Lecture Series** (speakers: *Sherilyn Fritz, Dick Wright, Alistair Seddon, Eric Wolff, Georgina Mace, Melanie Leng*) and (ii) in association with the Institute of Archaeology, the **UCL Lecture on Climate and Human History** (speakers: *Bill Ruddiman, Juan Luis Arsuaga, Eske Willerslev, Jared Diamond, Robin Dennell, Katerina Harvati*), which has attracted large audiences from across London and beyond.

Taken together, these initiatives have contributed to a dynamic intellectual environment and have laid the foundations for a sustainable future. Compared to the previous REF cycle, our research income increased substantially (Table 1), to a total of ~£22.5M. Our output production has also increased with significant contributions including 27 books, 33 edited books and 55 articles in the *Nature* and *Science* families of journals.

Future research strategy: Our aim is to sustain our culture of inclusivity in people and diversity in our research. We will further strengthen the role of clusters as centres of research activity and mentoring and provide funds to enable the delivery of research support and networking through seminars and meetings. To this end, we will formally recognise the role that cluster leaders play in our workload model. We will work to better integrate Early Career Researchers (ECRs) and PhD students into our enhanced clusters, ensuring a diverse pipeline of talent into the discipline. Our intention is to have a non-hierarchical learning community, empowering ECRs and PhD students to lead cluster activities when appropriate. We will also establish Summer Grant Writing Workshops for ECRs to introduce a comprehensive approach to planning a research proposal that embeds research design, impact and public engagement.

We are also committed to maintaining and enhancing our outstanding infrastructure and facilities, providing financial support for our successful lecture series, and continuing to play a leading role in interdisciplinary centres across UCL.

In addition, our future research strategy is informed by the evolving landscape in the discipline, with an emphasis on fostering interdisciplinarity:

(1) **The Anthropocene:** Many aspects of Geography are crucial to understanding the changing relationship between humanity and the planet, as global warming pushes the climate envelope beyond that experienced by modern humans. We are well-placed to address these interdisciplinary problems: our physical geographers are setting the agenda on the definition of the Anthropocene (*S.Lewis, Mackay, Maslin, Rose*), with contributions from human geographers (*Barry, Jazeel, Randalls*). Over the census period, we initiated a cross-departmental dialogue on the Anthropocene and have played a central role in establishing the **UCL Anthropocene** initiative (section 1.5), to increase interdisciplinary engagement across UCL.

(2) **Geographic Data Science:** The growth of quantitative, digital, and computational sciences has created a range of opportunities for geographical research. We are in an excellent position to capitalise on this with the appointment of two additional staff and the development of an MSc in Social and Geographic Data Science. The Department has sustained a strong tradition in quantitative human geography and has strengths in remote sensing and environmental modelling. A key objective will be to complement computational and quantitative research with insights from ethnographic and historical research, political economy, and social and political theory. The Department is playing a leading role in the Faculty's strategic vision to become a leader in social data science by establishing a UCL Social Data Institute (*Cheshire*).

These areas of growth will continue to enhance our inclusive vision of Geography as a discipline that cuts across boundaries.

Key risks and opportunities: With the likely economic consequences of the Covid-19 pandemic, the future funding landscape is increasingly uncertain. We therefore need to identify the areas where we are well positioned to pursue strategic funding and to diversify our funding sources. We will explore bilateral research opportunities such as the UKRI Global Challenges Research Fund / Newton Fund and the UKRI-US NSF Memorandum of Understanding. We will also seek to build on our track record of attracting funding from EU Horizon, NASA, the European Space Agency (ESA) and other organisations.

Table 1 Outputs and annual grant income between the previous and current REF.

	REF2014 (2008-2013)	REF2021 (2014-2020)
Books	19	27
Edited books	14	33
Chapters	149	221
Journal articles	705	1183
Grant income (£M/year)	1.33	3.21

1.4 Impact

UCL Geography has a long history of encouraging and enabling research that generates and achieves impact for international and national governments, agencies, industries, commerce, organisations, local communities, and vulnerable groups. We have: (i) delivered specialist knowledge and advice; (ii) developed and provided data products and tools; and (iii) raised public awareness of and participation in, environmental, cultural and political issues. Our impact case studies reflect our commitment to a diversity of styles and scales of research and to the beneficial application of knowledge beyond academia.

Over the census period, we have articulated a strong mission to encourage pathways to impact:

(1) Structural support

- **Department support:** we established a new Departmental Impact Coordinator (IC) (*Rose*) who has: (i) supported the integration of impact-generation activities within existing projects; (ii) identified future impact growth areas in collaboration with heads of research clusters; and (iii) advised on monitoring and curation of impact activities.
- **Institutional support:** we worked closely with UCL Research Impact Managers to develop impact. We have attracted institutional funding from the **Beacon Bursaries** (*Nold, Greaves*) and **OVPR's Research Impact Curation and Support** to: (i) organise pond restoration events in Norfolk (*Sayer*); (ii) contribute to NGO training guidelines on faith and humanitarian response to refugees (*Fiddian-Qasmiyeh*); (iii) investigate how our research in the Congo basin translates to policy reform, development projects and environmental activism (*S.Lewis*).
- **Research council support:** we secured NERC Impact Accelerator funding to explore new pathways to impact, including successfully establishing: (i) the UCL Norfolk Ponds Partnership (*Sayer*); (ii) the UCL Aquatic Restoration Partnership (*Bennion, Sayer*); (iii) an iOS app to help wetland managers assess the impacts of climate change (*Thompson*).

(2) Training and sharing of best practice

- We have initiated Departmental **Impact Open Days** for our staff to showcase our impact activities and to share best practice in the identification of impact opportunities in research activities and the integration of impact within future research plans.
- **Research impact training** is delivered to our PhD students at both the Departmental and institutional level. For example: (i) UCL **Train and Engage** sessions, which include training for research students in public engagement, and an opportunity to apply for £1000 funding to run public engagement projects aligned with PhD research (*Slatter, Taylor*); (ii) an annual UCL Geography Public Engagement event; and (iii) research students within the London NERC DTP are encouraged to undertake internships and secondments to develop impact and engage with policy; five of our PhD students have been seconded to the Tropical Biology Association, Willis Towers Watson, PBA Applied Ecology and Defra.
- Impact activities now form part of Departmental **annual staff reviews** and are recognised in the **criteria** for academic promotion and salary increments.

Our **future impact strategy** focuses on impact growth by: (1) promoting a Departmental research culture in which impact is highly valued, and (2) maximising institutional investment in research / research-led teaching to shape the future of impact. Through Department-focused *Impact Days*, we will build on the experience of our well-established activities in public engagement, knowledge exchange, and delivering data and tools, and we will explore new ways of embedding, integrating, and realising impact. Institutionally, our connections to UCL East (UCL's enterprise, innovation and engagement focused expansion in east London) over the next 5 years will create new roles (Geography is establishing a postgraduate programme in Citizen Science) and opportunity (space, resource, and collaboration) that support our plans to take a leading role in defining and understanding the future of impact.

