

Institution: University of the West of England
Unit of Assessment: 17 Geography, Environmental Studies and Archaeology
<p>a. OVERVIEW</p> <p>Research in the Department of Geography and Environmental Management (DGEM), Faculty of Environment and Technology (FET) is theoretically informed, applied in nature, and conducted within a collaborative interdisciplinary framework. It is focused in three targeted research areas: (i) <i>Air Quality and Carbon Management</i>; (ii) <i>Water and Society</i>; and (iii) <i>Society, Culture and Community</i>.</p>
<p>b. RESEARCH STRATEGY</p> <p>Since 2008, the Unit's strategy has comprised three aims (articulated in RAE 2008), with two additional aims introduced post RAE 2008. There has been a deliberate shift to more applied, policy-aligned research. These aims have been addressed as follows (with detailed summaries about the Unit's three targeted research areas coming after):</p> <p>1. To develop our internationally excellent profile in terms of research outputs, esteem, and impact by strategically focusing research in targeted areas of strength</p> <p>In overview, academic activity and outcomes in our areas of strength are:</p> <ul style="list-style-type: none"> • £2.3m of external funding spent; £176K per FTE staff submitted, with 16 RCUK projects; • 10.1 research student completions over the census period (including three RCUK funded); • 197 refereed journal articles, 11 authored monographs, 16 edited books, 95 book chapters, 47 conference sessions convened, 290 conference papers, 50 keynote presentations; and • 42 (inter)national conferences convened, 3 Editorships, 20 Editorial Board memberships. <p>2. To unite theoretically informed research with strong policy relevance and user-engagement</p> <p>This involves developing and sustaining <u>long-term collaborations</u> with government agencies (UK: Defra, DECC, EA, SEPA, LAs, Forestry Commission; international: DG Environment; Dept. of Environment Affairs, South Africa), private sector (e.g. Bristol Water plc), and professional bodies/learned societies (e.g. RGS-IBG, Society for the Environment, CIWEM, British Land Reclamation Society, South African Academy of Science). Such collaborations have enabled research to <u>inform national and international policy/practice</u> in air quality, flood/water/river management and community development. The Unit's <i>Water and Society</i> research has targeted <u>engagement with end users</u> in water/flood practice (EA, LAs, third sector, National/Scottish Flood Fora, media, county archives) and has <u>progressed methodological developments</u> (e.g. stakeholder competency group models – where research end-users are iteratively engaged throughout research processes - ESRC 'Flood Memories'; <i>McEwen</i>). In <i>Air Quality and Carbon Management</i>, the Unit has long-established relationships with LAs, central government and devolved administrations across the UK advising on air quality management (AQM) problems, providing technical assistance with modelling and monitoring of air quality and capacity development training, and supporting policy development in AQM. Advisory Panels for our research areas include end-users to ensure <u>strong inter-professional partnerships of research-policy-practice</u>.</p> <p>3. To disseminate academically excellent research through innovation in knowledge exchange (KE)/science communication</p> <p>Creative development and application of KE has involved collaboration with UWE's internationally reputed Science Communication Unit (e.g. <i>Longhurst</i>, Co-I with SCU, 'Science for Environment Policy', EC funded; 2008-2011 & 2011-2013). The Unit's KE approaches have included:</p> <ul style="list-style-type: none"> • trialling use of <u>digital stories</u> to build community flood knowledge (<i>McEwen</i>; ESRC KE); • <u>role-play/Second Life</u> in flood science communication with local government (<i>McEwen</i>; NERC); • <u>simulation</u> e.g. for marine/fisheries research-practice (the Bristol mock Ecocide Trial; <i>Appleby</i>); • <u>creation of an NGO with conference delegates</u> (Community of Arran Seabed Trust; <i>Appleby</i>); and • published <u>policy briefings</u> (RGS-IBG Policy Briefing 'Water Policy in the UK', ICE-Southwest Position paper on 'Water Infrastructure', both 2012; <i>Staddon</i>) which put statements about the policy implications of our research into the hands of Parliamentarians and civil servants at a time when new water legislation was being developed.

