

University of Westminster : 17 - Earth Systems and Environmental Sciences

RAE 2008 : RA5a - Research environment and esteem

Context

The University of Westminster is submitting to this unit of assessment for the first time following the strategic decision to consolidate existing research expertise by establishing an interdisciplinary cluster in September 2007, under the leadership of Professor Petts (previously Director of the Centre for Environmental Research at Birmingham University). The cluster of senior staff focuses on ecological change and risk mitigation by advancing studies at the interface of biological and physical sciences, and its translation into policy and regulation. This fits well with the Westminster mission '*educating for professional life*' and extends one of the University's strategic themes, *Sustainable Development*. It will interface, through collaborative networks, with three other clusters, namely, Sustainable Urban Development (UoA 31), Policy Studies (UoA 32) and, Governance and Sustainability (UoA 39).

The School of Biosciences provides an active and lively research environment largely focussed around medically related research themes but with long expertise and experience in biotechnological and environmental research. Since RAE2001 355 peer reviewed papers have been published from the School (Westminster Research, <http://westminsterresearch.wmin.ac.uk/view/subjects/UOW2.html>) and £2.27 million of income has been generated from national and international sources. The School has 50 PhD students and PDRAs engaged in research. 23 members of staff have been reported to other UoAs (8, 12, 44).

Westminster Water Science for Sustainable Development

Developing science and policy in water resource management

The protection and management of water resources and water-dependent ecosystems is of major concern given the pressures of climate change, population growth, urbanisation and expanding commercial and industrial activity.

The aims for this research cluster are to advance novel research into

1. water science to protect and manage water resources
2. knowledge transfer for environmental policy-making

This new cluster will consolidate our research in water science and have permeable boundaries enabling us to respond to interdisciplinary funding opportunities by capitalising on links with related UoAs. It will provide a significant scientific contribution to the University's innovative collaborative network for research and knowledge transfer on *Sustainable Development* that facilitates the exchange of information and debate between scientists, policy-makers and business leaders.

Research Activity (2001-2007)

The cluster includes five staff with considerable practical environmental experience whose interests have encompassed the translation of their practical results into more general policy and regulation, and advice for industry. Over the RAE period (2001-2007) they have published 4 books, 75 scientific journal papers, 17 chapters in edited works and 2 official reports; and been associated with research grants of over £1.7M^[1]. The following descriptions illustrate achievements and standing of the individuals concerned.

Professor Ian **Foster** was recently appointed to lead research development within the cluster. Foster has an international reputation for research on water quality, especially nutrient and sediment problems, and palaeolimnology. Foster's current research focuses on environmental degradation in Europe, Africa and the Middle East. He is known for contributions to three themes: (a) sediment and sediment-associated contaminant sources and pathways in fluvial and atmospheric systems (**Foster 1,2**); (b) sediment – water interactions in the coastal zone (**Foster 3**); and (c) reconstructing environmental change: impacts of climate, land use and land management changes in the late Holocene (**Foster 1,4**). These themes have been underpinned by research into the application of gamma-emitting radionuclides, environmental magnetism and sediment geochemistry to date, and fingerprint, sediment delivered to fluvial and limnic systems and to use this science base to inform local managers and policy

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makers. Since receiving a senior research scholarship from Rhodes University in 2005, Foster has developed and tested these methodologies in South Africa (**Foster, 4**) with NERC and British Academy funding and links have been established with other South African universities, managers and policy makers to encourage the incorporation of a strong science base into policy-making for river management.

