



Background paper

Re-framing Environmental Communication: engagement, understanding and action

August 27, 2018

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are the responsibility of the authors.



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Contents

1 Background and Mission	4
2 Scope and State of the Art	6
2.1 Re-framing environmental communication	6
2.2 Development of thinking around environmental communications over the past two decades	7
3 Research and Policy Challenges – an overview	11
3.1 Co-production, communication and imagined futures	11
3.2 Making issues, making publics	12
3.3 Expertise and evidence	12
3.4 Materiality and environmental communication	13
3.5 Ignorance and uncertainties in environmental knowledge	14
3.6 Cognitive processes and debating environmental values	14
3.7 Policy and governance issues and the economic framing of environmental goods	15
4 Research areas	16
4.1 Publics and organizations in environmental communication	16
4.2 Emerging formats and sites of environmental communication	17
4.3 Public knowledge-making on environmental issues	18
4.4 Values and emotions in environmental communication	19
4.5 Environmental communication, governance and evaluation	19
5 Conclusions and recommendations	21
References	22

1 Background and Mission

This report has been developed in response to Mistra's original terms of reference for the Working Group on Environmental Communication. As described there, 'Mistra's task is, in the environmental and sustainable development sector, to support the kind of research and development that favours society's progress and can be applied in decisions and societal actions. Included in this remit is a substantial interest in enhancing shared understanding of the nature of the links between knowledge and action for various target groups.' It is further specified by Mistra that '(a) research programme on environmental communication should be interdisciplinary in nature and link together relevant research from various academic disciplines and be conducted in a close dialogue between researchers and practitioners.'

In line with this remit, the tasks of the Working Group were:

- ▶ to describe the challenges facing society in this area;
- ▶ to provide an overview of where the research frontline is located and the status of Swedish research in the area from an international perspective;
- ▶ to provide conclusions and recommendations to Mistra on characteristics for a new research programme and the areas that are most relevant to support;
- ▶ to propose in detail the orientation of a new research programme (draft text for the call for funding applications).

Our work was specifically influenced by a previous knowledge report prepared for Mistra in 2017 by Climate Outreach: 'Communicating environmental and sustainability science: challenges, opportunities, and the changing political context.' (Corner et al., 2017). There is much that is shared between our report and this earlier document. We suggest it is read alongside the discussion and recommendations that follow. A recent report by the US National Academies of Sciences, Engineering and Medicine on 'Communicating science effectively' (2017) also provided a foundation to our work.

The working group met physically on one occasion at Mistra's office in Stockholm on May 21-23, 2018. However, we also worked through several video conferences and numerous email exchanges. The report that follows was very much a collective effort and we take shared responsibility for it. We are deeply grateful for the support we received from Mistra during this report's preparation. We would like to express special thanks to Malin Lindgren for her active contribution and constant assistance.

The main output from the Working Group's activities can be found in the five research areas presented in section 4. Before that, we set the scene more generally both in terms of the research background (i.e. the state of the art) and the possibilities we see for fresh approaches to these important, if also complex and cross-cutting, issues.

More specifically, in section 2, we first propose a broad perspective on environmental communication and then sketch (in very brief terms) the development of previous relevant research. In section 3 we present some of the research and policy challenges that we have identified. Once again, our intention is to open up rath-

er than close down areas for future activity. Our main aim in this section is to indicate how environmental communication might be ‘re-framed’ in a manner which is both intellectually exciting and practically significant. As will be seen throughout this report, we focus especially on the interface between environmental and science communication: including the role of science in the context of environmental communication. Section 4 makes some specific proposals for a future research programme. Finally, in section 5 we provide several conclusions and recommendations concerning the general characteristics of a new research programme.

As will be explored in the following sections, this is a broad, challenging, intellectually-diverse and cross-disciplinary field that requires an equally broad and imaginative research approach. We do not pretend to provide a comprehensive account of the research background nor to itemize all the questions which arise. Instead, our aim has been to present a larger framework within which future research projects can be located. In that sense also, we see this report as an invitation for other researchers to move beyond – both in empirical and conceptual terms – the basic approach that we are able to offer here.

2 Scope and State of the Art

2.1 Re-framing environmental communication

All forms of environmental action are inter-connected with issues of communication. Indeed, one can view environmental communication as in itself representing a crucial form of environmental action. Whether seeking to disseminate the results of a research project, to create new environmental regulations and standards, or campaigning for change around specific environmental concerns, communication is central to environmental understanding, management, engagement and practice. In this report, the Working Group has approached environmental communication as not merely a ‘secondary’ issue (once knowledge has been produced, decisions have been made and policy set) but as a fundamental aspect of understanding and acting upon environmental concerns. Hence also our call for environmental communication to be ‘re-framed’ in more open and ambitious ways.

It is certainly true that many of the environmental challenges being faced today – whether seeking global consensus on climate change, modifying consumer behaviour, or creating new forms of sustainable innovation – are bound up with communication issues. This is especially the case during a period when ‘the facts’ of particular environmental concerns are regularly called into question and the requirement for scientists and others to communicate clearly and effectively across a range of audiences is receiving greater prominence. One significant aspect of environmental communication has been the general move towards greater public dialogue and engagement around environmental issues. In this context, the emergence of new forms of citizen science and crowd-sourced evidence-making become important, but one should also take note of larger transformations in the media landscape – including the rise of social media and the loss of influence of ‘traditional’ communication forms such as printed newspapers (Horst et al., 2017).

