Science Advisory Council

Defra Science Advisory Council (SAC)

Minutes of meeting, 9th March 2022

Actions arising

Action number	Action	Owner
March (22) 01	Workplan: Schedule an update to reflect: (1) CSA/SAC interaction regarding the National Science and Technology Council, and (2) Natural Capital & Ecosystem Services (NCEA) - measuring and monitoring process and Horizon EU.	SAC Secretariat
March (22) 02	Pairing Scheme: Develop to include partnering with the Research and Development programme.	SAC Secretariat
March (22) 03	SAC opinion piece: Review the key matters raised during the SAC closed discussion and extract these to compile the basis of a SAC review document on their approach to systems thinking.	SAC/SAC Secretariat
March (22) 04	Meeting papers: The SAC secretariat to ensure papers presented are provided with sufficient detail on key supporting resources and links with other teams/individuals, where possible.	SAC Secretariat

1. Welcome and apologies

The Chair welcomed attendees, apologies are recorded in Annex A.

2. SAC reflections on working dinner

The previous evening's working dinner (8th March) was a valuable opportunity for the SAC to collaborate face-to-face following the lifting of England's COVID-19 restrictions and considerable changes in its membership, including the appointment of a new Chair in July 2021 (Professor Heathwaite). Guest speaker, Professor Sir Charles Godfray provided an overview of the Royal Society's Multifunctional Landscape Report (in production), defining its aims and emerging conclusions, and giving the SAC an opportunity to review the findings and provide informal feedback. Two recently departed SAC members, Professors Moore and Wood, provided an overview of their time as SAC members.

Professor Heathwaite opened the session and reflected on the conversations that followed the Royal Society report briefing, noting that the SAC had spent considerable time discussing social implications and that it is critical these

discussions are supported by data. It was not clear to the SAC if the relevant data is available or if more data needs to be collected. Furthermore, the Chair suggested there might be a knowledge gap at the catchment scale and that during the day's meeting it would be beneficial to explore if this is reflected in Defra's and the SAC's thinking.

When reviewing the evenings discussion on environmental land management schemes (ELMS), linked to the Royal Society report, the SAC questioned if those on the ground (e.g. landowners or farmers) know what needs to be done to achieve any given policy goal and asked how best Defra can provide them with the science to support any given intervention. Reflecting on individual experience the SAC described how farmers often do not know the relevant course of action to reach an externally set goal; the SAC considered uncertainty in an individual's role to have been reflected in some of Defra's past SAC meeting papers. The SAC suggested that assessments of how policy translates to those working on the ground would be valuable. The CSA noted that Defra is engaging with those on the ground to ensure they are best informed, yet this will take time and different approaches to this might need to be trialled across the system. A robust design of science communication is needed to move the discussion from focusing on independent users to broaching complex challenges at a landscape scale and this will in turn require a reliable evidence base; the SAC agreed that methods for achieving beneficial communications (between individuals, communities, and government) would benefit from future SAC review and discussion.

The SAC acknowledged that measuring small areas and considering them representative of larger areas might not be reliable and agreed that there was a lack of evidence at a landscape scale. To address the scale gap establishing 'real world laboratories' would deliver evidence at landscape scale facilitating assessment of government interventions. By gaining landscape scale knowledge Defra would be able to better understand what interventions deliver multiple benefits at scale and the intricacies of landscape configuration (e.g. how landscapes and their systems are connected). In turn, large scale data will help Defra in achieving multiple targets simultaneously (e.g. reducing greenhouse gas (GHG) emissions and improving biodiversity). Furthermore, while the SAC considered a board understanding of social-environmental parameters could facilitate change towards a set goal going forward, it was, however, emphasised that establishing monitoring after any given change/intervention has taken place is not enough, baseline monitoring should first be established to enable accurate assessment of change.

The SAC considered how the dynamic nature of landscapes (across time and space) and complexities of connectivity (regarding both connectivity within the landscape

and how landscape issues are cross discipline), will need to be reflected in policy configuration.

