

# Communicating Climate Science: A Matter of Credibility: Swedish Farmers' Perceptions of Climate-Change Information

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# Communicating climate science: a matter of credibility

## Swedish farmers perception of climate change information

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*Abstract: While climate change communication research has advanced in the last 10 years, we still lack a thorough discussion on credibility aspects of climate change information and communication. At the same time, and perhaps a bit paradoxically, communication theories suggest that whether a (climate change) frame resonates with a particular audience is due partly to its perceived credibility. This paper addresses the under-researched question of how a particular audience perceive climate change information. Based on focus group discussions with Swedish farmers, this paper explores both participants' perceptions on climate change information as well as the formation of participant perceptions. The analysis finds that participants make use of multidimensional ways of judging the adequacy of various information related to climate change. Specifically, the analysis suggests that participants hold different views concerning 1) whether consistent or contradictory climate information landscapes constitutes credible information, 2) what constitute credible knowledge production processes, e.g analytical vs experience-based approaches, 3) credibility of frame articulators. Lastly, the paper discusses how scientific evidence can be better communicated to more efficiently inform decision-making on climate change and argues for greater attention to audience segmentation based on audience perception of climate change information credibility.*

*Keywords: Climate change communication, credibility, focus groups, frame analysis*

### Introduction – overview of perceptions of CC and CCC

In a wider information landscape, the public can be seen as merely an audience of climate change information – information that are already articulated and then presented to audiences in and through communication processes. Although the public can be seen as an audience, this does not mean that they are inactive receivers of a message. On the contrary, the appeal of any information used in communication is influenced by the extent to which it resonates with the worldviews of its audiences (Snow and Benford 1988). Accordingly, the publics' interpretation of climate change information continues to (re)form the information. While studies on various audiences perceptions, beliefs and attitudes to climate change have been studied intensively since late 1990:s (for overviews see Wibeck 2014; Moser 2016), climate change communication studies still lack a thorough discussion on the role credibility plays in climate change communication processes. However, the issue of credibility has recently gained attention in the climate change communication literature with findings into source credibility, content credibility and process credibility:

*Studies concerned with source credibility* typically studies audiences credibility perceptions of various information sources. Based on survey with US public, Attari et al (2016) found large carbon footprints to reduce researcher's credibility compared to low footprints. On the contrary, Kotcher et al (2017) found the credibility of scientists suffer when scientists advocated for specific policies, however, perceived credibility of the climate scientist was high in general. Another study (Carlton et al 2015) examined the extent to which non-climate scientists are skeptical of climate science and found cultural values and political ideology to influence the scientists' beliefs of climate science as credible. Moreover, based on interviews with scholars, Jarreau et al (2017) highlight the importance of selecting experts who have experience, and credibility, in a given community who can formulate messages for the audience to which they are speaking. Empirical results from a study by Sleeth - Kepler et al (2017) strengthen the findings by showing that social and demographic groups in U.S that do not primarily rely on formal communicators e.g scientists and politicians, on solutions to climate change instead rely more on various informal communicators, e.g Pope Francis (Li et al, 2016). Similarly, various actors in Tanzania (Amars et al 2017), Uganda (Twongyirwe et al 2015) and Eastern Africa (Egeru 2016) ascribe low credibility to government actors. Civil society organizations and community meetings were however perceived as most accessible, reliable and dependable sources of information. Together, studies on source credibility suggests that it is becoming increasingly apparent that effective climate change communication must account not just for the 'facts' of climate change, but for the 'feel' of it, as well (Carlton et al 2015, p 8).

*Studies concerned with content credibility* found credibility linked to perceived uncertainty in scientific and political uncertainties (White et al 2015; Ingram et al 2017). The political uncertainty dealt with the unpredictable factors related to politics and legislation that make decision making difficult. Scientific certainty dealt with the ability or inability of science to render reliable/accurate predictions but scientific certainty also dealt with differing requirements for evidence – some actors needed scientific validation while others looked for experiential knowledge. On that note, Hinnant et al (2016) examined whether user comments based either anecdotal or scientific evidence had an effect on message reception. The results show that when taking into account a person's political leanings, scientific comments had the effect of diminishing story credibility among more conservative participants. Similarly, in a study on genre-typical features of scientific discourse, Bromme et al (2015) found no impact of "scientific style" on undergraduates' personal agreement with climate research. While Ingram et al (2017), Hinnant et al (2016) and Bromme et al (2015) pinpoint experience and associative based sense-making processes, McCrudden et al (2016) highlight author expertise for content credibility. Through a mixed-method study of secondary Norwegian students, they found author expertise more salient for the less familiar topic (nuclear power) than for the more familiar topic (climate change). Taken together, studies related to content

credibility suggests that content credibility is tightly linked to audience perception of knowledge production and method's validity.