In what follows we point to the communication challenges related to environmental decision-making and governance. On the one hand, it is necessary to see environmental communication as extending beyond statements of ‘fact’ so as to embrace matters of value, choice and preferred ‘environmental futures’. On the other, the sheer complexity of environmental concerns creates questions but also opportunities for environmental communication. How does one communicate uncertainty, complexity and disagreement but also the range of evidence relating to the natural world? What new possibilities emerge once we move away from thinking of communication as a one-way process and instead adopt notions of co-learning, dialogue, and shared understanding (including the addressing of conflicting values and viewpoints, multiple issue framings and distributed responsibilities)?

As will already have been gathered, in what follows we propose a large and expansive rather than a narrow vision of ‘environmental communication’. We therefore refer to deliberate and planned communication activities: including specific communication initiatives, events and publications aimed at larger dissemination and outreach. However, our ‘re-framing’ also includes less deliberate and instrumental activities: for example, statements of environmental policy, more informal discussions of environmental preferences (perhaps in the form of blogs and per-

sonal web pages) and everyday conversations around environmental issues. Across both deliberate and less deliberate activities, we seek to direct attention to the processes through which ‘technical’ information but also values, evidence and different issue-framings are disseminated.

There is already important research within Sweden on environmental communication. In addition to work within communication and environmental studies which directly addresses this topic, examples of related research can be found within psychology, teaching theory and practice, environmental history, sociology, philosophy, political science, brain research, rhetoric, media studies, economics and science & technology studies (STS). Going further, the Working Group’s ambition is to emphasize the larger dimensions of the issues under discussion in order to draw in researchers with an even broader expertise. If we are to ‘re-frame’ environmental communication, and specifically to bring in questions of engagement, understanding and action, then the contribution of those who do not currently see themselves as working on environmental communication will be essential.

From our perspective, research into environmental communication is not a tightly-defined or restricted area but is instead open to a range of perspectives and disciplines. Future research should acknowledge even more forcefully the socio-technical and cross-disciplinary challenges of this area. Some relevant research therefore falls directly within the heading of ‘communication’, but much else will be found across a range of disciplines and sub-disciplines within the humanities, design and informatics, and the social and natural sciences. We also emphasize the need to work in dialogue between researchers, public groups and practitioners of various kinds.

These are not small or simple issues and they will require imaginative and boundary-spanning approaches. In the following analyses and reflections we have deliberately emphasized the depth and range of research relevant to this topic. Our hope is that by presenting the field in this way we will be able to inspire others to create innovative research directions and new empirically-based projects. Taking up this challenge, the next section of our report reflects on the emergence of this cross-disciplinary field.

2.2 Development of thinking around environmental communications over the past two decades

Over the past twenty years or more – often against the backdrop of public concerns about scientific developments and environmental issues - the relationship between science, the environment and society, and the place of communications within this, have become a significant field of study and practice world-wide. In this section, we do not aim to be comprehensive in reviewing this literature. Instead, we highlight the key research and core ideas that have framed how the Working Group came to think about the challenges of communication around environmental issues, discussed in more detail in the subsequent sections of the report.

During the late 20th Century, public concerns around certain scientific and environmental developments such as nuclear power and industrial pollution, accompanied by the persistent voice of environmental and anti-nuclear NGOs, came to be seen by many international scientists and policymakers as ‘problems’ that needed to be addressed. The response adopted by some scientists, scientific bodies and professional associations was that these oppositional views were often the result of ignorance and therefore could be brought around through more information and education – the so-called ‘deficit model’ (Irwin and Wynne, 1996). Public opinion and political decision-makers were presented as being misinformed about science and the issues arising from it. Fuelled by poor and sensationalist media coverage, this misinformation was said to lead to ‘irrational’ fears and hostility towards entire sectors of research and technological innovation (Bucchi and Trench, 2014a).

In keeping with this framework, environmental scientists were encouraged to share their data and explain their work to the public, and a range of activities designed to improve the public's understanding of science was developed. Much research in these areas during the 1980s and 1990s focused around analysis of media coverage, discourse patterns and the image and strategies of environmental activists and NGOs (Cox and DePoe, 2015). In science communication, work around 'popularization' of science (or the equivalent term in non-English languages) and models of communication and publics was of significance too, as well as measures of public attitudes to and knowledge of science (Bucchi and Trench, 2016; Smallman, 2014). Methodologically, surveys of public attitudes and of scientific literacy, and analysis of media coverage, often around case studies, were seen as valuable ways to understand – and ultimately improve – how the public interacts with technical and scientific material.

But around this time, and following significant public controversies around themes like food safety and GM crops and growing concern about climate change, greater insight into how people form views around risk and new technologies was emerging (Yearley, 2005: 113-75). For instance, surveys described how people's attitudes tended to become more polarized when they learnt more about a particular area of science or technology (Evans and Durant, 1995), and how different sectors of the population responded to particular scientific developments. The term 'publics' also came into use, as generalisations about 'the public' came to be seen as of limited value and even potentially misleading, as evidence built up on the diversity of perspectives within populations and between nations (Felt, Fochler and Winkler, 2010).

Empirical research in Science & Technology Studies (STS) around lay and expert understandings demonstrated that the ways we experience and interact with the world shape how we see and make sense of it. Such an approach also brings into question the idea that scientific 'expertise' is the only form of knowledge deserving to be communicated, and highlights the existence and relevance of public knowledges and understandings particularly in areas such as environment and health (Irwin, 1995; Irwin & Wynne, 1996). The boundaries between experts and the public, nature and society were appearing to be far more permeable and mobile than previously understood. Rather than the members of society being passive recipients of knowledge that has been produced autonomously by science, researchers began to argue that science and society shape each other in profound ways and that our understanding of the world is tied up with how we choose to live. This process has come to be known as 'co-production' (Jasanoff, 2004). In this light, the seeming neutrality of scientific and technical facts and measures was shown potentially to disguise a multitude of social, value-based judgments and choices, which become embedded in the objects and institutions around us.