4. To cultivate innovative interdisciplinary collaborations that bring new research perspectives to geographical/environmental problems, so identifying original solutions

- The Unit was significantly involved in UWE's successful £548k EPSRC Bridging the Gaps project 'HEAT@UWE' (*Longhurst*, Co-I, manager *Sinnett*) with a cross-university programme of activity to generate interdisciplinary research collaborations in Health, Environment and Technology. HEAT@UWE has led directly to new externally successful bids of over £4.3 m (£755k value to UWE) to date.
- Non-contiguous interdisciplinarity in research conceptualisation and delivery has included that between geography and the arts (*McEwen*, AHRC PI/Co-I): water narratives and performance theatre (with *Bottoms*, Manchester); cultural geography (with *Jones*, Gloucestershire); and creative media (with *Wilson*, Falmouth). This collaboration has led to development of new conceptual frameworks – 'sustainable flood memory' and 'watery sense of place' - applied to challenges of Living with Environmental Change. AHRC-ESRC funded research (*Maddrell* PI) has combined geography with theology (Glasgow), and history (London) developing innovative methodologies, conceptualisations and management strategies on the interrelation between landscape and pilgrimage (*Maddrell et al.*, 2014; 'Pilgrimage, landscape and heritage', Routledge).
- Policy-Practice-Pedagogy research innovation has notably been through the 'Sustainable Water Action Network' and Lloyd's Register Educational Trust 'International Water Security Network' (IWSN) projects (*Staddon*) addressing water resource management in East Africa (with sub-Saharan African partners), and in social studies of science through 'Biosphere 2' (Arizona); 'Eden Project' (Cornwall). Significant contributions have also been made to science application in legislation in air/water services (*Appleby*, *Everard*, *Staddon*), air quality (*Longhurst*, *Hayes*) and marine policy (*Appleby*).
- Across the Unit, staff have been/are leading seven funded networks that develop (inter)national interdisciplinary and inter-professional research dialogue through face-to-face and virtual engagement (see Section e for details).

5. To diversify research income streams in order to sustain and enhance the vitality of our areas of user-relevant research strength

- RCUK funding across four Research Councils has built research capacity: NERC - *Longhurst*, *McEwen*, *Hayes*; ESRC - *McEwen*, *Longhurst*, *Chatterton*; AHRC - *Chatterton*, *Maddrell*, *McEwen*; AHRC-ESRC - *Maddrell*; and EPSRC - *Chatterton*, *Longhurst*, *McEwen*; also GWR; National Science Foundation (South Africa) – both *Longhurst*. Total grant value awarded to UWE is £973k.
- EU funding successes have allowed longer-run user-focused projects (e.g. EU SWAN, *Staddon*; DG Environment, *Longhurst*, *Hayes*, *Chatterton*; URBAN-NEXUS, *Sinnett*; Environmental iNets, *Longhurst*, *Hayes*, *Bailey*). Total grant value awarded to UWE is £657.3k.
- Policy-relevant government funding has included Defra (*Longhurst*, *Hayes*, *Chatterton*); Welsh Government (*Hayes*); Spanish Government (*Casado-Diaz*); and EA (*McEwen*, *Longhurst*). Total grant value awarded to UWE is £379k.
- Diversifying into third sector streams has secured funding from Lloyd's Register Educational Trust (*Staddon* PI; *Hayes*, *Appleby* Co-I; 5 year project), Marine Management Organisation and Blue Marine Foundation (*Appleby*) and Living Streets (*Sinnett*). Total grant value awarded to UWE is £1.1m.

TARGETED RESEARCH AREAS

Research Area 1 - Air Quality and Carbon Management

(*Longhurst*, *Bailey*, *Chatterton* (0.8 FTE), *Hayes*, *Sinnett*; £1.4m attracted funding and 76 refereed journal articles over the period).

The Air Quality Management Resource Centre (AQMRC; established 1997) has strengthened its profile as a leading (inter)nationally engaged research and knowledge exchange centre in air quality and carbon management. The Centre addresses issues of efficiency and effectiveness of air quality management (AQM) and carbon management processes, interrelationships between AQM and other policy processes, and development of tools to enhance the effectiveness of AQM. Researchers in AQMRC provide research advice/guidance to DG Environment, UK government - Defra (funded from 1999-2011), devolved administrations and local authorities on air quality management. International air and carbon management projects have included policy development