*Studies concerned with process credibility* typically conclude that participatory methods and co-production of knowledge increases credibility in climate adaptation communication in various sectors such as agriculture (Bellochi et al 2015; Masere and Worth 2016; Sautier et al 2017, forest management (Blades et al 2016), water shed management (Kirchhoff et al 2015), and in assessments, more generally, of natural and social systems at risk from climate change (Jacobs and Buizer 2016).

Although somewhat scattered in empirical focus, recent studies highlight perceived credibility of sources, content and processes while few, if any, studies the formation of credibility perception. This paper addresses this knowledge gap, and advances the study of credibility in climate change communication, by qualitatively explore how Swedish farmers make sense of climate change information. In doing so, the paper analyzes a case of audience-specific climate communication in agriculture—a sector characterized as climate sensitive—in Sweden, a geographic location where the climate change's benefits are likely to overshadow its negative consequences. Farmers are identified as central to climate mitigation and adaptation (IPCC 2014ab) while being laypeople in terms of their knowledge of climate science advances. Empirically, the study employs focus group discussions with farmers, whose interactions revolve around information in general and climate change communication in particular. The aim is to study how farmers judge credibility aspects in climate change communication. Specifically, the article addresses the following research questions:

- What underlying views on communication contribute to the formation of credibility perceptions?
- What communicative resources, e.g. key words, metaphors, and comparisons, do the farmers use to form climate credibility perceptions?

## Conceptualising credibility

Climate change, like any issue, can be interpreted in terms of multiple frames. As argued by Rein and Schön (1991), however, audiences do not perceive all frames as equally acceptable and people generally seem to apply implicit criteria when judging the adequacy of a particular frame. To that end, Benford and Snow (2000) have suggested that whether a frame resonates with a particular audience depends partly on its perceived credibility. They see frame credibility primarily as a function of three factors: *frame consistency*, *empirical credibility*, and *credibility of the frame articulators*.

*Frame consistency* refers to the congruence between articulated beliefs, claims, and actions. This congruence may turn into inconsistency if beliefs or claims are contradictory or if frames and actions are contradictory. The perceived congruence between articulated climate change claims and subsequent actions informs judgments as to whether a particular climate change frame is perceived as credible.

*Empirical credibility* refers to the perceived fit between frames and phenomena in the world and concerns questions such as “Can the claims be empirically verified?” or “Is there something that can be pointed to as evidence of the claims embedded in the framing?” (Benford & Snow 2000, p 620). The concept of empirical credibility puts the spotlight on whether and why one set of claims is found to be more credible than others (Snow & Benford, 1988).

The final factor affecting frame credibility concerns the perceived *credibility of frame articulators*. Benford and Snow (2000) hypothesize that the greater the status or perceived expertise of the frame articulator from the audience perspective, the more plausible the frames.

The analytical concept of frame credibility is central to the analysis of farmers' discussions of climate change information and is a key to understanding why the farmers embrace or reject information on climate change. Hypothetically, if information is perceived as consistent and associated evidence claims and their articulators are deemed credible, the information will harmonize with how an issue has been experienced, resonating with the audiences' cultural narratives, and the information on climate change is likely to have a strong appeal. As Hahn et al (2016, p 191) conclude: set against these (hypothetical) considerations, it seems striking how limited research on these issues has been in the climate context.

### *Analysis of frame credibility*

Entman's (1993) description of frames as being “manifested by the presence or absence of certain keywords, stock phrases, stereotyped images, sources of information, and sentences” (p. 52) may serve to operationalize analysis of climate information credibility. Other framing devices or communicative resources include analogies, distinctions, metaphors, and prototypical examples (Asplund 2014; Marková et al 2007). By letting us experience one thing in relation to another, such communicative resources are said to structure how we perceive, think, and act (c.f Lakoff and Johnson 1980) and highlighting such framing devices enables an analysis of participant formation and construction of perceptions of climate information credibility (Asplund 2014; cf Pan and Kosicki 1993).

## Focus groups method and material

For this study, eight focus group interviews were conducted with a total of 44 participants. Focus groups (FGs) can be described as group interviews guided by a moderator working from predetermined discussion topics (Morgan 1998). However, FG methodology implies more than simply obtaining responses from individual participants; rather, it creates focused conversations *among* participants. The sharing and comparing of ideas, the group dynamics, and the interaction between participants are both central to FG methodology and constitute its main challenges (Wibeck, Abrandt Dahlgren, & Öberg 2007). To create a free-flowing discussion, while ensuring quality and consistency in the material, a semi-structured FG approach was used in which the same general, open-ended questions were posed to each group, accompanied by follow-up questions depending on the participants' own discussions. The same moderator guided all eight FGs.

### ***Recruitment and group composition***

The composition of the FGs was determined primarily by age, gender, and production system. Each FG consisted of three to six farmers, and while some groups were homogenous in production type but heterogeneous in age and gender, other groups were homogenous in age but differed in represented production types. Altogether, the data capture various perspectives of agricultural producers active in both crop and livestock production (see Table 1).