Meanwhile, researchers in risk analysis questioned approaches to risk that focused only on the technical dimension and instead began to develop a new communicative approach to environmental risk assessment, in which assessments of risk are understood to be individual and to involve personal beliefs and emotions, rather than simply rational assessments of probability (Cox and DePoe, 2015). Together, this research highlighted flaws in the dominant model of communication, criticizing it as 'top-down' and 'hierarchical' and challenging the idea that the target public was defined by a deficit in understanding (Bucchi and Trench, 2015, 2016). Furthermore, it flagged up how unrealistic were expectations that science could always provide decisive answers and unambiguous solutions to issues like climate change or biodiversity loss, leading to calls from researchers and others for more participatory approaches to decision making (Callon et al., 2001; Giddens, 1998; Jasanoff, 2003; Wynne, 1993).

In light of these developments in research and policy, historical accounts now describe how 'dialogue' was adopted as a new approach for mediating the rela-

tionship between science and society in the early 2000s, in what is sometimes described as the ‘dialogical turn’ (House of Lords, 2000). Drawing on practice in environmental regulation, planning and participatory technology assessment, this approach aimed to involve the public in two-way communication and decision-making around science – the rationale being that citizens’ levels of scientific understanding were not the key factor in driving public responses, but that instead decision making about these issues needed to take public perspectives and values into account. Accordingly, language within policy documents and funding schemes in many countries and at the European level moved from ‘public awareness of science’ to ‘citizen engagement’, from ‘communication’ to ‘dialogue’, and from ‘science and society’ to ‘science in society’ (Bucchi and Trench, 2014b; 2016; Felt et al., 2013; Irwin, 2006).

In presenting this highly-condensed summary, however, it must also be acknowledged that the story is more complex - with the field remaining diverse, both in terms of motivations and approaches taken. A report to the European Science Foundation (Felt et al., 2013) described the situation in terms of a ‘stratigraphy of science-society relations’. Over time, new layers of thought and action regarding science communication and engagement have developed: each temporal layer containing different actor constellations and ideals about what makes a good relationship between science and society. In this situation, new layers never simply replace old ones, but rather add to them. This may help explain the regular re-appearance of the ‘deficit model’, even though it has repeatedly been declared dead.

Meanwhile, researchers have remained interested in the possible range of communication models available and appropriate in different circumstances, how different models are applied, the often implicit and unchallenged assumptions embedded within models, and how different models can coexist. Surveys continue to be of importance, but with increasing sophistication – moving away from the previous measures of public knowledge of scientific facts (scientific literacy) to focus on dimensions like trust in science and to identify the areas of research and uses of science that citizens feel are important. Empirical studies have found that concern for and scepticism about certain scientific developments may actually be associated with higher levels of literacy and information and, *vice versa*, that blind trust – and in some cases even expectations of ‘miracles’ – with regard to science can be largely disconnected from actual knowledge and understanding (e.g. Bauer and Falade, 2014; Bucchi, 2009).

Media coverage of scientific and environmental issues – particularly how stories are framed and communicated and how material diffuses through different media - remains the subject of much research interest (Davies and Horst, 2016), moving away from general principles of media approaches towards looking at specific case studies, especially around environmental risk and GM crops (Smallman, 2014). Alongside this, much research has shifted away from simply advocating this dialogic turn towards studying the impact and effectiveness of new dialogue practices (Yearley et al., 2003), critiquing approaches in use (Irwin et al., 2013), and raising questions about the extent to which this shift to dialogue has actually taken place (Bucchi and Trench, 2014a; Irwin, 2001; Smallman, 2014). Researchers often found little evidence that public perspectives had been taken up by policy or scientists and argued that policymaking institutions were characteristically insufficiently reflexive and therefore tend to close down issues that need to be opened up. Others described how a perceived deficit in knowledge had been replaced by a perceived deficit in trust, with two-way communications adopted as a new means for science and scientific organisations to win public trust, without putting the objectives and values of the institutions themselves under scrutiny (Wynne, 2006).

The challenge of taking account of public perspectives, of scrutinizing the values of science and scientific institutions, and of mediating the relationship between science, environment and society, has been taken up more recently by two approaches

– Responsible Research and Innovation (RRI) and Citizen Science. In each, the line between research and practice is hard to draw, with learning emerging from action and practice-based research. Research here is shedding new light on how public perspectives can contribute to innovation and new ideas – both in terms of involving large groups of people in the process of doing research, and also in helping set the agendas. Coupled with new technologies, for instance smartphone-enabled air quality monitors, such moves are promising to impact on policymaking, potentially putting knowledge – and in turn policy – in the hands of citizens. Furthermore, calls for ‘responsibility’ to become embedded in the practice of science and innovation (Stilgoe and Guston, 2017; Stilgoe et al., 2013; von Schomberg, 2013) and for ‘excellence’ to be linked to relevance and responsibility (Felt et al., 2013) mean that such initiatives have the potential to change how science is done and alter what it is to be a scientist. This also suggests a shift in focus away from how science and technology are being developed and then received by society, towards caring about the futures being built with these technologies and innovations.

