Social Science in the Natural Environment (SSINE)

Moving towards interdisciplinarity - integrating social and natural science in UK environmental organisations.

First published August 2022

Natural England Joint Publication JP045

www.gov.uk/natural-england

Natural England Joint Publication JP045

Social Science in the Natural Environment (SSINE): Moving towards interdisciplinarity - integrating social and natural science in UK environmental organisations

Report of project funded by the Economic and Social Research Council's Impact Accelerator Account

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Published August 2022

ISBN: 978-1-78354-919-1

Project details

This report should be cited as: Morris, C., Brockett, B.F.T., & Green, S. 2022. Social Science in the Natural Environment (SSINE): Moving towards interdisciplinarity - integrating social and natural science in UK environmental organisations. Natural England report JP045.

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Keywords

Social science, social research, interdisciplinary, people and nature

Acknowledgements

With participation from social scientists from Cardiff University, Defra, Forest Research, Natural England, Natural Resources Wales, North Pennines Area of Outstanding Natural Beauty, NatureScot, RSPB, Supporting the People who Support Nature, WWF and additional work by Dr Sara Selwood and Dr Ashley Lewis.

Further information

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Executive summary

UK natural environment organisations (NEOs) are experiencing a social science ‘turn’ with a notable recent increase in the numbers of social scientists working in government, arm’s length bodies, the third sector and private sector environmental consultancies, along with increased demand for social science expertise, including in new areas of work. However, limited research attention has been given to understanding how social sciences are being integrated into the operation and impact of NEOs. This pilot project aimed to understand current social science practice in these organisations and explore opportunities for the sector to embrace, integrate and develop its social science capability and ambition to deliver greater socio-environmental impact.

The report showcases the findings of a literature review, exploratory interviews, surveys, a workshop discussion and an expert elicitation exercise looking at the backgrounds, current practices, experiences, and aspirations of social scientists in NEOs. The project is participatory, working with NEO partners to develop research on the integration and development of social science expertise within NEOs.

Literature review key themes

The review of literature is presented as an annotated bibliography to signal relevant areas of academic debate that provide the theoretical rationale for the project and beyond that to help situate and interpret its empirical findings. The review identified the following nine themes: the role of social science in organisations and research projects; the divide between the natural and social sciences; knowledge and expertise; the science-policy interface; interdisciplinarity environments; perceptions of interdisciplinarity; conceptualising the collaborative process; how to 'do' interdisciplinarity / transdiciplinarity; rationale for interdisciplinarity; taxonomy of interdisciplinarity.

Key findings of survey, interviews and workshop

The 20 project participants work for 11 different organisations and hold varied professional backgrounds, roles and experiences. However, there were some recurrent themes and trends. More participants than expected reported backgrounds in the natural sciences. One of the associated benefits reported by these participants was ‘speaking the same language’ as colleagues with natural science backgrounds. However, some such participants described experiencing imposter syndrome or perceiving distrust from ‘pure’ social scientists.

When asked about the disciplines utilised in their current role behavioural science was mentioned a number of times. Participants expressed some frustration about the narrow range of social science disciplines that their organisations thought were relevant: for example, encountering perceptions that social science is just about and for behaviour change. In some organisations social science is not defined as a profession and specified roles are not available.

Participants were engaged in a wide range of activities, including but not limited to designing, delivering, commissioning, training and translating social/natural/interdisciplinary scientific research. Overall, participants considered interdisciplinary work as complex and time-consuming but necessary in certain circumstances to achieve significant impact for the social sciences and their organisations. They were also involved in a wide range of subject areas, with 18 discrete areas listed.

Perceptions of social science and qualitative methods as ‘less rigorous’ or ‘less applicable’ than natural science and quantitative methods can inhibit productive interdisciplinary work and the impact of social sciences. Social science can be used as a ‘bolt-on’ in natural science-dominated projects and social scientists brought in late on in the project thinking, but there were some indications that this is happening less often.

There was variation in how valued participants felt social science was within their organisation. Senior colleagues were thought to be more likely to recognise the usefulness of bringing in social sciences. With some colleagues believing that economics as a social science discipline is sufficient to study the human dimension.

Generally, organisations frame nature as a natural science problem and so prioritise funding natural science evidence. There are emerging ‘people agendas’ but limited use of social science evidence regarding framings, culture and social practices.

Participant’s aspirations include improving social science resource, visibility and use of expertise. Including the position of qualitative methods. They want to communicate the relevance and diversity of social science, and there was an acknowledgement that social science needs to show applied functions to do so. Participants want to take on different/additional roles e.g., as a critical friend / disruptor within organisational strategy-making, to contribute more to in-house research and apply social science to new subject areas e.g. urban nature and sustainable diets. Social scientists across government are generally better networked than those in NGOs, and the workshop explored establishing an ongoing cross-sector social science network to bring together ideas for moving forward on achieving integration and impact.

Key findings of expert elicitation exercise

During the workshop participants discussed evidence gaps and ways that academic research could support their aspirations. These ideas, together with insights from the survey and interviews were used as the basis for an expert elicitation exercise designed to help identify priorities for follow-on research. In this, an initial ‘long’ list of research questions was scored, collated and commented on by participants in a first round and then, in a second round, a short-list of the highest scoring questions was re-presented to participants as a series of research question ‘packages’ for their further deliberation and prioritisation.

In general, there was appetite to continue the collective endeavour and utilise academic research to help social science to gain traction in the sector. This was the case even though there was no strong consensus around the nature and focus of future research.

This lack of consensus might be explained by the fact that information was gathered from people in a number of different NEOs in which social sciences are framed differently and at different stages of being integrated into the organisation.

The research question packages which obtained the most support focused on:

- Expanding the initial empirical work we started in this pilot: who is out there, what are they doing, what role are they occupying, what is their experience of gaining traction and not?
- Exploring social science expertise, including questions about what counts as relevant expertise, which social science disciplines, approaches and methods gain the most and least traction and questions exploring relationships with external social scientists.

There was also discussion around using action research to support collective ambitions. For example, through supporting a new network and associated activities and exploring its impact or researching new social science initiatives and using the research findings to support the development of the initiative in real time.

Overall reflections on the project

Social scientists in NEOs are very keen to engage in research to better understand the possible and envision, as a collective, where social science can make even more of a contribution in the future. Key to moving forward is to sustain the project's collaborative and co-design approach to ensure that any follow-on research has impact.

There is a social science 'turn' in NEOs with more resource but also more demand for what the social sciences can bring to the table. However, social sciences in conservation and natural environmental management are still narrowly framed and constrained, perhaps even more so than in the context of academia. Partly due to relatively low numbers (despite recent increases).

The narrow framing of social sciences within NEOs is a significant, ongoing source of frustration for social scientists who aspire to fulfil a much wider range of roles and therefore make a wider and deeper contribution to their organisations, and the sector more generally.

Participants were keen to understand what other social science roles they could occupy within the sector and how to introduce them. Other "distinct contributions that the social sciences can make to understanding and improving conservation" (Bennett et al. 2017) were discussed: descriptive, diagnostic, disruptive, reflexive, generative, innovative, and instrumental; and there was general agreement that social science in NEOs was mainly confined to instrumental (implementation and education) contributions. Notable within the wider range of roles NEO social scientists aspire to is the ability to perform the role of 'critical friend' or 'disruptor'.

This type of critical / disrupting role entails being given meaningful opportunities to pose deeper and more fundamental questions about the operation of power and control in

society, vested interests and inequality and how these are key to explaining the causes of environmental problems as well as signalling environmental solutions. It is a role that also entails challenging the operation of power within NEOs in respect of the formation and persistence of knowledge hierarchies, including which subjects are ‘suitable’ for social science scrutiny. This should be a focus of future research designed to support social sciences in the natural environment sector.

Diversity within the social sciences and the wider sector was also considered to be an important topic for further study.

One idea for future research would be to work with participants to create a vision of what NEOs who put more equal investment into the natural and social sciences might be able to achieve. As a way of trying to bypass the slow progress and incremental progress on social science investment over the last few decades and kick-start the real opportunities that the participants believe are possible if social science was taken to be an essential part of NEOs achieving their ambitions.

The definition of a social scientist and the bounding of the social science profession were popular discussion points. This was linked to the issue of who does social science and concerns around the robustness of work carried out by those not trained in the social sciences. The pervasive barriers to robust multi- or interdisciplinary working were also raised.

Transdisciplinary research, such as the SSINE project, that works to ‘build in’ research impact from the design stage is worthwhile and rewarding but time-consuming and resource intensive. It was noted that this project both helped to celebrate diversity and differences within social sciences and helped us collaborate, both features that were thought important to continue in any future work.

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1. Introduction

1.1 Background, rationale and aim

This is the final report of a collaborative project between Natural England (NE) (Beth Brockett and her colleagues in the Natural England Social Science Team) and the University of Nottingham (Carol Morris, School of Geography), funded by the Economic and Social Research Council's Impact Accelerator Award (ESRC IAA). This funding programme is designed to help academics enhance research impact through joint working with partner organisations. Typically, this takes place during or following an already existing research project. A different approach was adopted here as there was no existing research project. Rather, the intention was to use the IAA funding to develop research so that impact could be 'built in' to a future research funding proposal. The emphasis of effort was on 'up-streaming' research design with the likely beneficiaries. The project timeframe was January 2020 to March 2021.

The main aim of the project is to scope and develop collaboratively a new research project proposal that explores how, in UK natural environment organisations (NEO), social sciences are being integrated and developed alongside other forms of expertise including in particular the natural sciences, and the means by which this process of integration and development can be enhanced to deliver better environmental and societal outcomes. The project report is a long document, but it contains all the project outputs so that it can act as a resource to be drawn upon in different ways by users and in future stages of the research.

Empirical rationale

Empirically, the project is inspired by the move towards interdisciplinarity within NEOs, organisations with legislative, policy and management functions and responsibilities. They include non-departmental public bodies (i.e. NE, Natural Resources Wales, NatureScot (formally Scottish Natural Heritage), the Environment Agency, and Forest Research), departments of government (notably DEFRA and its devolved departments) and third sector environmental organisations such as the RSPB and WWF. The move towards interdisciplinary ways of working is illustrated by the Natural England Science Advisory Committee seminar (February 2018) on 'Different forms of knowledge in decision-making for the natural environment' (Darlow 2018) and the decision (March 2021) to establish a separate social science committee working to (and to eventually be incorporated into) Natural England's Science Advisory Committee (NESAC). Further illustration is provided by the recent move to employ more social scientists across NEOs. Natural England, for example, now (as of July 2021) has a team of 7 social science specialists within the Chief Scientist's Directorate from less than two full-time equivalents in 2016. DEFRA now

employs more than 80 social scientists when a decade ago this number was less than 20[1] and the RSPB have recently developed new social science roles. Such developments represent an important, possibly a paradigmatic shift as traditionally NEOs have been dominated by natural science expertise (a situation mirrored in an environmental research context). NEOs, it can be argued, are experiencing an interesting and exciting 'social science turn'.

Social scientists bring new forms of knowledge and expertise to NEOs with the potential to:

- reshape the expertise profile and knowledge cultures of institutions;
- inform in new ways the design and delivery of environmental policy and legislation including in particular helping to address the 'implementation gap' i.e. the failure of translating environmental laws and policies into action (a problem that has been attributed in part to the over-reliance on ecological knowledge in shaping policy design);
- develop social science in the space between policy and delivery as government advisors;
- develop new relationships with practitioners / policy 'recipients' such as farmers e.g. by taking more seriously the expertise of these groups, with the potential to enhance organisational reputation (with all that this implies for deepening and enhancing future engagement with practitioners and policy recipients).

In short, more – or more effectively deployed - social science, including within the context of interdisciplinary ways of working, has the potential to deliver better environmental and, hence societal outcomes.

There has been much research attention given to interdisciplinary working in the context of academia including the 'openness' of multi-discipline research fields to social science knowledges (e.g. Morris et al. 2019). Less research attention has been given to understanding how social sciences are integrated with other domains of expertise, particularly natural sciences within NEOs and what the arrival of more social science expertise means for the ways in which these organisations function and how they design and deliver environmental policy, management and practice.

Theoretical rationale

Research conducted within different parts of the social science community (Castree et al. 2014; Hakkarainen et al. 2020; Martin 2020) has illustrated that in spite of all the effort that has gone into developing multi and inter-disciplinary approaches to research (including but not limited to environmental matters) in recent decades the social sciences: a) remain

[1] C. Allen pers. comm.

inadequately represented within multi/inter-disciplinary research fields i.e. there is a deficit in social science and; b) the social sciences continue to be partially understood or misunderstood within these contexts i.e. these fields are often only ‘selectively open’ to social science (Morris et al. 2019). This has consequences for the ability of social sciences to contribute meaningfully to these broader fields of research and practice. For example, in a discussion of the role of social science within conservation science and practice Bennett et al. (2017) observe:

“a lack of awareness about the social sciences, including the different disciplines, objectives, methods and outputs, and uncertainty about the purpose of the conservation social sciences. We contend that this knowledge void and confusion interferes with the conservation community's ability to engage with the social sciences purposefully and constructively – i.e., in a manner that will guide conservation practice and improve conservation outcomes. Without greater knowledge of the breadth of fields and contributions, the promise of the social sciences to improve conservation will remain largely unfulfilled” (Bennett et al. 2017: 94)

Meanwhile, in the context of large-scale programmes of Global Environmental Change science:

“Calls for more broad-based, integrated, useful knowledge now abound … They evidence many scientists’ desire to help humanity confront the momentous biophysical implications of its own actions. But they also reveal a limited conception of social science and virtually ignore the humanities. They thereby endorse a stunted conception of ‘human dimensions’ at a time when the challenges posed by global environmental change are increasing in magnitude, scale and scope” (Castree et al. 2014: 763).

At the same time the need for the social sciences (and the humanities) to make contributions to research programmes with a significant, if not dominant, natural science component is identified as ever more pressing and urgent given the need to make these programmes more ‘relevant’ and ‘actionable’. In other words, it is increasingly widely recognised that there is a need to ‘make good’ the deficit and lack of understanding of the social sciences across various environmental (and other) research fields.

The project reported here proceeds on the assumption that because of the challenges faced by social science expertise within a research context, similar challenges might be faced by social scientists working within NEOs i.e. that social science is understood in particular (narrow) ways with consequences for the integration, impact and influence of social sciences in these organisations. Indeed, this is not a question of ‘it might be’ as revealed in our preliminary research with social scientists in NEOs and reported in Chapter 4.

1.2 Structure of report

The remainder of this report is organised as follows. In the next chapter we describe the different approaches and methods employed in the project including literature review,

preliminary interviews and survey, an online workshop and expert elicitation. Chapter 3 provides an overview of the literature review. Chapter 4 presents the findings of the preliminary interviews, survey and workshop discussions. Chapter 5 reports the expert elicitation process and its outcomes. Chapter 6 offers conclusions and recommendations. A project impact report is available by request to the lead authors.

2. Methods

This chapter describes the various approaches and methods employed within the project. The initial phase of the project entailed scoping research and a literature review to inform and provide the intellectual foundation for the follow-on research funding application. The scoping research aimed to undertake a preliminary 'mapping exercise' through initial survey / interviews with a range of social scientists from different disciplinary backgrounds employed by UK environmental organisations. Questions focused on their roles, when and why these roles are more or less foregrounded and the different ways that the move to interdisciplinarity is and isn't played out in different organisations (see appendices A.1 and A.2). For example, this might be in the context of organisational strategic development, day to day tasks, career development, training, etc. The literature review and resulting annotated bibliography (A.3) aimed to identify relevant cross-disciplinary social scientific work in the academic and grey literatures including but not limited to: environmental knowledges and expertise, the interface between (social) science expertise and policy, interdisciplinarity, and organisation studies.

Subsequent phases of the project were informed by the earlier stages and entailed an online workshop (A.4) and expert elicitation exercise (8.6), both of which were designed to engage social scientists from NEOs and enable them to input directly into the design of subsequent research.

2.1 Literature review

Initial sources for the literature review were identified by the project PI, partner and research assistant based on their knowledge of relevant publications and held in personal archives. As most of these initial sources focused on interdisciplinarity in academia (and specifically the fate of social science knowledges within this process), it was necessary to extend the search to find examples from industry or government where mixed research teams collaborated. Search strategies were also developed to identify 'grey' literature examining how social sciences are being integrated in government, NGOs and other organisations e.g. via the Campaign for Social Science website and Government Social Research profession reports and website, and research reports published on NEO websites. To enable additional academic sources to be identified searches were undertaken on key scholars in the field such as Andy Stirling, Jason Chilvers, Ulrike Felt, Brian Wynne and Sheila Jasanoff and how decision-making is being 'democratised' or 'opened up' in organisations to include a range of types of expertise.

As the review work progressed, we realised that it would not be possible, within the project budget, to produce a formal literature review and that instead this phase of project work would focus on the following outputs: i) identification of key themes within the literature; ii) an annotated bibliography (A.3) and iii) organisation of all sources into Zotero for future

use[2]. The sources were organised into three main folders within Zotero: 1) Social science / Interdisciplinarity 2) Public / Policy and 3) Expertise.

Development of the annotated bibliography revealed an absence of recently published (within the last 5 years) sources, which was probably due to source identification and snowball from our own libraries. To ensure the review was up to date a more systematic database search was undertaken using the following three search queries in the Web of Science database covering the previous 5 years: social science / knowledge / resource management; social science / knowledge / conservation; social science / knowledge / climate change. This systematic search yielded 20 additional sources (the most relevant papers based on reading of the abstracts) which were added to Zotero and citation details to the annotated bibliography. As time was limited, there wasn't an in-depth review of these 20 sources, so they are not included in the final thematic analysis.

2.2 Interviews and surveys

In order to obtain initial insight into the backgrounds, qualifications, roles, and experiences of social scientists working in a range of NEOs a series of interviews were conducted. These were also undertaken to help inform the design of the workshop (see section 2.3). Interview questions were developed by the PI, project partner and her NE colleagues and were based on a series of conversations which led up to the development of this pilot project. They reflected on-going discussions within NE about the role of social sciences and the desire to better understand the situation in other NEOs.

Project participants were recruited based on a willingness to engage throughout the pilot project via: an interview or a completion of a survey; attending an online workshop; and, taking part in an expert elicitation exercise. Participants were recruited from Defra as the UK Government department responsible for the majority of natural environment content, from government bodies which advise UK Government and devolved governments on the natural environment, non-government organisations which focus on protection of the natural environment, and consultancies which work with these organisations. Purposive recruitment to ensure a spread of participation across these bodies was undertaken via professional networks and contacts of the project investigators and colleagues.

Fourteen social scientists from 7 different organisations, all working in the natural environment and conservation sector, were interviewed (9 participants) or completed a survey distributed by email (5 participants). Nine participants work within government, devolved administrations and their public bodies, three within the third sector, one within academia (with a background in the third sector), and one participant owns a small social science consultancy and has a background in government agencies.

[2] Please send requests for access to the library to beth.brockett@naturalengland.org.uk

Interviews were conducted over the phone or via a video call. Interview duration ranged from 26 minutes to 1 hour. Interviewers asked the survey questions (A.2) in their own words and offered prompts and reflections where they saw appropriate to facilitate the interviews. There were two interviewers (referenced as Interview 1 and Interviewer 2).

Although there are well-cited issues with mixing methods, in this case surveys and interviews, due to practical reasons it was not possible to interview all participants and the principal investigators deemed that it was more beneficial to obtain information via a survey than no background information from those participants.

2.3 Workshop

A key part of the project was delivery of a workshop to bring together the participants. Its purpose was to create a space for starting a conversation about the role of social science in UK NEOs and how this role might be enhanced including through the contribution of academic research. The workshop was originally intended to take place face to face but was moved online due to the Covid pandemic. It took place, via Zoom, on May 5th 2020 over 5 hours including a lunch break.

Interview and survey data helped to inform the workshop programme (annex. A.4) by providing some preliminary data on the nature and extent of social science expertise within the sector as well as providing some provocations to stimulate discussion.

Thirteen of the interviewees/survey respondents also attended the workshop. In addition, 4 participants from another 4 organisations (government, devolved administrations and their agencies, plus one participant from academia who has experience of government) attended. There were 2 facilitators and 2 assistants/note-takers.

The initial project plan included a second workshop to enable further discussion and deliberation on the topic and involving a wider constituency of participants including natural scientists working in NEOs. The ongoing nature of the pandemic led to a change in project plan with an online expert elicitation exercise substituting for the second workshop (see below).

2.4 Analysis of transcripts & workshop notes

The interviews were transcribed in full. The text of the transcripts, together with the survey responses, were subject to a multi-stage process of analysis. The notes taken at the workshop were compiled and subjected to a preliminary coding by the project partner. The research assistant read through the interviews and the workshop notes, then transferred them to QSR NVivo for analysis. Coding was both in-vivo and guided by the preliminary workshop coding and established themes from the literature review. Codes were then sorted into overarching themes. The principal investigator and the project partner verified the codes and themes and suggested some adjustments to the labels. The research

assistant then went back to the raw interview data to check coding for accuracy and consistency and wrote up rationales for the overarching (annex. A.5).

2.5 Expert elicitation

An online expert elicitation of research questions comprised the final stage of the collaborative research design. During the workshop participants discussed evidence gaps and ways that academic research could support social science within their organisations and the sector. These ideas were used as the basis for an expert elicitation exercise. The 'Sutherland Method' of research prioritisation was adapted for this purpose (Sutherland et al. 2011; Morris et al. 2021). This process was utilised to help hone key research ideas generated from the workshop, as well as the interviews and surveys. It was also designed to enable participants to review all these ideas, reflect on them, and identify any gaps.

A spreadsheet was compiled of 46 suggested research questions about the impact and integration of social science in NEOs in the UK (annex. 8.6). The questions were developed from the information gathered during the initial phases of the project thereby enabling stakeholder ideas to be incorporated. The spreadsheet was circulated by email to all the participants (20) and 10 responded (including the project partner).

For each research question participants were asked to assign a score from 9 to 1 where 9 indicates a question of higher importance and 1 a question of lower importance according to participant knowledge and expertise. Participants were advised that no research was needed in order to complete the exercise which should take no longer than 20-30 minutes to complete. Use of the full range of scores including 9 was encouraged and participants were asked to consider the following criteria when scoring:

- the urgency of the question;
- does it address an important knowledge gap;
- the potential impact that research into this question could have for social science in our organisations;
- the suitability of this question for academic research.

In addition to scoring the questions provided participants were asked to:

- add into the spreadsheet any further questions they would like future research to address and give these a score;
- make comments on the questions in the dedicated comments column in the spreadsheet. For example, if they observed any similarities between two or more questions, suggesting that they should be amalgamated; suggestions to improve the phrasing of a question; highlight existing studies that have already addressed all or part of a question.

Participants were encouraged to consult with colleagues both within and beyond their organisation when undertaking these tasks. Scored spreadsheets were returned to the organisers via email. A total of 10 spreadsheets were returned. Scores from all

participants were amalgamated enabling an initial sorting / prioritisation of questions to take place. Questions were then refined and reformulated based on the comments provided by participants in their spreadsheets.

In a subsequent stage, participants were sent a prioritised list of research questions in the form of a series of research question ‘packages’ that included amalgamated and refined questions from the first stage. They were invited to identify their most and least preferred questions and encouraged to make comments on the questions themselves e.g. about how to further improve their scope or wording. Participants were also encouraged to provide suggestions about the most effective methods by which the questions could be operationalised within a research project and to assess the potential impact of answering the question for social science in their organisations. These comments were considered when preparing a final list of research questions for potentially taking forward into a project proposal. Nine participants responded.

Although a practical approach, with benefits in terms of allowing participants to respond in their own time, the lack of opportunity to discuss and deliberate the research questions (as would normally be the case in these types of exercises) will have affected the outcomes.

2.6 Reflections workshops

Two duplicate format hour-long online workshops were run on 1.7.21 (8 participants plus 2 facilitators and a note-taker) & 9.7.21 (another 8 participants plus 2 facilitators and a note-taker) to discuss the findings with the participants and ask for their reflections and conclusions. These sessions briefly outlined the key findings via a slidepack that had been circulated to participants beforehand along with a final draft of the project report. Facilitators then invited participants to reflect on the process, findings and next steps. These sessions provided the majority of the content of the conclusions and recommendations section (6).

3. Overview – literature review

This chapter provides a brief overview of each of the themes and sub-themes identified in the review of literature and preparation of the annotated bibliography. The themes are:

1. Role of social science in organisations and research projects
2. Divide between the natural and social sciences
3. Knowledge and expertise
4. The science-policy interface
5. Interdisciplinarity environments
6. Perceptions of interdisciplinarity
7. Conceptualising the collaborative process
8. How to 'do' interdisciplinarity / transdisciplinarity
9. Rationale for interdisciplinarity
10. Taxonomy of interdisciplinarity

Each sub-theme description is accompanied by a list of key sources, further details of which can be found in the annotated bibliography (annex. A.3).

This provides a review of relevant areas of academic debate that provide the theoretical rationale for the project and beyond that to help us situate the findings of this project within the wider corpus.