1.5 Interdisciplinary research

During the reporting period, we have pursued a significant expansion in our interdisciplinary research by assuming key roles in several initiatives. These have provided opportunities to explore new spaces and develop new collaborations.

(1) We play a leading role in the **UCL Urban Laboratory** (*Arabindoo, Harris, Robinson* co-Directors), which draws on a wide range of urban expertise across several UCL Faculties. Over the reporting period, the Urban Lab hosted international conferences and participated in an Erasmus Mundus international network of Urban Labs. Cross-faculty funding and additional grant income, as well as an interdisciplinary MSc Urban Studies, hosted in Geography, ensure long term sustainability. Well-established external collaborations include the London-wide network in urban studies, the Urban Salon.

(2) We are centrally involved in the UCL collaboration with the **Alan Turing Institute**, through the work of *Musolesi*, who is the UCL Lead for the Turing, coordinating the engagement of the entire UCL community with the Institute. *Law* recently joined the Department as Lecturer in Social Data Science, following an independent Research Fellowship at the Turing. During the REF period, we have engaged with the Turing through two funded research projects and three PhD studentships, while members of staff in the area of data-driven climate and coastal modelling have participated in events in Environmental Data Science organised by the Turing.

(3) Our physical geographers participate in the **UCL Environment Domain**, which builds on the work of the UCL Environment Institute (initially directed by *Maslin*). It provides a platform bringing together the breadth and depth of environmental expertise at UCL to develop interdisciplinary environmental collaborations and partnerships, and to provide development opportunities for early career environmental researchers. *Brierley* is a member of the Advisory Board.

(4) We founded the new **UCL Anthropocene** initiative (2020, co-convenor *Barry*) in the SHS Faculty. It draws expertise in Geography, Archaeology and the Environmental Sciences into new forms of dialogue with research in History, Anthropology, Political Science, Economics, and Sociology. It aims to: (i) contribute academic expertise to UCL's Sustainability Strategy; (ii) develop new interdisciplinary approaches to understanding the history, present state, and future of humanity's impact on the planet; and (iii) intervene in public debate and engage with citizens about climate change, sustainability, and the environment.

(5) The **UCL Global Governance Institute** undertakes interdisciplinary study across UCL of crucial governance 'deficits' in order to explore the nature of the problem, the processes, structures and institutions involved, and potential solutions. *Dittmer* was the Global Security thematic director and is currently on its Academic Steering Board.

(6) During the REF cycle, we played a key role in founding the **Institute of Advanced Studies** in 2015, with the idea of taking a critical approach to Area Studies. The IAS provides a home to a number of initiatives in which UCL geographers have been centrally involved:

- The **Centre for the Study of South Asia and the Indian Ocean World** (co- founded and directed by *Jazeel*) promotes research and teaching related to the geographical region of South Asia and its intersections with the wider world, including the South Asian diaspora. It brings together researchers and postgraduate students from SHS and Arts & Humanities Faculties and the Institute of Education.
- The **African Studies Research Centre** serves as a nexus of interaction for research across Africa. Collaborations with the Bartlett Development Planning Unit secured seed funding to establish a UCL-wide African urban studies network that includes urban and physical geographers (*Page, Robinson, Taylor, Thieme*). *Page* led the launch (funded by UCL Global Challenges) and is on the steering group.
- The **Refuge in a Moving World** Interdisciplinary Research Network is led by *Fiddian-Qasmiyeh* in collaboration with the UCL Institute of Global Prosperity. It brings together experts from across UCL to develop a full understanding of, and a means of responding to, the human, material and representational effects of intersecting processes of mass displacement around the world.
- The **Sarah Parker Remond Centre for the Study of Racism and Racialisation**. *Jazeel* and *Bressey* were on the committee that appointed its Founding Director, Paul Gilroy. *Jazeel* is on the Centre's Advisory Group and *Fiddian-Qasmiyeh, Ingram, Jazeel, Kneale, Latham, Western* and *Wilkin* are affiliated staff at the Centre.

1.6 Open research environment

The Department's culture of inclusivity extends to our research users. Our commitment to Open Access goes beyond the REF requirements, encouraging authors to deposit all published outputs in UCL Discovery, the open access institutional repository: **99.8%** of our articles and conference papers that were accepted from 1 April 2016 (not only those submitted as REF2 outputs) have been deposited in UCL Discovery, are gold open access or qualify for exceptions; **89%** comply with or have exceptions to the REF open access policy.

We have published four books (*Fiddian-Qasmiyeh*, *Haklay*, *Longley*, *Roseneil*) through UCL Press, the first fully open access university press in the UK. UCL Press also publishes the journal *UCL Open: Environment* (*Brierley* is on the editorial board). With *Mackay* as co-Editor-in-Chief, we were involved in founding the RGS-IBG's open access journal *Geo* in 2014, which publishes original geographical and environmental research articles. We are also leaders in the growth of citizen science at UCL, which was core to our impact in REF2014 (Open Air Laboratories Water Survey) and continues to be driven through our Extreme Citizen Science research (EPS Cluster).

1.7 Research integrity

The Department has played a leading role in the **UCL Ethics Review** and the development of a new **Ethics Policy** and **ethics review process** for UCL and the Faculty (*Burningham* chairs the UCL Ethics Review Steering Group, *Barry*, *Page*, *Varley* are all members), and in the generation of the new **UCL Code of Conduct for Research**. The Department has a Research Ethics and Integrity committee, which contributes and responds to wider changes in UCL ethics policy, considers complex cases, and fosters a culture of ethics and research integrity. All research conducted by students, researchers and staff undergoes a rigorous ethical review to ensure it conforms with accepted ethical and legal standards regarding data protection, research participants rights and consent.

2. People**2.1 Staffing strategy and staff development**

Recruitment and sustainability: Our abiding goal is to attract and develop the highest quality academic staff. Alongside turnover (three retirements, five relocations and, tragically, one death), the Department academic staff body has grown from 42 to 48 since 2013, comprising 6 Lecturers, 15 Associate Professors and 27 Professors. Fourteen staff are female (29%), of whom seven are professors. Twelve of our staff have international backgrounds. Of 14 new appointments, 10 have been of early career academics, representing the foundation of our future submissions.

Staff development: All new staff follow the UCL induction programme, which includes mandatory training in safety, information security and GDPR, unconscious bias training, and green awareness. Through the probationary review and annual appraisal system, staff are helped to make considered judgements about their research careers, and the appropriate balance between different responsibilities. Staff are encouraged to take part in training and personal development programmes offered by UCL Organisational Development, take wider roles in UCL in a way that contributes to career development. Our submission includes the Faculty Dean and two Vice Deans (Research, EDI).

Appraisals and promotions: We are committed to fair and transparent appraisals and promotions. Appraisers are trained and appraisal is carried out annually, in accordance with UCL procedures. Appraisals are an opportunity to recognise achievements formally, provide feedback, review research objectives, and identify development needs. Staff are encouraged to express an interest to the Departmental Promotions Committee, which provides feedback before final applications are made to UCL. During the reporting period, academic staff were promoted 33 times (64% male, 36% female); there were three unsuccessful attempts (3 male, 0 female).

