Sustainable development: the impacts of UK university research

Ben Williams analyses the sustainable development case studies that focus on environmental impact.

Sustainable development by its very definition is an approach that aims to balance competing needs within social, economic and environmental boundaries for both current and future generations. Without practising sustainable development on all fronts, we risk exacerbating climate change, which, through sea level rise, is threatening the existence of low-lying nations at present and is likely to be keenly felt closer to home over the coming years. If the loss of entire nations to the seas is not enough, climate change is expected to have a significant impact on global biodiversity, and unsustainable uses of finite resources could have significant political consequences globally.

Relevant impact case studies were found by first performing a search for "sustainable development" using the Higher Education Funding Council for England (HEFCE) online database[1]. The search was then refined by impact type: environmental, legal, health, cultural, societal and economic. This returned 164 that were considered relevant to sustainable development, of which 48 were considered to broadly address environmental impact. This review focuses on these 48 case studies.

The research undertaken beneath the umbrella of sustainable development is wide and varied; key topics include: resource management, the impact of climate change on society and policy-making, and biodiversity maintenance and its management. The research typically focuses on a number of areas:

- Informing policy development and adaptation at national and international levels;
- Informing companies at the forefront of natural resource acquisition such as mining, forestry and food production; and
- Those organisations that use these resources.

As shown, the impact from this area of research can be both wide-ranging and significant.

IMPACT ON POLICY

The impact on policy is wide and varied, and has not only contributed to policy change in the UK, but also in nations around the world, with a particular focus on developing nations. UK researchers have contributed to evidence-based policy-making within a variety of both governmental and non-governmental organisations (NGOs) including various local and national governments globally, the EC, the UN (UNESCO, UNFAO, and REDD among others), the OECD, the European Space Agency, NASA, the World Bank, Oxfam, Save the Children, and the WWF, to name a few.

Typically, the impact on policy is the result of evidence-gathering exercises and the development of methodological tools and models to help policy-makers interpret data, set targets, predict environmental change, and mitigate risk. The impact of the research in this field is often realised by way of close collaboration or working relationships with policy-makers, established through targeted funding mechanisms, dissemination through publication, and membership of relevant high-level forums and committees. The policy impact established by many of these case studies is demonstrable and powerful, showing how evidence-based policy-making can generate real-world change, from implementing flood risk management schemes to protect communities in the UK, to helping the international community set global carbon emissions targets, and encouraging organic farming in China.

BOX 1: DEVELOPING EVIDENCE-BASED POLICY[2]

Developing Evidence-Based Policies for Tropical Forest Management and Carbon Emission Reductions

Since 2008, researchers at Exeter University have been conducting research focused on quantifying the impacts of environmental change on fire risk and carbon dynamics in Amazonian forests. Their case study, submitted under the Geography and Environmental Studies Unit of Assessment which demonstrates several main impact streams arising from this work.

Their research into drought frequency and intensity and fire occurrence has directly informed the design and implementation of a 'zero fire' policy in the State of Acre in Brazil.

Furthermore, the research has also led to the development of new monitoring tools to assist policy-makers in understanding the interactions between climate, ecosystems, and human health in Amazonia. This team, research into carbon emissions has also influenced methodological development within the United National REDD (Reducing Emissions from Deforestation and Forest Degradation) programme in Colombia.

Finally, the case study highlights the attention this work has received from Brazilian and international media, which they argue has increased awareness of drought and fire issues in Amazonia amongst policy-makers and the general public. This includes interviews and features with several major newspapers and the BBC.

INFORMING CONSERVATION MEASURES

Several case studies demonstrate a direct impact on conservation measures. Areas of research have included engaging with remote community groups in several locations globally to help maintain a balance between conservation and social practices. Other research with impact includes the development of

satellite technology to enhance knowledge about wildfires, which can then be used to better inform the conservation of flora and fauna. Understanding of the palaeoenvironment was also used for developing forward-looking policies on land management and biodiversity conservation.

BOX 2: SCIENTIFIC ADVICE[3]

Scientific advisory services for climate adaptation and development planning

This case study gives examples of how research at Loughborough University since 1993 on regional climate modelling, risk assessment and adaption planning has delivered impact through services to national and international agencies, NGOs and commercial partners. These organisations are developing strategies to manage exposure of their portfolios to climate risks. By developing climate risk assessment frameworks and adaption planning approaches for long-lived water and energy infrastructure, this research has assisted these organisations in these tasks and delivered impact.

The research was primarily translated into beneficial services in the form of public domain software, practitioner training, and technical advice to policy makers. In this way, this research and associated engagements with partner organisation has helped to "build technical capacities in climate risk management and adaption options appraisal", particularly in vulnerable areas of Asia and the Middle East.

SUSTAINABLE ENERGY USE

Particular case studies focus on the impact of developing more efficient techniques for reducing energy consumption, such as reducing energy use in waste processing and improving the energy efficiency of buildings. Other case studies explain the impact of their research on helping governments, businesses and individuals to adopt practices for sustainable energy use as well as forging the way ahead with research into systems that will make sustainable energy production a shared reality in the future.

