

<b>Institution: Aberystwyth University</b>
<b>Unit of Assessment: 17: Geography, Environmental Studies and Archaeology</b>
<p><b>a. Overview</b></p> <p>Research in Geography, Environmental Studies and Archaeology at Aberystwyth University is organized through the Department of Geography and Earth Sciences (GES) (formerly the Institute of Geography and Earth Sciences, 1997-2013), which is submitted wholly to UoA 17. As one of the oldest and largest centres for research and teaching in its field in the UK, GES aims to undertake world-leading original and rigorous research that advances knowledge and sets new agendas in Geography and allied disciplines, and which has commercial, policy and societal relevance and impact. To support this aim, GES has adopted practices and structures that facilitate the vitality and sustainability of its research environment.</p> <p>Research in the department is primarily structured through seven research groups that reflect research activities focused on, though not limited to, the areas of cultural and historical geography; Earth observation and ecosystem dynamics; glaciology; political geography; Quaternary and recent environmental change, including geoarchaeology; river basin dynamics and hydrology; and society-environment interactions, including climate change impacts and responses. These groups are supplemented by a number of limited-life research clusters established to address new research agendas and concerns by promoting collaboration across the research groups and cognate departments in the university. The department has an inclusive research culture that offers equality of opportunity to all academic and research staff to develop strong research profiles, supported by financial, technical and administrative resources, training and monitoring procedures as detailed below. The research infrastructure has been strengthened by significant investment since 2008 in new and upgraded equipment, laboratory facilities and IT provision, and in research personnel.</p> <p>In the period since 2008, the research environment in GES has contributed to: (i) an increase in research-active staff numbers and the consolidation of new research areas; (ii) an increase in average research income per annum; (iii) the sustained growth of the postgraduate community; (iv) an expansion of international research collaborations; (v) an enhanced contribution to disciplinary leadership through journal editing and participation in professional associations; and (vi) the rising quality of our published outputs. These achievements have been facilitated through the mechanisms, policies and infrastructure outlined in this document.</p>
<p><b>b. Research strategy</b></p> <p>The strategic aims of the department of Geography and Earth Sciences in the assessment period have been to consolidate its existing areas of research excellence and to develop new areas of intellectual inquiry within the fields of Geography and allied subjects. These aims framed the GES Research Strategy for 2008-2013, developed through an inclusive process and adopted in January 2009, which set out targets and delivery mechanisms for five broad objectives:</p> <ol style="list-style-type: none"> <li>1) <b><i>To produce and publish high quality research, supported by an increased capture of external research funding</i></b> – supported by research mentoring and monitoring procedures, research development support, research leave policies and seedcorn funding, as detailed in Sections C and D below. Delivery of this objective is evidenced by the publication of eight research monographs and over 350 peer-reviewed articles in international journals during the assessment period, and by the capture of over £11.9m in new research grant awards, including £5.7m in RCUK awards.</li> <li>2) <b><i>To provide research leadership in Geography and allied subjects, nationally and internationally and contribute to the setting of new research agendas</i></b> – through journal editing, conference organization and participation, service for funding bodies and subject associations, and coordination of collaborative research projects, supported by targeted financial and administrative support, and by guest seminar series and hosting visiting scholars. Delivery of this objective is evidenced by the service of 13 staff members as journal editors or associate editors, 8 as officers in subject associations, and 10 on peer review panels or scientific advisory committees, by the organization of over 50 sessions at international conferences and presentation of over 350 conference papers, and hosting over 50 visiting researchers, as detailed in Section D below.</li> </ol>

- 3) **To develop the next generation of researchers** – by expanding the graduate school and supporting post-doctoral and early career researchers through training and professional development, mentoring, access to funding for conference participation and fieldwork, and accelerated research leave for ECRs. The delivery of this objective is evidenced by a 25% increase in research postgraduate student numbers, the publication of over 50 academic outputs by GES postgraduates and over 200 outputs by post-doctoral and early career researchers, and the success of GES postgraduates, post-doctoral staff and fixed-term ECRs in securing academic and research posts, as detailed in Section C.
- 4) **To build research capacity by investing in and maintaining world-class research facilities** – delivered through the investment of £830k of capital funding since 2008 in upgrading and enhancing facilities including the Luminescence laboratory, Earth Observation laboratory, ICP-MS instrument and field equipment collections, and connection to the High Performance Computing Wales network, as detailed in Section D.
- 5) **To strengthen the commercial and policy impact of our research and to contribute to public understanding of science, social science and the humanities** – supported by developing collaborations with private and public sector partners, including collaborative PhD studentships, appointment of non-academic partners to honorary positions, and financial and administrative support for knowledge exchange and outreach activities, as detailed in Section D and in REF3a. Delivery of this objective is evidenced by the impact case studies nominated in REF3b.