Theme 1. Role of social science in organisations and research projects

Sub-theme 1. Social science serves an instrumental role

In conservation fields and work, the social sciences are seen as instrumental to helping conservation work become more relevant and effective by understanding human decision making and behaviour. Social science, it is asserted, can help conservationists translate their scientific findings into practical and effective policies for people to understand and implement. For example, social sciences are seen as instrumental in connecting people with nature and therefore helping to preserve conservation science as a discipline. Social sciences are often brought into projects to help scientists understand the 'human dimensions' of environmental and conservation efforts, which social scientists argue is a limited use of their skills and capacities. A Canadian case study suggests a key determinant of how a social science gets 'used' by researchers is based on the behaviour of the researcher and the particular research context.

Sources: Bailey 2011; Balmford and Cowling 2006; Bennett et al. 2017; Noel Castree 2016; N. Castree et al. 2014; Landry, Amara, and Lamari 2001; Lowe, Whitman, and Phillipson 2009; Mascia et al. 2003; Zylstra et al. 2014

Sub-theme 2. Social sciences as the study of the 'human' dimension

Within policy and natural science contexts, social science tends to take on the role of understanding the 'human dimension' of research projects. This instrumental role of social sciences tends to be used to help understand 'publics' in order to later persuade them towards a policy, or to help experts engage with the public on co-production more effectively.

Sources: (Bailey 2011; Bisset, n.d.; ‘The Business of People: The Significance of Social Science over the next Decade’ 2015; Lowe, Whitman, and Phillipson 2009; Morris, Raman, and Seymour 2019; Marine Management Organisation 2014; Phillipson and Lowe 2008; Shah 2020; Tsouvalis and Little 2019)

Sub-theme 3. Social science serves a subservient role

In interdisciplinary collaborations, the social sciences often play a subordinate role to natural scientists, or a 'junior partner' on the project; this specific mode of interdisciplinarity is called subordination-service (see 'Modes' of interdisciplinarity). It is characterised by a lack of a social science contribution in the research methodology, scoping and implementation. Another 'support' role that social sciences provide in collaborations in natural science projects is in ELSI or 'ethical, legal and social issues' which has a clear danger for being a 'tick box' exercise. The social scientist is therefore meant to 'care' for the existing researchers and methods on the project, rather than intruding or ‘rocking the boat’ too much.

Over time this 'subordinated, end-of-pipe' role of social sciences has been recognised and literature emerges that that calls for more strategic and up-front interaction between the natural and social sciences. A particular risk for social sciences collaborating with natural sciences is the subversion of their discipline, specifically 'sociology'.

Sources: Bailey 2011; Balmer et al. 2015; Barry and Born 2013; Felt 2015; 2014; Holmwood 2010; Lowe, Phillipson, and Wilkinson 2013; Morris, Raman, and Seymour 2019; Viseu 2015

Sub-theme 4. 'Positivist' social science

A theory to investigate if some natural scientists find it 'easier' to work with or collaborate with social science disciplines that use maths / statistics / positivist approach to research (e.g. economics).

Sources: Hulme 2011; Lowe and Phillipson 2006; Phillipson, Lowe, and Bullock 2009

Sub-theme 5. Social science as an 'equal' partner

An idealised version of interdisciplinary work imagines the social sciences as 'integrated' into the research process as collaborators from beginning to end. This position has been

labelled as 'integration-synthesis' interdisciplinarity (see 'Modes' of interdisciplinarity). For example, the social sciences can understand how conservation narratives are 'framed', and what value and measurements a particular framing would imply. There is a desire and assumption that bringing the social sciences into new spaces will result in integration and an 'equal' partnership, however this is much less the case in practice. An academic approach of 'experimental entanglements' helps researchers collaborate without first bringing their interdisciplinary identity to the forefront. A 'good' outcome of social science collaborations is judged to be the increased 'reflexivity' experienced by their natural science collaborators and all research across the board.

The humanities also offer tools to engage with the cultural aspect of science (Nowotny et al. 2003). Hulme (2011) also discusses the role of humanities in research collaborations, which is to question and influence how problems have been traditionally framed by natural science peers.

Sources: Barry, Born, and Weszkalnys 2008; Hulme 2011; Lowe, Phillipson, and Wilkinson 2013; Lowe, Phillipson, and Lee 2008; Mace 2014; Nowotny, Scott, and Gibbons 2003; Phillipson and Lowe 2008; Redman, Grove, and Kuby 2004; Warburton 2005

Theme 2. Divide between the natural and social sciences

Sub-theme 1. Qualitative vs quantitative

The divide between the natural and social sciences is often perceived (by natural sciences) to be a divide between the qualitative and quantitative approaches to data.

Source: Phillipson, Lowe, and Bullock 2009

Sub-theme 2. Social Sciences as gendered

Social scientists in interdisciplinary or collaborative natural science projects are more likely to be women than their natural science counterparts. This can lead to gendered perceptions of the role of social sciences in the collaboration, for example, they can take a 'care' role or experience 'exclusion' from key research activities.

Sources: Jones and Solomon 2019; Viseu 2015

Sub-theme 3. Positivist vs interpretive

A perceived divide between the social and natural sciences is the positivist ('reductionist') approach of the natural sciences, which some social sciences also utilise (psychology, economics), and the interpretivist approach of many social sciences. The boundary

between 'subjectivity' and 'objectivity' is another line that is drawn between the natural and social sciences.

Sources: MacMynowski 2007; Öberg 2011; Phillipson, Lowe, and Bullock 2009; Shah 2020

Theme 3. Knowledge and expertise

Sub-theme 1. Knowledge hierarchy within science

The focus on 'subjectivity' vs. 'objectivity' is a main source of power dynamics between the natural and social sciences within interdisciplinary collaborations. This 'disciplinary hierarchy' manifests itself in government funding priorities, where more STEM research and projects are funded with the rationale that they serve a role in the government innovation and industrial strategy and are more relevant for environmental and climate 'science'.

Sources: Campaign for Social Science 2019; Felt 2014; MacMynowski 2007; Öberg 2011; Overland and Sovacool 2020

Sub-theme 2. Knowledge hierarchy between science and other forms of knowledge

There is a perceived boundary between 'non-certified' and 'certified' forms of knowledge expertise. One of the reasons behind this dualism is the focus on 'generalisability'. In order to upend this hierarchy, scientists can be framed as 'narrators' of their scientific position in order to reveal underlying values, preferences and positions. Increasingly, organisations are being encouraged to value alternative, indigenous and experiential forms of knowledge. An example of knowledge hierarchy in practice is 'science communication'. When engaging with other forms of 'knowledge', efforts should be made to recognise the plurality of experiences, interpretations and approaches, as reaching a 'consensus' will not always yield productive results. Outside of academia, knowledge hierarchies continue to exist; those in a higher civil service grade are granted more legitimacy in policy evidence and making. 'Trust' and 'belief' in existing scientific knowledge and advice are increasingly upending this traditional hierarchy. A lack of engagement and acknowledgement of other forms of 'expertise' contributes to a lack of 'trust' in science.

Sources: Colloff et al. 2017; Doubleday and Wilsdon 2013; Felt and Wynne 2007; Jasanoff 2003; Kay and Regier 2000; Morris 2017; Overland and Sovacool 2020; Pearce et al. 2017; Pretty 2011; Shortall 2013; Singh Mehmi and Bailey 2018; Wynne 1992

Sub-theme 3. Understanding scientific expertise and its role in policy making

The Sociology of Scientific Knowledge (SSK) or Science and Technology Studies (STS) is a field of study that focuses on the socio-cultural dynamics of science making. This dynamic is important to understand in the wake of people not trusting 'experts' or 'science', so understanding this engagement is topical.

The assumption that more scientific evidence will lead to clear directions in policy making is flawed as this relationship is complex and multidirectional rather than linear. In fact, more 'scientific' evidence can create more confusion in the policy making process. Scientific expertise is seen as 'removed' from the real world and in an 'ivory tower'. 'Good guidance' in using scientific expertise in policy includes making transparent the processes, data and interpretations used to arrive at scientific advice. Scientists engage in 'boundary work' when reflecting on their role as advisors in policy making.

Sources: Jasanoff 2003; Sarewitz 2004; Shortall 2013; van der Sluijs et al. 2008; Waterton 2005

Sub-theme 4. Specialist vs broad knowledge

There is an assumed trade-off between being specialised in your field, which is valued in academia, and having broad knowledge across different disciplines.

Sources: Cuevas Garcia 2015; Lau and Pasquini 2008

Theme 4. The science-policy interface

Sub-theme 1. Citizen science

Citizen science is a commonly cited avenue for participatory governance, as a way to make citizens feel empowered and for policy legitimacy. It is also utilised as a resource, having the public participate in research is free; examples of this include open source development in industry and data collection in government. Citizen science is linked with data collection technologies, which raises questions around ethics, privacy and data use, but also allows many people access to participate. Some issues around transparency of data also exist, for example what assumptions are made about the data being collected and how is it interpreted?

Sources: Darlow 2018; Hayhow et al. 2016; Irwin 2018; Kuchinskaya 2019; Lee, Hwang, and Choi 2012; Silvertown 2009; Simpson 2013; Star and Griesemer 1989; Tweddle et al. 2012

Sub-theme 2. Stakeholder engagement

Stakeholder engagement is a type of participatory governance for research and policy. It is seen as useful for 'increasing uptake' in policy and 'increasing success' of initiatives and policies as well as increasing 'trust' with members of the public. There is a danger that stakeholder engagement ends up being 'science communication' or 'token' engagement, so engagement needs to offer opportunities where the 'experts' are not always framing the problems or the questions. Another danger is the conceptualisation of publics and 'the public'; more reflexivity and an interpretive-relationship approach to public(s) engagement is needed to allow scientists to meaningfully incorporate other perspectives into science research and policy. To address these dangers, adopting a policy of 'openness' and 'transparency' can help increase two-way engagement between science / industry and public(s). Stakeholder engagement can range from public consultations to co-production practices, the latter sometimes being considered 'ideal' and more integrative of other knowledges. When involving multiple stakeholders, conflicts over methods, priorities and questions can arise because the choice to conserve or exploit nature is inherently political and value-laden. Engaging with the plurality and politics of diverse stakeholders is a proposed approach, as trying to reach a 'consensus' should not be the aim of stakeholder engagement.

Sources: Boccaccio, Brunner, and Powell 2009; Colloff et al. 2017; Grove-White, Macnaghten, and Wynne 2000; Lowe, Whitman, and Phillipson 2009; Pearce et al. 2017; Pound et al. 2016; Singh Mehmi and Bailey 2018; The Future of Conservation 2019; Warburton 2005; Wynne 2011; 2016; Young, Mitchell, and Redpath 2020

Sub-theme 3. Expert bodies and policy making

Within the context of growing mistrust in 'experts' a 'committee of experts' that is perceived as independent can gain some trust among some members of the public. To institutionalise social sciences into government bodies, creating a position of 'chief social scientist' is needed. Social and natural science experts are needed to make policy making more 'robust', as well as an 'open-mindedness' to appreciate different interpretations and value structures in presenting and evaluating different types of 'evidence'. An argument supporting an extent of 'closed' deliberations in expert bodies claims that the process of dissent and deliberation in scientific advice should not be made public as it erodes legitimacy. It is also important at this stage to remain 'independent' from special interest groups and lobbyists.

Sources: Bal, Bijker, and Hendriks 2004; ‘The Business of People: The Significance of Social Science over the next Decade’ 2015; Doubleday and Wilsdon 2013; Felt and Wynne 2007; Jasanoff 2003b; Owens and Rayner 1999; Stirling and Mitchell 2018; The Future of Conservation 2019

Theme 5. Interdisciplinarity environments

Sub-theme 1. Education

Taking an 'interdisciplinary' approach to education where some exercises or approaches from one discipline are used as a teaching tool for another discipline is seen to promote well rounded students prepared for real world work.

Sources: Cooley 2009; The Future of Conservation 2019

Sub-theme 2. Healthcare

Social sciences in healthcare is a common example where collaboration between natural and social science is seen as relevant, useful and necessary. There are many examples in research and policy where healthcare has used social sciences to adopt a 'person centred' approach to care.

Sources: Curry et al. 2012; McManus et al. 2018

Sub-theme 3. Business / industry

This is commonly referred to as cross-departmental working and encouraged. Interdisciplinarity and the inclusion of the social science in industry is often discussed in the context of facilitating innovations and therefore economic advancement. 'Breaking down' barriers between the industry and academia is seen as an important government priority to promote innovations. In researching examples of industry innovations (e.g. bio-fuels), taking a social science approach and studying an industry from a whole systems perspective can reveal underlying values and assumptions in research and industry decisions.

Sources: Campaign for Social Science 2019; ‘The Business of People: The Significance of Social Science over the next Decade’ 2015; Gleeson 2013; HM Government 2017; Mainzer 2011; Raman et al. 2015

Sub-theme 4. Government / policy

In a government context, social sciences tend to be valued for their quantitative abilities, therefore economics appears as a common 'social science' collaborator because they speak numerically.

For researchers within government organisations, the feedback is that social science research is approached in an ad hoc manner, with no systemic dissemination of methods, practitioners or results.

Cross departmental working and sharing of findings is also encouraged at the top, however implementation in practice is piecemeal and ad hoc. Understanding policy actors

and interactions are an important part of understanding wider socio-technical innovations and transitions (implicitly, social science research is the way forward on this front). Much of the case for encouraging more inclusion and funding of social science research is its value in aiding innovation in EU and British industrial strategy.

Evaluation of projects or government initiatives is a common recognised social research contribution.

Though there is a broad commitment to interdisciplinarity across all government departments, certain departments (education, healthcare and criminal justice) see more examples of social science research integration as demonstrated by example reports published on the website.

Sources: Academy of Social Sciences & The British Psychological Society 2019; Bailey 2011; Bisset, n.d.; Strategic Policy Making Team 1999; Campaign for Social Science 2019; 'The Business of People: The Significance of Social Science over the next Decade' 2015; Department for Education and ASK Research 2016; Felt 2014; GOV.UK n.d.; Krzywoszynska 2015; Mace 2014; Marine Management Organisation 2014; Shortall 2013a; Smith, Voß, and Grin 2010; Twigger-Ross 2005

Sub-theme 5. Academia / research

Interdisciplinarity is seen as the key to making academic research more socially relevant, a way to get more funding, the route to 'innovative' research and more 'impactful' research. In some examples of interdisciplinary collaborations, natural scientists found it easier to collaborate with disciplines such as economics, which take a quantitative and positivist approach to research. In the academic research realm, more STEM research and subjects are funded, therefore an opportunity for social sciences to gain access to this funding is to collaborate on these STEM projects. By some accounts, there is also a lack of funding in academia for transdisciplinary research as well, due to a lacking shared understanding and definition of what it entails.

Sources: Academy of Social Sciences & The British Psychological Society 2019; Campaign for Social Science 2019; 'The Business of People: The Significance of Social Science over the next Decade' 2015; Fitzgerald and Callard 2015; Cuevas Garcia 2015; Jahn, Bergmann, and Keil 2012; Lowe and Phillipson 2006; Lowe, Phillipson, and Lee 2008

Theme 6. Perceptions of interdisciplinarity

Sub-theme 1. Positive / promote

Cross-disciplinary collaborations are promoted and seen as 'future' approaches to research that enrich research and makes research more relevant. Interdisciplinarity is seen as the ideal research for 'real world' problems that cannot be departmentalised, particularly environment and sustainability. In conservation sciences, bringing social

sciences into the research space is seen as helping to 'connect' people to nature. In healthcare and climate change domains incorporating social sciences into research and working in interdisciplinary ways is seen as more 'holistic' than approaching research through 'narrowly focused' or 'limited' disciplines. The value of working in an interdisciplinary environment extends outside of these positive results and have other benefits related to the experience of the process of interdisciplinarity.

Sources: Fazey et al. 2018; Groß and Stauffacher 2014; Holmes et al. 2018; Lowe, Phillipson, and Lee 2008; Phillipson and Lowe 2008; Shah 2020; Stember 1991; Pretty 2011; Zylstra et al. 2014

Sub-theme 2. Negative / sceptical

Interdisciplinarity can be seen as leading to a breadth of knowledge to the detriment of specialised knowledge and therefore damage an academic career. Engaging in interdisciplinary collaboration is also seen as a 'risky' endeavour for a research career. There is the potential for sociology to lose disciplinary identity and integrity due to being co-opted as ‘applied’ science and research when contributing to interdisciplinary projects. There is literature that brings attention to projects that are only interdisciplinary in name, drawing a distinction between 'real' interdisciplinary collaborations and attempted ones. This distinction highlights the difficulty of 'doing' interdisciplinarity in practice.

Sources: Balmer et al. 2016; Holmwood 2010; Lau and Pasquini 2008; Petts, Owens, and Bulkeley 2008

Theme 7. Conceptualising the collaborative process

Sub-theme 1. Boundary objects

Boundary objects can be used as a tool or seen as a solution to interdisciplinary working as they allow different spaces of expertise to work together, while still occupying their own separate spaces. The ‘boundary objects’ exist at the locus of translation. Boundary objects can be anything from place borders, a cause or an abstract concept, anything that is flexible enough to be used or interpreted by many from different disciplines.

Sources: Balmer et al. 2016; Giorgi and Redclift 2000; Jahn, Bergmann, and Keil 2012; Star and Griesemer 1989

Sub-theme 2. Boundary work

Boundary work describes the negotiation conducted by scientists to delineate and demarcate their own discipline from other disciplines. These boundaries are socially constructed, flexible and constantly being negotiated relative to another discipline, job or world view. In the policy context, scientists conduct boundary work to delineate their work from politics and subjectivity by stating their work is impartial and 'fact' oriented. Boundary

work also takes place in the policy realm and involves active reflections of the scientists engaged in boundary work.

Sources: Balmer et al. 2016; Gieryn 1983; S. S. Jasanoff 1987; Morris 2017; Waterton 2005

Sub-theme 3. Post-normal science

Post-Normal science occurs when uncertainties are either of the epistemological or the ethical kind, or when decision stakes reflect conflicting purposes among stakeholders. The stakes are also high as they could involve harm to some groups. A common area where post normal science is applicable is climate change. Post-normal science can be used as an approach to determine and analyse 'ecological integrity', meaning that scientific fact is not taken as a given, but scientists are framed as 'narrators' of different scientific approaches and positions.

Sources: Funtowicz and Ravetz 1993; Kay and Regier 2000

Sub-theme 4. ‘Modes’ of interdisciplinarity

1. Integrative-synthesis - assumptions that two or more disciplines integrate together in a relatively symmetrical form. 2. Subordination-service - collaboration where one or more discipline is positioned as a service to another discipline. 3. Agonistic-antagonistic - where collaboration is driven by antagonistic relations between disciplines, usually in criticism or opposition to an established discipline or mode of working.

Source: Barry, Born, and Weszkalnys 2008

Sub-theme 5. Mode 2 knowledge

Mode 2 knowledge describes the evolution of knowledge and science making which is shifting towards more transdisciplinary approaches and social accountability. Mode 2 knowledge has more blurred boundaries between industry, policy and research. Mode 2 knowledge production indicates a changing relationship and contract between science and society, leading scientists to engage in more self-reflection of their role as advisors and conducting boundary work to understand their role in the scientific community, policy and wider society. As more actors and socio-cultural norms influence science making, a 'technologies of humility' approach to science policy making is recommended (Jasanoff).

Sources: Groß and Stauffacher 2014; S. Jasanoff 2003b; Nowotny, Scott, and Gibbons 2003; Waterton 2005

Theme 8. How to 'do' interdisciplinarity / transdisciplinarity

Sub-theme 1. Training / tools for interdisciplinarity

Predicated on the assumption that everyone ‘wants’ interdisciplinarity, practical exercises are given to collaborators in order to facilitate the process. Other literature offers practical suggestions for collaborating, including creating a safe space, appreciating difference, creating shared goals and strategies for dealing with conflict.

Sources: Curry et al. 2012; The Future of Conservation 2019; Öberg 2011

Sub-theme 2. Conflict management

The social sciences are positioned as the best discipline to understand and address conflict in environmental and conservation management. Conflicts inevitably arise amongst the different actors, diverse values and personal interests.

Sources: Gutiérrez et al. 2016; Young, Mitchell, and Redpath 2020

Sub-theme 3. Overcoming barriers to collaboration

'Doing' interdisciplinarity is hard, therefore some projects are unable to rise to the challenge of doing 'real' interdisciplinarity and some are only interdisciplinary in name. There are cultural, structural and regulative barriers to conducting interdisciplinary work that prevent interdisciplinary efforts from reaching their full potential. Lack of common 'language' and differences in methodologies are common challenges to interdisciplinary working. Lack of trust and respect for the other are seen as key barriers for cross-disciplinary collaboration. The additional time it takes for interdisciplinary researchers to work together and become acquainted with the project is also a constraining factor in this type of research.

Sources: Bailey 2011; Balmer et al. 2016; Buanes and Jentoft 2009; Curry et al. 2012; Gleeson 2013; Petts, Owens, and Bulkeley 2008; Pohl 2005

Theme 9. Rationale for interdisciplinarity

Sub-theme 1. Connectedness / relevance to 'publics'

'Accountability' is a 'logic' of interdisciplinarity, which researchers and policy makers use as an argument to include social sciences to help legitimise natural science research directions and decisions. This is the logic that drives public engagement and public consultation. It is a logic that is common in the environmental sectors. Cross-disciplinary collaboration can offer more 'reach' to 'publics' and make this engagement more effective.

Sources: Barry, Born, and Weszkalnys 2008; S. Jasanoff 2003b; Lowe and Phillipson 2006; Phillipson and Lowe 2008

Sub-theme 2. As a tool for innovation

'Innovation' is a 'logic' of interdisciplinarity, which researchers and policy makers use to argue for the inclusion of social sciences in the technology industry in order to reach new understandings and ideas. General interdisciplinarity as a concept is often considered a vector for innovation.

Sources: Barry, Born, and Weszkalnys 2008; Felt 2015; 2014; Hacklin and Wallin 2013

Theme 10. Taxonomy of Interdisciplinarity

Sub-theme 1. Transdisciplinarity

There are two main definitions of transdisciplinarity: 1) Transdisciplinary research is knowledge making where traditional expertise integrates with other forms of knowledge making, such as public engagement or collaboration with industry partners. Transdisciplinary research takes into account multiple perspectives. 2) Transdisciplinary research takes place when the resulting research 'transcends' or 'transforms' disciplinary boundaries or ways of working. The definition of 'transdisciplinary' research varies, resulting in confusion in collaboration and risk of a 'shallow' interpretation.

Sources: Fazey et al. 2018; Groß and Stauffacher 2014; Jahn, Bergmann, and Keil 2012; S. Jasanoff 2003b; Klein 2010; Pohl 2005; Nowotny, Scott, and Gibbons 2003

Sub-theme 2. Interdisciplinarity

Simultaneously a 'catch all' term and specific term to describe the nature of cross-disciplinary collaboration. Specifically, this term describes research that integrates methods, theories or disciplinary approaches.

Sources: Klein 2010

Sub-theme 3. Multi-disciplinarity

Research where disciplinary boundaries are maintained and different disciplines work 'alongside' each other. Some projects end up working at this level when they try to 'achieve' interdisciplinary working.

Sources: Klein 2010

Sub-theme 4. Post-disciplinarity

Post-disciplinary science is where research focuses on issues across traditional disciplinary boundaries. Post-disciplinary research is seen as more 'transformative' than multi-disciplinary research because multi-disciplinarity is still bound by disciplinary paradigms and ways of thinking.

Sources: Fazey et al. 2018; Fitzgerald and Callard 2015

4. Results of the pre-workshop survey & interviews

4.1 Who are the social scientists in Natural Environment Organisations?

4.1.1 Disciplinary backgrounds and qualifications

Participants have diverse disciplinary backgrounds, with the natural sciences featuring more prominently than may be expected. Eight out of fourteen participants have undergraduate degrees in the natural sciences, including environmental science, zoology, geology, engineering, biology and agriculture (Figure 1). This trend was reflected in an example provided by a participant in the workshop regarding setting up the Marine Social Science Network. A questionnaire was sent out to social scientists in various organisations working in the marine area, which revealed that many of these people had backgrounds in the natural sciences rather than social sciences.

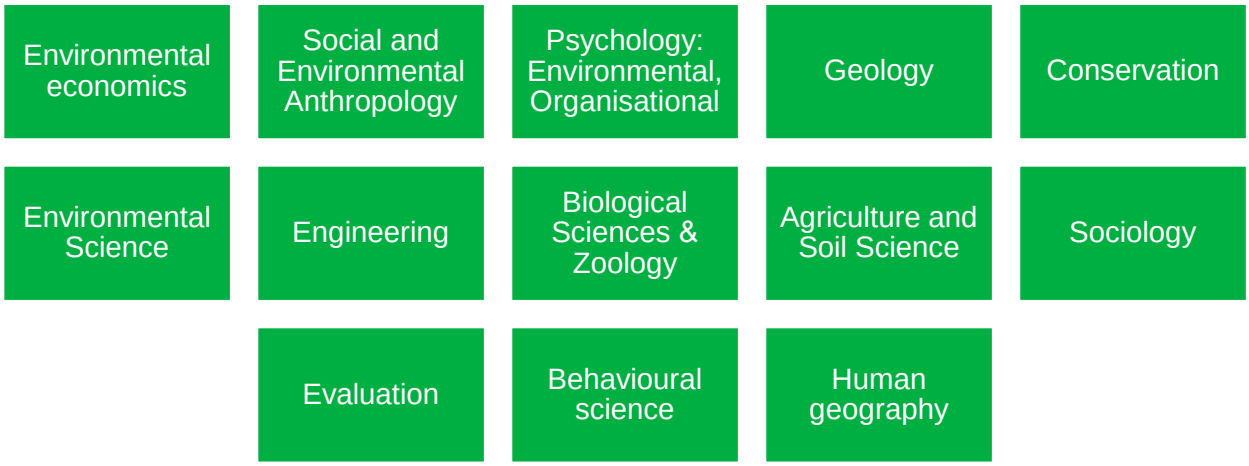

Figure 1. Participants' disciplinary backgrounds

Social science is an umbrella term for a wide range of disciplines. Participants identified a range of disciplines that they consider to be their 'main' discipline and other disciplines with which they have experience or training. Participants have a diversity of social sciences qualifications covering social and environmental anthropology, psychology, occupational psychology, environmental psychology, organisational psychology, social research and social research evaluation. Two participants defined themselves as a *"jack of all trades"* and a *"generalist",* having unspecialised backgrounds.