The CSA reflected on the sense that the SAC can offer the most value to policy teams (and government more generally) when talking about the science in an authoritative way; the opinions and decisions of politicians will be influenced by many factors and the SAC can help best inform them, by providing robust scientific analysis to help focus the debate. The CSA noted that past concerns regarding a lack of grounding in good science are being addressed by Defra with a desire for further improvement. The SAC agreed and added that their role go beyond simply examining existing evidence; with robust interdisciplinary considerations the SAC has the capacity to examine the intricacies of a given issue, enhancing their input through a process of internal dialog and debate across a spectrum of expertise.

3. Chief Scientific Adviser (CSA) update

The National Science and Technology Council (NSTC) is a new Cabinet Committee, established to make the strategic decisions needed to deliver the UK's ambitions, and propel science and technology to the heart of government business. It is designed to make decisions on the end-to-end steps needed to gain strategic advantages from science and technology. It will look at everything from funding of research through to the procurement, deployment, and uptake of science and technology for wealth, health and social benefits; the CSA could consult the SAC on elements of this in the future. Defra is looking at the institutional landscape in relation to a review of Research and Development (R&D). There is a current review of UK Research and Innovation (UKRI) which would provide scrutiny of performance and assurance that UKRI is achieving the core objectives that led to its creation, and an assessment of its readiness to contribute to the UK government's ambitions for the future of research and innovation.

Defra is examining the evidence to enable an informed decision regarding the use of neonicotinoids in sugar beet seed treatments, it was noted that there is a finely balanced scientific navigation. In relation to Gene Editing and parliamentary activity, secondary legislation to ease the regulatory process for the environmental releases of certain genetically modified plants for the purpose of research (possible innovations to improve agricultural crops) has passed through the House of Commons and would be debated in the House of Lords on the 14th of March 2022. There would be a public consultation on the Environment Act legally binding targets; it was noted that the SAC had previously advised on target setting. In terms of future interaction with the SAC it is probable that the CSA would seek advice on the Natural

Capital & Ecosystem Services Assessment (NCEA) measuring and monitoring process.

Given the current situation in Ukraine, Defra is actively looking at the implications for food supply, and scientific links with Ukraine.

Finally, the CSA thought that in terms of developing the Defra/SAC pairing scheme it would be helpful to widen the reach to include partnering with the R&D programme.

The SAC raised Horizon Europe, the European Union's (EU's) key funding programme for research and innovation. Under the Trade and Cooperation Agreement with the EU, the UK would associate with Horizon Europe, but ongoing delays are causing uncertainty to the research community. The SAC touched on potential reputational damage of the UK's exit from the EU, and it was agreed that a future SAC discussion around this might have merit. The CSA confirmed that the Horizon was a Department for Business, Energy & Industrial Strategy (BEIS) run programme.

ACTION March (22) 01: Update SAC workplan to reflect: CSA/SAC interaction regarding the National Science and Technology Council. Natural Capital & Ecosystem Services (NCEA) focussing on the measuring and monitoring process and Horizon EU.

ACTION March (22) 02: Secretariat to develop the Defra/SAC pairing scheme to include partnering with the Research and Development programme.

4. SAC session: systems approach – coordinating the SAC's perspective

The Chair opened the session by acknowledging the benefits of in person discussion hoping to utilise this opportunity to draw out a collective understanding of 'systems thinking' within the SAC to help in the framing of questions to Defra. It was acknowledged that individual SAC members will have their own perspectives regarding 'systems thinking' and that collating these and forming a shared understanding is key.

The SAC agreed that a universal understanding between members would be beneficial. It was acknowledged that an understanding of 'systems thinking' is limited when discussing it in the abstract and that it is often beneficial to have a specific example of how systems thinking is needed to focus the discussion. A key aspect raised was the ability to define a system and its boundaries in any given example,

deciding what is needed within the system versus what can remain external (e.g. using a reductionist approach). The need to transition from establishing the full potential network at the outset and then refining this to a useful network, amalgamating and simplifying the systems model to reach maximum efficiency was emphasised. The SAC considered a better understating on the relative strength of key connections following systems simplification helpful in the understanding and prediction of dis-benefits alongside unexpected benefits.

The SAC questioned to what extent a criterion for systems thinking is helpful and if there is an underlying concept that defines how elements of a system are connected. The way in which the SAC can input/impact on Defra's approach to 'systems thinking' was questioned, noting if their input could not be incorporated then they might be left at an impasse.