The delivery of the research strategy has been monitored through data collected in the PURE database, regular monitoring meetings with staff, and an annual progress report on each of the specified objectives and supporting mechanisms. The information collated is reviewed by the GES Research and Strategic Planning Committee and used to set an annual Research Action Plan, as well as feeding into regular departmental monitoring meetings with the University Research Committee.

The research strategy has been implemented through an organizational structure of seven research groups, which provide a vehicle for supporting research development and collaboration, monitoring and mentoring, and promotion and dissemination, with their work supported by an annual funding allocation. All academic staff, post-doctoral researchers and research postgraduate students are assigned to a research group as core members, and may be associate members of other research groups. The research groups are focused on established and emerging areas of research specialty, and have pursued research agendas aimed at advancing knowledge, understanding, concepts and techniques in their field. Five of the research groups were operational at RAE2008 and have consolidated their established activities during the present assessment period. These are:

- *Centre for Glaciology (CfG)*, with research exploring the response of ice masses to climate change; ice dynamics, debris-entrapment, discharge and depositional processes; ice sheet-fracturing; and sub-glacial topography, supported by funding from NERC, the Royal Society and commercial partners.
- *Cultural and Historical Geography Research Group (CHG)*, with established research strengths in the geographies of mobility, landscape, the spaces and places of memory, and critical social and spatial theory, extended by new staff appointments to the more-than-human geographies of the sea and children's geographies, and supported by funding from the AHRC.
- *New Political Geographies Research Group (NPG)*, with research developing new perspectives on neoliberal governmentality, social movements, relations of power, citizenship and resistance, and the political economies of rural change, supported by funding from the ESRC, Leverhulme Trust, EU Framework Programme 7 and the Welsh Government.
- *Quaternary and Recent Environmental Change Group (QREC)*, with research focused on assembling records of climate and environmental change over the last few million years through field research and laboratory analysis, and on developing techniques to unlock the Quaternary environmental record through Luminescence dating and tephrochronology, supported by funding from NERC, the Australian Research Council, Deutsche

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Forschungsgemeinschaft, and commercial partners.

- *River Basin Dynamics and Hydrology Research Group (RBDH)*, with research examining river system and catchment responses to environmental change, river dynamics and evolution, heavy metal pollution, and relationships between hydrology and health, supported by funding from NERC, EPSRC, the National Science Foundation, the Australian Research Council, EU Framework Programme 7, Defra and commercial partners; and including the *Centre for Research in Environment and Health (CREH)* specialising in analysis of fluxes of indicator bacteria and pathogens in recreational, coastal and flood waters, funded by NERC, RELU, INTERREG, EU Framework Programme 7, government agencies and commercial partners.

In addition, two new research groups have been established since 2008 to support the development and consolidation of research strengths beyond the primary concerns of the five established research groups. These are:

- *Earth Observation and Ecosystem Dynamics Research Group (EOED)*: Established to consolidate and expand research in remote sensing and GIS previously housed within QREC, with a particular focus on technique development and application to the characterisation and mapping of terrestrial ecosystems and the monitoring of carbon dynamics and biodiversity, supported by funding and resources from EU Framework Programme 7, the European Space Agency, the Japanese Aerospace Exploration Agency (JAXA), and commercial partners. The development of the EOED group has been supported by new staff appointments, an expansion of research postgraduate numbers, and capital investment in the Earth Observation Laboratory.
- *Environment and Society Research Group (ESRG)*: Created to facilitate cross-disciplinary research combining science, social science and humanities perspectives on contemporary environmental issues, with key areas of inquiry including critical perspectives of environmental hazards and disaster management; human dimensions of climate change; interactions between agriculture and soil systems; historical records of environmental change; and geoarchaeology, supported by funding from the AHRC, NERC, British Academy and Leverhulme Trust. The development of the ESRG has been supported by six new staff appointments.

To encourage research innovation and collaboration, the department has also introduced a model of more informal research clusters to bring together researchers from across different research groups around cross-cutting and emerging research interests. Supported by one-off seedcorn funding, the clusters have facilitated the development of new research and new collaborations on themes including 'Knowledge, Technology and Aesthetics', 'Mars Surface Environments', 'Microbes and the Earth', and 'Rural Society, Environment and Policy'. Additionally, the HEFCW-funded Climate Change Consortium of Wales (C3W) – highlighted as pending in the 2008 submission and confirmed in 2009 – has invested capacity-building resources for climate change research, engaging researchers from all GES research groups in inter-disciplinary networks with colleagues at Bangor, Cardiff and Swansea universities. This has complemented earlier HEFCW investments in the Centre for Catchment and Coastal Research (CCCR) and the Wales Institute for Social and Economic Research, Data and Methods (WISERD) (co-funded by the ESRC), which have supported research development and capacity-building in fluvial science and social science respectively, as detailed further in Sections C and D.

