#SmallNationBigIdeas: How Welsh science is contributing to the Sustainable Development Goals

Case Studies to support the release of the Welsh Government report: “UN Sustainable Development Goals: Wales’ Research Performance with UK and Global Comparators”

September 2021
What is this document?

Wales may be a small country but we punch above our weight in the quality and the quantity of research carried out here. A new report highlights the particular strength of Welsh science in contributing to efforts to meet the United Nations Sustainable Development Goals. The report, “UN SDGs: Wales’ Research Performance with UK and Global Comparators”, shows that a remarkably high proportion of Welsh research is contributing to tackling the global issues highlighted in the SDGs, and that this research is of unusually high quality. Welsh research on the SDGs is cited and used by others more often than that of other nations of the UK, the USA and European countries. Among the SDGs Welsh research is making a particularly strong contribution to those which relate to the planet such as SDGs 13 (Climate Action), 14 (Life below Water) and 15 (Life on Land). The report was launched at an event hosted by First Minister, Mark Drakeford, and Chief Scientific Advisor, Peter Halligan, on 30th September 2021.

We (the Low Carbon Energy and Environment Research Network Wales) have brought together this collection of case studies to illustrate the depth and breadth of excellent research going on in Wales which is contributing the biggest global challenges society faces.

What are the Sustainable Development Goals (SDGs)?

The Sustainable Development Goals (SDGs) were agreed by all member states of the United Nations in 2015. They are an urgent call for action by all countries - developed and developing. They recognize that ending poverty must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests.

Who are we?

The Low Carbon Energy and Environment Research Network Wales is a pan-Wales research initiative supporting Wales’ world-leading research in low carbon energy, nature-based solutions to environmental challenges, the bioeconomy, and sustainable food production. We aim to enhance and build upon the excellent research capability in Wales, and to increase the competitive funding secured in Wales. This growth in innovation and research will allow Wales to export its expertise across the UK and internationally, whilst generating benefits at home.

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The Case Studies

This document brings together examples of research from across Wales which is contributing to the Sustainable Development Goals. The selection is far from complete but it gives a useful taste of the huge diversity of relevant work going on. All the work highlighted here involves multiple partners, often across many institutions in many countries, but for simplicity we just highlight the key people based in Welsh Universities.

The case studies we have selected focus on the SDGs where Welsh research is particularly strong in comparison with other nations of the UK. These are SDG 2, 6, 7, 12, 13, 14, and 15 (see figure below taken from the recent Welsh Government report). This highlights the particular strength of Wales in research in areas related to agriculture, low carbon energy and the environment.

![Figure 2-9](image)

Wales’ relative activity index (RAI) compared to the UK’s activity level for SDG-related research per SDG, 2010–2019; red dotted line indicates UK average activity level (=1.0).

The case studies are organized in approximate order of the main SDG to which they contribute; starting with work contributing to SDG 2 (zero hunger), SDG 3 (good health and well-being), SDG 6 (clean water and sanitation), SDG 7 (affordable and clean energy), SDG 12 (responsible consumption), SDG 13 (climate action), SDG 14 (life below water) and SDG 15 (life on land).
Case studies contributing primarily to SDG 2: Zero Hunger

Delivering low glycaemic index grain to reduce type-2 diabetes in Africa and India  
*Dr Rattan Yadav, Aberystwyth University (ctn1@aber.ac.uk)*

Type-2 diabetes is a massive problem in Africa and India (affecting 30 and 75 million people in each region respectively). For a low-income family in African/Indian regions with a diabetic adult, as much as 25% of family income may be devoted to diabetes care. Aberystwyth are delivering low glycaemic index varieties of pearl millet (a widely used crop), that can contribute to lowering family healthcare cost and improve incomes. SDGs: 1, 2 & 3.

Breeding better rice  
*Dr Katherine Steele, Bangor University (k.a.steele@bangor.ac.uk)*

Rice is the staple food of half the world, yet high yielding varieties are vulnerable to crop losses because of drought or disease. Breeding locally-adapted varieties for both yield and resilience is now possible, but many national programme breeders do not have access to advanced selection tools. Working with breeders in Pakistan, India and Nepal, this project has developed new genomic markers that increase breeding efficiency. SDGs: 2,12 (1, 15).


