Institution: University of Southampton

Unit of Assessment: 14 Geography and Environmental Studies

1. Unit context and structure, research and impact strategy

1.1 Overview

We have delivered fully on our 2014-2021 *Research and Impact* strategy, with notable achievements including:

- A positive shift in working culture, underpinned by our values-led *Research Strategy* (§1.2) and indicated, for example, by an increased proportion of international staff (37% now, versus 18% during REF2014) and an Athena SWAN Bronze award in 2017;
- Increasing the number and gender balance of our post-doctoral (104 in total since 2014, of whom 44% are women) and post-graduate (63 at July 2020, of whom 63% are women) researchers. Doctorate awards also grew substantially, from 34.4 (REF2014) to 75.45 during REF2021 (§2.3);
- Strong growth in our research income (£5.0M/yr in 2019/20 *cf.* £2.6M/yr in 2013/14). With a total income of £27.4M during REF2021, we now rank within the top 5 UK geography departments on this measure (§3.1);
- With significant charitable funding (>£10M of awards from the Bill and Melinda Gates Foundation alone), the WorldPop Project has developed into a major initiative that develops and applies innovative methods for improving the spatial demographic evidence base in low- and middle-income countries;
- The publication of influential outputs with a global reach. Across 942 outputs during the period 2014-2019, 65% have international collaborators (*cf.* 53% during REF2014) and 28% fall within the top 10th citation percentile (Scopus, August 2020);
- The expansion of the reach of our impactful research, with new work in the Global South now complementing our ongoing work elsewhere across the globe, as reflected in our *Impact Case Studies* and the breadth and quality of our societal engagement more generally (§4.3).

As part of a 2018 institutional restructure (*see* REF5a, p2) we sought and succeeded in bringing in Environmental Sciences staff formerly based in the Faculty of Engineering (*see* §2.1), strengthening our work on sustainability. This merger created the School of Geography and Environmental Science (SoGES) in place of the former Department of Geography. At the census date, SoGES now comprises 40.42 FTE (headcount 44; 13F 31M) Category A staff, 37 (18F 19M) post-doctoral researchers (PDRAs) and 63 (40F 23M) research students (PGRs). Our submission includes four Independent Researchers (IRs): **Holland**, **Shengjie Lai**, **Lazar** and **Utazi**; two others (**Ruktanonchai** and **Sorichetta**) transitioned to permanent lecturer roles during the assessment period (§2.1.2, §2.2).

A Director of Research coordinates the activities of our Research Clusters, **GeoData**, and the Graduate School. Each Cluster (**Figure 1**) is aligned with specialisations that connect to global research agendas (§1.2.1), as well as with the University Strategic Research Groups (USRGs) and multi-disciplinary Institutes (REF5a, p2; §1.2.2). All staff belong to one Cluster; many are members of more, reflecting their cross-cutting interests.

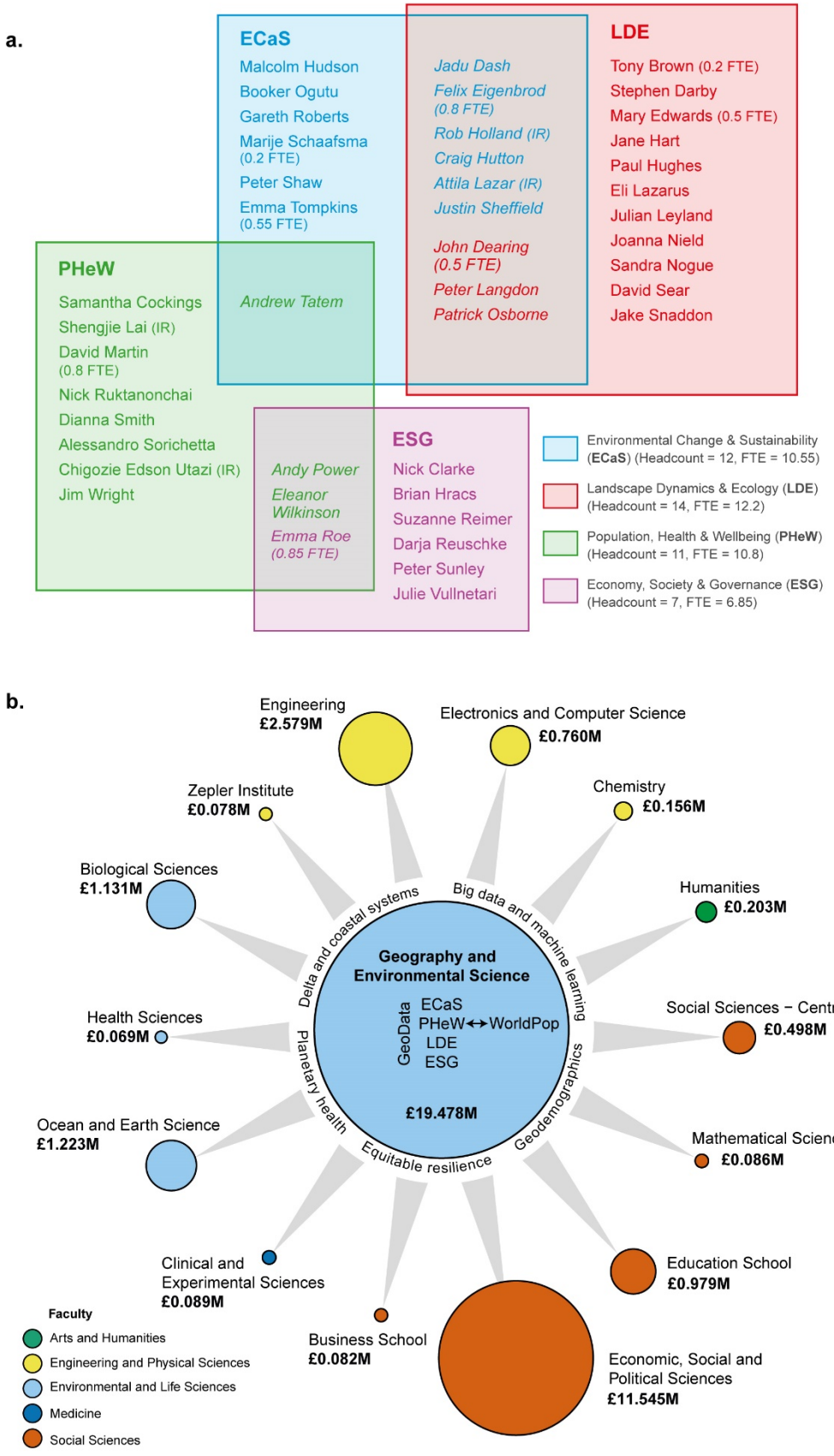

Figure 1. (a) *SoGES Research Clusters. Italicised text indicates staff associated with multiple Clusters. IR = Independent Researcher; (b) SoGES interactions (based on joint awards since 2014) across University of Southampton.*

1.2 Research and Impact Strategy

The outcomes of our 2014-2021 *Research and Impact Strategy* are listed below as a set of achievements, but in §1.2.2 we also frame them as a set of *values* about how we do research. It is enacting these values that provides a sustainable enabling context for our successes; consequently, we return to certain themes throughout. For example, our commitment to a culture of care is reflected in: supportive mentoring, collegiality, and equality of opportunity (§2); the ways we co-produce work with collaborators and engage with research participants, stakeholders and end-users; and our commitments to the broader discipline (§3 and §4). Indeed, this positive culture afforded some resilience during the challenging latter months of the review period. During this time our priority was, and remains, to support colleagues' (especially postdoctoral staff and PGRs) wellbeing while refocusing some research to aid the response to the Covid-19 pandemic (§2.2, §3.1 and §4.3).

1.2.1 Achievement of Strategic Aims

Economy, Society and Governance (**ESG**) focuses on economic geography; politics and the state; migration; feminist geography; and entrepreneurship and creative labour. The appointments of **Hracs**, **Reuschke** and **Vullnetari** enabled ESG to deepen its economic geography expertise while expanding its interests to include the creative economy and migration. Awards from the ERC and ESRC supported new projects on Anti-Politics (**Clarke**), advanced manufacturing and spatial rebalancing (**Sunley**), home-working, entrepreneurship and self-employment (**Reuschke**), alongside ongoing research on gender, care and migration in post-communist societies (**Vullnetari**), gendered labour and creative work (**Reimer**), and curation in creative industries **(Hracs)**.

Environmental Change and Sustainability (**ECaS**) works on global environmental change, its impacts on ecosystem services, biodiversity, food security, and associated human responses. The appointments of **Sheffield** and **Eigenbrod** enabled ECaS to deepen its work on the 'nexus' of energy, food and water insecurity, encompassing ecosystem services, environmental sustainability, and poverty alleviation. Significant projects include **Eigenbrod**'s ERC Starting grant on ecosystem services, **Sheffield**'s (with **Dash** and **Wright**) GCRF-GROW BRECcIA project on water and food security in sub-Saharan Africa, and **Tompkins**' (with **Hutton**) IDRC-funded *Deltas, Vulnerability and Change: Migration and Adaptation* project. ECaS has also continued its Newton-funded work on vegetation phenology and climate-smart agriculture (**Dash**).

