Institution: University of Plymouth

Unit of Assessment: UoA 6. Agriculture, Veterinary & Food Science

a. Overview

Work in this UoA involves fundamental and applied research that underpins innovation in terrestrial & aquatic food security, with a particular emphasis on the sustainability of animal/plant production and on improving health whilst ensuring the safety of the human food chain from new or incidental hazards associated with agricultural innovations. The UoA gives strong emphasis to environmental protection, the sustainability of the resources used in food production, and the integrity of ecosystem functions and services.

Since 2008, agriculture and food science research at Plymouth has been organised into Research Centres in accordance with the University's Research and Innovation Strategy (2009-2012 and 2012-2015), which identified national and international research priorities. The **Centre for Agricultural and Rural Sustainability (CARS)** and the **Ecotoxicology Research and Innovation Centre (ERIC)** have been established as core foci of research appropriate to this Unit of Assessment. Their multidisciplinary staff, drawn from a number of Schools, have been directly involved in both responding to priorities and initiatives and in establishing research priorities at international level. The University also established the **Institute of Sustainability Solutions Research (ISSR)** as a strategic focus for fostering key research activity with multi- and interdisciplinary capability and CARS and ERIC are key components of the ISSR. Key staff sit on the Board of ISSR and centre directors meet on a regular basis to ensure cross-talk.

The two Centres pursue research in fundamental and applied agricultural and food science and conduct research that investigates critical environmental, and food safety and security issues to highlight dangers or to reinforce confidence in agricultural and aquaculture innovations. Their principal concerns are plant sciences, ecosystems management, food and nutrition, aquaculture, rural development, aquatic ecotoxicology, environmental chemistry, environmental nano-science & nanotechnology, monitoring environmental change, wildlife health, terrestrial ecotoxicology and the sustainability of contaminated land. Within both Centres emphasis is placed on the multi-disciplinary nature of modern agriculture/aquaculture including policy and the social acceptance of new technological innovations. Researchers utilise a variety of scientific and social science enquiry approaches in their research including molecular studies (genomic, proteomic, immunomic), chemical analysis, electron microscopy, field-work and stakeholder engagement. The research conducted has impact and reach at both a fundamental scientific level and at policy level. The research centres are supported through shared resources in life sciences with the Translational Biomedicine Research Centre (UoA3) and in analytical chemistry with the BioGeoChemistry Research Group (UoA7).

b. Research strategy

Plymouth University has comprehensively reviewed and re-organised its research portfolio over the last five years and a significant outcome from this has been the mapping of research potential against national and international grand challenges, including **Food Security** and **Climate Change**. This strategic review led to the creation of a research structure in the university consisting of Research Institutes and Research Centres to provide the necessary strategic direction and academic focus. Under the leadership of senior academics, the Centres provide internal activities to support their research areas such as seminars, symposia, workshops and training courses and provide a focus for joint grant bid writing. These are supported by the University's DTC (Doctoral Training Centre) in Biosciences and the DTC in Earth and Environmental Sciences, which lead training development for all biology and environmentally focussed postgraduate research students. An associated overhaul of research infrastructure has led to investment in laboratory resources, especially in molecular biology and analytical chemistry.

The Centre for Agricultural and Rural Sustainability **(CARS)** and the Ecotoxicology Research and Innovation Centre **(ERIC)** are the means through which our overall research strategy aims to influence food production and its policy framework so that the human food chain and the environment that surrounds it are biologically and economically sustainable. The emphasis is on both fundamental and applied research that underpins new biological innovation affecting food production, whilst also ensuring the security of the human food chain and the protection of the

environment. Our research priorities are directed towards understanding the underlying processes regulating food production systems. We achieve our strategic aim by:

- aligning our research around leading researchers within CARS and ERIC;
- securing a sustainable resource and financial base for our research through funding from the University and a wide range of external sources;
- building on current strengths with strategic fit and developing new areas with potential impact;
- nurturing and expanding our post-graduate population and developing our early career researchers
- pursuing appropriate research partnerships and collaborations regionally, nationally and internationally;
- creating pathways that support knowledge and technology exchange with businesses leading to the commercialisation of our research outcomes for the good of our stakeholders:
- enhancing the understanding of science through stakeholder and public engagement.