Fungi for organic farming and sustainable food production  
*Professor Tariq Butt, Swansea University (T.Butt@Swansea.ac.uk)*

There is worldwide need for new products to support more environmentally friendly farming practices. Natural plant growth stimulants and pest control products can help reduce inputs of chemical fertilizers and pesticides which pollute the environment and can damage human health. Swansea University is leading research developing products from fungi which help increase yields while protecting plants from invertebrate pests, contributing to food security. SDGs: 2, 3, 15.
Case studies contributing primarily to SDG 3: Good Health and Well-Being

Spatial intelligence for malaria control
*Dr Andy Hardy, Aberystwyth University (ajh13@aber.ac.uk)*

Malaria remains a global burden but can be controlled and even eliminated through integrated solutions. Using satellite and drone imaging technology Aberystwyth University are providing mapped data on the location of malarial mosquito breeding sites. Using this spatial intelligence has resulted in an improved operational malaria control programme in Zanzibar. SDG: 3. Project website: https://menter.aber.ac.uk/en/dges/research/earth-observation-laboratory/research/sis-zanzibar/

Wastewater surveillance helps tackle pandemic
*Professor Andy Weightman, Cardiff University & Professor Davey Jones, Bangor University (weightman@cardiff.ac.uk, d.jones@bangor.ac.uk).*

Wastewater surveillance is a key public health tool. Building upon strengths that in Wales in environmental sciences, disease surveillance and pathogen genomics, an interdisciplinary team of Welsh experts from Cardiff University, Bangor University, Public Health Wales and Dŵr Cymru Welsh Water is currently monitoring COVID-19 levels in wastewater across Wales. They are also sharing their expertise with local and international partners to develop and apply monitoring systems worldwide, ensuring that these efforts are applicable to different contexts. Sharing best practice is allowing a resilient approach to tackle this worldwide pandemic. SDGs: 3, 6. Project Website: https://wastewatersurveillance.com/international-knowledge-exchange-projects-to-monitor-levels-of-covid-19-in-wastewater-worldwide/

Data for development – working with countries to develop and use better indicators of poverty and hunger
*Dr Shailen Nandy, Cardiff University (NandyS1@cardiff.ac.uk).*

Understanding and assessing progress towards meeting the SDGs requires reliable data for a wide range of new indicators. Cardiff-based research entails collaborating with national statistical offices, policy makers and UN bodies, like UNICEF, to develop better measures of multidimensional poverty to reflect the needs of adults and children as required by SDG1. The work also informs SDG2 (Zero hunger), since they showed why conventional indicators of malnutrition miss large numbers of malnourished children in west and central Africa; this work has implications for the resourcing of programmes seeking to deal with the challenge of global hunger. SDGs: 1, 2, 3. [Image from https://www.cardiff.ac.uk/news/view/1586839-million-more-children-in-west-and-central-africa-suffering-from-malnutrition,-according-to-study]
Case studies contributing primarily to SDG 6: Clean Water and Sanitation

Assessing resilience of groundwater resources in sub-Saharan Africa under climate change
Dr Mark Cuthbert, Cardiff University (cuthbertm2@cardiff.ac.uk).
Groundwater plays a vital role in sustaining water supplies and livelihoods in sub-Saharan Africa but the impacts of climate change on this resource is poorly understood. Research in Cardiff has revealed that groundwater replenishment is very sensitive to the intensity of rainfall, meaning that climate change may increase groundwater availability in some areas even if the overall amount of rain decreases. This research helps show when and where groundwater could be used to irrigate crops and to provide drinking water, while ensuring that stores of groundwater will still be there for future generations. SDGs: 2, 6.