Table 1: Group format of eight focus groups

<i>Group</i>	<i>Group Composition</i>	<i>Group size and gender</i>	<i>Age</i>	<i>Discussion length</i>
1	forest, crop and livestock production	1 woman 5 men	30-60	77 min
2	forest, crop and livestock production	6 men	50-70	74
3	livestock production	6 women	20-70	46
4	Crop production	3 men	30-40	103
5	forest, crop and livestock production	3 women 4 men	20-40	60 min
6	crop production	1 woman 6 men	30-70	71 min
7	crop and livestock production	3 men	30-80	51 min
8	crop and livestock production	6 men	20-30	67 min

### ***Analyzing procedure***

The FG discussions were audio-recorded and transcribed verbatim. All FG discussions were conducted in Swedish, and the original Swedish data were analyzed. For the purposes of this paper, excerpts were translated into English and adapted to written language conventions. The analytical procedure started with the identification of boundaries between the various topics in the FG transcriptions. Boundaries between topics were identified by noting explicit changes of topic or chains of minimal responses, pauses, laughter, etc. The list of topics was subsequently coded in order to identify recurrent themes (Marková et al 2007). Regarding climate change information, focus group conversations treated the following themes: 1) message character, 2) knowledge production, and 3) information sources. The themes present an empirically driven analysis of the three factors of frame credibility: *frame consistency* (message character), *empirical credibility* (knowledge production), and the *credibility of the frame articulators* (information sources) (Benford and Snow 2000). Participant perception of climate information credibility was analyzed by paying attention, not only to the content of what was being said in the FG discussions, but to implicit assumptions (reflected by participants use of keywords, metaphors, prototypical examples, analogies, and distinctions) regarding information and what constitutes credible climate change communication (cf. Asplund 2014; Marková et al 2007).

### **Findings**

This section comprises three sub-sections reflecting the themes and the main findings of this study, namely that farmers understand climate change communication through (1) perceived (in)consistency in message character, (2) judgement of what constitutes credible knowledge production, which together inform (3) the credibility of frame articulators (information sources). Discussions of consistency concerned different views of whether contradictory- or consistent-oriented information landscapes constitute credible information. Discussion of empirical credibility referred to knowledge production and knowledge claims. The credibility of the frame articulators concerned the credibility of various information sources. Each of these is discussed as follows:

*Experiences of communication inform perceptions on consistent -and contradictory oriented information landscapes*

The analysis of consistency revealed two possible views of what constitutes credible information in terms of consistency between articulated claims: the contradictory-oriented information landscape versus the consistency-like information landscape. Throughout the discussions on information in general, and not related to climate change, participants pointed out the need for multidimensional arguments and understandings. The farmers frequently used examples and comparisons (i.e. analogies and distinctions) based on their own experience in discussions on credibility of consistent or contradicting information landscape. The importance of a plurality of perspectives in securing balanced and impartial decision making was exemplified by the negative effects of decisions informed by only one person and perspective. Expressions such as ‘It’s very dangerous’ (FG 1) or ‘when you have received this advice from the specialists from the agricultural advisory services then you would like to discuss in order to get more opinion about it’ (FG 3) reoccurred throughout the empirical material. Hence, experience-based arguments and examples can be seen as supporting a contradictory frame of communication. Both excerpts highlight the importance of previous experiences of information for perceptions on information credibility. Kuzdas et al (2016) similarly point out that distrust, which has been formed by legacies of ineffective rural stakeholder engagement, diminished the credibility of water-related information used in decision processes and prolonged conflicts. Likewise, in this study, the participating farmers’ experiences of communication in general seemed to serv as a starting point from which to discuss climate change information.

**Consistency and contradictions in climate change information**

As noted above, the analysis of consistency revealed two possible views of what constitutes credible climate change information in terms of consistency between articulated claims: the contradictory-oriented information landscape versus the consistency-like information landscape. In discussions on climate change communication, participants on the one hand seemed to favour a contradicting information landscape while also considering such contradictions as confusing. The following excerpts illustrates a recurrent belief among participants that climate information was too consensus-like reflecting only part of a story that the farmers believed to have many facets:

Excerpt 1:

*Carla:* I read an article about these scientists who considered themselves not listened to because they had different views on climate change, and I would actually like to know more about that. Is that so? Or are they just whining? Or is it the way they suggest—that all the money goes to those who exaggerate (mm) (mm) this climate babble (mm) (mm). Is there any substance in it or not? That I would like to know.