Our strategic approach has increasingly led to the use of molecular and biochemical approaches to determine fundamental mechanisms that have facilitated our ability to demonstrate an international lead in key areas such as agricultural nanotechnology, fish nutrition and environmental analysis. This has been supported by our recent investments in new laboratory facilities that expand research capacity as we attract new personnel into the Research Centres. Similarly, we are forging collaborations, internally and externally, to bring new approaches to bear on our research – most notably mathematical and biometrical analyses. The strategy is constantly under review and the impact of our research is monitored and shared among Centre members (both staff and research students) through key publications, invitations to present at major scientific meetings and industrial collaborations. We also undertake horizon scanning for new technologies that may present benefits and risks to agriculture/aquaculture and the environments they utilize so as to assess our competence to deliver on such emergent themes, and then engage in our networks, where appropriate, in collaborative bidding for research grants. In this way we ensure that we continue to deliver focussed research that is relevant to our Research Centre themes.

The research themes in both CARS and ERIC are cognate and provide complementary research foci. Within **CARS**, research in ***plant sciences*** has developed as a strong theme around abiotic and biotic stresses to crop plants. Core activities include Fuller on weather and climate effects, Blackshaw and Benefer on the spatial ecology of root herbivores in agricultural landscapes, and Hanley and Singer on plant-herbivore interactions. This research involves multidisciplinary approaches such as the mathematical modelling of insect dispersal and integration into the BBSRC Farm Platform research programme at Rothamsted Research, North Wyke, with whom we co-supervise PhD students. Research in ***ecosystem management*** addresses the sustainability of anthropogenic landscapes. The programmes cover above ground systems, especially the work of Hanley, Knight, and Singer on the role of managed resources for pollinators and an emerging focus on soil biodiversity and nutrient cycling in the work of Matthews and Blackshaw in collaboration with Rothamsted Research. These areas are underpinned by the research of Franco into the spatial ecology of plants. Substantial investment in aquaculture resources has enabled the ***food & nutrition*** group of Davies, Merrifield, and Rana to become a leading centre for fish nutrition. The strong emphasis of this research on diet development and the use of probiotics informs an understanding of the implications for human health. This applied research is supported by the work of Jha and Moody on fish health, especially fish toxicology, and of Boden and Puschendorf on animal gut microbiology in relation to animal health and animal husbandry. Research in ***rural development*** by Lunt and Whitehead, with Wilson from Geography (UoA 17), focusses on providing the evidence base for UK Government policy and an understanding of production systems in the UK and developing countries.

For ERIC the research themes strongly support agricultural and food sciences through an analytical approach. The ***aquatic ecotoxicology and environmental chemistry*** theme provides fundamental information on the toxicity of chemicals used in agriculture and food sciences, and their detection, fate and behaviour in the environment. The focus here includes determining 'safe'