Healthy freshwaters for people and ecosystems
Prof Isabelle Durance, Prof Steve Ormerod, Prof Andrew Weightman
Cardiff University (durance@cardiff.ac.uk).
Healthy freshwaters provide a major source of clean drinking water and sustain all wildlife downstream, supporting key human activities including fisheries, agriculture and recreation. Despite this, freshwater ecosystems are amongst the most threatened in the world. Cardiff research found that transfers of energy by river ecosystems connect landscapes, river biodiversity and key services such as clean water or the provision of fish. These findings were key to a new, sustainable management programme of a UNESCO World Heritage Site in Africa. The research also prompted an overhaul of both the policy and practice of freshwater ecosystem management in Wales. SDGs: 6, 14 (3, 15). Project website: https://nerc-duress.org

Reducing the economic and environmental burden of the water sector
Dr Prysor Williams, Bangor University (prysor.williams@bangor.ac.uk)
The water sector is of critical importance to us all - needed by society, businesses, and the environment. However, the distribution and treatment (pre- and post-consumption) of water is very energy-intensive, and the sector is a major contributor the world's greenhouse gas emissions. Bangor University are working with the sector and with large users of water to find ways of reducing its energy usage and opportunities to generate clean sources of electricity and of heat. SDGs: 6, 7 (9, 11, 12).
Promoting accessible, resilient and sustainable water supplies  
*Dr Richard Gale and Dr Adrian Healy, Cardiff University* ([Healya2@cardiff.ac.uk](mailto:Healya2@cardiff.ac.uk)).  
A quarter of the world’s population lack access to safely-managed water supplies. As cities expand and climates change, pressures on urban water supplies are growing, with implications for towns and cities, particularly in parts of Africa. Working with local researchers and stakeholders in Somaliland, Cardiff research develops understanding of the cultural and social choices that guide decisions on water use, helping to promote new approaches to the sustainable management of water supplies. SDGs: 6, 11. [Image from https://www.cardiff.ac.uk/news/view/1519422-cardiff-university-develops-research-collaborations-with-somaliland](https://www.cardiff.ac.uk/news/view/1519422-cardiff-university-develops-research-collaborations-with-somaliland)

A new route to water disinfection  
*Regius Professor Graham J. Hutchings, Cardiff University* ([Hutch@cardiff.ac.uk](mailto:Hutch@cardiff.ac.uk)).  
Globally access to clean disinfected water is a major priority for many communities. At present chlorination is the major way in which disinfection of water is achieved but this can leave potentially toxic chemical residues in the treated water. Cardiff have developed a new catalytic approach to water disinfection which only requires the water to be treated and electricity that can be sustainably sourced that is markedly more effective than chlorination and provides water that is both residue-free and disinfected. **Image must be referenced on use:** Richards, T., Harrhy, J.H., Lewis, R.J., Howe, A.G., Suldecki, G.M., Folli, A., Morgan, D.J., Davies, T.E., Loveridge, E.J., Crole, D.A. and Edwards, J.K., 2021. A residue-free approach to water disinfection using catalytic in situ generation of reactive oxygen species. *Nature Catalysis*, 4(7), pp.575-585.

Restoring river continuity: better rivers for people and nature  
*Prof Carlos Garcia de Leaniz, Swansea University, ([c.garcialeaniz@swansea.ac.uk](mailto:c.garcialeaniz@swansea.ac.uk)).*  
Rivers rank among the most threatened ecosystems in the world, but also among the most valuable to society. One of the main threats rivers face is the fragmentation caused by a myriad of dams, weirs and other instream barriers, many of which from a bygone era and are no longer in use. Swansea-based research - published in the journal *Nature* – quantified for the first time the extent of river fragmentation across Europe, developed tools for restoring river connectivity, and informed the target of achieving 25,000 km of free-flowing rivers by 2030 included in the new European Biodiversity Strategy. SDGs: 6, 11, 12, 13, 14 & 15 (3,17). [Project website: www.amber.international](http://www.amber.international)

Rising riverine nutrient discharge into coastal areas risks a surge of greenhouse gas emissions from global mangroves  
*Dr Feng Mao, Cardiff University* ([MaoF1@cardiff.ac.uk](mailto:MaoF1@cardiff.ac.uk)).  
Mangroves are important in climate change mitigation because they remove carbon from the air, but they can also be a significant source of the greenhouse gas N₂O (nearly 300 times more potent than CO₂). Cardiff researchers have demonstrated a significant risk of increasing N₂O emissions from global mangroves by up to 74% by 2050 from 2000 due to the growth of riverine nutrient inputs. They are working with partners to deliver more holistic mangrove restoration strategies with improvements in catchment-scale nitrogen management. SDGs: 6, 13. [Image from: https://pixabay.com/photos/palawan-water-river-mangrove-jungle-172428/](https://pixabay.com/photos/palawan-water-river-mangrove-jungle-172428/).
Case studies contributing primarily to SDG 7: Affordable and Clean Energy

