

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

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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?

These two broad themes are both of major relevance to the science which informs rural affairs. Because rural areas reflect and represent a complex combination of social, economic and environmental processes and systems, it is important that the science embraces both social sciences and biophysical sciences. This is emphasised in the section in Section 3 dealing with generic issues. We are convinced of the need to develop better evidence-based policy and concur that the evidence base needs to build on both biophysical sciences and social sciences. We also agree with the need to make evidence available to policy makers in appropriate form and the need for the evidence base to be integrated.

The first broad category acknowledges the need to undertake science to explore how rural Scotland can adapt to global drivers and we support the assertion of this need. However, at the same time, it is important to realise that both global and local drivers interact to frame opportunities and desirable adaptive strategies. The science agenda thus needs to explore the interactions between global and local drivers and processes.

The desire to undertake science which supports optimising the potential of Scotland's natural assets seems unduly fixed on a world view that implies that optimisation is possible. In a pluralist world of contested values, the way in which we should use natural (and other) resources is likely to be both negotiable and mutable, and subject to considerable uncertainties. Optimisation suggests a degree of precision and unity that we do not believe can be anticipated in the social realm or indeed in any complex socio-ecological system. The emergent discipline of sustainability science acknowledges the difficulties of optimisation and the need to accommodate diversity of value and opinion. We agree with the importance of managing natural resources in a sustainable way, and consider that the application of the precautionary principle has merit to avoid undermining the natural asset base. However, we advocate a more informed view of social actors and human values that accommodates diversity and necessarily creates

uncertainties and negotiated outcomes rather than optima.

We concur with the stated view that this science agenda cannot be seen as exclusively rural. The same imperatives of sustainable production and consumption must underpin the pursuit of sustainable economic growth at a Scottish level. Many of the science demands in the rural arena will inform more than adaptation and policy development in rural areas. Urban and rural Scotland are inextricably woven together. The stronger the advocacy of interdisciplinary approaches, the greater the need to develop a science-informed vision based on the territorial inter-relatedness of rural and urban areas.

2. Are the descriptions of these set out in Section 3 (and Annex 3) comprehensive?

The descriptions are broad and reasonably comprehensive. Climate, trade and demographics are all highly important factors in driving change. But the capacity for endogenous wealth creation and competitiveness are also major drivers, as is the capacity for continuous innovation in sustainable production. The research agenda needs to be informed by geographical literacy. There are major differences in well-being over space; and there are major differences in the density of population and the accessibility and use of rural space. In spite of time-space compression in a globalised world, these geographical contingencies shape adaptive possibilities in rural Scotland and remain inadequately understood.

We see a danger where example drivers such as those listed are mentioned, that others may be seen as less important. Of those listed we agree with the prioritisation of climate change as an issue of major importance, given recent evidence of escalating anthropogenic climate forcing. However, we would ask that a longer list of drivers be kept in mind and that a breadth of analysis is retained.

By categorising into two broad areas there is a risk of over-simplifying the nature of pressures for change, leaving all other aspects of change within one sub-grouping. All other changes, including those in economic context, demographics, consumer behaviour, social attitudes appear to be presented under within the sub-category of 'Globalisation, trade and other'. This may convey a sense of imbalance in relative effort, with insufficient weighting being given to any context other than that of climate change.

The definition and interpretation of 'policy choices in Scotland' should be considered in light of more explicit definitions of policy. Questions of the level of policy should be made explicit, with policy impacts *on* Scotland being considered of equal weighting to those *in* Scotland. A 'watching brief' suggests an overly passive attitude. For example, the impacts of energy generation options should not only be seen as happening external to Scotland, rather the implications for Scotland's natural resources and economy can be considered in relation to issues of governance and policy impact (e.g. planning and energy policies as they affect Scotland).

As the document is currently written, there is insufficient read-across between the two headline issues. It could be more effectively presented by restructuring the theme on 'climate change' within that of 'Optimising the potential of Scotland's Natural Assets', but restructuring the second to consider external drivers. This would provide better balance across the themes.

