Institution: University of Exeter

Unit of Assessment: 14

1. Unit context and structure, research and impact strategy

1.1 Overview:

The past seven years have been a period of unprecedented success for Geography at Exeter. Our research and impact ranges across scales from local to global. We have led projects based on all seven continents and in every ocean basin on Earth, addressing critical societal and environmental issues. Our mission is *to be at the forefront of defining global intellectual and scientific agendas and, in doing so, to develop research impacts and engagements that catalyse change and benefit for key users, stakeholders and audiences*. To achieve this, we maintain and enhance a world-leading research environment, one in which researchers from all backgrounds and all career stages can flourish. Having grown to become one of the largest Geography units in the UK by REF2014, we have since fully capitalised on investments in staff and research facilities, achieving:

- ✓ **A near-doubling in research funding** to a total of **£30.6 million** for the REF2021 period (**£16.1** for REF2014).
- ✓ **Major advances in our national and international reputation:** Geography has become established as a World Top 20 department in the QS World Rankings in each of the last 4 years, including a ranking of 11th globally in 2018, and was ranked 5th (2019) in the Shanghai Global Rankings of Subjects.
- ✓ **A step-change in the impacts of our research upon society, economy and industry partners**, including our new partnership with South West Water, who have committed £21 million worth of industrial investment (values additional to funding figures highlighted above) to establish the Geography-led *Centre for Resilience in Environment, Water and Waste* (CREWW; www.exeter.ac.uk/creww/).
- ✓ **Athena SWAN Silver status** awarded at both campuses in 2015 and 2016.
- ✓ **Leadership of major interdisciplinary research agendas across the university**. Geography staff have undertaken leading roles in the *Environment and Sustainability Institute* (ESI, www.exeter.ac.uk/esi/ **Wills, Director**) the *Wellcome Centre for Cultures and Environments of Health* (WCCEH, www.wcceh.org **Hinchliffe, Co-Director**), CREWW (**Brazier**, **Co-Director**), and the *Global Systems Institute* (GSI, **Lenton**, **Director**, Geography staff member submitted to UoA7).
- ✓ **A sustained track record of highly-influential publications** in leading general science journals in Physical Geography, (e.g. 41 returned papers in physical geography (55%) are in *Nature* or *Science* family journals) and a substantial increase in major research monographs in Human Geography (seven double-weighted outputs; four in 2014).

1.2 Unit Context & Structure.

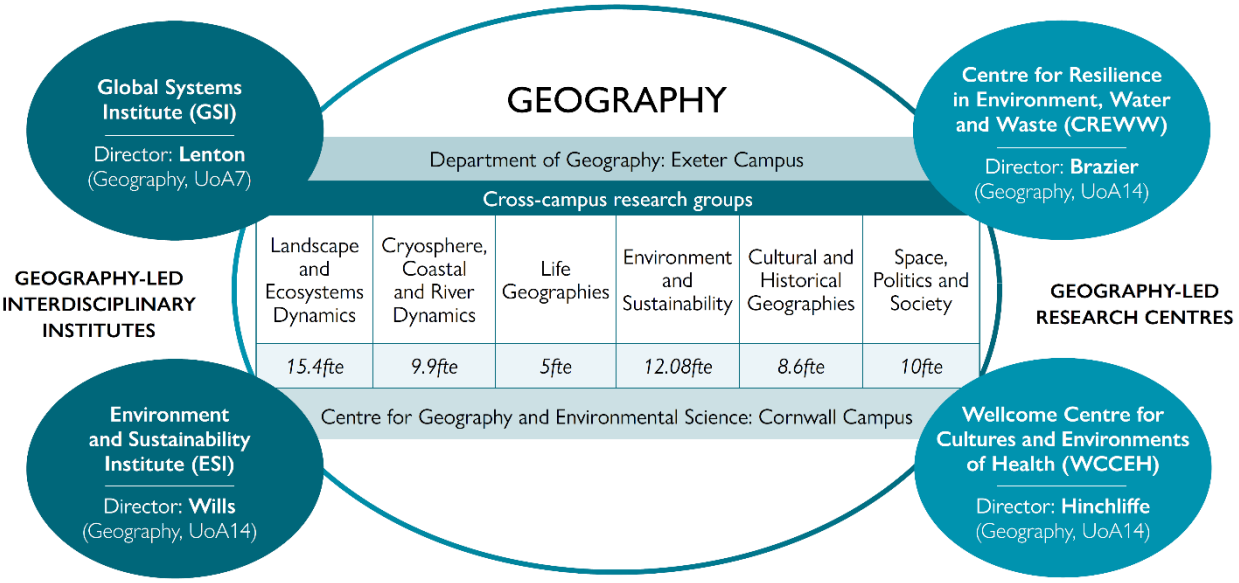

Figure 1. *Shape and structure of Geography, highlighting research groups, cross-campus status, and leadership of interdisciplinary Institutes and Research Centres*

We are based in the Department of Geography on the Exeter campus (**46.98 full-time equivalent employees (fte)**) and the Centre for Geography and Environmental Science (CGES) on the Cornwall campus (**14 fte**), with both being constituent departments of the College of Life and Environmental Sciences (CLES) **– see 1.3 Institutional Level Environment Statement (ILES)**. The dual campus context has promoted the development of a diverse unit. Climate change-related research represents a major focus in Exeter, aided by strong links with the UK Met Office, while for Cornwall-based researchers there is a unique focus on tackling key environmental and societal issues facing this deprived region of the UK. **13.6 fte** staff based in Geography across both campuses are returned to UoA7 Earth Systems and Environmental Sciences, reflecting distributions of expertise in oceanography and deep geological time.

Research and Impact activities across both campuses are managed through a single structure, led by two Directors of Research for human and physical geography (DoRs) and a Director of Impact. Together with Research Group leads, Directors of the Early Career Researcher Network (ECRN), and Directors of Postgraduate Research, they comprise the Geography Research Committee, which holds responsibility for oversight and development of our research culture and impact strategies.

Our research is focused through six cross-campus **RESEARCH GROUPS.** Current key research agendas and topics for each group are outlined below. **Further detailed information on each group's major research awards and outcomes in this REF period is presented in Section 3.2**

The **Landscape and Ecosystems Dynamics (LED)** research group (**15.4 fte: Anderson, Aragao, Bennie, Brazier, Charman, Cunliffe, Feldpausch, Gallego-Sala, Hartley, Hill, Mercado, Oechel, Pennington, Quine, Reinhardt, Sitch, Urrego**) studies functioning of terrestrial ecosystems, emphasising responses to, and feedbacks on, contemporary global

change, especially climate change and rising atmospheric CO_2 levels. Research on issues as diverse as permafrost thaw in the Arctic to tropical rainforest function has generated agenda-setting outputs. Group members also deliver strong impact, working with industry to improve landscape management for ecosystem service delivery.

The **Cryosphere, Coastal and River Dynamics (CCoRD)** research group (**9.9 fte: Aalto, Bennett, Harrison, Le Brocq, Nicholas, Palmer, Perry, Roland, Scourse, Van Maanen**) investigates geomorphic and ecosystem changes in the cryosphere, marine, coastal and fluvial systems. The group's research on carbonate budgets helps evaluate coral reef health globally, developing the *Reefbudget* tool adopted by reef monitoring agencies worldwide. High-profile cryosphere studies focus on the Russell Glacier in Greenland and Thwaites Glacier in Antarctica, while fluvial research investigates some of the largest river and delta systems globally.

The **Environment and Sustainability** research group (**12.08 fte: Adger, Barr, Bickerstaff, Butler, Brown, Chaigneau, Devine-Wright, Evans, Fitch-Roy, Mitchell, O'Neill, Safra de Campos, Turner, Woodman**) researches the theory, methods and policy of sustainability, including place attachment, the political economies of energy, climate justice, and sustainable development. The Cornwall-based Energy Policy Group is a leading hub for high-impact practitioner and government engagement.

The **Life Geographies** research group (**5 fte: Balayannis, Buller, Crowley, Davies, Hinchliffe**) advances theory on the spatialities of life, health, materiality, and knowledge, and focuses empirically on human and animal health (including anti-microbial resistance), biosecurity, scientific and laboratory cultures and geographies of waste.

The **Cultural and Historical Geographies** research group (**8.6 fte: Cook, Dawney, DeSilvey, Leyshon, C., Leyshon, M., Romanillos, Smith, Thomas, Wylie**) undertakes critical, creative and collaborative research on geographies of craft, commodities, coloniality, landscapes and heritage, with current research agendas and projects focusing on issues of materiality, authority, affectivity and environmental change in cultural landscapes, and contemporary and historical cultures of trade activism, volunteering, decoloniality, and creative making.

The **Space, Politics and Society** research group (**10 fte: Barnett, Caprotti, Carter, Cloke, Freeman, Gill, Goodwin, Kinsley, Lea, Little, Wills**) undertakes conceptual and empirical work on theories of democracy, injustice, technology and faith, with major funded projects on bordering practices and spaces of law, contemporary global urban and digital lives, popular geopolitics, localism and abortion mobilities.