> ‘‘As I say, I'm not, I’m not a deep specialist. I kind of moved around the kind of the … I suppose they all have a theme around the environment generally, the people, about place’ … ‘So it kind of means I am kind of a bit of ‘jack of all trades’ really” [Gov agency 6]

> “I would class myself as a generalist social researcher – my speciality is social research, rather than any area within specialist subject area” [Gov Agency 4]

Some participants started out doing a bachelor’s degree in natural sciences, and further study brought social theory and associated framings and methodologies into their work. For example, Consultancy 1 moved from studying agriculture and soil science to undertaking a PhD which looked at *“social capital in farmers’ transitions”.* Academia 1 did a bachelors in zoology before moving towards social science: “*initially, I guess I'd be more as a natural scientist … my master's and almost my subsequent work from 10 years ago onwards is more on the social science of wildlife conservation and environmental sustainability in general”.* Other participants had opportunities to engage with social science while working at universities.

> “So I did a lot on acid rain ... and I did a lot of the engineering and economics costings on the side … There were lots of opportunities to get involved with different parts of the University. So I kind of looked at environmental economics for a bit and realised it wasn't really for me. And then I hooked up with the Sociology department” [Gov Agency 3]

Some participants mentioned that an academic or career move towards social science occurred alongside a shift in how they framed environmental problems. Gov Agency 1, who has a background as a geologist, started delivering a social science course (environmental policy) while teaching geology at a university. They described delivering the environmental policy course as *“kind of almost really life-changing for me. And that sparked my interest really in social sciences and recognising the importance of those different framings in the way that we look at and approach environmental issues”.* Another participant expressed that, *“when you're into conservation, from my point of view, it was a revelation that it's all down to people”* [Gov Agency 2], going on to say that it influenced their return to education *“I did a BSc in environmental science. And it was a mix of Natural and Social Sciences”.*

The benefits and drawbacks of having a natural science background when working as a social scientist were discussed in the workshop and interviews. Whilst interviewing Academia 1, Interviewer 2 from a government agency said that for those who have moved over from natural sciences, *“there is perhaps an understanding there about natural science and why it's important”.* One of the benefits of understanding natural science was discussed in the workshop as the ability to ‘speak the same language’ with natural scientists and quantitative people in interdisciplinary teams. Gov Agency 3 said that having a natural science background does mean they can communicate with more disciplines, but they also described experiencing feeling out of depth interacting with a career-long sociologist: *“I think it gives me confidence to interact with other disciplines. I did realise,*

though, that I'm actually a bit of a poor sociologist. We have some work on behavioural change and social practice, for instance, and I just realised I couldn't cut it with a proper sociology professor. I just couldn't. I couldn't interact". Another participant spoke about perceiving a distrust from *"pure social scientists"* towards those who started out in natural sciences: *"maybe they think that we're not real social … they're often a bit suspicious of us"* [Academia 1].

4.1.2 Professional backgrounds

Every participant who detailed their professional backgrounds mentioned working in multiple sectors during their careers, mainly across academia, the third sector, local and national government, public bodies, and consultancies. Three out of fourteen participants have also worked in more diverse sectors, including business intelligence in a private law firm and manual farm work. Nine out of fourteen of the participants mentioned having worked in an academic research role, including Academia 1, who currently works on *"sustainable agriculture and sustainable food".* Some participants have worked as natural science researchers, and some have worked in multidisciplinary research: *"leading and conducting multidisciplinary research for a wide variety of conservation projects"* [NGO 2]. Others described research looking at the relationships between the natural environment and social phenomena.

> "My primary sort of specialism within the field of social anthropology is the understanding environmental anthropology. So understanding how human beings interact with the natural environment, and how that informs the way they think, how that informs the way they act, how the natural environment shapes political economy, how natural environment shapes spiritual practices, all of those sorts of things" [Gov 2]

> "I was looking at how wellbeing can be embedded as a foundation for tourist destinations. And thinking again about the connections between human wellbeing and different kinds of landscapes … how experiences can be generated for the different kinds of people, to connect them much more to the landscapes and … develop a sense of place for people" [Gov Agency 7]

Some participants discussed their motivations behind working in the natural environment sector. Gov Agency 5 explained, *"I was so interested in environmentalism and sort of that whole wanting to change the world thing from being really young".* Referring to previous interviews with participants with natural science backgrounds, Interviewer 2 reflected, *"it's almost like they've had that epiphany that they, they are not just interested in studying nature, they want change, they are very problem focussed, they want societal change, want to make a difference"* [Interviewing Academia 1]. Gov Agency 5 said that wanting to change conservation outcomes is their motivation for working in an interdisciplinary way.

> "I'm interested in social science in conservation because I want to change the conservation outcomes. That's my reason for doing the job … I know

as a social scientist that if I just studied people, but didn't do anything differently, then there would be no change. So I know that the only way for me to, you know, achieve what I want to achieve is to be interdisciplinary" [Gov Agency 5]

4.2 Social science roles in NEOs

4.2.1 Role titles

Thirteen out of fourteen role titles were provided by participants. The role titles indicate a range of roles and at differing levels of seniority within their organisations. There is variety in how roles titles are framed within the different organisations. Five role titles include the term 'social', and two include the term 'people'. The remaining six are not framed as 'social' or 'people' roles; for example, two titles contain 'conservation scientist'. However, all participants self-identified to some extent as social scientists and it was on this basis that they were recruited. The participant with a consultancy business gave the job title of 'social scientist'. All others with 'social' or 'people' in their titles are from government or government bodies; none of the three NGO participant's titles were framed in this way. However, role titles may not match how the social scientists see themselves; for example, one participant with 'specialist' in their role title said, *"I'm not a deep specialist"* [Gov agency 6].

4.2.2 Role descriptions

Most participants mentioned engaging in research, leading or supporting research projects, working in evaluation, or undertaking a translation role whereby they reformulate evidence into more accessible forms for their internal or external audiences. Other roles identified include commissioning research, providing advice and guidance on bringing in social science, promoting social science within organisations, providing evidence to policy colleagues, developing methods, supporting NGO conservation advocacy work, and project management.

"designing projects, securing internal or external funding, conducting fieldwork, analysis, write up and dissemination. We also provide social science support to a wide range of conservation projects" [NGO 3]

"My job and the team's job is to lead Social Sciences in the [name of Arms-Length Government Body]. And it's predominately a translation role, really from the outside social sciences and then identifying how to be more effective and efficient" [Gov agency 3]

"My main role is to manage an evaluation project. I also advise on research and evaluation projects, such as other evaluation projects and surveys. The aim is to also grow the social science evidence base within

> [name of arms-length government body]. I work with Defra Marine & Fisheries social researchers" [Gov Agency 4].

The participant with a small consultancy described their roles as:

> "business development; business management; contract management; consultancy; teaching [behaviour change and behaviour change management]; networking; practical support to clients (e.g. setting up a farmer cluster recently); supporting early-career social scientists" [Consultancy 1].

Some participants highlighted a lack of social science in their roles. NGO 1 said:

> "I wouldn't say there's particularly any social science in the role … I do kind of policy and advocacy work on UK policy, but also just occasionally dipping into other things. So sometimes I do a small bit for the sustainable diet team with more of that kind of social science lens, but nothing particularly official or large".

Gov Agency 6 said that they went through a stage whilst working in their current organisation where there was no social science in their role, other than translating external evidence:

> "They didn't know what to do with us quite honestly ... and my role was seen as kind of making sense of evidence externally and just bringing it inside internally, I think". Other participants said that there is too much time spent on project management, meaning there is less time to do social science work: "a lot of my time has been taken up with kind of project management type activities … people are frequently required to spend a lot of their time and energy doing things which are not what they are employed to do" [Gov 2].

4.2.3 Disciplines utilised in current role

This question wasn't asked directly (the related interview and survey questions were "What is your current role title? And how would you describe your role in a couple of sentences?" and "As a social scientist in your organisation, what roles, tasks or projects do you tend to take on?") but independently, behavioural science and related disciplines were mentioned several times, especially in the workshop. A number of participants said that they engage with behavioural science evidence or are involved in behaviour change work, for example, researching *"how to increase people's connection to nature and/or pro-conservation behaviours"* [NGO 3] or *"understanding the various characteristics that influence their [land manager's] behaviour. so that we can design the [named] scheme in such a way that we know that people will respond to it in other ways that we expect, so that our objectives are met"* [Gov 2]. NGO 1, who has a background in applied behavioural science, felt that there is a *"broad feeling"* within and beyond their NGO that behaviour change research and actions are just *"common sense"*, and therefore anyone is

qualified to examine them: *"people just are not aware of this close knowledge behind that [behaviour change], or there are biases and that kind of thing. So I think people just think they can do it themselves, if they think about it at all"* [NGO 1]. They then spoke about how their organisation states they *"don't 'do behaviour change'....we're more system change",* to which interviewer 2 responded that it is *"interesting that they [NGO] don't think they need social scientists for system change"* [Interviewer 2]. Gov Agency 6 suggested that there is a misconception that social science is just about and for behaviour change, speaking about their frustration at being pigeonholed into behaviour change work.

> "[The organisation] latched on to behaviour change 'because that's the thing that social scientists do'. So me and [NAME of another social scientist] were dragged into the strand work around … which we weren't leading, but were asked to contribute to …. behaviour change" [Gov agency 6]

Many participants indicated that they were generalist 'environmental scientists' or 'environmental social scientists', with the implication that they drew on a range of disciplines. Qualitative and quantitative approaches were mentioned. Other than behavioural science, other disciplines specifically mentioned in relation to their current role were psychology *"the psychology of connection to nature for reserve activities"* [NGO 2], environmental sociologist, evaluation, statistics, landscape specialist, conservation and economics.

4.2.4 What subjects do social scientists work on?

Some participants mentioned working on a specialist area like 'water quality and water supply policy' or 'land manager behaviours', whereas other participants work on a wider variety of topic areas. The topic most frequently worked on, by 5 participants, is around connecting people to nature and associated health and wellbeing. Figure 2 shows the range of subject areas mentioned.

Figure 2. Participants' subject areas.

Regarding the prominent subject of connecting people to nature and wellbeing, participants from NGOs described looking at the *"psychology of connection to nature"* [NGO 2], and a focus on *"how to increase people's connection to nature and/or pro-conservation behaviours"* [NGO 3]. Gov Agency 7 described approaching this subject area by linking it to a *"social inclusion"* focus, to understand inequalities in accessing and engaging with the natural environment. Gov Agency 6 said that before an internal review was conducted which considered the role of social science in their organisation, there wasn't seen to be a wider focus for social science outside of its application to connecting people to nature.

> "In the past, we'd been told very specifically to focus on what was Outcome Two, which was about people's enjoyment and engagement with the natural environment. So, it wasn't seen that there was any role around social science more generally, about how it might apply across all of our areas of work" [Gov agency 6]

4.2.5 What strategic roles do social scientists undertake?

Some participants see part of their role as promoting social science and teaching social methods and perspectives: *"I think we do need to be confident and shouting out when those [social] perspectives are what they need to hear"* [Gov Agency 3]. Regarding the tendency for government to view nature as a natural science problem, Gov Agency 1 said *"what I see as part of my role is to ... challenge that where I see it happening and ask why we're not looking at these different viewpoints".* Gov Agency 5 described taking on a *"rescue mission"* to get senior leaders to understand survey design is more than *"common sense".*

> "So the role I took on mainly with that was a championing role and a role to really get the senior leaders to understand 1. why we needed to resource it. And what a dog's dinner it had ended up as with no resource" [Gov Agency 5]

Participants also touched on the need to frame social science in specific ways to get their perspectives across: *"how to sort of play social science in so it is not alienating"* [Gov agency 5].

4.2.6 Methods used by social scientists & perceptions of methods.

The participants who described using predominantly qualitative methods work in academia and a consultancy (they do not currently work in government, government bodies, or NGOs). Other participants described mostly using mixed methods, some saying this is their preferred approach.

> "I don't think I have ever done a piece of research in [name of gov body] that hasn't been mixed methods. Because you know, the in-depth

> interviews, stroke, ethnography-style alongside of a quant pieces is for me so satisfyingly interesting and illuminating" [Gov Agency 2]

Participants spoke about pressure within NEOs to use quantitative rather than qualitative methods. Gov 2 said that this pressure has affected their role: *"I've noticed how I've sort of 'tacked-into the wind' as you like, to have that demand for evidence, which is set out in a very specific sort of way?' And that what that means is spreadsheets. What that means is, is graphs. What that means is, is stats".* Participants identified procedures and structures that underpin the favouring of quantitative methods in NEOs, for example, that evaluation frameworks *"tend to be rooted in quantifiable measures"* [Gov agency 1] and how outside of government, courts of law, journalists and publics all tend to prefer quantitative data, which influences policymakers.

> "...good quantitative data is very useful for demonstrating in a court of law or in a kind of journalistic context, that you've delivered a valuable impact on society with public money .... And we are still in a situation where the, I guess the kind of end customers for a lot of evidence in society like statistics, because they're kind of science flavoured" [Gov 2]

The preference for quantitative data was discussed in the workshop, not as a dismissal of qualitative social science but as an embedded practice that is practical for decision making. It was discussed that there is support for qualitative social science within organisations, but the challenge is how to feed this into decision-making because people prefer financial and quantitative data to make the ultimate decision. Quantitative measures create 'nice, neat graphs' and this is something that policymakers can grasp to help them make decisions. It is perceived that qualitative research is harder to translate by the evidence customer.

4.2.7 Bolted-on, used as facilitators & to provide insights

Some of the participants' evidence work is self-directed, where the individual or their team identifies an evidence gap and deems it a priority, and some work is directed from elsewhere or used to support existing projects. Sometimes social scientists are called upon to deliver 'ad-hoc' insights: *"we also do quite a lot of draw-down call-out work for FC and Defra colleagues. So, they're often on the phone to us asking for: 'Do you know of any publications about…?' 'What's your view on …?' 'Can you give us a quick summary around this?'"* [Gov agency 2]. Participants brought up the use of social science as a "*bolt-on"* for projects, with social scientists being included as a *"tick-box"* or being brought in near the end stages of a project to facilitate the socialisation of the project.

> "So you were always involved as an afterthought when things were too developed. So, and that ranges to from the technical advice you give around methods, so you know, 'sort this questionnaire out because it's a bit rubbish' right through to not being involved at the right stage" [Gov agency 6]

Some participants felt that this use of social science is typically still the case: *"[Social science] just is always a bolt-on and a plugin for everything"* [NGO 1]. Interviewer 2, who works for a government agency, reflected on their experience of being seen as a threat when they tried to move past the role of facilitator by challenging aspects of the project: *"especially when you're brought in, typically at the end, once all the design has been done, and it's like to socialise the project … And I think that can be quite threatening to some people when they just want to just do what they want to do"* [Interviewing Academia 1]. However, other participants reported positive change: *"We are well past when I started 10 years ago, we are well past being asked to be facilitators"* [Gov agency 2]. Gov 2 described a shift from evidence teams with social scientists being used at the end of projects in evaluation to bringing them in earlier on in the process. Giving the example of evidence teams being used to help shape the design of named schemes, they said that *"newer leaders and younger policymakers"* perceive an earlier role for social science evidence [Gov 2]. Gov Agency 3 spoke about how negative experiences with 'bolt-on' social science has led them to prioritise social science led work in their current role.

> "you could bolt-on a social scientist to a big European project because you wanted to get funded. And then you just do some crap social science framed by an engineer or natural scientists and I did learn that whilst you get a lot of good money that way, they weren't very good projects to do and I had a bias for getting involved in social science-led projects. And I still have that" [Gov agency 3]

4.2.8 Existing & desired social science roles

Participants agreed that social scientists are essential in NEOs: *"if an organisation is working on what the intent is to protect nature or to conserve nature, they absolutely have to have social scientists, at least one, if not be working with them'"* [Academia 1]. Participants discussed that these problems can't be solved unless in-depth and contextualised evidence is brought in from the social sciences and how the social side interacts with the physical (natural sciences) side of the problem is exposed. If only one disciplinary approach is used, any proposed solutions to environmental problems will not work long term. Gov 2 described social scientists as *"doctors of society",* saying that they *"can look at a situation and can identify certain problematic [social] dynamics and then draw people's attention to them. And help facilitate a collective solution to the problem".* However, one participant suggested that some public engagement work can involve other teams - fundraisers, marketers and researchers, who don't necessarily have a social science perspective. That social scientists may be called on to address particular needs with particular constituencies, such as farmers and specialist audiences, or to provide particular kinds of inputs or outputs.

During the workshop participants discussed a sector-wide desire for people to improve their environmental behaviours, thereby the requirement for evidence to be brought together and communicated to make clear recommendations. The value of social science is clear in this context.

Regarding evaluation, Gov Agency 6 said *"I think you need to have an appreciation of social science to be able to do evaluation''* along with an appreciation of other disciplines.

In the interviews and surveys, participants were asked if there is any work they would like to take on but cannot. Only Consultancy 1, who owns the business, said they would not: *"No thanks – a lot of work to do already!".* All other participants said there is work they would like to take on, including more research, both in-house and commissioned: *"there's a whole bunch of research that we would love to commission in an ideal world or love to get involved with and do ourselves"* [Gov Agency 7]. Gov 2 said they would like to make more of a contribution to strategy, thinking about *"how we change the behaviour of society and how we change the culture of society"*. NGO 3 answered that they would like to create learning resources to train non-social science colleagues in social science research methods. Gov Agency 5 said they would like to spend more time thinking about workplace cultures in NEOs, *"and how we can understand those cultures in order to play in our work better"*. Participants also want to investigate different topics.

> "There's quite a lot of urban stuff … I'm noticing the enormous contribution that tiny, tiny scrappy bits of green space and scrappy bits of neglected space make to the way in which nature functions" [Gov agency 2].

> "I think there's some perennial problems with respect to domestic water use and people's responses to flooding where social practices theory with some good social psychology norms and things could be useful" [Gov agency 3].

> "food security issues … the use of land and the benefits that people draw from it" [Gov agency 1].

Gov agency 2 said they would just like more time to pause and think, *"and then say actually, I'd like to be a bit creative. And I'd like to do something in this direction. Because I think there's a policy need or I think there's a research gap"* [Gov Agency 2]. Most participants pointed to time as a barrier in taking on work: *"We would like to undertake more internal research but this is limited due to resource/time constraints"* [Gov 1]. Lack of time also means it is more difficult to progress the role and impact of social science in NEOs.

> "We don't get the time to really think, reflect and think about our strategies and tactics, I guess in terms of how to deliver social science" [Gov agency 5]

> "...they're [social scientists] not necessarily going to have as much time to sort of persuade and manage-up in order to get their voices heard at a senior level" [Gov 2]

Gov 2 spoke about how there is a lack of time in the civil service due to it being a *"generalist institution"* where social scientists dedicate a lot of their time to project planning and therefore do not have much time to carry out research: *"There are lots of cases I can*

… think of where I've spent months of my time planning something and therefore only have like ... a couple of weeks, or even a couple days to actually answer actually do the evidence work itself" [Gov 2].

4.2.9 Who do social scientists work with?

The three NGO participants reported working with different kinds of colleagues. NGO 2, who works in a strategic role, said they mostly work with *"various 'Heads of…' roles within our [named people & nature] framework".* NGO 1 said that when an interdisciplinary team is brought together to work on a project, they typically work with science colleagues, people with policy backgrounds, people from campaigns, topic specialists, and occasionally media colleagues.

> "I have no idea what sort of scientists it will be just someone from the science team. So what I would hope that they would choose someone with an appropriate background, but I don't know" [NGO 1].

There are no defined social science roles in NGO 1's organisation: *"We have a whole science division in [NGO] and there are no social scientists at all".* In contrast, NGO 3 described working with *"the social science team"* as part of *"the broader Conservation Science team (e.g., for projects that involve ecology as well as social science)".* In addition, they work with *"the teams working on our nature reserves, as this is where most of my research takes place",* including market research, fundraising and communications, and education, *"who deliver connection activities for young people"* [NGO 3].

The two participants from government reported working both with policy teams and evidence colleagues and analysts from social sciences, natural sciences, economics and statistics. Policy colleagues can be *"... both on the kind of policy development design side as well as people more on a delivery side"* [Gov 2].

Most participants working for government bodies described working with colleagues across their organisations. Gov agency 2 described working with *"evidence, strategy and translation into practice":* everyone apart from business. This includes working with a team of about 12 social scientists. Gov agency 7 also described working with other social scientists and *"lots of other programme groups, so that basically cuts across the entire organisation".* Other participants described working more with leadership and strategy. Gov Agency 3 who works on translation rather than research said, *"I tend to work with head office, people who have more strategic roles"*. Regarding the kinds of evidence-colleagues participants work with, Gov Agency 7 said they just work with other social science scientists on the *"social inclusion and the natural environment agenda".* Other participants described working with a range of evidence colleagues and specialists.

> "We have behavioural scientists, anthropologists, sociologists, and conservation scientists, economists and statisticians in our group" [Gov Agency 2]

> "...also, with other specialists, so like obviously social scientists, evaluation, natural capital specialists, and specialists like natural environment specialists" [Gov Agency 6]

Some participants work for organisations that lack in-house social scientists and described working internally mostly with natural scientists while bringing in social science advice from external sources. For example, Gov Agency 1 works with the principal advisor on the scientific advisory committee, which has *"mainly scientists ... some people ... with more of a kind of social sciences bent".*

4.3 What is their experience of their role?

4.3.1 Complexity of interdisciplinarity

In the interviews, participants were asked what they thought were positive and negative aspects of interdisciplinary working. Negative aspects frequently mentioned were the complexity, difficulty and time it needed to work; the practical challenge of bringing together many viewpoints and doing so in a pressured environment.

> "The negative aspects would be just the sheer complexity of involving everybody. The practicalities of doing that. And … making sure that, you know, all those different viewpoints are properly represented" [Gov Agency 1]

> "...the amount of time and resources needed upfront to be able to properly scope something out and do it well, is not always possible in the kind of pressured environment that we're working in" [Gov agency 6]

NGO 1 expressed that this difficulty can be exacerbated when there are too many people on a team, that a few people can be productive, but *"once you start building that to 8,9,10 people ... we could end up with something really watered down, because everyone has to have a say or it's impossible to manage".* However, some participants suggested that the positive of bringing together perspectives outweighs the negative of complexity.

> "Sometimes engagement with multiple colleagues causes projects to be developed slightly more slowly, but this is far outweighed by the increase in quality of the evidence produced" [Gov 1]

In the workshop, participants considered that sometimes seeking out awkward collaborators can have the most productive outcomes and that out of disagreement and different points of view can come the most valuable conversations, insights and actions. Academia 1 said that while working within one's discipline is more manageable, *"we absolutely have to work with different disciplines to, to make big change".* A participant from a Gov Agency introduced a different perspective within the workshop:

> “Do we always have to be interdisciplinary in our activities? Sometimes a single discipline approach is appropriate / better.”

4.3.2 Positives of interdisciplinary working

Participants gave similar responses to each other regarding the positives of interdisciplinary work. Most participants responded that interdisciplinarity beneficially shares and integrates natural and social science perspectives, which can help people broaden their own perspective and can lead to better outcomes.

> “Definitely overall positive. It’s tremendously useful to have different professions bring their different thought processes, methods and experience to shape evidence so it best answers our policy questions” [Gov 1]

> “One positive is “where would we be without a challenge?” and “Where would we be if we didn't change our minds and extend our understanding? Because of the insights and understanding of others?” [Gov Agency 2]

Gov Agency 7 said that interdisciplinarity helps them understand why decisions were made through understanding what perspective they came from: *“it's a real positive actually to get those different perspectives from different sections of the organisation and to really understand what's driving some of those decisions that we make around operations and delivery”.* NGO 3 said that interdisciplinarity makes social science more visible: *“I like the fact that our Conservation Science team is multi-disciplinary; this means that social science research is included alongside ecology research as part of our science work, helping to raise its profile”.* NGO 1 made the point that interdisciplinary is only successful in sharing and integrating perspectives if conditions are met: *“[If] you get the right people into the team, then that is kind of a really great way to bring together lots of different ways of thinking lots of different knowledge”.* However, they said that *“the reality is often something different”.*

4.3.3 Barriers to interdisciplinary working

Participants said that while bringing together perspectives can be beneficial, other disciplines are not always ready to take social science perspectives on board due to the opinion that *“social sciences is a lesser, respected at least, science or not really a science tool”* [Gov agency 7]. This assumption that natural science methodologies are more rigorous than social science methodologies may impact how social research is conducted in projects: *“Despite positive intentions, I have observed that there remains a presumption that applying ecological/natural science approaches/ideologies to social science research is ‘correct’”* [NGO 3]. Academia 1 said that this negative perception can affect social scientists’ productivity, which further influences negative perceptions.