Support for early career staff: Newly-appointed staff have low teaching loads in their first year and are assigned a mentor. We have created a new post of Tutor for Postdoctoral and Early Career Researchers, who arranges meetings with our researchers and organises workshops on career development. During the REF period, we have initiated an induction programme specifically

for Research Staff (over and above that for all new staff) and a Research Staff Colloquium to highlight their research.

Sabbatical leave: All academic staff are entitled to one term of sabbatical leave after every three years. Staff who have carried high administrative burden are allowed a 'double sabbatical'. Staff returning from maternity leave receive an automatic equity sabbatical that does not impact their regular sabbatical. Additional sabbaticals have been authorised to assist early career staff with completing a major piece of work.

Stimulating and facilitating exchanges between academia and business, industry or public or third sector bodies: We encourage (through appraisals) and support (through provision of facilities) exchanges beyond academia, capitalising on long-established relationships (e.g. NASA, ESA, business, local authorities, police forces, NHS Trusts, government agencies). Institutional services facilitate exchanges: for example, UCL Consultants have enabled staff to engage with a range of commercial ventures across business and third sector bodies, generating a total activity of £535,489.

Incentivising and rewarding research excellence: Our workload model incentivises staff to obtain research grants by including credit for managing FEC research grants, equivalent to teaching one full-term course. Authors of REF Impact Case Studies were also given credit in the workload model. Recognition of Research and Enterprise, and External Engagement (including impact) are two of the four principal criteria for academic promotion at UCL. Outstanding research and impact may also be rewarded through additional salary increments.

2.2 Research Students

Recruitment and studentships: Postgraduate research students (PGRs) are central to our research environment. Our PGRs have been funded by Research Council studentships – 27 ESRC from the UCL ESRC DTC, 24 NERC DTP, including 3 with NERC CASE awards. Three students have received an additional year's funding through UCL Cross-Disciplinary awards. We attract excellent students, evidenced by our success in competitive funding from UCL and other national and international PhD awards (e.g. CNPq, Talentia, CONICYT).

Equal opportunities: All PGRs, including those studying part-time, have equal access to space, facilities and conference funding. PGRs can take unpaid study leave and are entitled to full parental leave.

Monitoring and support mechanisms: We appoint an experienced member of academic staff as Departmental Graduate Tutor (DGT), who will have served as Deputy DGT preceding their term. We ensure there is always a mix of a human and physical geographer in the DGT/Deputy roles. PGR students have two UCL supervisors who undergo UCL training in research supervision. Departmental guidelines provide guidance on good practice. Progress is carefully monitored via an online Research Student Log and annual reports. Formal procedures govern upgrading from MPhil to PhD status. Mandatory upgrade presentation sessions bring the PhD student cohort and staff together in two annual Upgrade Presentation Conferences, which further strengthen our research environment. The Department provides an annual fund to support PGR conference attendance. The Department has a dedicated Staff-Student Consultative Committee for PGRs. New PhD students are supported via a 'buddy system' which pairs them with an existing PhD student who acts as an informal mentor.

Skills development and career preparation: We support the career development of doctoral students with skills training and teaching experience. Training needs, covering both generic and specific skills, are considered on arrival and agreed by supervisor and student. Our PGRs benefit from the resources of the UCL Doctoral School, which provides a skills development programme with a wide range of modules (devising and managing research projects, preparing for viva, teaching and publishing, coping with writer's block). UCL Arena One is a development pathway for postgraduate teaching assistants (PGTA) to begin their teaching careers. It consists of a mandatory 'Gateway' session, followed by the full, optional Teaching Associate Programme (TAP). After attendance of TAP, our PGTAs are encouraged to continue their development and are supported in applying for Associate Fellowship of the Higher Education Academy. During the

REF period, 105 of our PGRs attended Arena Gateway and 21 Arena TAP. PGRs also have to attend a Departmental PGTA training session before they undertake teaching.

The Department runs a term-long training seminar, introduced in 2015-2016, which includes sharing project outlines, developing writing skills, impact, presenting research topics to peers, research integrity and information on approaching the upgrade, as well as fostering a sense of research community. Additionally, a half-day training event in mid-October each year provides an opportunity for new students to meet existing PhD students and staff in the Department. Since 2016, the Department has run workshops for late-stage students on *Careers in Academia* and on *Publishing from the PhD*. Students also have access to the UCL Careers service. PGRs are fully integrated into the Departmental research environment through participation in the research clusters and by organising their own reading groups. Conference presentations are a vital part of PGR training and our students present papers at international meetings and also run conferences, such as the annual Stadtcolloquium international seminar series. PGRs organise the popular Departmental weekly seminars in Palaeoclimate and in Physical Geography.

2.3 Equality and diversity

The Department holds the values of Equality, Diversity and Inclusion (EDI) to be central to our identity and culture. The Department was awarded an Athena Swan (AS) bronze award in 2016 and is working towards silver. Geography staff (*Burningham, Mackay*) participate in UCL panels to prepare AS applications and serve on the AdvanceHE panel to assess national applications. We work closely with the Faculty AS Coordinator, who also participates in our Departmental AS meetings.

Our EDI Committee ensures best practice across the Department for the benefit of all staff and students regardless of sex, gender identity, race, sexual orientation, disability, age, religion and belief. The Committee has a diverse membership of staff and students that reflects and supports the diversity of the Department more broadly. The EDI Committee is co-chaired by *Burningham* and *Mackay*, who are the first point of contact for individual EDI issues within the Department (*Burningham* and *Betts* are the Departmental Inclusion Leads). During the reporting period, *Mackay* has been the Faculty EDI Vice-Dean, co-chaired the Faculty EDI Strategic Board and the Gender Working Group, and has been a member of the UCL Equality Charters Group that oversees development of institutional charter marks, Race Equality charter, AS and the Provost's Inclusion Forum that monitors implementation of the new UCL EDI Strategy.

Our EDI Committee raises awareness of diversity and equality issues in the Department and provides advice and training when necessary. The Committee ensures that UCL's EDI Strategy and Race Equality Charters, and Faculty Equality Action Plans are implemented in the Department. The Committee has a series of prominent webpages on the Departmental website, which act as a focal point for EDI issues.

The Committee is also proactive in developing new Departmental initiatives to enhance EDI measures: we established an LGBTQ+ network (2017) for staff and students to identify issues related to sexuality and gender in the workplace (e.g. transphobia, homophobia), and a BAME network (2018) to provide a space where issues related to race and ethnicity in teaching and research could be freely discussed, as well as providing a social network for BAME research and other students. We have also created a network for people with disabilities and neurodiverse students and staff, and a network for women in physical geography (2020). In 2018, our LGBTQ+ network held a gender diversity workshop that was well attended by staff and research students from across UCL, while the BAME network has held a series of events including careers advice workshops for research students about to enter the workplace. Key contacts for both networks include staff and research students.