Research groups provide focus, internal funding (c.**£350k** in this REF period), and a supportive context for research and impact in Geography, across all researchers from professors to postgraduates. Group activities include peer review of grant applications and publications, external seminars, reading groups, group projects and research retreats. Groups are coalitions of activity and research interest rather than silos with fixed memberships; researchers can participate in the activities of multiple groups. **Devolved research group funding** enables and sustains bottom-up research cultures, as well as supporting research travel and conference participation.

Geography has a **strong interdisciplinary research and impact environment** as exemplified by key leadership roles in interdisciplinary Centres and Institutes across Exeter (**see Fig. 1, ILES 1.3**). At Exeter, the *Global Systems Institute* (GSI) focuses on interdisciplinary research on climate change and socio-ecological systems. **15** UoA14 staff are core members of the GSI community, and Director Tim Lenton (UoA7) is a Geography staff member. In Cornwall, **Wills** is Director of the

Environment and Sustainability Institute (ESI), focused on problems of environmental change. **Anderson, Chaigneau, DeSilvey** and **Turner** are core ESI members. **Hinchliffe** is founding Co-Director of the Exeter-based *Wellcome Centre for Cultures and Environments of Health* (WCCEH), while **Brazier** is inaugural Director of the *Centre for Resilience in Environment Water and Waste* (CREWW). **Mitchell** and **Woodman** lead the cross-disciplinary, Cornwall-based *Energy Policy* group. Geography staff contribute strongly to the cross-campus Exeter Marine Network (www.exeter.ac.uk/research/marine/), reflecting expertise in coastal governance and marine conservation (including **Evans**, **Turner**, **Perry, Scourse**).

Our research and impact ecosystem involves major ongoing collaborations with industry, business, public and voluntary sectors. CREWW is a highlight example, attracting £21 million of commitment from the water industry (matched by £10.5 million from Research England; **see ILES 1.7**). In Cornwall, the *Social Innovation Group* (SIG), led by **C. Leyshon** and **M. Leyshon,** represents a high-profile example of our research with public and charitable/voluntary sectors, having established a long-term programme of research and impact activities promoting positive health changes in Cornish communities.

1.3 Research Ethics, Research Integrity & Open Access

Strong commitments to research ethics and research integrity underpin all our structures, in line with the University's commitment to the Concordat to Support Research Integrity (**ILES 2.9**). All research is assessed by the Geography Ethics Committee, which sits independently of committees chaired by DoRs and the Head of Department (HoD). Exeter's successes in furthering Open Access and open research initiatives are evidenced by the institution having one of the 10 top repositories in the UK (*Institutional Repository Usage Statistics UK*). The annual number of downloads of Geography outputs increased nine-fold between 2014 and 2019 (from 4,000 to >35,000 downloads), and we have capitalised on editorial expertise among senior staff (**see Section 4.3**) to disseminate best practice regarding Open Access. Geographers producing larger datasets and new code/algorithms routinely make their work open access, e.g., through code sharing *via* GitHub. Our leadership in promoting research integrity within the university is further demonstrated by **Davies'** role as Responsible Metrics Champion for the College (**ILES 2.8**). Our staff are 100% ORCID registered.

1.4 Research and Impact Strategy

Our Research and Impact Strategy has pursued four objectives, outlined in REF2014.

Objective1) Enhancing research sustainability – maintaining excellence, diversity and resilience across research lifecycles.

We have an outstanding track record of research funding and awards. While substantially growing UKRI awards, we have **notably diversified and innovated in terms of our awards portfolio**. Researchers have had notable success with EU funding, with awards including leading a €12 million (>£2 million to Exeter) European Research Council (ERC) Synergy Grant (**Scourse**), ERC Starter and Consolidator grants (**Gill, Gallego-Sala**), and >£900k in EU Interreg grants (**C. Leyshon, M. Leyshon**). We are building a new and distinctive track-record of Wellcome Trust funding (**Davies**, **Hinchliffe**). Our agility in responding to evolving funding systems is evidenced by UKRI Covid-19 Rapid Response funding (**Balayannis**), numerous awards from GCRF and Newton funds (e.g. **Anderson**, **Brown**, **Barnett**, **Caprotti, Evans, Feldpausch, Gallego-Sala**, **Pennington, Quine**), UKRI / UK Government collaborations (e.g., ESRC/DfiD, ESRC/DEFRA, NERC/DECC awards (**Adger**, **Brazier**, **Buller**, **Hinchliffe, Hartley, Safra De Campos**) and from

the Alan Turing Institute (**Caprotti**). Exeter Geography is recognised by multiple companies as a key partner in addressing industry-led research priorities (**see also ILES 1.7**), with strong and long-term relationships with South West Water (**Anderson**, **Brazier, Gallego-Sala, Hartley**), Shell (**Hill, Jones**) and the Malaysian Palm Oil Board (**Hill**).

Objective2) Training the next generation of researchers – providing an outstanding research environment for PGRs and early career researchers.

Key to this objective has been our ability to attract the strongest applicants for PhD scholarships. This is based upon **successful participation in every relevant UKRI Doctoral Training Partnership (DTP)** through this REF period, with ESRC and NERC DTP awards especially significant. Our commitment to research training is further evidenced by College match-funding for DTP PhD awards (43 awards in UoA14). Geography PGRs have benefitted from **£2.75 million of College match-funding**, much of which has funded links with industry, diversifying PGR employability and promoting long-lasting industrial partnerships (see Objective1 above). We have also secured funding via institutional-level competitive PhD awards, including Vice-Chancellor's Scholarships and strategic partnerships with the Universities of Queensland (Australia) and Tsinghua (China). These investments have ensured a sustainable and thriving PGR community – **see Section 2.4 for further details**. Furthermore, growth and diversification in income streams has nurtured significant expansion of post-doctoral researchers, increasing from **43** in 2014 to **80** on the census date.

Objective3) Creating an equitable and supportive research environment – focusing on equality, diversity and inclusivity (EDI), ensuring that all researchers at all career stages have opportunities to flourish.

EDI involves ongoing processes of action and reflection for all researchers. The director of EDI (**Little**) sits on the departmental executive group, and DoRs are core members of **the Geography EDI committee (GEDI)**, which holds responsibility for policy development and which includes postgraduate and postdoctoral representation. Our success in enacting effective policies and actions for future EDI work, is evidenced by the award of Athena SWAN Silver Awards to Geography at both campuses in 2015 and 2016. We are one of only six Geography units in the UK to achieve this. We are now deepening our EDI work to consider issues of Black and Minority Ethnic (BAME) / People of Colour (POC) representation within research communities and explore pathways towards decolonising research cultures in human and physical geographies – **see Section 2.3 for further details on our EDI commitments**.

Objective4) Maximising the benefits and impacts of our research – creating cultures of engaged and impactful research across Geography.

In 2015 we created a new role of Director of Impact (DoI). Working with DoRs and research group leads, the DoI (**Thomas**) has developed new systems and structures providing advice and assistance to researchers, which have had a transformative effect on our research impact. A key focus has been embedding an engaged culture across all research activities. Annual impact showcase days allow a focused concentration on best practice with linked mentoring. The DoI is supported by an annual £10k budget for promoting new/emerging impact activities, especially targeting ECRs. This has facilitated development workshops targeted at advanced skills training. For example, a learning to podcast workshop led to a PhD student secondment with the Royal Geographical Society with the Institute of British Geographers (RGS-IBG) to develop a new podcast series. Additional College and institutional support has included funding of **>£25k** to facilitate collaborations between Geography researchers and Exeter-based production studio

Kaleider, providing innovative opportunities for researchers to translate findings/insights into publicly-accessible creative works and performances, supported by a dedicated producer. For example, **Evans'** work '*Buoyed'* is a collaboration bringing voices of inshore fishing communities in England to the general public and decision-makers, now touring at UK festivals. As outlined above (1.4 Objective1), we have been successful in establishing a portfolio of long-term industrial partnerships, aided by support from the University's *Innovation Impact and Business* (IIB) team. Substantial College investment (1.4 Objective2) in match-funding PhDs partnering industry has underpinned the development of these relationships.

The diversity of our impact, in terms of the range of beneficiaries and sectors involved, as well as locations and scales of activity, is exemplified by the breadth of our REF2021 impact case studies:

1. The promotion of person-centred, place-based and community-led approaches to transform policy and practice in healthcare provision in Cornwall (led by **Leyshon** and **Leyshon**)

2. The development of a new tool for monitoring coral reef health across tropical oceans, allowing reefs in need of urgent management interventions to be identified (**Perry**)

3. Using novel interdisciplinary approaches to halt unlawful detention of asylum seekers and facilitate access to justice (led by **Gill,** shortlisted for an ESRC research impact award, 2016)

4. Establishment of the environmental and financial evidence-base required to justify catchment restoration and the promotion of nature-based solutions for water resource management (led by **Brazier**)

5. Production of practical recommendations for promoting transformation in the UK energy sector towards decarbonisation (led by **Mitchell**).

1.5 Future Research and Impact Strategies

Our five-year strategy to 2026 aims to enhance our position as a world-leading centre for geographical research, and to ensure our work continues to address key societal and environmental issues across scales. We will achieve this through focusing on four objectives:

1. Targeted growth in key research areas: CREWW and WCCEH are offering exciting new opportunities for geography. We have thus identified the **geographies of life, health and wellbeing** and **hydrological sciences** as key priority areas for growth, with the former expected to be particularly important in the contexts of Covid-19. The new centres offer opportunities to attract world-leading researchers to work in cutting-edge facilities and research environments. Three staff members (**Brown, Cloke, Mitchell**) are retiring imminently, and we have clear succession planning to maintain critical mass across key research areas.