The diffusion of digital media, as well as the increasing communicative activism of research institutions, allows end-users an unprecedented quantity and variety of communication materials (for example, videos, interviews with scientists, selected news items). This in turn contributes to what could be defined as a ‘crisis of mediators’. Traditional mediators of science and environmental communication such as newspapers, magazines, television and radio programmes, science museums and centres are losing their traditional centrality as filters and guarantors of the quality of information (Bucchi, 2017; Corner et al., 2017). This also means that science and environmental communication should be seen as a diverse ‘ecosystem’ rather than a single channel or platform (Davies and Horst, 2016).

Discussions in this area have also contributed to a shift from a narrow concept of ‘scientific culture’ (mainly equated with science literacy) to a broader notion of ‘science culture’ and ‘culture of science’. This more comprehensive view underscores the increasing diversity and fragmentation within science practice: significant permeability of the boundaries between contemporary science and society; cross-fertilisation between images and narratives in general culture and scientific concepts and ideas; increased visibility and presence of scientific figures and concepts in the public sphere as well as in contemporary arts (Davies and Horst, 2016). The notion of ‘culture of science in society’ encompasses not just understanding of specific scientific content, but also an awareness and social intelligence of science as part of society and culture, and an ability to discuss and evaluate science’s role, priorities and implications in an open, balanced and critical fashion (Lévy-Leblond, 1996). In the context of environmental communication, this view helps highlight the connections between environmental themes and broader public discussions, for example, with discourses about environmental issues like climate change coming to be used as wider narratives about the future. Particularly in the context of digital media, the key role of images and visual elements in framing discourse about the environment is also emphasized (Bucchi and Saracino, 2016; Dunaway, 2015).

3 Research and Policy Challenges - an overview

3.1 Co-production, communication and imagined futures

We broadly propose that the communication of environmental topics be studied from a co-productionist perspective (Jasanoff, 2004). This means being attentive to the ways in which our knowledge and the material dimensions of the world around us, the social orders we live by, and the normative values we share are all intertwined. We assume that our choices in the ways we live in this world also find their expressions in what and how we know. Creating knowledge about the environment involves therefore never only the sciences or specific technologies (e.g. measuring devices such as satellites or environmental models and so on), but also brings into play new institutional actors or social movements and with it new argumentative repertoires and value structures. Using such a lens to interpret and account for complex environmental phenomena reveals new dimensions in environmental communication when it comes to ethical as well as power-related questions, as it invites the analyst to be attentive to what we tend to omit or delete for strategic reasons, as well as to those all-too-easy unidimensional explanatory efforts which promise control in a complex situation.

Researching environmental communication therefore means engaging with different sites (from mass media and public debate to regulatory offices) where such processes of co-production happen. It also invites engagement with wider (societally) shared and sometimes even institutionally stabilized visions and imaginings (often referred to as ‘imaginaries’) of desirable futures (Jasanoff and Kim, 2015; McNeil et al., 2017). These imaginaries contain ideas about the publics to care for and to give voice to, the knowledges and experiences that are valuable and necessary, as well as the norms and values (including regulation) that should guide choices and actions. This makes it essential to explore the conditions of production and circulation of such future visions, identify moments (when?), processes (how?), places (where?) and actors (who?) involved and also the relationship to power and ordering in contemporary societies. Ideas of the future are too often constructed as linear continuations, trajectories that build on past and present experiences in order to create a forward projection, partially stripping it of the unexpected nature of any complex development.

Thinking in terms of the futures that need to be cared for and the complexity this entails, also invites consideration of temporal dimensions more generally, embedded in the ways we understand and frame environmental problems, potential solutions as well as the very processes of communication (Adam, 1998; Felt, 2016). When will actions in the now become tangible and visible (e.g. current debates on nuclear waste)? How many generations do we think of when discussing issues of environmental responsibility? How fast changing are the developments we have to care for? This also suggests that we need to question our assumptions concerning what kinds of time structures are taken for granted within environmental discussions.

3.2 Making issues, making publics

Starting from the perspective outlined above means that any environmental communication has to be seen as co-producing a specific imagination of the addressees, the publics, what they should be informed about and engaged with, and how this should, in turn, impact their perception of scientific knowledge and the ways they should act.

To put it in a nutshell: publics are not simply out there, waiting to get drawn into any act of communication, but are formed through – as well as forming themselves around – the very act of communication (Felt and Fochler, 2010). This means that the way a problem gets conceptualized and turned into an issue of public concern always bring about the formation of specific publics. In short, the process of issue formation produces publics (Dewey, 1991; Marres, 2007). In relation to science communication this means that publics are not simply addressed by media reports, exhibitions or other communicative environments, but are brought into being through the very act of making something into a ‘public issue’. At the same time, social groups and social movement organizations hold the power of bringing an issue into being (Epstein, 1996) and perhaps turning considerations of environmental justice into classical expert driven thinking (Ottinger, 2013). Therefore, one primary objective is to understand how publics, issues and specific kinds of political articulations are produced in one and the same move.

3.3 Expertise and evidence

What counts as credible evidence and as trustworthy ‘public proof’ is central when it comes to communication and engagement with environmental issues. This is in turn closely connected to questions of who is regarded as holding relevant expertise, how diverse actors claim authority over problem definitions, and whose values, concerns and vulnerabilities should matter when it comes to societal choices.

The following aspects are especially significant when reflecting upon expertise and evidence.