The potential difference between systems education and systems modelling was considered; the former being a means to expand the thinking of a given team to consider the consequences across a whole system following any given action, the latter a means of creating and defining a systems network to assess what is a useful consideration and what can be ignored.

The need for systems thinking with regards to the UK's resources and what might be lost because of any given action/policy was highlighted. One given example was the loss of complexity resulting from a lack of data of non-linear associations of real word relationships. The SAC outlined some key considerations they believe should be at the forefront of a systems approach:

- There needs to be an understanding of the least fungible elements of an environmental system such as key biodiversity sites (e.g. ancient woodlands) versus those which have greater fungibility (e.g. carbon).
- It should be acknowledged that not every component within a system is equal and as such there should be an appropriate means to weight certain components.
- System boundaries shouldn't be set solely based upon Defra's interests but should be linked across government with consequences needing to be considered throughout the whole system (e.g. improving health via reducing inequality). Defining how to think about the whole system is therefore crucial given policies are made by many organisations, without a 'systems approach' their work may trigger unintended consequences that could have been predicted/prevented if a systems thinking approach was used.

- The appropriate level(s) of detail to pitch 'systems thinking' to government policy teams and other relevant persons (e.g. ministers) needs to be assessed before the model is rolled out across government.

Reflecting on the systems tool (shared with the SAC prior to the meeting), the SAC thought the addition of a means for users to easily identify the most highly sensitive individual nodes across the whole system was needed, alongside a means to identify at risk sub-systems. Identification of highly sensitive nodes and/or areas that need further thinking would require appropriate data and knowledge and it is aspect that the SAC might be able to add most value.

The CSA agreed with the comments raised by the SAC adding that given the way in which government policy creation operates (e.g. through the work of individual policy teams) there is an increasing need for individual teams across government to have an appreciation of the system thinking approach to help understand/identify potential consequences of any given action (intended or unintended). It was, however, acknowledged that using a full 'systems thinking' approach would increase the time it takes for policy to be produced and likely make it more difficult to act on. As such, the CSA agreed there needs to be careful consideration as to how in-depth the process of systems thinking needs to be for any one person/team and that getting the level right is a critical aspect that needs to be established before widespread rollout.

In closing the session the Chair reflected on the SAC's conversations, suggesting that taken together they could form the basis of a document defining the SAC's approach to systems thinking. The key matters raised could thus help the SAC to work more coherently going forward.

ACTION March (22) 03: The secretariat to review the key matters raised during the SAC closed discussion and extract these to compile the basis of a SAC review document on their approach to systems thinking.

5. Systems - Land use trade-offs and Net Zero System

The Chair opened the session by thanking the Systems Research Teams in Defra and the Net Zero Systems team in BEIS and noting the paper presented demonstrated this project was an excellent example of cross-government collaboration.

Defra and BEIS officials provided a summary of the Net Zero Systems Tool and showed how it could support policy officials dealing with highly complex systems by

allowing them to be aware of the whole system while focusing on sub-systems or their individual components.

Officials described how systems thinking is already being used in several areas across government work and that the process of embedding the tool was underway. It is hoped that the broader adoption of systems thinking principles will help teams connect, break down siloed thinking, and allow for broader interactions across government.

The SAC's initial feedback on the net zero systems tool was that it was an attractive means to display and help in the understanding of the non-linearity of complex systems. SAC suggested that the tool should be further enriched with social aspects of land use and land use change system.

The Chair closed the session by suggesting to the team to reflect how best the SAC can help with the tool's embedding going forward and encouraged conversations to continue outside of the meeting.

6. Land use - science perspective

Defra's Land use and planning directorate has set up land use change project to collect and use data to support the policy process that needs to balance the land use demand for housing, infrastructure, food, ecosystems, and the green energy transition. The first phase of the land use change project documented the case for change in land use while the current phase highlights what change is needed and how actions would add value. The aim of the current phase is to provide Defra with the evidence and capability to develop a strategic and operational framework for land use change. Defra's land use R&D budget is part of the Net Zero R&D funding that was distributed to subject areas, with £6.6 bn of funding now available for land use R&D between April 2022-2025. The research programmes focus on four research areas: land use target development, behavioural modelling, spatial land allocation modelling, and assessing of social, economic, and environmental impacts of land use change. The SAC were asked for their views on the project's framing specifically around what might be missing, the research questions, and ways to maximise transdisciplinary research.

