

<p><b>Institution: University of Bedfordshire (UoB)</b></p>
<p><b>Unit of Assessment: 7- Earth Systems &amp; Environmental Sciences</b></p>
<p><b>a. Context</b></p> <p>The Institute of Biomedical and Environmental Science and Technology (iBEST) provides a focus and mechanism for delivering world-class research and impact in life sciences at the University of Bedfordshire (UoB). All academic members of staff of the Department of Life Sciences (DLS) are affiliated to the Institute along with staff from other areas of the University with complementary research expertise and interests (19 FTE currently).</p> <p>The institute was previously known as Luton Institute of Research in the Applied Natural Sciences (LIRANS; RAE2008 submission to UoA17). The name of the institute was changed to iBEST during the academic year 2011-12 and the thematic research areas were restructured in line with the research expertise and interests of the affiliated academics. iBEST is an interdisciplinary institute with two major research areas - Biomedical science and Environmental science. Academics affiliated to the institute have expertise in specialisms such as molecular genetics, genomics, proteomics, biotechnology and bioinformatics that span both of the major research areas. This underpins our strategy of delivering excellence with impact. Research outputs and impact contributions of our academics within the biomedical science area are being submitted to UoA3 (professions allied to health) along with academics from other institutes within UoB (e.g. Institute of Health Research).</p> <p>Within environmental sciences, the context is impact-oriented interdisciplinary research leading to the development of new knowledge and applicable technologies. The aim is to inform and develop management, policy and practice for improved environmental monitoring and sustainability in the face of global change. This includes improving the understanding of the resilience of biological systems in response to global warming and climate change to aid better environmental protection and quality of life through novel application of biotechnologies such as biosensors.</p> <p>This has been achieved by pro- and re-actively engaging with a range of research, policy and practice organisations including academia, industry, government agencies and non-governmental bodies.</p>
<p><b>b. Approach to impact</b></p> <p>The Institute has followed a multi-pronged strategy to translate research into use and to create impact including the research carried out within UoA7. The approach has been to use the following facilities, expertise, resources and processes supported by and within the University as well as by engaging with external stakeholders and organisations at local, regional, national and international levels. The aim is to develop new knowledge and technologies and then to translate the research into use through knowledge and/or technology transfer.</p> <p>The UoB's Knowledge Hub acts as a gateway for the University to reach out to organisations and for them to access expertise within the University; over 400 experts and leading researchers work with businesses to facilitate knowledge transfer. Types of support include undertaking the design, testing or evaluation of a product or system, acting as an expert witness and the provision of bespoke training or management development programmes. Research and Enterprise Office led by the Pro-Vice Chancellor Professor Carsten Maple spearheads the drive to work with local, regional, national and international communities and businesses, building new links and actively seeking new potential partnerships.</p> <p>Faculty level Business Development Manager (BDM) provides opportunities to actively promote our research ideas and innovations to potential beneficiaries outside academia and acts as a portal for industry to access the expertise. The BDM's function is to translate our specialised knowledge and technologies to a wider audience, in a manner that is relevant and accessible to end-users. The appointment in early 2013 of a Director of Innovation with University-wide co-ordination responsibilities further enlivens the interactions with the wider commercial and societal interests.</p> <p>Engaging with Industry, Community-based organisations, Public bodies, Key Users, Beneficiaries and Audiences enables us to develop, deliver and sustain demand-driven and impact-oriented</p>

**Impact template (REF3a)**

research by proactively developing partnerships with a wide range of stakeholders internationally. This includes academic collaborators through to governmental, non-governmental and community-based organisations and the industry, nationally and internationally. Examples include TASTE - Toledo Association for Sustainable Tourism and Empowerment, and TIDE - Toledo Institute for Development and Environment, Belize; National Environmental Protection Agency, Jamaica; Environmental Agency, UK. Our successful approach to creating impact by capacity building and knowledge transfer work with and to the Department of Fisheries and the local community-based organisations in Belize is reflected by the comments of the Director of Fisheries, Belize “this was an important undertaking which has resulted in increased GDP from our fishing industry” and an NGO participant “for the first time we were able to engage with someone from the Fisheries Department to make a significant change to reef preservation”.

Another example of generating industry-facing impact is our staff working for, with and in industry to design and manufacture prototype sensor systems; work with sponsors to test prototypes under ‘real’ conditions; and, where necessary, work with third parties to transfer technology and facilitate scale-up from laboratory to manufacturing prototype production (further details in Section **d**). Our organisational structure and experience of manufacturability, commercial and end-user issues related to developing ‘real’ sensor systems were attractive to industrial and other sponsors looking to undertake commercially sensitive development work outside the scope or capacity of their in-house staff.

These approaches have led to the promotion of impact-oriented interdisciplinary research and knowledge/technology transfer across fundamental to applied environmental science related to global change and sustainability. This has been achieved through externally funded (e.g. Earthwatch Institute and the Oak foundation, USA in the coral reefs area; Johnson and Johnson, and Unilever/Unipath in the biosensors area) and the University-facilitated processes and initiatives targeting impact through public-private partnerships.