Promoting and supporting diversity in the PGR population: UCL established the Research Opportunity Scholarships to support BAME PGR degree students, starting in 2018; the Department was successful in obtaining two out of the five offered across UCL in that year. The SHS Faculty is developing further strategic initiatives to attract, fund and support BAME PGR students. Results of the Postgraduate Research Experience Surveys are examined with particular

attention to equalities issues by the DGT and Deputy DGT, who submit proposals to the Departmental Management Team if any action is required.

Promoting and supporting diversity among staff: All staff on appointment panels undergo training on unconscious bias, and specific training has been organised for all staff and postgraduates on bullying and harassment. Our appointments panels since the last REF have a 50/50 gender balance. The EDI Committee coordinates and analyses qualitative and quantitative information relevant to the Departmental structure and procedures. This includes review and edit of job descriptions and advertisements, and analysis of long-term data trends for gender and ethnicity of people applying to UCL Geography jobs, those who obtain interviews, those who are offered jobs and those who finally accept offered positions.

The proportion of our UoA staff (HESA3 and HESA2, the 'baseline') with protected characteristics is 33% female and 13% BAME, which is below the institutional baseline of 44% and 17%, respectively. Closer inspection shows that the HESA2 profile of our staff is 42% female and 13% BAME, while the HESA3 profile is 30% female and 8% BAME. We have therefore explicitly encouraged applications from women and ethnic minorities in our recent job advertisements. In the current REF cycle, we have made fourteen new academic appointments, of whom seven are female and two of BAME background. While we recognise that there is much to be done to improve the diversity of our academic posts, we are encouraged by the situation in our research staff. Thus, part of our strategy to improve diversity in academic recruitments is our continued support and investment in the earlier stages of the pipeline.

Wellbeing of staff and research students: Promoting the wellbeing of staff and students is a crucial dimension of being an inclusive department. We have a Wellbeing Champion (*Mackay*) and two PGR representatives on the Self-Assessment Team. The Wellbeing Champion and Inclusion Leads both provide designated hours every week to meet with staff and students to chat about wellbeing issues when needed. The Department has weekly yoga classes and also its own thriving running group (UCLgeoggers) to promote health and wellbeing amongst the student and staff body.

Promoting an inclusive environment: The Department ensures that all staff and students can attend meetings and key events (including social events). We have a core hours policy of 10am to 4pm and where requested we do not timetable lectures for academic staff with caring responsibilities during early morning or late afternoon slots. Social events are not centred around alcohol. Our four networks (BAME, LGBTQ+, Women in Physical Geography, Disability and Neurodiversity) organise events for staff and students, including film screenings and LGBTQ+ themed wikithons. Events and meetings are accessible to staff and students with disabilities. We ensure that images on our websites represent the diversity to which UCL Geography is committed.

Construction of the REF submission: Our REF strategy developed over a series of all-staff away days, with the Research Committee overseeing its implementation. It was collectively agreed that output selection would have no bearing on appraisals and promotions. The composition of the Research Committee varied during the REF cycle, reflecting turnover in cluster leadership, but on average comprised 3-4 female and 5-6 male staff. Members received EDI training. Output assessors attended a workshop on REF guidelines to ensure uniformity of practice. The results of the assessment were communicated to staff, aiming to provide constructive advice; assessors also reviewed draft manuscripts and provided feedback. External assessors reviewed a subset of outputs to ensure calibration and advised on their selection. The impact case studies have been written by the staff directly involved in the research and impact, with feedback from Research Committee, the IC and the Faculty Research Impact Manager. The selection of independent researchers followed the UCL REF2021 Code of Practice.

The UoA submission (56 people, 55.5 FTE) includes 18 female (32%) and 5 BAME (9%; the ethnicity of an additional 3 is undeclared), compared to our baseline distribution (female 33%, BAME 13%). The percentage of attributed outputs by staff with protected characteristics is 30% female, 6.5% BAME; the likelihood, therefore, of an output being attributed to female staff is 0.91 and BAME is 0.71, but we note that 8% of outputs are by staff of undeclared ethnicity, with a likelihood of attribution of 1.46. The UCL REF team has made us aware of institutional problems with the collection of ethnicity data which UCL is seeking urgently to address.

The pattern of output distribution reveals that the likelihood of female staff having five outputs attributed is 0.89, while that of having one output attributed is 1.17. Thus, despite a staff selection that is in line with the demographics of the baseline, this pattern raises questions that need to be analysed and understood (e.g. the number of outputs attributed per person may not be a reflection of the total number of outputs published). In terms of seniority, the output distribution suggests that while Professors are equally likely to have from one to five outputs attributed to them, early career staff are more likely to have fewer than three outputs. Our aspiration is that just as early career staff at the start of this REF cycle (section 1.3) have now contributed five or four outputs each, recently-appointed Lecturers will have a similar progression over the next cycle, as part of our long-term staffing strategy.

3. Income, infrastructure and facilities

3.1 Research funding and strategies for generating research income, including links between research funding and high-quality research output or impact

One of the future objectives articulated in our REF2014 strategy was to increase our research income. Over the reporting period, our portfolio of projects was worth £22,434,860. To achieve this, we enhanced proven practices and pursued new initiatives by:

(1) Promoting a stimulating research environment, with weekly research seminars and termly cluster meetings to provide a platform for discussing research plans.

(2) Establishing a rigorous internal peer review of proposals.

(3) Providing support for grant applications through a dedicated Departmental facilitator.

(4) Making full use of Faculty and University research facilitators.

(5) Placing a stronger emphasis on European funding. In the previous REF cycle, we submitted 23 applications to FP7 of which 6 were funded (including 1 ERC AdG) and awarded a total of ~£3M. In the current cycle, we submitted 34 applications to Horizon 2020 of which 13 were funded and awarded a total of ~£8M (part of which is carried over to the next REF period), including 4 ERC grants (*Fiddian-Qasmiyeh* [StG], *Haklay* [AdG], *Marais* [StG], (*Robinson* [AdG]).

(6) Pursuing strategic funding:

- NASA (for 3D forest measurement, new satellite mission support), ESA (mission support, forest carbon, and new product development), National Centre for Earth Observation (capital funding, and National Capability funding for Official Development Assistance work), UK Government funding (Newton STFC / DFID for crop security co-funded with Chinese government) (*Disney*, *P.Lewis*).
- AHRC-ESRC Global Challenges Research Fund for work on refugees and local host communities (*Fiddian-Qasmiyeh*).
- ESRC Urban Transformations to support research and comparative analyses of the politics of large-scale urban developments in China, South Africa and the UK (*Robinson*).
- Partnerships with business and government organisations around the acquisition and synthesis of diverse sources of 'Big Data' (*GSAC cluster*). ESRC Consumer Data Research Centre (CDRC), with UCL Geography the lead institution (*Longley*).
- The Royal Society - DFID Capacity Building Initiative Consortium Grant AfriWatSan: sustaining urban groundwater-fed water supplies and sanitation systems in Africa; and NERC 'Directed – International: 'Groundwater Futures' in Sub-Saharan Africa (*Taylor*).