To start with, expertise is not simply related to the specific kind of scientific knowledge or technical skills a person possesses, nor can experts straightforwardly claim the moral virtue of disinterestedness and impartiality. The matter of who holds relevant expertise and is accepted as an expert is much more the outcome of a complex interaction between the participants in the context of an environmental issue (Grundmann, 2017). On such a view, expertise is not seen as a property of a person, but as something that needs to be re-established in every fundamentally new situation (Limoges, 1993). Therefore, the way in which expertise is exercised or performed matters and needs thorough examination (Hilgartner, 2000), but it is also essential to consider the so-called ‘expertise barrier’ (Parthasarathy, 2010) which keeps members of society away from being considered to hold relevant expertise.

It follows that what counts as relevant evidence is not necessarily clear at the outset when an environmental issue takes shape but develops as part of the process through which the issue is deliberated. Indeed, what observations/collected data are evidence for depends on the set of assumptions that are held (e.g. the models that are used and the questions to which they are supposed to relate). In the domain of environmental health, for example, observations/collected data only can be turned into evidence of specific health impacts if they are collected in a stable manner over longer periods of time. Therefore, even if there is agreement on the observations/data, there can still be disagreement on the conclusions to be drawn from them. It is thus the transformation process from data to evidence which needs close scrutiny when looking into environmental communication. This is key at a time when evidence-based policy making and action are high on the agenda.

More specifically, environmental problem-making has become closely tied up with big data. Indeed, quantification has developed into an important technology of trust, somewhat replacing the classical idea of expertise (Gabrys, 2016). In particular, when external pressures rise and stakes are high, as is the case in environmental communication, data collection procedures (through sensors, satellites, recording stations and so on) start to become a powerful substitute for trust based on personal knowledge. This goes in line with an increasing call for evidence-based policy making, which links to a combination of trust in numbers and efforts to control, formalize and standardize the ways in which we see science-related topics such as the environment (Jasanoff, 2017).

Thus, in a period where big data plays a central role in framing our principal problems and shaping the ways we see the world, it is essential to be aware that objects and subjects are not simply described through the processes of collecting, analysing, and presenting data — they are brought into being through these data and related methods (Ruppert et al., 2017). Therefore, in analysing the role of environmental data collection, deployment and communication around them, it will be essential to attend to how these new procedures bring about novel forms of power relations and politics. This also calls for closer scrutiny of the ways in which data processing and automated reasoning are conducted algorithmically. Values and judgements become embedded in the ways we collect, model and ‘read’ data through algorithms, rendering them largely invisible. This carries the danger of making environmental communication through big data and corresponding algorithms unresponsive or even immune to societal questioning.

3.4 Materiality and environmental communication

Understandably, studies of communications about the environment have frequently focused on the transmission or acquiring of beliefs and ideas. But a strong tradition of work on the role of science and technology in everyday life has highlighted the role that material objects (including equipment and machines) play in communication and in the building of knowledge. In the current context, attention to materiality is important in at least three senses.

Firstly, there is the way in which environmental communication is linked to tools and devices which may offer different opportunities and affordances to senders and receivers. New forms of communication allow messages to be targeted in novel and more precise ways, while other forms of media have been designed to encourage the bottom-up sharing of opinions and the circulation of visual images. People are now much more easily broadcasters as well as receivers of media content and images, thus creating possible changes in the experience of environmental communication. Increasingly, citizens and community groups are the originators of environmental communications.

The second sense of materiality relates to the way in which environmental monitoring and observation – formerly an activity of people and agencies – is now routinely delegated to sensors and automated equipment. Trackers are increasingly fitted to wildlife, while sensors report on the movement of glacier ice or ocean currents. The range of entities engaged in communication is increasingly rapidly (as commonly expressed in the idea of an Internet of Things) and these new possibilities need to be encompassed in understandings of environmental communications.

A final point about material elements in communication arises from the observation that people’s beliefs are enacted in contexts which are pre-shaped in key ways by the nature of material things and the capacities of technologies. For example, people may receive communications about urban air pollution and wish to act on them, but they live in cities with pre-existing transport networks so that their options are shaped not only by what they know and learn but also by what their practical options are for getting to work or taking their children to school. These

points – often grouped together as aspects of ‘practice theory’ (Shove et al., 2012) – present a limit to people’s ability to respond to environmental information and constitute a key component of the contemporary communications context.

3.5 Ignorance and uncertainties in environmental knowledge

It is easy to over-emphasise the importance of the things people *know*, for example by assuming that the success of communication can be assessed in terms of how well readers or audience members understand and can recall the most salient information with which they have been presented. The communication of environmental knowledge can readily focus on how much members of the public or civil society organisations ‘get’ the official messages. But such an emphasis overlooks the extent to which scientific and policy understandings may themselves be characterised by uncertainty (as mentioned above in section 2.2).

Some processes may be understood only stochastically or may be in-principle unpredictable. The likelihood, even the precise mechanism, of sea-glacier melting in the Antarctic is not known with certainty. The possibility of deep oceanic currents being re-directed by changes in oceanic temperatures and associated trends in salinity (the disruption of the so-called thermohaline circulation) is not susceptible to prediction. The responses of migrating animals to environmental changes are not known in detail, while natural selection and evolutionary processes are inherently unpredictable. Accordingly, there is a big practical challenge in terms of communicating the nature and extent of environmental uncertainty. As is well known, these difficulties can also be exploited in tendentious ways by opponents of environmental interventions who argue that, since we don’t know things for certain, it’s not worth taking action yet.