> “Your productivity and your outputs are being massively hampered by the lack of appreciation of social science, which is actually just then sort of

> underlining more people perceive social science to be not that useful, 'why should we bother to get involved?'" [Academia 1].

Gov Agency 1 linked this knowledge hierarchy to the social environment within universities: *"you know, social scientists would be the butt of all of the natural scientists' jokes in the pecking order and that sort of thing. And, you know, it's stuck with people".* Academia 1 expressed that they understand the importance of natural science, but they feel that *"at the moment, the natural scientists don't see the importance of me".* However, another participant suggested that a lack of appreciation can go both ways, that *"the appreciation of complexities or importance of the 'other' discipline (from either side in a social versus ecological world) can be forgotten to the detriment of team cohesion"* [NGO 2]. Part of what is seen to lack rigour in social science approaches is qualitative methods, partly due to the trade-off of sample size when gathering rich data.

> "So in-depth interviews of a small number of people to reveal issues which, you know, immediately dismissed by scientists as "well, you didn't interview enough people – you need thousands of people" [Gov Agency 1]

Consultancy 1 suggested that the use of qualitative methods is discouraged as they can excessively challenge the status quo: *"Because qualitative data probes more deeply and gains richer, more profound insights, it may be seen as excessively challenging to the status quo: editorial gatekeeping and even censorship becomes an issue".* Participants suggested various causes for tensions between disciplines, such as being underpinned by different epistemologies, different understandings of research ethics and of what counts as 'natural' phenomenon to be studied.

> "The whole like: "What is objective? What is subjective?" I mean, that is quite a worldview point of view that can be exasperating, as you know, especially if you're the minority, I guess. Something about, you know, it makes it really frustrating" [Gov agency 5]

> "When you think about and feel that you know the world in different ways that can be incredibly frustrating. So for instance, I remember one natural scientist mentioning to me "Oh, but how can you even have a journal published when you've only done it a few interviews"? Like, "how is it science? How is that valid"? Trying to convey different approaches to research, I think is really, really tough." [Academia 1]

> "People will say, 'Well, you know, urban green space and surrounds - that's not nature. You know, nature is, is in a protected, it's in rural areas, it's in protected areas, but it's not in urban areas' - just seems to me to be absurd…" [Gov agency 1]

Participants also brought up how economics as a discipline is preferred over other social sciences: *"that seems to be the more accepted part of social science. And people that are willing to say 'oh, yes, of course, the economists are important. And understanding the economy is really, really important'"* [Academia 1]. Gov 2 said that they think that in

government, there is *"still a perception that economics is sufficient in its own right and that it can tell you everything that you need to know about human behaviour".* They said that this perception is not helped by *"how certain economists talk and how by certain economists behave in terms of actually understanding and engaging with social science".* They also spoke about how economists get more access to key stakeholders *"like the Treasury, for example, like Number 10"* which can *"make their perspectives more dominant"*, and that this leverage is related to organisational processes built around financial concerns.

> "A lot of how government plans its activities is monetarily based … because economists deal with money and deal with resources that they are … experiencing a certain kind of leverage that other scientists other sciences don't possess" [Gov 2]

Participants spoke about how social science is not as well funded as natural science research: *"Social science research can be disadvantaged when competing against ecological research for internal funding because it is less well-understood by senior managers who are making the decisions"* [NGO 3]. In the workshop, participants suggested that social science is not prioritised for funding, as when decision making needs to happen quickly, people use the solutions they know. Participants also spoke about instances where they were included only as a 'tick-box' in interdisciplinary projects in order for organisations to secure funding: *"there were loads of European possibilities where you could bolt on social scientists to a big European project because you wanted to get funded"* [Gov agency 3]. Although social science is still sometimes considered as a 'bolt-on', Academia 1 said interdisciplinary work is increasingly better funded: *"historically, it was actually quite difficult to get funding to do interdisciplinary research. But I do think … that's changing".*

4.3.4 Social science resource

We asked participants how many social scientists are currently working in their organisations. Gov 2 said that there are now *"quite a lot"* of social scientists within their department, including 12 social scientists working on a programme in which they are involved, and that being in a big team allows them to be *"much more of a specialist than I might otherwise have been allowed".* Other participants said there are only a few, or no other social scientists in the workplace.

> "I am the only government social researcher within the [name of arms-length government body]. There are lots of people with evidence backgrounds but these are more from a physical science perspective" [Gov Agency 4]

> "we have a whole Science Division in [name of NGO] and there are no social scientists at all" [NGO 1]

Gov Agency 1 said that in a team of around 15 they are in, only *"maybe one or two would actually be social scientists"* and that a lack of social science expertise in their organisation

is a *"weakness that the organisation has had for some time"*. Some participants described a lack of in-house social science expertise, but the use of externally commissioned social science research. Talking about the NGO sector NGO 1 said *"I don't come across any many straight up social scientists in these in these organisations … they tend to commission those people [behavioural insights teams] to do a particular piece work for them without necessarily having experienced or applied or built capacity of social science internally".* Gov 1 said that a mix of in-house and commissioned research is carried out in government, but resource constraints prevent them from doing more internal research. Gov Agency 7 also said that resource constraints are a barrier to conducting more research, but that there is a good range of expertise in-house and that using external expertise is useful and unproblematic: *"I think we have a good broad range of expertise in the organisation. And I also think we have an excellent reach externally. So you know, partnering with those who have expertise where, where there are gaps internally, I don't think is an issue".*

Gov 2 said that individual's areas of expertise are not well utilised and that social scientists can be called upon to work on many subjects.

> "I think that doesn't seem to be much awareness within government that you really do want experts on a specific topic to be working on that topic. It seems to be like, 'Oh, we can just get another social scientist to work on this' even if they previously haven't worked on this same subject area at all … it ignores the fact that subject knowledge is a thing" [Gov 2]

They make the point that failing to use appropriate expertise can negatively impact policy outcomes: *''they deliver it and it doesn't work, and the government has wasted millions of pounds of taxpayers money and and thousands and thousands of man hours of time developing a policy"* [Gov 2].

4.3.5 Organisational framings, agendas and strategies

Participants spoke about agendas and strategies in NEOs and how socio-environmental problems are framed. Gov Agency 5 said that in the past, government did not consider the social dimension of climate change, *"even though climate change is man-made, you know"* [Gov agency 5]. Gov agency 7 pointed to emerging agendas around social inclusion and community cohesion giving the example of the Royal Horticultural Society: *"they're doing a lot of work around community gardens and getting people involved. They're really starting from that perspective of inclusion and community cohesion"*. They also spoke about the connecting people to nature and wellbeing agenda, giving the example of one NGO, who are trying to understand *"the multiple values of nature"* and the *"worth of canals and rivers"* to physical and mental wellbeing. Despite an emerging people focus across the sector, NGO 1 highlighted that culture, social practices and behaviours are still not being properly understood or considered in their organisation, referring to strategies around the sustainable diets agenda:

> "One of the big pushes into strategy at the moment is food. A whole large part of that is supposed to be sustainable diets. But they just are struggling to actually think about how you might actually think about people rather than, you know, they want to look at landscape and fishermen and how do you produce palm oil ... Why do people buy things at that price or choice? Or is it culture? Yeah, none of that are things we are thinking about" [NGO 1]

Gov Agency 1 said that organisations have not traditionally framed conservation through an environmental justice agenda that acknowledges that *"the use of land and the benefits that people draw from it, including the state of nature as a result of that is really about distribution of costs and benefits''*. Defining strategy can be difficult because of the different ways issues can be framed and approached. Gov Agency 1 spoke about how the *"nature of the problem itself and even whether there is a problem"* can be contested. They described the civil service as *"quite siloed and fragmented"* and that to enact their agenda *"the degree of integration within the organisation needs to be much better and needs to be constantly improved".* They also discussed how their organisation's advisory committee is called the *"scientific advisory committee",* using language which can sideline social science framings:

> "People have said, 'well, when we talk about science, of course, we mean all evidence', but actually the clue's in the words, and the fact that people use 'science' usually steers them towards scientific framings rather than wider social science ones" [Gov agency 1]

Participants spoke about the problems with the standard approaches in NEOs to framing and addressing socio-environmental problems. Gov agency 1 said the civil service's structures and processes can create a detachment from real-world problems: *"you tend as an organisation to see the world through those structures and organisations that you've set up, rather than the real world problems that you're trying to solve".* Participants brought up examples of work around agriculture in academia and government, giving examples of where farmers' perspectives and social contexts have not been properly considered when introducing new technologies and practices. Academia 1 said that there is an assumption that farmers will adopt new technologies: *"when people are designing technology and practices and things like that, that they expect farmers or consumers to use or whatever they come with",* and that natural scientists don't understand *"why farmers decide to do different things".* Rather than understanding the different reasons why people do or don't adopt new practices or technologies, conservation tends to assume an information deficit module: *"conservation tends to take the view that, you know, people if people don't agree with what we're advocating, then it must be for a lack of evidence"* [Gov Agency 1]. Gov 2 spoke about how before social scientists were working on the [named] scheme, the farmers' perspectives were not adequately considered:

> "[Farmers] basically had to, they have a stack of points that they had to allocate … that he could spend on different areas of land within their holding. And that proportion of points spent in a certain way from a long list of options. And actually, you know, if you look at that, from a kind of, like

choice architecture, from a behavioural insight perspective, that's a huge cognitive load to place on a person" [Gov 2]

4.3.6 Trajectory of social science in NEOs

Regarding the trajectory of social science in NEOs, there was mostly a consensus that social science is becoming more embedded and valued, with more social scientists being employed, more 'people' orientated initiatives, and some new areas of work opening-up to social scientists. This may be a 'social science 'turn' in NEOs. However, Gov Agency 5 said that it is only recently that most NGOs have moved beyond having *"a very small amount of social science resource"*. However, despite a historically small number of people employed as social scientists, Academia 1 said that social science perspectives are valued within NGOs in which they have worked, *"while they may not necessarily have the job title, or describe themselves to others as social scientists, it does seem to be very much embedded in the organisation to the NGOs I've worked with in the past".* In NGOs it is now seen that *"social science really is integral into helping to create societal change"* [Academia 1].

Participants in the workshop discussed trends within the sector and organisations, and how social sciences have fallen in and out of favour over time. Social sciences are currently on the rise because of the types of problems that are being prioritised; for example, work around the EU Exit in DEFRA has led to a recruitment of social scientists. The history of the organisation may also influence the ways in which social science is understood and used. While there is a *"history of social science in government"* [Gov agency 5], this is not so much the case for NGOs.

Participants in the workshop discussed an NGO where a small increase in the number of social scientists employed has seen more support for what they are doing and that in turn creates more space for social sciences. The organisation now has more 'people' orientated initiatives in the organisation demonstrating that there is a positive shift occurring. However, participants also highlighted that how much social science is valued varies among colleagues within NEOs. In the workshop, a discussion followed a poll which asked participants about the degree to which they think social science is valued in their organisation. The majority of responses indicated that some colleagues value social science, and social science is valued in some work areas but not in others.

Gov Agency 1 said that while the senior staff are sympathetic towards social science perspectives, *"it is still quite an uphill struggle with colleagues".* Valuing is also dependent on the topic of investigation. Whilst social scientists are included in some projects, there are certain topics where their expertise is not considered. Regarding discussions around 'net zero', Gov Agency 5 said that *"it's not so much that we're excluded. It's just that we're not even thought, you know, and not just us the economists even are not thought about in the net zero discussion ... I would definitely think it's a nature conservation sector issue".* Other participants from government agencies said that some new areas of work are opening up for social scientists.

> “We are being kind of pulled into areas of work where we've been pushing for years to get in and making very little headway. So that's been really exciting” [Gov agency 1]

> “There’s absolutely loads of things which we haven't been able to get involved in for a variety of reasons. I think things are starting to change” [Gov agency 6]

4.3.7 Social science networks

In the surveys and interviews, participants were asked who they know who works in a similar role in other environmental organisations. Participants who work in the public sector were aware of the increase of social scientists in Natural England and DEFRA: *“I know of a lot of people who are within Defra and Natural England”* [Gov 2]. Gov Agency 2 referred to existing networks which connect social scientists in government and it’s public bodies:

> “I feel quite connected to a large community. There are lots of opportunities to, particularly within Defra and Defra group to sit and talk about stuff these days. So, you know, there's the behavioural change network … There's the Social Scientists Network, there's the Social Scientists and the Environment Network” [Gov Agency 2]

Social scientists within government and its public bodies expressed that their networks mainly are contained within the public sector. Gov 2, who knows lots of social scientists in DEFRA, felt they did not know a large number of social scientists in NGO’s. Gov Agency 5 stated that they did not know any other social scientists in NEOs until they joined their current role: *“and I think that in itself is quite interesting in terms of - it is not networked into mainstream conservation”* [Gov Agency 5]. Among participants, there was some awareness of social science presence in NGOs and social science-focused consultancy businesses in the sector.

> “I believe there are social science roles in the National Trust insight team” [NGO 3]

> “There are lots of little research businesses as well. Larger and smaller, so SME type research businesses” [Gov agency 2]

Consultancy 1 said that they know *“a handful of other social science consultants … but not many people”.* The participants from NGOs also described having limited contacts with social scientists in other organisations. NGO 3 said that they know *“some of the social science team at Natural England*”, and NGO 1 spoke about communicating with an individual social scientist from a Wildlife Trust. It was suggested that social scientists within NGOs do not have as defined roles as in government, meaning there is limited visibility and so networking with other social scientists is more difficult. Responding to an earlier comment from NGO 1, the interviewer reflected that it was interesting what they said about *“the campaigns and the comms and marketing people, because I think sometimes these*

sort of, I guess, Social Research, understandings or skills are maybe brought by individuals to their job, but it's never defined, like you say, as a profession" [Interviewer 2, Gov Agency]. Similarly, Gov Agency 7 said that there are dedicated people working on the *"people agenda"* throughout their partner organisations, who are *"doing what we classify social science research"* and *"applying social science methods to their work",* however, they are unsure *"whether they actually classify themselves as social scientists or have a dedicated social science team"* [Gov Agency 7].

4.3.8 Professional memberships

Ten out of fourteen participants are members of one or more professional bodies, and four participants have no current memberships. The most widely held membership is in the Government Social Research profession (GSR), reflecting the make-up of the participant group. Participants also are members of the Government Economic Service, the Society for Conservation Biology, the IUCN Species Survival Commission and the IUCN Sustainable Use Advisory Group, the Royal Anthropological Institute, the British Sociological Association, the British Psychological Society, the Health and Care Professions Council and the UK Evaluation Society. Participants have also held past memberships in the British Mammal Society, the British Ecological Society, the Social Research Association, the Royal Geographical Society and the Royal Society of Arts. Some participants said they left their previous memberships as they felt they were no longer relevant to their job.

> "I've been a chartered waste manager and a chartered water manager but I let those lapse since being in [Govt Body] because they don't really fit to what I'm doing now" [Gov Agency 5]

> "I was a fellow of the Geological Society of London for years, and I gave that up just because it wasn't related to the job. Similarly, I was a fellow with the Royal Society of Arts, which I might rekindle, again, that was seen as not being so directly relevant to the job" [Gov agency 1]

Some participants expressed dissatisfaction with the professional bodies available, saying that no professional body is *"quite right"* [Gov Agency 2] and that they *"haven't found a home yet"* [Gov agency 5]. Despite many participants being members of the Government Social Research profession, some offered criticism.

> "I feel I get more from talking to different people through things like team calls, at conferences, or whatever, than anything we get through GSR" [Gov Agency 6]

> "The GSR service was always a bit poor" [Gov Agency 3]

Participants brought up experiences of sociological bodies not covering environmental topics, referring to the British Association of Sociologists, and the Social Research Association. Gov Agency 6 said that *"in the past, the Social Research Association was quite useful around applied methods, then wasn't as useful around the subject*

knowledge". Conversely, some participants discussed experiences of environmental associations not including social perspectives. Gov Agency 5 explained that *"water management [professional body] is very much you know … engineering, ecology are dominant paradigms and the social is not in there".* Academia 1 chose to leave the British Ecological Society in part because it *"is still very much from a natural science point of view".* However, they also mentioned how two bodies they currently have memberships in, the Society for Conservation Biology and the IUCN Species Survival Commission, have a *"social science working group"* and act as *an "interface between natural and social science"* respectively. Gov Agency 6 raised the issue that *"because social science is such a broad church"* and that their background is *"so general"*, that they do not see any single professional body as particularly useful. They suggest, *"it would be helpful to have actually probably, you know, almost four or five kinds of memberships to kind of reflect your different kind of interests"*. A couple of participants mentioned financial considerations to joining professional bodies. NGO 1, who has no professional memberships, said that *"I've never been [a staff member of] a big, big corporate where they're like, yeah, we'll pay for that membership".* Gov Agency 3 said that their employer would pay for one membership, and that they have joined the British Sociological Association as their agency decided not to join the GSR: *"the agency has been a bit resistant to going down the civil service route, badging, jobs and things because they don't want to lose control over their employees".*

4.4 What are participants' aspirations?

4.4.1 Improving social science resource

In the workshop and the interviews, participants articulated a desire for more social scientists to be employed in the sector to improve the role of social science: *"absolutely, more social scientists needed"* [Gov Agency 6]. Participants in the workshop also discussed the need to identify those with the skills already in an organisation to increase the visibility and impact of social science. It is hard to find out who has social science expertise or training within an organisation, it is often 'invisible'. It was suggested that NEOs should focus on ensuring that they have the correct disciplinary communities and perspectives.

> "I think anthropology has a lot to contribute. Social psychology has a lot to contribute, behavioural economics and behavioural psychology have lots of contribute, quantitative sociology and qualitative sociology an enormous amount to contribute. So I think by working together, we can we can essentially provide the kind of missing ingredients to the kind of conceptual solutions that are and practical solutions which are required to literally save our society [laughs] from collapse" [Gov 2]

4.4.2 Improving understanding and use of social science

Participants want to promote qualitative methods as applicable and rigorous: *"I've been thinking about ways of improving ... the position of ethnography within government"* [Gov

2]. In the workshop, the need to show why qualitative methods are rigorous was discussed, and that mixed methods should be encouraged. For example, quantitative data can show trends, and qualitative data can show the reason behind those trends. This approach tends to go down well in NEOs. One participant mentioned wanting to carry out methods competency training for non-social science colleagues.

> "I would also like the time to be able to create resources or guidance to enable non-social science colleagues to undertake basic elements of social science research competently (e.g. basic survey/interview good practice) whilst understanding when they need expert input from us" [NGO 3]

Social science framings should be considered when thinking about how problems. In the workshop, what was called for was a shift in how problems were approached. Any starting point must understand the problem at hand: is it a scientific problem? Is it about people? Is it both? This understanding should determine how to tackle the problem and what evidence is needed. Participants want the importance of social science to be understood better in NEOs. Participants expressed wanting to share strategies for communicating the relevance of social science framings and methods.

> "I think what we all really appreciate is the, is the benefits of a social science perspective. And, you know, that kind of rigour, rigour around social science and, and really learning from others how this is embedded within different organisations, and how it's effectively communicated and taken up within different organisations is really, really interesting" [Gov agency 7]

Participants argued that promoting social perspectives is needed to achieve positive socio-environmental outcomes: *"Those organisations need to have a strong social scientific voice, or chorus of voices, informing them about the best way to be as active as they can be"* [Gov 2]. As well as improving the evidence base, participants expressed that there needs to be a greater emphasis on intervention, in which social science can play a role: *"it should be working with people that can actually intervene and try stuff"* [Gov agency 5].

4.4.3 Learning through SSiNE & building networks

In the surveys and interviews, participants were asked why they were interested in attending the SSiNE workshop. Participants said they would like to find out where social scientists are employed in NEOs and the roles in which they are engaged.

> "To learn more about people using social sciences in progressing priorities around nature" [Gov agency 1]

> "...understanding the different ways in which people are valued and being usefully employed" [Gov Agency 2]

Some participants emphasised learning about others' experiences of working in interdisciplinary teams: *"hopefully it will give me some insight into how others work successfully with natural scientists"* [Gov agency 4]. One participant said they would like to promote interdisciplinary working between academia and government and get *"examples of when this way of working has worked particularly well and added value to policy making"* [Gov 1].

All participants said that the workshop would be an opportunity to expand their networks and establish contacts with people they can continue to communicate with: *"to broaden my network of social science contacts … and how we can potentially learn from each other and collaborate in future"* [NGO 3]. Most participants said they would look to collaborate in the future, NGO 2 making the point that cross-sector collaboration would be useful *"so we aren't all inventing similar wheels!"* and participants expressed a desire for an ongoing cross-sector network.

> "I would love to be part of an ongoing cross-organisation network of social scientists that could share ideas, resources, support and provide a forum for me to talk to colleagues from similar disciplines" [NGO 3]

In the workshop, participants discussed the next steps for a SSiNE network. It was raised that other networks do already exist, for example the Natural Environment Social Research Network which is geared towards government and the public sector, and so there needs to be a consideration of what different thing a SSiNE network would offer; what would be the added value? Would the network include the academic link, and what would be the focus and clear purpose of the network?

4.5 Good examples of using & embedding social science in NEOs

4.5.1 Leadership

A few participants brought up the role of organisational leaders as gatekeepers of social science, and examples of changes in leadership facilitating social science perspectives.

> "Until we had managers asking the right questions and who were supportive and who weren't constantly trying to put us on the back foot and asking us to justify our existence, that's when we started to try and make some inroads into this. And started to change the thinking" [Gov agency 6]

Having a social scientist with a high grade in government was also identified by Gov agency 6 as *"hugely helpful"* as they are able to *"challenge back on some of this stuff"*, namely social scientists being left out of conversations. There is a need to start *"thinking about how you can get the people who are higher up to think it's important and worthwhile"* [NGO 1]. In the workshop, discussion came up around the need to start thinking about the role of gatekeepers. How are recruitment and funding decisions being made? Who do they

leave out? Who do they prioritise? Should information around social sciences be targeted around specific decisions rather than social sciences generally, and does this contribute to social sciences not being prioritised when time is limited, and organisational decision-makers going back to solutions they know?

4.5.2 Relationships & reputation

Gov Agency 5 emphasized the importance of individual social scientist's reputations and professional relationships: *"we have a really excellent team … they're also very articulate and well regarded. And I think that that is been incredibly helpful for the profile of social science".* Participants highlighted that employment practices can improve the position of the social sciences *"by getting good people into the right roles"* [Gov 2]. Reputation is also built by teams: a participant in the workshop gave an example of a team of 25-30 social scientists in a centre for rural economy that had built up a reputation over a long time for producing policy-related social science evidence, and that reputation is crucial to it being used by DEFRA and other organisations.

4.5.3 Social Science as useful

> "We do try to make ourselves useful by focusing on problems facing the organisation... there is lots of advice but it's often not based on the evidence. We can get on top of the data and evidence" [Gov agency 3].

Social scientists can be problem solvers, helping to move on intractable, complex or persistent problems. In the workshop, a participant gave an example of social science researchers teaming up with other teams (e.g. digital and people-facing teams) to engage with stakeholders and solve the problem of flood warnings being too technical and incomprehensible.

One form social science evidence can take is uncovering alternative values and framings. A participant in the workshop shared an example of their organisation addressing 150-year-old conservation conflicts, which could not be resolved by the production of more quantitative data and evidence. Social scientists who were employed to look at the issue provided a totally different perspective on moving forward which drew on understanding *"real world"* values and framing. Those insights work by bringing diverse perspectives together, countering stereotypical viewpoints (reinforced through social media), and highlighting shared viewpoints and common ground, which serves as traction to influence others.

Understanding values, framings and underlying causes of conflict can gain insights which challenge the information deficit model: *"Just throw more information at it. They'll see the light and transform their ways. But of course, it's not as simple as that"* [Gov agency 1]. One participant described a piece of work which highlighted how values around nature need to be understood in their social context: *"You need to understand the relational, relational values, how much we care about what other people think about what we do for the environment or don't do"* [Gov agency 1]. Examples were raised in the workshop and

in interviews where participants described work that was conducted mapping the values and framing around conservation within their organisation. A participant in the workshop said it was insightful to know where people sat and how broadly they sat from each other. Gov Agency 1 described this process:

> "I got loads of people in the organisation to complete the survey and send me the results. So I could plot where we were, as an organisation ... So I could begin to see any patterns emerging and different framings of nature and so on. It was quite interesting in that the board and SLT (senior leadership team) were much more in the kind of new conservation space …. And the rest of the organisation which was scattered towards a more traditional conservation space" [Gov agency 1]

In the workshop, participants gave multiple examples of where qualitative approaches have added value. However, participants also advocated for an openness to methods: *"an ability to work with both quantitative and qualitative data ... I think social scientists should be able to do that"* [Gov 2]. It was suggested in the workshop that one of the challenges of working in social science is that people tend to be an advocate for a particular method. However, the choice of methods should be steered towards the problem, not the other way around. Sometimes this can be qualitative and at other times quantitative, and at other times a fully 'integrated' mixed methods approach can be appropriate. A social science approach is not always qualitative which can sometimes be the perception. It was suggested that being open to different methods can shift people's attitudes around social science.