The strategic priorities for research in the next REF assessment period are to continue to advance the boundaries of scientific understanding in our established areas of expertise – in cultural and historical geography, glaciology, political geography, Quaternary environmental change and river basin dynamics and hydrology – as well as consolidating and developing more recent areas of investment – including contemporary climate change, Earth observation, environmental microbiology, environmental history, political ecology and hazards research. Confirmed research grant awards will support research over the next 2-3 years in these areas, including on valuing the historical built environment (AHRC); sub-glacial ice mechanics and meltwater flow (NERC), and constraints on ice mass balance (Belgian Science Policy Office); globalization and rural change and development (ERC Advanced Grant, €2.27m), and neoliberalism (ESRC, £190k); reconstruction of the British ice sheet (NERC, £200k) and the 500,000 year environment record for

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Chew Bahir, Ethiopia (NERC, £434k); flood dynamics (Australian Research Council), improving bathing water quality (United Utilities, £200k) and the treatment of minewaters (Defra, £425k); geologic carbon capture (EU Marie Curie); retrieving soil moisture from Earth observation data (EU Marie Curie) and participatory environmental data sourcing and application (FP7, £377k); and environmental histories of extreme weather events (AHRC, £260k).

To support the delivery of these research priorities and to facilitate the impact of our research with both academic and non-academic audiences, nationally and internationally, the GES Research Strategy for the next REF assessment period will continue to emphasize ongoing investment in equipment, facilities and postgraduate studentships, and support for academic staff in securing external research funding and developing collaborative and inter-disciplinary research. Specific objectives of the strategy will include:

- Developing inter-disciplinary collaboration with biologists and environmental scientists through the establishment of an environmental microbiology research centre, consolidating the exploratory work of the Microbes and the Earth Research Cluster. This will include the creation of an Extreme Experimental Environments Laboratory during 2013-14, supported by £350k from HEFCW research capital investment funding.
- Strengthening inter-disciplinary collaboration with historians and political scientists in the recently-formed Institute of Geography, History and Politics through the creation of a new research centre for the study of Welsh society, history and politics, building on the capacity-building activities of WISERD.
- Continuing the work of the Climate Change Consortium of Wales (C3W) by translating C3W capacity-building activities into successful research grant proposals.
- Further increasing research grant capture, including by leading on the submission of large grant and consortium proposals to the UK research councils, European Research Council, Horizon 2020 and other funding bodies.
- Consolidating our international research profile and networks by establishing partnership agreements with targeted departments and introducing a formal visiting researcher programme.
- Further expanding the graduate school, maintaining ESRC Doctoral Training Centre status and obtaining recognition as part of a NERC Doctoral Training Partnership, and broadening studentship funding secured from international schemes.
- Enhancing the engagement of GES researchers in leadership and service in the subject community, by formally incorporating service as journal editors, society officers, etc., into a new workload model, and by hosting international conferences, including the Remote Sensing and Photogrammetry Society conference in 2014, and the UK-US-Canadian Quadrennial Rural Geography conference in 2015.
- Facilitating compliance with new Open Access publishing policies by providing self-archiving resources through the Cadair repository and discretionary funding for publication fees.

### **c. People, including:**

#### **i. Staffing strategy and staff development**

The staffing strategy of the department is to recruit, develop, retain and reward active and skilful researchers with a commitment to undertaking high quality, agenda-setting research and communicating findings to academic and non-academic audiences. Since 2008, GES has made 17 open-ended academic appointments, of which seven have been replacement posts. These have included strategic investments in posts linked to developing research areas or research capacity-building, including a Senior Lectureship in Climate Change (Thomas); Senior Lectureship in Human Geography (Rose); Senior Lectureship in Remote Sensing (Bunting); and lectureships in Environmental Earth Science (Mitchell), Environmental Hazards (Fearnley), Remote Sensing (Petropoulos), River Basin Dynamics and Hydrology (R Williams), Glaciology (Quincey, replaced by Irvine-Fynn), and Human Geography (Bear, replaced by Peters; Gagen; Grove). Three further lectureships have been appointed as part of a strategic investment in Welsh-medium education (Griffiths, C Jones, RD Jones). Research capacity has also been enhanced by HEFCW-funded investment in post-doctoral research fellowship or associate positions linked to C3W (4 PDRF

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posts), WISERD (2.5 PDRA posts) and CCCR (3 PDRA posts). As a commitment to capacity-building and career development, one WISERD PDRA post has been converted into an open-ended lectureship (Heley). The department is committed to equal opportunities and has contributed to the University's application for Athena Swan Bronze status. Through new appointments the proportion of academic staff who are women has been increased from 12% to 24% during the assessment period.