*Betty:* But Al Gore makes money (yeah right) Yes

*Violet:* That’s people like him that makes you a little hesitant too (mm). You don’t trust it because it is such a commerce. No. (Mm). Then you want to find out the facts from another source instead

*Carla:* Yes, it would be interesting to hear from both sides. (FG 3)

As to what they associate climate change information with, participants started to discuss media coverage; Carla, in particular, claims that media coverage of climate change overlook alternate perspectives. By referring to having read about scientists who did not accept the dominant view of climate change, Carla raises the matter of biased media coverage of climate change. Another participant, Betty, continues to reinforce the idea of biased climate information by letting Al Gore serve as an example. A new participant enters the discussion, Violet, posing yet another argument that supports the claim of biased climate information by suggesting “it is such a commerce”. Carla once again reaffirms her argument and the discussion ends with the shared perception of climate information as too homogenous. The excerpt illustrates how ideas regarding various information sources, are adopted and co-evolve to shape credibility of climate change information. In contrast to this perceived one-sidedness, other farmers contend that the media already present too many perspectives on climate change, illustrated by the reference to media coverage of “a hundred theories” (FG 8) about what climate change is and whether it is human-induced, resulting in a feeling of not knowing what to believe. Similar arguments occurred in other groups: “You belong to one faculty that says one thing and then, on the same problem, next faculty sees it the opposite way. And we are too mix all that together and create a picture of it all” (FG 2). On contrary to the first excerpts, this example indicates that the more perspectives that are presented, the more difficulties some farmers encountered in making sense of the information. Together, the examples suggests that the question of climate information credibility concern underlying views on credible communication as consistent or contradictory, from an audience point of view. Participants used various communicative resources, e.g. key words, metaphors, and comparisons, to form perceptions on climate information as consistent or contradictory.

**Communicative resources participants use in formation of perceptions on climate information as consistent and contradictory**

As shown above, the analysis found to dominant ways participant understood climate information: as contradictory or as consistent. These two frames were in dialogue with each other through argumentative cycles with either of the frames supported by certain keywords, metaphors and prototypical examples (see Table 2).

Table 2. Climate information as perceived by FG participants

	<i>Consistent</i>	<i>Contradictory</i>
<i>Keywords</i>	Biased, unbalanced, controlled	Mixed messages, two different opinions
<i>Metaphors</i>	Humans are (like) sheep	Climate debate, two schools
<i>Examples</i>	Al Gore	Newsstories that contradicts earlier newsstories
<i>Comparisons (analogies and distinctions)</i>	Analogies to media coverage of Swedish agriculture as contributing to environmental damage – which has proven, according to participants, to be wrong	

*Keywords* While consistent climate information was typically described as “biased”, contradictory climate information was understood as landscape of mixed messages.

*Metaphors* Information sources presenting climate information too consistently were metaphorically presented as sheep - illuminating the perception of information sources as behaving in the same way with the inability to act independently. On the other hand, climate information was by other participants understood as a “debate”, as two “schools”, “categories” or “faculties”.

*Examples* Examples of news reports from newspapers, radio or TV served as a common framing device to support arguments. For instance, Al Gore was used to exemplify climate information as biased. Examples cited in discussions of climate information as contradicting were news stories on climate change, e.g snowmelting in Himalya and measurements showing the warmest decade, which then were perceived as being contrasted in another newscast.

*Comparisons (analogies and distinctions)* The farmers frequently used comparisons based on their previous experience of various media, to support or counter arguments. Analogy with media reports that have according to participants proven wrong, e.g agricultural contribution to eutrophication. Such analogies leads to the statement that one-sided messages are biased. However, participants also viewed climate information as contradictory through the analogy to news reporting over time. Analogy to news reports on nutrients two decades ago with the similarity that media attention is high for a while but less frequent as time passes. The analogy makes similarities to information as a trend.

The analysis of participant use of communicative tools reveal a negative tone, and hence, low credibility to both perceived consistency in, as well as contradictory climate information. Information credibility seemed to depend on their interpretative frameworks – guided by previous experience of media reporting on farming as well as on media reports climate change (table 2). Generally, though, most farmer participants seemed to share the view that a credible climate information landscape should contain a plurality of perspectives – i.e. they preferred for a contradictory frame of communication. The greater and more transparent the contradictions between claims, the greater the feeling of having a sufficient knowledge base for farm-level decisions and actions. The result contradicts Snow and Benfords (2000) argument that perceived congruence between articulated climate change claims informs judgments as to whether a particular climate change frame is perceived as credible. Based on UK public reception of climate science, Hahn et al (2016) make similar conclusions. They argue that hearing multiple scientists agree should increase our belief in their reliability. Surprisingly, they found reliability depend on whether or not climate scientists were perceived to be biased towards a positive report or not. Moreover, Cook and Lewandowsky (2016) show how agents may change their beliefs in opposite directions, given the same piece of evidence, simply because they have different underlying causal models of the world.

