

A COORDINATED AGENDA FOR MARINE, ENVIRONMENT AND RURAL AFFAIRS SCIENCE (CAMERAS) (2011-2016)

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Consultation Questions

Headline Themes

1. Do you agree that the two broad categories of “Local Responses to Global Change” and “Optimising the Potential of Scotland’s Natural Assets” are helpful in providing an overlying structure to the Co-ordinated Agenda?
 - Yes, these themes provide a sound basis for formulating subsequent scientific policy. BUT, they must be underpinned by infrastructure and capacity building initiatives. Science can not be turned on and off – capacity must be maintained.
2. Are the descriptions of these set out in Section 3 (and Annex 3) comprehensive?
 - “Climate change” and “optimising the potential of Scotland’s natural assets” are reasonably comprehensive. The impact of climate change on Scotland’s environment seems underexplored, including possible positive impacts.
 - Food security, particularly in light of worldwide challenges for energy and water, also seems underexplored.
 - The issue of biosecurity is extremely important and should be considered worthy of a separate headline. The impact on the economy and the environment in the event that biosecurity measures fail cannot be underestimated.
3. Do these cover the major policy challenges where science can contribute as you see them?
 - Science can contribute to all policy areas where a change in the status quo is required or envisaged, or where the need is for the identification and monitoring of threats to the status quo.
4. Are they likely to remain broadly relevant over the longer time horizon (well beyond the 2016 focus of this Coordinated Agenda)?
 - Yes – these issues will become more relevant and challenging with time

5. Do you agree with the description of support for the National Capability Theme set out in Section 3 (and Annex 3)?
- The National Capability Theme is critical to the success of the science policy. However, the Government should carefully consider the means by which it maintains this capacity, and the organizations through which the capacity funding are channelled.
6. What facilities, resources and data do you think are important for Scotland to maintain?
- It is self evident that capacity must be maintained to meet statutory and regulatory requirements (for plant, animal and environmental health)
 - However, capacity must be maintain to enable policy-related research and opportunity-related research to be performed. This includes:
 - Plant, animal and environmental health
 - Plant, animal and environmental genomics
 - Ecological, epidemiological and population-level data collection, curation and interrogation
 - Plant, animal and cell technologies
 - Plant, animal and aquacultural production system sciences
 - Predictive modelling
7. Are there other resources that Scotland needs to acquire to support future policy development?
- A necessary requirement is to keep abreast of genomic technologies and continue investing in those likely to give the greatest benefits. Cutting edge technologies must be adopted where they do not already exist and be maintained at the highest standards where they do. Such technologies include:
 - Aquaculture facilities
 - Bio banking of tissues and other biological samples
 - Category 4 containment facilities for handling the most highly infectious organisms (this applies to research and diagnostics)
 - State of the art large animal facilities for research purposes
 - State of the art poultry facilities for research purposes
 - State of the art genomic equipment
 - State of the art informatics infrastructure

Policy Issues

8. Have we correctly identified the key policy issues and the associated scientific opportunities in Section 3?
- Food security does not appear as a stand-alone high-level policy issue. We consider that this is key policy issue that needs to be addressed, A second green revolution is required to meet the challenges of a) continued growth in demand for food as a result of population growth; b) continued growth in demand for animal protein as a result of

increased prosperity; c) loss of productive land as a result of climate change, erosion, flooding, pollution; d) competition for water; e) competition for plant material that will also be required as an energy source or as a chemical feedstock source to replace oil/gas/coal.

- Biosecurity is a major concern given the extensive movement of stock and other produce. A failure of biosecurity could lead to huge economic losses and detrimental environmental impact for Scotland.

9. Are there additional issues that should be included?

- See Q. 8.

10. What do you think will be the most important influences on Scotland's future in the Marine, Environment, Rural Affairs and related areas?