The issue of how to communicate uncertainty relates to a larger picture which has come to be known as ‘ignorance studies’ (called by some ‘agnotology’) (Gross and McGoey, 2015). The key issue here is that there are different kinds of ignorance: for example, things that are currently unknown but knowable in principle versus things which are believed to be unpredictable *per se*. There are even things which we do not know that we don’t know. Inevitably, these latter forms of ignorance are only ever discovered after the event: the impact of volcanic dust on aircraft engines, which became a key issue for airline companies during the eruption of Eyjafjallajökull for example, was something that regulators did not know that they needed to know until they had to decide whether planes could safely fly in the days after the ash clouds. Different groups in society will respond in varying ways to ignorance. Ignorance can be invoked as a justification for certain forms of failure or the avoidance of responsibility, so that ignorance may even be embraced. Ignorance is often paired with vulnerability, in relation to events that hit us unprepared. Accordingly, work on environmental communication should include the communicating and interpretation of uncertainty, ignorance and not-knowing.

3.6 Cognitive processes and debating environmental values

The analysis of ignorance also invites us to think about the psychological underpinnings of knowing and not knowing, in addition to the epistemic qualities of the knowledge. Increasing amounts of work in cognitive psychology allied to neuroscience propose that people do not handle information in the rational ways that we tend to presuppose (for an overview, see UCL Policy Commission on the Communication of Climate Science, 2014: 41-64). Experimental evidence suggests that human beings make judgements using cues and strategies of which they are

not consciously aware. Accordingly, there can be very significant psychological influences over the way in which information is received or messages decoded of which people are unaware. This work has received considerable attention in relation to shortcomings in rationalistic models of economic actors and, more recently, in relation to political decision-making and voter behaviour and also to climate change (see Kahan, 2012). Approaches drawing on big-data techniques are suggesting that there are patterns to cognitive and other judgements of which actors are consistently unconscious and which people themselves are normally incapable of monitoring. These could turn out to be highly relevant to judgements about environmental options and ecologically significant behaviours.

It is easy to give primacy to the communicating of scientific ideas, factual claims or data. Official bodies and NGOs may even seek to assess the efficacy of their communication in terms of how well readers or audience members seem to recall the most salient aspects of their messages. But environmental understanding inevitably also involves values and affect. Indeed, in one sense these are the fundamental reasons for many environmental interventions – for instance, to protect an endangered habitat or a cherished landscape or to enhance the quality of life in urban areas. This implies that research on environmental communication should encompass analyses of the ways in which values are conveyed and treated in communications. Some key research challenges here include the examination of the way in which values and emotions are tied to a sense of environmental responsibility. Other topical questions arise too: for example, are social media forms of communication more suited to the consideration of affect than conventional means of communicating?

3.7 Policy and governance issues and the economic framing of environmental goods

It might be thought that communication and governance are separate spheres – that policies are made and only subsequently communicated. But – as noted above – analysts have shown that the two activities overlap and mingle, that governance is exercised in part through communication. Environmental communications can be a way to get citizens to behave in certain ways or to ‘train’ young people to acquire specific values – both forms of governance. In turn this raises significant questions about the ways in which responsibilities for different aspects of the natural world and the environment are distributed and managed in the course of communication. Which roles are associated with citizens and civil-society organisations: what are firms expected to do; what are the powers and obligations of state actors?

In this regard, one particularly topical point is the way in which environmental policy issues are increasingly expressed in economic terms – ecological resources are portrayed as offering ‘ecosystems services’ and economic pricing is used to nudge consumers into compliance with environmental targets. The way in which an economic framing of environmental issues is communicated is relatively under-investigated and is likely to be a key issue in this research context (Yearley, 2018).

Finally in this section, there is a question about the link between governance and time horizons (see also section 3.1). Environmental issues operate over many time scales: for example, as is well known, different greenhouse gases remain in the atmosphere for very different periods so the impact and meaning of various kinds of emissions vary across time. Environmental changes can occur rapidly or over millennia. Nuclear waste management has to be considered over tens of thousands of years. For this reason, communications about the environment will also be about handling time and also envisaging and imagining futures – for ourselves and our environments.

4 Research areas

Drawing upon the review and discussion presented in the previous sections of this background paper, we now propose five specific areas for future research.

4.1 Publics and organizations in environmental communication

Understanding publics and organizations involved in environmental communications is important if we are to make sense of how issues relating to the environment are perceived and understood. Rather than seeing this as a matter of an ‘audience’, on the one hand, and ‘knowledge transmitters’, on the other, it is necessary to recognise that environmental communications involve diverse actors and publics who are often active participants in making, shaping and sharing environmental issues and problem constructions.

Publics are not fixed identities, but are created, sometimes by public groups themselves, in the context of a particular activity, issue or place. Underpinning this are social and institutional structures and processes, as well as shared imaginaries – or a sense of the kind of future(s) being worked towards. Understanding publics and actors involved in environmental communications means understanding more about the processes and imaginaries underlying these constructions, including recent developments in cognitive sciences. These processes will also affect the shape, interpretation and impact of communication. Questions arising include how we are to understand the construction of publics and actors. Is it possible to anticipate who becomes excluded in this process? Is there variation across issues, time and place? And what factors are at play in shaping the way in which these publics form or are enacted and how does this matter in specific cases of environmental communications?

Furthermore, environmental communications need to resonate with and engage diverse actors. It is important to notice that the vulnerability, stakes and influence of different publics involved in communicating particular environmental issues are not evenly spread. For instance, some publics may be more affected by floods than others. To offer another example, the scientific community might have access to fewer communication resources than some other organisations. In certain cases, actions to construct particular audiences might involuntarily and implicitly exclude others. This means giving thought to specific approaches and different framings in some instances, but also taking into account the unequal distribution of voice. Gaining insight into the values and perspectives of diverse groups – including those considered to be hard to reach or disengaged, or those with particular vulnerabilities or stakes in an issue – will be necessary in order to understand what effective environmental communications might mean in these circumstances.