3. Do these cover the major policy challenges where science can contribute as you see them?

Science can and must contribute to enhancing the adaptive capacity of rural Scotland to meet pending imperatives relating to climate change. But natural and social science must also inform how rural economies develop or decline when faced with major globally induced economic perturbations such as are currently being experienced.

We recognise a need to nurture different types of science, including disciplinary and inter-disciplinary approaches. Linked to question 22, the issue is also one of the impact science can have, which means topic and timing. For science to contribute to policy challenges, investment is required in strategic scientific capability to enable responses to issues not yet apparent.

4. Are they likely to remain broadly relevant over the longer time horizon (well beyond the 2016 focus of this Coordinated Agenda)?

The lack of certainty with which the major issues 'well beyond' 2016 can be predicted (e.g. significant shocks to a system) means that although the headline themes are likely to remain relevant beyond 2016, by compartmentalising in the current manner the medium-term investment in capacity to address issues may be not be sufficiently adaptable to provide the most effective support to policy.

5. Do you agree with the description of support for the National Capability Theme set out in Section 3 (and Annex 3)?

Scotland's distinctive natural resource base and its geography make it imperative that there is national capability, specifically that there is capacity:

- a) to focus on those facets of the natural resource base that are distinctive and
- b) where the management of these has capacity to shape national well-being and underpin national wealth creation; and
- c) where the mismanagement of these resources - whether fishing stocks, fresh water or carbon reserves - has capacity to undermine national wellbeing.

We welcome the inclusion of intellectual resources within the national capability of Scotland. However, there should be recognition that national capability is also funded by non-government sources, including commercial and charitable organisations. This includes intellectual capabilities, and datasets. It is not apparent from the current description if the Scottish Government proposes to create conditions for added-value to the combination of private and public sector resources, including appropriate mechanisms for enabling access and long-term investment.

We also consider that there is a case for considering which of the elements of distinctiveness need most to be supported by national capability. National capability extends to social science as well as natural sciences.

6. What facilities, resources and data do you think are important for Scotland to maintain?

It is desirable to have up-to-date and reliable data on any social, economic and environmental systems that are or have recently been threatened by overuse, mismanagement or adverse effect arising from external pressure. Some of these facilities are necessary for compliance with European legislation (e.g. water with regard to the Water Framework Directive or fishery stocks for compliance with Fisheries legislation). Equally, having world class capacity in the investigation of carbon seems desirable given the high volumes of carbon sequestered in Scotland's soils.

As well as having good biophysical data a deeper and more sophisticated awareness of the contributing factors to rural well-being may be needed, especially in relation to understanding the capacity of rural Scotland to adapt to low-carbon lifestyles. This type of knowledge requires not only an understanding of biophysical processes and conditions but also a knowledge of societal adaptive capacity and creativity and the ability of a future rural Scotland to generate sustainable livelihoods in a transformed and dynamic world.

7. Are there other resources that Scotland needs to acquire to support future policy development?

Scotland has a relatively strong natural sciences base and has been able to retain this substantial national asset when it has been diluted in many other countries. We should nurture and treasure this national capacity. We are, however, concerned that there are many gaps in the understanding of social and economic well-being and rural areas and the complex socio-economic interconnections between rural and urban areas. We would like to see national capacity enhanced in the social sciences relating to rural areas, in relation to a number of areas including, in particular, the management of transitions towards a low carbon economy, a deeper notion of well-being embracing quality of life as well as narrowly defined financial parameters

(including health) and the collaborative improvement of governance regimes over natural resource access and use. All of these require spatial understanding and awareness of issues relating to cohesion and inclusion. Maintaining and enhancing intellectual capacity, and the development of methods as envisaged in Section 3, requires mechanisms for access to knowledge from wider international networks outwith those of the European Union (e.g. North America, Australasia, Asia). Current mechanisms do not resource direct involvement access in more global initiatives. New programmes of funding targeted at non-European collaborations would enable Scotland to contribute to, and draw on, international skill sets in a more effective manner