Environment template (REF5)

and science translation in India, Nigeria and South Africa. *Longhurst, Hayes and Chatterton* have provided advice to UK Ministers, MPs and civil servants with significant impact on national and local policy formulation processes (e.g. Defra's Technical (TG09) and Policy Guidance (PG09)) and practices of AQM in national (Defra, Scottish Government, Welsh Government, DoE, Northern Ireland) and 200 local government departments. Research has been funded through EPSRC/RCUK Energy Programme (*Chatterton*); ESRC (*Longhurst*); NERC (*Hayes, Longhurst*); DECC (*Chatterton*); and EPSRC (*Longhurst*). AQMRC's project portfolio has also included funding from GWR (*Longhurst*), Environment Agency (*Longhurst*), Defra (*Hayes, Longhurst, Chatterton*); DG Environment, EC (*Hayes, Longhurst, Chatterton*), and Nigerian Space Research and Development Agency (*Longhurst*). *Bailey, Hayes and Longhurst* have, with EPSRC funding, researched the 2050 low carbon futures for Bristol. *Bailey* is now extending this work to engage the public in decision-making about alternate 2050 Bristol futures.

Research Area 2 - Water and Society

(*McEwen, Appleby, Cole, Everard* (0.2 FTE), *Parker, Quinn, Staddon*; £1.7m funding attracted and 74 refereed journal articles over the period).

Water research during the period, particularly into social-scientific dimensions of water services, has been developed into a more coherent and stronger whole under the 'Bristol Group for Water Research' banner. Key research contributions since 2008 include: development of new methodologies for flood risk analysis (*Quinn*, with Wilby, Loughborough); embedding ecosystem services into science/practice (*Appleby, Everard, Quinn*); co-developing models that improve representations of river catchment sediment dynamics for stakeholder decision-making (now trialled for national implementation by SEPA) (*Parker*); advancing knowledge of timing/impact of Late Holocene floods on cold environment rivers (*McEwen*); engaging in activity at the forefront of applying environmental law to marine conservation/fisheries governance in UK, the EU and its overseas territories (*Appleby*); policy-practice-pedagogy of international urban water security; and new ways of stakeholder public participation in water management (*Staddon*); and innovative socio-ecological framing of water and tourism development for better understanding of the tourism industry's unsustainable water use (*Cole*). The IWSN project (*Staddon, Appleby, Hayes*; 2013-2018) aims to establish a regionally representative global network of centres of excellence on key topics related to water security including urban, water quality and transboundary water security.

In 2012, new staffing in FET with interdisciplinary research expertise in flood resilience (*McEwen*), building on existing expertise in 'community' research, has acted as a platform for strategic development of a new interdisciplinary UWE Centre for Floods, Communities and Resilience (CFCR). This responds to research needs resulting from UK policy shifts to distributed flood risk management (FRM). CFCR's explicit focus on community flood risk and its collaboration with staff in the Department of Architecture and the Built Environment at UWE is unique. Its developing research foci are at the interstices of: water/engineering science; community development and resilience; representation, perception and behaviour; and policy and governance. Cross-cutting themes are in flood knowledges, education and science communication for flood resilient futures. CFCR has already been successful in bidding for RCUK funds (ESRC 'Flood Memory'; AHRC 'Multi-story water'; ESPRC 'Sesame'; AHRC 'Hydrocitizenship' – funding recommended (grade 5)), underlining the contemporary importance of the Unit's focus.

Research Area 3 - Society, Culture and Community

(*Maddrell, Casado-Diaz, Cole, Jordan, Staddon*; £1.2m funding attracted and 47 refereed journal articles over the period).

In RAE 2008, DGEM signalled an intention to broaden Human Geography research, linking tourism with wider social and cultural geographies. There has been a subsequent focus on tourism and leisure mobilities, gender, communities and the intersection between material and more-than-representational geographies. The Research Area links to *Water and Society* and the Centre for Transport and Society (CTS, UoA 16) relocated within DGEM through internal re-structuring in 2013. Innovative research includes: the geopolitics of water for mobile tourists (*Cole*); sacred mobilities (*Maddrell*); UK-Spain retirement migration and social capital (*Casado-Diaz*); gender and tourism mobilities (*Jordan*). Research on the more-than-human includes: the political ecology of human-forest interactions (*Staddon*); pilgrimage practices and performances (*Maddrell*), and related work on polysemic liminal spaces of memory and remembrance (*Maddrell, McClymont* (UoA 16)). Influential research on geographical thought and practice includes BA funded 'Complex

Environment template (REF5)