Landscape Dynamics and Ecology (**LDE**) focuses on palaeo-environmental reconstruction and global change, geomorphology, and the relationships between climate, ecosystem dynamics and land surface systems. With the appointment of **Lazarus**, LDE extended its scope to coastal systems, delivering on a long-held strategic goal. Awards from NERC (BLUEcoast Highlight Topic) and the Leverhulme Trust are supporting work on inter-tidal zone biogenic roughness (**Leyland**) and over-wash deposits (**Lazarus**). This coastal focus complements LDE's long-standing research on fluvial systems with, for example, NERC and BBSRC-GCRF projects supporting **Darby** and **Leyland**'s work on sediment fluxes in Asian mega-rivers. Supported by a new facility (§3.3), LDE also developed its environmental sensing capability, with major papers on cryospheric environments by **Hart** based on a NERC Internet of Things sensing project, and **Leyland**'s pioneering use of mobile laser scanning to discriminate roughness. A NERC/NSF project (**Nield**) is investigating aeolian dunes using laser scanning and innovative refractive index matching. The appointment of **Nogué** further developed LDE's

molecular work on palaeo-environmental change, with the creation of the UK's first sedimentary ancient DNA (sedaDNA) laboratory (§3.3) also supporting a major AHRC project (**Brown** and **Langdon**) and **Edwards**' work on past ecosystems. LDE further benefited from a new tephra extraction laboratory, resulting in papers identifying new tephras (**Hughes, Langdon**), and enhanced its socio-ecological systems research with key outputs (**Dearing** and **Langdon**) developing the concept of regional safe operating spaces.

Population, Health and Wellbeing (**PHeW**) specialises in spatial analysis of census and population data, geographies of care and wellbeing, and human and planetary health geography. PHeW recorded major successes in its work on time-space population geographies and future population estimation, through **Martin**'s deputy directorship of the £13.7M ESRC Administrative Data Research Centre for England (ADRC-E) and **Martin** and **Cockings**' ESRC-funded Pop24/7 project. Major charitable funding has enabled the **WorldPop Project** (**Tatem**, **Shengjie Lai**, **Ruktanonchai**, **Sorichetta** and **Utazi**) to develop innovative spatial demographic datasets and apply them to support global development and health applications. PHeW also developed its work on care and wellbeing, with the appointment of **Wilkinson**, whose ESRC Future Research Leaders Fellowship supported research on young adults and housing benefit reform, complementing **Power**'s ESRC- and NIHR-funded research on welfare and disabilities, and **Roe's** Wellcome Collaborative Award to investigate farm and laboratory animal welfare. The group's health-related work also continues to excel, with **Smith**'s appointment driving significant support from Public Health England (with **Moon**) and NIHR for spatial health inequalities work, **Roe's** EPSRC-funded infection prevention research, **Wright's** MRC-funded water-borne and zoonotic disease work in sub-Saharan Africa, and **Roe's** AHRC-funded work on protein diets addressing planetary health.

Alongside the four Clusters, ***GeoData*** is an applied research and enterprise group that addresses social and environmental challenges, focusing on food and water security, poverty alleviation and climate change adaptation (*e.g.*, GeoData supported the UN FAO in delivering a Turkish Ministry of Agriculture programme on climate smart agriculture). GeoData has particular expertise in capacity development and Open Research (§1.2.2) and contributed to two (**ICS-1** and **ICS-2**) of our *Impact Case Studies (ICS)*.

1.2.2 Research and Impact Environment and Culture

Below we outline the six values (*intellectual achievement*; *thinking space*; *collaboration*; *impact*; *open research*; *research integrity*) of our *Research and Impact Strategy*; although introduced in discrete sub-sections, in reality these strongly interweave.

i. Prioritising Intellectual Achievement

We encourage staff to: extend their *ambitions*; take the *risks* necessary to pursue agenda-shaping work; and *prioritise intellectual achievement*. These emphases are reflected in changes to appraisal processes (§2.1.1) that now prioritise quality over quantity of work and strategic objective setting over longer (3+ years) timescales than the annual objectives used before. The success of this approach is evidenced in: (i) the growing visibility and reach of our outputs, as indicated by the numbers of articles in interdisciplinary journals (*e.g.*, 23% of our selected outputs are in *PNAS, Science* or *Nature* group journals; *cf*. 6% at REF2014); (ii) winning larger awards (mean value >£121k, *cf*. £64k in REF2014; §3.1); and (iii) the quality of postgraduate research, as reflected in improved completion times and career destinations (§2.3).

ii. Space for Thinking

We promote equitable workload management and offer generous sabbatical provision (§2.1.1), ensuring *all* colleagues have time to think and write. Intellectual exchange is fostered by discourse within and between Research Clusters (*e.g.*, through research away days and writing retreats, cross-cluster seminars and reading groups). The Clusters also foster connections between visitors, established and early career staff and research students, as well as promoting exchanges, mentoring and collaborations (*see* below and §4.1).

iii. Encouraging Collaboration

We work with other leading individuals and institutions, to enhance our visibility and internationalise the intellectual content and impact of our work. This is reflected in the number and quality of collaborations with researchers (§4.1) and end-users (§4.3), and the international reach of our publications (§1.1) and *ICS*. We promote collaboration by:

Engaging with the *University Strategic Research Groups (USRGs)* and *University Strategic Interdisciplinary Institutes (USIRIs)* (REF5a, pp7-8), which enable interdisciplinary synergies for tackling global challenges. SoGES staff play leading roles in the *Autonomous Systems* (**Leyland**) and *Network for Anti-Microbial Resistance and Infection Prevention* (**Roe**) USRGs. These have enabled successes including the NERC BLUEcoast project (with 5 UK Universities, plus BGS, NOC and HR Wallingford), the EPSRC/NERC NEXUSS CDT (with UEA, Heriot-Watt, BAS and NOC), the EPSRC 'Bridging the Gap' AMR network, and the Wellcome-funded *Animal Research Nexus* network.

Building on our intellectual strengths (§1.2.1), and facilitated by targeted hires (*e.g.*, **Schaafsma**, **Sheffield**), we have leveraged opportunities afforded by the Global Challenges Research Fund. Together with our overseas partners we have won GCRF awards worth >£3.4M (§3.1), working with 30 overseas universities in 16 nations and with partners including Chatham House, UN FAO, UNDP, and the Stockholm Environment Institute. We are careful to ensure all our ODA work is co-designed and co-produced in equitable partnerships driven by real end-user needs (*see* vi. Research Integrity, below), providing a significant and sustainable means of delivering our aspirations around internationalisation and societal impact.

Promoting capacity building via **GeoData** and **WorldPop's** CPD programmes, and GCRF projects. For example, WorldPop delivered training on data use at UNFPA headquarters in New York; via UN regional workshops for heads of statistical offices; and by means of in-country sessions, with cohorts trained to deliver future training to governments. Importantly, we view our capacity building activities as a long-term investment in our research ecosystem, intersecting with other dimensions of our strategy, notably *Impact* and *Open Research*. GeoData have developed a global network of clients (>650 since 2014, including OECD, UN FAO, IUCN) who often subsequently become co-producers, funders and end-users of our research. For example, following geospatial data training, the Ghana Statistical Service funded the development of GIS tools to aid enumeration area design for the 2021 Ghana national census; these tools are also now supporting census planning by the World Bank in Zambia.

iv. Societal Impact

SoGES' Impact Champion coordinates impact activity, supports funding bids, and shares good practice. We also engage with institutional units (Public Policy|Southampton and the Public Engagement with Research unit (PERu); REF5a, pp9-10) that support impact delivery and the production and dissemination of policy briefs.

We make extensive use of Southampton's Impact Acceleration Accounts, with 16 (10F 6M PIs) awards since 2014, for activities including work with the Food Standards Agency on anti-microbial resistance in food supply chains, and on using GIS to optimise aid disbursement in Nepal. Seven other impact-enabling awards (2F 5M) were made through Southampton's GCRF Strategic Development Fund.

Two groups within SoGES have considerable expertise in developing impact, and these act as 'beacons of excellence' to share best-practice (*e.g.*, through staff development seminars). **WorldPop** partners with the non-profit Flowminder Foundation (**Tatem** is a Director and their staff share office space) to facilitate the scale-up and implementation of WorldPop's research findings (*e.g.*, **ICS-2** and **ICS-3**). **GeoData** has a large client base (discussed above), with many years' experience of engaging with end-users, and actively contributed to two *ICS* (**ICS-1** and **ICS-2**). Our *ICS* reflect the most mature relationships between SoGES and end-users, but numerous other such relationships exist (§4.3), across all career levels, affording a well-developed pipeline that assures the future sustainability of our societal impact.

v. Open Research

Institutional support for open access publishing is provided (REF5a, p7). Since 2014 we have increased the volume of Open Research tools and data, explicitly to promote end-user uptake and advance academic and societal impact. Of our submitted outputs, 60% are available via 'Gold' open access; we also published 23 open data/software papers (of these 7 are in the top 5% globally in terms of citations for documents in the same publication year and field; Scopus, August 2020). All our *ICS* are underpinned by Open Research. For example, the geospatial data products produced by the Office for National Statistics (ONS) using **Martin, Cockings and Harfoot's** automated zone design methods (**ICS-1**) are available under the Open Government Licence (OGL) via ONS' GeoPortal (>73,000 downloads since 2014). Similarly, **WorldPop**'s global demographic data (www.worldpop.org; >110,000 downloads since 2014) are fully open access, using transparent, documented and shareable methods (**ICS-2** and **ICS-3**). The European Space Agency funded vegetation product OLCI Terrestrial Chlorophyll Index (OTCI) developed by **Dash** is used within the Copernicus Sentinel-3 programme (**ICS-4**); 2.44 pebibytes of such OTCI data were downloaded during 2017 alone.

