Institution: Queen's University Belfast: School of Geography, Archaeology & Palaeoecology

Unit of Assessment: 17

a. Context

GAP was formed in 2005 through a merger of the Schools of Geography, and Archaeology & Palaeoecology to strengthen pre-existing links between scientists focused on environmental change and archaeologists and human geographers concerned with the historical, cultural, political and spatial dimensions of human societies. This combination of expertise enhanced GAP's capacity for research having impact, particularly in stone conservation, public policy on labour market mobility, crime investigation, and public archaeology. The principal user groups who have benefitted from the research are: government agencies (e.g. Census Office NI, Northern Ireland Environment Agency [NIEA], Police Service of Northern Ireland, Historic Scotland); charities (e.g. National Trust); international agencies (e.g. UNESCO, Habitat International); local community groups (e.g. history and archaeology societies) and media audiences (e.g. BBC, UTV, Channel 4). GAP, with its history of investigating the relationships between the human and natural environments developed a strategy of investment in a select number of research centres that provide the infrastructure and technical support, as well as the academic know-how, for the application of its research to wider societal questions. Primary among these are: the establishment in 2003 of the ^{14}CHRONO Centre for Climate, the Environment and Chronology [Reimer], providing around 350 radiocarbon dates per month to academic and commercial users worldwide; the Centre for Archaeological Fieldwork [CAF, Donnelly], established in 2002, to undertake the fieldwork requirements of the NIEA; the Centre for Data Digitisation and Analysis [CDDA, Ell], set up in 1999, a not-for-profit developer of digital education and community electronic resources in the UK and Ireland. GAP obtained 11 of the University's Department of Education and Learning [DEL] funded 'Programme for Government' PhD studentships [2008-11] designed to spearhead applied projects, for example, assessing the sustainability of small island communities in the Western Isles and integrating remotely acquired and ground survey based data for assessing slope stability on major roads. These projects directly address social and environmental challenges and have adopted research designs that are explicitly problem-solving in focus. In addition, GAP has been successful in developing key partnerships with a range of stakeholders, internationally and nationally. These include a consultancy-based projects on the impact of oil exploration on small islands [Royle: Falkland Islands]; in collaboration with the National Museum of Archaeology Malta, and RCUK-funded, the excavation, conservation and protection of a temple site in Gozo, Malta [Malone: Gozo]; and youth education at the Belfast Branch of the Young Archaeologists' Club [Murphy].

Extensive support is given by QUB infrastructure through its Enterprise Development Unit, which gives significant levels of advice and practical help for exploitation/knowledge exchange. It offers an integrated package for patent filing, contract negotiation and brokerage between companies and investigators. QUBIS supports spin out companies by direct investment as well as by providing business services and mentoring.

b. Approach to impact

GAP's approach to impact has been multi-pronged, reflecting the unique range of skills and interdisciplinary expertise brought together under the umbrella of the School, and capitalising on the synergies between the disciplines in tackling human-environment relationships. Strengthening the impact of our research on the wider society has taken three distinct forms.

First, the School's approach to impact by those working in environmental impact research has been to dovetail the fundamental science, with the practical application of these findings through collaboration with a range of government agencies, NGOs and private companies (see geoforensics and stone weathering case studies). The blue-sky research carried out by Reimer and her team in ^{14}CHRONO in determining the calibration of radiocarbon dates – a field of inquiry with over 20,000 citations – has been foundational to all subsequent climate modeling that underpins the data produced in the reports of the Intergovernmental Panel on Climate Change [IPCC]. The School recognizes that this research provides the scientific benchmark for applications made by other experts in the field and that its impact is therefore significant but indirect. GIS

and geostatistical techniques developed by McKinley, and working in collaboration with the NI Cancer Registry and Geological Survey of NI, have been applied to monitoring/assessing the significance of soil toxicity and the spatial incidence of cancer [funded by Department of Enterprise, Trade and Investment, NI]. Orford's research on coastal dynamics has resulted in (i) involvement with the Halcrow Group in developing the Shoreline Management Planning approach now implemented by DEFRA for the coasts of England and Wales; and (ii) his being one of two British scientists invited on the Governor of Louisiana's Science for Envisioning the Future of the Mississippi Delta and New Orleans, post hurricane Katrina (2006), which they then developed into the Louisiana Coastal Master Plan (2012) for the future sustainable strengthening of the Mississippi delta region against hurricane surges.

Second, for research in archaeology and human geography, GAP's approach has been to harvest the convergence of conceptually-driven research with a variety of qualitative and quantitative data sets that can deliver impacts at the micro and macro scale across a range of societal issues (see labour market/archaeology case-studies). The impact of oil on the socio- economic welfare of the Falkland islanders, conducted by Royle, on behalf of Plexus Energy, and in dialogue with the FI government, informed public policy on labour market migration planning and infrastructural provision for the islands. Lilley's [AHRC funded] work on medieval Chester has provided the baseline data for the Chester Urban Archaeological Database and informed decision-making on heritage management and tourism potential of the city. CDDA's digitisation, scanning and transcription of 7 million hand written Vital Registration Data Records from 1864 to 1974 for the NI General Registrar's Office (GRONI) has allowed GRONI to make radically more efficient their provision of VRD to the public (Ell). CAF's policy document 'Condition and Management Survey of the Archaeological Resource' informed and changed NIEA policy in relation to managing state care sites in NI. Drawing on their research on housing and development, and funded by Habitat for Humanity-Northern Ireland [HFH], Majury and Kumar reviewed the parent group's projects in Africa-Middle East, in terms of the UN's Millennium Development Goals and their recommendations altered HFH's approach to advocacy in poverty alleviation. Reframing the terms of the debate underpinned Agnew's public engagement with politicians [Rudd, Australia; Mützenich (SDP)], government advisors [Smith, Deputy National Security Adviser to USA V-P Biden), and think tanks (Roy, Director of the Kissinger Institute on China and the USA] at the Friedrich Ebert Stiftung Tiergarten conference, where he critically considered the question of a geostrategic shift of US security policy from the trans-Atlantic to the Asia-Pacific [2012].