levels of agrochemicals for crop protection and for novel feed ingredients such as trace metals and probiotics in animal feed, and the implications for the human food chain. Also highly important is research on the effects on animal health (as in the work of Handy, Jha, and Shaw on sub-lethal physiological changes that might alter growth or organ pathologies) and the welfare effects of alternative methods of animal husbandry. The work of Turner, Comber, Hill, Braungardt, Fitzsimons, and Matthews in environmental chemistry, chemical speciation, and soil matrices) informs the work of Handy and Shaw on bioavailability and uptake from both water and dietary sources. Boden, Singer, and Hanley investigate the use of symbiotic pathogens as a plant defence mechanism, methane degradation by microbes and gut microbiology of insect larvae, and toxic host plant resistance. Handy and Jha work in ***environmental nanoscience & nanotechnology***, reflecting its current high interest and potential immense benefits to agriculture through new ways of delivering crop protection products, new feed ingredients, new veterinary medicines, and new ways of detecting chemicals in food and the environment through nanosensor technology, with implications for ensuring food quality and safety through forensics, traceability and shelf life labelling. Members of ERIC were founder members of UK and international working groups to establish policy on the regulation and release of nanoparticles that are essential if the government and the food industry is to avoid the socio-backlash associated with other major technology innovations such as those concerning GM foods, BSE, and food irradiation. We provide a one-stop-shop service on nanotechnology from chemical characterisation and environmental chemistry, to effects testing/bioaccumulation, and risk assessments for a variety of applications. The ***monitoring environmental change and wildlife health*** theme is extremely important from the perspective of ensuring good environmental quality (soil/sediment chemistry, water quality), but the work of Comber also recognises the issues arising from trying to maintain and improve agriculture in the face of massive environmental change, particularly climate change, leading to extreme weather events including saline soils and drought. A strong track record has been established in chemical detection and monitoring, the use of biomarkers, and a range of techniques to measure health at the organism level that spans 'microbes to man' through laboratory and field work including emergency responses to pollution incidents in agriculture. The final theme is emergent research on ***contaminated land and water courses*** and builds on the work of Hutchinson and Boden on organism ecotoxicology (invertebrates and plants) and that of Matthews on partitioning of chemicals and metals in complex environmental matrices such as sediments/soils and microbial bioremediation of soils. This includes the work of Boden, Braungardt, and Hill on the effects of storm surge events/sea level rises on soil metal mobilisation and downstream effect on microbes underpinning the nitrogen cycle in coastal agricultural soils, heavy metal and radio-metal transport and quantification methods in agricultural soils, and of Boden, Hill, and Fitzsimons on biorecovery of heavy metals from contaminated land for use in industry, sulphur biogeochemistry in agricultural soils and watercourses, organo-sulphur compound metabolism in roots of crucifers, ecotoxicology of f-block metals, selenium and tellurium mobility in soils and watercourses. This theme recognises that the anthropogenic pressures on land use and the quality of terrestrial ecosystems is multi-faceted, and that contaminated land is an inevitable feature of intensive agriculture in the UK that also has high human population density providing competing pressures for land and water use.

c. People, including:

i. Staffing strategy and staff development

Our **People** strategy is to maintain a structured mix of research leaders, early career researchers and researchers in training and to encourage team approaches and mentoring to develop researchers. The Academic Schools in which the staff contributing to this UoA sit, subscribe to the policy of only appointing research active academic staff according to the strategic ambitions of the Research Centres to which a new member of staff will be affiliated and to teaching needs within their School. Support for the research development of staff includes a system of workload allocation, designed to protect from an overly burdensome teaching and administrative load, and the scheduling of teaching to facilitate the release of blocks of time for research activities. A vibrant research culture is encouraged and developed through a balanced expertise profile that facilitates a breadth of research competence and enables effective postgraduate supervision. Over the current assessment period there has been a turnover of 30% of staff split as replacements (4 staff) and as investment in key research areas (5 staff). Furthermore, retiring staff have been retained in an Emeritus status for periods of time to enable the transfer of expertise and help with mentoring of new staff.

Irrespective of academic grade, the most appropriate teams are identified for different research applications and projects and support mechanisms are put in place that are appropriate for the staff involved. Early career researchers are supported through a peer mentoring process that aims to develop their capabilities. Wider staff career development is delivered by an annual Personal Development Review (PDR), which includes objective expectation setting of research performance indicators (research student supervision, publications and research income generation). We also maintain a policy of talent retention that allows our most promising research students and postdoctoral researchers to develop early career academic positions. This is a route followed by Merrifield, Shaw, Benefer and Ellis. Each is mentored by a Professor and provided with opportunities to co-supervise research students, to become co-PI's on research grants, and is given protection from overly heavy teaching and administration workloads through the workload allocation system. These processes have successfully led to good staff retention and career progression from postdoc to permanent academic positions to Associate Professor to full Professor.

Staff are supported to engage with research focussed sabbaticals and frequently spend periods of time in the field or in collaborators' laboratories in the UK or internationally. We recognise the particular importance of these collaborations in producing high impact research outputs.

There can be several routes to a research career and we facilitate these as an integral part of our wider networks. For example we encourage our technicians to become involved in research projects and in the publication of our research and facilitate their professional development through part-time registration for higher degrees. In response to enquiries from industrial partners associated with this UoA the University amended and adapted its policy towards PhD and MPhil qualifications by publications to include both staff at partner colleges, such as Duchy College and industry colleagues. Furthermore our ESF research capability project with Duchy College has engaged both staff and associate staff to engage with the Research Masters programme and the Research Legacy workshops that we run in Cornwall.