The department has particularly excelled at appointing outstanding early career researchers and supporting their career development. Twenty-four current staff obtained their first academic appointment in GES, and the current demographic profile of academic staff includes 24 staff aged under 40. Early- and mid-career researchers are encouraged to lead research projects and to take on leadership positions within the department, acquiring experience and expertise that will consolidate the sustainability of the research environment. Six academic staff members have completed leadership training courses. Staff development is supported by regular research planning and monitoring meetings; research mentoring; peer advising on research proposals and draft outputs; as well as a system of wider performance review; and staff are encouraged to participate in internal and external training courses (supported by a staff development fund). Applications for promotion are encouraged, and the University has introduced mentoring for candidates for senior lectureships, readerships and personal chairs. Since 2008, 14 current academic staff have received internal promotions, including eight to personal chairs (Grattan, B Hubbard, R Jones, Lamb, Lucas, Pearce, Whitehead, Woods), three to readerships (A Hubbard, Merriman, Tooth) and three to senior lectureships (Brewer, Davies, Roberts). Three staff returned in 2008 have been appointed to chairs at other institutions (Brasington, Dixon, M Jones).

The department operates a research leave scheme for all academic staff on a schedule of six-months leave every four years, subject to an appropriate research plan for the leave period, with early career researchers qualifying for their first period of leave after three years in post to support their career development. Reports on research leave outcomes are reviewed by the University Research Committee to ensure the opportunity is used effectively. The research leave policy also provides for short periods of leave for fieldwork or to complete writing projects, and for buy-outs funded by external grant income, with 4 GES staff securing external research fellowships in the assessment period, funded by the AHRC, the Marie-Curie Intra-European Fellowship, and the Alexander von Humboldt Foundation. External funding through C3W and CCCR has additionally facilitated a total of 195 months of research leave for academic staff, enabling the development of research grant applications, conduct of research, and writing of significant outputs.

All academic staff – including early career and fixed-term staff - have equal access to research support and professional development opportunities, including research planning and monitoring meetings, research surgeries, internal peer review processes, research leave scheme, professional development courses, apportionment of overheads from research grants, University conference fund, University research fund and annual departmental conference/research fund allocation. A departmental discretionary research fund additionally provides funding for conference participation, research development meetings, publication charges and activities to facilitate research impact. Early career researchers (including fixed-term staff) are also supported by mentoring and encouraged to apply for small research grants (including from the university research fund, which prioritises applications from early career staff) and fellowships, and to contribute to larger grant applications as co-applicants with established staff. Since 2008, early career academic staff on fixed-term contracts have submitted 18 grant applications and published over 70 outputs; and 10 have been appointed to permanent academic positions at Aberystwyth (Bunting, Fearnley, Quincey [moved to Leeds]), Bangor (Bird, Yorke), Birmingham (Pykett), Cardiff (Bear), Hull (FitzGerald), Manchester Metropolitan (Cook) and Newcastle (Henderson).

Currently, 38 academic staff are on open-ended contracts, and 11 on fixed-term contracts. The University has a policy of transferring fixed-term staff to open-ended contracts after 4 years of employment, and 9 academic and research staff in GES have been transferred from fixed-term to open-ended contracts since 2008. The department is committed to implementing the Concordat to Support the Career Development of Researchers, and post-doctoral research staff are assigned to research groups and with independent mentors, have access to internal and external professional development courses, and are encouraged to participate in research seminars and other

departmental activities, and to publish and present at conferences on their own research. In the period since 2008, post-doctoral research staff have published over 100 outputs during their appointments with GES; and twelve have been appointed to academic positions at Aberystwyth (4), Royal Holloway, University College Dublin, Bentley University (US), Murray State University (US), Trinity Western University (Canada), the Université de Lausanne (Switzerland), the Pyreanean Institute of Ecology (Spain) and the Universitat de Lleida (Spain).

Standards of research quality and integrity are articulated in the Aberystwyth University Policy on Safeguarding Good Research Practice and the GES Statement of Ethical Practice in Research and maintained through ethical approval procedures for research involving human subjects, internal peer review of research proposals, and research planning and monitoring meetings, with 'substantial assurance' of compliance with RCUK conditions on research integrity confirmed in February 2013. Good practice in research management is also reinforced through compulsory training for principal investigators and project initiation meetings for new grant awards. The University received awards for Human Resources Excellence in Research in 2010 and 2012.