Breeding biomass crops to provide clean energy
Prof Iain Donnison, Aberystwyth University (Colin Nosworthy, ctn1@aber.ac.uk)
Biomass is used worldwide to generate renewable heat and electricity, but can also be used as a feedstock for green manufacturing and, when bioenergy is combined with carbon capture and storage (BECCS), used to achieve net zero targets. The UK is one of the largest importers of biomass in the world, and as demand in other countries increases it is becoming increasingly important to develop biomass crops that can be grown on land less suited to food production in the UK and globally. Miscanthus is one such crop, and work in Aberystwyth on domesticating it and breeding new varieties is increasing biomass availability and so contribute to SDGs on climate action and clean energy. SDGs: 7, 12, 13.
Website: https://www.aber.ac.uk/en/ibers/research-and-enterprise/research/climate-change-adaptation/crops-for-sustainable-energy/

Tidal-energy research supporting access to predictable renewable power
Professor Tim O'Doherty, Cardiff University, Dr Matt Lewis & Professor Simon Neill, Bangor University (Odoherty@cardiff.ac.uk).
Research carried out in Wales and Scotland (with partners from Mexico, The Philippines, Indonesia and Japan) is leading to the development of technology which can move local and coastal communities towards sustainable marine energy. Their research includes modelling, and field measurements. The resulting technology is providing stable electrical supply to stimulate socio-economic growth, and provide vital energy to power off-grid communities and industry such as desalination. SDGs: 7, 13 (6).

Living Well in the Zero-Carbon Home of the Future
Prof Nick Pidgeon, Psychology, (pidgeonn@cardiff.ac.uk)
Prof Karen Henwood, Social Sciences, (henwoodk@cardiff.ac.uk), Cardiff University
One of the most intractable problems facing the UK and the world is how to deliver warm, affordable and zero carbon homes for all. World-leading trials are underway in Wales of ‘active homes’ – smart buildings which aim to generate, store and supply their own power. Cardiff University are conducting research into the experiences of families living in active homes, finding enthusiasm for their environmental and well-being benefits while helping designers to match the technologies installed to residents’ life aspirations and understandings. SDGs 3, 7, 11, 13
Addressing impact of tidal renewable energy devices on seabirds
Emma Louise Cole and Prof. E. Shepard, Swansea University (Emmalouise.cole@swansea.ac.uk)
Tidal renewables hold real promise for consistent production of renewable energy but their impact on wildlife is unknown. Swansea University researchers are using cutting-edge tagging technology to understand the movements and dive behaviour of seabirds in relation to ocean currents in north Wales. This is providing vital information on whether birds target or avoid the areas where tidal renewables might be located which can result in less impact from this vital industry. SDGs: 12, 13, 14

Nuclear energy contributing to the SDGs
Dr Simon Middleburgh, Dr Michael Rushton, Prof Bill Lee (s.middleburgh@bangor.ac.uk)
Bangor University’s Nuclear Futures Institute is leading the way in developing the next generation of nuclear reactor and fuel systems including advanced fission and fusion reactors that shall not only produce clean, abundant electricity, but also enables co-generation, providing clean water (SDG6), nuclear medicine (SDG3) and advances in industry (SDG9) in a sustainable manner (SDG11). As part of a number of international collaborations, the team at Bangor are testing materials to their limits and designing new ones to ensure that the next generation of nuclear energy can be affordable, reliable and sustainable in order for humanity to take urgent action to combat climate change. SDG: 13. Project website: https://nubu.nu/ [Image must be accompany this statement: Image modified from “Nuclear power plant ‘Isar’ at night” by bagalute, licensed under CC BY 2.0]

Integrated Multi-Energy Networks to enable a Zero Carbon Future
Prof Jianzhong Wu, Cardiff University (wuj5@cardiff.ac.uk).
Improved energy networks are vital for the energy sector to continue to supply energy while society moves towards Net Zero. Research in Cardiff (in close collaboration with industry, government and leading researchers globally), established a new research area to understand, quantify and optimise the interdependencies and interactions between energy networks (e.g. electricity, gas, heating/cooling, hydrogen and electrified transport networks), in order to achieve a more secure, reliable, sustainable, and affordable energy future. SDGs: 7, 9, 11, 12, 13 (1, 8, 10) Website: https://www.cardiff.ac.uk/people/view/364498-wu-jianzhong
Case studies contributing primarily to SDG 11 (Sustainable Cities) & 13 (Responsible Consumption)