3.2 Organisational infrastructure and areas of significant investment

Over the REF cycle, support for research and impact infrastructure has been planned and implemented through close co-ordination between the Department, the Faculty Dean and Vice-Dean for Research.

Research in Physical Geography is supported by two main laboratory facilities, the **Geography Laboratories** and the **Bloomsbury Environmental Isotope Facility (BEIF)**, which includes the **UCL Environmental Radiometric Facility (ERF)**. The Geography Laboratories are staffed by a Laboratory Manager and three full-time technicians. Overall strategy and operation are overseen by a Departmental Laboratory Committee. BEIF is a joint facility with the Department of Earth

Sciences, staffed by a Manager, who is a joint appointment with Earth Sciences, and a Research Fellow who supports the ERF facility. The operation of BEIF is overseen by a steering committee, comprising members from the 'parent' departments. Computing facilities have been managed by the Computer System Administrator, supported by a team of a Webmaster and a Database Developer.

During the census period, a major investment in maintaining and enhancing our world-leading operational infrastructure has been undertaken through Departmental and UCL Research Capital Equipment Funds:

- Coulter Counter (£35K).
- X-ray fluorescence spectrometer (XRF) (£90K).
- Fourier-Transform Infra-Red imaging microscope (μ FTIR) for the rapid analysis of microplastics and other organic and inorganic determinands (£60K).
- ROBIN airborne and mobile laser scanning for cutting-edge 3D observations of forests, terrain, urban and aquatic/marine environments (£161K).
- Nu Perspective IRMS for oxygen and carbon isotope analyses, and automated clumped-isotope measurements for BEIF (£189K from Geography; £148.7K from Earth Sciences).
- Picarro L2130-i water analyser for O and H isotope analysis of natural waters with rapid throughput for BEIF (£131.3K).
- Geocomputing cluster for Artificial Intelligence, human-environmental system modelling, and Earth Observation (£141K).

3.3. Operational and scholarly infrastructure

Laboratories and field equipment: The Geography laboratories include facilities for the curation of sediment cores and samples and the routine preparation of sediments for sedimentological, palaeoecological (diatoms, pollen, foraminifera, ostracods), geochemical and stable isotope analyses. The laboratories include: an ultra-clean preparation room with laminar flow bench for trace element analysis and biomarkers; two HF-grade laboratories for pollen sample preparations; a suite of research microscopes and reference collections for microfossil analyses; a water chemistry laboratory for cation, anion and nutrient analysis; an ICP laboratory (joint with Earth Sciences). Investment during the census period has enhanced our capabilities for bulk geochemical and grain size analyses of sediments. The ERF lab hosts a gamma spectrometry facility with four Ametek gamma spectrometers for radioisotope analyses, including $^{210}\text{Pb}/^{137}\text{Cs}$ dating. The Department has an extensive range of field equipment, including five research boats, Livingstone, Russian, Hiller, Mini Mackereth gravity and percussion corers, hydrographic and coastal oceanographic instrumentation, dGPS, sounding and side-scan sonar equipment.

BEIF has expertise analysing inorganic and organic stable isotopes. It houses one dual-inlet (ThermoFisher MAT253) and two continuous-flow (ThermoFisher Delta V & Delta Plus XP) mass spectrometers with a variety of peripheral systems capable of measuring stable isotopes ($\delta^{18}\text{O}$, $\delta^{15}\text{N}$, $\delta^{13}\text{C}$ and $\delta^2\text{H}$) generated from a variety of materials. New equipment includes the Nu Perspective IRMS; the Picarro CRDS; and IsoLink and Delta V IRMS.

Map Library: Our map library houses one of the largest Geography department map collections in the UK, containing over 100,000 historic maps and charts that support a range of research activities. The library is being progressively digitised so that this substantial historical resource can be delivered as a curated digital collection supporting historical, spatial and geographical research within and beyond the Department.

Computing: Our strength in computational geographies, ranging from HPC-dedicated tasks (e.g. climate modelling) through algorithm work (e.g. model development and machine learning) to intensive analysis of large datasets, is underpinned by a large Linux network exclusively for the Department's use. The Department also accesses some of the fastest university-owned HPC in the country through UCL's Grace machine (initially benchmarked in the Top 100 machines globally). National facilities such as ARCHER and Jasmin are also used.

A local cluster of high-performance Linux workstations supports advanced PhD and MSc research and enables us to deliver UCL's research-based Connected Curriculum. All of the systems benefit

from the latest versions of Matlab, Envi/IDL, Intel Compilers, Anaconda Python, R and QGIS. We also run specialist modelling software (e.g. Mike SHE) via Windows virtual machines.

In addition to these facilities, the Consumer Data Research Centre has eight compute nodes each with 16 cores and 192GB RAM. There are an additional two compute nodes with 16 cores and 768GB RAM for working on larger datasets. A server with 128GB RAM and a very fast disk storage 20TB array provides database services. Further servers provide web and other ancillary services. These are all underpinned by storage systems providing >100TB of storage.

3.4. EDI issues: support for acquiring research funding or accessing infrastructure

We promote an inclusive and accessible research and work culture and ensure that our scholarly and operational infrastructure is accessible to any member of the Department (including students) with disabilities. For example, we employ a part-time PA to assist a member of staff with visual impairments to facilitate written work and communication; we utilise new technology and equipment to support those with hearing and voice impairments; and we have lift and ramp access to the different floors in our buildings. During the current pandemic, the Department adopted new accessibility standards in relation to online working.

4. Collaboration and contribution to the research base, economy and society

4.1 Arrangements, support in place for and effectiveness of research collaborations, networks and partnerships and indicators of their success

UCL Geography fosters an inclusive research environment and values diversity in approaches to collaborative working that collectively support the progression of our staff, advance of our disciplines, and sharing of knowledge and understanding with wider society. Ultimately, the extent and depth of such collaborations inform the Departmental research and impact strategy, and long-term investment in facilities. We actively encourage (through appraisals) and support (through provision of space, laboratory and computing facilities) the creation and nurturing of collaborations, networks and partnerships.

We have drawn on UCL funding initiatives aiming to promote collaborations: (i) **Grand Challenges** (*Bressey, Coulter, Fiddian-Qasmiyeh, Robinson, Varley*); (ii) **Global Engagement Fund (GEF)** (*Arabindoo, Dittmer, Harris, V.Jones, Page, Rose, Thompson*); (iii) **Cities Partnerships** (*Arabindoo, Tzedakis*); and (iv) **UCL-French Embassy** (*Arabindoo*). For example, **GEF** enabled *Arabindoo* to develop collaborations with Indian partners (Anna University, Chennai and IIT-Madras) on the impact of the 2015 Chennai floods and its aftermath. The **Cities Partnerships** provided *Tzedakis* with seed funding to establish a new research collaboration with partners at the University of Rome 'La Sapienza' and the Italian CNR; this in turn led to a successful joint NERC-funded application.