Research development and management has been supported by the University Research Office, established in 2010. The office has organized various meetings and events, including a monthly Research Café and interdisciplinary workshops around funding opportunities, run a Researcher Development Programme, including a new researcher welcome day and a new researcher induction pack, and individual support for research grant preparation, and has invested in a £130k Current Research Information System (PURE). Research Development Officers for Science and Social Science have met monthly with the Head and Director of Research for Geography and Earth Sciences, to discuss funding opportunities, proposal development and the research support needs of the department. The University has introduced demand management for prestigious funding competitions with peer-mentoring for selected candidates, including Whitehead and Jones's successful bid to the ESRC Transformative Social Science competition. In July 2013, the Research Office merged with the University's Enterprise Office to create the Department of Research, Business and Innovation with a combined staff of over 50, which will provide integrated and proactive research enterprise development services into the next assessment period.

## ii. Research students

The expansion of the graduate school has been a key objective for the department during the assessment period, with a 25% increase in research postgraduate student numbers, and a 69% increase in students on research-led taught postgraduate programmes. The completion rate for PhD students with a submission deadline during the assessment period was 93%.

PhD studentships have been funded from a range of sources including 10 ESRC awards (8 quota + 2 DTC), 9 NERC awards, 1 AHRC award, 10 EU-funded Knowledge Economy Skills Studentships involving collaboration with industrial partners, 23 awards from the Aberystwyth University studentship competitions, and 7 awards from other external sources, including the Association of Commonwealth Universities. The department has additionally funded 11 studentships, including 2 co-funded with the British Geological Survey through the BUFI competition. Research students in GES each have two supervisors, and 31 current academic staff have supervised research students during the assessment period.

Geography and Earth Sciences at Aberystwyth is accredited in the Human Geography pathway for the ESRC Wales Doctoral Training Centre, receiving one DTC quota studentship in 2011, and competitively securing one further DTC studentship in 2012 and one in 2013 (starting October 2013). GES is also part of a consortium bid to the NERC Doctoral Partnership competition, currently in review. Research postgraduate students are required to complete a research training programme, including subject-specific training delivered within the department and generic training delivered through the University's Graduate School, and have access to further professional development activities within the vitae research development framework as well as to the monthly Research Cafés run by the University Research, Business and Innovation Department.

Research students are assigned to research groups and encouraged to participate fully in the department's research culture. In particular, postgraduate students are responsible for organizing the two research seminar series in human geography and physical geography – which have involved over 90 external speakers since 2008 – gaining invaluable experience and contacts; and GES postgraduates organized and hosted the 2010 RGS-IBG Postgraduate Conference, attended

by over 80 participants, with financial and clerical support from the department. Research students are encouraged to participate in national and international conferences, with support available from a Postgraduate Discretionary Research Fund in addition to RTS allocations; and to publish in appropriate journals, with all doctoral students now required to participate in a writing school run by the University. Since 2008, GES research students have published over 50 papers in academic journals, organized 13 conferences and conference sessions and have presented over 140 papers and posters at conferences (including AAG:13, AGU:5, EGU:8, RGS-IBG:19). Training opportunities available to postgraduate students have included workshops on applying for academic and non-academic jobs, and 53% of PhD students completing since 2008 have secured academic appointments, including lecturing or teaching posts at Aberystwyth, Gävle, Leeds, Leicester, Loughborough, Oxford and Xi'an Jiaoting-Liverpool University, and research positions at Aberystwyth, Bristol, Cardiff, Sheffield, TU Delft and the University of Southern California.

#### **d. Income, infrastructure and facilities**

##### *Research Income*

As reported in REF4b and REF4c, the department has received £8.9m in external research income during the assessment period, and has secured £11.9m in new competitive research grant awards, including RCUK awards from NERC (21 awards; £4.17m total value), AHRC (10 awards, £939k), EPSRC (3 awards, £393k) and ESRC (2 awards, £201k); and awards from EU Framework Programme 7 (7 awards, £1.31m), EU Structural Funds (3 awards, £2.87m), UK and Welsh government (16 awards, £839k), the Leverhulme Trust (2 awards, £136k), Royal Society (9 awards, £51k), British Academy (2 awards, £11k) and industry (3 awards, £609k). This represents an increase in research grant capture per annum of 98% on RAE 2008. External research funding has been obtained by 33 academic staff during the assessment period, with the median value of grant capture by permanent academic staff across the period increased by 461% on RAE 2008. External research income has been used to support research fieldwork in 35 countries, employ 34 research staff, facilitate data analysis including the use of specialist facilities, and release staff time for research work, leading to high quality publications and other outputs.

Strategies for generating grant income involve support at both departmental and University levels. At the start of the assessment period, all academic staff in the department were required to submit 3-year plans identifying proposed applications, which were discussed, reviewed and updated through subsequent research planning and monitoring meetings. Data on research grant applications and awards is regularly reviewed by the GES Research Committee. Assistance with identifying research opportunities and developing applications is provided by the University Research Office and through the research group structure, as well as through resources including an internal library of successful grant applications. Strategic bids for large research grants are facilitated through research groups and clusters, as well as by the University Research Office. A departmental Research Development Fund supports the travel costs of staff attending briefing meetings and workshops and working on collaborative bids with colleagues at other institutions.

