Institution: University of Stirling

Unit of Assessment: C17 Geography, Environmental Studies, Archaeology

a. Context: In endeavouring to understand complex society – environment interactions our research develops and tests policy and management solutions that give new approaches to mitigate or reverse the impacts of human activities on biodiversity, environmental services and natural resources, and support local communities. Our research themes readily translate to impact and we deliver to public, private and third sector user groups in the UK and internationally (Fig. 1). Our research groups work directly with non-academic user groups to ensure research is shaped to deliver appropriate impact. *Conservation* delivers policy and legal impact in relation to species and habitat management practice in developed and developing nations. *Environmental Protection* influences policy, standards, regulatory practice and enforcement on the control of bacterial, pathogenic, nutrients and pollutants together with flood risk management. *Sustainable Aquaculture* delivers resilient aquatic resource management practices to local communities in developing nations and influences aquatic food security policy. *Environmental Change & Landscape History* impacts upon national standards and protocols for radiocarbon measurement, and on policy and management practices for protected archaeological sites and landscapes including heritage tourism.

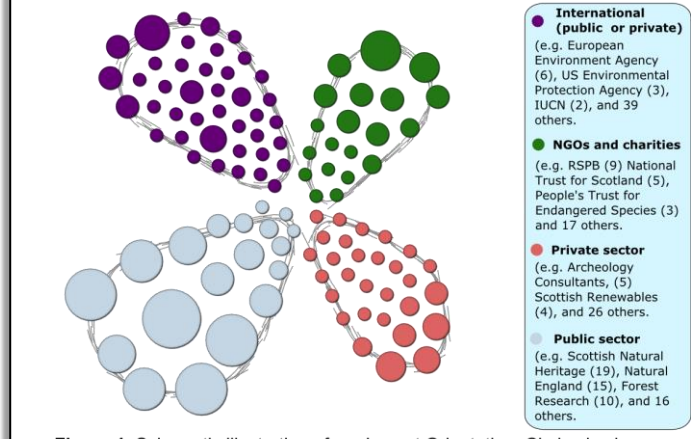

Figure 1. Schematic illustration of our Impact Orientation. Circle size increases with the number of staff identifying an end-user of their research.

b. Approach to impact: We have explicitly defined, through extensive and continuing discussion with user groups, the generic impact areas to which each of our research groups will contribute. These areas are defined as *policy,* directly influencing new courses of action; *practice,* shaping new management adopted by user groups; *legal,* changing existing legal frameworks; and *standards,* defining new protocols to ensure appropriate levels of quality and safety. We engage and develop relationships with end-user groups in the following ways:

Contribution to policy forums: Our staff are members of advisory panels and commissions for governments, industry and charitable bodies actively influencing policy and practice through research-led approaches. **Lee, Buchanan-Smith** and **Abernethy** are members of the International Union for Conservation of Nature's Species Survival Commission, providing information and guidance on biodiversity conservation and Lee sits on a House of Lords committee on elephant welfare. **Abernethy** is a member of two of Gabon's National Committees: Non-Timber Forest Products, and National Strategy on Bushmeat Management, as well as an expert advisor on environment to the First Lady of Gabon leading to revisions of laws and policy on bushmeat hunting (cf REF 3b); **Park** was elected on to the board of trustees of the Bat Conservation Trust in 2012, influencing the science policy of this organisation; **Tyler** was elected to convene the International Electrotechnical Commission Working Group (Nuclear Instrumentation Subcommittee 45B-Environmental Radiation Protection) and was project leader for the international standards on mobile monitoring and in-situ gamma spectrometry instrumentation. This has resulted in IEC technical standards that manufacturers adhere to in the construction, technical specification and environmental tolerances of equipment used for environmental radioactivity measurement, monitoring and dosimetry. **Willby and Oliver's** research in community ecology, fluvial geomorphology and agricultural pollutants has guided and influenced the UK's response to the key EU Environmental Directives - Water Framework, Flooding, Species & Habitats and Bathing Waters. This work has steered the pan-European comparison of bio-assessment methods that now underpins common water policy (cf REF 3b). **Telfer** is member of the Core Group (Environment) for the EU Aquaculture Technology and Innovation Platform influencing aquaculture promotion and development. **Bayliss** leads the Dating team at English Heritage and is responsible for the

development of corporate policy and national standards for archaeological chronologies.