Nature-based defence solutions for climate-proof coastal management
John Griffin & Harshinie Karunarathna, Swansea University (J.N.Griffin@swansea.ac.uk, H.U.Karunarathna@swansea.ac.uk).
Coastal flooding is expected to affect 15% of world population and cost £50Billion annually by 2050. Wetlands such as saltmarshes have potential to buffer storm impacts, serving as a Nature-based Solution. Research in Swansea, in collaboration with international research partners, governments, industry and general-public has shown that they can be successfully integrated for sustainable coastal zone management against growing pressures of climate change impacts. SDGs: 11 & 13.

Microalgae delivering on the Sustainable Development Goals!
Professor Carole Llewellyn, Swansea University (c.a.llewellyn@swansea.ac.uk)
Microalgae can play a key role in reducing waste, cleaning water, creating food and valuable products and ultimately in helping to reduce poverty and hunger across the world. Swansea University is using a circular economy approach to cultivate microalgae using waste nutrients from farming and food industries which is then used to generate new products such as animal feed and agricultural biostimulants. Thus working with farmers, industry and policy makers they are reducing waste and replacing unsustainable products with ones that are sustainable! SDGs: 12, 13. Project website: https://nweurope.eu/alg-ad

Reduction of single use plastic packaging helping move us towards a net zero food economy
Dr Graham Ormondroyd, Bangor University (g.ormondroyd@bangor.ac.uk)
Bangor University is working closely with the packaging industry to develop new ‘bio-based’ materials from sustainable resources for use in the food and drink sector. Projects include the development of new biobased plastic formulations that don’t generate microplastics, products that will help to keep food cool, and additives that help to increase shelf life of food and therefore reduce food waste. These projects contribute to efforts to reach net zero but also, though work with partners around the world, are increasing research, innovation and investment in poor regions of the world. This research has direct impacts on 9 SDGs (2,3,7,8,9,11, 12,13 and 14).

Assisting event organisers to hold more sustainable sporting and cultural events
Dr Andrea Collins & Professor Max Munday, Cardiff University (CollinsA@cf.ac.uk; Mundaymc@cf.ac.uk).
Research in Cardiff University has changed how policymakers, event organisers and consultants understand and evaluate the environmental impacts of major events. The researchers have worked with a wide variety of partners to produce the environmental section of the ‘eventIMPACTS’ toolkit from UK Sport (the UK’s high-performance sports agency) and has led to the staging of more sustainable events in five continents. For example the research has influenced the development and scope of the first International Sustainability Standard for Golf Tournaments, which runs major tournaments in the US, Italy, and China. SDGs: 12, 13.
Case studies contributing primarily to SDG 13: Climate Action

Assessing public perspectives on climate action in the UK and beyond
Dr Kat Steentjes, Dr Caroline Verfuerth & Dr Stuart Capstick (SteentjesK@cardiff.ac.uk).
The involvement of the wider public is imperative for climate action, both in terms of people’s support for ambitious emissions reduction policies, and their participation in low-carbon social transformations. Cardiff-based research in the UK, China, Sweden and Brazil assesses public attitudes towards climate change using representative opinion surveys; they also look at people’s views in more detail through speaking with smaller groups of individuals about their interests and concerns. This work is helping to inform climate policy and maintain wider momentum for climate action across society. SDGs: 13 (3, 12). Centre website: www.cast.ac.uk See also: https://cast.ac.uk/wp-content/uploads/2021/03/CAST-Briefing-08.pdf Infographics: https://cast.ac.uk/wp-content/uploads/2021/03/CAST-08-inographic-printable.pdf