Key questions to be considered include: How do different publics frame issues and make use of and engage with environmental communications? How can the values and perspectives of hard to reach or disengaged groups be explored and reflected in environmental communications? What light can recent findings from

cognitive sciences (and other research domains) shed on how audiences receive and make sense of environmental communications?

4.2 Emerging formats and sites of environmental communication

During the last few years, significant changes relevant to communicating about nature and the environment have taken place. These have occurred both in the general media landscape (media technology, media economy, habits and rhythms of media usage) and in more specific media and platforms, where new formats have been created (e.g. YouTube channels, blogs and vlogs, different social media). Traditional formats and contexts have also been redefined e.g. print media, television, radio. Of particular relevance to environmental communication have been the changes that have blurred the divide between authors and audiences. Citizens and small-scale actors can be authors and transmitters as well as receivers of communication (see also 4.1 above).

Thorough understanding of the implications of these changes and their challenges for environmental communication requires researchers to address a number of key research themes.

First of all, monitoring short- and long-term trends in social conversations about environment-related themes across multiple media contexts is key to understanding broad changes and, more specifically, issue cycles. In this context, one relevant theme is the potential divergence between the temporal horizons of public discourse and media coverage, on one side, and policy planning, on the other (e.g. short term vs. long term). It is also important to consider the consequences of this temporal shift for communication as well as environmental governance in general (see also 4.5 below).

In addition, we need to explore and understand better how different formats/sites of environmental communication relate to: patterns of interaction between experts and general audiences; processes of credibility assessment of relevant knowledge and results; changing social attitudes towards environmental and scientific expertise. Diversity in media resource-mobilization by different groups and stakeholders with regard to environmental communication (e.g. activists, non-profit organizations, business actors, institutions, researchers) is also a theme deserving closer attention. Research in this area could encompass experiments in media-making and social media usage as well as more conventional communication studies.

Finally, with some significant exceptions, research in this field has neglected in-depth analysis of the role of the visual and forms of visualization of environmental themes and the natural world. This neglect also extends to the implications of established visual conventions for framing relevant environmental issues and problems by different audiences. This theme has become particularly relevant in the contemporary media landscape, in which the sharing and circulation of images plays a key role. Why do certain images become powerful stereotypes and attain widespread iconic currency within public discourse about the environment (e.g. the polar bear standing on the iceberg as a metonym for climate change or the sea horse with the cotton bud as a metonym for ocean pollution)? Are such images global or culturally specific? How are they used by different actors as forms of knowledge validation in public contexts (see 4.3)?

4.3 Public knowledge-making on environmental issues

Any process of communication or intervention into environment-related issues must engage with pre-existing knowledge, experiences and opinions. More fundamental questions also arise regarding potentially contradictory perceptions of what defines an environmental issue in the first place (e.g. connecting extreme weather events with climate change) and therefore what counts as relevant and acceptable knowledge. Thus, public knowledge-making is essential in two ways: understanding how publicly shared and widely accepted knowledge on environmental issues develops, as well as how publics contribute to what we know about the environment.

This suggests the need to be attentive to how public knowledge and experiences (e.g. citizen science; environmental movements) might contribute actively to the very understanding of the phenomena at stake (Gabrys et al., 2016), while not overlooking persistent asymmetries in credibility between different kinds of knowledge. Understanding public knowledge-making in this context invites investigation into two processes: how people draw on publicly available information in critical and creative ways to arrive at a specific understanding of environmental issues; and how they make efforts to contribute to knowledge or data, and potentially produce new practices and interpretative understandings of the environment through citizen projects. This might well go beyond the ways in which Western societies use data to act on environmental issues and potentially lead to collective pushes towards addressing (e.g. regulating) environmental issues differently. Furthermore, it is essential to consider the political, historical and culturally rooted processes through which any communication activity is embedded and the presence, in any given context, of widely accepted ways of relating to scientific knowledge and expertise in making collective choices.

While scientific evidence is increasingly called for, we also face public challenges of what counts as acceptable facts with regard to environmental issues (e.g. climate change). Thus environmental communication is facing a three-fold challenge. First, it needs to engage in establishing what should be seen as central knowledge to be widely shared and to form the basis of collective and individual action. Secondly, persistent uncertainties around many environmental issues need to be addressed. Not only is it unclear what counts in practice as uncertain knowledge, it is also open as to how uncertainty might be remedied through further knowledge. In this tension, between establishing facts and addressing uncertainty, public debate often avoids addressing the limits of knowledge, on the assumption that it would undermine the public's confidence in science. Simultaneously, uncertainty may be used strategically in order to shape environmental perceptions and actions. The third challenge consists of dealing with the issue of 'public ignorance', often strongly present in scientists' and policy makers' discourse on public knowledge. If we move away from addressing ignorance as a deficit category but rather as an active positioning, this allows us to open up new perspectives: by looking into ignorance in environmental research itself (e.g. undone science – things that seem not worth knowing) as well as into public ignorance of environmental research grounded in specific views of and positions in the world.

Public knowledge making, together with issues of uncertainty and ignorance, opens up a series of key questions. What are the multiple practices of how evidence and related data become (re)presented in environmental communications? What space is given to citizen ways of producing knowledge about the environment? How are models introduced to public arenas so as to capture environmental challenges? Relatedly, which indicators become established as a means of making environmental changes collectively observable? There are also questions of: How is expertise,

credibility and trust established and what gets widely accepted as a public proof for environment-related concerns? In which ways are uncertainties framed and woven into powerful arguments for (non)action? How can ignorance be addressed beyond the deficit framing and understood as an active component within environmental communication?