GeoData has expertise in the development and application of Open Spatial Data Infrastructure, and promotes Open Research across SoGES. Examples of GeoData-led work include the 'Delta Portal' (www.delta-portal.net) for sharing data across delta-focused research projects (**Darby**, **Hutton**, **Lazar**, **Tompkins**), and **Smith**'s work on local area data (www.mylocalmap.org.uk/iaahealth). Dissemination of Open Research expertise forms an explicit component of our capacity building (discussed above) and extends into research training more generally; all research students are trained in, and required to develop, Open Data Management Plans (§2.3.4).

vi. Research Integrity

The culture of research integrity is embedded throughout the Research Clusters, alongside a staff mentoring and appraisal process which has a focus on excellence, accountability, equity, and transparency (§2.1.1). Training in research integrity is provided to all PGR students through the University's Doctoral College (§2.3.3). All staff complete an annual register of interests return in accordance with Southampton's *Conflict of Interests Policy*. All research involving human subjects, including research using social media and secondary data, is reviewed by the Faculty Ethics Committee, which applies University Ethics procedures (REF5a,

p9). Particular attention is paid to the development of equitable partnerships, especially in relation to our portfolio of research in the Global South. Health research, where required, adheres to national NHS Research Ethics Committee requirements. The SoGES Ethics Coordinator contributes to ethics policy development by means of their membership of the Faculty Ethics Committee. Formal mentoring on publication and co-authorship is given to PDRAs and PGRs, with the clear expectation that they will lead-author their work, per the Vancouver Protocol.

1.3 Future Aims and Goals

Over the next five years the School will work across and within our Research Clusters to tackle major global challenges. We will focus on building hubs around our research on: risk and resilience in social and physical systems; planetary health challenges; embedding nature-based solutions in environmental management; and capacity building to steer sustainable transformations through future crises. We will also develop sub-disciplinary areas as follows:

ECaS will develop its excellence in geospatial analysis and understanding of environmental change. It will strengthen its remote sensing and computational modelling research to deliver innovations in monitoring and prediction of change and its drivers, addressing environmental challenges such as microplastics, water and food security, and climate adaptation.

ESG will extend its expertise at the intersection of economic and social-cultural geographies. It will strengthen its research on feminist economic geographies and post-colonial geographies, with work on inequality, housing, migration and austerity. It will deploy its expertise on governance and citizenship to investigate new political and ethical understandings and practices emerging in response to Brexit and environmental crises, including evolving socio-spatial inequalities across and within different segments of society. It will continue to investigate changing working practices, gendered labour, value creation and their relations to spaces of creativity and innovation.

LDE will investigate the response of natural environments to climate change and other human pressures and explore the implications of these changes for society. It will develop new work on the interaction between biological and geomorphic systems while continuing to pursue innovative molecular approaches (*e.g.*, sedimentary DNA) to studies of environmental change, and will research past and present ecological dynamics to better understand the role of biodiversity in multi-use landscapes.

PHeW will continue its research on time-space population geographies and its leadership in population health and behaviours through its international and UK population and disease mapping and transmission projects. It will expand its work on the cultures, spaces and practices of care, with cutting-edge work on inequality, planetary health challenges, and human/more-than-human care relations. It will produce innovative community-engaged work with marginalised groups, alongside an examination of how science, corporate, and state governance systems shape contemporary caringscapes.

Staffing*:* We will expand staff numbers (to ~45 FTE by 2025), to develop the research opportunities identified above, through a combination of: (i) strategic hires (focusing on areas that cut across the Research Clusters' goals, *e.g.* planetary health challenges and socio-environmental justice/governance), as permitted by healthy School finances, alongside (ii) continued transitioning of outstanding post-doctoral staff to permanent academic roles, and (iii) attracting externally-funded fellowships.

***Funding Streams**:* We will attract substantial research income (remaining in the top 5 UK Geography departments during the next REF). We will build on the >£9M of awards already secured to the end of 2022 (§3.1) by: (i) focusing on larger bids; (ii) targeting UKRI Fellowships (*see* Staffing, above); (iii) targeting the Industrial Strategy Challenge Fund; and (iv) consolidating our charitable income.

***Postgraduate Research**:* The Graduate School will continue to grow (with the aim of lying among the top 10 UK Geography departments by awards), resourced by leadership of CDTs/ITNs alongside an increased proportion of international students, the latter drawing on collaborations with our partners in the Global South. We will continue to focus on the quality of outcomes, with further improved completion rates, career destinations, and influential PGR-led publications.

***Facilities and Infrastructure**:* We will invest in: (i) High Performance Computing (HPC) and data infrastructure to provide continued support for our geospatial, computational and environmental sensing research and (ii) our facilities supporting molecular approaches to palaeo-environmental reconstruction. We will also use the new *Boldrewood Innovation Campus,* which houses the £48M (of which £26M from EPSRC) *National Infrastructure Laboratory (NIL)* (REF5a, pp16-17), to deploy state-of-the-art fluid dynamics laboratories in our work on earth surface processes.

2. People

2.1 Staffing Strategy and Staff Development

Our values-led *Research and Impact* Strategy (§1) has driven our staffing strategy in this REF cycle, with recruitment activity seeking to maintain a balance between early and later career staff, while enhancing overall diversity and focusing on staff development. Growth in staff numbers has been possible through: (i) *strategic hires* filling defined capability gaps; and (ii) natural turnover aiding *reinvestment in early career staff*. Note that recruitment detailed below was completed by 2016; new staff have, therefore, had the opportunity to become embedded, be nurtured, and develop their careers, with many subsequently being promoted (§2.1.1).

Our ***strategic hires*** comprised one Professorial (1M) and two (1F 1M) Associate Professor appointments in 2015-2016. **Eigenbrod's** expertise in spatial ecology and ecosystem services strengthens our *Environmental Change and Sustainability* (*ECaS*) and *Landscape Dynamics and Ecology* (*LDE*) Clusters, while **Reuschke's** research on home-working and wellbeing complements *Economy, Society and Governance (ESG)* and *Population, Health and Wellbeing (PHeW)*. At Professorial level **Sheffield** (recruited with a Royal Society Wolfson Merit award) brings expertise in hydrological extremes, strengthening both *ECaS* and *LDE*.

Departures of Professorial staff (**Atkinson** took up a Deanship at Lancaster, **Petts** a Vice-Chancellorship at Plymouth, while **Carling**, **Moon** and **Wrigley** retired) allowed ***reinvestment in early career staff***: **Garrett** (moved to Sydney; 2017), **Hracs**, **Kemeny** (moved to QMUL; 2017), **Vullnetari** and **Wilkinson** were all appointed in 2014, with **Lewis** (moved to US Center for Disease Control; 2019) and **Smith** following in 2015, strengthening *ESG* and *PHeW*. **Ogutu** and **Nogué** (appointed 2015) extend our expertise in Earth Observation and molecular approaches to palaeo-environments, respectively, while **Lazarus** (2016) added coastal systems expertise. Finally, an important development was the movement of talented research staff from fixed-term to secure academic (lecturer) contracts (§2.1.2).

As a result of these changes we have maintained a staff profile (53% are <45 and 16% >56) that we regard as optimal for the sustainability and vitality of SoGES and our contributions to the discipline. These changes had also increased the number of female staff (in 2017 37% were female, *cf*. 33% at REF2014). However, the moves from Engineering of **Hudson**, **Osborne**, **Shaw**, and **Snaddon** (all male) in the 2018 institutional re-structure (*see* §1.1) then slightly reduced our proportion of female staff (30%). Nevertheless, SoGES has diversified through increased international (37% non-UK *cf.* 18% in REF2014) and BAME (11% *cf*. 3% in REF2014) staff. All Category A staff are in permanent roles, with 8 (4F 4M) on fractional contracts, reflecting our commitment to providing flexible working opportunities to support caring commitments, transitions towards retirements, adjustments following serious illness, or to help manage disabilities or mental health.

2.1.1 Career Development and Support of Established Staff

Since 2016 appraisals have been undertaken by specially trained individuals to ensure consistency in the process. This change is a direct result of our Athena SWAN action plan (working towards Silver) that itself was driven by staff feedback to give primacy to career development and future aspirations as opposed to a prior focus on past performance and achievements. In our new system, PIs still appraise researchers working on their grants, but a pool of 5 (1F 4M) 'super-appraisers' (SAs) now appraise staff within defined career levels, rather than Research Cluster leads appraising staff within their groups. SAs help appraisees develop their research plans and agree expectations around research and impact activity that align with Cluster and School strategies. Full allowance is made for special circumstances, and all appraisals include a discussion on any issues affecting wellbeing and work-life balance. A key responsibility of the SA is to focus on career development, nurturing staff to their next promotion, liaising closely with the School Promotions Panel (*see* below). There are two (one physical and one human geographer for each level) SAs for Lecturers and Associate Professors; the Head of School appraises Professorial staff.

Our Athena SWAN action plan also led to reforms of promotions processes. Our new Promotions and Regrading Advisory Group (PRAG) is more gender-balanced (4F 5M) than the panel it replaced and ensures active support for staff with protected characteristics. In direct response to concerns that some staff, especially women, are reluctant to put themselves forward for promotion, PRAG pro-actively reviews the progress of *all* staff annually, not just those who indicate they are seeking promotion or those recommended by appraisers. PRAG identifies individuals ready for promotion, then mentors them through the process. These changes have proven successful in enabling career progression. Since 2014, 8 (1F 7M) colleagues have been promoted to Professor: **Dash**, **Eigenbrod**, **Hughes**, **Hutton**, **Langdon**, **Tatem**, **Tompkins** and **Wright**, with one (M) unsuccessful application. A further 11 staff (3F 8M) (14 applied; 5F 9M) were promoted to Associate Professor: **Clarke**, **Cockings**, **Hracs**, **Hudson**, **Lazarus**, **Leyland**, **Nield**, **Power**, **Roe**, **Sorichetta** and **Wilkinson**. All three (1F 2M) applicants (**Nogué**, **Ogutu** and **Snaddon**) for promotion from Level 4 (equivalent to Lecturer A) to Level 5 (Lecturer B) were successful. PRAG has also focused on rewarding research staff, including those on short-term contracts, with 12 (4F 8M) PDRAs being promoted (from Level 4 to 5).