### ***Empirical credibility in climate change information: a matter of practical experience and analytical reasoning***

Empirical credibility involves the ability of the farmers to verify the claims underpinning the climate change frame (cf Benford and Snow, 2000). This may seem particularly important for an issue such as climate change, because it is virtually impossible for people to experience climate change directly. Underlying the farmers’ understanding of what qualifies as legitimate knowledge were various views of the extent to which information is perceived as practically or analytically based. The analysis found two main ways in which participants judged the credibility of knowledge production. Climate change information was seen credible when “evidence” was 1) based on practical knowledge or 2) based on a mixture of practical and analytical reasoning.

When participants judged practical experience as more credible than more theoretical and analytical reasoning, typically advice from farmers who had already made, or were about to make, similar changes as oneself were accorded particular importance, as illustrated by excerpt 2:

Excerpt 2:

*Ted:* Those who’ve made a similar change are more helpful, really, than calling and asking an extension officer, because the agent has read it from a paper, so to speak, but the other [farmer]—for example, if we are talking about choosing a crop or building a barn—he has tried, so he has his own idea, so to speak, about what it really means. (FG 8)

Above excerpt exemplifies the empirical credibility of colleagues’ advice as shaped by the extent to which knowledge is rooted in practical experience. The credibility of fellow farmers, having made similar production changes and possessing practical skills, was deemed greater than that of, for example, extension officers<sup>1</sup>, whose work was referred to as “paperwork.”. Participants recurrently during the focus group discussions favored experience as illustrated by these examples: “mum and dad have been farming for forty years, so there’s a lot of knowledge there” (FG 3), “Now we have reached the age when we have a lot of experiences to draw upon” (FG 2). In contrast to the assessment of practical know-how as producing credible knowledge, the analysis found participants to favour information formed by a mixture of practical experience and analytical reasoning. When participants ascribed credibility to the mix of practical and analytical reasoning, agricultural extension services, as this excerpt illustrates, perceived as knowledge brokers linking scientific research to agricultural practices:

*Carl:* Well, it is really like this. There is theory and practice. What is said in a farming magazine – “Sow this and your yield will be so many tonnes per hectare” – that’s theory. And then many of the experts present here [i.e., in an agricultural extension firm], none of them works practically ... you’ve got a situation where you need to adapt to your own conditions and your own machinery, the type of soil you have, and so on (M mm) and such things, that, yes, an answer is not always right, but it provides me with a basis for making a decision. Or (Andy mm) am I wrong?

*Six turns omitted*

*Owen:* The agricultural extension officers are way better at combining theory and practice than we are. There are those [farmers] who can do that, but they [i.e., the agricultural extension officers] are able to do that. The first and best step in changing yourself is to accept advice from agricultural extension officers. I would say so. (FG 4)

Participants shared view on the important role played by extension services for changes in agricultural production is shown by both listener support (Andy mm) and arguments (Owen’s supporting Carl’s argument). In this excerpt, extension services are ascribed credibility due to their perceived ability to combine theory and practice. Participants in other groups share the same view as extension services are metaphorically described as “sounding board” because they have the ability to translate scientific findings (FG 7), hence a form of knowledge-brokering. Together, the examples suggests that questions of epistemology underlie issues of credibility, and participants ascribed particular relevance to practical and experience-based knowledge. Participants used various communicative resources, e.g. key words, metaphors, and comparisons, to form perceptions on empirical credibility of climate information.

**Communicative resources participants use in formation of perceptions on empirical credibility of climate information**

Various communicative resources were seen as contributing to the perception formation of credibility as a matter of practical experience or mixing practical experience and analytical reasoning (table 3):

Table 3. FG participants judgement of empirical credibility of climate information

	<i>Empirical credibility: a matter of practical experience</i>	<i>Empirical credibility: a matter of mixing practical experience and analytical reasoning</i>
<i>Keywords</i>	colleagues, farmer, neighbour	extension services, research, farmer
<i>Metaphors</i>	farmer as a ”creator” and”do-it-all-man	”information bank”, ”information bank”, ”sounding board”
<i>Examples</i>	examples of negative effects of decisions informed by extension agents	Examples of successful communication with extension services

<sup>1</sup> The modern agricultural extension service involves various companies that disseminate information and advice associated with agriculture and rural development (Umrani, 2010).

<i>Comparisons (analogies and distinctions)</i>	<i>Distinctions</i> between farmers and extension officers in which farmers were seen as having qualities extension officers or researchers lacked.	<i>Distinctions</i> between researchers at and politicians and media in which researchers are deemed more impartial and therefore more credible, <i>Distinctions</i> today's global and competitive market make the participants feel that they need to turn to "someone who knows" (FG 4).
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*Keywords* While colleagues, farmers, and neighbors were identified as keywords when participants deemed practical experiences credible, the perception formation of credibility as a mixture of practical experience and analytical reasoning often referred to extension services, research and farmer.