Locations' (*Maddrell* 2009, RGS-IBG/Wiley), described as the 'apogee of hidden histories' (Powell 2011); and a related AHRC CDA with RGS-IBG 2010-13: 'Terra Incognita. Women in the expedition archive' (*Maddrell*). 'Community' is the conceptual and empirical focus of on-going research on: local pilgrimages; community practices of remembrance (*Maddrell*); charity retailing, community service, volunteering, and regeneration (*Maddrell*, Tallon); community water provision in Less Economically Developed Countries (*Staddon*, Terry); and community services (Williams). Up to May 2013, this Research Area incorporated former Unit staff from the cross-institutional Countryside and Community Research Institute (Curry, Jones, Maye, Reed), now unified under Uni. of Gloucestershire – allied to the Unit's strengthened emphasis on and redirected investment in *Water and Society*. Maddrell was appointed as DGEM's Associate Head of Department for Research and Scholarship in 2013 and will oversee consolidation/development of this Research Area, developing its synergies/collaboration with CTS.

THE UNIT'S FORWARD STRATEGY

Deriving from the 'UWE Bristol Strategy 2020' and its 'Research with impact' priority, the Unit will deliver internationally excellent research that meets the needs of industry/society, focusing on regional, national and international priorities and partnerships. This continues to develop the five aims articulated above. Strategic developments to enable us to progress these aims are as follows:

- To develop water/flood research at the research-practice interface with strong focus on security and resilience. Over the next three years and on the current trajectory, the Unit will build the case for a cross-cutting interdisciplinary Water Institute at UWE, with a reputation for internationally excellent research with impact, and with strong productive partnerships - well embedded at regional, national and international levels (leads *McEwen*, *Staddon*). This will build on successes of the Centre for Floods, Communities and Resilience, and the evolution of IWSN.
- To further develop carbon management as a theme within the *Air Quality and Carbon Management* area (lead *Longhurst*).
- To explore the potential of ecosystem services as a cross-cutting research theme across *Water and Society*, and *Air Quality and Carbon Management* areas (lead *Everard*).
- To grow capacity in *Society, Culture and Community* research, with further integration of expertise on mobilities, tourism, gender and community (lead *Maddrell*).
- To develop existing international collaborative work of the three areas (*Air Quality and Carbon Management* in Europe, South Africa, Nigeria and India; *Water and Society* in the EU, USA, South Africa, Australia and Brazil; *Society, Culture and Community* in Costa Rica and Malawi).
- To capitalise on Faculty investment in UWE's Science Communication Unit to extend the creativity and effectiveness of research exchange with stakeholders.

Looking to a horizon of 2020, we expect to continue and extend an emphasis on consolidating, evolving and growing our areas of research strength, further improving the coherence of the Unit and the international profile of its contribution to associated fields of research and practice. Major projects (e.g. IWSN; Centre for Floods, Communities and Resilience; ecosystem service research) are already providing strong impetus for an increased scale of activity across REF indicators; this trajectory will be built on going forward. Research development will be addressed through a strong ethos of co-working and research capacity building (see Section c). All groups have management teams that review strategy, and monitor individual/collective progress relative to KPIs, reporting to DGEM, Faculty and University. DGEM's Research Strategy Group (Group heads, Associate Head of Department (Research & Scholarship), Associate Professors/Professors) meets regularly to direct/evaluate the Unit's research strategy to ensure vibrancy, sustainability and synergies in research activities.

c. PEOPLE

STAFFING STRATEGY AND STAFF DEVELOPMENT

Our approach has involved the following elements:

- **Ensuring strong leadership of research areas** - *Air Quality and Carbon Management*: Professorial lead *Longhurst*; *Water and Society*: Professorial lead *McEwen*; and *Society, Culture and Community*: Associate Professorial lead *Maddrell*. The interdisciplinary Centre for Floods, Communities and Resilience has shared leadership with the Department of Architecture and the Built Environment. Key external leadership appointments have been made in environmental management (*McEwen* from Uni. of Gloucestershire) and ecosystem services (*Everard*);

Environment template (REF5)

Environment Agency). *Maddrell, Staddon and Quinn* have been promoted to Associate Professor, providing specific thematic lead development roles.