4.5.4 Social Science as strategic

Advocating for social science within roles was discussed in the workshop, that there may be a case for a 'roving role' for social science, where a person is tasked with helping colleagues understand how useful social sciences can be and working from the 'bottom up' to help people in need. This is different from the 'strategic' approach of integrating social sciences from above. Other participants suggested adopting a lower profile, finding out what's going on and offering advice. It was suggested that such a soft consultative role isn't necessarily ground-breaking, but it does provide a way of introducing the kinds of values that social science can add.

4.5.5 Interdisciplinary working

Participants identified interdisciplinary work in NEOs as having potential to create better solutions to problems through integrating perspectives and as having potential to make social science more visible. However, in the workshop, participants discussed that while interdisciplinary approaches are needed for some problems, in other instances, a single disciplinary approach is more appropriate. Additionally, it was discussed that interdisciplinarity is not necessarily required for social science to contribute within an organisation.

Ways to improve working practices in interdisciplinary teams were also discussed in the workshop. The ability to speak in the same disciplinary languages can facilitate effective working, and this includes the ability to communicate with colleagues who have a quantitative background, which was seen as key to integrate social sciences to [NGO participant] organisation's team. It was seen to help make colleagues feel more familiar with social sciences and open to collaboration if they recognise familiar language and prevents people from feeling 'out of their depth' and just 'getting on with what they know'. Understanding and respecting the 'other' discipline improves interdisciplinary work, and this needs to go both ways:

> "if you can get if you can get people around the table, and if you can get them to come down off their high horses so that everyone's having a productive conversation, you can end up in interesting and worthwhile places" [Gov agency 2].

It was highlighted that the behavioural science community has been successful at communicating between disciplines, leading to policy colleagues adopting behaviour science approaches.

4.5.6 Valuing & understanding social science

It was highlighted in the workshop that to overcome the 'perception problem' and improve how social science is understood and valued in organisations, social scientists need to communicate its relevance. Conversations which challenge notions of social science as 'weaker' and 'woolly' need to happen outside of isolated social science spaces. One way of doing this is to give talks about the role of social science to different groups, including the professional analytical constituencies of economists, operational researchers, and government researchers. Talks can also be targeted at directorial and other levels of leadership.

It was discussed that social scientists need to show operational and applied functions because there hasn't been space for creative blue-sky social science within NEOs. This can be done via case studies or promotional material that can be used repeatedly to show success and 'added-value'. In the workshop, one participant offered an example where they showcased the value of social sciences in collaborative projects using case studies from policy makers and natural scientists. These case studies helped people understand how they could use social science research and findings and how they could be used and integrated with other research approaches. The case studies were presented on their website as short summaries, and links to reports were provided so people could read them in detail. These case studies came from calls from the organisation asking for examples of successful research collaborations. Gov agency 3 said that *"flooding as a socio-technical system is now accepted, which is partly due to our team and the previous team".*

Social scientists can also play a role in influencing strategy and can be effective in dialogue with organisational strategy and governance colleagues. For example, social scientists can support people who are working to restructure the organisation and advise

them on how social science can add value in achieving organisational goals. Gov Agency 1 discussed their work on strategy:

> “we've got a ‘transforming how you work’ strand. And some really good people are trying to develop a new operating model as we as we move into a new corporate plan. And [Name] and I are just trying to set up a colleague to do a PhD using ... action learning in, in sort of showing how we move or not move towards being more kind of a learning organisation” [Gov agency 1].

4.5.7 Using Networks

In the workshop, participants identified existing networks to pinpoint gaps where a SSiNE network could offer added value. Participants mentioned the Natural Environment Social Research Network, which is geared towards government and the public sector, a behavioural science and the environment network, and The Society for Conservation Biology social science working group. Gov Agency 6 said that the Natural Environment Social Research Network has been a good platform for sharing thinking around the role of social sciences in interdisciplinary work in government. Gov Agency 5 considered existing networks and expressed that they would like a new network to add value through being cross-sector and problem focussed.

> “There’s so many networks that exist within government. And networks, like the Valuing Nature Network, which is brilliant, but it is very academic … I would really love to build the capability around a network and, you know, so it's cross-sector and it's not just in these pockets that are … you know, quite distant, I guess from the actual problem that we're trying to solve” [Gov agency 5]

Gov 2 expressed that working in a cross-sector capacity will be more powerful in the process of social re-framings.

> “The problems that we experience with our environment currently: climate change, the biodiversity crisis, and so on. These are not technological problems. These are not even economic problems. These are social problems … so if we all band together and pool our resources and work together, there's a chance that we will turn into a big spotlight instead. And that's much better for resolving that blind spot” [Gov 2]

In the workshop, participants also raised that a current gap is a cross-sector network that includes academics, as well as a network that builds a shared understanding of social science methods that are used across the environment sector. Sharing case studies across the network was one idea and that it would be useful to pick out topic areas such as ‘evaluation’, ‘behavioural insights’, and different policy areas as a focus. However, it was discussed that these approaches could be too big, broad and diverse. Other ideas included using a network to share job notices and other opportunities and could also coordinate research funding.

> “An understanding of who other social scientists are that are facing similar, or complementary, research questions so we can work together; collaboration on external funding which may mean the opportunity to engage more staff” [NGO 2]

A challenge is bringing together academics, the third sector and government into a collaborative forum for putting in research bids around social science and the environment. A participant suggested that SSiNE could learn from the Food Climate Research Network, which has been successful at collaborative problem-solving. A first step could be investigating how they made this work. One participant gave the example of how the Marine Social Science Network started. Firstly, the network helped to create a community of isolated social scientists to create a critical mass; this was a broad-brush approach to just give people a home, so initially, it lacked a focused remit. It was discussed that this could be a good approach for a SSiNE network; to create a community and see where it goes.

Regarding the pros and cons of a network, it was discussed that there is a danger of being a member of too many networks and not having enough time to login and engage. The range of different participants could be the unique selling point but could also be a limitation because too broad means too many diverse interests and perspectives leading to a lack of focus. The possibility of a ‘task force’ instead of a network was raised. This would help focus on a particular problem or issue, a specific task, output or outcome, and then see if that would grow into something bigger or eventually change trajectory. The ongoing SSiNE project aims to be collaborative and to further understand how to improve the role of social science in NEOs.

> “social science is a bolt-on and that going forward is not really the most effective way to work. So I think the project [SSiNE] might provide a bit of input … looking to maybe try and resolve that or help that would be beneficial to everybody” [NGO 1].

5. Results of the expert elicitation process

In this section of the report, we present potential research questions as identified through an expert elicitation exercise that has been informed, very broadly, by the 'Sutherland method'. It involves 10 of the social scientist participants from a range of NEOs suggesting, ranking and refining a priority list of research questions. Following a first round in which a long list of research questions were scored, collated and commented on by participants a short-list of the highest scoring questions was re-presented to participants as a series of research question 'packages' for their further deliberation and prioritisation. Annex. 8.6 and 8.7 contains the details of both stages. Here, brief commentary is provided on each of the research question packages from round 2 of the process together with some general conclusions.

Research question package 1 - What are the 'right' conditions for integrating social science into natural environment organisations (NEOs) and what is the role of power?

1a. How does power operate in NEOs, including through the activities of gatekeepers, to enable or prevent the influence and impact of social science in NEOs?

1b. What factors are leveraged to improve the integration of social sciences into NEOs?

1c: When have social science recommendations/ideas been implemented ahead of/alongside economic or other dominant framings and how can this be explained?

Responses summary:

- Focus on 'what works and why' (cf 'theorising'); importance of practical findings and case studies of what works; focus on positive ways of integrating SS into NEOs.

- Issue / knowledge 'framings' perspective – interesting and important but also more 'academic'.

- Social science doesn't have to be 'integrated'; it can stand alone and offer a distinctive voice and perspective. Can make this an empirical question i.e. what works best – a multi (in which social science 'stands alone') or integrated approach?

- Note – in spite of the power question being scored highly in round one it doesn't really feature as significant here.

Research question package 2 - Multi-team working and integrating social science into NEOs

2a. How do colleagues from different knowledge traditions (social sciences, natural sciences, economics, policy, etc.) understand one another's contributions to the NE sector, how do these understandings (and their underpinning values, ontologies and epistemologies) shape the relationships between these different colleagues, including in the context of interdisciplinary working?

2b. How do these values/ontologies/epistemologies make a difference to how social science is embedded/treated within organisations?

2c. How important is 'speaking the same language' / using the same framings/paradigms as other disciplines (especially the natural sciences and economics) in enabling or constraining the impact of social sciences within organisations?

2d. What is the role of training in opening up understanding of social science and its potential within the sector and how could this training be most efficiently organised across the sector?

Responses summary:

- Importance and value of bottom up empirical research i.e. through interviewing (social)scientists in situ about their experiences
- Training (in its broadest sense) of non-social scientists is important in all sorts of ways.
- Follows from learning produced through package 1.
- Fairly high scoring package but divided the participants!

Research question package 3 - Case studies of NEOs – how histories & organisational cultures have influenced the integration of social science

3a. How has the history and culture of Natural England (or other NEO) and predecessor bodies influenced how they integrate social sciences?

3b. How and why has the acceptance / rejection (suppression) of social science changed over time within natural environment organisations?

Responses summary:

- Too past-oriented and a reflection of wider systems e.g. of education. Need to focus on the future – how to improve things from here.
- The historical context for package 1 questions. Context is important but there is a tension here with the desire to improve things right here, right now as we move ahead.
- Need to focus on when social science is adopted and why.
- Generally low scoring although if reframed in terms of a basis for understanding organisational change some indication that it may land better.

Research question package 4 - Monitoring and evaluation of social sciences in NEOs

4. How is the impact/success of social science within natural environment organisations identified, measured, assessed and shared and how can this monitoring and evaluation be improved?

Response summary:

- Important to establish when, where and why social science is successful and to effectively communicate this.
- Part of a bigger question about how to assess NEO impact / success more generally.
- Requires collection of evidence including through new interviews.
- Link to what works and why (i.e. package 1)
- Difficult to assess impact. Start in a more modest way.
- Mixed response.

Research question package 5 - Social science expertise in NEOs

5a. What counts as relevant expertise/training/qualifications/experience when addressing ‘people’ or social questions within NEOs and what are the implications for the answers produced and the status of social science within NEOs?

5b. To what extent is it recognised, accepted, and acted upon within natural environment organisations that all nature conservation issues involve people?

5c. Which social science disciplines, approaches and methods gain the most and least traction within NEOs, how and why?

5d. How is external social science expertise used within NEOs?

5e. What are the relationships between social scientists in NEOs and with social scientists in research institutions (both public and commercial) and how could these relationships better support social science in NEOs to enable its further impact and integration?

5f. What are the risks and opportunities in involving, within the 'social science endeavour', more colleagues who work in ‘people roles’ (e.g. marketing, education, communications, fund raising) but don't identify as/aren't formally trained as social scientists?

Response summary:

- Most popular.
- Scope for a lot of empirical research here but including through low resource methods and short time frames. Maybe too much detail would be generated when the key is to get on with embedding social science.
- Don’t single out social science but examine how science is used by NEOs.

Research question package 6 - The current state of social science in NEOs (NB This work has been started by the SSINE pilot project)

6a. How is the social science contribution framed within different natural environment organisations (Govt, agencies, NGOs)? What are the implications of these framings for the impact and influence of social science?

6b. What roles are performed by social scientists in NEOs (generalist / specialist), what work do they do now and what work would they like to do in the future, what constraints and opportunities do they face in these respects and how and why does this vary between different types of NEOs?

Response summary:

- Generally positive response. Close / overlaps with 1 and 5. Also relates to 3 – understanding the past to understand the present.

- Good, useful baseline info. Likely to lead to applied learning.

General conclusions from expert elicitation exercise:

- There is ongoing interest and appetite for further investigation in this area even though there was no strong consensus around the nature and focus of future research. This lack of consensus might be explained by the diversity of NEOs.

- The most popular research question packages were: 5 Social science expertise in NEOs and 6 The current state of social science in NEOs. Those research question packages attracting a mixed response were 2 Multi-team working and integrating social science into NEOs and 4 Monitoring and evaluation of social sciences in NEOs. Lower scoring research question packages were: 1 What are the 'right' conditions for integrating social science into NEOs and what is the role of power? & 3 Case studies of NEOs – how histories & organisational cultures have influenced the integration of social science.

- There is interest in developing the investigation of what works, what doesn't and why for social science and how this can help social science to gain further traction in the sector.

- There is interest in expanding the initial empirical work we started in this pilot, by exploring who is out there, what are they doing, what roles are they occupying, experience of gaining traction as social scientists and not?

- Research question package 1 did not score as highly as expected based on stage 1 scoring – this may be an artefact of our attempt to translate these into packages of research questions. As such, the process should be seen as indicative rather than conclusive.

- Further consideration should be given to whether future research should focus on social science in NEOs or the integration of social sciences with other disciplines and interdisciplinary working.

- A future research project could be usefully grounded in an empirical case of such as the new NE Social Science Expert Panel or NatureScot's scoping work.

- How to make the most effective use of the academic partner in follow on research needs further discussion.

6. Reflections

In this final section of the report, we offer some overall reflections on the project work. As explained in the methodology, discussions with project participants in two ‘reflections workshops’ (before which a draft of this report had been circulated) have helped to shape these reflections. As such, this offers something different from a standard set of report conclusions.

As a project funded by the ESRC’s Impact Accelerator Account the work reported herein has focused on ‘upstreaming’ research impact by engaging throughout with NEOs to develop research into the role of social science expertise in NEOS. This has been carried out from a place of true transdisciplinary working where the impact is clearly understood and envisaged from the design stage. This remains a relatively unusual way of addressing research impact and our experience of undertaking this project has shown us that it is an approach that, while important and worthwhile, requires considerable time and resource.

The project’s scoping work has clearly demonstrated that social scientists in NEOs are very keen to engage with this kind of research (both its topic focus and its collaborative methodology) and use it to better understand the possible and envision as a collective where social science can make even more of a contribution to the sector in the future. Key to moving forward is to sustain the project’s collaborative and co-design approach to ensure that any follow-on research has impact.

Our research has confirmed that the thinking behind the project’s design was correct – that there is a social science ‘turn’ in NEOs with more resource being made available but also more demand for what the social sciences can bring to the table. It has also demonstrated that the role of social sciences in conservation and natural environmental management is still narrowly framed and constrained, perhaps even more so than in academia and these are findings supported by McKinley's (2020) work on marine social science in the UK. As is the finding that social scientists in the sector frequently move between disciplines and subject specialisms. The narrow framing of social sciences within NEOs is a significant, ongoing source of frustration for social scientists who aspire to fulfil a much wider range of roles and therefore make a wider and deeper contribution to their organisations, and the sector more generally. One suggestion made in the workshop to address this issue was to encourage more social scientists into more senior (non-social science) roles.

Bennett et al’s paper (2017) from the literature review, listing the “ten distinct contributions that the social sciences can make to understanding and improving conservation”, was discussed in the reflection workshops. The contributions listed are “descriptive, diagnostic, disruptive, reflexive, generative, innovative, and instrumental”; and there was general agreement that social science in NEOs was mainly confined to instrumental (implementation and education) contributions. Notable within the wider range of roles NEO social scientists aspire to is the ability to perform the role of ‘critical friend’ or ‘disruptor’ within NEOs, akin to the ‘challenge function’ elaborated in Kattirtzi's (2016) examination of social science in the Department for Energy and Climate Change (DECC). This type of critical / disrupting role entails being given meaningful opportunities to pose deeper and

more fundamental questions about the operation of power and control in society, vested interests and inequality and how these are key to explaining the causes of environmental problems as well as signalling environmental solutions. It is a role that also entails challenging the operation of power within NEOs in respect of the formation and persistence of knowledge hierarchies (i.e. which forms of expertise are prioritised) and how these are gendered; the power held by natural science when it refuses to accept its political nature, including the political nature of research methods; and, how organisational structures (e.g. funding cycles) affect what is possible. Linked to this was a discussion on how the requirements of civil servants to be apolitical (and public servants who follow the civil service code) can constrain what are seen as acceptable research questions and methods, as well as what subjects social sciences should be working on. Workshop participants thought that addressing these different dimensions of power and knowledge should be a focus of future research designed to support social sciences in the natural environment sector (despite the mixed feedback via the expert elicitation exercise).

It was noted in the final workshop that issues such as protecting the natural environment, sustainable production, bending the curve on biodiversity loss, and hitting net zero carbon emissions are not generally linked with sustainable consumption and therefore less suitable subjects for social science to address. This was perceived as a “blind spot” within the sector.

The majority of SSINE participants were female (3 males) and, anecdotally, it appears that the majority of social scientists in NEOs are female. There was discussion about how this is perceived to influence the impact of social science within NEOs (mainly negatively). This has prompted one lead author to reflect that formalising the challenge function of social science (as happens in some civil service analyst roles, see Kattirtzi 2016) may help address gender issues, as her experience is that challenge can be more problematic for women (a proposition supported by a broader sector meta-analysis by Williams and Tiedens 2016).

The lack of ethnic diversity and possibly other protected characteristics within the profession, and reflected more broadly within the sector, is also a concern. This has been the subject of a recent Social Research Association survey for all sectors and it could prove insightful to reference these findings to explore the issue further within NEOs. How can social science methods bring about a more inclusive agenda?

One idea for future research would be to work with participants to create a vision of what NEOs who put more equal investment into the natural and social sciences might be able to achieve. As a way of trying to bypass the slow and incremental progress on social science investment over the last few decades and kick-start the real opportunities that the participants believe are possible if social science was taken to be an essential part of NEOs achieving their ambitions.

‘What counts as relevant expertise/training/qualifications/experience when addressing ‘people’ or social questions within NEOs’ continued to be a popular subject for discussion in both final workshops (as indicated from the expert elicitation exercise). ‘User research’ was suggested of one example where the boundaries were grey. In one workshop the

different approaches to this within NEOs was discussed including ‘boundary work’ undertaken around defining who is a social scientist and who is a specialist working with people. Different organisations, teams and individuals have different approaches. A related discussion covered the need to distinguish between expertise and significance on the one hand, and the kinds of attitudes that exist in the world on the other. This was in the context of concern about how the gaps between natural science and social science research tend to be addressed: that people who aren’t trained as social scientists proffer what are political, social and moral opinions in the grey spaces where they aren’t trained (this was echoed in some of the interviews where social science approaches was observed as being carried out by those with little or no training or seen as “common sense”). One suggested solution was to ensure adherence to evidence standards.

It was acknowledged that multi- or interdisciplinary working was likely an issue for other disciplines too and one role for social science may be to set out what would be needed to enable such working. Many social scientists in NEOs effectively take on this role by default as the dominant agendas often change and the small number of social scientists means we need to be adaptable. Although in the earlier interviews it was suggested that social scientists should not be assumed to be the people to take the interdisciplinary facilitation role on, as it is a specialism in itself.

One of the workshops finished the discussion by noting that this project both helped to celebrate diversity and differences within social sciences and helped us collaborate, both features that were thought important to continue in any future work.

List of figures

Figure 1. Participants' disciplinary backgrounds.

Figure 2. Participants' subject areas.

Appendices

A.1 Survey questions

1. What is your current role title and how would you describe your role in a couple of sentences?
2. What is your professional background?
3. Do you hold any related professional memberships? If you answered ‘yes’, what are they?
4. Who else do you know who works in this kind of role both within your own and other environmental organisations?
5. As a social scientist in your organisation, what roles, tasks or projects do you tend to take on?
6. Are there other roles, tasks or projects you would like to assume or work on but are unable to? If you answered ‘yes’, what is stopping you?
7. Who do you mostly work with in your organisation?
8. Can you identify one positive and one negative aspect to multidisciplinary working in your organisation?
9. Why are you interested in attending the workshop? What would you like to get out of the workshop and potentially a longer-term collaboration with the organisers and other participants?
10. Finally, have you written or do you know of any documents which speak about the role of social science in nature conservation or other natural environment organisations or in the wider movement?

A.2 Interview questions

1. What is your current role? What is your current role title? And how would you describe your role in a couple of sentences
2. What's your professional background? In other words, what roles have you had previously, and in which organizations?
3. Do you hold any related professional memberships?
4. Who else do you know who works in a similar kind of role both within your own and other environmental organizations?
5. As a social scientist or social researcher in your organization, what roles, tasks or projects do you tend to take on?
6. Are there other roles, tasks or projects you would like to assume or work on, but are unable to, and if so, what's stopping you?
7. Who do you mostly work with in your organization?
8. Can you identify one positive and one negative aspect to interdisciplinary working?
9. Why are you interested in attending the workshop? And what would you like to get out of it and potentially a longer-term collaboration with the organizers and other participants?

10. Have you written or do you know of any documents which speak about the role of social science in nature conservation or other natural environment organizations or in the wider movement?

A.3 The annotated bibliography

Bailey, P. (2011) Using Social Science to Regulate People, Business and Technology: A practitioner's Handbook. Report to the Strategic Society Centre.

Executive summary: This paper explores the challenges and opportunities of practicing social science in a government regulator and agency, presenting a repertoire of practices developed and learnt working in a regulator. The repertoire ranges from the simple provision of social facts to much more involved techniques, such as leading the organisation with social science. The paper concludes that social scientists must understand the organisational context of government departments, agencies and regulators if they wish to operate effectively. This includes learning to work with other analytical professions (such as science, statistics and economics) and developing social scientific practices that produce instrumental evidence and advice that assist in the solving of problems.

Balmer, Andrew S., Jane Calvert, Claire Marris, Susan Molyneux-Hodgson, Emma Frow, Matthew Kearnes, Kate Bulpin, Pablo Schyfter, Adrian Mackenzie, and Paul Martin. 'Five Rules of Thumb for Post-ELSI Interdisciplinary Collaborations'. Journal of Responsible Innovation 3, no. 1 (2016): 73–80.

Abstract: Based on criticism of the "ethical, legal and social implications" (ELSI) paradigm, researchers in science and technology studies (STS) have begun to create and move into "post-ELSI" spaces. In this paper, we pool our experiences of working towards collaborative practices with colleagues in engineering and science disciplines in the field of synthetic biology. We identify a number of different roles that we have taken, been assumed to take, or have had foisted upon us as we have sought to develop post- ELSI practices. We argue that the post-ELSI situation is characterised by the demands placed on STS researchers and other social scientists to fluctuate between roles as contexts shift in terms of power relations, affective tenor, and across space and over time. This leads us to posit four orientations for post-ELSI collaborative practices that could help establish more fruitful negotiations around these roles.

- This paper describes the experiences of social researchers in projects in synthetic biology.

- There is an assumption in these projects that adding a token sociologist will make the research more acceptable and fulfil the ELSI requirements of a research project, therefore removing any critical capacity of the researchers in this context.

- Natural scientists in these research contexts have limited view of what issues should be addressed in their science making, ie - to make it more acceptable to the public and to

asses public risk - to provide a gendered ‘care’ role, - to provide a critique of the research being undertaken, which can create some tensions within the project, - a disruptor of the existing research methods and assumptions, - to institutionalise reflexivity, - to educate others on what they do, - to be a supportive colleague in the project (these roles are by no means static and can change over time.

- The ideal or goal for them would be to be a genuine co-producer of knowledge

Balmford, Andrew, and Richard M. Cowling. ‘Fusion or Failure? The Future of Conservation Biology’. Conservation Biology 20, no. 3 (June 2006): 692–95.

Abstract: No abstract provided.

- This introduction to a special issue argues that working with social sciences in conservation science is necessary for the preservation of the natural environment as conservation science efforts alone have been less effective. (the first author is a Zoology professor)

- Insights that can be provided by the social sciences include help in creating models, reconnecting people with nature, assessing and improve the affects of interventions, putting conservation plans in practice and finding way to incorporate conservation practice in organisations.

In what ways do these suggestions / practical recommendations for working with social sciences stand to help or reinforce the role of conservation in the world, is there a way of seeing the social scientist as a real partner in the research rather than as a practical applicator of conservation knowledge?

Barry, Andrew, Georgina Born, and Gisa Weszkalnys. ‘Logics of Interdisciplinarity’. Economy and Society 37, no. 1 (2008): 20–49.

Abstract: This paper interrogates influential contemporary accounts of interdisciplinarity, in which it is portrayed as offering new ways of rendering science accountable to society and/or of forging closer relations between scientific research and innovation. The basis of the paper is an eighteen-month empirical study of three interdisciplinary fields that cross the boundaries between the natural sciences or engineering, on the one hand, and the social sciences or arts, on the other. The fields are: 1) environmental and climate change research, 2) ethnography in the IT industry and 3) art-science. In the first part of the paper, in contrast to existing accounts, we question the idea that interdisciplinarity should be understood in terms of the synthesis of two or more disciplines. We stress the forms of agonism and antagonism that often characterize relations between disciplinary and interdisciplinary research, and distinguish between three modes of interdisciplinarity. In the second part we outline three distinctive logics or rationales that guide interdisciplinary research. In addition to the logics of accountability and innovation, we identify the logic of ontology, that is, an orientation apparent in diverse interdisciplinary practices in each of our three fields towards effecting ontological transformation in the objects and relations of research. While the three logics are interdependent, they are not reducible to each other and are differently entangled in each of the fields. We point to the potential for invention in such interdisciplinary practices

and, against the equation of disciplinary research with autonomy, to the possibility of forms of interdisciplinary autonomy.