We endorse the University's commitment to the **Concordat to support the career development of researchers** and members of our Centres were instrumental in the University obtaining the European Commission's HR Excellence Award in September 2010 and sit on the HR Excellence Review and Implementation Working Group. We have adopted the Vitae Researcher Development Framework (RDF) for our research students and include elements of the RDF in our staff Personal Development Reviews (PDR). We endorse the University's emphasis on supporting staff and research students to work to deliver sustainable research solutions and encouraging interdisciplinary working that facilitates researchers developing synergies between research areas both within and beyond the University. We also support a targeted prioritisation of internal PhD studentships for early career academics.

Staff are required to attend the Supervisory Development and Mentoring programme to support good practice in research degree supervision and in Research Degree Examining briefing sessions and take part in peer mentoring groups. Good Practice in research student supervision and mentoring is shared with our research partners, particularly with Duchy College of Agriculture where we are leading a major ESF funded project in developing research capability in Cornwall. Also our industrial research sponsors are invited to be on supervisory teams on CASE funded studentships and a number who have sustained contact with us have been invited to submit for PhD's by publications through the University. In this way we have built a research network of full-time researchers and associates affiliated with our Research Centres. These networks increase our capabilities to work on a wide range of research topics and to tap into other networks in the public sector and in industry and provide us with dissemination platforms.

We fully support the University's **equality and diversity** policies and procedures in recruiting staff and research students and two of our Centre staff sit on the University's Equality and Diversity committee. Staff recruitment and promotion is strictly related to merit and we particularly value indicators of competent research capability such as early completion of PhD thesis, publication record in high impact journals, grants received and grant applications made. Equality

considerations are monitored at Centre level and our gender balance is maintained in line with the national levels for our subject by keeping this issue under review during recruitment. Attention to equality and diversity issues has resulted in an **Athena Swan award in STEMM subjects** at the University which supports our **European Commission HR Excellence Award**.

ii. Research Students

The supervision and training of postgraduate students is a core function for our Research Centres with 50 current research students in CARS and 40 in ERIC. All of these research students enter either the University's Doctoral Training Centre (**DTC) in Bioscience** or the **DTC in Earth and Environmental Sciences**. These DTCs provide foci for a rigorous and vibrant research training culture underpinned by the extensive research expertise of researchers within the research centres and offer rich and stimulating environments for training the next generation of innovative researchers. Students are supported in a cohort approach with a mentoring system of peer student support. DTCs are an integral part of the University's Graduate School, which provides a unified regulatory and procedural framework which includes the appointment of experienced supervisory teams and utilises a student focussed logbook for monitoring progress from initial registration through to timely completion.

In addition to **subject specific skills training** in the DTC our research students are supported to engage with the Graduate School's **Researcher Development Programme** mapped to the **VITAE RDF in the four key domains** of development of Knowledge and Intellectual Ability, Personal Effectiveness, Research Governance and Organisation, and Engagement, Influence and Impact. The sustainability of this programme was assured in 2011 through the efforts of members of our Research Centres in pursuing the RCUK recommended route of raising research student registration fees (by £200 pa) and the programme now guarantees the offer of over 130 workshops a year in order to help develop self-determination, self-management, assertive communication, team interaction, research conceptualisation, public communication and creative thinking in the next generation of researchers.

CARS and ERIC work in tandem with the DTCs to provide biannual student focussed Symposia where all research students have to present their work to their peers and the academic community of the research centres. This helps to develop presentation competencies prior to presenting research papers in national and international arenas.