Policy Issues

8. Have we correctly identified the key policy issues and the associated scientific opportunities in Section 3?

In terms of policy issues, we support the strong emphasis on climate change. We concur with the findings of the Stern Report that climate change is almost certainly the greatest negative externality the world has ever faced. This creates a need for evidence-informed policy on both the possible adaptation of the land based industries but also a need to understand societal adaptive capacity. Far more people live in rural Scotland than work the land. So what is needed is better biophysical science to inform land management adaptation and better social science to inform how people might behave in response to unparalleled challenges to their lifestyles. Wrapped up in this discussion of policy is a need to explore the multiple policy possibilities of carrots and sticks and how behaviour change might be effected.

We concur to with the need to have a policy framework which supports Scottish economic development. In part, this requires underpinning natural science to address threats such as animal diseases, but Scotland's economic success is also contingent on having an informed adaptable workforce, operating within an innovative milieu, supported by state, industry and third sector. We think that Scotland could learn from the social science addressing policy issues such as rural regional development in Nordic countries and more widely, especially that research exploring the triple-helix type approaches to engendering development and some of the transition management theorising developing in the Netherlands and elsewhere.

9. Are there additional issues that should be included?

These are touched on above. We think that the overall CAMERAS ethos is sound but that the social sciences component, which is clearly flagged as important, needs to be strengthened. The negotiation and contestation over natural resource use, the growing debates about future securities, and the

overriding imperatives towards sustainable use and effective responses to climate change create a need for an informed and multi-disciplinary social science with economic, sociological, anthropological and psychological components and spatial awareness.

Rural areas can contribute to all the headline objectives. RERAD could better capture those multiple roles than it currently does, by building social science capacity and strengthening inter-disciplinarity throughout its commissioned research.

The generic issues of a scientific nature, identified in Section 3, included recognition that methodological development *may* be required. This will certainly be the case, both in ways of working (e.g. linkages between those developing policy, and those contributing to a robust evidence base), and this should be reflected in the process of research as well as mechanisms of knowledge exchange.

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 most important influences can be simplified to those of climate change, global economic conditions and social demand. The ongoing change in the balance of between urban and rural populations, and consequent pressures on infrastructure (e.g. transport, energy) and land use leads to needs for choices and trade-offs between the services expected from the land and sea.

In the current economic down turn maintaining investment to enhance natural resource management – in particular soil and water (fresh and marine) quality and the ecosystems they support. Also, critical is the speed with which policy changes can deliver on necessary, but still aspirational, GHG emission reductions and wider sustainable development targets. Critical to this is that government recognises the true value of ecosystem goods and services, and meaningful ways of changing behaviour to reduce our environmental footprint, both individually and collectively.

11. Why do you think these are important?

The assessment of importance of influences is one for research. However, to achieve Scottish Government aims of increasing sustainable economic growth, alongside enhancing the natural environment, there will be consequent competition for natural and economic resources. Therefore, better understanding of the functions of the land, and the services supported, with effective communication of the necessity of choices, and nature and timing of opportunities is more likely to gain public support. Without this, the interpretation of what constitutes an environment to be enjoyed will not be deliverable. Affirmative action based on the current evidence-base is a minimum requirement to slowing, let alone reversing, environmental degradation.

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

The recognition of the need for greater integration across an interdisciplinary evidence-base requires more effort in synthesis of existing knowledge. In many cases this will require more realistic conceptual and mechanistic models to capture key natural and social processes in the same framework. As a result ways to evaluate the synergies and trade-offs between different ecosystem goods and services, especially under different scenarios of interacting drivers of change, is a major challenge. This requires a better understanding of i) market and non-market value of ecosystems goods and services, ii) behavioural change of individuals, business, institutions and government, and, in-turn, iii) the potential influence of different policy interventions on human-environment interactions.