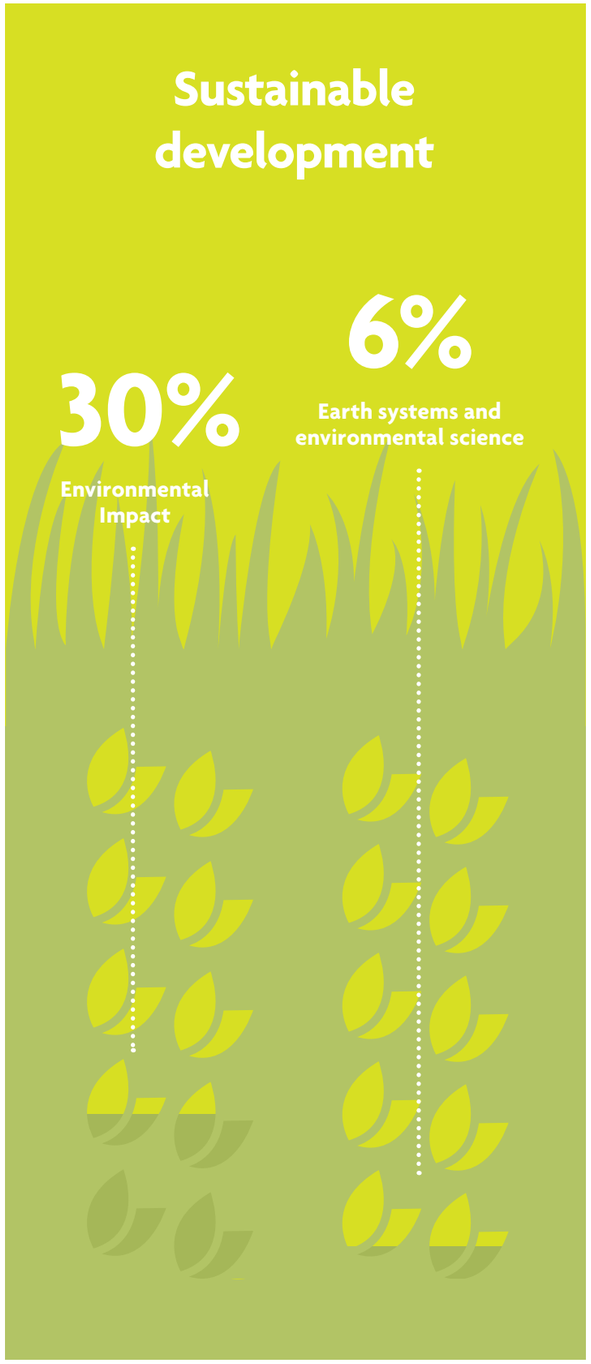
IMPROVING PUBLIC HEALTH

Some case studies demonstrate impact in the protection of human health. Examples include:

- Predicting the likelihood of droughts using satellite data in sub-Saharan African nations;
- The detection of harmful algal blooms and toxins in shellfish;
- Establishing frameworks for sustainable global food production; and
- Improved access to water for marginalised communities in Kenya.

INDUSTRIAL BEST PRACTICE

While impacts on government policy at a national and international level are likely to contribute to changes in industry, only a few case studies demonstrate direct influence on industry best practice. One case study describes a contribution to the improved competitiveness of the European aquaculture industry; another body of work led to changes to the regulatory system at European Commission level.



▲ **Figure 1. The percentages of case studies assigned the Summary Impact Type 'environmental', and which were submitted under the Earth systems and environmental science UoA. (Source: REF2014 impact case study database; search term: "sustainable development").**

WHAT CAN WE LEARN?

The United Nations Division for Sustainable Development has 17 goals[2], all of which aim to address the balance between social, economic and environmental boundaries. As a collection, the submissions to REF 2014 touch upon each one in some form, which by itself shows the strong international presence UK institutions have in this important area. This is also seen in the spread of submissions within this field across many of REF 2014's units of assessment (UoAs) (see **Table 1**). The submissions focusing on the environment accounted for approximately 34 per cent of all those provided under the sustainable development heading.

These environment-focused, sustainable development impact case studies demonstrate that the UK is at the forefront of research into how to minimise global contributions to climate change and develop systems for reducing its impact on the biosphere as a whole.

BOX 3: LESSONS FROM THE PAST[6]

Peru - Aridification and Landscape Modification: Lessons from the Past

Research from the University of Cambridge combining paleoenvironmental research with study of sedimentary and archaeological data in Ethiopia, New Mexico and Peru indicates a long-term climatic trend "from a damper and well-vegetated environment to the currently prevailing semi-arid, almost desert-like, conditions". This case study explores the impact of this work on education and conservation in the Ica Valley, on Peru's southern coast.