Professor Jane **Lewis** (Dean of School) specializes in the ecology and taxonomy of marine dinoflagellates: (a) to unravel palaeoenvironmental change and (b) to detect harmful algal species using novel molecular techniques. Under the first theme, and with NERC funding, she has made a substantial contribution to establishing cyst-theca relationships in the *Gonyaulacales* (**Lewis, 1,2,3**) and has demonstrated for the first time the utility of using living dinoflagellates to model environmental influences that can be tracked in the fossil record in collaboration with Dr I. Harding (Geologist, Southampton University)(**Lewis, 2**). Uniquely, dinoflagellate species relevant to the geological record have been grown and encysted under varying experimental conditions. Under the second theme, work has been progressed, largely with EU funding, in collaboration with a multidisciplinary team from across Europe. This has led to the building of a prototype portable algal detection device (www.algadec.net/index2.html) that will be further developed and tested. Lewis continues an active interest in the ecology of harmful algal blooms (editor *Journal of Harmful Algae*) and bacterial dinoflagellate interactions (**Lewis 4**) and through EU funding is investigating a novel harmful algal mitigation strategy (www.icm.csic.es/bio/seed/). Molecular techniques have become increasingly important in microalgal systematics. Lewis was co-organiser of a 2006 conference analysing progress in this field and co-edited the resulting book, *Unravelling the Algae*. Lewis has been influential in the design of monitoring programmes for harmful algae in the UK by providing professional courses and literature (NRA Marine Algae report, 1996) for CEFAS, EA and fish farmers. A recent development has been utilising cyst content in sediments to assess the risk of transfer of harmful algal problems to new areas.

Dr Sharron **McEldowney** focuses on the interaction between science and environmental policy-making and regulation. Interlinked research themes include the role of science in the application of the precautionary principle, managing scientific uncertainty and risk assessment in policy-making and environmental standard setting. Under the first two themes McEldowney was invited to present the key-note address at an Anglo-Japanese Academy conference (**McEldowney, 1**) and at *Les colloques de L'Institut Servier, La prévention et la protection dans la société du risque: le principe de précaution* (2001). Her expertise in environmental standard setting and environmental regulation led to co-authoring *Environmental Law and Regulation* Blackstone Press/OUP (2001) (**McEldowney, 2**) and research related to all three themes has been developed further in the co-authored (50%) *Contemporary Issues in Environmental Law* (Edward Elgar 2008). Both books include a critical analysis of environmental standards in aquatic systems. McEldowney has undertaken a detailed analysis of environmental regulation of chemicals within the EU (**McEldowney, 3**) and is currently expanding this research to include diffuse and point source discharges to aquatic systems. Further, McEldowney has advanced understanding of the influence of science education on the communication of scientific information, risk and uncertainty to the public and policy makers (**McEldowney, 4**). She has recently been invited to become joint Editor-in-Chief of a new monograph series entitled *Comparative Environmental Law* (Beck Publishing, Germany). McEldowney is an Editor-in-Chief for *Law, Science and Policy*, AB Academic Publishers. and a member of the Gee Environmental Editorial Board, Sweet & Maxwell. She has also made substantive contributions to the UK Planning and Environmental Law Reform Working Group.

Professor Geoff **Petts** has pioneered research at the interface of ecology, hydrology and geomorphology; was founding Editor (1986), and remains Editor-in-Chief, of the leading international journal in the field, and in 2007 Petts' contributions to research on river conservation, especially on river regulation below dams, was recognised in the award of the Busk Medal by the Royal Geographical Society. Petts' research has achieved major advances in two areas. First, the geomorphological dynamics of rivers, especially those impacted by dams and flow regulation, and the role of riparian vegetation. He was co-leader of a joint programme between Birmingham and ETH-Zurich that undertook novel research to understand the role of riparian vegetation and dead wood on mechanisms supporting the evolution and maintenance of river islands, secondary channels, habitat diversity and biodiversity along river corridors. Among the 10 publications co-authored by Petts arising from this research programme during this RAE period, (including **Petts 1**), one in the semi-popular 'Frontiers in Ecology and Environment' (2005, 377-382) synthesised new advances in knowledge for a wider audience. Another (**Petts 2**) provided an original synthesis of his 25 years of research on regulated rivers emphasizing interactions between riparian tree development and river channel instability.