Our international PGR recruitment (60% international) illustrates the reach of the research reputation of our staff. A good gender balance has been maintained among these despite a preponderance of male scholarship-holding applicants from developing countries such as the Middle East. Our international **student recruitment provides a good cultural diversity** and this is a particularly important counterbalance when we consider the research development process associated with our regional initiative in Cornwall where the ESF engagement rules are skewed towards developing locally based talent (100% home).

d. Income, infrastructure and facilities

The university has made considerable investment in infrastructure and facilities for directly supporting the Research Centres in this UoA. Large infrastructure investments include a new £2 million second generation 'omics facility and an adjacent behavioural and ecology suite to facilitate the use of modern molecular ecology tools. Significant investment has also been made in aquaria facilities (licenced to Home Office specifications) for both aquaculture nutrition and for ecotoxicology/hazard assessment. Our aquaria are supported by nutrition formulation and analytical laboratories and are among the largest at any university in England, with purpose built space for making animal diets and conducting food chain studies. Facilities for plant sciences include greenhouses and experimental field plots (supported by full time technicians) and a unique herbarium and dedicated aquatic plant facilities for higher plants and algae, both marine and freshwater. Additional facilities for plant physiology include a dedicated plant-tissue culture-suite, plant growth cabinets, and phytotrons. The laboratory suites are organised around techniques, with facilities open to all users. For example, there are dedicated ecotoxicology labs, a Zebrafish facility, as well as open access labs with PCRs, plate readers, spectrophotometers, homogenisers etc., for use by staff, students and visiting researchers. There is a dedicated histology suite (for all

organisms including wax, resin and histochemistry), plant and animal biochemistry, a genomics and proteomics suite and an electron microscope facility that has TEM, SEM, wet SEM and x-ray microanalysis. Our analytical chemistry suite is of an exceptionally high standard and is ISO9000-accredited and includes ICP-MS, ICP-AES, FAAS instruments, voltammetry, HPLC, radio-isotope facility and computing for speciation modelling and maintains extensive specimen reference archives from European and UK projects. Facilities are available for colloid chemistry, characterising soils, water and natural particles (NTA, DLS, FFF etc), and we are amongst only a handful of UK Universities with sufficient facilities to perform all our own in-house characterisation of nanomaterials. We also have access to industrial-standard clean rooms in our Nano Fabrication Facility, including the Wolfson Nanotechnology Laboratory, and a Materials Characterisation Centre. As well as providing an excellent research facility the ISO9000 accreditation facilitates an 'Analytical Bureau' provision for us to work with commercial clients. All of these laboratories are fully supported by dedicated trained specialist Technicians who work with researchers and postgraduate students and deliver on bespoke training courses such as the 'Genomic and Proteomic Workshop' and 'NanoImpactNet'. Researchers and PhD students are also supported by an extensive library with well-resourced online journal access to Web of Knowledge through Primo. Similarly researchers are supported by a dedicated Research Support and Development Unit, Research Advisory Gateway, and Graduate School located in the Research and Innovation Division.

There are several areas where we routinely share our research infrastructure. On terrestrial agriculture projects there has been a long-standing collaboration with Rothamsted Research, North Wyke which has capacity for larger field trials. In return, staff at North Wyke have access to our plant culture and analytical chemistry facilities. This is evidenced through the research degree supervision of North Wyke staff and co-supervision in shared studentships. We also share resources with Duchy College of Agriculture especially through our research capability building programme in Cornwall. In the area of fish farming and large scale fish nutrition trials, the sharing of infrastructure is mainly with commercial companies or national level fisheries/food safety institutes. For example, we work routinely with the Norwegian National Institute of Nutrition and Seafood Research (NIFES) in a mutually beneficial collaboration with our biochemistry and histology facilities, NIFES providing large scale commercial-farm facilities. We also work with global commercial companies such as Alltech (Aquaculture Division) and with the University of Porto, Portugal who have excellent facilities for studying warmer-water fishes. Locally, we collaborate with the National Lobster Hatchery in Cornwall with co-financed and co-supervised PhD students, allowing our researchers and students gain access to a unique commercial facility.

We attract visiting scientists who come to our Research Centres to learn a variety of research skills, including for example molecular biology, nanoscience and its application to fisheries, food or environmental safety. Visiting PhD students and post-doctoral workers have come from such places as the National Institute of Science and Technology USA (NIST), the centre for Cereal Research and ICARDA Syria, the US Agricultural Research Service (ARS-USDA), and the Australian Department for Primary Industry (DPI). In addition, there are ongoing institutional collaborative research capacity building programmes with Syria, Egypt and Iraq that includes postgraduate students and visiting sabbatical academics integrated into the research programmes of both CARS and ERIC.