***Direct collaboration with end users**: O*ur approach to research impact has attracted end users to locate their offices within the School of Natural Sciences (British Trust for Ornithology, Bumblebee Conservation Trust, Royal Society for the Protection of Birds), and conservation partnerships are embedded within our research programmes through the UK's Statutory Nature Conservation Organisations. Specific examples of collaborations include Woodland Creation and Ecological Networks, a new programme between Stirling, Forest Research and Natural England that arose following **Fuentes-Montemayor** and **Park's** work on the efficacy of agri-environment, and woodland creation schemes. **Abernethy** works with the regional TRAFFIC hunting working group in Gabon, contributing up to date knowledge on the wild meat trade and contributing 'live' data to a public access forum. **Buchanan-Smith** and **Lee** collaborate with zoos on welfare and captive animal management, and with tropical conservation NGOs on issues of sustainability and mammalian population dynamics. **Oliver's** research on the behavioural traits of contaminants in environmental and agricultural systems has examined mitigation options though engaging with end-users in diffuse pollution control (cf. REF 3b). We are increasingly working directly with local communities; **Little, McAdam** and **Telfer** work with fish farmers and distributors in Asia and Africa addressing key areas of long term sustainability of the sector resulting in improved aquatic food security (cf. REF 3b).

Providing the evidence base for policy and practice: Our research is sought out by non-academic user groups. At a European scale **Buchanan-Smith** contributes results from animal welfare studies that have supported successful lobbies for changes in EU law on minimum cage sizes for captive primates. **Park** and **Minderman's** research on the effects of micro-turbines on wildlife is now used in the UK's Statutory Nature Conservation Organisation's guidance documents and these researchers now contribute to European guidance through the EU's EUROBATs. **Lee** and **Abernethy's** work has improved our understanding of the attitudes of local people towards protected areas and human-wildlife conflicts informing and influencing policy in several countries in Africa and Asia including Gabon, Kenya, Tanzania and Cambodia (cf. REF 3b). Through research, lobbying and direct input to the Convention on International Trade in Endangered Species **Lee** has influenced the debate on the sustainability of the legal ivory trade (*Science* 2010 - 328). Nationally, **Hunter's** research on visualisations for impact assessment of proposed wind energy developments is revising existing standards for local councils and has been used in public enquiries in relation to planning applications for new wind farms. He also provides expert advice on risk assessment and management issues for cyanobacteria and associated toxins to the UK regulatory bodies and industry. **Tyler** provides expert advice on the on/offshore detection, recovery and health impacts of hot particles for SEPA (advisory panels at Dounreay and Dalgety Bay) and the Nuclear Decommissioning Authority (Dounreay and Sellafield) establishing the evidence base to interpret the UK's contaminated land regulations. A briefing paper produced by **Little** for Worldfish, an international non-profit research organisation, is being used by development agencies to rethink global aquatic food security.

Profile raising: We have a highly visible external profile: For example, **Lee** *The One Show* on elephant health in zoos; Radio 4's *Start the Week* on elephant conservation; **Park** and **Minderman's** work on micro-turbines and wildlife with extensive international coverage including BBC radio interviews, internet and newspaper articles, and featured by the European Commission's *Science for Environmental Policy* service; Research on human-wildlife interactions by **Bunnefeld** (moose vehicle collisions in Sweden, trophy hunting of brown bears in Croatia) has featured in the EC's *Science for Environmental Policy* service, Scientific America, Nature World News as well as European Voice, a leading source of news and analysis on key EU policies, laws and institutions. We have excellent links MSPs and MEPs; Sustainable Aquaculture (**Little**) is notable in challenging perceptions of international aquaculture development, while **Adderley, Simpson, Tipping** (with colleagues in History and Politics) engaged in a two day public meeting with the Scottish Government's Cabinet Secretary for Culture and External Affairs. This event facilitated interaction between the public and academics, debating conflicts associated with heritage, identity and place.