<u>Social aspects</u>
The SAC asked what Defra meant by sustainable, describing that behaviour was a key aspect. It would be necessary to parametrise behavioural models and factors of participation and spatial land allocation. The behaviour modelling which is based on land managers should also account for other changes such as organisations buying

land for carbon offsetting or changes in diet. The SAC asked Defra to consider the social and cultural importance of land use and to think about how the impacts move upstream to political and social structure rather than purely on its impact on land. The SAC thought that a systems approach was required to identify the interactions, expand the remit as all land use change will impact politics and behaviour. The Defra systems team are involved and provide behavioural and social aspects to the project.

The SAC asked about the impacts of land use change on heritage and culture. Defra confirmed that heritage layers are included within the spatial model to filter out land use change.

Technical aspects

The SAC returned to their earlier discussion on establishing real-world laboratories to test and validate assumptions in Defra's land use models, suggesting this could be achieved by partnering with non-governmental organisations (NGOs). The challenge of modelling to integrate a levelling up component to capture the value of the natural environment was also noted.

The SAC wanted to know more about the granularity of the spatial land use model with different resolutions being important for engaging with local groups. The scale for modelling will need to vary for use, with an example of a 1 km gridding being used for an estuarine catchment and for economic models, whereas a field boundary resolution is better suited for farmers and landowners to reflect landowner agreements. Using the resolution of field boundaries can make it difficult to compare datasets temporally because fields get aggregated and divided over time. Connectivity needs to be represented to highlight ecological diversity, and habitat corridors and size with this being difficult to capture at varying scales. The SAC also commented that when combining variables, it is important to account for what variables have good or bad data and differences in resolution, otherwise averaging between them will not provide useful outputs. Defra explained that the systems tool will not focus on one scale but can select different scales to process input data on demand. There will be a need to account for a landownership resolution because this will determine the complexity of producing land use agreements. Finally the SAC wanted to know how climate change scenarios could be included to assess resilience of different land use types and local communities relating to differing climate scenarios.

Successful examples

The SAC provided an example of a well-run interdisciplinary programmes relevant to the land use project was the Rural Economy and Land Use (RELU) programme

which involved many research councils and started with the social-scientific considerations. There is also a joint project to reach harder to reach rural farmers by the Universities of Sheffield and Reading.

Defra's land use tool will be created by combining developed models and tools from arm's length bodies (ALBs) and other departments. This will hopefully make it useful for all types of user and for ELMS projects. Conceptually the tool could be similar to the biodiversity offsets model which is gridded at 1 km where inputs are incentives/disincentives with added market prices and biodiversity to calculate the best pricing for each grid square based on the initiative chosen. SAC also suggested that there is also a good example of combining multiple indices, also looking at the input data for the deprivation index provides more valuable insight for social economic aspects.

The Scottish representative highlighted a project that the Scottish Government is working on that envisages what the Scottish landscape should look like by 2025 and 2050 if all net zero, biodiversity and thriving rural economy targets where met. The project is achieved through three compartment models: technological solutions that can be added as filters to support research grants, a Scotland digital data platform to collate data, then operational tools.

7. United Kingdom emissions trading scheme (UK ETS)

The Net Zero and Carbon Budget team in Defra presented plans to publish a consultation package on developing the UK ETS, led by the UK ETS Authority. The consultation package has since launched and is available on Gov.uk closing for responses on the 17th of June 2022. The UK ETS launched in January 2021, succeeding the EU emissions trading system (EU ETS) and currently covers approximately one third of the UK economy. The package includes three calls for evidence relevant to Defra sectors:

- Reducing emissions from waste – a call for evidence on expanding the UK ETS to include waste incineration and energy from waste.
- Reducing emissions from agriculture and land use – a call for evidence on how emissions can be suitably measured, reported, and verified.
- Greenhouse gas removals – a call for evidence on the role the UK ETS could have as a future potential market for sequestration units.