We routinely host national and international research training events for postgraduate students, together with invited international experts in the field, most recently in January 2011 (the SETAC Europe winter training school on Environmental Nanoscience). Several of our laboratories also hold specialist equipment purchased from national funders (e.g. Nanosight LM10, NERC funded) which is made available for any NERC student to use according to the NERC shared equipment agreement. Our Research Council JREI funded Infrared Thermography System has been used in projects with a wide variety national and international partners (Newcastle University, University of Sheffield, Scottish Crop Research Institute, ARS-USDA, University of Southern Queensland, DPI Australia, University of Adelaide, University of Saskatchewan, University of California-Berkley, University of Damascus, University of Baghdad, Al-Baath University).

Income and Governance.
We are successful with funding for our research from a diversity of sources including BBSRC, NERC, DEFRA, EA, Rural England, International Governments and Agencies, EC Frameworks and Industry. The mix of funding is typical for a unit of our nature and ensures that our researchers are 'grounded' and focussed on the pathways to impact of their research. We will continue to respond to national calls for research especially through DEFRA, NERC and BBSRC and are also focussed on multi-partnered bids through the European Frameworks and in collaboration with our international partners.

We endorse and uphold the research governance policies of the university including the Research Ethics Code of Practice which is mapped to the RCUK Concordat to Support Research Integrity. Research Ethics issues and approvals are handled by a Faculty Research Ethics Committee and animal research is regulated under Home Office licence. As holders of the EC HR Research Excellence Award we are collectively responsible for the implementation of the principles which underpin the Concordat for Researchers and the European Charter and Code of Practice for Researchers.

e. Collaboration and contribution to the discipline or research base
Aspects of our research provide collaboration both internally and externally in specialist and interdisciplinary projects. In nano-science, the safety aspects developed for the study of health effects on animals and on animal feed issues also apply to human health and we work with colleagues in Dietetics and Human Nutrition on dietary aspects of nanomaterials in rodents and in human gut cells to evaluate effects into clinical situations including examining the uses and antibacterial properties of nanomaterials in dentistry. We are also working with physicists in the School of Computing & Mathematics to develop nano-sensors to make new instruments for measuring substances in complex media (blood, water, soil) that will have a wide range of applications across the sciences. Internationally, we have led several working groups on the safety of nanotechnology, especially on effects-testing and measurement techniques and this involves collaborating with risk assessors, engineers, physicists, biologists and chemists (e.g., the European NanoImpactNet 2007-2012). Regionally we continue to foster good collaborative research relationships with other research communities at Plymouth Marine Laboratory (NERC), Rothamsted Research (North Wyke and Harpenden BBSRC), Astra Zeneca Brixham and the Peninsula Partnership for the Rural Environment (PPRE).

All of the staff contributing to this UoA have made substantial contributions to the research environment as external reviewers for national and international grant awarding bodies: nine of our members either sit on the NERC peer review college or are specialist reviewers for NERC, five for the BBSRC, three for the EPSRC, two for DEFRA, two for the British Council, two for Leverhulme Trus, two for the Welcome Trust, two for the Technology Strategy Board and two for the Royal Society. In Europe, seven of our staff have contributed either to research policy development committees or have reviewed research grant applications for FP7 or Marie Curie initiatives and eight have been expert reviewers for national grant awarding bodies in France, Italy, Portugal, Norway and Russia. Overseas nine of our staff have been expert reviewers for national grant awarding bodies in the USA and Canada, three in Australia, one for Israel, and one for Chile. One of our staff was a reviewer for the Inter-Governmental Panel for Climate Change.