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Secondly, Petts has advanced a scientific approach to assess the flow needs of riverine ecosystems in the face of water abstractions. Petts' earlier work (e.g. *Regulated Rivers* 1996, 12, 353-366; NRA Report on Determination of Minimum Flows, 1996) had a major influence on the Environment Agency's Catchment Abstraction Management Strategy (2002). Petts was invited to serve on the IUCN Scientific Committee on Water Research, preparing a knowledge-transfer report on environmental flows (**Petts 3**), and to lead a think-tank for the US Army Corps of Engineers to identify research gaps to advance scientifically-sound tools for integrating environmental flows into water-resources management (**Petts 4**). Both papers highlighted the role of flow variability over a range of time-scales and the linkages between flow variability, habitat variability and biological population responses. The former provided the first articulation of the fundamental principles for conserving riverine ecosystems impacted by water resource developments; the latter identified knowledge gaps that need to be filled to translate this scientific understanding into practice using new models.

Since joining Westminster in 2000, Dr David **Thompson** has developed his research from post-doctoral work with Prof. W.J. Davies' group at Lancaster on ecophysiology of crop plants by focussing on the relationship between plant water relations and growth (**Thompson 3**). Thompson's distinctive research is on the role of the plant cell wall in plant growth and its regulation, particularly consideration of how cell wall mechanical properties arise from cell wall chemistry (**Thompson1, 4**). This has involved a critical evaluation of current models and proposal of alternatives based on synthetic polymer rheology. These new theories have recently led to the discovery that changes in cell wall water content alter wall extensibility and therefore that reduced water availability can affect plant growth by a direct effect on wall behaviour (**Thompson 2**). This mechanism of growth inhibition is completely new and suggests that drought responses may include previously unforeseen changes in cell wall chemistry to control water content. Identification of such changes may be of use in better understanding drought resistance and maintaining crop yields in the face of reduced water availability.

Research Structure

The School's Research Committee oversees research strategy, research student support and degree administration and coordination of staff research objectives. It is chaired by the School Research Director who reports directly to the Dean. Staff are associated with one or more research clusters where research activities pertinent to their interests are discussed and collaborative actions agreed.

Research promotion and culture

Biosciences fosters a research culture through a regular forum involving staff, postdoctoral and postgraduate research assistants and students to inform and debate relevant research issues. Research groupings within the School are used to encourage all staff within the School to contribute to research activities. A weekly research seminar programme offers presentations from eminent external speakers. Staff development funds are used to help staff attend international scientific conferences and to host external conferences and workshops.

Staff support and development

Research active staff receive annual teaching relief concomitant with their research commitments set against measurable outputs (e.g. grant applications, journal papers). The School has also introduced a sabbatical policy allowing staff of five years standing to take a semester free from their regular duties against defined research targets.

Staff undertake annual appraisal where development needs are identified and staff are encouraged to attend conferences, supervisors and grant application workshops. The University's Masters in HE has a module (Supervising Research Students) available as CPD provision.

Support for new staff

Appointment of new academic staff is based on their research potential and affinity with one or more of our research areas congruent with our teaching needs. Start-up funding for newly appointed staff is provided against agreed research plans and progress is monitored against agreed targets. All new staff have mentors to guide them through their first two years when teaching loads are deliberately light. New staff are encouraged to join supervisory teams for PhD students and are recruited to be assessors for the PhD programme to prepare them for supervising

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students of their own. The School's Research Scholarships programme provides fully funded PhD scholarships that are preferentially allocated to collaborative research programmes of new staff.

PhD programme

New PhD students have an induction programme during the first semester, including an introduction to all research areas within the School. Other training opportunities and a journal club facilitate interaction with staff from throughout the School and formation of lasting ties with their peers. PhD students are encouraged to undertake development activities associated with their studies and financial support is available for attending conferences, specialist workshops and other external training opportunities. Over this RAE period graduates supervised by staff in this UoA have gained related employment at home and overseas including in the UK – universities, EA (2), ADAS, Meteorological Office, British Waterways and private consultancies (5); and overseas - EPA (Kuwait); IFREMER (Brest), CNRS (Roscoff), University of Al-Albayt (Mafraq, Jordan), Badia Research and Development Programme (Al Safawi, Jordan) and the oil industry (Canada/UAE).