- The major influences are:
 - Climate change.
 - Disease challenges: exotic and endemic.
 - Environmental impact & pollution.
 - Food security.
 - Biosecurity threats from exotic species
 - Energy policy, influencing land use.
 - International trade, as affected by physical constraints (energy, water, etc) and political constraints (trade barriers, tariffs, population change, etc).
 - Fisheries policy.
 - Public perceptions: animal welfare, attitudes to GM technologies, organic production systems, etc
 - Forestry and woodland landscapes could be integrated with wild, natural and managed landscapes and maintained for natural populations rather than as an isolated and stand-alone resource.
 - The use of plant based diets in aquaculture
- There is a case to substitute the term "influence" with "threat". In that case the list could be augmented with the following:
 - Risk of crop failure leading to low feed for stock animals
 - The changing location of animal farming forced as a result of e.g. flooding Forestry and woodland landscapes could be integrated with wild, natural and managed landscapes and maintained for natural populations rather than as an isolated and stand-alone resource.

11. Why do you think these are important?

- Each of these factors will influence the shape of Scotland's future food production landscape (terrestrial and marine/aquatic food production) as well as environmental usage and quality. The impacts are many and various; too numerous to list here.

12. Are there other scientific opportunities which should be highlighted?

- Genomics, in its many manifestations, is becoming pervasive in biology. Some unrealistic claims that have been made re the impact of genomics in animal and plant production and environmental stewardship. However, these have been inaccurate mainly in timescale; with genomics advancing at rates not seen hitherto, unforeseen opportunities will inevitably arise. Scotland is currently in an excellent position to be at the forefront of Marine, Environment and Rural Affairs science. Research in Scotland is driving developments in biotechnology and integrative biology and it is critical that support is provided to retain that capacity.

The Science

13. What existing areas of Scottish based scientific expertise should be maintained to contribute evidence to key policy issues?

- Key areas include:
 - Plant, animal and environmental health
 - Plant, animal and environmental genetics and genomics
 - Ecological, epidemiological and population-level data collection, curation and interrogation
 - Plant, animal and cell technologies
 - Plant, animal and aquacultural production system sciences
 - Veterinary science
 - Predictive modelling

14. How clear is the relationship between the scientific areas and the key policy issues?

- In principle the scientific areas map onto the key policy areas, as they represent the underpinning technologies. However, there are constraints that often hinder full exploitation of the science. The key constraint is the collection, curation and interrogation of appropriate data. For example, animal health data are often collected as part of statutory and regulatory requirements, yet these valuable data are divorced from other data recording protocols (e.g. animal identification, pedigree and performance recording) that would maximize the utility of the data. Coordinated collection and curation of data recording activities is a key step that would enable the science to map more close to policy issues – this extends across animal, plant and environmental sciences.

15. In which areas of science can we continue to make use of expertise supported elsewhere e.g. at the UK, EU and international levels?

- All modern science works best through large-scale multidisciplinary collaborative research. Scottish science must also work in the same

way. Therefore, interaction with science funded at the UK, EU and international levels is critical, irrespective of the discipline. This is particularly the case given that Scotland is a small nation, and the science spend is necessarily limited.

- It is difficult to envisage the Scottish Government fully supporting blue-sky underpinning science. A large proportion of the funding for this area will continue to come from UK funding initiatives. However, the National Capacity Theme will place Scottish Scientists well for the exploitation of such funding opportunities – this will give added value and leverage to Scottish Government funding initiatives.

16. In the time frame for CAMERAS (2011-2016) what new emerging areas of science are likely to mature and become available for more general use or application?

- Genomics is likely to become ever more pervasive, especially with fast-evolving genomic technologies. This will manifest itself in more effective plant and animal improvement opportunities, as well as exploitation of environmental genomics.
- Data handling and analytical capacities are ever improving. The combination of bioinformatics and analytical techniques will enable greater exploitation of data at the cell, animal and population levels.
- Imaging technologies are developing at a fast rate leading to improved methods for diagnosis, modelling, monitoring, etc. Use of such techniques will enable much improved stock management through improved health and welfare.
- The development of biomass utilization and energy capture will provide new opportunities for sustainable energy production.
- Biotechnology continues to thrive in Scotland and our World leading reputation in a number of areas within this field must be nurtured in order retain this status and lead to sound economic advances.