2. Leading global interdisciplinary research agendas: Our leadership of and involvement in interdisciplinary Institutes and Research Centres in the University (Fig. 1), makes us uniquely placed to drive multidisciplinary and global research agendas in Exeter. The GSI in particular will offer new opportunities for co-location of interdisciplinary teams. We further aim to develop increasingly ambitious international projects, building on ongoing collaborations in regions where we have significant experience and expertise, including Latin America, East Africa, South East and South Asia (incl. India, Bangladesh, Malaysia) and China.

3. Further enhancing cultures of impact and engagement: We aim to build more and deeper relationships with industry, with CREWW serving as a beacon for long-term partnerships. In

addition to international impact activities, we aim to enhance research that contributes directly to regional development in South West England, with local impacts being an important focus of our Cornwall research. Co-development of research with local and global industries and communities has increased dramatically over this REF period and we will grow this further over the next five years.

4. Promoting inclusivity and addressing under-representation of researcher groups: We will deepen the work of GEDI to explore, understand, and address barriers to access for under-represented cohorts of researchers. While major progress has been made in addressing barriers to gender equality, and work will continue in this area, a key focus for Exeter geography going forward is BAME/POC representation (**see also ILES 3.14**). The increasingly international nature of our research, and our researcher community, makes further enhancing the inclusivity of our research environment a key priority now and going forward.

2. People

2.1 Overview

Our goal is to provide a vibrant, supportive and inclusive environment, where talented academic researchers from all backgrounds can flourish. Our successes in achieving this are evidenced by:

- ✓ **Athena SWAN Silver status** being awarded at both campuses;
- ✓ **Major increases in the number of academic promotions** reflecting enhanced support for career development, and our ongoing success in research (35 promotions during this REF period, with 20 to female researchers);
- ✓ **Substantial expansion of post-doctoral researcher cohorts** from 43 in 2013/14 to 80 in 2019/20, reflecting rising research funding;
- ✓ **Attracting excellent PGR students and training the next generation of geographers**, with c.50% of our graduating PhD students having progressed to research positions in academia and industry.

2.1.1 Growth in staff numbers

Geography's staff profile is as follows:

Grade	Headcount (66)	Male	Female	FTE (60.98)	Male	Female
Professor	30	22	8	27.40	19.50	7.00
Associate Professor	10	5	5	9.30	5.90	4.30
Senior Lecturer	16	9	7	14.68	8.20	6.48
Lecturer	8	2	6	7.60	2.00	5.60
Research Only	2	2	0	2.00	2.00	0.00

In the REF2014 period, Geography grew from 36 to 58 researchers, achieving critical mass in key research areas. In the current REF period, we have seen further growth (66 staff, 60.98 fte). Furthermore, substantial increases in research funding have resulted in major expansion of our post-doctoral researcher community (see above), enabling the development of an increasingly dynamic research community.

2.1.2 Staff Recruitment

Our recruitment strategy seeks to: 1) sustain critical mass in key research areas, 2) expand into new priority areas, 3) further EDI agendas, and 4) work in partnership with Exeter's interdisciplinary Institutes and Centres on strategic appointments. We aim to attract the highest quality researchers globally and provide them with the resources to develop their research careers.

Recruitment is also tailored to campus-specific priorities, and firmly committed to making permanent, not fixed-term, appointments. We have appointed 18 permanent academic staff in this REF period. At the Cornwall campus, two Professorial appointments (**Scourse, Wills**) have provided fresh senior leadership to both CGES and the ESI, alongside four further appointments at Lecturer and Senior Lecturer (**Bennie, Chaigneau, Crowley, Turner**), further strengthening links with the ESI. On the Exeter campus we have maintained the balance, vibrancy and sustainability of our research environment by prioritising appointments at Lecturer and Senior Lecturer level. Therefore, alongside two Associate Professor/Professor appointments (**Pennington, Caprotti**), we have appointed 11 new Lecturers/Senior Lecturers (**Bagelman, Balayannis, Cinnamon, Dawney, Hill, Smith, van Maanen, Freeman, Safra de Campos, Roland, Bennett**). Across campuses there have been 11 leavers; one retirement, one deceased, one moving to industry, and eight to other academic roles in the UK or overseas (including **Bagelman, Cinnamon**).

2.2 Staff Development

2.2.1 Key Support and Career Development Policies for Researchers

Our staffing strategies are developed within the framework of the **Researcher Development Concordat** and reflect the University's commitments to supporting research careers at all levels (**see 2.9 ILES**). All staff engage with researcher development courses (**see 3.5 and 3.6 ILES**), while, in 2016, the introduction of the new 'Exeter Academic' system for career development (**see 3.3 ILES**) has promoted a refreshed approach to staff support in geography. Our Academic Lead system (**see 3.6 ILES**), in which senior staff mentor 4-5 researchers, has been revised to provide enhanced progression and promotion support. Each Academic Lead now supports staff at a single career stage, thus becoming expert in identifying when staff have a case for promotion. The success of the Exeter Academic and Geography's Academic Lead systems is evidenced by a large increase in Academic Promotions during this REF Period, especially for female staff (see Section 2.3):

- Lecturer to Senior Lecturer: 15 (**Bennie, Butler, Chaigneau, Evans, Feldpausch, Gallego-Sala, Kinsley, Lea, Le Brocq, Mercado, O'Neill, Palmer, Romanillos, Turner, Urrego**)
- Senior Lecturer to Assoc. Professor: 11 (**Anderson, Bickerstaff, Carter, DeSilvey, Feldpausch, Gallego-Sala, Hartley, Hill, Mercado, O'Neill, Thomas**)

- Associate Professor to Professor: 9 (**Barr, Cook, DeSilvey, Gallego-Sala, Gill, Harrison, Hartley, Nicholas, Thomas**)

Clear policies support research career development. New academic staff at all levels are awarded start-up funds, typically to the value of ~£20k. In addition, new staff benefit from reduced education/administrative workloads in their first year, enabling them to focus on establishing their research. All Education & Research (E&R) academics are allocated 20% of their workload for research and impact activities. Furthermore, to provide extended periods of research-focused time, we have introduced (2015) a new Strategic Alignment of Research and Education (STARE) system. This relieves staff of core administrative, tutorial and student project work for an academic year, on a rotational basis.

Researcher development is further supported by internal funding sources. The College-level Strategic Development Fund (SDF), aims to pump-prime new research ideas and in this REF period, 23 researchers in Geography have received a total of **£240k** of funding, with early career staff prioritised. To develop and strengthen international collaborations, the university has established Outward Mobility Academic Fellowships (OMAF) and Visiting International Fellowships (VIAF). 11 Geography staff have been awarded OMAF and VIAF funding to the value of **£115k** in this REF period. Researchers in Geography have also been able to enhance the impact of their work through UKRI Impact Acceleration Accounts (IAAs); ESRC IAA funding has especially benefitted human geographers. Research groups provide a supportive culture for research and impact, as well as funding for research travel and conference participation (**see Section 1.2**).

2.2.2 Early Career Researchers

Exeter provides a dedicated training/development programme for ECRs, mapped against the Researcher Development Concordat (**see ILES 3.8-9**). This programme has been particularly important in Geography as, early in this REF period, the unit contained a high percentage of ECRs. Internally, we employ a review system for grant applications, overseen by Research Group Leads and DoRs. We also have a strong track record of senior staff involving ECRs in their proposals and supporting new staff in initial applications. Consequently, more than two thirds (68%) of geography staff are currently in receipt of funding, and on average ~80% make an application each year. The success of our support for new lecturers is evidenced by 13 promotions to Senior Lecturer and above since 2014.

In 2016, we established an Early Career Research Network (ECRN), currently directed by **Balayannis** and **Roland**, to provide bespoke support to senior PGRs and postdoctoral researchers. Recognising diversity in terms of academic background, nationality, working fraction, and contract length, the ECRN acts to promote inclusivity, and offers an informal setting through which researchers can engage in career development opportunities beyond those supplied by PIs and research groups. Regular activities include workshops on CV and grant writing, job application development, sessions on UK Higher Education policies and systems, dissemination and discussion of new frameworks including the Researcher Development Concordat. Post-doctoral researchers also benefit from mentoring through the Academic Lead system outlined above and are represented in university-level decision making through ECR liaison forums (**see ILES 3.1 and 3.8**).

2.2.3 Mid-Career Researchers

Support for mid-career researchers recognises the challenges of balancing increasing levels of responsibility and assuming leadership roles. Through Academic Lead and workload planning systems, we support mid-career researchers to assume appropriate leadership roles, including Research Group leads and Directors of Postgraduate Research. We also support leadership training, including sponsoring researchers through the Advance HE Aurora programme for female researchers. Mid-career researchers have particularly benefitted from the mobility fellowships described in Section 2.2.1.