In this region, research is revealing how agriculture and climate change have acted to trigger major social upheaval in the past. The historical insights offered by this research are now informing education programmes and policy development in the present, in the hope of sustaining sympathetic land use for the future. One specific project, in collaboration with the Royal Botanic Gardens at Kew has highlighted the threats to livelihoods and biodiversity associated with felling vital tree species, and this is being translated into education policy. This research has also contributed to the implementation of Peruvian decrees regarding education and forest conservation, and has been an informing factor in the establishment of forest-management agreements with major landowners.

WHAT IMPACT IS NOT CAPTURED BY REF 2014?

When evaluating whether REF 2014 reflects the true impact of environmental research on sustainable development, one must consider that this is the first time research impact has been assessed at this level and therefore clear methods for measuring and gathering evidence of impact may not have yet been fully

Table 1. REF 2014's units of assessment covering sustainable development and the environment

REF unit of assessment	Number of case studies
A5 Biological Sciences	5
A6 Agricultural , Veterinary and Food Sciences	3
B7 Earth Systems and Environmental Sciences	6
B12 Aeronautical, Mechanical, Chemical and Manufacturing Engineering	1
B14 Civil and Construction Engineering	1
B15 General Engineering	1
C16 Architecture, Built Environment and Planning	2
C17 Geography, Environmental Studies and Archaeology	16
C19 Business and Management Studies	5
C21 Politics and International Studies	2
C23 Sociology	1
C24 Anthropology and Development Studies	1
C26 Sport and Exercise Sciences, Leisure and Tourism	1
D29 English Language and Literature	1
D 32 Philosophy	1
Unknown	1

▲ **Figure 2. Wildfire burning on savannah in Kenya, January 2013. One case study[5] explained how researchers have developed methods for estimating albedo and thus classifying a 'burned area' from Earth Observation data, which is being used for fire management by various government agencies. © Byelikova | Dreamstime**

developed by institutions and their researchers. The impact of our research in general could be improved by providing institutions with very clear guidelines on what constitutes impact at each standard of excellence.

Many researchers both within and outside this field have found impact difficult to quantify. The research can be original, robust and powerful, yet influencing meaningful policy change can be an uphill struggle. For example, an incumbent government may be receptive to new research and willing to enact policy changes, yet political differences mean an incoming government is not interested, resulting in the impact of the research being degraded or lost.

References to impact on policy decisions at the government level abound, both because it is easy to substantiate and because the measure of impact in other important areas (such as influencing business decisions, social interactions and behaviours) is not as well defined. These case studies therefore focus on high-level impact because researchers need to provide evidence in order to reach the higher star ratings, but in doing so we may be missing the more subtle influences that research has on society as a whole. Engendering behavioural change on a local and individual level is increasingly important when it comes to environmental issues, so evaluating the successful impact of new policies or regulations. Methods for defining and assessing these different kinds of impact will be the challenge for researchers and institutions to overcome in future rounds of assessment.

CONCLUSIONS

There are case studies presented here that provide a fantastic insight into the impact that UK researchers can have on a global scale. However, policy may take a while to percolate through regulatory systems and thus impact generated through policy, particularly in this field, may not necessarily have a significant effect immediately (although some within these submissions most certainly have). Impact at industry level, from the development of new products and technologies to the reduction in energy consumption could contribute to immediate impact but may not be felt as widely.

The challenge for researchers and institutions across the UK is to combine rigorous academic research with lasting, real-world impacts. The current crop of impact case studies in sustainable development demonstrate just this; that UK researchers have an influence globally, helping combat the causes and consequences of climate change, habitat loss and resource depletion. Essentially, what makes good research in this field is what always has – research that aims to make a positive difference to the world, its inhabitants, and future generations. ES

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Biodiversity conservation: the impacts of UK university research

Christian Devenish shows that the most common impacts of research are on biodiversity management, planning and policy.

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This article aims to review the impact of research carried out in UK higher education institutions on biodiversity conservation worldwide. I begin by describing areas where most impact has been documented, its geographical scope and beneficiaries. Then I look at how research topics map to impact areas and some characteristics of the research generating this impact. Finally, I suggest areas where impact is not sufficiently represented and put forward recommendations for improving impact in biodiversity conservation.

To characterise types of impact in the field of biodiversity conservation, I performed a search of case studies with the keywords, "biodiversity conservation" OR "nature conservation" OR "wildlife conservation". The search returned 86 case studies, produced by 56 institutions, with a third presenting more than one case study. I recognise that this is not a definitive group of case studies related to biodiversity conservation; different arrangements and choices of keywords may bring up more results, but also include a greater number of case studies further removed from this impact area. An automated topic analysis by Kings College London[1], allowing each case study to be tagged by up to three topic areas, found 147 case studies under the impact area of nature and conservation, although the group selected for this review is not wholly included in that number. To conduct this review I performed an ad hoc classification of the case studies in terms of major impact themes and research areas.