We have taken a central role in national institutional collaborations: UCL was one of the five founding universities of the Alan Turing Institute (coordinated at UCL by *Musolesi* (section 1.5)). UCL has joined the Met Office Academic Partnership (MOAP) of leading institutions advancing the science and skill of weather and climate prediction (*Brierley* is on the UCL-MOAP Management Board).

The global coverage of our research sites during the reporting period (Fig. 1) reflects the development of collaborations with local researchers and international consortia. Notable examples include:

- *Fiddian-Qasmiyeh* is Academic Co-Chair of the **Joint Learning Initiative Refugees and Forced Migration Hub**, bringing together academics, policy makers, practitioners and faith leaders who work on displacement, to 'jointly learn' and ensure that policies and practices in this field are based on appropriate forms of evidence. It has ~100 members (including Oxfam, UNHCR and a range of faith-based NGOs).
- *P.Jones* conceived and leads the ongoing **Marine Protected Area Governance (MPAG)** research network (with UNEP funding) and the former **European Marine Spatial Planning Research Network** (with EU FP7 funding). These research networks have involved over 130

scientists, postgraduate researchers and policy practitioners from 32 countries, who have contributed 63 case studies.

- *S.Lewis* founded and co-manages the **African Tropical Rainforest Observatory Network (AfriTRON)**, a network of long-term inventory plots across 12 countries in tropical Africa, involving partners from 22 countries. AfriTRON provides vital insights into mechanisms underlying current responses of tropical ecosystems to climate and possible futures of African forests under climate and other environmental changes scenarios.
- *Taylor* and Favreau (IRD, France) conceived and lead the **Chronicles Consortium**, through which over 30 scientists from 14 countries in Africa and beyond (UK, France, USA) compile and analyse long-term observations to understand groundwater storage responses to climate variability and human use. The Consortium also develops long-term benchmark datasets to test numerical models, linking allied observatories in the **Network of African Groundwater Observatories**.
- *Tzedakis* founded and co-leads the **Quaternary Interglacials (QUIGS 2015-2022) Working Group** of the Past Global Changes project. QUIGS has involved 95 palaeoclimate scientists from four continents and aims to improve understanding of the climate processes during warm periods of the Quaternary. Its research findings are contributing to the 6th Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC).

4.2 Engagement with key research users, beneficiaries or audiences

The Department is committed to a knowledge exchange agenda that extends across public, private, commercial, and government sectors. Our research-led scientific, technological, and conceptual advances now underpin and inform policy and practice. Community and citizen-focused engagement and data collection have augmented our research activities and outputs. The collaborations and interactions arising from these have, in turn, enriched the intellectual environment of the Department.

Internationally, our research has influenced and informed **global policy and practice**, such as marine protected area governance for UNEP (*P.Jones*) and international humanitarian engagement and delivery of 'good practice examples' to UNHCR (*Fiddian-Qasmiyeh*). Our research has advised local government in South Africa (*Robinson*), and national water authorities to influence groundwater policy and management across sub-Saharan Africa (*Taylor*). Our earth observation modelling underpins ESA/NASA algorithms and products (*Disney; P.Lewis*).

Research undertaken in the Department has delivered expert knowledge and guidance to **national and regional government and policy organisations** in the **UK**. *Dittmer* and McConnell reported to the Foreign and Commonwealth Office Policy Unit on the changing nature of digital diplomacy and potential changes to FCO's practices. *Page* has advised the FCO and the All Party Parliamentary Group for Africa on the social and historical context of the 2018 Cameroon conflict. The CDRC (*Longley, Cheshire*) provide consumer data for the social good, used by local authorities, police forces and NHS Trusts. Working with Cefas, *Burningham* has delivered research and geomorphological advice to the British Energy Estuarine and Marine Studies programme, informing decision-making on nuclear energy planning. *Kneale* advised the Museum of London Archaeological Service on analysing time capsules recovered after the demolition of the National Temperance Hospital.

Our research has been influential in **conservation and environmental management and decision-making**. We work directly with stakeholders to implement specific research agendas to support: (i) the protection of rare species (*V.Jones*: in Scotland and Madagascar); (ii) assessment of climate change impacts on environments (*Thompson*: English Heritage, Environment Agency, Natural England, RSPB and the Wildlife Trusts); (iii) restoration and management of freshwaters, particularly in terms of the effects of eutrophication (*Sayer, Bennion*: Wildlife and Rivers Trusts, National Trust); (iv) environmental decision making (*Burningham*: estuary management - Deben Estuary Partnership; licencing decision-making for the UK seabed estate - The Crown Estate); (v) evidence-based practice through the Department-based consultancy *Ensis Ltd*, working with Defra (running the Upland Waters Monitoring Network until 2018) and agencies (Scottish EPA; SNH; Welsh Government; Natural Resources Wales; Forest Research; Marine Scotland) as well as the

Centre for Ecology and Hydrology (CEH) on recovery from surface water acidification and confounding factors in upland UK (*Battarbee, Rose, V.Jones*); and (vi) participatory modelling of coastal change, involving communities and agencies (*French, Burningham*: NERC iCOASST).

At the **grassroots** level, we have a long history of working with **local communities, public organisations** and **vulnerable groups**. In these examples, collaboration is embedded at all stages of research, from design to impact and dissemination. We have built networks and relationships to encourage good practice in local initiatives to support the increase in biodiversity in agricultural landscapes (*Sayer*: Norfolk Pond Project). We advised community-based mobilisation in response to failing flood defences and water quality in Chennai (*Arabindoo*), and work with the Just Space alliance of community groups in London and Planact in Johannesburg, to support public engagement in metropolitan and local plan processes (*Robinson*). Our research on religion and its significance in suburbia has enriched connections across communities, increasing tolerance and awareness of faiths (*Dwyer*). In sub-Saharan Africa, our groundwater research directly benefits local communities in assisting the provision of reliable water supplies (*Taylor*). Through researching skills and aspirations amongst young offenders in the UK, we have supported groups such as the Changing Paths Charitable Trust to develop sustainable livelihoods for ex-offenders (*Thieme*). Working with refugees has delivered critical support and assistance to both displaced and host communities in Syria, Jordan and Turkey (*Fiddian-Qasmiyeh*). Collaborative projects with refugee activists in Greece (Active Citizens Sound Archive) provide a platform for community building and political inclusion (*Western*).