2.2.4 Senior Researchers

Our approach to supporting Professorial-level researchers recognises the diversity of this group, which ranges considerably in terms of age and experience. At University level, Professors have benefited from a clarified approach to pay/reward which supplements Academic Lead mentoring with bi-annual review of achievements and challenges. HoDs in Geography play an important role in mentoring senior staff. This includes succession planning for senior leadership roles, while staff concluding terms as HoD, DoR & Director of Education (DoE) benefit from post-leadership research time in their workloads. We also support senior researchers in leading major funding proposals, making prestigious Fellowship applications (including to the Leverhulme Trust, British Academy, Royal Society and Wellcome Trust), and in further internationalising research and impact through visiting fellowships and secondments (**see Section 4.1**). Our contribution to senior University leadership is outstanding, with three Geography staff occupying senior university and college management roles (**Goodwin, Quine** – both Deputy Vice-Chancellors; **Charman** – Executive Dean, CLES).

2.3 Equality, Diversity & Inclusivity (EDI)

As discussed in **Section 1.4**, strong commitment to EDI underpins all our research and impact activities. The GEDI committee, including the HoD, DoRs, and representatives from post-doctoral, postgraduate and undergraduate communities, is central to departmental decision making. The Director of GEDI is a senior role in Geography and a permanent member of the Executive committee. All staff complete mandatory training courses in equality and diversity (**see 3.15 ILES**), and those in senior management roles, including REF-panel related roles, additionally receive training in avoiding Unconscious Bias. **EDI considerations have also been central to our REF2021 preparations**. In accordance with the University's REF2021 Code of Practice, our selection of both Outputs and Impact Case Studies has been made by gender-balanced panels and has been informed by EDI considerations throughout.

At the start of the REF period, Athena SWAN agendas were the primary focus of our EDI activities. The effectiveness of our response to gender inequalities is evidenced by our Athena SWAN Silver Awards (Cornwall, 2015, Exeter, 2016). Changes to our Academic Lead system outlined in section 2.2.1 were a key response to evidence that researchers identifying as female were progressively under-represented at more senior levels. All interview and promotion panels in Geography are gender-balanced, and all staff involved are required to have completed EDI recruitment training. Female researchers account for >50% (20/35) of academic promotions in this REF period. While work on gender equality continues (under-representation of female researchers at senior levels is reduced, not eliminated), our EDI work is now also focusing on under-representation of BAME/POC researchers. Work is ongoing to identify, understand, and address barriers to inclusion, with attention also focusing upon staff understanding of the racialised histories of geography. Geographers (including **Cook, Thomas**) are at the forefront of initiatives to decolonise research and education cultures at Exeter.

Our EDI team are central to ongoing efforts to balance academic workloads. The GEDI Director supports the HoDs, DoRs, DoEs, and Academic Leads in planning and monitoring staff workloads across research, education and administrative/leadership activities, using the University's SWARM workload system. In response to University-wide staff engagement surveys in 2018, the GEDI team conducted focus groups with different staff cohorts, including PGRs and post-doctoral researchers, to identify and tackle priorities for cultural change. The GEDI committee has thus developed initiatives to support staff and student wellbeing, taking a leading role in University mental health training and facilitating accessible/family friendly social and well-being events. The committee also works with occupational health (**see 3.17 ILES**) to support staff returning to work after a leave of absence. Geography promotes flexibility in working, with staff entitled to reduce both fractions and available working hours. To facilitate this, we ensure all meetings and training events take place within core working hours, and part-time staff are never disadvantaged in terms of access to research support (e.g. research group or SDF funds), with head count rather than fte being used in all budget allocations. Exeter has sector-leading policies to support Shared Parental Leave (**see 3.16 ILES**), with no qualifying length of service. The success of these policies is evidenced by eight part-time staff having been promoted during this REF cycle; thus, proportionally, part-time staff are at least as well represented in promotions as full-time staff.

Finally, beyond Exeter, Geography staff have helped promote gender equality across academia. Staff in the Energy Policy group produced a key UK Energy Research Centre-commissioned report identifying barriers to female researchers in obtaining funding and progressing careers in energy research. Geography staff, especially **Gallego-Sala**, have played a key role in the College's 'Soapbox Science' initiative to promote women in science to the public. **Thomas**'s research has helped identify gendered barriers to career progression in UK academia and Geography in particular, while **Anderson** has co-edited two special issues in Drone Science and Remote Sensing journals aimed at promoting woman in these disciplines.

2.4 Research Students

2.4.1 PhD numbers and funding

Research students are the bedrock of our research environment. A total of **117** students have been awarded doctorates (1.9 per fte) in this REF period, and we currently host a total of 77 research students. Our large and diverse PhD community has been made possible by Exeter participating in 7 DTPs (**see 1.8 ILES**). We have been successful in attracting very strong students into the DTPs: **22 awards from NERC, 14 from ESRC, 3 from AHRC and 4 from EPSRC**. Furthermore, the College has made major investments in PhD match-funding (£2.75 million to UoA14) aimed at supporting two key geography priorities (**see Section 1.4**). Firstly, to strengthen links with industry and promote applied research, 65% of the investment has supported studentships partnering industry and NGOs. Partnerships with several companies and NGOs were initially fostered through shared PhD studentship funding, including with Shell and South-West Water. Secondly, we have invested in international PhDs studentships to support our global research agendas, including funding three PhD research projects as part of the University's QUEX Partnership with the University of Queensland. Academics in Geography also supervise PhD students based at other Universities both in the UK and internationally. In 2019, this involved 22 UK-based and 12 International PhD students in Australia, Brazil, China and Mexico. Geography staff, including **Anderson** and **Scourse**, have also been core members of EU Marie Curie PhD Training Networks.

2.4.2 Research student environment: facilities and engagement.

Every PGR student in Geography is provided with dedicated desk space and IT equipment. Most students receive a Research Training & Support Grant (RTSG) through their funder, and those who do not are allocated a RTSG by the College; £1,000 per annum in physical geography, £300 per annum in human geography. Research group funding supports PGR participation in retreats and events, promoting an inclusive research culture, with PGR students also being key contributors to seminar series. In addition, CLEScon is an annual conference where PGRs from across the College present their research and expand networks across discipline boundaries. Liaison Forums allow PGR representatives to meet and discuss issues with Directors of Postgraduate Research, and PGRs are represented through the ECRN, on the EDI committee, and at our twice-termly all-Staff Meetings. At institutional level, in 2018/19, Geography PGRs were instrumental in the development of new Doctoral College policies (**see also 3.10-3.12 ILES**) and practices regarding student mental health and wellbeing.

2.4.3 PGR progression, training and outcomes

In 2016, Exeter established a University-wide Doctoral College, bringing together support, training, and administration for all PGRs and ECRs. In Geography, students and supervisors complete an annual Training Needs Analysis, to identify student-specific support priorities. Directors of Postgraduate Research oversee Annual Monitoring and Review. Our formal 'upgrade' process from MPhil to PhD registration occurs near the end of the first year and has been enhanced over this REF period to include submission of a refreshed research plan, literature review and chapter outlines, plus an oral viva. In addition, an 18-month mid-PhD review is conducted to gauge progress since upgrade and provide extra support where needed. The success of our internal policies is evidenced by 80% of PGRs submitting within 4 years, and, in particular, by our consistently strong graduate outcomes. In this REF period, >30 of our PGRs have progressed to further research and lecturing positions in academia, and >20 have progressed to positions in industry and commercial research.

3. Income, infrastructure and facilities

3.1. Overview

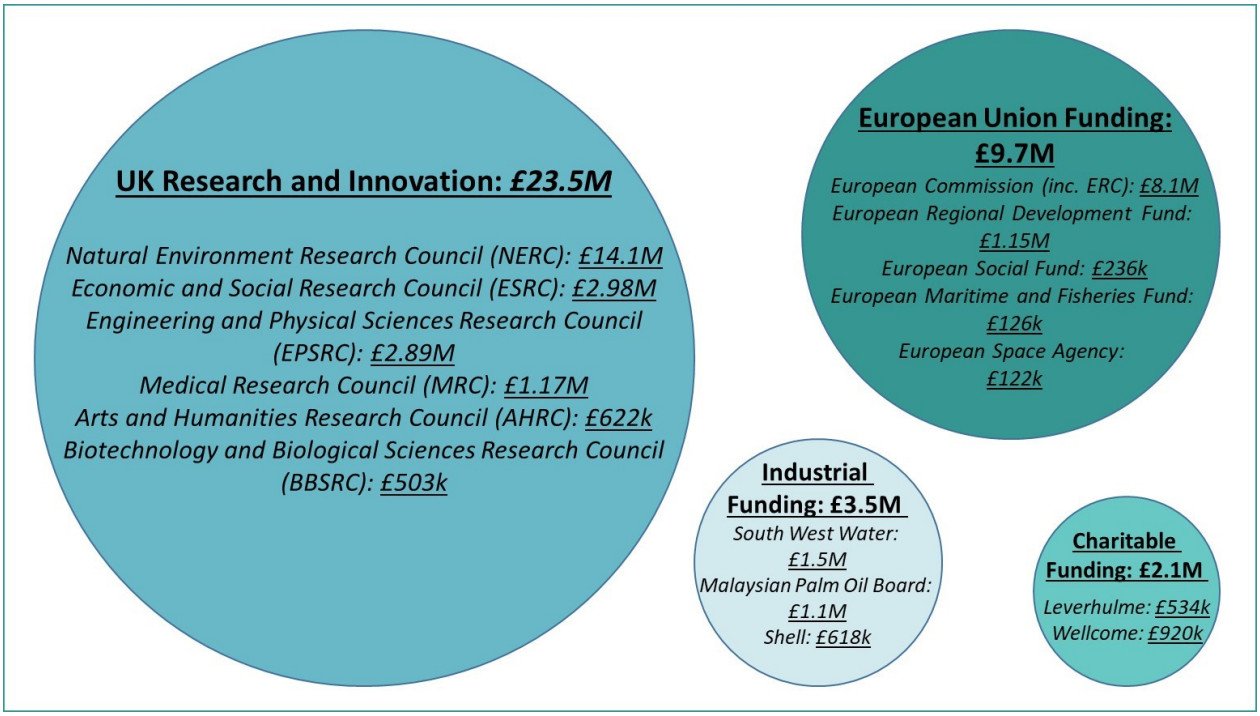

***Figure 2**. Main funders contributing to the **£42.1M** of new awards during this REF period.*

Having reached critical mass in our key research areas, we have enjoyed a period of unprecedented success which has promoted internal and external investment in our research infrastructure and facilities. Key developments include:

- ✓ **Research income near doubling since REF2014** (**£30.6M/£16.1M)**, driven largely by **income per fte** increasing from **£52K** in 2013/14 to **£95K** in 2019/20;
- ✓ **£42.1M of new awards in the current REF period (Fig. 2):** The sustainability of our research environment is evidenced by the value of new awards exceeding research income by >35%. Thus, our research portfolio is expanding and we currently have more funded projects and post-doctoral researchers than ever before;
- ✓ **Diversification of funding sources (see Fig. 2).** In addition to increased UKRI funding (e.g. Exeter now ranks 2nd in the UK for NERC grant funding, with physical geography attracting more NERC funding than any other Exeter discipline), our income from the **EU**, **charities** and **industry** has grown significantly;
- ✓ An additional **£31.5 million investment** in the ***Centre for Resilience in Environment, Water and Waste (CREWW)***, including a commitment of £21 million from South West Water, the largest university-based R&D investment by a water utility (**this funding is not included in the research income or new awards values presented above**);
- ✓ **Establishment of new research facilities on both campuses** including a new Carbon-Cycle research laboratory and upgrades to analytical equipment on our Exeter campus, and new Drone and Sclerochronology laboratories in Cornwall.

3.2 Research Groups: major funded activities and outcomes.

This section outlines how research income and major awards have advanced research agendas within our key research groups (see Section 1.2 for group outlines).

Landscape and Ecosystems Dynamics (LED) research group: High-value awards have allowed the group to pioneer applied **landscape restoration** approaches to environmental problems. *South West Water* has funded work by **Anderson, Brazier, Gallego-Sala, Hartley** investigating how management of upland and riparian areas can improve water quality and reduce flooding risks downstream. Further UKRI and charity funding allowed **Anderson, Brazier** to demonstrate the benefits of beaver reintroduction for water quality and ecosystem service delivery. The partnership with *South West Water* has ultimately led to the establishment of the new **£31.5 million CREWW** centre, with **Brazier** as co-director. CREWW will provide state-of-the-art laboratories and enhanced fieldwork support, allowing researchers to address pressing issues facing water resource managers globally, including access to clean drinking water, and resilience to floods, droughts and pollution. With funding from *Shell* and the *Malaysian Palm Oil Board*, **Hill** has used novel methodologies to quantify the potential for land management interventions to remove atmospheric CO_2 and reduce greenhouse gas emissions from oil palm. NERC-NEWTON funded research (**Quine, Hartley**) has used critical zone science to promote agricultural sustainability with the aim of alleviating poverty in rural China, while **Pennington** leads BBSRC/GCRF-funded projects to improve agroforestry sustainability and the livelihoods of farmers in the Brazilian "arc of deforestation".

The major blue skies focus of LED is on **global change impacts on terrestrial ecosystems**. In tropical and subtropical regions, with NERC funding: **Feldpausch** led research to uncover the role

of past human disturbance in controlling contemporary Amazon forest dynamics; **Mercado, Sitch** and **Hartley** have used natural climatic gradients in the Colombian Andes to determine the sensitivity of tropical montane forests to climate warming; **Hartley, Mercado** and **Aragão** established the first large-scale, manipulation of soil nutrient availability in primary rainforest in Central Amazonia; **Sitch** has determined the potential for ozone pollution to limit tropical plant productivity; and **Brazier, Hill, Anderson** and **Cunliffe** have investigated the role of drylands in the global C sink. With GCRF/NERC funding **Urrego, Feldpausch, Pennington, Mercado** have advanced understanding of natural and societal drivers of post-conflict deforestation in Colombia, and **Gallego-Sala** has recently been awarded an ERC consolidator grant to determine the role of tropical peatlands in the global C cycle.

In temperate and high-latitude regions, NERC funding is allowing researchers to determine the role of soil nutrient availability in controlling responses of mature forests and grasslands to rising atmospheric CO_2 (**Hartley, Mercado, Sitch**), as well as the effects of climate change on soil carbon storage and methane emissions, including the dynamics of northern peatlands (**Gallego-Sala, Anderson, Charman**) and consequences of permafrost thaw (**Hartley, Charman**). Research led by **Charman** characterised the widespread biological response to rapid warming on the Antarctic Peninsula, with a key publication in *Current Biology* receiving the 5th highest media coverage of any climate change publication in 2017. Finally, research funded by the EU Structural Investment Fund has allowed **Bennie** to quantify ecological impacts of night-time light pollution.

Cryosphere, Coastal and River Dynamics (CCoRD) research group: Increased and diversified funding has supported research across three main areas. Firstly, NERC and BBSRC funding has promoted major advances in understanding **large river system and upland catchment dynamics**. **Nicholas** and **Aalto** have quantified and modelled major controls exerted by fluvial sediment flux on channel and floodplain functioning, and how large rivers respond to climate, erosion rates and human impact. They have developed new insight into natural and anthropogenic impacts on sediment delivery to mega deltas at risk from rising sea levels. Work is now extending via Newton funding and Brazilian partners to predict river dynamics in the Amazon Basin. With NERC and Newton support, **Bennett** has quantified rainfall-triggered landslide hazards in mountainous regions of the Philippines, Nepal and the USA, with new NERC funding extending this research to develop novel Wireless Sensor Networks for landslide and flood management.

The group have also advanced understanding of **ice sheet dynamics** and glacial hazards at multiple global locations. With NERC funding, **Harrison** identified rapid glacial lake transitions under climate change in the Andes, quantified global glacier volume changes under high-end climate scenarios, and delivered new understanding of the role of rock glaciers across Himalayan and Andean systems using remote sensing. **Palmer's** NERC-funded work has used high resolution remote sensing techniques to constrain subglacial lake drainage patterns, winter subglacial ice storage, and ocean bathymetry in Greenland. Highly cited work by **Le Brocq** has constrained the role of ice-sheet margin instability on glacier retreat, and quantified ice dynamics in West Antarctica.

In the area of **coastal and marine global change,** **Perry's** NERC-funded work has shed light on turbid-zone coral reef ecology, growth capacity and resilience to climate stressors, with funding from Leverhulme Trust and Bertarelli Foundation quantifying severe bleaching impacts on reef growth in the central Indian Ocean, and reef capacity to track future sea-level rise. NERC funding has helped **Scourse** pioneer the use of ultra-high-resolution Sclerochronology to reconstruct

ocean basin-wide climate dynamics. This technique has improved palaeoclimatic reconstructions of the North Atlantic and enhanced understanding of rapid deglaciation on the west Antarctic Peninsula. **Scourse** will now lead the major **ERC Synergy grant, SEACHANGE** (total value €12M), that will establish new baselines for understanding marine environmental change.

Cultural & Historical Geographies research group (CHGRG): New funding streams, partnerships and creative collaborations have supported work on geographies of creative practice, heritage and landscape, and place-based care and well-being. Significant AHRC funding (4 awards, plus support from the Norwegian Research Council) has supported **DeSilvey's** development of new paradigms for environmental change and heritage landscapes, using innovative creative and curatorial methodologies, and resulting in prize-winning publications and new partnerships with heritage organisations including the *National Trust*. AHRC and British Academy funding (4 awards) has supported **Thomas's** work on intersections of heritage, region and craft, generating new insights into the work of UK regional craft guilds and craft in the creative economy. With AHRC-led funding (3 awards, incorporating support from EPSRC), **Wylie's** work on creative approaches to landscape has enabled the development of the *Common Line* project, a national-level land art project focusing upon immersive digital art experiences of landscape. Funding and support from ESRC and RGS-IBG has underpinned **Cook's** development of the Museum of Contemporary Commodities (http://www.moccguide.net/) in collaboration with artists, producing innovative interactions for public understandings of digital data structures and commodity systems. **Substantial new EU funding** (Interreg 2Seas HAIRE project) to **C. Leyshon** and **M. Leyshon** and the Social Innovation Group (SIG) supports research involving a range of European collaborators and partners on healthy ageing amongst older age groups in rural/coastal regions.