*Metaphorical representation* of the farmer as a "creator" and "do-it-all-man" reflect the understanding as credible knowledge as rooted in practical experience, while metaphorical representations of extension services as "information bank", "knowledge bank", "sounding board", suggest a positive link between research and farm practices

*Examples* In cases where farmers favored experiential knowledge over theoretical knowledge, participants used examples of negative effects of decisions informed by extension agents. On the contrary, participants also used examples of successful communication with extension services, e.g when participants have called an extension agent to discuss management practices or examples of extension driven experimental cultivation which later proved to result in less pests.

*Comparisons (analogies and distinctions)* When farmers favored experiential knowledge over theoretical knowledge, distinctions between farmers and extension officers were used to ascribe qualities to farmers that extension officers or researchers were perceived lacking, e.g experience of "reality". Comparisons were also made between researchers and politicians (e.g Al Gore), and media, to distinct media and politics from research generally considered as impartial and therefore more credible. When a mixture of practical experience and analytical reasoning underlied views on credibility, participants made use of *distinctions* between being a farmer today than in the past, pinpointing different conditions for farm management in today's global and competitive market making the participants feel that they need to turn to "someone who knows" (FG 4).

The concept of empirical credibility puts the spotlight on whether and why one set of claims is found to be more credible than others (Snow & Benford, 1988) and concerns questions such as "Can the claims be empirically verified?" or "Is there something that can be pointed to as evidence of the claims embedded in the framing?" (Benford & Snow 2000, p 620). The analysis presented here found two main ways in which participants judged the credibility of knowledge production. The analysis of underlying views on communication suggest that climate change information is seen credible when "evidence" is 1) based on practical knowledge or 2) based on a mixture of practical and analytical reasoning. Each of the understandings and judgement of credibility can be seen supported with various communicative resources, e.g. key words, metaphors, and comparisons. A few empirical studies show that audience perception of knowledge production and method's validity form perceptions on credibility. Ingram et al (2017), for instance, found differing views about what constitutes evidence. While the studied advisers look more for scientific validation (cause and effect relationships) and seek the authority of the scientific knowledge producing process, farmers are described as largely uninterested in scientific explanation, preferring to look to their own experiences and those of other farmers for proof. Similarly, Sautier et al (2017) found that French farmers, throughout the process of three workshops asked facilitators how data were collected and produced. The authors conclude that participants struggle to trust such models since they cannot verify whether they are consistent with their knowledge. Hence, in dialogues about climate change, "it is not far-fetched to suggest that anecdotal evidence could be an important tool." (Hinnan et al 2016)

### ***Credibility of information sources***

The final factor affecting frame credibility concerns the perceived *credibility of frame articulators*. Benford and Snow (2000) hypothesize that the greater the status or perceived expertise of the information source from the audience perspective, the more plausible the information. I found farm magazines, news media, extension service firms, and colleagues to be the most important sources of information guiding farmers' decision making. Rather than perceptions of expertise, the two dimensions of consistency vs contradictory information landscapes and empirical credibility appeared to underlie the farmers' judgment of frame articulators: first, aspects of whether claims were perceived as aligned or conflicting with consensual views and second, to what degree knowledge production is analytically versus practically produced. When empirical credibility was attributed to practical knowledge, colleagues, farm magazines, and extension services were seen as more credible but mainstream media and science as less credible. Frames emphasizing the mixture of analytically derived and practical experience typically put more trust in extension services, while colleagues and science came second, and both mainstream and specialized media were viewed as the least trustworthy.

## **Discussion – How scientific evidence can be better communicated to more efficiently inform**



## decision-making on climate change

While climate change communication research has advanced in the last 10 years, specifically regarding barriers to public engagement, discussions on the role of credibility of climate change communication are limited. Nevertheless, empirical studies on credibility in climate change communication typically summarize statements of a source's credibility (e.g. Egeru 2016; Gallford et al 2016), and explore relationships between the various variables such as cultural and political Values (Carlton et al 2015; Hinnant et al 2016). This study contributes with knowledge on underlying views on what constitutes a credible information landscape, from an audience point of view.

Studies, including this, has identified the natural scientific prevalence of climate change communication as problematic (Hinnant et al 2016; Ingram et al 2017; White et al 2015). As the credibility of climate change information is partly judged by how knowledge of climate change is produced the very concept of climate change is embedded with challenges. Defined by statistical measures, climate change comprises long-term changes identified through, in the words of the IPCC, "analyses from observations of the climate system, paleoclimate archives, theoretical studies of climate processes and simulations using climate models" (IPCC, 2013, p. 4). Scientific knowledge claims tend to be theoretically and analytically derived and perceived of as unable to render reliable and accurate predictions (White et al 2015). Furthermore, studies on audiences' different requirements for evidence show that some actors need scientific validation while others rely on experiential knowledge in making sense of climate change and its effects (Bromme et al 2015; Hinnant et al 2016; Ingram et al 2017; McCrudden et al 2016).