- This paper outlines the different modes and forms that the interdisciplinary process could take.
- One of the particular modes subordination-synthesis describes a common configuration where the social sciences are working in subordination to natural science and positivist research approaches in project collaborations. Integrative-synthesis mode of interdisciplinarity tends to be what collaborators try to achieve.
- These modes can help conceptualise the dynamics and processes of interdisciplinary collaborations in environmental organisations.
- These modes can provide a foundation which can help contextualise any feelings or perceptions of social science collaborators in organisations
- This paper outlines two main 'logics' that researchers or policy makers take when arguing for interdisciplinarity, including 'accountability' and 'innovation'.

Whilst working together on a project do different collaborators from different disciplines perceive the collaboration from different modes? Why?

Bennett, Nathan J., Robin Roth, Sarah C. Klain, Kai Chan, Patrick Christie, Douglas A. Clark, Georgina Cullman, et al. 'Conservation Social Science: Understanding and Integrating Human Dimensions to Improve Conservation'. Biological Conservation 205 (2017): 93–108.

Abstract: It has long been claimed that a better understanding of human or social dimensions of environmental issues will improve conservation. The social sciences are one important means through which researchers and practitioners can attain that better understanding. Yet, a lack of awareness of the scope and uncertainty about the purpose of the conservation social sciences impedes the conservation community's effective engagement with the human dimensions. This paper examines the scope and purpose of eighteen subfields of classic, interdisciplinary and applied conservation social sciences and articulates ten distinct contributions that the social sciences can make to understanding and improving conservation. In brief, the conservation social sciences can be valuable to conservation for descriptive, diagnostic, disruptive, reflexive, generative, innovative, or instrumental reasons. This review and supporting materials provides a succinct yet comprehensive reference for conservation scientists and practitioners. We contend that the social sciences can help facilitate conservation policies, actions and outcome that are more legitimate, salient, robust and effective.

- This paper argues how often social scientists are labelled as 'educators and implementors' of conservation science and policy; and that their purpose is only instrumental to the conservation sciences.
- In response to the above limited understanding of what social science is for and what it can do this paper points to research papers that demonstrate how social science can be "valuable for descriptive, diagnostic, disruptive, reflexive, generative, innovative, or instrumental reasons. (p. 103).

• This paper describes the many interdisciplinary fields of conservations sciences (STS, Ethno-ecology) where social science plays a role in researching conservation.

Boccaccio, Luigi, Ariel Brunner, and Andrew Powell. 'How Is EU Rural Development Policy Delivering for Biodiversity?' Could Do Better. Birdlife International, May 2009.

Abstract: Executive summary provided:

This study reviews the potential effects on biodiversity of the 2007-2013 Rural Development

Programmes across the European Union. The evaluation is based on an assessment of approved national and regional Rural Development Policies, carried out by BirdLife Partners in their respective countries. The survey confirms that Rural Development policy has considerable potential to tackle the biodiversity challenge. The main strengths contributing to this are: (i) well-defined objectives, (ii) strategic approach to programming, (iii) a Common Monitoring and Evaluation Framework, (iv) approval process at EU level, (v) partnership principle, (vi) contractual basis and (vii) cofinancing.

Examples of actions that are likely to benefit biodiversity have been highlighted in almost all measures and Rural Development Policies. On the other hand, although major improvements have been made in comparison with the previous programming period, the potential of Rural Development to achieve its objectives for biodiversity is still severely undermined by poorly designed schemes and insufficient allocation of resources.

The following high level recommendations therefore arise from the study:

· Axis 2 measures should be revised to ensure that they are directly targeting biodiversity, and financial resources should be directed to these schemes. This is especially critical for the achievement of the Natura 2000 objectives.

· Axis 2 schemes (e.g. Less Favoured Area & agri-environment payments) need to have SMART objectives and clear value for the environment. Payment levels should be proportional to the real burden of commitments and to the expected outcome.

· Detailed and explicit environmental safeguards should be set for all investments in physical capital, in order to prevent depletion of water resources, increase in carbon emissions, increased soil sealing, and fragmentation or degradation of habitats.

· Rural development measures across all axes should be combined more effectively to create synergies for competitiveness, human capital, environmental and quality of life objectives.

· The development of measurable targets for biodiversity is far behind where it should be. Member States need to prioritise the design and monitoring of meaningful impact indicators and assessment of schemes' effectiveness. The results of monitoring should feed back into the design of schemes and into funding allocation.

· In the next programming period, the implementation of the strategic approach and partnership principle should be improved.

Despite the improvements needed, Rural Development remains the best model for a future Common Agricultural Policy (CAP), which should be based on the principle of rewarding

farmers for the delivery of public goods; hardly any of the soundness principles underpinning RD can be found in the CAP Pillar 1. The outcome of the CAP “Health Check” has created an invaluable opportunity to develop Rural Development in this direction. As annual revision of programmes is possible, substantial improvements can be introduced within the current programming period in all Member States, not only in those that will be implementing additional modulation. The European Commission, and national and regional authorities managing Rural Development Policies, should seize this chance to make significant and urgent improvements in the implementation of Rural Development policy, not only to address the EU’s pressing environmental problems, but also to provide a more solid base for the continuation of EU spending in this field.

- Found on RSPB website
- Added because on Pg 9, section 3.2, it discusses the 'partnership principle' in policy.

"Involving farmers and other professionals in scheme design may increase the likelihood of uptake and actual success of agronomic, business and logistic concerns can be tackled at the beginning."

This is about the usefulness of having genuine consultation and collaboration outside of natural scientists to improve policy efficacy.

Buanes, Arild, and Svein Jentoft. ‘Building Bridges: Institutional Perspectives on Interdisciplinarity’. Futures 41, no. 7 (2009): 446–54.

Abstract: There have been a number of contributions to this journal (Futures) that discuss interdisciplinarity and transdisciplinarity (see our reference list), several of which refer to the institutional character of academic disciplines. The exact nature of this institutional character, however, is generally not discussed in great detail. Our contribution draws on W. Richard Scott’s synthetic reconstruction of the many approaches to institutional analysis, aiming to elucidate what an institutional perspective on interdisciplinarity would entail.

Without knowledge from several academic disciplines, important problems in contemporary society cannot be solved. Consequently, the quest for interdisciplinary is gaining support among many scientists and funding agencies. In this article, we argue that even if we can understand the ambitions of interdisciplinarity, we also need to be aware of the barriers involved. Interdisciplinary approaches to framing and solving problems will almost inevitably stumble into barriers that are of a structural, cultural and a cognitive nature and problems related to disciplines as social institutions. The question to be discussed is if and how these barriers can be overcome. We claim that it is the structural barriers that are the easiest ones to address, whereas the cultural barriers are more difficult to overcome because they require more than a regulatory fix.

- This paper questions the substance and unwavering positive behind the promotion of interdisciplinarity by discussing that the ‘pillars’ that hold up the disciplines present real barriers to making interdisciplinarity work.
- These ‘pillars’ are, the regulative nature that forms and creates a boundary around a discipline, the cognitive nature of a discipline that describes that epistemology and

methodology of different disciplines and finally a normative nature that outlines the values and acceptable behaviour for those in the discipline.

- Therefore, in order to ensure interdisciplinarity takes hold, these three ‘pillars’ of a disciplines need to be toppled.

Castree, N., W.M. Adams, J. Barry, D. Brockington, B. Büscher, E. Corbera, D. Demeritt, et al. ‘Changing the Intellectual Climate’. Nature Climate Change 4, no. 9 (September 2014): 763–68.

Abstract: Calls for more broad-based, integrated, useful knowledge now abound in the world of global environmental change science. They evidence many scientists’ desire to help humanity confront the momentous biophysical implications of its own actions.

But they also reveal a limited conception of social science and virtually ignore the humanities. They thereby endorse a stunted conception of ‘human dimensions’ at a time when the challenges posed by global environmental change are increasing in

magnitude, scale and scope. Here, we make the case for a richer conception predicated on broader intellectual engagement and identify some preconditions for its practical fulfilment. Interdisciplinary dialogue, we suggest, should engender plural representations of Earth’s present and future that are reflective of divergent human values and aspirations. In turn, this might insure publics and decision-makers against overly narrow conceptions of what is possible and desirable as they consider the profound questions raised by global environmental change.

- Discusses how engagement with the social sciences as the ‘human dimension’ of climate change research and policy includes a very limited perception of what their knowledge can contribute.
- This paper calls for a collaboration of ‘ways’ of knowing including scientific, interpretive and critical knowledge that would reflect the plurality of the real world.
- Authors include: Brian Wynne and Ulrike Felt

Chilvers, J., and M. Kearnes. Remaking Participation: Science, Environment and Emergent Publics. Oxen: Routledge, 2016.

Abstract: No abstract, but Introduction to Chapter 5: The uncomfortable sense of an endemic but intensifying crisis, not only for Western liberal democracies but globally, over the relations between science and democracy, is difficult to pin down precisely, but equally difficult to ignore. This sense of mounting disorientation and crisis may be manifesting itself in diverse forms and arenas, but in virtually all of these there are recurrent themes. For example, there is confusion and ambiguity as to what is meant as object of the proliferating references to ‘science’ as public authority, often for claims which overextend science’s proper authority and transform it into normative ‘findings’ or ‘demands’ supposedly from nature. There is also the increasing experience of science’s subordination to neoliberal political-economic controls, with erosion of what were at least significantly independent influences over scientific cultures, and suppression of healthy scientific dissent when commercial interests are threatened by evidence. These dynamics relate to an

unacknowledged process of mutual, emergent co-production (Jasanoff 2004) of policy, commercial and scientific – human and 'natural' – orders, in which each can pass the buck to the other in terms of accountability for problematic and sometimes controversial commitments.

- This book includes a contribution from Brian Wynne, Chapter 5 – "GHOSTS OF THE MACHINE Publics, meanings and social science in a time of expert dogma and denial"
- Wynne argues that the uptake of social sciences and their methods in policy making and engagement with 'publics' is limited and advocates adopting a more interpretative-relationship approach for social science research.
- This approach will change the idea that publics are used for 'extracting' (data, opinions) and relate to publics that encourages reflexivity in the scientists who are interacting with them.
- Discusses the definition and perception of 'the' public by scientific researchers and suggests different ways of understanding, interpreting and relating to the public.
- Wynne argues for more institutional reflexivity in public relations.

Cooley, Amanda Harmon. '"Piggybacking" on Business Communication Through Interdisciplinarity: Developing Student Communication Skills in Legal Environment of Business Courses'. Business Communication Quarterly 72, no. 4 (2009): 431–38.

No Abstract provided: This article documents a classroom assignment and activity that took place in a legal environment for business course meant to build business communication skills. The author set out the 'problem' that in academia, education is separated into departments when in actuality they have a lot to learn from one another. By using knowledge from another 'discipline' students can learn employable skills and become the more effective communicators.

- This article discusses how 'interdisciplinarity' is deployed in an educational context, by taking an exercise and using it to build communication skills within a legal and business context.
- The choice to take this interdisciplinary route is to prepare students for the variety of tasks needed in the real world: "The desired outcome of this interdisciplinary perspective is a better prepared student who will be ready to tackle writing projects on diverse subject matters when he or she enters the professional world." (p. 432)

'Countering the Terrorist Threat: Social and Behavioural Science, How Academia and Industry Can Play Their Part'. Office for Security and Counter-Terrorism, a Directorate of the Home Office, 2010.

Abstract: No abstract provided: Introduction: The 2010 National Security Strategy identified international terrorism as the most significant immediate security threat to the UK. While terrorism is not new, the current threat is different from those we have faced before in its scope, capability and ambition. Contemporary international terrorist organisations have an

international cause, plan and conduct attacks in and from a range of countries and aim to inflict significant civilian casualties. Many seek to recruit people in this country. Some organisations aspire to use Chemical, Biological, Radiological, Nuclear (CBRN) materials as weapons*. The nature of the threat and the Government's response is set out in the UK's Strategy for Countering International Terrorism (CONTEST), published in 2009 a brief review of the first year of the revised CONTEST strategy will be published shortly. The aim of CONTEST is: "to reduce the risk to the United Kingdom and its interests overseas from international terrorism, so that people can go about their lives freely and with confidence".

- Added as this is an example of how social sciences are explicitly being used in government, this indicates where the social sciences are thought to belong and how they could contribute.

- The audience for this booklet is: "for everyone in academia, industry and other research organisations whose work on social and behavioural science could help counter the terrorist threat to the UK."

Darlow, A. 'Different Forms of Knowledge in Decision-Making for the Natural Environment A Natural England Science Advisory Committee (NESAC) Science into Practice Seminar'. Internal report. Natural England, 7 February 2018.

Abstract: Introduction: The following report summarises the presentations and discussions at a seminar on 6th February 2018 organised by Natural England on behalf of the Natural England Science Advisory Committee (NESAC), on the subject of forms of knowledge in decision-making for the natural environment. Based on the discussions and insights on the day, it sets out some conclusions from how this agenda might be taken forward by Natural England.

- In the report social sciences were distinguished from natural sciences in their methodological approach, with natural sciences tending more toward quantitative measures and social science tending toward more interpretive measures; culturally the natural sciences are seen as more legitimate and objective and occupy a higher space in the sciences hierarchy when in actuality, 'biases' exist in all forms of research.

- Some real-world case studies are given to discuss how citizen science and interdisciplinary approaches helped to make the public feel included and empowered – though this required a lot of management.

Doubleday, R., and J. Wilsdon. 'Future Directions for Scientific Advice in Whitehall', 2013.

Abstract: No abstract provided. A collection of writings from different experts in the field about how the government could and should use scientific advice from both the natural and social sciences.

- This edited report includes contributions from Alice Bell about alternative forms of public expertise existing, however the hierarchy of scientific knowledge remains largely unaffected in its approach and methods.

- Sheila Jasanoff discusses science advice in the policy realm and how STS as a field can be used in conjunction with science advice to further their goals.

- An article by Cary Cooper and Stephen Anderson advocate for the need of a chief social scientist in the UK central government to bring social science strategy and policy together in a holistic way.

Gieryn, Thomas F. 'Boundary-Work and the Demarcation of Science from Non-Science: Strains and Interests in Professional Ideologies of Scientists'. American Sociological Review 48, no. 6 (1983): 781–95.

Abstract: The demarcation of science from other intellectual activities-long an analytic problem for philosophers and sociologists-is here examined as a practical problem for scientists. Construction of a boundary between science and varieties of non-science is useful for scientists' pursuit of professional goals: acquisition of intellectual authority and career opportunities; denial of these resources to "pseudoscientists"; and protection of the autonomy of scientific research from political interference. "Boundary-work" describes an ideological style found in scientists' attempts to create a public image for science by contrasting it favorably to non-scientific intellectual or technical activities. Alternative sets of characteristics available for ideological attribution to science reflect ambivalences or strains within the institution: science can be made to look empirical or theoretical, pure or applied. However, selection of one or another description depends on which characteristics best achieve the demarcation in a way that justifies scientists' claims to authority or resources. Thus, "science" is no single thing: its boundaries are drawn and redrawn inflexible, historically changing and sometimes ambiguous ways.

- "Boundary-work" could potentially provide a good conceptual foundation to frame the interactions and perceptions of scientists collaborating in research and governmental organisations.

Is boundary work being conducted by social scientists or natural scientists in organisations? What form does it take? How do the social / natural scientists differentiate themselves or their work from other sciences or expertise in members of the public? What about policy makers in government?

GOV.UK. 'Government Social Research'. Government. Accessed 3 March 2020.

Abstract: Web page, so no abstract provided

- To understand the role that government imagines the role of social researchers to play government. There is a social research 'fast stream' which priorities and actively recruits social scientists to work in government. The focus is on 'social trends' and 'social research'.

- The priority of skills that they are looking for in social scientists are quantitative methods:

"A qualifying social science subject is one which contains substantial social research methods training (comprising around one third of modules taken in the course) including

quantitative research methods and three of the following: systematic/literature reviews; qualitative methods; interpretation of data and presentation of results; study design and hypothesis testing; and application of ethics to research."

- More evidence that a positivist approach is desired:

"Your work might involve developing surveys, analysing data, producing statistics, reviewing existing research evidence and working with other analysts in government to provide timely, relevant and robust briefings for policy colleagues and ministers."

GOV.UK. 'Government Social Research Profession: About Us'. Government. Accessed 3 March 2020.

Abstract: Web page, so no abstract provided

- Outlines what government thinks of the role of social researchers in their field and what they can contribute to:

The Role of Government Social Researchers

"Government social researchers play a critical role in gathering analysing and interpreting the information. This forms the foundation for decision-making affecting every UK resident. As a Research Officer (Fast Stream) you can contribute to:

- reporting social trends
- developing government policy
- evaluating how policies make a difference to public services

Your work might involve:

- developing surveys
- analysing data
- producing statistics
- reviewing existing research evidence
- working with other analysts in government"

- Two examples of reports are given to show what social research can do in government, one is written by an internal government employee, the other is commissioned work by ASK Research, a social research consultancy.

Hacklin, Fredrik, and Martin W. Wallin. 'Convergence and Interdisciplinarity in Innovation Management: A Review, Critique, and Future Directions'. The Service Industries Journal 33, no. 7–8 (2013): 774–88.

Abstract: Knowledge integration in the interstices between different disciplinary fields is becoming a critical challenge to innovation management. As disciplines converge

into new hybrid fields, such as information and communication technology or nanobiotechnology, it ultimately creates winners and losers, be they new firms that displace

incumbents or individual scientists better positioned to reap rewards from new targeted grants. While received literature recognizes the importance of interdisciplinarity, little is known about its theoretical and conceptual antecedents. To meet this challenge, we first review and critique the literature on interdisciplinarity from a knowledge-based perspective, and, second, identify challenges for innovation management and formulate implications for further research. In particular, we outline how individual and team-level heterogeneity should be addressed. By adopting such a micro-level perspective, innovation management can embrace heterogeneity and effectively unlock the true value of interdisciplinary knowledge.

- In this paper, the 'power' of integrating knowledge lies in its ability to innovate new products or services that then lead to increased performance.
- In this paper, they discuss the challenges involved in interdisciplinarity and how to address them in practical terms, namely to understand the costs involved when disciplines are 'far' from each other and an assessment of workers to do interdisciplinary work.

HM Government, 'Industrial Strategy: Building a Britain Fit for the Future'. White Paper. HM Government, 2017.

Abstract: No Abstract Provided

This report outlines five foundations (Ideas, People, Infrastructure, Business Environment, Places) for transforming the British economy and four challenges (Artificial Intelligence & Data Economy, Clean Growth, Future of Mobility, Ageing Society) and key policy areas around each foundation.

- Added because the Campaign for Social Science published this report: The Importance of the Social Sciences for the Industrial Strategy and references this white paper.
- Within the Industrial strategy, there are discussions of 'breaking down' barriers between disciplines as well as between business and academia in order to help the industry by fostering innovation. This is thought to help economic competition on the international scale.

Holmes, Helen, Nicky Gregson, Matt Watson, Alastair Buckley, Prue Chiles, Anna Krzywoszynska, and Jose Maywin. 'Interdisciplinarity in Transdisciplinary Projects: Circulating Knowledges, Practices and Effects'. DisP - The Planning Review 54, no. 2 (2018): 77–93.

Abstract: This article argues that the emphasis on solving substantive "real-world" problems through interdisciplinary research collaboration can neglect the wider value created by such collaborations. Championing the role of a knowledge integration and reflection facilitator, the article contends that more recognition be given to the value of "spillover" effects associated with interdisciplinary modes of working, rather than focusing solely on knowledge outputs and impacts. Drawing on embedded research conducted in relation to a project on local energy futures involving physicists, architects and geographers, the paper illustrates such "spillover" in relation to academic practice in teaching, project management and research methods. Such "spillovers" signal that what travels in interdisciplinary working is much more

than formal knowledge and point to potential long-term legacy effects from interdisciplinary working occurring back in the disciplines.

- This paper is a reflection of the context of an interdisciplinary energy research project.
- Outside of acknowledging the ‘problem centred’ approach of interdisciplinary, this project focuses on the unintended positive and ‘mundane’ effects that the collaboration had on the researchers that may have been personal and not necessarily project related. For example, learning about and using a different research methodology in your own work or pedagogic practices from other disciplines being incorporated into teaching.

Hulme, Mike. ‘Meet the Humanities’. Nature Climate Change 1, no. 4 (July 2011): 177–79.

Abstract: None, this is a ‘Commentary’ letter with the leading line: “An introduction needs to be made between the rich cultural knowledge of social studies and the natural sciences.”

- Hulme argues that due to the dominance of natural science and economics in international climate change organisations, the problem framing of the issue has been limited to 'improving climate predictions' and 'creating new economic policy instruments' rather than focusing on rethinking values of consumption or other potential social solutions. The need to consider solutions that humanities would provide is needed.
- “A recent study2 analysed the disciplinary source literatures of the three working groups for the third assessment report of the Intergovernmental Panel on Climate Change (IPCC). It showed that the cited literature was heavily dominated by natural science disciplines, especially the Earth sciences, while the minority social science content was heavily dominated by economics.” (p 177)
- Mike Hulme is a professor of human geography.

Here economics is cited as the most common social science to engage with climate change research in this instance, this discipline comes up a few times in environmental research. What is it about economics that makes it more amenable / acceptable to collaborate with natural sciences? Is it a positivist approach? The ability for economics to model and make predictions?

Jarratt, Susanne. ‘Linking the Environmentally Friendly Farming Careers of Farmers to Their Effective Delivery of Wildlife Habitats within the East of England’. University of Nottingham, 2014.

Abstract: Previous social scientific research into agri-environment schemes (AESs) has tended to provide temporal ‘snapshots’ of farmer attitudes towards and interpretations of conservation. Evaluations of AESs, performed within the natural sciences, have concentrated on whether they have met their ecological objectives overall in the wider countryside. There has been a lack of interdisciplinary research that links explicitly the social dimensions of AES implementation with the ecological outcomes of this process and little exploration of how these dimensions develop and evolve over time. The aim of this interdisciplinary research was to explore the relationship between farmers’ Environmentally Friendly Farming (EFF) careers and the wildlife habitats produced on their farms, where the

broader concept of EFF includes AESs. The study area was in the East of England comprising the North West Norfolk, Breckland and East Anglian Chalk National Character Areas and was chosen to be an area of predominantly arable farming with relatively homogeneous soils, geology, landscape and climate.

The need to explore the development of farmers' environmental attitudes, knowledges and practices within AESs and EFF over time was addressed by adapting Goffman's concept of moral careers to investigate farmer EFF careers. Although the concept of moral careers has been used in other fields, it has not been applied previously in the field of farming and agri-environment schemes. A linking or 'paratactical' approach to interdisciplinarity was chosen, which allows the disciplines to operate side by side and where the research objectives link the objects of study: EFF careers and the delivery of wildlife habitats.

Farmers' EFF careers were explored through oral histories; face-to-face interviews with 43 farmers with an explicit temporal focus, which explored in detail the events and influences on the farmer that contributed to his environmental management of the farm over time. Ecological surveys of hedges, grass margins, Wild Bird Seed plots and stubbles were performed using a Rapid Condition Assessment methodology adapted from previous evaluations of AESs, which measured the quality of the vegetation structure and species composition of each habitat. A quantitative statistical analysis was then used as the linking methodology to test the null hypothesis that there is no difference in the quality of wildlife habitats between the different EFF Careers.

Five EFF careers were identified: the Self Directed career, the Conservation at the Margin career, the Conservation Wage career and the Conservation Opportunity career, plus the Conservation for Shooting career which is a parallel career. The ecological surveys showed that whilst the farmers often fell short of the quality indicators set by this research, they were largely compliant with the lesser requirements of the AES schemes. The overall sense of the results shows that there is no statistically significant difference in the quality of hedges, margins, WBS and stubbles between farmers in different EFF careers and shows that there is no simple relationship between a farmer's engagement with AESs and the wildlife habitats they create on the ground.

The existing policy arrangements for the English AESs are set to change in 2015 and as this research sets out the relationships between the EFF careers and the current AESs it can contribute to an understanding of the issues faced by Natural England and farmers when transitioning to the new 'greening' arrangements. This research has also provided some indications for initiating and developing farmers' involvement with AESs, including the importance of advisors on farmers' career progression, supporting the findings of other research.

Jasanoff, S. 'Contested Boundaries in Policy-Relevant Science'. In Social Studies of Science, 17:195–230. SAGE, 1987.

Abstract: In the United States, as in other industrialized nations, regulatory decisions to protect the environment and public health depend heavily on scientific information. Yet the process of decision-making places unusual strains on science. Knowledge claims are deconstructed during the rule-making process, exposing areas of weakness or uncertainty and threating the cognitive authority of science. At the same time, the legitimacy of the final

regulatory decision depends upon the regulator's ability to reconstruct a plausible scientific rationale for the proposed action. The processes of deconstructing and reconstructing knowledge claims give rise to competition among scientists, public officials and political interest groups, all of whom have a stake in determining how policy-relevant science should be interpreted and by whom. All of these actors use boundary-defining language in order to distinguish between science and policy, and to allocate the right to interpret science in ways that further their own interest. This paper explores the contours of such boundary disputes in the context of controversies over carcinogen regulation. It focuses on the contested definitions and strategic implications of three groups of concepts: trans-science or science policy, risk assessment and risk management, and peer review.