Pilot research to develop larger grant applications is supported through the University Research Fund, with 13 small grant awards made to GES since 2008 (total value of £62k), as well as through the Climate Change Consortium of Wales (C3W), the Centre for Catchment and Coastal Research (CCCR) and the Wales Institute of Social and Economic Research, Data and Methods (WISERD) – funded as research capacity-building initiatives by the HEFCW Reconfiguration and Collaboration Fund. These initiatives have additionally provided training for research capacity-building, assistance with research grant development, and networking to support the formulation of collaborative research grant applications from Welsh universities.

##### *Research Infrastructure and Facilities*

Research in Geography and Earth Sciences is supported by world-class laboratory facilities and resources. Key facilities and resources include:

- the *Aberystwyth Luminescence Research Laboratory*, a NERC-recognised facility with instrumentation for Luminescence dating analysis;
- a *XRF Core Scanner* for high resolution elemental analysis of sediment cores;
- geochemistry laboratories including a laser ablation *ICP-MS instrument* for mass spectrometry;
- *palaeoecology laboratories*, with pollen preparation and microscopy facilities and an extensive

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pollen reference collection;

- the *Earth Observation Laboratory*, equipped with hardware and software for the analysis of remotely-sensed, LiDAR and SAR data, including a spectroradiometer instrument;
- an *Ice and Snow Climate Research Facility*, including a Cryoflux system;
- an extensive collection of *field equipment* for glaciological and hydrological research, including drilling and coring equipment;
- *social science research resources*, including subscription to the Qualtrics online survey tool.

Significant capital funding totalling £830k has been invested in upgrading and enhancing research infrastructure and facilities in the department since 2008, including: upgrading of the ICP-MS instrument (£150k); new glaciology field and analysis equipment (£280k); enhancement of the Luminescence laboratory, including purchase of a new Luminescence reader and new preparation and researcher office facilities (£205k); upgrading of the department's computing network, storage array and server, and refurbishment of Earth Observation Laboratory accommodation (£143k); and modernisation of fume cupboard facilities in the palaeoecology laboratory (£50k). Additionally, a Digital Map Library has been created as a combined research and teaching facility with departmental and University co-funding, providing access to an integrated georeferenced platform of data generated by GES research that has been assembled with funding from JISC.

Research in GES also benefits from wider local resources, including the University library, with an annual periodicals budget for Geography and Earth Sciences of £120k, and the adjacent National Library of Wales, a UK copyright library. Researchers in the department also have access to the infrastructure of High Performance Computing Wales, a distributed network of high performance computer clusters linked by a 1Gbit/sec broadband connection, which has been developed as a collaboration between Welsh universities, the Welsh Government and Fujitsu. High performance computing is being used in GES to facilitate work in Earth observation and in fluvial and cryospheric modelling.

All GES academic and research staff, research students and laboratories are accommodated in the Llandinam Building on the University's main campus. Spacious academic offices are organized by research group to encourage interaction and collaboration, as are open-plan researcher offices. All research students have dedicated desk and computing facilities, and final year PhD students are located in individual offices or small research group offices. Technical support is provided by a team of five laboratory, electronics and workshop technicians and a cartographer.

#### e. Collaboration or contribution to the discipline or research base

##### *Research Collaboration*

The department is committed to collaborative and interdisciplinary research, locally, nationally and internationally. Within Aberystwyth University, GES staff collaborate with researchers in Art; Biological, Environmental and Rural Sciences (IBERS); Computer Science; Education; History; Information Studies; Physics; Politics; Psychology; and Theatre, Film and Television Studies, through collaborative research projects, co-authored publications and joint PhD supervision. Interdisciplinary collaboration has been facilitated by the engagement of cognate researchers in GES research clusters (e.g. biologists in the Microbes and the Earth cluster; physicists in the Mars Surface Environments cluster), and participation of GES staff and research students in groups initiated by other disciplines (e.g. African Studies Group; Citizenship Studies Group; Environmental Politics Research Group).

Collaboration with other universities in Wales has been enhanced by involvement in three major initiatives supported by the HEFCW Reconfiguration and Collaboration Fund. The *Centre for Catchment and Coastal Research* (CCCR; £1.34m to GES) was established as part of the Aberystwyth-Bangor Research and Enterprise Partnership, and links river scientists in the department with ocean scientists at Bangor. Through enhanced capacity, CCCR at Aberystwyth and Bangor secured £22m in external research funding between 2006 and 2011. The *Climate Change Consortium of Wales* (C3W; £806k to GES) was proposed from the department and involves 21 GES academic staff in four inter-disciplinary research themes, working with natural and social scientists at Bangor, Cardiff and Swansea universities. Hambrey was the founding director of C3W. The *Wales Institute of Social and Economic Research, Data and Methods* (WISERD; £492k to GES) connects human geographers in GES with economists, geographers and

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sociologists at Bangor, Cardiff, Glamorgan and Swansea universities. Staff in the department have led the WISERD locality research programme (M. Jones, to 2013) and convened its Environment, Tourism and Leisure, and Language, Citizenship and Identity thematic groups (Woods; R. A. Jones).