4.3 Wider contributions to the economy and society, not captured in impact case studies

Several of our research groups deliver multiple tools and data products to national and international agencies that arise from innovative analytical approaches and substantial advances in data assimilation techniques. In particular, our work with Earth Observation data, in combination with modelling and field surveys, has led to transformative shifts in decision-making for conservation, agricultural and climate change mitigation. Research led by *S.Lewis* integrated the first field datasets of depth and carbon content of the **central Congo swamp forests** with satellite data, discovering the world's largest tropical peatland complex, containing an estimated 30.6 billion tonnes of carbon, equivalent to 20 years of the fossil fuel emissions from the US. As a direct consequence of this work, the Republic of Congo and Democratic Republic of Congo governments signed the Brazzaville Declaration to protect the peatland, leading to over \$20 million being invested in further research, sustainable landscape management and protection of the central Congo peatlands. Research led by *P.Lewis* has established a data assimilation-based crop monitoring system that works at unprecedented high resolution over large geographic areas. Study sites in the **North China Plain** account for 80% of China's wheat production, where simulations and predictions of crop performance have supported strategic planning, regional production optimisation, and management of national food supply and security. This work was awarded the **Newton Prize 2019**, recognising the best science and innovation partnerships between the UK and Newton partner countries.

Through our migration-focused research activities, we are addressing key challenges in the delivery of meaningful support to, and social justice for, **refugees**. Research led by *Fiddian-Qasmiyeh* explores the motivations, nature, and implications of the Global South aid response, establishing the concept of **overlapping displacement**, that raises the importance of host communities (including refugees) as responders to displacement. The work has disseminated evidence-based, best-practice examples and religious literacy guidance to inform humanitarian aid programmes and NGO training courses.

The social enterprise Mapping for Change (MfC) was established to utilise participatory mapping know-how, using software created through research led by *Haklay*. Since 2010, MfC has supported over thirty communities to undertake **citizen science monitoring programmes** to measure, map and increase awareness of air pollution in London, Barcelona, Katowice and Kampala. The activities have influenced public awareness of air quality issues, changed practices of public transport providers and local authorities, and have been drawn on in policy documents.

4.4 Engagement with diverse communities and audiences

Communication and dissemination of our research activity to a variety of audiences is essential to our mission to deliver impact for public benefit. We have made increasing use of **UCL Culture's public engagement team** to embed a culture of engagement in the Department, and our initiatives have been recognised in the UCL '**Provost's Awards for Public Engagement**' (*Fiddian-Qasmiyeh, Haklay, Sayer*).

The Department has a strong online presence and we engage with social media audiences, with ~10,000 followers across Twitter, Facebook and Instagram. We deliver a range of online resources and commentary, including the UCL Geography blog (9520 users), and in 2015 we relaunched the Bloomsbury Geographer, a student-led online journal.

Several of our research groups and projects run online activities that connect with wider public and academic audiences and enhance open access to our research findings and learning, such as the Pond Restoration Research Group (*Sayer* uclponds.org). *Cheshire's* site (jcheshire.com) attracts 100,000 visits a year, with many utilising tutorials on the use of the R statistics package for mapping and visualisation. *Disney* is lead educator on the ESA-funded Massive Open Online Course on Earth Observation in the Optical Domain (hosted by futurelearn.com), with over 10,000 completed participants to date.

Our research outputs have contributed to the **delivery of open (free) tools or data products** that are utilised by the public and a wide range of organisations. **Datashine.org.uk** (*Cheshire*, supported by ESRC Future Research Leaders funding) is used across the public, private, charity and educational sectors. The iOS **Wetland Tool** supports managers by providing assessments of climate change impacts for any wetland in England and Wales (*Thompson*, with CEH, supported by NERC Impact Award funding). The **Coastal and Estuarine System Mapping** QGIS plugin has been used by the National Trust (Poole Harbour) and Magnox Ltd (for the Nuclear Decommissioning Authority, evaluating 'end state' options for Bradwell power station) to map coastal systems and capture processes/influences (*French, Burningham*, NERC iCOASST).

We undertake media engagement activities, contributing to open discourse around key issues relating to our research, but also to engage the widest possible public audience. *Fiddian-Qasmiyeh's* research, including the 'Refugee Hosts' project, has been exhibited at the *Imperial War Museum*, London and in the 2017 *Venice Biennale*, in addition to being showcased at the House of Commons and at the Headquarters of the UNHCR. The 'Refugee Hosts' website has been visited by over 66,000 people. *Ingram* organised a public event and a public discussion (*Al-Mutanabbi Street Starts Here*) about challenges of working in and through war, occupation and cultural destruction, informed by his research on art in relation to the 2003 Iraq war.

Our research activity and output has been covered in national and international newspapers, TV and radio channels. Since 2014, 15 staff and PhD students have contributed 54 articles to '*The Conversation*', eliciting over 2500 comments and over two million reads. One article (*Maslin*) has more than one million reads. Staff are on Cheltenham Science Festival Advisory Committee (*Maslin*) and have contributed to exhibitions at the British Library, Barbican Open Lab Festival, Interference Archive in New York and Kettle's Yard, Cambridge (*Roseneil*).

4.5 Contribution to the sustainability of the discipline, interdisciplinary research, and responsiveness to national and international priorities and initiatives

Our research is at the forefront of contemporary debates in our discipline and we are actively involved in working groups or leading partnerships that address these.

Staff contributed to de-colonising the discipline by publishing work at the intersection of Black, post-, de-, and anti-colonial geography that has helped to advance discussions around colonial legacies (*Bressey, Datta, Jazeel, Robinson*). *Bressey* and *Jazeel* were instrumental in discussions that led to the establishment of the **RGS's Race, Culture and Equality Working Group** in 2015. Research in the Department continues to aim at the pluralisation of the discipline and critical engagements with its prevailing whiteness (e.g. 'Making Africa Urban', *Robinson*).

We contributed to national and international priorities and initiatives: *Axmacher* is Lead Author of Chapter 4 of the **Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem**

Services regional assessment report on biodiversity and ecosystem services for Asia and the Pacific; *Bennion* is leading the development of the **Aquatic Restoration Partnership**, committed to the sustainable restoration of UK aquatic ecosystems; *Brierley* is contributing author to Chapter 3 of the **IPCC AR6**. *Kelman and Maslin* are part of the **Lancet Countdown on health and climate change**; Rose is a member of the **Anthropocene Working Group** of the **Subcommission on Quaternary Stratigraphy**; *Taylor's AfriWatSan* Consortium contributes to the **UN Sustainability Development Goal 6** by providing solutions to the development, operation and management of water supply and sanitation in low-income settlements in Africa; *Thompson, Burningham, Cheshire, Page* contributed to the **Climate Impact Research Capacity and Leadership Enhancement Programme for sub-Saharan Africa**, a DFID-funded programme implemented through the Association of Commonwealth Universities and the African Academy of Sciences.

During the **Covid-19 pandemic**, we have advanced public knowledge and provided expert comment:

- *Arabindoo* analysed the harsh dilemmas that poor cities face between lockdown and access to markets (*City and Society*; RGS-IBG blog *Geography Directions*).
- *Cheshire* and *Trasberg* have analysed measures derived from in-app phone data to chart how activity has changed in major UK cities during the lockdown (*Financial Times*, 12/5/2020).
- *Datta* examined the redeployment of existing technologies of surveillance and sousveillance to monitor the Covid-19 crisis in India (*Dialogues in Human Geography*) and the impacts of Covid-19 on migrant populations (RGS-IBG blog *Geography Directions*).
- *Fiddian-Qasmiyeh's* 'Refugee Hosts' project launched a blog series exploring the ways that refugees are experiencing and responding to Covid-19.
- GSAC's ethnicity estimation methods have provided data to government bodies in England and Wales to inform understanding of the relationship between ethnicity and Covid-19 infections and outcomes.
- *P. Jones* and *Maslin* have written in *The Ecologist* on the significance of Covid-19 for governance and the Green New Deal.
- *Thompson* and colleagues reviewed coronavirus detection, presence and persistence in the water environment (*Water Research*).