- **Appointing Visiting Professors and Visiting Fellows for targeted collaboration/sharing of expertise** - The Unit has 4 Visiting Professors (VPs) and 2 Visiting Research Fellows (VRFs) who contribute to research development (3-year appointments). Three VP and 1 VRF support air/carbon management research; 1 VRF (Solandt, Marine Conservation Society NGO) supports marine/fisheries research; 1 VP (Martin; Institution of Environmental Sciences) advises on Education for Sustainable Development research.
- **Recruiting and supporting early career researchers (ECRs)** - *Bailey, Parker* and *Williams* have been recruited since RAE 2008 and have subsequently benefited from UWE's £1.5m investment over the period in a competitive ECR scheme awarding grants of up to £20,000: *Parker* – 'Hydromorphological response to woody debris in rivers', £13k, 2010; *Bailey* – 'Public views on low carbon futures through art/digital media', £18k, 2013; and *Williams* – 'Children, flood risk and behaviour change', £20k, 2013.
- **Supporting staff to develop their research skills and outputs** - All staff are supported through thematic reading/writing groups (e.g. Mobilities reading group/summer workshops, *Maddrell*), 'work in progress' research seminars (e.g. DGEM Water seminar series co-sponsored with CIWEM/RGS, *McEwen, Staddon*), joint research between more/less experienced staff, adoption of writing buddies, departmentally organised grant bidding workshops and academic writing retreats (led by *McEwen, Quinn*). Formal Performance Development Reviews with line managers examine staff's research activity and expectations, alongside clearly identifying staff development needs. All academic staff are linked to a research group as required in the Faculty Research Strategy. New staff are research mentored, with additional support as appropriate via the University-wide Women Researchers Mentoring Scheme.
- **Targeting research investment funds (DGEM, Faculty, UWE)** – internal investment at different levels supports staff development and pump-priming of novel research collaborations (e.g. HEAT@UWE - *McEwen, Quinn*), research publication with impact, PGR scholarships and enhancement of peer esteem (e.g. competitive targeted 6-month sabbaticals - *Appleby, Maddrell*). In addition, financial support for conference participation (baseline £650 per FTE annually) is supported through staff development funds.
- **Encouraging and supporting staff secondment and external placement** – this enhances collaboration and research-policy linkages. Key examples are: *Chatterton* - ESRC/RCUK Energy Programme Social Science Policy Placement Fellowship in DECC (2010/11) with subsequent ESRC funding to extend KE activity with 3 further government departments, NGOs and businesses; *Staddon* - Distinguished Lectureship, West Texas A & M Uni. (2008), Research Fellow, Global Research Institute, Uni. of North Carolina (2012-14) and Research Professorship, Uni. of Arizona (2012-15); and *Casado-Diaz* - Secondment to Institute for Tourism Research, Alicante Uni., Spanish Ministry for Science and Education Mobility Programme (2008).
- **Ensuring equality and supporting diversity** - the Unit aims to create research environments that respect staff/student diversity, enabling all to derive maximum benefit/enjoyment from their research involvement. We are proactive about ensuring people are treated fairly regardless of age, disability, race, nationality, ethnicity, gender, religion or sexual orientation. UWE is third highest ranked UK University in the Stonewall Workplace Equality Index Top 100; and an Athena SWAN Charter member committed to addressing gender inequalities in STEMM subjects.

RESEARCH STUDENTS

The Unit has had 10.1 doctoral research degrees awarded, funded by: RCUK (EPSRC-CASE, EPSRC/RCUK Energy Programme); EA and Great Western Research; overseas funded (Nigerian Space Research & Development Agency); institutional and self-funding. UWE's approach in the census period has been to improve: the fit of doctoral research to its research environment, the student experience and the quality and timeliness of outcomes. Internal bursaries continue to be available and the Unit is securing studentships as part of new major projects (e.g. IWSN, SWAN; AHRC CDA with RGS IBG, EPSRC) – creating strong exposure to training and opportunity for the students concerned. The Unit's research students are supported by local supervisory teams in partnership with the University's Graduate School, which adheres to UWE's Code of Practice for Postgraduate Research Study - closely aligned to the QAA Code of Practice. For research students, the Graduate School provides a range of tailored support, including access to

Environment template (REF5)

regional/national networks, training events, bursary support and careers advice. For supervisors, it provides training/development programmes, addressing many areas of the Vitae Researcher Development Framework. All new academic staff, without prior training, take a module in research student supervision in their Academic Development Programme. DGEM provides financial support for student training and conference/workshop attendance, while the Faculty makes awards available to students who successfully pursue high quality published outputs with their supervisors – incentivising/supporting the importance of dissemination skills development as part of the doctoral experience. The National Postgraduate Research Experience Survey (2013) showed overall student satisfaction with Research Degree Programmes in the Unit's Faculty is 91.9%, compared with 82% nationally.