Environment & Sustainability research group: Diverse funding sources have allowed the group to establish global collaborations (including in South East Asia, Africa, India, and Bangladesh) to advance research in climate change, energy geographies and transitions, resilience, sustainable development and ecosystem services. Funding from ESRC/DFID, IDRC, Belmont Forum, and H2020 grants has allowed **Adger** and **Safra de Campos** to demonstrate the potential of human migration to allow adaptation to climate change, and document options for integrating new migrant populations into safe and sustainable cities. Research investigating public environmental actions and understandings of climate change by **Barr** and **O'Neill** (funded by ESRC Future Leaders, NERC) has shown how lay and expert public actors frame and make sense of climate change. With ESRC, NIHR, Belmont and Wellcome funding **Butler**, **O'Neill**, **Bickerstaff** and **Brown** have shown the mechanisms by which climate impacts result in mental health burdens, and the second order risks of adaptation. **Brown** and **Chaigneau's** research (funded by two UKRI ESPA awards and AXA Outlook) documented fundamental linkages between ecosystem services and human wellbeing, including the differential role of gender, equity and non-monetary aspects of ecosystem services in Kenya and Mozambique. Investment from GCRF (2 awards, 'Blue Communities' and 'Coral Communities') supports **Evans** and **Chaigneau's** work on sustainable marine communities and ecosystems in East and South-East Asia.

Research on energy policy by **Mitchell, Fitch-Roy** and **Woodman**, funded by EPSRC and an ESRC New Investigators grant, have supported innovative contributions to energy policy in the UK. **Devine-Wright** (EPSRC and H2020 funding) has shown how public attitudes to energy and

infrastructure are directly affected by attitudes to place and identity. **Butler** and **Bickerstaff** (EPSRC funding) have demonstrated the possibilities for welfare and employment policy to contribute to UK energy use reduction.

Life Geographies research group: Significant investments in new research programmes and centres have enabled the group to make major contributions to geographies of science, human and non-human health, disease and welfare. **Hinchliffe** played a leading role in securing major funding for the *Wellcome Centre for Cultures and Environments of Health* (**£4.1 million** overall, 2017) and now fulfils the role of Co-Director. The Centre explores experiences of health, illness and medical knowledge and investigates how evidence from the humanities and social sciences can develop innovative and effective public health initiatives. Further Wellcome Trust funding supports **Davies's** Animal-Research Nexus research programme, drawing together interdisciplinary expertise regarding policies and practices of animal health in research and laboratory contexts. ESRC support enabled **Crowley** to develop new interdisciplinary research investigating the complexities of wildlife re-introduction and species management policies. European Commission funding has enabled **Buller** to explore innovative practice-led solutions to welfare issues in laying hen production ('Hennovation' Project). **Buller** and **Hinchliffe** have been at the forefront of recent social science research into anti-microbial resistance (**see also ILES 2.3**), with ESRC (DIAL Project) and UKRI/DEFRA ('Production without medicalisation' Project) funding enabling new policy recommendations to reduce (i) antimicrobial use in livestock agriculture, and (ii) pharmaceutical pressures in shrimp and prawn aquaculture in Bangladesh. Lastly, new insights into current geographies of health/life are supported via a recent UKRI (ESRC) Covid-19 award to **Balayannis**, investigating UK waste industry responses to the pandemic.

Space, Politics and Society research group: Extensive funding and partnerships have supported the group's research on mobilities, governance, everyday lives and urbanism. Significant investment from **ERC (Consolidator award, 2015-2020)** supports **Gill's** programme of comparative research on the mobilities and legal geographies of asylum seekers across the EU. A recent ESRC New Investigator Award to **Freeman** focuses upon mobilities, abortion and reproductive health rights in Latin America. Investments from funders including ESRC, GCRF, British Academy and the Chiang Ching-kuo Foundation have supported **Caprotti's** research programme in urban political ecologies, establishing new findings in relation to 'smart cities' and sustainable energy agendas in China and South Africa, with the latter being awarded a prestigious ***Newton Prize (2020)*** to be used to promote off-grid solar energy provision in informal settlements. Related work by **Barnett** on South African cities and planetary urbanism has been supported by Leverhulme Fellowship and Newton funding. New insights on the intersections of policy and governance have been supported by: Leverhulme Fellowship funding and support from Dorset County Council for **Little's** work on domestic violence in rural spaces, British Academy and ESRC funding for **Cloke** and **Goodwin's** investigations of austerity, homelessness and food bank provision in the UK, and Trust for London and the Locality Commission's investments in **Wills'** work on political localism and living wage campaigns. ESRC funding and internal SDF investment enabled **Carter's** identification of the ludic and domestic as key geopolitical spaces and **Lea's** explorations of emotional and affective labour spaces of yoga and massage. New ESRC funding for **Barnett** and **Kinsley** will evaluate the role of algorithmic systems in post-Brexit UK immigration governance.

3.3 Infrastructure & Facilities:

3.3.1. Laboratories: Existing Facilities

Research in physical geography is supported by **twelve specialist research laboratories** across our campuses, maintained by a senior laboratory manager and four laboratory managers, with a Geography-based **electronics and mechanical workshop** supporting manufacture of bespoke research equipment essential for our field and laboratory research.

In Exeter, our **Fallout Radionuclide Facility** supports research into landscape and river dynamics and is the largest such facility in the UK, now comprising 50 alpha spectrometers and 20 gamma spectrometers. Another major asset is our **Experimental Landscapes Facility** (2001; £3.7M), housing a rainfall simulator and a sedimentation basin for alluvial fan experiments. In addition, the **Fire Laboratory** (established 2013) represents a globally-unique facility for addressing questions regarding how vegetation flammability has changed over geological time, and causes and impacts of contemporary fires. Our recently-refurbished **analytical laboratories** support environmental science research, and we have two dedicated **palaeoenvironmental** laboratories with advanced microscopy facilities. In Cornwall, research is supported by a bespoke **Micropalaeontology** laboratory with high specification microscopy facilities and a sediment processing laboratory for textural and property analysis. We routinely utilise other world-class College and University analytical infrastructure including the Stable Isotope Facility (ESI), DNA sequencing and Electron Microscopy (Biosciences), and EDX, XRD, and Micro-CT (Engineering).

3.3.2 Investment during this REF period

The University has made major investments to enhance our research infrastructure on both campuses. In 2016, as part of a £300k refurbishment, within the **Experimental Landscape Facility** we established a new **Carbon-Cycle Research Laboratory** with a CO_2 (including stable isotope tracing) and temperature-controlled plant growth facility, which was instrumental in securing new UKRI funding into potential controls on soil C sequestration. Within the **analytical laboratories** major equipment purchases include: a new ICP-OES (£49k), fluorescence plate reader (£23k), new alpha counters (£30k), two new high-performance microscopes (£30k), and enhanced sample drying and grinding facilities (£20k). Our field-based research has seen considerable investment in portable greenhouse gas analysers (>£150k for leaf gas exchange, soil CH_4 and CO_2, and $^{13}CO_2$ analysers), terrestrial laser scanning (£70k), portable X-Ray Fluorescence (£20k), and Digital GPS (£15k). In Cornwall, University investment has supported two new research facilities: the **DroneLab** (£60k) and **Sclerochronology laboratory** (£14k). The former builds on **Anderson's** research into drone platforms, supporting research across Geography. Within CREWW, the DroneLab's facilities will be further expanded for water-resources research, including new real-time-kinematic GPS equipment and state-of-the-art survey drones with specialised sensors for landscape monitoring (£200k). The Sclerochronology facility supports marine environmental change research and was instrumental in securing an ERC Synergy Grant (**Scourse**).

3.3.3. Field sites

In South West England, we maintain **long-term upland research catchments** on Exmoor and Dartmoor in which drainage ditches have been blocked, monitoring changes in hydrology, vegetation community and biodiversity, and greenhouse gas balance. Test catchments in Dartmoor are also monitored to determine the potential effects of beaver reintroduction on water quality and flood risks. Overseas, we have established **permanent plots in the Brazilian Amazon**

where the impacts of long-term forest degradation are assessed, as well as the effects of soil nutrient availability on forest function. With the University of New Mexico, we maintain **permanently-instrumented dryland sites** comprising eddy covariance towers in the Siviletta National Wildlife Refuge. These unique field sites have supported Exeter, US and Brazilian MSc & PhD students and multiple funding applications.

3.3.4. Computing facilities and support

Many of our highest-profile projects involve empirical scientists working with process-based and Earth system modellers. Modelling is supported by **high-performance computing** at both campuses including the Streatham Beowulf cluster. The College has provided a major increase in support for our modelling and GIS researchers, with the employment of a **Senior Computing Science Officer**, and a **UK Earth System model and JULES researcher**. They provide vital training to researchers and are frequently included as Researcher CoIs on funding applications.

3.3.5. Professional services research support

Geography's pre- and post-award research support provides discipline-facing horizon scanning, call-specific advice, and assistance with costings and gaining necessary institutional approvals (**see 4.6 ILES**). The support has been further enhanced by the development of an online Research Toolkit and by a £2.5 million investment in a **new Research Management system** (**see 4.7 ILES**). Our industry-facing research is supported by Innovation, Impact and Business (IIB) partners, providing bespoke geography-specific advice and helping foster and develop long-term partnerships (**see 4.8 ILES**).