SoGES ensures staff have the support they need to flourish, paying attention to issues of equity when allocating resources:

- ***Annual Research Budgets*** based on staff grade are provided to all Category A staff (including Independent Researchers), replacing a 'points-based' algorithm (used during REF2014) that favoured Professorial staff. This ensures gender parity within grades and

gives primacy to less established staff (in 2019/20 Lecturers received £1250, Associate Professors £1200 and Professors £900). Staff also retain a proportion (10%) of grant overheads which, together with consultancy funds, can be carried over from year to year. These mechanisms enable activities such as conference attendance or seed-corn funding of new work.

- ***Workload Management*** is based on time (not credits) and includes teaching, research, impact, and administrative duties. Our workload model (WLM) includes research student supervision (§2.3.4), Directly Allocated hours linked to external grants, and assigns teaching and administrative duties in a way that assures staff have a substantial baseline (>40% of working time) for research. This baseline excludes research leave (discussed below) and can be adjusted upwards, by reducing teaching and/or administration, for staff with special circumstances (*e.g.*, following illness or parental leave); 4 (2F 2M) such adjustments have been made since 2014. Workload levels and allocation processes are fully transparent; a spreadsheet detailing all assigned tasks and their loadings is shared with all staff. For the most recent academic year (2019/20), female and male staff who were not on research leave spent on average 51% and 44% of their time on research, respectively.
- ***Research Leave*** is available to all (part-time and full-time) Category A staff, with one semester awarded (contingent on an application detailing a strategic research plan) for every eight served. Eligibility is unaffected by timing, but sabbaticals may be scheduled to accommodate staff circumstances and some have been brought forward to enable transitions back following parental leave (*e.g.*, **Roe**, **Tompkins**). Since 2014, 48 semesters of research leave have been taken (38% by women), with 35 (80%) of our 44 staff having taken at least one semester (the other 9 have not yet accrued sufficient service to be eligible). Additional opportunities are afforded by securing external funding to 'buy-out' from other duties; there have been five (all men) such instances since 2014, including **Brown**'s Advanced Leverhulme Trust Research Fellowship. Staff with Directly Allocated hours on external grants that exceed the baseline research allocation (*see* 'Workload Management') also receive an equivalent reduction in teaching/administration; 6 staff (2F 4M) have benefitted from such reductions.
- ***Impact*** is supported by the Faculty Impact Officer who coordinates impact activity and funding opportunities, including support for research staff secondments to non-academic organisations. Recent examples of such secondments include **Floyd's** placement to support her work on mobile phone records at the Vodafone Foundation, **Harfoot's** secondment to ONS to transfer zone design techniques, and **Domecka's** placement with the OECD Centre for Entrepreneurship, SMEs and Local Development (LEED) team.

2.1.2 Career Development of ECRs

SoGES supports PDRAs through initiatives led by the ECR Mentoring and Faculty Concordat Champions. All PDRAs have assigned mentors to guide them through probation and develop career plans. Changes to appraisals (§2.1.1) have benefited PDRAs by recognising that appraisals and probation need to balance the needs of the project(s) that hired them with their longer-term career development needs. Indeed, since 2016 all PDRA job specifications were revised to explicitly include a time allocation (5%) for their career development. Consequently, for those PDRAs who aspire to lecturing positions, growing numbers are voluntarily being mentored through Higher Education Academy (HEA) teaching qualifications. PDRAs also

contribute to the running of the University, by sitting on the School Management Group (SMG; 1 M representative currently) and Faculty boards (two (1F 1M) representatives currently).

The Head of School and Director of Research meet PDRAs monthly, to promote discussion, offer advice and respond to emerging needs, resulting in various development opportunities having been offered, including promotions workshops, interviewing skills sessions, and fellowship bidding 'masterclasses'. Technical skills are developed within Research Cluster fora. In 2019, in response to ECR feedback, we introduced processes, supported by internal peer-review of applications (including applications for fellowships to be held at other institutions), that now allow ECRs to act as P/CIs on their own grant applications, making progression towards research leadership easier; 23 such bids have since been made, with 6 (26%; total value £0.35M) funded.

We have also made concerted efforts to move researchers from fixed-term contracts to secure roles. For example, a NERC ESPA Fellowship was explicitly constructed to allow transition to a permanent academic post, enabling **Schaafsma** (F) to join in 2014 (transition completed 2018). **Sorichetta** and **Ruktanonchai** (previously Independent Researchers, both M) moved from fixed-term research to permanent lecturing posts in January 2020. Two other post-doctoral researchers (both F) moved from fixed-term to open-ended research contracts, in 2016 and 2018 respectively.

We are proud of the contributions that our ECRs make to the School, and their achievements are reflected in the numbers attaining promotion (§2.1) and their destinations after leaving us. Of the 67 (30F 37M) (who are additional to the 37 currently employed) PDRAs who left SoGES since 2014, 85% (of whom 52% are female) remain in academia. The majority (78%) are PDRAs (including two NERC Independent Fellows), with the rest permanent academics (*e.g.,* at Edinburgh, Glasgow, Montpellier, Oxford). Those who left academia (15%) are all in teaching or government employment (*e.g.*, NASA, National Health Scotland, ONS).

2.2 Equality, Diversity, Inclusion, Wellbeing

SoGES' EDI group coordinates activities to improve engagement, wellbeing, workplace culture, and work-life balance. Our Athena Swan Team is part of this group and during the assessment period much of our action plan for working to Silver has been delivered (*e.g.*, new appraisal and promotion systems, advertising administrative roles, transparent workload model, meetings within core hours, and an email policy to curtail usage outside working hours). **Power** and **Snaddon** have qualified as Mental Health First Aiders to assist with mental health concerns. Other areas (not discussed previously) include work to increase the visibility of female role models (*see* §4.1 on the Gregory Lecture), efforts to address the research career pipeline for BAME PGRs and ECRS, and embedding Athena SWAN processes across our organisational structures.

As discussed above, a notable development has been the transition of fixed-term research staff to permanent roles (§2.1.2). We follow the University's parental leave policies (REF5a, p13), and Southampton's staff policies apply equally to full-time and part-time staff. Consequently, SoGES makes no distinction between full and part-time staff when allocating resources (§2.1.1). SoGES supported all flexible working requests made since 2014.

Since March 2020, our response (*see* REF5a Annex for institutional context) to the Covid-19 pandemic has centred on ensuring the wellbeing and safety of staff and students. We implemented regular 'no agenda' all staff meetings, with the Head of School also leading focused group (*e.g.*, with PDRAs, PGRs, carers, and technicians) meetings, to support

colleagues and ensure concerns were addressed swiftly. Additionally, we surveyed all colleagues to determine impact and support required. In response to feedback, we re-opened our laboratories (6th July 2020) immediately after detailed Health and Safety protocols had been developed, and prioritised the partial re-opening of offices to those, particularly PGRs and PDRAs, who had felt isolated during lockdown. Regular (bi-weekly) fora have continued to allow us to consider wellbeing issues holistically across the School.

Full regard to EDI issues has been paid while constructing our submission. All staff provided input to this REF5b and throughout key facets (*e.g.*, research income, PGR supervision, external roles) are reported using gender breakdowns of supporting data. We have followed Southampton's REF Code of Practice and the profile of our submitted outputs is representative of SoGES' demographics (**Table 1**).

Table 1. *Profile of submitted outputs.*

Staff Characteristic	Proportion of Outputs in Submission (%)	Proportion of Staff by Headcount (%)
Female staff	30	30
BAME staff	10	11

2.3 Research students

SoGES' Graduate School (SoGES-GS) is led by a Director supported by an administrator and Graduate School committee (comprising the Director, Research Cluster Leaders and a PGR representative) who oversee recruitment, training, supervision and progression. After a disappointing REF2014 (25th in our Unit of Assessment on doctoral awards), we set the objective of sustainably (*see* §2.3.4) growing the Graduate School to increase the number of graduating PGRs. Successes in attracting UKRI studentships, coupled with an ongoing programme of internal investment (>£2.3M since 2014) into co-funded studentships (this co-funding intersects with our impact strategy; §2.3.2), and supportive mentorship (§2.3.4), have enabled us to achieve this goal. SoGES-GS now spans the full range of our research interests, with virtually all (95%, including IRs) staff actively supervising our 63 (40F 23M) PGRs. Some 75.45 doctorates have been awarded (**Table 2**), at a substantially enhanced rate (10.8 per year) compared to REF14 (6.9 per year); we now rank 11th out of 49 UK Geography departments (HESA data for 2013/14 to 2018/19) on this measure. Gender balance has also improved markedly: 42% of graduates in the review period were female compared to 33% in 2013/14.

2.3.1 Working Environment

PGRs are housed in the 'Hub', which offers individual workstations, open plan space for Year 1 students, and shared offices for Years 2+. The inclusion of students in a single space promotes collaboration and creative thinking within and across Research Clusters.