Third, public engagement through collaborating with a variety of media outlets both locally and nationally [BBC/ITV/Channel 4/RTE]. Working with Channel 4's *Time Team* in 2008, 2009, 2012, 2013 CAF brought NI's archaeological heritage to national audiences of 1.2M (10M globally), while directly engaging local communities. Based on Livingstone's work carried out over twenty years on the relationships between science, knowledge and society, BBC Radio 4 commissioned him to write and present five fifteen-minute programmes on BBC Radio 4, *The Empire of Climate*, aired to 1.6m listeners in 2010. Shuttleworth's analysis of the results of the 2011 Northern Ireland Census has attracted widespread broadcast coverage as well as in print outlets such as the *Economist*. In summary, the School has succeeded in fostering a unique and integrated approach to impact that capitalizes on the connections between the three disciplines within the unit. The strong technical and laboratory provision [e.g. AMS; GIS] across the School has provided infrastructural support for many projects. Time to develop networks is enhanced by the School's sabbatical leave system – 3 (ca 10%) per year – as well as success in gaining replacement teaching fellowships [eg. Campbell (Wissenschaftskolleg zu Berlin) and Livingstone (Leverhulme)]. GAP obtained funding for two Knowledge Exchange Partnerships [Smith 2008 and Ruffell 2009] and was a partner in an AHRC Knowledge Exchange Fellowship (Lilley 2013) each of which have bridged academic research and user applications. A QUB Impact Award through the EPSRC Pathways to Impact scheme enabled the Weathering Research Group (McCabe) to produce training and awareness videos, disseminated via YouTube, with >1000 views among practitioners.

c. Strategy and plans

GAP has a long-standing tradition of successfully translating research into high impact outcomes dating back to Estyn Evans' pivotal role in setting up the Ulster Folk and Transport Museum in the 1960s. The School's strategy is based on a vision of combining critical foundational research with practical applications within the wider society. GAP views this process as iterative, cumulative and non-linear, and recognises the key role of users/stakeholders in the formulation, as well as reception of, important research agendas. There are four strands to the School's strategy to maximize our capacity to enhance impact. ***Discussion*** At the School's annual research day, presentations on avenues of impact are undertaken. In 2011, this included a session 'public engagement with science' which brought together historical geographers and palaeoecologists in dialogue about how to bring scientific knowledge to non-academic audiences. Impact is a recurrent agenda item on the School's Management Board; Post-graduate Committee, and Cluster committees where individual and collective goals are formulated. ***Stakeholder participation*** – The School has fostered strong links with key user/stakeholder bodies spanning the last two decades [e.g. NIEA; National Museums NI; Police Service NI; National Trust; Natural England; NI Census Office; UNESCO; Habitat International], and seeks to widen connections with ex-UK organisations (e.g. Superintendence of Cultural Heritage Malta), and deepen existing links through stakeholder open-days; increasing RCUK-CDA studentships; and expanding public engagement events.. ***Training*** - We currently run two Masters programmes with strong applied foci – Professional Archaeology and Heritage Science. One of the tasks of a newly-appointed (2013) Recruitment Officer is to attract larger numbers of practitioners [on secondment] into these degree programmes, and widen and deepen linkages between the School and staff working in non-academic organisations. ***Funding*** – GAP's impact profile has been stimulated through a variety of consultancy, RCUK, charity, and business funding bases. The strategy is to deepen staff awareness of the funding opportunities that align with their research interests and provide mechanisms [seed-funding to conduct meetings with stakeholders] to formulate impact objectives. The School recently hosted an 'Increasing the Impact of Research' conference and workshop for staff and research students across the University. In addition doctoral students obtain impact training from the University's Post-Graduate Office. Together these strategies guide the furtherance of our impact agenda, while recognising that the impact of some research in the School will often be long-term, sometimes even unpredictable and unplanned.

d. Relationship to case studies

For each case study, external peer-reviewed funding supported the underpinning research. Developing links with local stakeholders provided the initial impetus for impact. Geoforensics and stone weathering began by having impacts in the Ireland/NI setting before diffusing to other jurisdictions. Using pollen and radiocarbon dating methods within the School, as well as geostatistical and geological research Ruffell et al could provide accurate and expert testimony in the acquisition and veracity of forensic data for the legal system. The Weathering Group's understanding of the processes of stone decay, facilitated by in-house laboratory provision, spearheaded its practical application to the conservation of stone in historic buildings and natural settings. For public engagement with archaeology and labour markets the Northern Irish political context itself was crucial to achieving impact. Fair employment legislation and the contested past were both stimuli for conducting applied research. Shuttleworth's quantitative skills, supported by the School's GIS laboratory, enabled him to answer key questions about the NI economy. With the support of RCUK-funded projects as well as DEL-funded consultancies, Shuttleworth's policy research proved directly relevant to the government's strategy to enhance employment in NI. Public engagement in archaeology has been particularly facilitated by the role of CAF in the excavation, management and public education it provides at NIEA sites. Using the School's AMS facilities, excavation tools and historical knowledge of post-Medieval sites has led archaeology to perform as an key partner in a wider public discourse and policy aimed at resolving conflict in deeply divided societies.