3.3.6. External facilities

Finally, UoA14 staff have benefitted substantially from access to Research Council facilities with >£500k of support from the *NERC Radiocarbon Facility*, >£300k for *Research Vessel Time*, and awards from the *NERC Isotope Geochemistry Facility*.

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

This section discusses Geography's extensive academic and non-academic research collaborations, providing evidence of the impacts of our work on diverse users, audiences and beneficiaries. We have developed some of Exeter's most important industrial partnerships, contributed to policy development across scales, promoted high-profile public engagement activities, received significant external recognition *via* prizes and awards, and played an integral role in ensuring the vitality and sustainability of the discipline.

4.1 Research networks and collaborations.

a) Institutionally. Our strategy emphasises collaboration as essential to research sustainability and success. The interdisciplinary reach of our research is evidenced by Geography staff taking leading roles within Exeter's research institutes (**see Section 1.2 and ILES 1.3**) and collaborating on funded projects or PhD supervision with researchers from seventeen other disciplines at Exeter.

b) Key regional and national networks. Exeter is one of six UK institutions to have a formal collaboration agreement with the Met Office and has invested substantially in joint appointments (**see ILES 1.7**), with many Geography researchers maintaining close research links. For example, staff haven taken major roles (e.g. **Mercado**) in the development of the *Joint Land Environment*

Simulator (*JULES*), the UK's national capability land-surface model used in weather forecasting, climate, and Earth-system models.

Notable further examples of funded UK-focused networks include **Dawney's** founding membership of the interdisciplinary *Authority Research Network*, with Cardiff, Bristol and Warwick; **Davies'** (Co-PI) *Wellcome Trust Collaborative Award – The Animal Research Nexus*, involving Nottingham, Manchester, Southampton and Oxford; and **Gill's** ESRC-funded *Immigration Detention Seminar Series* with Lancaster, Birmingham, Oxford and York.

c) International Research Training Partnerships. Geographers have played leading roles in establishing Exeter PhD partnerships with international institutions (**ILES 1.9**) including with the University of Queensland, Australia (QUEX Institute, **Gallego-Sala, Feldpausch**), and Tsinghua University, China (**Adger, Sitch**). Long-term collaborations built by **Feldpausch, Hartley, Mercado, Pennington** and **Urrego** with >10 Central and Latin American universities and research institutes contribute to training the next generation of environmental scientists throughout these regions. For example, **Feldpausch** is now a permanent faculty member at INPA (Manaus, Brazil), and UNEMAT (Mato Grosso, Brazil), developing researcher training programmes and leading supervision of MSc and PhD students. Since 2016, ten masters and four PhD students from INPA (Brazil) have undertaken their degrees within the Amazon Fertilisation Experiment (**Hartley**). **Anderson** has collaborated with 12 pan-EU partners to develop a major training network in the remote sensing of plant traits (TRUSTEE ITN), while **Scourse** was PI on the ARAMACC ITN which trained 10 PhD students from UK, Croatia, Netherlands, Germany, Norway and France.

d) International networks. Geography researchers are active in >100 networks worldwide. Some key examples include:

- **Caprotti's** €1.4M 'Smart Eco-Cities for a Green Economy (SMART-ECO)' research consortium has been developed with colleagues in the Netherlands, France, Germany, and China.
- **DeSilvey's** work on ruination and environmental change, supported by the Norwegian Research Council, has established sustained relationships with international scholars on projects led by University of Tromso.
- **Evans** and **Chaigneau's** GCRF-funded *Blue Communities* project is collaborative with universities in Malaysia, Vietnam, The Philippines, and Indonesia.
- **Gallego-Sala** is co-lead of the international *C-Peat Network*, supported by the *Past Global Changes* (PAGES) program, which aims to better understand the role peatlands play in the global C cycle, and brought leading peatland researchers to Exeter in 2019.
- **Harrison** partners with Indian researchers on the Water Security Assessment of Indian Rivers originating from the Himalayas (WEIGH) network.
- The *DRYFLOR* network led by **Pennington** involves >80 Latin American researchers and conservationists working to protect neotropical dry forests.
- **Perry** has established globally-extended networks of researchers measuring carbonate budgets to quantify the health/vulnerability of coral reef systems.

e) Visiting Fellowships. Highlight examples include:

- **Adger** and **Brown:** Distinguished Visiting Scientists at *CSIRO*, Australia (2015).
- **Barnett:** Newton Advanced Fellowship, establishing new collaborations between Exeter and the University of Cape Town, South Africa.

- **Buller**: Visiting Professor at the Department of Animal Environment and Health, Swedish University of Agricultural Sciences, Uppsala (2016).
- **Cook**: Visiting Professor, Université Paris Diderot (2016-17).
- **Davies**: Visiting Fellow, Chicago Center for Contemporary Theory, University of Chicago (2014).
- **DeSilvey**: Invited Fellow, Centre for Advanced Study, Norwegian Academy of Science and Letters, Oslo, Norway (2016-17).
- **Fitch-Roy**: Visiting Fellow at Fridtjof Nansen Institute, Oslo. 2020-23.
- **Leyshon, M.**: Visiting Chair at Kenyon College, Ohio (2017); Visiting Chair in Rural Geography Sun Yat-sen University.
- **Quine:** Honorary and visiting Professor at Tianjin University (2018), and member of International Steering Committee for the Institute of Surface-Earth System Science
- **Wylie**: Visiting Fellow, School of Foreign Languages and Literature, Nankai University, China (2020 – postponed, Covid-19).

4.2 Contributions to economy and society: Key research users, beneficiaries and audiences

Beyond the breadth of impacts and benefits showcased in Geography's Impact Case Studies (ICSs; see **Section 1.3** for details), our research produces benefits and impacts for numerous diverse users across government, industry, NGOS's and public audiences:

***a) Major industry partnerships*:**

As outlined in Section 3.1, **Brazier** and **Hill** have established major and ongoing partnerships with *South West Water, Shell* and the *Malaysian Palm Oil Board (MPOB*).

***b) Impacts for national/local government & official bodies*:**

Key Exeter geography contributions here include:

- **Anderson:** has shaped UK policy and international practice on drone use in environmental research, including presenting to the Science in Parliament group in Westminster.
- **Barr:** works with local authorities and councils to understand flood risk, housing and transport needs.
- **Brazier:** research on the impacts of beaver reintroduction resulted in government policy changing to allow beavers to live freely in England for the first time in 600 years.
- **Brazier:** invited advisor to the DEFRA Catchment Sensitive Farming partnership, working with farmers to improve water quality.
- **Buller:** served as Chair of the DEFRA Welfare at Killing Working Group and as member of the Farm Welfare Committee until 2017.
- **Davies:** Member of the UK Home Office Animals in Science Committee 2013-2019 and served as Chair of the Harm-Benefit Analysis (HBA) subgroup, 2014-2017. Her work as Chair informed the improvement of HBA processes in regulatory bodies, clarifying objectives around the use of animals in education and training through bringing a wider range of voices, including patients, into conversations about ethics and translational biomedical research.
- **Devine-Wright** and **Butler:** work on energy and sustainable transitions has contributed key advice to developing policy and pricing for the National Grid (UK), EirGrid (Ireland), the State of Guernsey, and the Department for Energy and Climate Change.

- **Harrison:** Head of the Climate Change Expert Panel for the Office for Nuclear Regulation (HSE).
- **Hinchliffe:** research on biosecurity and anti-microbial resistance (AMR) has led to appointments to the DEFRA Scientific Advisory Committee on Exotic Diseases (2017-), the DEFRA Social Science Expert Group (2017-2019) and the Food Standards Agency Social Science Research Committee (2011-2017). He is also co-author of the World Health Organisation (Europe) *Cultural Contexts of Health* report on AMR.
- **Little:** has led research delivering new understandings of domestic violence for Devon County Council.
- As showcased in the ICS led by **Mitchell**, the Energy Policy Group has made major contributions to transforming governance of the United Kingdom Energy System, driving the creation of a new area of focus in the UK Competition and Markets Authority's Energy Market Review (2016).
- **Safra de Campos:** gave oral evidence at a House of Lords' EU Affairs Committee Inquiry on migration (2020).
- **Thomas:** member of the All-Party Parliamentary Group for Craft

c) Impacts for NGO's and businesses:

- **Brazier's** research, detailed in an ICS, directly influenced *South West Water*'s business case to OfWat, embedding research-level understanding in the decision-making of the water company and promoting environmentally progressive approaches to water management.
- **Cook** has a key role in the Global Coordination team of *Fashion Revolution*, a global NGO campaigning for social and environmental justice in the fashion industry. In 2017, he further led the design and delivery of '*Who Made My Clothes*', a free online MOOC course attracting >16,000 participants from 190 countries.
- **Crowley** was member of the Science and Evidence Forum for the River Otter Beaver Trial (*Devon Wildlife Trust*) and co-wrote the advisory report on social impacts of the eradication of rats from St Agnes, Isles of Scilly (*RSPB*).
- **DeSilvey's** prize-winning work on changing approaches to management of vulnerable heritage landscapes in the context of climate change has informed the work of key agencies and NGO's including *Historic England* and the *National Trust*.
- The work of the *Social Innovation Group* (SIG), led by **C. Leyshon** and **M. Leyshon**, and showcased in an ICS, benefits a wide range of Cornwall-based charities and local government organisations working in the healthcare sector.
- **Pennington's** work with the World Wildlife Fund in Brazil is promoting conservation of tropical dry forests.
- **Thomas** sits on the Boards of two arts organisations (Arts Council NPO *Kaleider* and *Double Elephant Print Workshop*)

d) Public engagements with diverse audiences:

Geography staff engage with multiple approaches to disseminate research insights to diverse public audiences:

- **Anderson's** work using LiDAR data to explore urban greenspaces has led to visualisations of the data including interactive *Minecraft* games and 3D-printed models of urban greenspace.