d. INCOME, INFRASTRUCTURE AND FACILITIES

Income - Since 2008, research activity has sustained annual research income, with significant increases from 2010/11 onwards – allied to the Unit's developments reported earlier and with growth in RCUK, EU and Government funding. In RAE 2008 (7 year census period), total external income was £1.4m, compared with £2.3m in this period (6 years). Key externally funded grants secured over the period include:

- 'Review of the Thematic Strategy on Air Pollution' (EC; 2012-2013; *Longhurst, Hayes, Chatterton*; £74k to UWE; £202k project)
- 'Framework Contract on Services supporting the evaluation, implementation and further development of air quality policies with reopening of competition' (EC Framework Contract 2013 -2017; *Hayes, Chatterton, Longhurst* in consortium with partners Triple E Consulting, TNO, TML, DTU ME-SYS and DCE; €80,000 [£65k] to UWE, €4m project)
- 'Review and assessment of air quality' AQMRC, £545k (Defra and the devolved administrations 2007-2011; *Longhurst, Hayes, Chatterton*)
- 'Participatory Approaches to Sustainable Water in the 21st Century' (EC; 2011-2016; *Staddon*; €287k [£250k] to UWE; €2m total project)
- 'URBAN-NEXUS' (EC; 2011-2014; *Sinnett Co-I*; £106k to UWE, £853k project)
- 'The Lloyd's Register Educational Trust International Water Security Network' (Lloyd's Register Educational Trust; 2013-2018, *Staddon*; £1m to UWE, £2.6m project)
- 'Sustainable Flood Memory' (ESRC; 2012-2014; *McEwen*; £242k ESRC funding plus £39k KE funding plus EA partnership contribution)
- 'Organisational operational flood response' (EPSRC; *McEwen*; £146k to UWE; £1.3m project)
- ERDF/South West of England Regional Development Agency 'Environmental iNet - Networking for Innovation'. £1.9m total; £1m to UWE (£353k; *Longhurst*)
- 'Terra Incognita: women in expedition archives 1913-1980' (AHRC; 2010-2013; *Maddrell*; £57k)
- 'Landscape aesthetics, meaning and experience in Christian pilgrimage' (AHRC; 2010-2011; *Maddrell*; £20k to UWE; £53k project)

Infrastructure and facilities - The Unit operates within the 'Research with Impact' policy overseen by the Faculty Associate Dean (Research and KE). The Unit contributes to (i) the Faculty's Research and KE Committee which addresses matters of policy, practice and resources; and (ii) the Faculty Research Management Group which shares experience and addresses operational matters. The UWE Research/Finance teams and the Research, Business and Innovation (RBI) Unit provide tailored individual support for bid preparation/costing, bid approval, and in management of projects post-award. The Unit's research is supported by strategic University investment in high-quality physical research infrastructure, including refurbishment (2011) of existing physical geography laboratories to allow different wet/dry soil and water analyses, and maintenance of a fully-equipped environmental change laboratory with facilities for diverse analytical techniques for soil/sediment analysis and micropalaeontology (SRIF-funded). Researchers in water/air groups also use other Faculty laboratories outside of DGEM, all supported by dedicated technicians. The Faculty is currently investing in the redevelopment of its research computing provision, and in upgraded/expanded working space for water/flood research.

e. COLLABORATION OR CONTRIBUTION TO THE DISCIPLINE OR RESEARCH BASE

An effective interdisciplinary research base requires strong sustained partnerships, evidenced in many staff activities: strategic co-working with researchers from project conception to delivery (including other UWE research groups); knowledge exchange projects delivered in collaboration

Environment template (REF5)

with government partners; and research collaborations with industry.