This study suggests that audience's perceptions on credibility in information processes and content underlie judgement of source credibility. Whether the specific information sources are specialized magazines, colleagues or extension services as in this study or climate scientists (Attari et al 2016; Carlton et al 2015; Collins and Nerlich 2016; Kotcher et al 2017), government agencies (Amars et al 2017; Twongyirwe et al 2015), formal and informal communicators (Sleeth - Kepler et al 2017), community meetings (Egeru 2016), climate services/intermediaries (Reinecke 2015), or Pope Francis (Li et al 2016), it is of great importance to select experts who have experience, and credibility, in a given community (Jarreau et al 2017). Because evidence about climate change is evaluated by different individuals according to their preexisting ideological and value-based beliefs, Hahn et al (2016) conclude that communicating the consensus as a strategy for public engagement on climate change is a much more complex proposition than it first appears. For example, the same piece of testimonial evidence (e.g., a newspaper report providing evidence on a topic) can have opposite effects if people have opposing views on the reliability of the source (Cook and Lewandowsky 2016). Case studies concerned with process credibility typically conclude that participatory methods and co-production of knowledge increases credibility in climate adaptation communication in agriculture (Bellochi et al 2015; Masere and Worth 2016; Sautier et al 2017), forest management (Blades et al 2016), and water shed management (Kirchhoff et al 2015).

Together, studies on the role of credibility in climate change communication suggests that it is becoming increasingly apparent that effective climate change communication must account not just for the 'facts' of climate change, but for the 'feel' of it, as well (Carlton et al 2015, p 8). Taken together, these studies suggests that content credibility is tightly linked to audience perception of valid knowledge production and strengthens findings on the importance of transparency, inclusion and dialogue for increased credibility in climate change information processes. Hence, effective climate change communication need not only take into account audience segmentation with regard to perceptions of climate change (Wibeck 2013; Jarreau 2017), but segment audiences with regard to underlying views of information and credibility. Hence a future research agenda on effective (i.e. credible) communication should include both qualitative and quantitative methods to ensure in-depth analyses as well as representations among various audiences and stakeholder groups.

## REFERENCES

- Amars, L., Fridahl, M., Hagemann, M., Röser, F., Linnér, B O. 2017. "The transformational potential of Nationally Appropriate Mitigation Actions in Tanzania: assessing the concept's cultural legitimacy among stakeholders in the solar energy sector" *Local Environment* 22(1):86-105
- Attari, S Z., Krantz, D H., Weber, E U. 2016. "Statements about climate researchers' carbon footprints affect their credibility and the impact of their advice" *Climatic Change* 138(1-2): 325-338
- Asplund, T. 2014. *Climate Change Frames and Frame Formation: an analysis of climate communication in the Swedish agricultural sector*. PhD dissertation, Linköping University
- Benford, R D., & Snow, D A. 2000. "Framing processes and Social movements: An overview and assessment" *Annual Review of Sociology*, 26: 611-639.
- Blades, J J., Klos, P Z., Kemp, K B., (...), Morgan, P., Tinkham, W T. 2016. "Forest managers' response to climate change science: Evaluating the constructs of boundary objects and organizations" *Forest Ecology and Management* 360: 376-387
- Bromme, R., Scharrer, L., Stadtler, M., Hömberg, J., Torspecken, R. 2015. "Is it believable when it's scientific? How Scientific discourse style influences laypeople's resolution of conflicts" *Journal of Research in Science Teaching* 52(1): 36-57