- Jasanoff discusses the boundary work that takes place amongst actors in science policy making and where different actors arbitrarily draw the line between what is 'science' and what is 'policy'; her argument is that these boundaries are blurred due to science not being so clear cut (there are social issues at play here) and policy being very politically charged.

- Jasanoff points out how actors' disciplinary bias colours their understanding of a science problem with a solution that fits in with their discipline. For example, an administrator may assume that a solution to a policy problem would be within administrative law and choose the evidence available that supports that decision.

- Peer review specifically is an issue, as it is a source of legitimacy for scientific work, this practice struggles to translate into the regulatory context, where money can be 'wasted' on advisory committees, or seen as too closed off if not allowed to be put up to public scrutiny.

Jones, Megan S., and Jennifer Solomon. 'Challenges and Supports for Women Conservation Leaders'. Conservation Science and Practice 1, no. 6 (June 2019): e36.

Abstract: Leadership and inclusivity are increasingly recognized as fundamental to conservation success, yet women's leadership within the conservation profession is understudied. This study identifies gender-related challenges women conservation leaders experienced in their careers, and supports helping them advance. Using an intersectionality framing to identify intersections between gender, race/ethnicity, age, and leadership position, we conducted and analyzed semi-structured interviews with 56 women leaders in conservation organizations across the United States. All interviewees reported experiencing or witnessing a gender-related workplace challenge in at least one of six categories, and the vast majority reported encountering four or more of these challenges: salary inequality and difficulty negotiating, formal exclusion, informal exclusion, harassment and inadequate organizational response, assumptions of inadequacy, and assumptions of wrongness.

Participants also experienced two categories of supports: structural supports and supportive relationships. Women's experiences varied based on age, race and ethnicity, and leadership position. Our results indicate more effort is needed to identify effective strategies for making conservation a more inclusive, empowering, and appealing profession in which to work.

- This paper outlines six categories of gender related challenges in the conservation industry and likens them to challenges faced by women in the wider STEM professions.

Krzywoszynska, Anna. 'Nexus Network DEFRA Fellowship Scoping Report: The Opportunities and Barriers to Nexus Approaches at DEFRA'. Defra, 2015.

Abstract: Problem framing: This report is written on the basis of a review of relevant literature, and interviews with 37 civil servants at DEFRA. These included policymakers and evidence specialists (including research fellows) from the directorates of Resource, Atmosphere and Sustainability; Animal Health and Welfare; Marine and Fisheries; Plant and Animal Health; Sustainable Land Management and Livestock Farming; Food and Environmental Risk; Water and Flood Risk Management; and Strategic Evidence and Analysis.

The fellowship researched what civil servants in Defra think about working across the domains of food, water, energy and environment, and how working across these domains happens within the department. The research questions of the fellowship were:

- How is the 'nexus' understood by civil servants in Defra?
- Understanding and use of the term
- Understanding of the significance of looking at the inter-relations between water, food, energy and environment
- Is working across the domains of the nexus seen as important?
- If so, why is it seen as important?
- What are the institutional drivers to inter-domain working at Defra?
- What are the institutional opportunities for inter-domain working in Defra?
- What are the institutional barriers to inter-domain working at Defra?
- Written by an intern to understand Defra's approach to working in a 'Nexus', or collaborating across departmental lines to share knowledge and avoid inefficiencies.
- Overall the report commented on the lack of incentives and structures that would facilitate this collaboration and called for more working groups. Nexus' collaboration was more in name according to the perception of civil servants rather than a working practice, though they did value the concept in principle.

Lau, Lisa, and Margaret Pasquini. '"Jack of All Trades"? The Negotiation of Interdisciplinarity within Geography'. Geoforum 39, no. 2 (March 2008): 552–60.

Abstract: This paper explores the relationship between interdisciplinary studies and research and researchers' positionalities, both within and beyond geography. The profound degree to which researchers' assumptions, expectations and attitudes (which in turn are affected by their personal backgrounds, training, location, etc.) influences the very notion of interdisciplinarity, and what it involves and consists of, is often neither noted nor appreciated.

This paper will illustrate, particularly through personal examples, how positionality is part of the circuit of knowledge production, informing academic research, employment and publishing to no small extent. The boundaries of interdisciplinary research are shown to be under constant negotiation, still far from mutual understanding or consensus, a fact which explains the often uneasy identification and negotiation of oneself as an interdisciplinary scholar. The paper concludes by making recommendations at individual and institutional level on how to overcome some of the constraints imposed by researchers' positionalities to the promotion of interdisciplinary research.

- This paper outlines that researchers' understanding of interdisciplinarity is widely varied and can vary based on background, experience and tenure in academia; this understanding in turn determines how you would approach interdisciplinarity.

- Interdisciplinary researchers face challenges in the academic workforce: 1) interdisciplinary researchers are applying for more subject specialists posts 2) establishing academic credentials is a challenge because most 'high ranking' journals are disciplinary specific and 3) promoting interdisciplinarity is a challenge, however one that is worth it, given the positive reception to differing approaches to a topic in a workshop conducted for this study.

Lee, Sang M., Taewon Hwang, and Donghyun Choi. 'Open Innovation in the Public Sector of Leading Countries'. Management Decision 50, no. 1 (2012): 147–62.

Abstract: Purpose – The purpose of this study is to examine the current open innovation practices in the public sector of leading countries.

Design/methodology/approach – Using a framework based on the role of the government in open innovation, this study analyses a profile of early open innovation adopters based on collected data from secondary sources.

Findings – First, the U.S., Australia and Singapore developed open innovation policies at the national level, facilitating a positive innovation climate. Many projects, especially those in online platforms, were established under these policies. Second, although outside-in open innovation principles seem to be popular, there have been emerging attempts to exploit the value of government data through inside-out approaches.

Research limitations/implications– Most governments are in the early stages of adoption of open innovation and are in the process of understanding relevant issues. Future research should investigate how governments adopt open innovation, in particular inside-out initiatives.

Practical implications– Governments should develop an overarching strategic plan, which would help its employees to recognise that new change is consistent with the needs of their workplace practices.

Social implications– Some organisations and projects led by citizens help the government engage external idea in solving issues that are beyond its control.

Originality/value– This study is the first attempt to examine the current open innovation policies at the government level.

- NGOs are cited as an example of ‘citizen networks’ to enhance public value of the public sector.
- Many innovative ‘ideas and actors’ from ‘external sources’ are a part of company strategy to boost their research and development programmes.
- Open innovation projects for the US government developed public platforms to encourage public participation and collaboration.

Lowe, Philip, and Jeremy Phillipson. ‘Reflexive Interdisciplinary Research: The Making of a Research Programme on the Rural Economy and Land Use’. Journal of Agricultural Economics 57, no. 2 (2006): 165–84.

Abstract: This paper provides an account of the origins and formation of the UK Research Councils’ Rural Economy and Land Use (RELU) programme and its approach to promoting interdisciplinary working between social and natural scientists. The programme is set in the context of broader developments in science policy, including a policy discourse centred upon sustainable development and the knowledge economy and associated demands for greater accountability in science. Interdisciplinarity promises research that will be more relevant and responsive to public needs and concerns. In describing the provenance of the RELU programme, therefore, the paper seeks to lay out the different stages in its initiation and design to show how, to varying degrees, these were open to external scrutiny and influence. The process of developing the programme illustrates that it is not straightforward to make research agendas and funding more transparent and accountable. It also provides insights into the challenges that interdisciplinarity and accountability present to established science institutions.

- Interdisciplinarity is seen as a tool to make research more responsive and relevant to public needs (Is this similar discourse to including the social science in conservation research projects to make the people more ‘connected’ to nature and conservation?)
- Interdisciplinarity is differentiated between multi-disciplinarity and disciplinarity due to levels of ‘interaction and joint working’
- In assessing the Relu programme, Ecology was the top discipline included in projects followed by economics.

Does economics as a social science play a clear and distinct role with natural scientists in project / research collaborations?

Lowe, Philip, Geoff Whitman, and Jeremy Phillipson. ‘Ecology and the Social Sciences’. Journal of Applied Ecology 46, no. 2 (2009): 297–305.

Abstract: 1. The urgency and complexity of current environmental problems require ecologists to engage in cross-disciplinary research with social scientists, among others.

2. This study explores what ecologists expect from such cross-disciplinary engagements, through a review of editorial statements in key ecological journals and an empirical survey of ecologists working with social scientists.

3. Ecologists were found to have different perspectives on collaborating with social scientists depending upon whether they had an instrumental or non-instrumental outlook on the role of social sciences.

4. Ecologists are also pursuing other approaches to incorporate human dimensions into their work, including engaging end-users and stakeholders in their research; and enlarging the scope of ecology to include human subjects/objects in their research focus.

5. Synthesis and applications. Ecologists face strategic choices when incorporating human/social dimensions in their work – whether engagement with stakeholders, enlargement of ecology as a life science, or active exchange with the social sciences. The choice depends on the stance taken on the place of humans in nature. Each strategy poses specific challenges for ecologists relating respectively to: the justification of how and which stakeholders to engage; the avoidance of naïve borrowings of terms and methods from the social sciences; and the training needed for working in interdisciplinary teams.

- Engagement with social scientists from an ecologists perspective was understood in reference to an instrumental or non-instrumental approach.

- Stakeholder engagement is a common approach taken by those in Relu programme to integrate social sciences into their research, however this also preserves the research boundary between ecology and the social sciences.

MacMynowski, Dena P. ‘Pausing at the Brink of Interdisciplinarity: Power and Knowledge at the Meeting of Social and Biophysical Science’. Ecology and Society 12, no. 1 (2007): art20.

Abstract: Interdisciplinary environmental research has been deemed essential to addressing the dynamics of coupled social-biophysical systems. Although decades of scholarship in science and technology studies (STS) take the analysis of interdisciplinarity out of the realm of anecdote, there is almost no overlap between this literature and discussions of interdisciplinarity in ecology-oriented journals. The goals of researchers in these areas are quite different, and thus far, their analyses of interdisciplinarity have been incommensurate with each other's purposes. To introduce an STS perspective into how environmental scientists think about interdisciplinarity, I argue that biophysical and social scientists are not just bringing information and different understandings of biophysical and social systems to the intellectual table. Those knowledge claims have differential power associated with them: within the sciences, between social and biophysical science, and between science and society. Power can manifest in many ways, e.g., individual scientific status, the most accepted account of an environmental problem, inclusion or exclusion of researchers, or perceived relevance of research to policy decisions. I propose four possible scenarios:

conflict, tolerant ambivalence, mutual identification, cooperation, and fundamental transformation for how an interdisciplinary undertaking might unfold. Then, to constructively confront the relationship between power and knowledge, I outline a three stage process to enhance the transparent development of interdisciplinary research. First, there is differentiation of the analytical elements of the research, then clarification of purposes, and finally, the steps toward intellectual synthesis. As core differences are encountered, e.g.,

"subjectivity" vs. "objectivity," active engagement with these issues will be essential to successful communication, collaboration, and innovation.

- This paper focuses on the power dynamics of taking place between disciplinary knowledges, other forms of expertise and within the sciences.

- A source of conflict and a common barrier to interdisciplinary research is the power dynamics between the social sciences and biophysical science, namely around ‘subjectivity’ in research; the natural sciences claim to ‘objectivity’ legitimises the claim of access to the ‘truth’ in research.

- This idea of the ‘subjective’ social science leads to the perception of a disparate group within the social sciences and the unified ground of the natural sciences.

Mainzer, Klaus. ‘Interdisciplinarity and Innovation Dynamics. On Convergence of Research, Technology, Economy, and Society’. Poiesis & Praxis 7, no. 4 (2011): 275–89.

Abstract: In the age of globalization, economic growth and the welfare of nations decisively depend on basic innovations. Therefore, education and knowledge is an important advantage of competition in highly developed countries with high standards of salaries, but raw material shortage. In the twenty-first century, innovations will arise from problem-oriented research, crossing over traditional faculties and disciplines. Therefore, we need platforms of interdisciplinary dialogue to choose transdisciplinary problems (e.g., environment, energy, information, health, welfare) and to cluster new portfolios of technologies. The clusters of research during the excellence initiative at German universities are examples of converging sciences.

The integration of natural and engineering sciences as well as medicine can only be realized if the research training programs (e.g., graduate schools) generate a considerable added value in terms of multidisciplinary experience, international networking, scientific and entrepreneurial know-how, and personality development.

- This article discusses a current ‘trend’ that says education and industry are coming together, and the knowledge of education creates a competitive advantage through innovations.

- Rather than take a ‘bottom up’ approach to learning and understanding phenomena, this paper advocates a ‘systems’ approach to understanding things like brain function and decision making.

- This paper is a promotion of the Carl von Linde-Academy which takes an interdisciplinary approach to research incorporating the social and engineering sciences together to contribute to innovation dynamics and address cultural challenges in times of globalisation.

'Mapping User Experiences of the Education, Health and Care Process: A Qualitative Study.' Case Study. Department for Education and ASK Research, 2016.

Abstract: Background: The Children and Families Act 2014 entitles individuals aged 0 to 25 with special educational needs (SEN) to an Education, Health and Care (EHC) assessment and plan when additional learning support from educational settings has proved insufficient. The EHC plan aims to improve an individual's outcomes and help prepare them for adulthood. It recognises that special educational needs may be driven by health and social care circumstances, not just difficulties with learning, behaviour and/or disability. ECH plans address these factors holistically through high quality, Local Authority led multiagency assessments. Individuals with SEN and their families are placed at the centre of the process and should have a positive experience of gaining support.

Research purpose: The DfE permanent secretary challenged officials to use innovative methods as part of a wide evidence gathering programme to support local delivery of the reforms. One requirement was to understand whether EHC assessment and plans were proving to be a positive experience for families and identify causes of satisfaction and dissatisfaction. This learning could then be used to inform local authorities and service provider so they can 'maximise user experience' as well as achieve bespoke, joined-up educational support.

- This was added because it was posted as an example of a case study to "offer practical examples of the type of work undertaken by Government Social Researchers across Government." on the Government Social Research profession website
- This work is a qualitative study using workshops and qualitative interviews and mapping respective responses from deliverers and receivers of care to understand any potential gaps between the objectives of the service and the actual experience.
- This work was commissioned by the government from ASK research.

Mascia, Michael B., J. Peter Brosius, Tracy A. Dobson, Bruce C. Forbes, Leah Horowitz, Margaret A. McKean, and Nancy J. Turner. 'Conservation and the Social Sciences'. Conservation Biology 17, no. 3 (June 2003): 649–50.

Abstract: No abstract provided

- This editorial argues that the social sciences have long been excluded from conservation science research, discussions and organisations.
- The editorial also argues that there is a disconnect between conservationist goals and effectiveness / buy in from people; and the key to make conservation a reality is to use insights from the social sciences to influence relevant policy, understand and change human behaviour
- The editorial then provides practical suggestions for including social sciences in future conservation work in conservation organisations and how to engage with the social science academic community.

McManus, Jim, Michelle Constable, Amanda Bunten, and Tim Chadborn. 'Improving People's Health: Applying Behavioural and Social Sciences to Improve Population Health and Wellbeing in England'. Public Health England, 2018.

Abstract: Executive summary: Public health has been described as the art and science of organised, societal efforts to improve and protect the health of the population (1).

In recent years the contributions of behavioural and social sciences (including psychology, behavioural economics, sociology and anthropology) to improving the health of the public have gained more prominence. However, they are still underutilised in practice and insufficiently integrated when applied to public health, and the workforce that is qualified to provide this behavioural and social science input remains small. Complex social phenomena and the pressures and challenges imposed on individuals by the contemporary world, as well as digital innovation and system restructuring, mean that we need to enlist and learn from these sciences more thoroughly, and strengthen transdisciplinary approaches (which are problem-based and 'person-centred'), to deliver effective and efficient change.

- This paper links 'innovation' with transdisciplinary approaches that utilised the social and behavioural sciences.
- Added as an example of where social science is being used explicitly in policy in the government.

What does this say that this is a health care initiative? That this field already appreciates human aspects? That this topic lends itself well to social science collaboration?

Morris, Carol. 'Environmental Knowledges and Expertise'. In International Encyclopedia of Geography: People, the Earth, Environment and Technology, edited by Douglas Richardson, Noel Castree, Michael F. Goodchild, Audrey Kobayashi, Weidong Liu, and Richard A. Marston, 1–8. Oxford, UK: John Wiley & Sons, Ltd, 2017.

Abstract: No abstract provided.

- This paper draws a distinction between non-certified and certified environmental knowledges in geography. Non-certified knowledge is one that takes place outside of the formal institutions or processes of knowledge making, such as indigenous knowledge or knowledge from residents close to the geographical issue. Certified expert knowledge takes place with a scientific training or formal occupation.
- Even within certified expert knowledge, boundary work can take place as a way to expand influence and authority.
- Coproduction taking place between certified and non-certified knowledge challenges is another common theme in geography.

Morris, Carol, Sujatha Raman, and Susanne Seymour. ‘Openness to Social Science Knowledges? The Politics of Disciplinary Collaboration within the Field of UK Food Security Research: Openness to Social Science Knowledges?’ Sociologia Ruralis 59, no. 1 (2019): 23–43.

Abstract: This article explores a form of knowledge politics played out within and between universities and research institutes as sites of certified disciplinary expertise in the agro-food domain. It investigates the openness of this domain to the expertise of the agro-food social sciences particularly when challenge-led research programmes require collaboration across disciplines. A case study is provided by the multi-discipline field of food security research in the UK involving interviews with key stakeholders. The article examines how this research field’s disciplinary diversity is understood by key stakeholders. Interview data are analysed thematically in terms of the current and potential contribution of social science disciplines, the different ways in which stakeholders imagine social science research, and whether social scientists themselves recognise and align with these different imaginaries. The article concludes by arguing that the field of food security research in the UK is open only selectively to agro-food social science knowledges and that this is likely to have negative implications for addressing the challenges of food security. Further, if the promise of collaborative working between disciplines in agro-food research fields is to be made good then the emphasis of agro-food knowledge politics scholarship and the governance of knowledge-making needs to change.

- In food security research, the social science are often seen as ‘strategic supporters’ in inter / multi-disciplinary efforts and used to make it easier to translate or pass scientific or technical initiatives to implementation. (This is often at the end of the ‘research’ phase.)
- Social science are also often seen as the research used to understand the ‘human dimension’ or ‘behavioural’ research ways to get people (consumers or famers to act in a more desirable manner based on the research or assumptions of the natural scientists.

Nowotny, Helga, Peter Scott, and Michael Gibbons. ‘Introduction: “Mode 2” Revisited: The New Production of Knowledge’. Minerva, Special Issue: Reflections on the New Production of Knowledge, 41, no. 3 (2003): 179–94.

Abstract: No abstract, an introduction to a special issue

- This article is in response to the responses and criticisms of the original Mode 2 thesis presented in The New Production of Knowledge, and Re-thinking Science. It introduces a Minerva special issue of articles that engage with the Mode 2 theis.
- Those who responded most warmly to the thesis were politicians and civil servants trying to link knowledge production with innovation and researchers working in more applied sectors.
- Discusses the role of humanities specifically in the production of knowledge; from the authors’ perception this discipline has often been thought of as separate or detached, but the authors’ argue that due to its engagement with culture, the humanities are actually very integrated in all types of knowledge making. (p.188)

Öberg, G. Interdisciplinary Environmental Studies: A Primer. New York: Wiley-Blackwell, 2011.

- Discusses the perceived gap between the natural and social sciences. (Chapter 2)
- Acknowledges the disciplinary hierarchy within academia with hard / positivist sciences occupying the top space. (Chapter 12)
- Provides a practical framework to approach interdisciplinary working to facilitate the process and address difficulties / barriers. (Chapter 3)

Owens, Susan, and Tim Rayner. '"When Knowledge Matters": The Role and Influence of the Royal Commission on Environmental Pollution'. Journal of Environmental Policy & Planning 1, no. 1 (March 1999): 7–24.

Abstract: Adopting a 'knowledge perspective', in which policy-making is seen as a process of collective learning through argument and persuasion, this paper assesses the record of the UK Royal Commission on Environmental Pollution as an advocate of concepts and reforms associated with ecological modernization. Drawing on extensive empirical research, it considers how the social and political climate in which the Commission has operated, as well as certain characteristics of the Commission as an advisory body, have conditioned its degree of influence over time. It argues that in various roles—as knowledge broker, policy entrepreneur and persuasive advocate—the Commission has been able to exert a significant influence on environmental policy in the UK and beyond. The paper also reflects on the utility of different approaches in theorizing the role of advisory bodies in the policy process.

- In this case study, the authors say that the commission has made important strides in influencing policy in the environmental realm. It did so by working across policy streams and being seen as an 'independent authority'.
- Timing is also a factor in being successful in policy.

Petts, Judith, Susan Owens, and Harriet Bulkeley. 'Crossing Boundaries: Interdisciplinarity in the Context of Urban Environments'. Geoforum 39, no. 2 (2008): 593–601.

Abstract: Drawing upon the discussions and insights provided by researchers and policy-makers during a seminar series, this paper explores the rationales for, and the practices and difficulties of, interdisciplinarity. The urban environment provides the problem context. Despite a consistent rhetoric and repeated attempts to promote interdisciplinary research, not least by the funding councils in response to policy imperatives, success appears to have been limited. The paper suggests that rather than viewing interdisciplinarity as a distinct, often difficult, category of research it is more useful to consider a continuum of research types from multi- to transdisciplinarity. The paper furthers the interdisciplinarity debate by characterising five categories of 'border troubles'. These involve the relentless association of interdisciplinarity with 'real world problems', the epistemological structuring of disciplines, assumptions about the disciplinary division of labour and the privileging of certain frames and forms of enquiry, the increasing complexity of knowledge transfer, and the 'hard wiring'

of the research funding and assessment system. However, we conclude optimistically in terms of the evident willingness of researchers to occupy hazardous disciplinary border zones to further urban environmental understanding and propose a set of 'conditions for success' encompassing both the approach and practices of participants in interdisciplinary work as well as operational and contextual factors.

- By creating a continuum on interdisciplinarity, this paper makes a distinction between 'genuine' interdisciplinarity and research that is not. This could be a key thought to consider if social scientists see their participation as genuinely integrated or not.
- This paper tries to make a 'realistic' case for approaching interdisciplinarity by discussing its intellectual challenges and an acknowledgement of the financial costs incurred by the length of time it takes to engage in interdisciplinary research.
- Despite bringing attention to the challenges of interdisciplinarity, this paper expresses 'goodwill' towards the research and says that Geography as a discipline is well placed for interdisciplinary collaboration across the 'human and environmental'.

Phillipson, Jeremy, Philip Lowe, and James M. Bullock. 'Navigating the Social Sciences: Interdisciplinarity and Ecology'. Journal of Applied Ecology 46, no. 2 (2009): 261–64.

Abstract: Introduction: In this paper, we introduce the first Special Profile of Journal of Applied Ecology to concentrate on the relationship between social sciences and ecology. We report on a survey of ecologists engaged in interdisciplinary research to see how they navigated their choice of social science partners. In introducing the research papers, we explore what they reveal about the development of common analytical methods and approaches for collaboration between social scientists and ecologists, as well as various roles of humans in applied ecology.

- This paper is a guest editorial that reports on the survey findings around the core question: how do ecologists choose social science partners? This article introduces those papers
- In the survey, some ecologists said that working with "more reductionist" social science disciplines (some economics and psychologists) that follow a hypothesis approach to research resulted in more compatible ways of working than more "holistic and qualitative" social sciences (p 262)
- A prominent role imagined for the social sciences was to "illuminate the social preferences, attitudes, values and motivations of diverse stakeholders and audiences." (p. 262)

Pound, Diana, Lucy Armitage, Joel Pound, Scotland, Scottish Government, and APS Group Scotland. Engaging and Empowering Communities and Stakeholders in Rural Land Use and Land Management in Scotland, 2016.

Abstract: Introduction: Land use and land management in Scotland is changing. This is a result of environmental processes (such as climate change), new ways of working (such as

integrated landscape or river management), increased demands on land (such as for recreation, energy and food), new environmental and social policy and greater understanding of the benefits of engagement and empowerment. To adapt, organisations that manage land need to transition to new ways of working with communities and stakeholders. This report explores the background to these changes, describes the experiences of those working with communities and stakeholders around land use and land management, provides a framework for thinking about engagement and empowerment, and provides suggestions and recommendations.

- This is a report written with the Scottish Government and led by social researchers who work at a separate agency, Dialogue Matters.
- There is reference to a report from Wales that discussed the 'shifting culture of environmental bodies' which aimed to take into account other forms of knowledge and knowing.
- This report views stakeholder engagement as the key to win social capital, increase confidence and create more robust conclusions and approaches to land use management.

Pretty, Jules. 'Interdisciplinary Progress in Approaches to Address Social-Ecological and Ecocultural Systems'. Environmental Conservation 38, no. 2 (2011): 127–39.