**c. Strategy and plans**

Demand-led translational research, knowledge and technology transfer, capacity and capability building, and trusted partnerships are the cornerstones of our strategy and plans for achieving research impact. Integrating environmental bioscience and biotechnologies with social sciences for the benefit of the end users is the overarching objective in achieving our goal. Our successful track record in developing and delivering impact-oriented interdisciplinary research at local to international levels provides us a credible platform to access organisations in a position to utilise our expertise globally. Our researchers with interdisciplinary expertise in environmental science are proactive in developing excellence-driven science as well as in translating research outputs into applicable technologies, policy and practice. In this context, the strategy is to continually engage with a wide range stakeholders including research, regulatory and industry-facing organisations fully utilising the various structures and support mechanisms within UoB as well as building on our track record (described above in Section **b**).

New appointments have been made to sustain and further develop our research-impact efforts. For example, Prof Sreenivasaprasad (joined in 2011) previously led a series of impact-driven projects on food security funded by the UK-Department for International Development contributing to improved crop protection and production measures in developing countries (c. £1.3 M; focused in sub-Saharan Africa and Asia). Sreenivasaprasad won a UoB-Research Investment Programme competitive grant ‘to understand environmental change adaptation in biological systems’; Dr Worsfold (joined in 2013) has gained UoB funds to develop molecular microcosms. These have led to our collaborative participation in external projects funded by RCUK and International agencies. For example, ‘Environmental ‘Omics’ led by Professor T. Meagher, St Andrews, Science and Technologies Facilities Council (STFC); ‘Pathogen Epidemiology and Genetics’, Portuguese Government Foundation of Science and Technology (Sreenivasaprasad, CoInvestigator). This has provided a platform for improving the resilience of biological systems to environmental change. Further, where members of the team have either retired or left the university recently, opportunities have been created to continue their contribution, for example, David Rawson, Emeritus Professor contributes to research on biosensors to improve water quality of the river Lea now led by Dr. Barry Hagggett; involving close engagement with the Environment Agency.

**Impact template (REF3a)**

An example of how we proactively engage with local and regional stakeholders and the industry using the University-supported mechanisms is the event organised by the Knowledge Hub on 'Biotechnology: Environment, Food and Health', held at UoB in 2011 which attracted wide participation including RCUK Programme Leaders (e.g. STFC) to Directors of Industry (e.g. Alemar; Vortex). Keynote speakers Crabbe and Sreenivasaprasad highlighted our research expertise in the application of biotechnology for impact in sustainable environmental futures. This has contributed to our participation in the STFC-funded 'Environmental 'Omics' project with links to the NERC-funded 'Environmental 'Omics Synthesis Centre' at Cardiff University.

Our recent/on-going interactions and engagement with local industry including at the SME level and the regulatory authorities is exemplified by our visit to a local site of environmental pollution concern to Luton Hoo and the Environmental Agency. The visit and interactions co-ordinated by our BDM Mr. Brady and Sreenivasaprasad included our researchers Rawson, Haggett and Ajmal as well as industry representatives Mr. Biffen (Elite Hotels) and Dr. Adams (LTH Electronics) to assess the pollution issues and monitoring methodologies with the aim of further developing and applying our expertise in biosensors for water quality monitoring.

In addition, we also use various media channels to promote our research and its benefits to end users as well as to raise public awareness of topical environmental and sustainability issues (e.g. Sustaining Coral Reefs, Radio Interviews/Public engagements, Crabbe; 'Invasive species and Ash die-back', Interview on BBC Three Counties Radio, Sreenivasaprasad).

Thus, public-private partnerships, pro- and re-active engagement with stakeholders representing academia, policy and practice organisations globally, and interdisciplinary innovation systems reflect our approach to achieve impact underpinned by research excellence.

**d. Relationship to case studies**

Developing and sustaining our demand-driven and impact-oriented research, and the external interactions and partnerships in generating the impact, as exemplified by the two case studies presented in 3b, are driven and supported by the enabling environment and the support structures provided by the University described above (e.g. Section b).

**Stabilising the resilience of coral reefs to global environmental change** – this case study exemplifies one of our main strategic approaches to achieving research impact, i.e. knowledge transfer, capacity building and informing policy and practice by engaging with a comprehensive range of stakeholders across the research-policy-practice continuum. This involved collaborations with various academic organisations internationally and close engagement and partnerships with governmental, non-governmental and community-based organisations in various countries. Economists estimate that coral reefs are worth many billions of dollars to national economies in the Caribbean alone; while coral ecosystems are the most under threat from climate change. Measures adopted as a result of our research helped to maximise the resilience of the coral reefs to increasing global warming and climate change by informing managers and policy-makers in developing countries (e.g. Belize and Jamaica). This has led to innovative approaches in sustainable management of the coral reefs and increased income from fishing in the Caribbean.

**Biosensor technologies for improved environmental monitoring** – this case study exemplifies another of our main strategic approaches to achieving research impact, i.e. technology transfer and up- and out-scaling by engaging with various industry-facing stakeholders through public-private partnerships. This involved collaborations (e.g. Professor Steve McGrath, Rothamsted Research), direct partnerships with the industry (e.g. Johnson & Johnson, Unilever/Unipath, and Yorkshire Water) and close engagement with government regulatory bodies (e.g. Environmental Agency, UK). Disposable sensor systems offer considerable scope for practical use in environmental protection and health and wellbeing with an estimated market value of US\$17billion by 2018. The concept of using immobilised biological whole cells and sensor systems for environmental protection and health and wellbeing was developed with sponsorship from a range of stakeholders and support from the Environment Agency over a 15 year period leading to considerable collaborative expertise and research-impact.