Table 2. *Doctoral degrees awarded. Note: no research-based professional doctorates were awarded in the review period.*

	Academic Year							
	2013/14	**2014/15**	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**Total**
Doctoral degrees awarded	9.5	8.3	7.6	14.35	14.1	11.15	10.45	75.45

2.3.2 Recruitment and Financial Support

Applicants are assessed by two trained academics at a recruitment day where they present previous research and undertake an interview. Funding comes from four main sources, with just 2 students (3%) self-funding:

(i) *UKRI Studentships*. Numbers (23: 16F 7M) of UKRI-funded students have increased substantially since REF2014, comprising 37% of PGRs (*cf.* 20% in 2013). We participate in 4 of the 21 active doctoral training centres hosted at, or partnered with, the University (REF5a, pp13-14), playing leading roles in two of them. **Moon** led the ESRC South Coast DTP bid writing team, our staff co-ordinate two of its training pathways (in *Population Change, Health and Wellbeing* and *Sustainability, Environment and Resilience*) and we established a 1+3 Human Geography pathway for our Masters in Social Research Methods, transforming the pipeline into doctoral study within the *PHeW* and *ESG* Clusters. We are also a key partner in the NERC INSPIRE DTP2 (2019-2028, successor to SPITFIRE), with responsibility for designing its training programme which promotes employability, work experience and networking links to industry and government. Additional pipelines to doctoral research in the *ECaS* and *LDE* clusters include an EPSRC CDT (in *Web Science*) and the NERC/EPSRC NEXUSS CDT in *Smart and Autonomous Observing Systems*, the latter linking to our new Environmental Sensing facility (§3.3).

(ii) *Other Funders and Match-Funding* (21: 14F 7M, representing 33% of PGRs). Other external funders include the European Research Council, Leverhulme and Wellcome. SoGES also provides matched funding (typically equivalent to 4 new studentships at UKRI rates each year, totalling £2.38M invested since 2014) to incentivise external partners (*e.g.*, Environment Agency, European Space Agency, Natural Resources Wales) to jointly conceive, fund and, where appropriate, supervise studentships. These projects often address policy-relevant work, offering a notable contribution to our impact strategy.

(iii) *Overseas Students*. Overseas (*i.e.*, non-UK/EU) students (12: 6F 6M, 19% of PGRs) are supported largely by the China Scholarship Council as well as the governments of five other nations.

(iv) *Institutional Schemes*. Competitive awards are allocated via the University's Strategic Research Groups and Multi-Disciplinary Institutes. Our roles in the USRGs (§1.2.2) have left us well placed to target such schemes, with 5 (3F 2M) students (8% of total) currently funded either through *Vice Chancellor's Studentships* or the Southampton Marine and Maritime Institute.

2.3.3 Training and Support

All PGRs receive UKRI level stipends; non-UKRI students also receive support grants (£1000/yr) to fund conference attendance/fieldwork. At the outset, PGRs follow a School Induction Programme and work with their supervisory teams to identify and address their training, equipment, and fieldwork needs; this Academic Needs Analysis (ANA) is subsequently reviewed annually. All PGRs take general skills/research training courses, including on Research Integrity, Impact and Open Research (§1.2.2), with numerous other training opportunities made available through the University Doctoral College's (UDC) GradBook online booking system; all courses are mapped to the UKRI sponsored *Vitae Researcher Development Framework*.

All PGRs are allocated to a Research Cluster (many join more than one) where they participate in reading groups, away days and meetings that often have PGR focused themes such as 'publishing your first journal article'. PGRs also attend the School's seminar programme (all final year PGRs are invited to speak in this series), promoting interaction with external speakers. All PGRs also present at the annual SoGES-GS Conference, while the UDC's annual *Festival of Research* facilitates broader inter-disciplinary engagement. Together with a peer-mentoring scheme established in 2015, in which PGRs are allocated a mentor from the year above (finalists are mentored by a postdoctoral researcher), these activities sustain a supportive intellectual environment in which our PGRs thrive and develop (§2.3.4). Any issues that do arise can be raised through a Senior Tutor (who provides pastoral care) and/or the staff-PGR liaison committee whose representatives (currently 3F and 1M) also sit on the Faculty boards that deal with the Graduate School, teaching and research.

2.3.4 Supervision and Progression

PGRs have a primary supervisor leading a supervisory team approved by the Graduate School. Early career lecturing staff and Independent Researchers co-supervise with more established academics, and all staff must complete supervisor training before they can supervise. To ensure sustainable workloads and quality input, supervisory loads are capped (at a maximum 5.0 FTE) and included in the School's workload model (§2.1.1). At the end of Year 1 progress is reviewed by a single assessor to decide progression to Year 2 (FTE). For progression to Year 3 (FTE) students undertake a 'Confirmation' examination, comprising a presentation followed by a rigorous *viva voce* conducted by two independent internal assessors, based on the assessment of (at least) two draft chapters, a work plan, and an Open Data Management Plan. This structure for progression reviews means that PGRs receive detailed feedback from staff beyond their supervisory team. The web-based 'PGR Tracker' provides an online record of training courses attended, supervisory meetings, progress reviews and outcomes.

Overall, our PGR students play a vital role in our research culture. We celebrate their achievements, which provide evidence of the quality and effectiveness of supervision practices and provision of skills for career development:

(i) PGR completion rates (UKRI definition: mean time to submit), which have improved from 4.66 (2013) to 4.34 years on average since 2014 (note data includes full *and* part time students);

(ii) Strong destinations data, with 51% (34%F, 66%M) of our post-2014 graduates remaining in academia (of whom 63% are PDRAs, 32% lecturers and 5% technicians; destinations include the Universities of Bern, Birmingham, Manchester, Royal Holloway, SOAS and Utrecht). A further 15% (75%F, 25%M) are employed in the private sector (*e.g.*, Jacobs Global, Ordnance Survey), and 13% (30%F, 70%M) in government employment (*e.g.*, FCDO, Environment Agency); the remainder work for NGOs (8%; *e.g.*, IUCN), or are teachers or self-employed;

(iii) High quality publications, with 16% of our selected outputs for REF2021 having been first-authored by PGRs, highlighting the quality of our PGR cohorts.

3. Income, infrastructure and facilities

3.1 Research Funding

(NB: awards/income data are current at 31/7/2020; comparative rankings are from 2018/19 HESA data, the most recent available)

We support staff at all career levels in their efforts to attract external research income, through a coherent approach involving:

(i) targeted use of internal funding schemes (including the Faculty Strategic Interdisciplinary Research Fund, as well as re-investment of overheads; §2.1.1) to allow concept-proofing of ideas and the development of subsequent bids;

(ii) supportive internal peer-review and mentoring (*e.g.*, through Research Cluster workshops and away days);

(iii) supporting mid- and later career staff to bid for larger value awards (as per our strategy of encouraging ambition; §1.2.2).

Since 2014 95% (85%F, 100%M) of our staff (including all four IRs) have secured external awards, with a total portfolio of 262 grants worth £31.74M. Mean award size has increased substantially (>£121k now, *cf.* £64k in 2014) while maintaining very high overall success rates (42%, *cf.* 41% during REF2014) in the face of heightened competition. Indeed, our total income (*i.e.*, research spend) of £27.4M now places us among the top 5 UK Geography Departments. During REF2021 mean annual income (£3.91 M/yr) has doubled compared to REF2014 (£1.89 M/yr), rising to £5.0M in 2019/20 (**Figure 2a,** next page). During April to July 2020, bidding activity declined somewhat (30% by value compared to April-July 2019), as our response to the Covid-19 crisis sought to balance staff wellbeing (§2.2) with pivoting, where appropriate and possible, some research towards aiding the response to the pandemic (examples below and in §4.3). Nevertheless, as of August 2020 we already hold £9.1M of awards secured to the end of 2021/2022, indicating the sustainability of our pipeline of funded research.

Our 2014-2021 research strategy explicitly sought to diversify income sources (**Figure 2b**) to afford resilience to shocks. UKRI and Academies income (£8.88M) comprises 32% of our portfolio, with awards from all 7 UKRI councils and balanced splits between ESRC and NERC. For ESRC, we have a key leadership role in the *National Centre for Research Methods* (**Martin**) and led the *ADRC-E* (**Martin, Moon**; 2013-2018). SoGES has also enjoyed success within the Global Challenges Research Fund (£3.4M awarded), with leadership of the GCRF-GROW BRECcIA project (**Sheffield, Wright, Dash**), and awards from: AHRC-GCRF for anti-microbial resistance (**Roe**); ESRC-GCRF for tele-connected Sargassum risks across the Atlantic (**Tompkins**, **Dash**) and for water and waste management in Africa (**Wright**, **Shaw**); MRC-GCRF on microbial contamination of drinking water (**Wright**); and BBSRC-GCRF and NERC Newton Fund for work on Asian deltas (**Darby**, **Hutton**). **Schaafsma** is also a CI on the GCRF *Trade, Development and the Environment* Hub. During spring 2020, we secured awards for Covid-19 related work from the British Academy (**Clarke:** investigating how people interpret demands to act responsibly), GCRF (**Leyland:** investigating illegal sand-mining during 'lockdown' in Vietnam), and ESRC (**Reuschke:** researching impacts on the UK's self-employed). **WorldPop** also secured three awards (two from the Gates Foundation and one from ONS) to research the influence of mobility on Covid-19 transmission in LMICs and the UK, contributing in part to two *Impact Case Studies* (**ICS-2** and **ICS-3**).