4.4 Values and emotions in environmental communication

When considering communications on environmental topics it is easy to give primacy to the communicating of scientific ideas, factual claims or data. The efficacy of communication might even be assessed in terms of how well readers or audience members understand and can recall the most salient facts. But environmental understanding inevitably also involves values and affect. Indeed, as noted above, these are among the fundamental reasons for ecological interventions – for instance, to protect an endangered habitat or a cherished landscape or to enhance the quality of life in urban areas.

Accordingly, a key element within this theme will be to consider how values and affect are communicated and how these play a role within environmental discussions. Values may be implicitly communicated because they are built into indicators or taken for granted within widely circulated images and framings. A related point is to examine how values can be mobilised to communicate about nature and the environment. At the same time, one can ask whether currently-dominant forms of environmental communication work against public recognition of the importance of extra-scientific reasons for valuing the environment. For example, with the increase in policy uses of framings from environmental economics (such as presentations in terms of natural capital or the valuing of environments in terms of the ecosystems services they supply) there has also been a rise in the communication of these economic and market-based expressions of environmental worth.

These points imply that research on environmental communication should encompass analyses of the ways in which values are conveyed, treated and come to matter within communications: for example, how are emotional and aesthetic connections to the environment represented? At the same time, do forms of communication which prioritise accuracy and precision tend to exclude discursive values by presenting the issues as ‘value free’? What has been the effect of the widespread use of economic evaluations of ecological goods in the public sphere? One could additionally ask whether new forms of communication media – platforms that promote the use of narratives and images – offer novel ways to encourage the presentation and discussion of values and the expression of affect.

The key research challenge here is to examine how values and emotions are expressed in environmental communications and how they relate to actors’ and organisations’ sense of environmental responsibility. How have these idioms, linguistic repertoires and images been developed and by which kinds of actors? Are social media forms of communication more suited to the consideration of affect? These questions have a long-term impact since, in the broadest sense, environmental interventions are also about envisaging our ecological future, and values are clearly an irreducible part of future-making.

4.5 Environmental communication, governance and evaluation

Governance, strategy and decision-making around environmental issues are generally seen as operating at some distance from environmental communication. However, communication can also be central to the policy and decision process. In what

ways do different forms of communication shape – and help constitute – governance processes? Viewed in instrumental terms, communication includes deliberate attempts to influence decision-making through public relations, environmental campaigns and lobbying. But successful governance also requires a clear communication of policies and outcomes in order to bring about desired changes and to influence environmental behaviour. At the same time, decision makers need to be open to a range of communications around the environment – and to ‘make sense’ of these messages (including those expressed in the language of doubt, complexity, disagreement and uncertainty). It is therefore important to consider the governance implications of the environmental communication activities of a range of societal groups, including scientific, governmental, campaigning and industrial bodies.

One important element within this theme is the relationship between environmental communication and the different ‘discourse coalitions’ (Hajer, 2009) which constitute a key feature of contemporary environmental governance. Attention might also be paid to the relationship between environmental communication, governance and the different temporalities (or time relations) at play in this field: is the intention to inform and develop governance processes now or in the longer term? Scale is also significant here as governing processes deal with both highly globalised and more local settings.

Key questions to be considered within this theme include: what are the implications for environmental governance of different forms of environmental communication? In what ways are assumptions about, for example, environmental management and decision-making built into specific communication activities? Do environmental communication activities create specific imaginaries of environmental futures and of the timing and scale of environmental actions? How can legitimate areas of uncertainty and disagreement be communicated by policy-makers and others?

Furthermore, this theme invites research into how specific forms of environmental communication are judged to be ‘successful’ or otherwise – and the consequences of this evaluation for environmental governance. What is considered by different parties to be ‘good’ environmental communication? According to which success criteria should it be judged? Environmental communication is often institutionally assessed in rather standard ways: for example, the numbers of website hits, public views, workshop participants or event attendees. However, the manner in which specific exercises are evaluated is likely to have influence both on the conduct of environmental communication in practice but also over larger governance processes: for example, as different environmental perspectives and frameworks are given voice, reframed or effectively silenced. How do different forms of evaluation influence the phenomena they seek to measure? How can the evaluation of particular forms of environmental communication embrace multiple perspectives?

5 Conclusions and recommendations

Given the challenges that the five research areas sketched above present, and in the light of the research background outlined in sections 2 and 3 above, we suggest that the work supported by Mistra should:

- ▶ be **interdisciplinary** (across the social sciences and humanities, informatics, natural science and design) and **cross the boundaries** of conventional studies of (environmental) communication;
- ▶ be **analytically innovative** but also act as an incentive to develop new forms of **communications practice**, as well as outlining the policy implication of research results;
- ▶ be open to the challenges and possibilities raised by **novel technologies** – and also to new forms of working with **emerging technological possibilities** (e.g. collaborative work between artists, designers and IT specialists);
- ▶ be encouraging to **multi-actor approaches**, including practice partners and communications professionals, public authorities and environmental organizations and other NGOs;
- ▶ be organised with a strong **international dimension and partners**, also with a view to capacity building in the Swedish research community.

As we hope to have suggested in this report, environmental communication is a vital field – both in research and practice terms. An initiative by Mistra could be a substantial opportunity to ‘re-frame’ the issues in a manner which will be of national but also international significance.

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