Internationally, since 2008 GES staff have led two EU Framework Programme 7 consortia (DERREG: Woods (€1.5m total; £129k to GES); VIROCLIME: Kay (€2.42m total; £475k to GES)), and participated in three further FP7 consortia (BIOSOS; COBWEB; UMBRELLA). Researchers from GES have also led the multi-national Greenland Analogue Programme (A. Hubbard); co-directed an AHRC-NSF collaborative programme with colleagues in the USA (Dixon to 2012); coordinated work streams in the Japanese Aerospace Exploration Agency's Kyoto and Carbon initiative (Lucas) and the Group on Earth Observation (GEO) Biodiversity Observation Network (Lucas); and contributed to collaborative projects funded by the Australian Research Council (Duller; Lucas; Macklin; Woods), Belgian Science Policy Office (B Hubbard), Canadian Social Science and Humanities Research Council (Whitehead), Deutsche Forschungsgemeinschaft (Lamb), EU COST-Action on Climate Change and Migration (Grove), International Continental Scientific Drilling Program (Lamb), NASA (Lucas), Smithsonian Institute (Tooth) and US National Science Foundation (Mitchell; Tooth). International collaboration is also promoted by the appointment of international partners as Honorary Professors (Aitken, SDSU; Keil, York; Levy, UCSD; Marston, Arizona; Paasi, Oulu; Pomeroy, Saskatchewan; Ruddick, Toronto). Since 2008, GES has hosted 52 visiting researchers from 21 countries – including visiting fellowships funded by the Leverhulme Trust, China Scholarship Council and the Japan Society for the Promotion of Science - and 11 GES staff have held visiting positions at universities and research institutes overseas, including the Belle van Zuylen Chair at Utrecht (Macklin), the William Evans Visiting Fellowship at the University of Otago (Hambrey), and Visiting Professorships at Goethe Universität Frankfurt (Hannah), the University of Arizona (Dixon, to 2012), the University of Ljubljana (Woods) and the University of Queensland (Woods).

Collaboration with industrial and public sector partners is important both for supporting research and facilitating knowledge exchange (described further in REF3a). Key partnerships include agreements with Environment Systems Ltd., for collaboration on remote sensing and GIS research; Natural Resources Wales (formerly the Countryside Council for Wales), involving data and equipment sharing for analysis of remotely-sensed data for biodiversity monitoring; Forest Research Wales, in the Dyfi Catchment and Forest Research Platform; and Reynolds International and Robertson Geologging, supporting glaciology research. Relations with industrial partners have also been consolidated through appointments as Honorary Professors (Brown, Evans, Lloyd, Reynolds, Tregay) and Honorary Departmental Fellows (Sharland), recognising contributions to research, teaching and departmental strategy.

Cooperation in postgraduate training has included the involvement of 11 public, commercial and third sector partners in co-supervision of PhD and MPhil research through the Knowledge Economy Skills Scholarships scheme and NERC Open CASE Studentships, and collaborative provision with Cardiff and Swansea universities through the ESRC Doctoral Training Centre for Wales. This has built on an established annual Postgraduate Symposium and expanded to include a residential 'Theory School' and arrangements for co-supervision of PhD students. Additionally, five academic staff in GES have been external supervisors for PhD students at other institutions during the assessment period.

***Contribution to the Discipline***

Contribution to the wider research base in Geography through active participation in subject conferences, organizations and periodicals is a key objective of the GES Research Strategy. Staff in the department are encouraged to participate in major international conferences - with travel support available from the AU Conference Fund, the GES Research Support Fund, an annual departmental research allocation of £250 per staff member, and staff discretionary funds accrued from the apportionment of research grant overheads – and to contribute to conference organization. Since 2008, the department has hosted and provided support for five conferences, including the British Branch of the International Glaciological Society (2010), Mineralogical Society (2011), UK Luminescence and ESR Conference (2012), AHRC Living Landscapes conference (2009, co-hosted with Theatre, TV and Film Studies) and the RGS-IBG Mid-term Postgraduate

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Conference (2010), and staff have contributed to the organizing committees for five further conferences. GES staff have also convened over 50 sessions at major conferences (including AAG:11, AGU:4, EGU:12, RGS-IBG: 15), and presented over 350 conference papers (including AAG:30, AGU:39, EGU:27, RGS-IBG:33), including 37 invited plenary or keynote addresses, as well as over 40 invited lectures or seminars to universities and institutions in the UK, Ireland, Sweden (Royal Swedish Academy of Science Vega Symposium), United States, Canada, China, Australia, New Zealand, Sudan and Japan.