Abstract: The emergent human cultures have shaped, and in turn been shaped by, local ecosystems. Yet humanity's intense modification of the environment has resulted in dramatic worldwide declines in natural and cultural capital. Social-ecological systems are becoming more vulnerable through the disruption of livelihoods, governance, institutions, resources and cultural traditions. This paper reviews the environmental sub-disciplines that have emerged to seek solutions for conservation and maintenance of the resilience of social-ecological systems. It shows that a central component is engagement with the knowledges of people within their contexts. Local knowledges of nature (traditional, indigenous, local ecological knowledge and ecoliteracy) are used by place-based cultures to guide actions towards nature. The importance of new engagements between different knowledges is now becoming more widely recognized by scientific institutions. Yet there still exist many false dualisms (for example local knowledge versus science) which tend to emphasize a superiority of one over the other. Ecocultures retain or strive to regain their connections with the environment, and thus improve their own resilience. Revitalization projects offer ways to connect knowledge with action to produce optimal outcomes for both nature and culture, suggesting that systems can be redesigned by emphasis on incorporation of local and traditional knowledge systems.

- Discusses the 'false dualism' of local and scientific knowledges and how local knowledge has not be legitimised in this space due to its lack of 'generaliseability'
- By encouraging more integration of the sciences with local knowledge and expertise, we can further 'connect people' with conservation efforts.

Raman, Sujatha, Alison Mohr, Richard Helliwell, Barbara Ribeiro, Orla Shortall, Robert Smith, and Kate Millar. 'Integrating Social and Value Dimensions into Sustainability Assessment of Lignocellulosic Biofuels'. Biomass and Bioenergy, Implementing Sustainable Bioenergy Systems: Insights from the 2014 RCUK International Bioenergy Conference, 82 (November 2015): 49–62.

Abstract: The paper clarifies the social and value dimensions for integrated sustainability assessments of lignocellulosic biofuels. We develop a responsible innovation approach, looking at technology impacts and implementation challenges, assumptions and value conflicts influencing how impacts are identified and assessed, and different visions for future development. We identify three distinct value-based visions. From a techno-economic perspective, lignocellulosic biofuels can contribute to energy security with improved GHG implications and fewer sustainability problems than fossil fuels and first-generation biofuels, especially when biomass is domestically sourced. From socio-economic and cultural-economic perspectives, there are concerns about the capacity to support UK-sourced feedstocks in a global agri-economy, difficulties monitoring large-scale supply chains and their potential for distributing impacts unfairly, and tensions between domestic sourcing and established legacies of farming. To respond to these concerns, we identify the potential for moving away from a one-size-fits-all biofuel/biorefinery model to regionally-tailored bioenergy configurations that might lower large-scale uses of land for meat, reduce monocultures and fossil-energy needs of farming and diversify business models. These configurations could explore ways of reconciling some conflicts between food, fuel and feed (by mixing feed crops with lignocellulosic material for fuel, combining livestock grazing with energy crops, or using crops such as miscanthus to manage land that is no longer arable); different bioenergy applications (with on-farm use of feedstocks for heat and power and for commercial biofuel production); and climate change objectives and pressures on farming. Findings are based on stakeholder interviews, literature synthesis and discussions with an expert advisory group.

- Here is an example of social science being used in a traditionally natural science space (technology of bio-fuel generation) in order to approach the generation of bio-fuels from a responsible innovation perspective.
- By understanding the socio-technical aspects from a whole systems and actors perspective, the authors proposed future visions for the production of biofuels based around socio-economic justice and a preservation of the UK farming culture as alternatives rather than just a technical perspective.
- This study revealed the various value based perspectives currently existing in the bio-fuel industry, with a tendency to value and take into account aspects that are quantifiable.

Redman, Charles L., J. Morgan Grove, and Lauren H. Kuby. 'Integrating Social Science into the Long-Term Ecological Research (LTER) Network: Social Dimensions of Ecological Change and Ecological Dimensions of Social Change'. Ecosystems 7, no. 2 (2004): 161–71.

Abstract: The integration of the social sciences into long-term ecological research is an urgent priority. To address this need, a group of social, earth, and life scientists associated with the National Science Foundation's (NSF) Long-Term Ecological Research (LTER) Network have articulated a conceptual framework for understanding the human dimensions of ecological change for the LTER Network. This framework explicitly advocates that what is often divided into "natural" and human systems be considered a single, complex social-ecological system (SES). In this paper, we propose a list of core social science research areas, concepts, and questions; identify the need for multiscale investigatory frameworks crucial for implementing integrated research; and suggest practical approaches for integration. In sum, this paper is a general outline for empirical and cross-site research projects where investigators agree that bringing together social, biological, and earth scientists can lead to synthetic approaches and a unified understanding of the mechanisms regulating SES. Although the motivation for this goal is specific to the LTER Network and similar projects, we believe that the issues and ideas presented here are widely applicable to other interdisciplinary SES studies.

- The first author of this paper heads a sustainability institute, is 'committed' to interdisciplinary research and has an anthropology background.
- This paper promotes interdisciplinary research with the natural and social sciences and insists on an 'integrated' approach, with the assumption that the two knowledge camps act as equal partners.

Shah, Hetan. 'Global Problems Need Social Science'. Nature 577, no. 7790 (January 2020): 295–295.

Abstract: No abstract provided, is a Nature opinion piece.

- Shah has a background in Law and Economics and is the Chief Executive of the British Academy.
- This opinion piece calls for more social science and humanities to be brought into research and policy domains to help meet future 'challenges' including global health, national health and climate change.
- Shah differentiates data from the social sciences as data can only 'narrowly' address problems; disciplines such as anthropology, psychology, political science, history and sociology to understand social phenomena and human behaviour.

How important is it to differentiate the social sciences from people who provide data inputs into research? Are institutions differentiating between these two job roles?

Smith, Adrian, Jan-Peter Voß, and John Grin. ‘Innovation Studies and Sustainability Transitions: The Allure of the Multi-Level Perspective and Its Challenges’. Research Policy 39, no. 4 (2010): 435–48.

Abstract: Sustainable development is prompting a re-assessment of innovation and technological change. This review paper contributes three things towards this re-assessment activity. First, it considers how the history of innovation studies for sustainability development can be explained as a process of linking broader analytical frameworks to successively larger problem framings. Second it introduces an emerging framework whose allure rests in its ability to capture the bigger picture: the multi-level perspective on socio-technical transitions (MLP). Whilst burgeoning researcher networks and literature suggests this policy-relevant theory is attractive, it is not without its challenges. The third purpose of this paper is to elaborate these challenges as areas for further research and development. We do this by drawing upon contributions to this special section and the wider literature.

- This article suggests researching the policy processes behind socio-technical changes, such as regulations, research funding and market interventions. The authors recommend that understanding these processes and the interactions with different policy actors is vital for understanding innovations in socio-technical systems.
- Whilst a suggestion to research and understand policy is recommended, any discussion of incorporation social researchers or interdisciplinarity is not mentioned explicitly.

Star, Susan Leigh, and James R. Griesemer. ‘Institutional Ecology, `Translations’ and Boundary Objects: Amateurs and Professionals in Berkeley’s Museum of Vertebrate Zoology, 1907-39’. Social Studies of Science 19, no. 3 (1989): 387–420.

Abstract: Scientific work is heterogeneous, requiring many different actors and viewpoints. It also requires cooperation. The two create tension between divergent viewpoints and the need for generalizable findings. We present a model of how one group of actors managed this tension. It draws on the work of amateurs, professionals, administrators and others connected to the Museum of Vertebrate Zoology at the University of California, Berkeley, during its early years. Extending the Latour-Callon model of interessement, two major activities are central for translating between viewpoints: standardization of methods, and the development of `boundary objects'. Boundary objects are both adaptable to different viewpoints and robust enough to maintain identity across them. We distinguish four types of boundary objects: repositories, ideal types, coincident boundaries and standardized forms.

- The concept of ‘boundary objects’ can apply to interdisciplinary project where researchers find ways to work together.
- The Museum example in the article highlights the relationship between professional and non-professionals when populating the museum inventory – it is an example of citizen science.

- Boundary objects can be used as a tool or seen as a solution to interdisciplinary working as it allows different spaces of expertise to work together, while still occupying their own separate spaces. The ‘boundary objects’ exist at the locus of translation.

For projects in government or other environmental organisations, have there been examples of ‘boundary objects’ being used to coordinate activities with citizens or social scientists?

Stember, Marilyn. ‘Advancing the Social Sciences through the Interdisciplinary Enterprise’. The Social Science Journal 28, no. 1 (1991): 1–14.

Abstract: Although interdisciplinary work in universities has expanded in recent decades, the Influence of academic disciplines is pervasive. The article makes explicit the opportunities and challenges of interdisciplinarity for the social sciences. The strategies offered for enhancing the interdisciplinary enterprise include selecting appropriate group members, establishing ground rules, explicating and bridging epistemological and methodological differences, and promoting infrastructural support.

- This article supports interdisciplinary academic approaches because integrating knowledge is seen as a good thing and on the grounds that the world is not organised into disciplines.

- In addition to providing practical suggestions to facilitate interdisciplinary working, this paper advocates for continued and enhanced interdisciplinary working for the Western Social Science Association. This is an organisation that the author was president of.

Strategic Policy Making Team. ‘PROFESSIONAL POLICY MAKING FOR THE TWENTY FIRST CENTURY’. Cabinet Office, September 1999.

Abstract: None, this is a government report.

1.1 The Modernising Government White Paper promises changes to policy making to ensure that policies are strategic, outcome focused, joined up (if necessary), inclusive, flexible, innovative and robust. This report is the culmination of work on policy making carried out by the Cabinet Office to follow up publication of the White Paper. It aims to

· examine what professional ‘modernised’ policy making should look like;

· provide a snapshot of current good practice as a high-level indication of areas where policy making is ; and

· suggest possible levers for change to help to bring about the White Paper ‘vision’ for policy making.

1.3 The results of the work on good practice are set out in Chapters 4 to 10. Together with the other work done as part of the project, they suggest that policy makers have already assimilated and are acting upon several parts of the agenda to modernise policy making. In particular, the importance of joining up effectively is now well understood by policy makers though they are still feeling their way when it comes to how best to achieve it. The need to involve and communicate effectively with those affected by policies as well as those who deliver them on the ground is also well understood and is producing innovative ways of

consulting and involving a wider audience in the policy-making process. Likewise, policy makers are drawing increasingly on the experience of other countries in developing their own thinking, though there is still some way to go before this outward looking approach becomes the norm across Whitehall. For other elements of the policy process the picture is patchy.

There remain obstacles – real and perceived – both to the development of more forward-looking and long-term policies and to greater innovation and creativity in policy making. Whilst there are examples of good practice in the way policy makers use evidence and in the way they learn lessons from past experience, there is a need to spread that good practice more widely and to overcome the barriers that inhibit policy makers from adopting it.

- In Chapter 7, this policy document discusses the various types and forms that 'evidence' can take to inform government policy.

- Social researchers and public consultations (lay knowledge) are cited as sources of evidence.

- 7.3 "The principle that interventions should be tested is less widely accepted in those policy areas where it is difficult to produce data with the same degree of scientific reliability and validity. This is especially true of economic and other social science research dealing with controversial and politically contested policies." What does this say about assumptions in government regarding positivist ideas of 'reliability and validity'? Do we see these assumptions playing here?

- 7.12 "Joining up between departments: The drawing up of departmental research strategies alone is not enough: they also need to be joined up. There are many examples of good cross-departmental co-operation on individual projects and programmes – such as DTI and DETR working together on environmental research and developing new technologies for transport and the Government Social Research Network – but the arrangements for sharing views on priorities or approaches are patchy. One option for further strengthening the overall co-ordination of research across government would be to give someone overall responsibility for ensuring that research effort is joined up and avoids both duplication and gaps." How does encouraging cross departmental sharing encourage cross disciplinary research engagement?

Tsouvalis, J., and R. Little. 2019. 'Co-Design, Co-Production and Participatory Policy Making - Insights From the Social Sciences'. Co-Design, Co-production and Participatory Policy Making - Insights From the Social Sciences

Abstract: No abstract provided

- This is a review written for Defra by academic contractors. It was commissioned to inform Defra's commitment to co-designing their new Environmental Land Management Scheme. The authors are also involved with a large ESRC project looking at co-design in policy making and Ruth Little at Sheffield is the contact.

- This report methodology pulls from literature from the social sciences regarding how to most effectively approach co-design with the public in order to create more relevant, legitimate and effective policy.

Twigger-Ross, Clare for DEFRA/Environment Agency Flood and Coastal Erosion Risk Management R & D Programme (Great Britain). Improving the Contribution of Social Science to the Flood Risk Management Science Programme. Bristol: Environment Agency, 2005.

Abstract: Research aim: The main aim of this research was to review options for improving the contribution of social science to the Environment Agency's Flood Risk Management (FRM) science programme.

This report presents the collation and review of relevant research and practice both in terms of the role of social science and also in terms of FRM social science research and other relevant Environment Agency social science research carried out between 1999 and 2005. Both the FRM social science research and the Environment Agency social science research were examined in terms of social science approach and methods. In addition, relevant social science projects and programmes both from within the Environment Agency and externally were collated. Fourteen formal interviews were carried out with people from the following groups: Environment Agency and Defra policy staff, Environment Agency regional/operations staff, Environment Agency and Defra social scientists, other government department social scientists, academics/researchers working in FRM, academics/researchers working on the role of science in policy making and other practitioners in FRM.

- This is a key report outlining how social science research is used in these existing government agencies.
- The main conclusions are that social science research is not incorporated systematically into the work of the agency and is lacking an overall strategy.
- Existing staff also have low levels of methods and theory of social science research, leaving it open to interpretation, therefore building this skill and capacity is cited as a priority.
- Internal dissemination of any social science research after it has been conducted happens on an ad hoc basis.

Wynne, Brian. 'Intolerance: Science Informs, Not Defines'. Nature 471, no. 7338 (March 2011): 305–305.

- This is a short letter to nature that describes the dynamic of science communication with the public and an argument of how it should look.
- Wynne argues that scientists should respond and engage with the public when asked questions around the safety of vaccines and GMO products. Here the scientists presume and define the questions around the debate, rather than allowing members of the public to define the questions for themselves.

Zylstra, Matthew J., Andrew T. Knight, Karen J. Esler, and Lesley L. L. Le Grange. 'Connectedness as a Core Conservation Concern: An Interdisciplinary Review of Theory and a Call for Practice'. Springer Science Reviews 2, no. 1–2 (December 2014): 119–43.

Abstract: Calls for society to 'reconnect with nature' are commonplace in the scientific literature and popular environmental discourse. However, the expression is often used haphazardly without the clarity of the process involved, the practical outcomes desired, and/or the relevance to conservation. This interdisciplinary review finds that the Western disconnect from nature is central to the convergent social-ecological crises and is primarily a problem in consciousness. Connectedness with nature (CWN) is therefore defined as a stable state of consciousness comprising symbiotic cognitive, affective, and experiential traits that reflect, through consistent attitudes and behaviors, a sustained awareness of the interrelatedness between one's self and the rest of nature. CWN sits on a continuum comprising information about nature and experience in nature but is differentiated as a more holistic process for realizing transformative outcomes that serve oneself and their community. Various instruments are available to measure the CWN construct, although their cross-cultural transferability is unclear. Multiple benefits of CWN linked to physical and psychological well-being have been identified and CWN is distinct in that it supports happiness and more purposeful, fulfilling, and meaningful lives. CWN has been found as a reliable predictor and motivation for environmentally responsible behavior (ERB). CWN may benefit conservation discourse by providing: a more compelling language; hope and buffering frustration in the face of environmental crises; a more enduring motivation for ERB; and an accepted avenue for tackling 'fuzzy' concepts often avoided in conservation. Bolstered by interdisciplinary collaborations and action-oriented education, CWN presents itself as a radical but necessary prerequisite for realizing desired conservation and environmental behavior outcomes.

- This paper discusses measuring connectedness with nature by reviewing existing measurement indexes cited in academic literature such as Inclusion of Nature in Self (INS) and suggests that these measures could be further improved by adding in could possibly be further improved by "including dimensions of collective identity (as conceived in social psychology and sociology literature). (p.129)

- The authors argue that a conceptualisation of connectedness with nature is missing the 'action' element to ensure that there is more of it. Therefore, an interdisciplinary approach that values the insights provided by the social sciences and psychology to help understand human motivations and the human mind will provide insights to help translate more people into actually being connected to nature. This element is seen as central to making conservation efforts more effective. They argue that historically the conservation sciences have neglected the social element of the research and hence the disconnectedness between people and caring about nature.

Later search citation details:

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A.4 Workshop programme

SOCIAL SCIENCE IN THE NATURAL ENVIRONMENT

Project workshop programme: 5.5.2020

Introduction: background and rationale

Thank you for agreeing to take part in this workshop which has been jointly organised by Natural England (Beth Brockett and the rest of the Social Science Team: Rose O’Neill, Cheryl Willis, Alison Darlow, Emma Hinton) and the University of Nottingham (Carol Morris, School of Geography). The workshop is one element of a project, funded by the Economic and Social Research Council’s Impact Accelerator Award, entitled ‘Moving towards interdisciplinarity: integrating social and natural science in UK environmental organisations’.

The workshop brings together social scientists from a number of different environmental organisations and research institutions. It seeks to create a space for starting a conversation about the role of social science in UK environmental organisations and how this role might be enhanced including through the contribution of research. A further workshop will be held later in 2020 to develop these discussions and will also include colleagues from the natural sciences.

The workshop is interested in exploring the following questions:

- What does it mean to be a social scientist and ‘do’ social science within an environmental organisation?

- What factors enable and constrain social science in this context?

- When, and why, has social science made a positive difference to the delivery of environmental outcomes?

- What needs to change to enable the more effective integration of social and natural sciences in environmental organisations?

- How can research / academia support this process of change? What questions should it be asking, why and how?

- Is there a role for a formal network of social scientists to support and promote their work within environmental organisations?

Workshop: online ‘venue’ and information about how to attend

Due to the Covid-19 restrictions the workshop will take place online via Zoom. Details about downloading the Zoom software and joining a Zoom meeting are provided at the end of this document. We will be sending out a calendar invitation to join the meeting by email next week.

Workshop programme:

10.00 – Workshop orientation and preparation offline. In the 30 minutes before the formal start of the online workshop we invite you to read through a couple of short documents that will be circulated in advance: participant biographies; list of social scientists working across a range of environmental organisations in the UK – please ‘sense check’ this list for any obvious omissions.

10.30 – Log in to online workshop. Please join the workshop at least 5 minutes before the formal start at 10.45 to allow for any technical issues to be resolved.

10.45 – 11.10 – Welcome, technical advice and short introductions from participants.

11.10 – 11.15 – Introductory Poll 1.

11.15 – 11.30 - Introduction to the project, workshop aims and etiquette.

11.30 – 11.50 – Presentation and discussion of material from pre-workshop interviews with participants.

11.50 – 11.55 – Comfort break.

11.55 – 12.00 - Poll 2.

12.00 – 12.15 – Discussion, including use of online chat function: why do you think that social science is or isn’t valued in your organisation?

12.15 – 1.00 – Break out group discussions: three groups, 3 questions to discuss.

1.00 – 1.45 – Lunch break.

1.45 – 2.15 – Back together as an entire group with feed-back from each of the break-out groups and discussion (10 minutes per group).

2.15 – 2.55 – Discussion, including use of online chat function, of next steps: SSiNE ‘network’ including on social media; second workshop in autumn 2020 – aims, participants, outcomes.

2.55 – 3.00 – Feedback and workshop follow-up.

3.0 – Workshop ends.

A.5 Themes identified from the interview, survey and workshop data

1. **Social Science roles-** This theme includes participants' job titles and descriptions, which roles, tasks or projects participants tend to take on, and which they prefer. It includes roles they would like to assume but are unable to. The theme also includes the kinds of roles perceived to be 'social science' roles by different actors and stances on when to involve social science in projects: *"I think it's particularly amongst newer leaders and younger policymakers, is that they are interested in coming to evidence [teams] very early on and saying, 'Can you help us develop our ideas?'"* [Gov 2]. It also includes roles which social scientists feel are necessary, for instance the necessary role of advocating social science: *"I see as part of my role … is to challenge that where I see it happening, and ask why we're not looking at these different viewpoints"* [Gov agency 1].

2. **Values & interests-** This theme includes participants' intellectual interests, values and goals "I'm interested in social science in conservation, because I want to change the conservation outcomes" [Gov agency 5].

3. **Framings-** The theme includes how participants identify and frame themselves and their colleagues disciplinarily. It includes how social science disciplines are understood and framed by participants and by actors within organisations: *"having that kind of critical approach is perhaps what distinguishes us [social scientists] from others"* [Gov agency 7]. The theme includes how organisations frame their teams, agendas and strategies and how professional bodies and networks are framed disciplinarily. Finally, it includes how nature and particular environmental issues are understood by participants and actors within organisation via natural and social framings: *"I think there is a, quite a strong tendency within government to view nature as a natural science problem"* [Gov agency 1].

4. **Hierarchy and power-** This theme includes organisational structures and processes which constrain or facilitate positive socio-environmental outcomes and social science in NEOs: *"there aren't necessarily as many opportunities for social researchers to move up into G seven and G six roles"* [Gov 2]. It includes the existence of disciplinary knowledge hierarchies within organisations: *"it can be viewed as a 'social science thing' in a natural science organisation, I think that people can have more of a negative view of that"* [Gov agency 6]. The theme also includes examples of and ideas for improving the standing and reputation of social science within organisations, and for creating social and environmental change using social science through organisations.

5. **Interdisciplinarity-** The theme includes accounts of participants' disciplinary academic and professional backgrounds, and accounts of who participants' work with in interdisciplinary organisational settings. It includes how embedded social science is within interdisciplinary teams: *"I really need to understand that design and think is this just a tick box exercise? And if it is, I'm not gonna get involved' [Academia 1]. The theme also includes difficulties within teams regarding clashes and conflict, and complexity of the work. Finally, the theme includes the extent which disciplinary perspectives are shared and integrated: "Rather than just natural sciences taking some social science research into their own approaches, social scientists can learn from the natural scientists as well"* [workshop].

6. **Methods-** This theme includes methods used and preferred by social scientists, dominant methods and methodological developments within organisations, applied methods shared through professional bodies and networks, and the perceived value and rigorousness of different methods by various actors: *"end customers for a lot of evidence in society like statistics, because they're kind of science flavoured"* [Gov 2].

7. **Communication and relationships-** This theme includes communicating the relevance of social science and persuading actors within organisations to adopt social perspectives. It includes the benefits of speaking the same disciplinary language and challenges communicating between these languages. The theme also includes existing trust and relationships in organisations: *"I'm actually wondering whether or not some natural scientists see social scientists as a bit of a threat"* [Academia 1], and the role of building trust *"if you cede power, that can help build relationships and trust. When you just want to be helpful, people were more receptive"* [workshop].

8. **Resources-** This theme includes the resources of time and money regarding the funding environment and organisational demands for efficiency and 'value for money' outcomes. It includes human resources regarding the number of social scientists and expertise within organisations and working on projects. The theme also includes constraints to social science and interdisciplinary work caused through a lack of resources and the relationships between securing and using resources: *"there were loads of European possibilities where you could bolt on social scientist to a big European project because you wanted to get funded"* [Gov agency 3].

9. **Networks and collaboration-** The theme includes description of participants' professional memberships and accounts of participants' established networks with other social scientists within and outside of their organisations. It includes examples of knowledge sharing and collaboration within established networks: *"I've written a couple of social science papers actually with [name] who used to work for the Centre for Ecology and Hydrology"* [Gov agency 1]. The theme also includes networks which are desired by participants; growing personal networks and ideas for establishing a new professional network: *"something like a nature conservation professional organisation that has a social bent. that doesn't seem to exist"* [Gov agency 5].

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List of abbreviations

AES – agri-environment scheme

CAP – Common Agricultural Policy

CBRN - Chemical, Biological, Radiological, Nuclear

CWN – Connection With Nature

DECC – Department for Energy and Climate Change

Defra – Department for Environment, Farming and Rural Affairs

DfE – Department for Education

EA – Environment Agency

EFF- Environmentally Friendly Farming

EHC - Education, Health and Care

ELSI – ethical, legal and social issues

ERB – environmentally responsible behaviour

ESRC IAA – Economic and Social Research Council's Impact Accelerator Award

EU – European Union

GMO – Genetically Modified Organism

GSR – Government Social Research

INS – Inclusion of Nature in Self

IPCC – International Panel on Climate Change

IUCN – International Union for Conservation of Nature

LTER - Long-Term Ecological Research

NE – Natural England

NEOs – Natural Environment Organisations

NESAC – Natural England Science Advisory Committee

NGOs – Non-Governmental Organisations

NRW – Natural Resources Wales

NSF - National Science Foundation’s

PI – Principal Investigator

RSPB – Royal Society for the Protection of Birds

SEN – special educational needs

SES – social-ecological system

SMART– Specific, Measurable, Attainable, Realistic, and Time Bound

SME – Small or Medium Enterprise

SSINE – Social Science in the Natural Environment

STEM – Science, Technology, Engineering and Maths

STS – Science and Technology Studies

UK – United Kingdom

WWF – World-Wide Fund for Nature

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ISBN 978-1-78354-919-1

Catalogue code: JP045

NATURAL ENGLAND