(Inter)national academic collaboration during the period – These have included: (i) interdisciplinary research on behaviour change/adaptive learning in businesses regarding flood risk as result of engagement with agent based modelling (EPSRC *McEwen* with Harries (behavioural change; Kingston), Coates (agent-based modelling, PI Durham), McGuinness (business management, Sheffield) and Wright/Guan (hydrology/economics; Leeds)); (ii) development of concept of sustainable flood memory and its links to local knowledge (ESRC *McEwen* PI with Jones (cultural geography, Gloucestershire) and Garde-Hansen (media/memory, Warwick)); (iii) development of water management and security research through new international partnerships (*Staddon* with AQUASEC Center of Excellence (Uni. of Arizona) and African Water Node (Monash Uni. South Africa)); (iv) development of research into air quality management policy and practice (*Longhurst* with international partners including Indian Institute of Technology, Chennai/Delhi Academy of Sciences and Kwa Zulu Natal Uni. National Framework for South Africa); (v) interdisciplinary research on pilgrimage and landscape (AHRC-ESRC *Maddrell* PI with Bristol, Glasgow and London); and (vi) participation on three Swansea Uni. Norway Jotunheimen Expeditions to lead collaborative research on flood impacts on cold environment rivers (*McEwen*).

Leading research networks - The Unit leads seven (inter)national research networks to maximise its research advancement/impact and that of network participants (Section b. aim 4). Networks include: (i) ESRC Seminar Series 'Tourism, Inequality and Social Justice' (*Cole*; 2008); (ii) HEIF funded 'Water and Tourism Network' of academics, practitioners, industry, third sector organisations at water-tourism nexus (*Cole*; 2010); (iii) AHRC 'Living Flood Histories' network (LWEC; bringing arts/humanities into flood resilience discourses alongside environmental and social sciences, practising artists and FRM professionals; *McEwen*; funded 2010-2011); and (iv) the 'International Water Security Network' (*Staddon*; 2013-2018). Outputs include special journal editions - Journal of Culture and Religion 2013, 'Spaces of Renewal' (*Maddrell*); Journal of Arts and Communities 2012, 'Living Flood Histories' (*McEwen*).

(Inter)national non-academic collaboration during the period – Unit staff are proactive in the co-generation of knowledge with non-academic partners. Examples include: (i) assessment of air quality/carbon dioxide emissions in Niger Delta working with Nigerian National Space Research and Development Agency (*Longhurst*, PI, 2008-2011); (ii) Membership of the Scientific Advisory Committee of the International Union of Air Pollution Prevention Associations World Congress, Cape Town 2013 (*Hayes/Longhurst*); (iii) focus on carbon management at city scale through an EPSRC CASE Award with the Centre for Sustainable Energy and Bristol City Council (*Longhurst*); (iv) assessment of air quality management in Delhi working with Central Pollution Control Board, Delhi Traffic Police and Indian Institute of Technology in Delhi (*Chatterton*); (v) advice to Chief Minister and senior government staff in Indian state of Maharashtra on conducting a state-wide study akin to the UK National Ecosystem Assessment (*Everard*); and (vi) continued support and technical guidance to EU-wide VinylPlus programme, proactively implementing sustainable development initiatives across PVC industry and its major supply and value chain (*Everard*).

Leadership roles – These have included:

Journal editorial boards: Annals of Tourism Research (*Cole*, Editor); Gender, Place and Culture (*Maddrell*, Editor); Journal of Culture and Religion (*Maddrell*, Assistant Editor, 2011-12); RGS-IBG Book Series (*Maddrell*, Editorial Board); Transactions on Ecology and the Environment (*Longhurst*, Editorial Board); Investigaciones Turísticas (*Casado-Diaz*, Editorial Board); Journal of Hospitality, Leisure, Sport and Tourism Education (*Jordan*, Leisure Editor).

Contribution to professional associations/learned societies: RGS-IBG Research and Higher Education Committee (*Maddrell*; elected member); Gender and Feminist Geographies RG (*Maddrell*; chair 2009-2013); Institution of Environmental Sciences (*Longhurst*, Vice President 2006-present); UKPHA Management Board (*Chatterton*); IAPSC Chair (*Chatterton*); EPUK Air Quality Committee (*Chatterton*); ATLAS SIG Tourism Geographies (*Casado-Diaz*, Chair 2008-13).

Panel membership and peer review: Invited Panel Chair for Environment and Global Change Panel, Portuguese Foundation for Science and Technology 2012 (*Longhurst*, led 17 person international expert panel reviewing 341 research proposals valued at €6m); International expert invited to join South Africa's Academy of Science Consensus Panel to explore Durban's low carbon future (*Longhurst*, 2009-2011); Great Western Research Sustainability Panel (*Longhurst*, Chair; *McEwen*, Member – both 2008-2011).