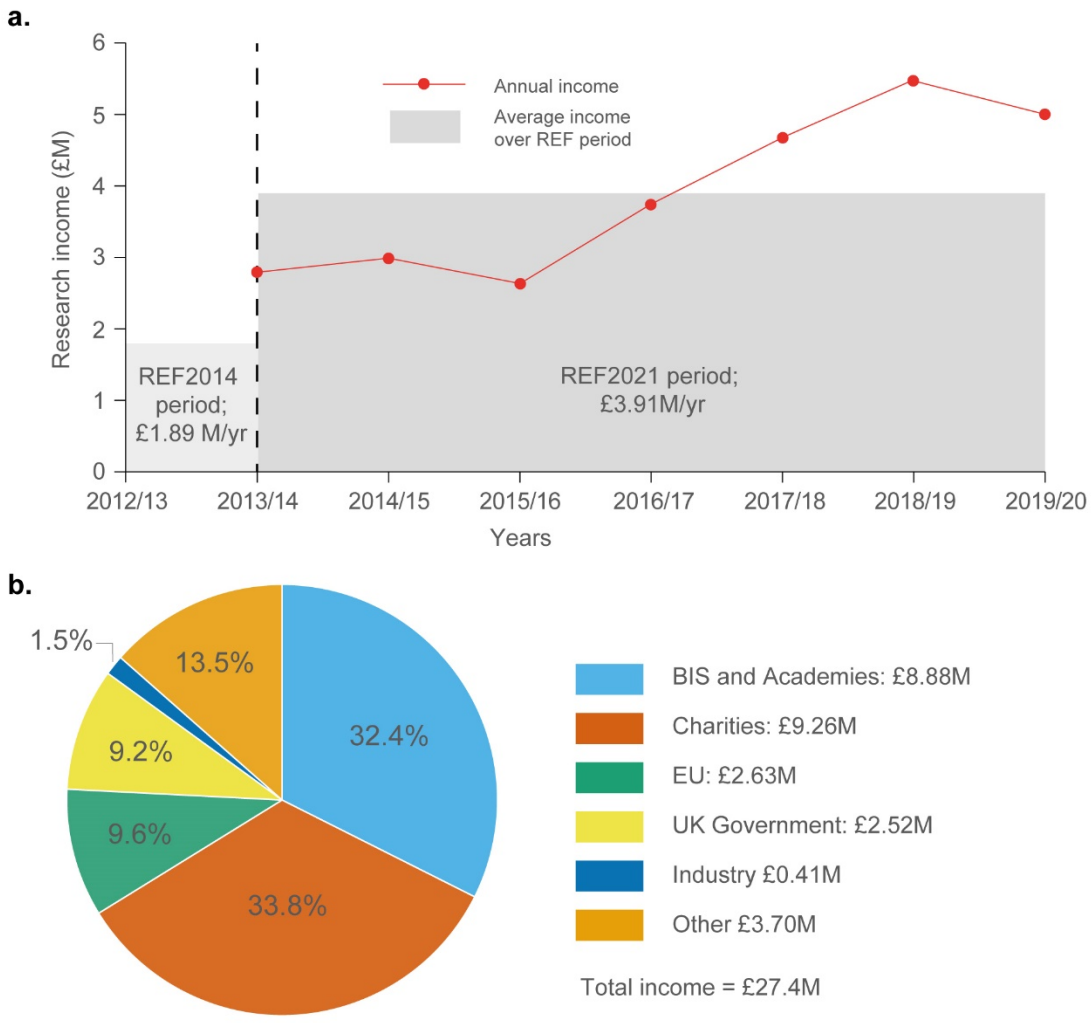

Figure 2. *(a) Temporal trend and (b) sources of SoGES research income.*

In our REF2014 submission we signalled our intention to target EU funding. ERC Starting Grants were awarded to **Reuschke** and **Eigenbrod** and an ERC Advanced Grant to **Brown**. These and other awards have driven growth in EU income (£2.63M, *cf.* £928k during REF2014), albeit this is sufficiently measured (10% of our portfolio) to remain resilient to any potential post-Brexit isolation from EU funding. We have also had considerable success with Charitable, Government and Industrial funding (£12.2M, 45% of our portfolio), with government funding including grants from Defra (*e.g.*, **Sear**'s work on fine sediments in aquatic ecosystems) and Public Health England (**Moon** and **Smith**), all with a strong applied focus. A key development has been to secure significant charitable income (>£10M of *awards* from the Bill and Melinda Gates Foundation alone) to support **WorldPop**'s research on high-resolution gridded population surfaces. This, along with GCRF awards, means that the Global South is now a major focus of our research, enabling us to draw upon synergies between researchers and projects, share best practice in ODA research and impact activity (§2.1.1) and, through equitable partnerships, build strong collaborations with our partners in LMICs (§4.1).

Most awards entail collaboration with other leading institutions within the UK and internationally. With respect to larger-scale collaborations, we already highlighted **Martin**'s roles in the ESRC *NCRM* and *ADRC-E*; he also serves as Deputy Director of ESRC's UK Data Service. These involve(d) collaboration with 5 UK Universities and the Office for National Statistics (ONS).

Sheffield leads the *BRECcIA* consortium which includes the Universities of Ghana, Kenyatta, Malawi, Nairobi, the Technical University of Kenya, as well as the African Institute for Development Policy, UNESCO, and 2 UK institutes. **Tompkins** and **Hutton**'s *Deltas, Vulnerability and Climate Change: Migration and Adaptation* project partnered with the Bangladesh University of Engineering and Technology and the Universities of Dhaka, Ghana, and Jadavpur, as well as 5 UK institutes, including the Met Office. **Moon**'s NIHR-funded work had partners at Portsmouth, QMUL, Newcastle, Sheffield and Warwick. **Roe**'s Wellcome-funded *Animal Research Nexus* involves collaboration with Exeter, Nottingham, Manchester and Oxford.

3.2 Research Infrastructure

WorldPop has seen major growth (from 1 to 28 research and technical staff since 2014). To accommodate this, the University invested £187k to enable the team to be housed together in refurbished facilities that are now shared with the non-profit Flowminder Foundation, as part of our strategy to aid translation of research findings to end-users (§1.2.2).

3.3 Research Facilities

Since 2014 we have invested over £0.5M in our laboratories, equipment and facilities, which are supported by 3.8 FTE technical staff, including an electronics technician and cartographic support, with two new strategic initiatives:

1. ***Environmental Sensing at Southampton*** (£275k): Created in 2015/16 by procuring a fleet of Unmanned Aerial Vehicles (UAVs), an Autonomous Surface water Vehicle (ASV), and associated sensors (including laser scanners), *Environmental Sensing at Southampton* (ES@S, www.esas.soton.ac.uk) represents a state-of-the-art autonomous sensing facility supporting research within SoGES and across the University (*e.g.*, NERC BLUEcoast consortium, supporting **Lazarus**, **Leyland** and colleagues from Ocean Science), with links to the institution's *Autonomous Systems* Research Group and the EPSRC/NERC NEXUSS CDT (§2.3). With three Terrestrial Laser Scanners (TLS), dGPS systems, and a dual-head MultiBeam Echo Sounding (MBES) system, ES@S provides Mobile Laser Scanning (MLS) capabilities, allowing simultaneous above- and below-water survey. This capability supports the *Landscape Dynamics and Ecology C*luster's work on rivers, resulting in major papers by **Leyland** and **Darby**. We also made new equipment purchases to support: (i) our earth-surface process work (sonic anemometers, Acoustic Doppler Current Profilers, and a LISST suspended sediment profiler), and (ii) the work of staff in the *Environmental Change and Sustainability* Cluster in developing protocols for assessing measurement uncertainty and ensuring traceability in satellite data validation (LI-COR canopy analysis to monitor leaf area indices *in situ*).
2. ***Palaeo-Environmental and Earth surface laboratories*** (£250k): In 2015 we created the UK's first sedaDNA facility, allowing the extraction of sedaDNA samples for processing at the School of Biological Sciences sequencing facilities. This new capability has supported work using molecular approaches to reconstruct palaeo-environments, with key publications from **Brown**, **Edwards**, and **Nogué**. In addition, we upgraded our microscopy capabilities to support **Hudson's** micro-plastics research and purchased a hand-held XRF analyser for geochemical analyses of sediment cores.

We also work closely with other laboratories in the University (REF5a, pp16-17):

(i) We are major users of Itrax core-scanning (*e.g.*, **Brown**, **Dearing**, **Langdon**, **Sear**), inductively coupled plasma mass spectrometry (ICP-MS) (**Hughes**), flux-gate magnetometer and DNA sequencing facilities at the National Oceanography Centre;

(ii) We employ the University's £3M μVis system (X-ray CT), for example to support **Leyland** and **Sear's** NERC-funded research on river-bed sediment structure;

(iii) Southampton's High Performance Computing facilities were upgraded in 2017; Iridis 5 now ranks amongst the top 500 supercomputers globally. Iridis is freely available to staff and PGRs, and is used widely (e.g., **Darby**'s global modelling of future changes in sediment delivery to deltas, as well as point cloud processing for **Leyland**'s analyses of river bank erosion, and **Nield**'s work on aeolian processes and surface change).

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

4.1 Collaborations (*NB*: *Collaborations via funded projects are discussed in* §3)

During 2014-2019, 65% (*cf*. 51% in 2014) of our publications were with colleagues at international institutions, reaching 69% in 2019 (Scopus, August 2020). Our co-authorships are drawn from 692 academic (including 76 of the top 100 Universities in the 2019 *QS World University Rankings*) and, as an indicator of our commitment to co-producing research with end-users, 232 non-academic institutes from 78 nations (**Figure 3**; next page).

We encourage disciplinary leaders to visit, having hosted 47 (19F 28M) visiting academics (from 17 countries) since 2014. Additionally, formal Visiting Professorships include: **Jim Best** (Illinois), **Adrian Collins** (ADAS) and **Maarten Kleinhans** (Utrecht), who contribute to the *LDE* cluster; while **Vanessa Lawrence** (former Chief Executive of Ordnance Survey) and **Paul Curran** (City University) contribute to *ECaS*. SoGES staff also hold Visiting Professorships: **Brown** (Kyoto), **Darby** (East China Normal University), **Hracs** (Leibniz Institute), **Nield** (Texas A&M).