Contributions have been made by staff in the department during the assessment period as editors, associate editors, review editors and editorial board members of scientific journals, including: Abrahams: Editorial Board, *Journal of Environmental Science and Health*; Dixon (to 2012): Editor, *Gender, Place and Culture*, Editorial Board, *Aether: a Journal of Media Geography*, *Dialogues in Human Geography*; Duller: Editor, *Ancient TL*, Associate Editor, *Radiation Measurements*, Editorial Board, *Archaeometry*, *Journal of Quaternary Science*; Gagen: Editorial Board, *Childrens' Geographies*; Glasser: Scientific Editor, *Journal of Glaciology*, Editor, *Quaternary Science Reviews*; Grattan: Editor, *Journal of Archaeological Science*; Griffiths: Editorial Board, *Gwerddon*; Grove: Editorial Board, *Geography Compass* (Political Geography section); Hambrey: Editor, *GeoReach*; Hannah: Editor, *Social Geography*, Editorial Board, *Annals of the Association of American Geographers*; A Hubbard: Associate Editor, *Reviews of Geophysics*; B Hubbard: Scientific Editor, *Journal of Glaciology*, Editor, *Journal of Geophysical Research – Earth Surface*; M Jones (to 2013): Editor, *Territory, Politics, Governance*; R.A. Jones: Reviews Editor, *Space and Polity*, Editorial Board, *Political Geography*, *Gwerddon*; Kay: Editorial Board, *Water Quality Exposure and Health*; Lucas: Associate Editor, *Canadian Journal of Remote Sensing*; Macklin: Editorial Board, *Geomorphology*; Merriman: Associate Editor, *Transfers: Interdisciplinary Journal of Mobility Studies*, Reviews Editor, *Cultural Geographies*, Editorial Board, *Mobilities*, *Rodopi*; Whitehead: Managing Editor, *Environmental Values*, Reviews Editor, *Area*, Editorial Board, *Social and Cultural Geography*; Woods: Editor, *Journal of Rural Studies*, Editorial Board, *Dialogues in Human Geography*, *European Countryside*, *Studia Obszarow Wiejskich*. The department additionally provides editorial office facilities for the Regional Studies Association journals, *Regional Studies* and *Territory, Politics, Governance*.

Staff in GES during the assessment period have also served as officers or committee members of subject associations, and as members of scientific advisory boards for research councils and other bodies, including: *Bear* (to 2012): Committee member, Social and Cultural Geography Research Group; *Davies*: Secretary, International Society for Diatom Research; Member, NERC Isotope Geosciences Steering Group; *Glasser*: Member, NERC Cosmogenic Isotope Analysis Facility Steering Committee; *Hambrey*: Member, Geological Society Awards Committee; *A. Hubbard*: Secretary, International Glaciological Society – British Branch; *B. Hubbard*: UK Correspondent, International Glaciological Society; UK Correspondent, International Association of Cryospheric Sciences; *M. Jones* (to 2013): Chair, Publications Management Board, Regional Studies Association; *R D Jones*: Membership Secretary, Social and Cultural Geography Research Group; *Lamb*: UK correspondent, Geological Society of America; *Pearce*: Committee member, Mineralogical Society; *Tooth*: Committee member, British Society for Geomorphology; Member, NERC Services Review Group; *Whitehead*: Vice-chair, Political Geography Research Group; *Woods*: Member, Council of British Geography; Member, HEFCW Research, Innovation and Engagement Committee; *Wynne-Jones*: Secretary, Participatory Geography Research Group.

Contributions to the discipline have additionally be made as members of peer review panels or colleges for a number of research funding bodies, including the AHRC (R.A. Jones, Merriman), NERC (Glasser, Hambrey, A. Hubbard, B. Hubbard, Tooth), Australian Research Council (Woods), Greek Scholarship Council Postgraduate Review Panel (Petropoulos), Research Council of Norway (Macklin), Portuguese Foundation for Science and Technology (Macklin), Scientific Committee on Antarctic Research (Hambrey) and the Scottish Government Environment and Rural Affairs Department Major Research Programme Commissioning Panel (Woods).

Research leadership in the discipline has been recognized by awards and prizes received by GES researchers since 2008, including the Polar Medal second clasp (Hambrey), Geological Society Bigsby Medal (Duller), Belle van Zuylen Chair (Macklin), AAG Julian Minghi Outstanding Research Award (Hannah), and AAG John Fraser Hart Award (Woods).