Research Infrastructure and facilities

The School of Biosciences has dedicated research laboratories that have benefited from recent building refurbishment and new equipment funded through University investment and SRIF (£4 million). This has provided new research facilities, particularly analytical instrumentation, fermentation and cell culture facilities and facilities for molecular biology and biomechanical testing of cells and tissues. Works have included the completion of a dedicated imaging suite, housing a three-laser, dual-microscope confocal system, fluorescent imaging facilities including a cell sorter and a Power PC analysis system. PhD students have been provided with new office facilities. For this UoA, £300k has been spent rebuilding and updating the laboratory supporting environmental research. This facility includes an algal culture suite with walk-in incubator; light and fluorescent microscopy; FPLC and custom built extensimeters for biomechanical characterisation of plant material.

Research Strategy

Members of the cluster will continue to pursue scientific excellence in their individual fields but progressively they will converge to focus on science for scientifically-sound policy development with a particular focus on water resource management. We intend to achieve this over the next six years through:

- Growth of staff including a Lecturer in bioremediation/biodegradation (2008); Research Fellow (March 2008), and PhD students (from autumn 2008) advancing our inter-disciplinary agenda. Resources have been secured for these posts from University funds.
- Applying for Research Council funding to support the development of collaborative research projects (from autumn 2008).
- Creating a web presence (by autumn 2008).
- Introducing a seminar series with the other members of the University's 'Sustainable Development' collaborative network (start autumn 2008).
- Running an international forum on Embedding Water Science in Policy and Practice (spring 2009) resulting in a special volume of *Law, Science & Policy* (autumn 2009).
- Establishing a network incorporating scientists, economists, business leaders and policy-makers (spring 2010 onwards).
- Proposing a meeting of the International Association for Sediment / Water Sciences that focuses on integrating science into catchment policy and management (paper to be tabled at IASWS 2008 to hold a meeting in South Africa in 2014).

Development of the Water Science Cluster will be guided by a steering group, involving knowledge users, under the Chairmanship of Professor Michael Depledge, former Chief Scientific Advisor of the Environment Agency and currently member of the Royal Commission on Environmental Pollution. The steering group will oversee research activities and advise on research strategy (to be established by March 2008). The core group will also maintain their own research strands (indicated below) but these will be directed so as to encompass key issues, including those related to the EU Water Framework Directive as well as other international frameworks and themes through our collaborative network on Sustainable Development.

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Foster

- To advance interdisciplinary research into land degradation in a European and Southern African context and to influence decisions made by managers and policy makers through funded research, publication and the organisation of a conference / workshop (e.g. grant applications pending to Leverhulme Trust, South African Water Research Commission (SAWRC); IAHS meeting 2008; proposal of IASWS meeting for 2014)
- Advance methodological developments in palaeoenvironmental reconstruction and sediment source tracing and demonstrate how these might be used in a policy-making context through publications in international peer reviewed journals (e.g. journal papers in preparation for SA Journal Science and Geology, by September 2008; Invitation to attend SAWRC workshop Stellenbosch 2008)

Lewis:

- To complete distribution work on *Alexandrium* in the UK (complete end 2008)
- To explore mitigation strategy for *Alexandrium* species using Belfast Lough as a model system (complete: end 2008)
- To contribute to the further development of automated algal detection system (EU funded; start date tbc; commercial product by 2012)
- To contribute to development of microarrays for algal detection (EU funded, start date tbc; working system by 2012)
- To extend encystment work for interpretation of fossil record to new species (further grant and papers by 2013)

McEldowney

- To publish a jointly authored book *Environmental Law* expanding on the overarching topic of science and environmental regulation (Pearson Education, 2009).
- To develop, as joint Editor-in-Chief, an international monograph series entitled *Comparative Environmental Law*, the first book in the series to be published in 2010 (Beck Publishing, Germany).
- Continued development of work on environmental standard setting specifically linked to water systems and chemicals (further papers by 2013).
- Advancing research on the impact of scientific uncertainty and the precautionary principle on environmental policy-making and regulation for the protection of aquatic systems (cross-disciplinary grant and papers by 2013).