SoGES hosts the annual Gregory Lecture series and since 2014 we have expanded its scope to include an associated seminar, specifically for ECRs and PGRs, that focuses on providing career advice and raising aspirations. Since 2014 the series has included a more diverse (5F, 2M, 1BAME) set of speakers (Running, Montana, 2014; Brigham-Grette, Massachusetts, 2015; Subramanian, Harvard, 2016; Bell, Lamont-Doherty, 2017; Robinson, UCL, 2018; Rosenzweig, NASA Goddard/Columbia, 2019; Pain, Newcastle, 2020).

SoGES promotes interactions between staff, students and key research users, utilising our close links with industrial (Dr Neil McCourt, UK Director at Telefónica UK, is a Visiting Professor), government and supranational organisations including Food Standards Agency, Office for National Statistics, and the Organisation for Economic Co-operation and Development (OECD).

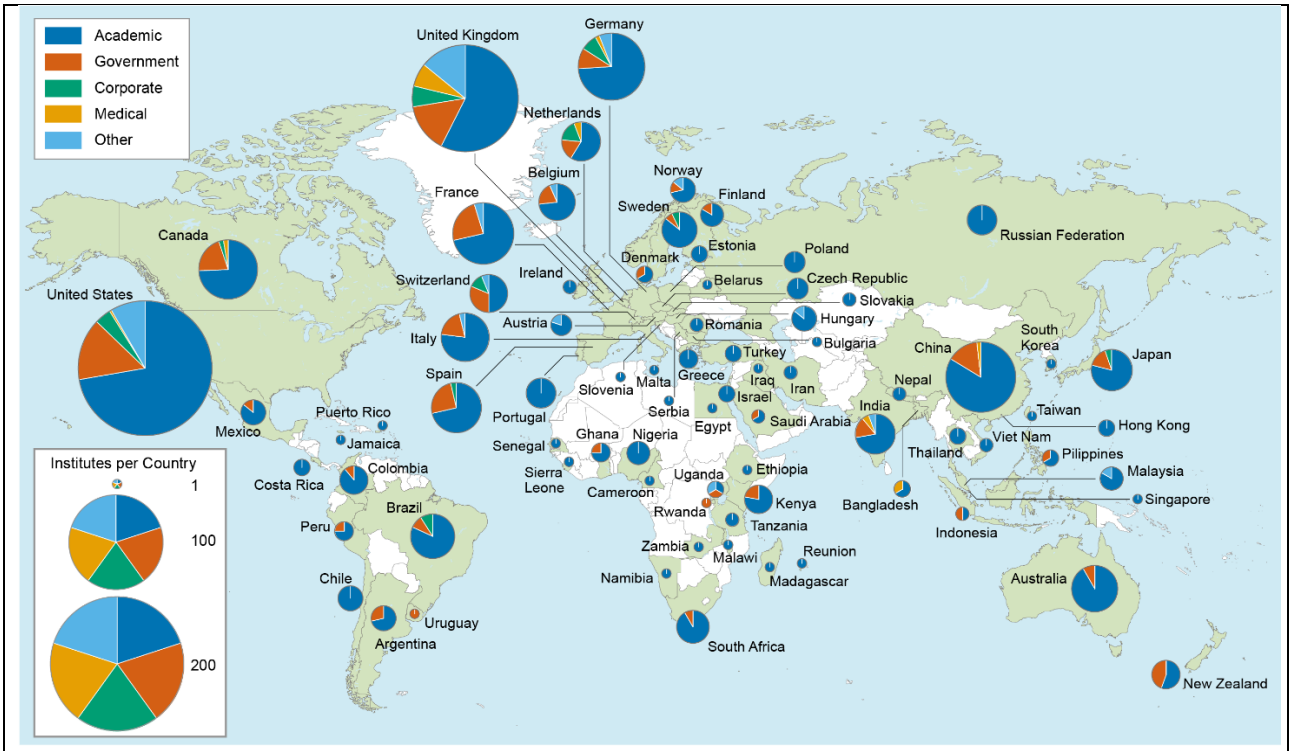

Figure 3. *SoGES' collaborations as indicated by co-publications with institutions of varying types. Data from Scopus, August 2020.*

4.2 Contributions to the Research Base (*NB: current as of July 2020 unless stated*)

4.2.1 Research Councils

Twenty-four colleagues (55% of submitted staff; 7F, 17M) have contributed (*i.e.*, advisory roles, Panel memberships, *etc.*) to the work of research councils. The breadth of our expertise is reflected in 5 of the 7 UKRI councils, along with other UK and international funding bodies, being represented below:

- *AHRC:* **Brown** (Panel C Thematic Large Projects; Strategic Review Panel).
- *BBSRC:* **Dash** (Peer Review College (PRC)).
- *British Council*: **Dash** (Newton Programme PRC).
- *Commonwealth Scholarship Commission*: **Snaddon** (Academic Adviser Panel).
- *ESRC:* **Martin** (ESRC Council and ESRC Audit Committee, both 2014-2016; Chair, Commissioning Panels for the 2015 *What Works Wellbeing Centre* and 2017 *National Centre for Research Methods Phase II* Research Projects programmes; Chair, ESRC/MRC *Life Study Transition Board*, 2015-2016; Member, UK Census Longitudinal Studies research support units commissioning panel, 2020); **Moon** (ESRC-Turing Fellowship Panel, 2017; Mental Health Leader Fellowship Panel, 2016-2017); **Reuschke** (ESRC Grants Assessment Panel D); **Sunley** (NPIF Fellowship Panel, 2019). **Clarke**, **Cockings**, **Moon**, **Power**, **Reuschke**, **Sunley**, **Tompkins**, **Wilkinson** and **Wright** are PRC members.
- *EPSRC:* **Sear** (PRC).
- *European Research Council:* **Edwards** (Advanced Grants panel PE-10, 2014-2017), **Hart** (CHIST-ERA co-chair, 2020).

- *European Economic Area Grants*: **Dearing** (collaborative projects panels, 2018-2019).
- *GCRF:* **Sheffield** (GCRF *Future Leaders African Independent Research* appointments panel, 2018-2020; GCRF-*GROW* programme panel); **Wright** (NERC/ESRC/AHRC GCRF resilience programme review panel, 2016).
- *Irish Research Council:* **Clarke**, **Hart**, **Langdon**, **Power** (all Outer International Assessment Board).
- *Luxembourg Ministry for Higher Education and Research:* **Sheffield** (peer review panel, Luxembourg Institute of Science and Technology).
- *NERC:* **Hart** (*Technology Proof of Concept* panel, 2016; *Digital Environment Expert Network,* 2019-); **Hudson** (*Towards a Sustainable Earth* panel, 2018); **Langdon** (Large Grants panel, 2018); **Lazarus** (*Strategic Programmes Advisory Group,* 2014-2015); **Leyland** (*Constructing a Digital Environment* panel, 2020); **Sheffield** (*SHEAR programme* grants panel, 2018). **Darby**, **Langdon** and **Sear** are PRC members.
- *Norwegian Research Council:* **Hart** (Geoscience grants, 2014; Antarctica grants, 2015).
- *Royal Society:* **Darby** (University Research Fellowships panels, 2018-2019).
- *Strategic Priorities Fund:* **Sheffield** (*UK Climate Resilience Programme* panel, 2020)
- *Swedish Research Council:* **Roe** (*Animal Health and Welfare* panel, 2019).
- *Swiss National Science Foundation*: **Reuschke** (Spark scheme panel).

4.2.2 Journal Editorships

Twenty-five (57%) colleagues (7F 18M) serve(d) as Editors, Associate Editors, or on the Editorial Boards of 34 journals (*e.g.*, *Area*, *Earth Surface Processes and Landforms*, *Frontiers in Ecology and Evolution*, *Social and Cultural Geography*). In addition, SoGES hosts/hosted Editors-in-Chief at: *Health and Place* (**Moon**, 2014-2016), *J. Wetland Archaeology* (**Brown**, 2014-2017), *Applied Spatial Analysis and Policy* (**Smith**), and *Remote Sensing* (**Dash**).

4.2.3 Learned Societies and Other Professional Organisations

Staff of all levels offer disciplinary leadership through their contributions to learned societies and other organisations:

- *American Geophysical Union:* **Hart** (Chair, Earth and Space Sciences Informatics Section Fall Meeting Programme Committee, 2018).
- *British Society for Geomorphology*: **Brown** (Co-Chair, Anthropocene Working Group, 2014-2017); **Leyland** (Treasurer, 2015-2018); **Nield** (Research Committee, 2017-2019); **Darby** (Trustee, 2014-2018; Chair, 2017-2018).
- *Community Surface Dynamics Modeling System:* **Lazarus** (Co-Chair, Coastal Working Group, 2016-2020).
- *European Geosciences Union:* **Hart** (Deputy President, Earth and Space Sciences Informatics Division); **Nield** (Science Officer, Geomorphology Division, 2018-2020); **Sheffield** (Plinius Medal Committee).
- *Freshwater Biological Association:* **Shaw** (Council, 2014-2016).

- *IMISCOE (International Migration, Integration and Social Cohesion in Europe) Research Network:* **Vullnetari** (Maria Bagahna Dissertation award jury, 2019-).
- *Institution of Environmental Sciences:* **Shaw** (Council, 2014-2016; Chair, Grants Committee, 2014-2016).
- *International Arctic Science Committee:* **Edwards** (UK representative, Terrestrial Science Group, 2017-2020).
- *International Biogeography Society*: **Nogué** (Vice President, Communications and Public Affairs, 2019-).
- *International Union for Quaternary Research:* **Langdon** (Vice President, INQUA sub-commission on *Humans and the Biosphere*)
- *Quaternary Research Association:* **Hart** (Vice President).
- *Remote Sensing and Photogrammetry Society*: **Dash** (Council, 2014-2018).
- *Regional Studies Association:* **Sunley** (Research Committee)
- *Royal Geographical Society (with the Institute for British Geographers)*: **Darby** (Council, 2020-); **Langdon** (2016 Gilchrist panel); **Martin** (Policy Advisory Group, 2015-2017); **Nield** (Co-author, 2017 *Benchmark Review of the State of Physical Geography in the UK*); **Power** (Chair, Geographies of Health and Wellbeing Research Group, 2016-2019); **Wilkinson** (Treasurer, Feminist Geography Research Group).
- *UK Polar Partnership Steering Committee:* **Edwards** (Member).