The Science

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

The SNIFFER "Initial Scoping Review of High Level Strategic Themes...." identified knowledge gaps which could hamper progress in delivering on a number of key sustainable development issues. Implicit in this review is that there is a need to maintain directed research across a range of natural, social and economic science. However, above all else there is explicit recognition of a need for increasing integration through closer collaboration between scientific disciplines and research institutions focused on the same specific goals.

Of course, a corollary to this question is "What areas should we drop?" Whilst some change in direction is inevitable in a research environment, it would be a mistake to cut vast swathes through whole areas of science just because their immediate relevance to changing policy issues is not apparent. See also answer to Q21.

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

The relationships between science and policy are increasingly clear although science and policy work with different timescales and on the basis of different questions. Clarity in linking scientific areas and policy issues can come from new institutional and working relationships that allow the combined expertise and knowledge of policy groups and scientists to be focused on policy issues. Support could be provided for synthesis or cross-cutting programmes that deliberately address policy issues within timeframes of relevance to the policy makers and issues. These programmes would complement research programmes that address strategic, applied, and basic science that follow more traditional scientific processes and protocols and enable the Scottish

science base to network and collaborate with other scientist worldwide. This dual approach of research programmes and focussed synthesis programmes is increasingly recognised with international efforts such as the Millennium Ecosystem Assessment and Intergovernmental Panel on Climate Change demonstrating the benefits of synthesis of research knowledge and expertise on issues of high policy interest. In Scotland similar synthesis efforts show focussed contributions to policy debate (e.g. Royal Society of Edinburgh Committee of Inquiry into the Future of Scotland's Hills and Island)

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?

The science base in Scotland has strong links to other areas of expertise supported from elsewhere; scientific progress depends on networks and processes that encourage collaboration. Resources and support are needed in Scotland to allow networks and collaboration to develop. Resources and support include funding and agreements between Scottish and UK Governments that provide Scotland's science base full access to competitive response mode funding from UK Research Councils, match funding for participation in European and international networks and research programmes.

This question seems to ask "what areas of science can we outsource?" It needs to be stressed that whilst we can collaborate successfully with UK, EU and International scientists, there are particularities associated with Scotland's geography (in the broadest sense of the word) that mean relying on work from other areas to inform Scottish policy could be a mistake.

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?

We identify the following as new emerging areas of science:

- Ecosystem and sustainability assessment framework approaches to resource evaluation and planning
- Risk based approaches to function and health of soils, catchments, and landscapes
- Institutional and governance issues
- Climate or carbon proofing major policy directives such as the WFD
- Molecular biodiversity profiling and characterisation
- Evolution of the consequences of habitat fragmentation on biodiversity

- Consequence of global change (especially energy and food prices) on current land use and farming activities

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

Through collaboration across Institutes and research providers, and through the development of innovative and integrated research constructs and themes, many of these issues can be addressed. What is also required is a more consistent realisation that a systems approach to science must be supported which will underpin development options and promote sustainable economic growth. Artificial (usually institutional barriers) between air, land, water and marine science must be minimised.

Increasingly science must be integrated into policy and planning at an earlier stage and there will be a requirement for specific “policy research” evaluating options to provide strategic guidance for the Scottish Government on options, to enhance “win-wins”, reduce duplication of effort, and to remove conflict between different policies.

The ability to respond rapidly to emerging issues such as global economic drivers, trade, energy, and environmental and human health requires maintaining a national science capacity of recognised international excellence, through which to help adapt, protect, Scotland’s people and their environment.

The recent “Science for Scotland” Paper highlighted that Government will in future prioritise *both* research excellence *and* strategic knowledge exchange involving demanding businesses given the need for both to secure sustainable economic growth. This will only be achieved with an increasing synergistic engagement between the science, policy, industry, stakeholders and the public, and the support of an innovative and enabling research portfolio.

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

The purpose of self-reliance in certain areas of science requires clarification. These can be summarised as:

- (i) Independence from changing priorities in investment in regions, which may not share issues with sufficient similarity to Scotland, thus reducing the relevance of research to Scottish policy;
- (ii) Proximity of advice and support on science for policy for Scottish

- Government and its agencies;
- (iii) Targeting of issues of particular geographic or contemporary importance.