Changing public thinking: We engage the wider public in our work, with training (e.g. media engagement) and support (e.g. drafting press releases) helping us to achieve high levels of public recognition. **Buchanan-Smith** is a key player in the design of the *Living Links to Human Evolution*

Research Centre situated within Edinburgh Zoo, overseeing the research on the welfare of the two species of primates. Over 300K people visit Living Links each year with live research conducted under the public eye. She has developed interactive learning stations, science engagement panels, online materials for school syllabuses on methodology and videos to engage the public in science. Research demonstrated that viewing live, active science was the most engaging activity (PLoS ONE 7(4): e34505). Our research in *Environmental Change and Landscape History* (**Adderley, Simpson**) has enabled the creation of RCUK funded real-time audio-visual generative art work influencing public perceptions of human responses to climate change in Sahelian Africa (Leonardo, 42) and on living with environmental change in Greenland. Nine public exhibitions of these works from 2008 have taken place in various Scottish venues including the National Museum, and in London, Prague and San Antonio, attracting over 3000 visitors.

Impact mechanisms: Our current approach encourages and facilitates impact through: i) the *Achieving Success* appraisal system for staff that identifies current/future impact plans, resource, training and support needs; ii) training in grant writing and in-house internal peer review processes provide expertise from appropriate Research Committees on maximising impact, including assessment of successful and unsuccessful submissions; iii) we have a full time colleague whose role is to articulate our research activities and students with end user employers; we are developing this post into a permanent position; iv) we support an active honorary staff system explicitly to foster collaborations and ensure the translation of research findings to real-world applications. The further potential of our impact agenda has been recognised with institutional support from the University Impact Fellowships Scheme from 2011 (4 submitted with this unit) and the Impact Studentship Programme (6 students currently with this unit). These positions promote research excellence within collaborative projects that include non-academic organisations.

c. Strategy and plans: Our vision is to develop academic-end-user partnerships from the point of conceiving a new research idea and ensuring engagement at all stages of the proposal formulation and during the execution of successful projects. Our research will achieve creative tensions between academics, policy makers, end-users and local communities, and achieve tangible change. Our strategy has recently been reviewed (as part of School of Natural Sciences research review 2013); definition of user groups and impact areas continue to be appropriate but we highlight new emphases on international work with local community groups and on achieving economic impact in Scotland and the UK. To further maximise potential we will: (i) working closely with the University's press office at the launch of a project to encourage and stimulate wide project engagement; (ii) including government, NGOs and industry membership on project advisory panels; (iii) collaborating with leading international non-academic partners; (iv) organising end-user workshops at critical points of the project to ensure a two way dialogue of understanding; (v) offer RPG and post-doctoral secondments with end-user organisations; (vi) develop project web pages and newsletters; (vii) exploit social media such as twitter; and (viii) contribute to local and nationally organised science day events. Further impact is secured by providing analytical services and consultancy as direct outputs from our research, supported where necessary by gaining laboratory accreditations to qualify for research and development monies from industry and the UK regulators. The outputs from these activities have direct impact as they are a required and critical contribution to effective decision-making and policy formulation.

d. Relationship to case studies: Our case studies exemplify our approach to research impact. Development of research impact strategy and approaches is explicitly shaped by experiences from case studies. This includes the three presented in this unit and those from other School of Natural Sciences units. They have been used to develop resource support for impact described above, notably in building impact contributions into workload modelling. The Centre for River Ecosystem Science's research on aquatic systems and work conducted by the African Ecology group on relations between wildlife distribution and human dietary habits have demonstrated how we can engage with policy advisory panels. They have also helped us recognise the different working practices required in engagement at UK, European and international policy forums. The work of the Sustainable Aquaculture group has provided us with clear protocols and working practices enabling research impact to be brought into sensitive local community settings and in different cultural contexts with decentralised systems of organisation in developing nations.