4.6 Indicators of wider influence, contributions to and recognition by the research base

We support the discipline by undertaking editorial roles and serving on committees. We were involved in founding the journals *Geo* (2014) and *Migration and Society* (2019). In addition:

Editorships: *Arabindoo*: City Journal. *Bennion*: Journal of Paleolimnology; Frontiers in Ecology and Evolution, special section Paleoeology. *Datta*: Urban Geography; Dialogues in Human Geography. *Disney*: Remote Sensing in Ecology and Conservation. *Dittmer*: Social and Cultural Geography; Geopolitical Bodies, Material Worlds Book Series. *Fiddian-Quasmiyeh*: Migration and Society. *Holmes*: Science Bulletin; Journal of Paleolimnology. *Ingram*: Ashgate Critical Geopolitics book series. *Jazeel*: Antipode; Environment and Planning d: Society and Space. *Kneale*: Journal of Victorian Culture; Social History of Alcohol and Drugs. *Mackay*: Geo: Geography and Environment. *Maslin*: Global Sustainability. *Robinson*: IJURR book series (Studies in Urban and Social Change). *Roseneil*: Palgrave book series (Citizenship, Gender and Diversity). *Thornalley*: Climate of the Past, Paleoceanography and Paleoclimatology. *Varley*: Bulletin of Latin American Research. *Waters*: Migration and Society.

Grants committees: Funding review panels for British Ecological Society (*Mackay*), British Academy Cities and Infrastructure Research Programme (*Robinson*), ERC (*Haklay, Longley*); EU JTC Scientific Evaluation Panel-FLAG-ERA Flagship Programme (*Longley*), EU EKLIPSE Biodiversity (*Kovacs*, co-chair), EU Marie Curie Fellowship (*Dittmer*), European Science Foundation (*Mackay*), Swedish Research Council for Sustainable Development (*Arabindoo*), DFF (Denmark) Green Transition Research Committee (*Barry*), DFG (Germany) panel - Regional Sea Level Change and Society (*French*), NASA Terrestrial Ecology (*Disney*), Research Council of Norway (*Barry, Thornalley, Varley*), US EPA STAR (*Marais*).

UKRI committees: Peer review panels and colleges for: EPSRC (*Haklay*), ESRC (*Varley, Waters*), NERC (*Disney, Holmes*); Strategic advisory and steering panels for AHRC-GCRF and

AHRC-ODA (*Fiddian-Quasmiyeh*), ESRC Data Resources with special responsibility for business data (*Longley*), NERC Isotope Geosciences Facilities (*Mackay*), NERC British Ocean Sediment Core Research Facility (*Tzedakis*). Programme panels for NERC 'Understanding the Effectiveness of Natural Flood Management' (*Thompson*), NERC-ESRC-DFID 'Ecosystem Services for Poverty Alleviation' (*Axmacher*).

Leadership: *Bennion* is Chair of the International Paleolimnology Association. *Disney* is on the Remote Sensing Advisory Group, Gabon Government, and US-NSF Advisory Committee for Terrestrial Laser Scanning Research Coordination Network. *French* is Founding member of the International Geographical Union Commission on Geomorphology and Society. *Haklay* served on the Board of the Citizen Science Association and the European Citizen Science Association. *Holmes* is Advisory Board member of Paleoclimate Commission of the International Quaternary Association and Chair of the Ostracod Group of the Micropalaeontological Society. *Jazeel* is Academic Trustee of The Geographical Association, and on the Strategic advisory and steering panels for British Academy South Asia Area. *Kelman* is director of the London Polar Group, the Many Strong Voices programme and the Risk Reduction Education for Disasters; he is on the UK Advisory Board of the Polar Research and Policy Initiative. *Kneale* is on the RGS Historical Geography Research Group committee. *Kneale* and *Randalls* were on the committee of the Royal Statistical Society's History of Statistics Section. *Longley* is member of the Nanjing Plan 111, China. *Marais* is steering committee member of the International GEOS-Chem chemical transport model. *Roseneil* served as a Trustee and as Chair of the Association of Psychosocial Studies and is on the Council of the Academy of Social Sciences. *Sayer* is committee member for the European Pond Conservation Network. *Waters* is on the RGS Research and Higher Education Committee.

Staff have organised **80 scientific meetings** and have delivered **141 keynote lectures**. During the REF period, their outstanding research has been recognised in **fellowships and prizes**: *Cheshire*: North American Cartographic Information Society's Corlis Benefidio Award (2018); Royal Geographical Society's Cuthbert Peek Award (2017); The British Cartographic Society Award (2015, 2017); The JC Bartholomew Award for Thematic Mapping (2017); Winner London Book Fair Innovation in Travel Publishing Prize. (2017); The British Cartographic Society Award. (2015); The Stanford's Award for Printed Mapping (2015). *Dittmer*: Georg Bollenbeck Fellow, University of Siegen (2017). *Fiddian-Qasmiyeh*: Philip Leverhulme Prize (2015). *Kovacs*: Leverhulme Early Career Fellowship (2018) and British Academy Tackling International Challenges Award (2017). *S.Lewis*: Clarivate's 'Highly Cited Researchers' list (2018). *P.Lewis* and *Wu*: 2019 Newton Prize chair award. *Robinson*: Fellow of the Society of South African Geographers (2016). *Roseneil*: Fellow of the Academy of Social Sciences; Founding Scholar of the British Psychoanalytic Council; Professor-at-Large Fellow, Institute of Advanced Studies, University of Western Australia. *Thornalley*: Philip Leverhulme Prize (2016). *Waters*: Fellow of the Learned Society of Wales. *Western*: Marie Skłodowska-Curie Actions Individual Fellowship and artist in residence at Stegi of the Onassis Foundation, Athens, Greece.

Reflection on the REF process and concluding remarks

A challenge for every UoA is to ensure that staff members recognise the improvements in research environment, staff development and equality and diversity practices arising from the REF exercise and thereby own the process. Over the current REF cycle, we have engaged with staff in an inclusive, constructive and self-reflexive manner, agreeing together the process of preparing our submission. We have sought to establish mechanisms that are perceived as improving research rather than merely assessing it. Underpinning our approach to REF has been an emphasis on sharing a collective purpose and a mutual respect and trust in each other's expertise, perspective and abilities. Our goal has been to produce a dynamic, lively and collegiate intellectual atmosphere in which every individual's research might flourish. Our self-assessment is that since REF2014 our outstanding research environment has provided a platform to produce research and impact at the forefront of geography.