Petts

- To advance the science of environmental flows and associated policies and practices through A) publication of empirical research on (i) long-term variability in channel siltation (2008) and (ii) uncertainty in environmental-flow setting (2009); and B) conference organisation (1st International Symposium on River Science, 2009).
- To advance the collaborative network on Sustainable Development within the University of Westminster and to promote the application of river science in developing new concepts for urban restoration along river, stream and canal corridors. Culminating in major international symposium as part of our 175th anniversary celebrations (2013)

Thompson

- To investigate whether plant cell wall water binding is altered in plants adapted to grow under conditions of low water availability (establishment of collaborative network and funding leading to publication 2009),
- To determine the contributions of individual wall components to maintaining water content (research leading to publication 2008),

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- To identify strategies for using this information in development of drought resistant crop varieties (contact with appropriate research or commercial partners for development from 2010).

Esteem Indicators

Foster: Received Hugh Kelly senior visiting scholarship from Rhodes University, July – November 2005; Visiting Professor, Rhodes University, January 2006-. Member of NERC Peer Review committee (Freshwater Sciences) 1999-2002; Executive Committee Member International Association for Sediment-Water Science 2005-; Member Executive Committee of the Field Studies Council 2001-2007. Ralph Brown Expedition Award Assessor, (Royal Geographical Society), 2000-. Joint organiser International Phosphorus Transfer Workshop, Slapton Ley, Devon (2001) (With Dr P. Haygarth & Prof. T. Burt). Research grant referee for NERC, EPSRC, Natural Sciences and Engineering Research Council of Canada, Belgian Fund for Scientific Research, Grant Agency Academy of Sciences of the Czech Republic.

Lewis: Editor, *J. Harmful Algae*; Invited speaker, 10th International Conference on Harmful Algal Blooms, Florida 2002 and 7th International Conference of Modern and Fossil Dinoflagellates, 2003, Japan; Chair, Publication Committee, ISSHA; Joint organiser of conference *Unravelling the Algae* (2006) and edited book of the same title (2007); Member, International organising committee for International Harmful Algal Bloom meetings (Florida, 2002; Cape Town, 2004; Copenhagen 2006; Hong Kong 2008); examined international PhD theses (Australia, Ireland). Research grant referee for NERC; Marine Institute (Ireland) and NOAA (USA).

McEldowney: Co-Editor in Chief (and founding editor) of *Law, Science and Policy. An International Journal*. AB Academic Publishers, UK; Co-Editor in Chief (invited) of *Comparative Environmental Law* (monograph series), Beck Publishing, Germany; Member of the Gee Environmental Board, Sweet & Maxwell; Invited key note speaker at the Anglo-Japanese Academy Conference 2001, and Les Colloques de L'Institut Servier 2001. Reviewer for *J. Chemical Technology and Biotechnology*, and *World Journal of Microbiology and Biotechnology*; Contributor to the UK Planning and Environmental Law Reform Working Group.

Petts: Busk Medal, Royal Geographical Society (2007); Editor-in-Chief *River Research and Applications*, Wiley (1985-); Member, ICSU Scientific Committee on Water Research (1996-2003); Chair, International Organising Committee for Symposia on Regulated Streams 2003 (Australia) and 2006 (Scotland); Member Scientific Advisory Board, The Nature Conservancy Centre for River Conservation/Great Rivers Project, USA (2005 -); Council Member Freshwater Biological Association (1999-2003); NERC Peer Review College (2003-7), RELU Project Review Board (2004-6), Centre for Ecology and Hydrology Programme Development Group (1996-), Chair LOCAR/Tern Board, Co-I of LOCAR Thematic Programme (2001-6); Co-editor, *Managing Water Resources in the British Isles in a Changing Environment*, AREA Special Issue 2006 (38, 7-78); Reviewer for ACIA (Arctic Climate Impact Assessment) 2003. Major invited keynote presentations included: Ecology and Civil Engineering Society, Tokyo, Japan, 2001; The Binghampton Symposium, PA, USA, 2002; Australian Limnology Society, Adelaide, 2004; The Institute of British Geographers, London, 2005.

Thompson: Referee for *J. Experimental Botany*, *Planta*, *New Phytologist* the *J. Plant Growth Regulation* and the *Australian Journal of Botany*; Peer reviewer for PMS committee BBSRC; Review Editor for *Law, Science and Policy*.

[1] Includes research income of Petts and Foster related to research at Birmingham and Coventry Universities respectively during this RAE period.