Permanence

Defra sought SAC advice on how to resolve issues of permanence within monitoring, reporting, and verification (MRV) in the agriculture and land use sectors. The SAC advice focussed on soil organic carbon measurements.

The SAC advised that if agriculture and land use sectors were to ever be included in the UK ETS, there will be a need to be clearly specified carbon storage timeframes to avoid the assumption that carbon is stored permanently. In the UK, calculations for long term carbon storage such as tree planting relies on the world leading Woodland Carbon Code, which does account for permanence in the methodology and aligns with the Intergovernmental Panel on Climate Change (IPCC) approach. The SAC advised that measuring total soil carbon can be more difficult as there are several methods and aspects to measure, such as soil organic carbon or mineral associated carbon. The SAC suggested an option could be disincentivising activities that deplete carbon in the soil, accounting for the complexity of different soils, rather than a need to quantify the soil carbon. In addition, covenants were suggested to protect long term soil carbon improvements. For Defra to achieve the necessary scale of soil carbon sampling, innovations in remote sensing would likely be needed (e.g. development of a hyperspectral library of soils chemistry).

The SAC thought there is a role for government regarding farm/land-based carbon audit tools to achieve robust MRV. There are a variety of tools developed by private enterprises, so the SAC advised there is a need avoid the confusion in the current market.

Ecosystem and voluntary markets

Defra sought the SAC's advice on the relationship between the UK ETS and other ecosystem markets (e.g. water quality and biodiversity), as well as with voluntary carbon markets. Better standards and rules, such as carbon or other ecosystem codes help to validate investments and direct investments to the correct projects. Defra officials also acknowledged the need to consider the relationship between ecosystems markets and public funding, asking if they should be standardising farm-level auditing for voluntary markets.

The SAC raised in discussion how carbon markets could work alongside other ecosystem markets without compounding benefits. They noted the potential for increased complexity and confusion around how broader ecosystem markets might interact with the UK ETS, as well as with Defra schemes which reward environmental land management, or biodiversity net-gain schemes.

Methane

The SAC also noted that if methane is included in the UK ETS, it must be done in a way that avoids exchanging methane (CH_4) emissions for carbon dioxide (CO_2) emissions which have a longer atmospheric lifespan. The SAC recommended Defra adds a carbon protection checklist.

Energy from Waste

The SAC asked how extending the UK ETS to waste incineration and energy from waste could be achieved without causing a perverse impact on landfill and recycling. Defra officials advised analysis is currently being conducted on how to avoid negative effects of adding a higher price to waste incineration and energy from waste facilities which could increase waste to landfill or reduce recycling.

8. Wrap Up Session

This was an opportunity to reflect on the meeting papers and discussion and identify connectivity between themes and cross cutting connections to Defra's agenda.

The SAC's considered their discussion on systems thinking particularly helpful in consolidating their understanding and establishing foundations for the SAC to return to defra to provide their thoughts on maximising the positive impact of systems thinking. Reflection on where SAC input is most beneficial concluded that early comments and targeted feedback is key, with policy teams best able to utilise expert input when it is received at the right time.

Reflecting on the national capability of UK research institutions and research funders, it was questioned if there should be greater collaboration between private institutions (e.g. Universities, research institutions, large land managers) and Defra. It was considered that there is likely data produced within the scientific community that is not getting into government, particularly where government data gaps have been identified. As such the SAC believes Defra needs to improve communications with academic and industry experts, and data and knowledge exchange. Concerns were also raised around Defra's capacity to build on and utilise the full breadth of available knowledge if they do not have enough resources (e.g. personnel).

When reviewing land use across England and the UK the SAC first considered changes post-World War Two and how initially changes in land management were driven by economics and national security through arm's length agencies, with less consideration of future environmental impacts. The SAC also considered other European case studies as successful examples of local interventions leading to national level environmental protection of critical resources (e.g. water reserves). This led the SAC to consider best practice for negotiations with local communities or individuals who might not want to engage with government schemes.

When reflecting on Defra's modelling capabilities the SAC acknowledged that the right models need to be used depending on the questions being asked. For example, planting woodland with the aim of maximising carbon sequestration versus

facilitating recreation or improving biodiversity would all need to be modelled differently. How does Defra bring together the modelling community to address these questions/issues?