With a capacity to deliver on these demands it can also contribute to Scotland's comparative advantages and thus competitiveness. A reputation for sound policy, based on high quality evidence, will also enable Scotland to provide international leadership in selected areas.

Scotland must ensure that it has a competent national science capacity with specific focus on the challenges faced by its people and environment. Understanding trade off between land use, climate change, and energy will be one key area of understanding needed for the future. The protection and enhancement of Scotland natural assets – water, soil, biodiversity along with its people and culture through understanding natural and social processes and behaviour provides a mechanism for resilience in a changing world. Scotland must maintain disciplinary depth in earth system and social sciences, and the intellectual capacity to deliver interdisciplinary solutions and to provide a supportive environment in which such approaches can be 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

Knowledge exchange should continue to be an explicit and integral aspect of delivery of the coordinated agenda. It must, however, become more fully embedded within both the thinking and the processes of how we do both science and policy. This embedded approach must be reflected in changes to the work practices and programmes of scientists and policy-advisers and makers. These should be multi-lateral **partnerships** rather than what has been historically a linear path whereby science is expected to feed into policy with management of the activity mostly from the science side.

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?

As suggested above (Question 14), specific synthesis programmes allow provide a mechanism and forum for integration of evidence from a diverse range of sources into forms that are accessible to end users. Key to the synthesis activity is that it is an active, managed and focussed partnership and collaboration between the different groups and individuals who produce and use the evidence. Synthesis programmes may be carried out over shorter or longer time periods depending on the policy and end-user need. They may be established and report quickly for some policy issues, or act as

'rolling' synthesis activities over a longer time period and continually integrate new evidence as scientific progress is made. The IPCC, with a series of reports, is an example of the latter, longer-term and rolling synthesis activity. Consideration should also be given to networks of knowledge exchange actors, whereby communication is phased, the targeting of different types of audience, and the significance of the scale of authority or responsibility.

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?

Funding focussed synthesis programmes that are responsive to short term demands and research programmes that are focussed on strategic research provides flexibility and is a mechanism for management of both of the objectives expressed in this question.

One answer to this, is to fund a set of strategic long-term, wide-ranging interdisciplinary studies. Through these, scientists will have the evidence and have developed theory underpinning it (i.e. this is more than just monitoring) such that they are able to answer policy questions in the short term. The scope of the studies should be wide enough to cover not only policy issues in the next five years, but the next ten, and the next twenty. It is for this reason that areas not of immediate policy relevance should not be cut (see Q13).

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?

The use of the word 'optimised' is to understate the importance of multiple communication channels, each for different purposes, and operational over different timescales. As for question 20, synthesis programmes would be designed to manage the required 2 way flow of knowledge from science to policy and from policy to the academic community. These activities would require commitment from policy groups and individuals; an advantage is that the two way flow would be based on relationships, collaboration and communication. At the moment there appears to be a lack of critical capacity at the science policy interface. This does not require the creation of any new institutions but rather the development of different ways of working together where the value of "shared or co-learning" is emphasised and rewarded.

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

Changed working practices and expectations would be required for synthesis programmes to be effective. However, establishing funded synthesis programmes alongside research programmes would clarify expectations and working practices. As identified in question 22, effective two way exchange should be based on effective relationships, collaboration and communication, rather than on structures, although establishing an ethos and working practice of engagement between scientists and policy advisors and makers would be facilitated by support for synthesis programmes and activities as structural mechanisms

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

There is extensive work on Boundary organisations reported in the literature with examples of successful organisations employing these methods around the world. The proposal for a New Institute based on Macaulay Land Use Research Institute and SCRI explicitly recognises the contribution and role of synthesis and collaboration between science and policy in the design of the New Institute and in identifying that the new Institute would be a boundary organisation. Similar recognition is needed from the Scottish Government with respect to its own role and participation in better links between science and policy.

General Comments

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