Inspiring climate action in future generations through a school science outreach programme
Dr Will Bryan and Professor Mary Gagen, Swansea University (s4science@swansea.ac.uk)
Science outreach programmes are a vital tool to make science research and education accessible and diverse; ensuring future generations are motivated and inspired to address the challenges society faces. However, science education often fails to engage with all student demographics. By successfully widening access to science, researchers at Swansea aim to ensure all young people have a chance to become confident and capable global science citizens with the skills and training they need to build a successful low carbon society. SDGs: 13 (7,12,14 and 15). Website www.s4science.co.uk

Providing global maps of global change in a globally important ecosystem
Dr. Peter Bunting, Aberystwyth University (pfb@aber.ac.uk)
Mangrove forests are a critical component of coastlines, particularly across tropical and subtropical regions, but have suffered substantial loss and degradation over recent decades. The Global Mangrove Watch is providing global and openly available maps of mangrove extent for each decade from the 1990s and change alerts for selected countries. This is contributing towards their sustainable management and restoration and addressing climate change mitigation. SDGs: 13, 14, 15 (3). Project website: https://www.mangrovealliance.org/global-mangrove-watch/
Case studies contributing primarily to SDG 14: Life below Water

Addressing the ecological damage of bottom trawling
Professor Jan Geert Hiddink, Bangor University (j.hiddink@bangor.ac.uk)

Mobile bottom-fishing provides 35% of global catches worth over £27 billion, but it can cause serious ecological damage. Research at Bangor University provides the tools to estimate bottom fishing impacts worldwide. This is making a difference for the fishing industry, conservation and the people who depend on fish. SDGs addressed by the work: 12, 14.

Making intensive aquaculture more sustainable in the face of climate change
Professor Sofia Consuegra, Swansea University (s.consuegra@swansea.ac.uk)

Worldwide demand for seafood has increased steadily over the last few decades, with fish consumption expected to double by 2020, most of which will have to come from farmed fish, as traditional wild fisheries are stagnant or over-exploited. Swansea-based research, in collaboration with producers and other relevant stakeholders, focuses on making aquaculture intensification more sustainable by improving fish domestication and welfare, increasing their resilience to changing climate, reducing the need for marine feeds and decreasing the introduction of non-native species. SDGs: 2, 12, 14 (3, 13). https://www.swansea.ac.uk/staff/science/biosciences/s.consuegra/

Using seabird-fisheries interactions to better design Marine Protected Areas
Professor Luca Börger, Swansea University (L.Borger@Swansea.ac.uk)

There is an urgent need for more sustainable fisheries management, to reduce and mitigate the negative impact on rapidly declining seabird species whilst at the same time respond to the increasing global human demand of food from the sea. However, better understanding of the interactions between fisheries, and other species which also depend on these marine resources, is needed. Swansea University is combining fine-scale data on seabirds and fisheries which is contributing to better design of marine protected areas. SDGs: 2, 14.

Understanding climate change impacts in the ‘world’s cleanest sea’
Professor John Turner & Dr Ronan Roach, Bangor University (r.roche@bangor.ac.uk)

Climate change impacts really do get everywhere. Research by Bangor University on the coral reefs of the Chagos Archipelago has shown that despite being incredibly remote (2000km south of Sri Lanka, meaning there is limited local pollution), the impact of climate change is being acutely felt due to successive ‘bleaching’ events caused by warming seas. Given the important role coral reefs play as nursery grounds for fish, and for the ecology of the wider ocean, this research is a useful warning of how far-reaching climate change impacts really are. SDGs: 13, 14 (2). Website: https://www.marine.science/
Case studies contributing primarily to SDG 15: Life on Land

Ensuring tropical forest conservation contributes to poverty alleviation
Prof Julia P G Jones, Bangor University (Julia.jones@bangor.ac.uk).
Tropical forest conservation and forest restoration is vital in the fight against climate change, and to conserve biodiversity. However forest conservation and restoration, where not designed appropriately, can exacerbate poverty. Research by Bangor University, and engagement with stakeholders, from governments to multilateral and bilateral donors, has improved the implementation of tropical forest conservation and restoration for the sake of people and planet. SDGs: 13, 15 (1, 10). Website: http://forest4climateandpeople.bangor.ac.uk/