The SAC acknowledged there is still uncertainty around large scale environmental systems (e.g. the optimal grazing area for livestock) as data is currently documenting small, isolated case studies. Additionally, the speed of movement within other research and policy areas such as 'biodiversity recovery' has resulted in lots of questions being asked with insufficient time to fully investigate in detail and at scale. Both examples were used to highlight the data gaps in the modelling to test and calibrate against. The SAC discussed the option of Defra co-investing in a long-term research network to facilitate landscape scale research and in establishing a robust, open-access data sharing portal.

The Chair and CSA agreed that Defra need to be commissioning more research yet noted that there may also be data collected for alternate purposes that might be able to fill other research gaps, highlighting the need for meta-analysis.

A final reflection was regarding the SAC's insight into work presented, the SAC felt they were not always getting enough detail or supporting evidence in the papers that are provided. It was agreed that a better idea of the landscape in which the team are working is needed to give the SAC greater confidence in Defra's data/analysis, but they were unsure how to resolve this without creating substantially more work for Defra officials. While references lists were considered a good first step, it was also suggested that presenters disclose what other internal/external teams/individuals they are working with. A good understanding of what Defra officials have drawn upon in their work to date, might also enable the SAC to provide additional key resources.

ACTION March (22) 04: The SAC secretariat to ensure papers presented are provided with sufficient detail on key supporting resources and links with other teams/individuals.

9. Workplan: future SAC discussion proposals

The SAC raised two proposals for future discussions, focusing on brining individual member expertise to the SAC to broaden understanding of emerging and cutting-edge research within their respective fields:

1. Where relevant and needed, SAC members could be commissioned to produce short summary documents on current state of knowledge on specific fields. This would facilitate a broader understanding of issues at hand within the SAC, helping them identify areas of concern that might have not been

addressed by Defra or bought to the SAC for review. The CSA acknowledged that it was the purpose of the SAC to have a large expertise, so internal sessions and shared resource would help towards this goal and is something that could be explored in the future.

2. In instances where the SAC challenge ideas or work presented by Defra, SAC members with relevant expertise could look to work individually with the Defra team to produce a short research piece to support them.

10. Any other business

No other business raised.

Annex A: Attendees and apologies

SAC Members

Louise Heathwaite (Chair)
Peter Cox
Lin Field
Rosie Hails
Rowland Kao
Nick Hanley (virtually)
Susan Owens
Richard Bardgett
Felix Eigenbrod
Lisa Collins (virtually)

Defra's Chief Scientific Adviser's Office

Gideon Henderson – Chief Scientific Adviser
Rob Bradburne – Deputy Chief Scientific Adviser
SAC Secretariat

Devolved administration observers

Matthew Williams – Scottish Government Observer
Caryl Williams – Welsh Government Observer

Defra and other officials in relation to specific agenda discussion

Systems - Land use trade-offs and Net Zero System
Head of Systems, Innovation and Futures, Chief Scientific Advisor's Office (CSAO)
Team Leader, EU Exit Priority Evidence Funding; CSAO
Team Leader, Land use, Food and Net Zero Systems, CSAO
Head of net zero systems, The Department for Business, Energy and Industrial Strategy (BEIS)
Operational Research Analyst, Net Zero Systems Team, BEIS

Land use - science perspective
Land use and Planning, Land Use Programme, Environment Strategy
Land use and Planning, Land Use Programme, Environment Strategy

Emissions trading scheme
Team Leader, Net Zero and Carbon Budget Strategy, Environment Strategy
Head of Climate Mitigation Science, Climate Division
Green Finance Programme, Environment Strategy
Net Zero and Carbon Budgets

Systems: Land use trade-offs and Net Zero System
Defra secondee, EU Exit Priority Evidence Funding, CSAO
EU Exit Priority Evidence Funding, CSAO
Systems Researcher, EU Exit Priority Evidence Funding, CSAO

Emissions trading scheme
Agri-Climate Team
Team Leader, Residual Waste and Infrastructure
Residual Waste and Infrastructure
Deputy Director, Climate

Apologies
Alistair Carson – Northern Irish Observer