- Carlton, J S., Perry-Hill, R., Huber, M., Prokopy, L S. 2015. "The climate change consensus extends beyond climate scientists" *Environmental Research Letters* 10(9):094025
- Collins, L C., Nerlich, B. 2016. "Uncertainty discourses in the context of climate change: A corpus-assisted analysis of UK national newspaper articles" *Communications* 41(3): 291-313
- Cook, J and Lewandowsky, S (2016). "Rational Irrationality: Modeling Climate Change Belief Polarization Using Bayesian Networks" *Topics in Cognitive Science* 8(1): 160-179
- Egeru, A. 2016. "Climate risk management information, sources and responses in a pastoral region in East Africa" *Climate Risk Management* 11: 1-14
- Entman, R.M. 1993. "Framing: toward clarification of a fractured paradigm" *Journal of Communication* 43(4):51–58
- Hahn,U., Harris,A J L., Corner, A. 2016. "Public Reception of Climate Science: Coherence, Reliability, and Independence" *Topics in Cognitive Science* 8(1): 180-195
- Hinnant, A., Subramanian, R., Young, R. 2016. "User comments on climate stories: impacts of anecdotal vs. scientific evidence" *Climatic Change* 138(3-4): 411-424
- Ingram, J., Mills, J., Dibari, C., (...), Molnar, A., Sánchez, B. 2017. "Communicating soil carbon science to farmers: Incorporating credibility, salience and legitimacy" *Journal of Rural Studies* 48: 115-128
- IPCC, 2014a: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1132 pp
- IPCC, 2014b: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA
- Jacobs, K L.,Buizer, J L. 2016. "Building community, credibility and knowledge: the third US National Climate Assessment" *Climatic Change* 135(1): 9-22
- Jarreau, P B., Altinay, Z., Reynolds, A. 2017. "Best Practices in Environmental Communication: A Case Study of Louisiana's Coastal Crisis" *Environmental Communication* 11(2): 143-165
- Kuzdas, C., Warner, B., Wiek, A., (...), Vignola, R., Ramírez-Cover, A. 2016. "Identifying the potential of governance regimes to aggravate or mitigate local water conflicts in regions threatened by climate change" *Local Environment* 21(11): 1387-1408
- Kirchhoff, C J., Esselman, R., Brown, D. 2015. "Boundary organizations to boundary chains: Prospects for advancing climate science application" *Climate Risk Management* 9: 20-29
- Kotcher, J E., Myers, T A., Vraga, E K., Stenhouse, N., Maibach, E W. 2017. "Does Engagement in Advocacy Hurt the Credibility of Scientists? Results from a Randomized National Survey Experiment" *Environmental Communication* Article in Press
- Lakoff, G., Johnson, M. 1980. *Metaphors we live by*. University of Chicago Press, Chicago U.S.A.
- Li, N., Hilgard, J., Scheufele, D A., Winneg, K M., Jamieson, K H. 2016. "Cross-pressuring conservative Catholics? Effects of Pope Francis' encyclical on the U.S. public opinion on climate change" *Climatic Change* 139(3-4): 367-380
- Markova, I., Linell, P., Grossen, M., & Salazar Orvig, A. 2007. *Dialogue in focus groups: Exploring socially shared knowledge*. London, UK: Equinox
- Masere, T P, Worth, S. 2016. "Applicability of APSIM in decision-making by small-scale resource-constrained farmers: A case of lower Gweru communal area, Zimbabwe" *Journal of International Agricultural and Extension Education* 22(3): 20-34
- McCrudden, M T., Stenseth, T., Bråten, I., Strømsø, H.I. 2016. "The effects of topic familiarity, author expertise, and content relevance on norwegian students' document selection: A mixed methods study" *Journal of Educational Psychology* 108(2): 147-162
- Morgan, D. 1998. *The focus group guidebook*. Thousand Oaks, CA: SAGE
- Moser, S. 2016. "Reflections on climate change communication research and practice in the second decade of the 21st century: what more is there to say?" *WIREs climate change*. Published Online: Apr 05 2016
- Pan, Z., and Kosicki, G M. 1993. "Framing analysis: an approach to news discourse." *Political Communication* 10(1):55–73.
- Rein, M., and Schön, D. 1991. Frame reflective policy discourse. In Wagner et al. (Eds). *Social sciences and modern states: national experiences and theoretical crossroads*. Cambridge University Press; Cambridge.
- Reinecke, S. 2015. "Knowledge brokerage designs and practices in four european climate services: A role model for biodiversity policies?" *Environmental Science and Policy* 54: 513-521
- Sautier M, Piquet M, Duru M , Martin-Clouaire R. 2017. "Exploring adaptations to climate change with stakeholders: A participatory method to design grassland-based farming systems" *Journal of Environmental Management* 193:541-550

## JOURNAL TITLE

- Sleeth-Keppler, D., Perkowitz, R., Speiser, M. 2017. "It's a Matter of Trust: American Judgments of the Credibility of Informal Communicators on Solutions to Climate Change" *Environmental Communication* 11(1):17-40
- Snow, D A. & Benford, R D. 1988. "Ideology, frame resonance, and participant mobilization" *International Social Movement Reserach* 1(1):197-218
- Twongyirwe, R., Sheil, D., Sandbrook, C G., Sandbrook, L C. 2015. "REDD at the crossroads? The opportunities and challenges of REDD for conservation and human welfare in South West Uganda" *International Journal of Environment and Sustainable Development* 14(3): 273-298
- Umrani, R.J. 2010. *Agricultural extension worldwide innovations*. Jaipur, India: Global Media.
- White, D D., Wutich, A Y., Larson, K L., Lant, T. 2015. "Water management decision makers' evaluations of uncertainty in a decision support system: the case of WaterSim in the Decision Theater" *Journal of Environmental Planning and Management* 58(4): 616-630
- Wibeck, V., Abrandt Dahlgren, M. & Öberg, G. 2007. "Learning in focus groups: an analytical dimension for enhancing focus group research." *Qualitative Research* 7(2):249-267
- Wibeck, V. 2014. "Enhancing learning, communication and public engagement about climate change – some lessons from recent literature". *Environmental Education Research* 20(3): 387-411

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