All of our staff are editors, associate editors or members of editorial boards of international Thompson Reuters indexed journals including: *European Journal of Agronomy*; *Agronomy; Journal of Applied Entomology*; *PloS One; Frontiers in Evolutionary and Population Genetics*; *European Journal of Soil Science*; *InterPore News*; *Frontiers in Microbial Physiology & Metabolism; Frontiers in Terrestrial Microbiology*; *Fisheries; Aquaculture Journal; Journal of Aquaculture Research and Development*; *Aquaculture Research*; *Journal of Aquaculture Feed Science and Nutrition*; *International Aquafeed; Aquaculture International; International Journal of Aquaculture; Aquaculture Nutrition*; *Aquaculture Research; Environmental Chemistry Letters; Journal of Fish Biology*; *Ecotoxicology; Journal of Analytical Atomic Spectrometry*; *Atomic Spectrometry Updates*; *Ecotoxicology*; *Mutation Research; The Science of the Total Environment; Mine Water and the Environment*; *Journal of Applied Phycology*; *Journal of Toxicology* and *Environmental Health Sciences*; *Chemical Speciation and Bioavailability*; *Oecologia* in addition to being reviewers for a

further 50 journals.

Many of our staff have also been active during this REF period on international and national committees or as trustees for organisations that enrich the research environment including:

National Committees

UK Nanotechnology task force (representing NERC and DEFRA); UK Advisory Committee on Pesticides; DARDNI Research and Education Advisory Panel; Biosciences Federation Animal Sciences Committee; Society of Biology Animal Sciences Committee; Management Committee of the Soil Ecology Society; National Centre for the Replacement, Refinement and Reduction of Animals in Research (NC3Rs); DEFRA Sustainable Arable LINK; The Soil Ecology Society; British Soil Water Physics Group; UK Peatlands Public Inquiry for the Scottish Parliament; Severn Tidal Feasibility Study Group, Department of Energy and Climate Change; UK & Ireland Women in Science Fellowships Committee; UK Council for Graduate Education (UKCGE) (one of our staff is currently Chair of UKCGE).

International Committees

European Environment Agency; European Science Foundation; OCED's working party on manufactured nanomaterials; EC COST; SETAC Global Advisory Group on Endocrine Disrupter Risk Assessment; EC Directorate General for Research and Innovation "Towards a European Framework for Research Careers"; Steering Group for the EUA-CDE (council for doctoral education); EU External Scientific Advisory Committee (ESAC); L'Oréal-UNESCO; Scientific Committee of the COMPADRE and COMADRE, Max Planck Institute, Rostock; Management Board of 'MARES' European Doctoral Programme.

Trusts and Societies

The Royal Entomological Society; The UK Controlled Environment Users Group; The Seale-Hayne Education Trust. The Royal Society of Chemistry: Fellow; Chair of the Regional Steering Group Committee; Member if the Instrumental Methods sub-committee and Analytical Division Council; Instrumental Criteria Committee and Instrumental Analytical Division; Analytical Methods Committee

Several have acted as industrial advisors: e.g. Consultant Aquaculture specialist for Alltech USA; Director of BioORE, a consortium of BGS and UK HEIs (Plymouth, Birmingham, Manchester). Staff have contributed to UKTI trade missions to the Middle East, SE Asia and S. America.

Staff in our UoA have also responded to national initiatives and have influenced the setting of research priorities. For example, we provide the sole UK academic advisor to DEFRA's strategic Aquaculture Planning Group for an aquaculture consortium to promote the development of an English aquaculture alliance of stake-holders and producers. This will be a strategic document that will set an agenda for an emerging aquaculture industry with important implications in government policy supporting commerce, sustainability and new opportunities for aquaculture in England. We also advised government through DEFRA on training priorities for environmental scientists to address the nanotechnology skills gap and has been involved in an FP7 EU initiative on Nanosafety. We also contributed an advisor to DEFRA's Sustainable Agriculture LINK programme and led a capacity building project for the Northern Ireland Government to increase research capability for tree health and plant biosecurity. We contributed to the evidence to support the Environment Agency's (EA) work on improving water quality, which was cited in the 2009 South West River Basin Management Plan as a "measure" to help deliver the EU Water Framework Directive. The EU SCAN committee have noted evidence gained from our research that shows that maximum thresholds for Selenium in feeds for trout and salmon should be revised to meet health and welfare considerations for these and other farmed fish species. In addition work on nanoparticles with the OECD has led to advice delivered to the Office of the President of the United States and in Canada. This has contributed to the National Nanoscience Initiative which has set nano-science research priorities in the USA. In Canada, this includes an external advisor role on a large NSERC funded consortium which addresses all sectors of agriculture and food.