Conservation of the okapi: the Congo rainforest’s lost giraffe
Professor Mike Bruford, Cardiff University (BrufordMW@Cardiff.ac.uk).
The okapi is one of the most enigmatic rainforest mammals on earth; only discovered at the beginning of the 20th century and first photographed in the wild in 2008. Genetic research by Cardiff University (working with partners including the Zoological Society of London) has shown it is a ‘ghost lineage (extraordinarily distinct evolutionarily). The team have used DNA barcoding of faeces to assess the status of this hard-to-survey species which resulted in it being recognized as more threatened than previously thought and new conservation action. SDG 15

Developing new methods for cover and change monitoring across the globe
Prof. Richard Lucas, Aberystwyth University (richard.lucas@aber.ac.uk).
Aberystwyth is leading the way in using earth observation data to routinely and consistently construct historical and current maps of land cover and change for countries globally. This allows policy makers and other stakeholders to propose and visualise future landscapes, and to monitor progress towards achieving goals and ambitions, including those associated with the SDGs. The approach has been applied at a national level in countries, including Wales. SDGs: 13, 14, 15 (3). Project website: https://wales.livingearth.online/

Animal behavioural responses to changing environments
Dr Andrew J King, Swansea University (a.j.king@swansea.ac.uk)
Humans have brought about unprecedented changes to environments, and for many species, behavioural adjustments represent the first response to altered conditions. Research in Swansea involves collaboration across disciplines and sectors to apply behavioural studies to the effective management and conservation of wild animal populations worldwide. For example, they have developed tools for assessing the scale and nature of Nitrogen pollution arising from sheep-grazed pastures in Wales, shown that ocean acidification does not cause behavioural alterations in European sea bass, and studied the causes and consequences of baboons foraging in urban and agricultural landscapes in South Africa. SDGs: 14, 15 (3, 12, 13). Project website: www.SHOALgroup.org [Image: Lucy Lush]
Tracking turtles for conservation
Dr Nicole Esteban, Swansea University (n.esteban@swansea.ac.uk, 07713088362)
Marine animal movement research informs design of marine protected areas and assessment of important habitats. Swansea University are satellite tracking sea turtles and carrying out ecology research which has led to the discovery of vast areas of climate-resilient deep-water seagrass meadows. They are working with stakeholders engaged with policy development and implementation to help translate their data into conservation outcomes. SDGs: 13, 14.

Halting biodiversity loss through genetic management guidelines
Dr Isa-Rita Russo, Cardiff University (russoim@cardiff.ac.uk).
Cardiff University are developing genetic management guidelines for large mammals in southern Africa, in partnership with conservation practitioners, policymakers, and academics in the region. Through the guidelines, they aim to protect genetic diversity within species by preventing excessive mixing of genetically unique populations, which would ultimately reduce species' ability to adapt to climate change and lead to a loss of biodiversity. SDG: 15.

Multidisciplinary landscape and biodiversity management in the Lower Kinabatangan Wildlife Sanctuary, Sabah, Malaysia. Prof. Benoit Goossens, Prof Mike Bruford, Dr TC Hales, Cardiff University (BrufordMW@Cardiff.ac.uk). Multifunctional landscapes of high biodiversity value provide numerous scientific challenges, particularly in balancing the requirements of local communities, wildlife and ecosystem service provision. In Sabah, Cardiff University have been working with actors from governmental departments to local communities to develop management plans in an environment where landscape change (deforestation and palm oil agriculture) has resulting in declining populations of key wildlife species for ecotourism (eg Bornean elephant, orang-utan, crocodile) and loss of ecosystem services. They are also collaborating with community forest restoration via the Regrow Borneo program, that seeks to reconnect the ‘corridor of life’ envisaged for the Lower Kinabatangan floodplain. SDGs: 13, 14, 15.
Website - https://www.cardiff.ac.uk/danau-girang-field-centre

Global biomass and biomass change
Heather Kay, Aberystwyth University (hek4@aber.ac.uk). Information on the quantities of carbon held in the world's forests is essential for working out how much greenhouse gas emissions are caused by changes in land cover and use and to inform mitigation strategies. As part of the European Space Agency's Climate Change Initiative, global maps of above ground biomass have been generated for 2010, 2017 and 2018; highlighting the spatial variation across different biomes and indicating change over time. These maps are being used to support the development and evaluation of global climate models and carbon cycle science. SDGs: 13, 15. Project website: https://climate.esa.int/en/projects/biomass/