4.2.4 Conferences and Seminar Series

We collectively delivered >165 invited/keynote lectures or seminars for major conferences, Universities, Governmental and Non-Governmental Organisations, and learned societies (*e.g.*, **Darby** and **Tatem** gave 'Monday night lectures' at RGS-IBG in London) both in the UK and overseas (>45 countries). We convened 62 special sessions at major meetings (*e.g.*, AAG, AGU, EGU, IAG, INQUA, RGS-IBG) and hosted 3 meetings at Southampton: *British Society for Geomorphology* (2015), *Remote Sensing and Photogrammetry Society* (2015) and the *British Animal Studies Network* (2017).

4.2.5 Academic Recognition

Major honours bestowed on staff include **Dearing**'s appointment as Visiting Professor to the *Chinese Academy of Sciences* in 2014-2015 and his receipt of the 2014 *Royal Geographical Society (RGS) Murchison Award*. **Martin** received the 2015 *RGS Back Award*, and **Nield** the 2016 *RGS Gill Memorial Award*. **Sheffield** received a *Royal Society Wolfson Award* and the 2019 *American Meteorological Society Robert E. Horton* Award; he was also on the *Clarivate Analytics Highly Cited Researchers* lists in 2017 to 2019. In 2018 **Ogutu** won the *Remote Sensing and Photogrammetry Society Len Curtis Award* for best paper in remote sensing, and **Utazi** won the *Taylor and Francis Commonwealth Scholar Best Journal Article Prize*. In 2019 **Martin** was awarded an *OBE* in the Queen's New Year's Honours list, for services to Geography and Population Studies, while **Tatem** was elected as a Fellow of the *Academy of Social Sciences*. **Tatem** was also awarded the 2016 Global Mobile Award from the *Mobile World Congress* and the 2020 *RGS Back Award.* **Hill** (GeoData) received the 2020 *RGS Cuthbert Peek Award* for his provision of geospatial expertise to aid understanding of human impact on the environment.

4.3 Broader Contributions to the Economy and Society

4.3.1 Economic and Societal Benefits

In addition to our *ICS*, which focus on: improved methods for the collection of official statistics (**ICS-1**); using demographic data to aid disease elimination in LMICs (**ICS-2**); the use of mobile network data in disaster relief, disease and development applications (**ICS-3**); and (iv) strengthening the European Space Agency's terrestrial vegetation monitoring capability to support biodiversity monitoring and drought surveillance (**ICS-4**), societal impact is derived across a broad base of SoGES research. Examples include **Wilkinson**'s ESRC-funded *Hitting Home* project (co-produced with the *Young Women's Trust*), which addressed the equalities impacts of welfare reform on young people and which was presented at a policy event at the House of Commons. **Reuschke**'s ERC Starting Grant *WORKANDHOME* research was taken up by the OECD and the Scottish Government to develop policy guides advising governments on inclusive entrepreneurship. Evidence from **Clarke**'s ESRC project *Popular Understandings of Politics* was provided to the House of Lords Select Committee on Citizenship and Civic Engagement. **Darby**, drawing on BBSRC-funded research, advised Vietnam's Ministry of Agriculture and Rural Development on flood resilient agriculture in the Mekong delta. **Hutton**'s work within the NERC/ESRC/DfID-funded *ESPA Deltas* project informed the Bangladesh Government's Delta Plan. An ESPA Impact Acceleration grant allowed **Schaafsma** to advise the Government of Malawi on integrating environment into poverty measures for the UNEP PEI Africa Programme. **Sunley** is a member of the ESRC/Innovate UK *Innovation Caucus*.

ECRs are also very active in developing impact. Independent Researcher **Shengjie Lai** led a series of Covid-19 studies (published in *Nature* and *Science*) using mobility and epidemiological data to assess the risk of Covid-19 spread and to quantify the effects of non-pharmaceutical interventions, with results used by the WHO and other national and international organisations to tailor strategies during the pandemic. Meanwhile IR **Holland**'s work on biodiversity loss (published in *PNAS*) was adopted by the IUCN (*see* §4.3.2). PhD work supervised by **Hudson** and **Eigenbrod** documented the importance of charcoal to Malawi's poor and is cited in national forestry and energy policy documents arguing for easing sanctions on the charcoal industry. PhD work supervised by **Hughes** informed Welsh Government policy on farm management of upland peat for carbon sequestration.

4.3.2 Shaping Policy and Practice: Agenda-Setting Roles

Staff (13 total, 4F 9M) sit on bodies that assist in shaping public policy and/or practice, in the UK and overseas. Specifically: **Brown** served (2014-2017) on the Home Office Forensic Sciences Advisory Group; **Cockings** is a Member of the Office for National Statistics (ONS) Census and Statistical Geographies Advisory Group; **Dash** is Vice Chair of the Committee on Space Research (COSPAR) Sub-commission on *Land Process Morphology*. He also co-chairs the Committee on Earth Observation Satellite (CEOS) Land Product Validation sub-group on *Land Surface Phenology*, and sits on the European Space Agency expert group for the Sentinel 3 mission; **Edwards** presented findings from NERC's first Arctic Programme to the All Party Parliamentary Group (AAPG) on the Polar Regions; **Eigenbrod** co-organised the Isaac Newton Institute workshop on *Evidence-Based Decision Making for UK Landscapes*; **Holland** sat on the IUCN World Commission on Protected Areas and Species Survival and the IUCN Red List standards group; **Martin** is a Member of the National Statistics Population Theme Advisory Board and the UK Statistics Authority Methodological Assurance Review Panel - Census; **Moon** is Honorary Consultant to Public Health England; **Roberts** co-chairs the Committee on Earth

Observation Satellite (CEOS) Land Product Validation sub-group on *Fire Disturbance;* **Schaafsma** lead-authored the 2019 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) assessment on valuing biodiversity and ecosystem services; **Sear** sits on the Environment Agency/Defra Technical Advisory Group on *Flood and Erosion Risk Management Policy* and the *Flood Management Strategy Working Group*. **Tatem** sits on the World Health Organisation (WHO) Expert Review Group on *Assessment of Malariogenic Potential* and the WHO International Consultation on *risk mapping of the spread of vector-borne diseases via air travel*. **Vullnetari** serves on the Independent Advisory Group for Country Information (IAGCI), which advises the *Chief Inspector of Borders and Immigration.*

4.3.3 Public Engagement

Our public engagement work involves close liaison with the University's Public Engagement with Research unit (PERu) and includes a range of outreach activities. Notable examples include the GCRF-GROW project BRECcIA (**Sheffield**, **Dash**, **Wright**), which hosted an event in Malawi (July 2019, 500 participants) to raise awareness of water and food security. In the UK we have a strong presence in the Southampton Science and Engineering Festival (SOTSEF), the University's award-winning annual science festival. The *Microbe Masquerade* ran at Bestival (2016, 40,000 attendees), communicating findings from **Roe**'s EPSRC-funded work on AMR. **Clarke**'s ESRC work on *The Rise of Anti-Politics in Britain* was presented at an event hosted by Tristram Hunt MP at Portcullis House (attended by 72 MPs, think tank representatives and journalists). **Roe**'s Wellcome-funded *The Mouse Exchange* (3 science and humanities fairs since 2018), one of 4 winners at the 2020 Openness Awards (held and judged by Understanding Animal Research), engages participants in using craft techniques to explore the laboratory mouse as a scientific tool and living animal. Looking forward, we will pursue the collaborative opportunities afforded by Southampton's bid to become UK City of Culture in 2025.

We increased our visibility in national and international news media through close liaison with the University's media teams. For example, **Edwards** wrote and presented a BBC R4 programme on Arctic Alaska in the series *Climate Change and Me* (aired May 2018). **Clarke**'s work on popular understanding of politics featured on BBC R4 (*MPs' Expenses,* aired May 2019). **Darby**'s work on the Mekong was featured by BBC News at Ten ahead of the IPCC SR15 meeting in October 2018, and by BBC World in December 2019. **Roe**'s AHRC *Man Food* project was covered by >30 outlets (including BBC R4's *The World Tonight*), while **Smith**'s work on food poverty was covered by the BBC and national newspapers. **Tatem** was featured on a BBC1 Panorama (aired July 2020) programme on Covid-19. **Eigenbrod**'s work on global losses of mammal and bird ecological strategies was covered by 95 outlets, ranging from CNN to the *Clacton Gazette*. **Hudson** was interviewed on microplastics research and policy for BBC News, Sky News, and Al-Jazeera, and **Langdon** is a scientific advisor for CBeebies' environment-related programming.

The significant extent to which the public engage with our work is evidenced by Altmetric data (analysed September 2020; these data cover online engagement). Specifically, our outputs authored during 2014-2020 have been referenced by: (i) >2170 mainstream online news outlets; (ii) 93 Wikipedia entries; (iii) 168 policy citations; and (iv) >29000 shares or posts on social media. A total of 176 (17.4%) of our publications have Altmetric Attention Scores (AAS) in excess of 33, placing them within the top 5% of all research outputs tracked by Altmetric.