- **Cook's** work with dramaturge Paula Crutchlow led to the establishment of the *Museum of Contemporary Commodities*, a touring interactive digital installation, engaging >2000 participants at sites across the UK (including the RGS-IBG London) with issues of online consumption, privacy and data activism.
- **Crowley** is leading a citizen-science project with 400 cat-owning households, working to identify effective means of reducing cat predation on wildlife.
- **DeSilvey**'s book *Curated Decay: Heritage Beyond Saving* (2017) featured extensively in print (Times, Telegraph, Daily Mail, Guardian, Independent and local newspapers) and broadcast media (BBC R4 Thinking Allowed, New Books Network, BBC One Countryfile Diaries), and led to a dedicated panel at *Nesta's* FutureFest 2018, a public workshop on 'Objects and Memory' at *Tate Britain*, and a '*Curating Decay*' continuous professional development course, including contributions from *Historic England* and the *National Trust*.
- **Feldpausch** and **Hartley** recorded videos that play on a continuous loop to visitors (>1 million people in 2019) to the *Eden Project's* rainforest biome's new *Canopy Walkway exhibition*, outlining the importance of rainforests globally. Geography-designed exercises are used by *Eden Project* staff in teaching secondary school students about forest surveying and impacts of deforestation.
- **Gallego-Sala** has helped develop videos on the carbon cycle that have been recognised at the *Learning on Screen awards* and the *2020 Geographical Association Publisher' Awards*.
- In collaboration with game developers, **Le Brocq** devised *Ice Flows,* a videogame for children that promotes understanding of ice sheet dynamics, now installed at *Discovery Point Museum* (Dundee).
- **O'Neill** has directly advised the *Eden Project*, the Met Office, and the Irish EPA on climate change communication.
- **Palmer** and **Le Brocq** developed a 3D landscape visualisation and modelling tool which provides the basis for virtual field trips to cryosphere and high-latitude locales otherwise inaccessible to public audiences. This work was awarded a **Times' Higher Education prize** as **UK Digital Innovation of the Year 2020**.
- **Thomas** curated the touring exhibition *Two Make*, showcasing new craft collaborations (*AHRC/Arts Council* with the Gloucestershire Guild of Craftsmen) and *Risk Makers* (with Made by Hand Online) to highlight the challenges of making a livelihood.

4.3 Contributions to the discipline and research base

Geography at Exeter has extended its distinguished record of providing external leadership and sustaining the discipline's research base.

a) International and UK climate change committees:

Exeter Geography continues to make significant contributions to the work of the Intergovernmental Panel on Climate Change (IPCC). For the 5th Assessment Report **Adger** was a Coordinating Lead Author of WGII Chapter 12 *Human Security* (2014). For the 6th Assessment Report (due 2022) in WGIII, **Mitchell** is a Coordinating Lead Author and **Devine-Wright** is a Lead Author. **Adger** was a member of the core writing team for the second UK Climate Change Risk Assessment Panel in 2017 and serves on the expert advisory panel for the third assessment (2019-2021).

b) UKRI & International funding body roles:

Exeter Geographers have contributed strongly as panellists and peer college members across UKRI Councils, with 5 staff serving on the AHRC Peer Review College, 10 on the ESRC College, 3 on the NERC College, 1 on the EPSRC College. **Hartley** is an invited member of the NERC Radiocarbon/Environmental Isotope Facility steering committee. Beyond UKRI:

- **Adger** chaired the European Research Council (ERC) Panel on Institutions Environment and Space (2010-2018).
- **Brown** has been a member of the UK-wide GCRF Strategic Advisory Group (2016-), and was Co-Chair of the International Programme Advisory Committee, Ecosystem Services and Poverty Alleviation Programme, (ESRC/NERC/DFID, 2011 -2018).
- **Caprotti, Gallego-Sala** and **Gill** have served on ERC and EU Horizon 2020 Panels.
- **DeSilvey** sits on the international assessment panel of the *Joint Programming Initiative on Cultural Heritage* funding call on *Conservation, Protection and Use* (EU).
- **Scourse** is core member of the Royal Society AI Research Fellowship panel and serves on the awards committee for the Geological Society of London and the Learned Society of Wales's Frances Hoggan Medal.
- **Wills** served on the 2019 panel for the Phillip Leverhulme Prize award in Geography.
- Internationally, our expertise is regularly sought by government funding agencies, for example in Belgium and France (**Gallego-Sala, Buller**), Czech Republic (**Hartley**), Norway (**Butler**), Georgia (**Barr**), the Netherlands (**Devine-Wright**) and Denmark (**Pennington**).

c) Contributions to geographical associations:

We contribute strongly to the management and running of relevant learned societies. **Thomas** served as Honorary Secretary (RHED) of the RGS-IBG, a key senior strategic role within UK Geography's most important learned society (2014-2020). Also for RGS-IBG, **Barr** is currently Chair of the Planning and Environment Research Group, and previously Treasurer of the Energy Geographies working group; **Butler** was Secretary of the Energy Research group until 2018; **Gill** is Secretary of the Political Geography Research group, and **Dawney** is a committee member of the Social and Cultural Geography research group.

In 2014, **Charman** was president of the *Quaternary Research Association*, which has an international membership of 1000 researchers. **Le Brocq** is Vice President of the British Branch of the *International Glaciological Society*. **Butler** is currently the convenor of the British Sociological Association's Climate Change study group.

***d) Journal and Book Series Editorships**:*

Exeter Geography offers significant leadership to key disciplinary journals and series:

- **Little:** Editor, *Transactions of the Institute of British Geographers*
- **Wylie:** Editor, *Cultural Geographies*
- **Thomas:** Editor in Chief, *Journal of Historical Geography*
- **Davies:** Co-editor of *GEO: Geography and Environment*
- **Kinsley**: Editor in Chief, *Digital Geography and Society*
- **Buller**: Lead editor of the Routledge *'Human Animal Studies'* book series
- **Barnett:** Editor for the Routledge *Research in Place, Space and Politics* Series
- **Fitch-Roy:** Co-editor *Palgrave Progressive Energy Policy* series.

Additionally, researchers serve as Associate Editor for a wide range of key journals, including *Scientific Reports* (**Perry**), *Local Environment* (**Barr**), *Ecology and Society* (**Adger**), *Global Environmental Change* (**Brown**), *Plants, People, Planet* (**Pennington**), *People and Nature* (**Crowley**), *Journal of Unmanned Vehicle Systems* and *Remote Sensing in Ecology and Conservation* (**Anderson**). Staff have acted as Special Issue editors for >20 journals and serve as editorial board members for a further 25 journals.

4.4 Awards and Recognition

Geography staff have been recognised by numerous external awards and prizes:

- **Adger:** Lifetime Achievement Award from the Human Dimensions of Global Change Group, *American Association of Geographers*, 2018.
- **Buller:** Guardian Antimicrobial Resistance Award (research team award, 2018).
- **Brown**: Honorary Doctorate, Wageningen University – fourth ever female recipient, 2017.
- **Caprotti:** Chair's Prize (£500K), Newton Awards, 2020 for the UMBANE project that will install solar micro-grids in informal settlements in South Africa, transforming lives in disadvantaged communities, with a focus on female entrepreneurs.
- **Cloke**: Fellow of the British Academy, ongoing.
- **Davies**: Wellcome Trust Fellowship (2016-20).
- **DeSilvey:** Historical Preservation Book Prize 2018, for *Curated Decay.*
- **Devine Wight**: Environmental Design Research Association Achievement Award, 2014.

In addition, Geography staff have been awarded Leverhulme Fellowships (**Barnett, Little, Perry**), become fellows of the Academy of Social Sciences (**Adger, Brown, Barnett, Goodwin, Hinchliffe, Wills**), and been recognised as ISI Highly-Cited Researchers (**Adger, Brown, Devine-Wright, Sitch**)

SUMMARY: Exeter Geography maintains a world-leading research environment in which researchers from all backgrounds and at all career stages can flourish, with commitments to equality and diversity externally recognised. Our submission demonstrates a continuous upward trajectory in research performance since REF2014. This trajectory is based on: i) substantial increases in total income and income per FTE; ii) the strength and quality of our outputs as indicated by our position within global geography subject rankings and by esteem measures; iii) our development of strong and sustainable industrial partnerships; iv) the high demand for our expertise by governments, businesses and NGOs; v) the central role we have played in driving interdisciplinary research in Exeter, including in the formation of new research Institutes and Centres. Our research is helping to address key political, cultural, environmental and scientific challenges. With more research funding and active projects than ever before, we are in an exciting position as we move beyond REF2021.