17. Do we have the expertise available to be able to use these new opportunities?

- Expertise in animal science is being nurtured in various organizations and consortia, notably the Easter Bush Research Consortium (EBRC). Thus, whilst expertise is currently available, care must be taken to ensure maintenance and growth. The members of the EBRC are also involved in development of the Scottish Partnership for Animal Science Excellence (SPASE). This Scotland-wide partnership brings together animal science research from a variety of different organisations (government, academic, industrial) to find the most effective routes to translate top class research into cutting edge technologies, diagnostics, therapies, etc.

18. In which areas does Scotland need to be self reliant?

- All statutory and regulatory requirements, including plant, animal and environmental health (self evident)

- Genomics and bioinformatic technologies required to exploit genomic data
- Analytical techniques for collating and interpreting genomic and population-level data.
- Predictive modelling/biology is critical in, for example, assessing the risk of an infectious disease outbreak or the affect of selective breeding in certain animals. Managing our own resources will require expertise to be retained and developed.

Delivery

19. Knowledge Exchange is essential for scientific activity to achieve impact. Do you agree that KE should be an explicit and integral aspect of the delivery of this Coordinated Agenda

- Yes

20. How can we continue to improve the integration of evidence from a diverse range of sources into forms that are accessible to end users?

- Technology interpretation organizations such as the Genesis Faraday Partnership should be supported or formed where there is a requirement.

21. How can we reconcile the requirement for science to be responsive and flexible to short term demands while at the same time ensuring that longer term strategic research continues to progress our knowledge and understanding?

- Underpinning funding for appropriate research providers – this may include the traditional MRPs, but also newer centres of excellence, such as the EBRC.
- There should be increased support for strategic research institutes and higher education institutes. Many strategic research institutes are within the HEIs and these should not be overlooked.
- A mix of basic and applied (economic impact) science should be retained rather than the focus becoming solely on the latter. Basic science leads to applied sciences so it is important not to become too focused on specific outcomes.

22. How can we ensure that the 2 way flow of knowledge from science to policy and from policy to the academic community is optimised?

- Science works better under a framework rather than by addressing short term reactive projects. Space to manoeuvre through the sponsorship of scoping studies enables and encourages high levels of communication between scientists, policy makers and stakeholders.
- Help make science a more attractive and less temporary career. Without scientists there will be no flow.

23. Are there alternative structures/systems or new approaches/organisations that could enhance these flows?

- In order to maximise the knowledge resource base in the scientific community, it is important to bring together organisations that share common interests and goals. For example, The Roslin Institute is a member of the Easter Bush Research Consortium (EBRC), which brings together over 500 scientists from The Roslin Institute, the Moredun Research Institute and the Animal Sciences Researchers of the Scottish Agricultural College. The partnerships within the EBRC, and integration with clinical practice and education in the Royal (Dick) School of Veterinary Studies, provide major opportunities for application and exploitation of the research of the consortium partners.

Together, the EBRC forms one of the largest groups focussed on the biology of companion and production animals in the world. It undertakes basic and translational science to tackle pressing issues in animal genetics and genomics, development, health and welfare and their implications for human health.

EBRC research has a large focus on animal and human health and this includes identifying new and emerging diseases that can pass from livestock and wild animals to humans and understanding the ways in which these diseases work. EBRC scientists with common and complimentary interests in research work closely together to develop effective disease controls and treatments, improved food safety, improved animal welfare and sustainable management of farm animals.

Members of the EBRC have agreed in turn to join a partnership, the Scottish Partnership for Animal Science Excellence (SPASE), which aims to develop joint programmes and infrastructure under a pooling initiative. This partnership of scientific excellence and relevance in the animal biosciences has the aim of exploiting the existing excellence in Scotland, pooling its research strengths and enhancing further its international competitiveness.

The principal players will include universities and research organisations from across Scotland but it is expected that they would attract additional collaborators from the HEI and FEI sectors, industry and end-user communities.

24. Are there science delivery models which could provide examples of good practice for Scotland to follow?

- See response to question 23.

General Comments

25. We would also welcome any other general comments you may have on any of the issues raised in this document.

- We wish to re-emphasise the two key themes that will contribute to longer-term policy relevant science
 - Maintenance of research capacity for genomics, which is pervasive to all policy issues
 - Creation of joined-up data collection, curation and analysis.