

Narrative as a Method for Eliciting Tacit Knowledge of Climate Variability in Bangladesh

SCOTT BREMER AND ANNE BLANCHARD

Centre for the Study of the Sciences and the Humanities, University of Bergen, Bergen, Norway

NABIR MAMNUN

Bangladesh Centre for Advanced Studies, Dhaka, Bangladesh

MATHEW STILLER-REEVE

Uni Research Climate, Bergen, Norway

MD. MAHFUJUL HAQUE

Department of Aquaculture, Bangladesh Agricultural University, Mymensingh, Bangladesh

ENDRE TVINNEREIM

Uni Research Rokkan Centre, Bergen, Norway

(Manuscript received 18 January 2017, in final form 13 May 2017)

ABSTRACT

Climate change adaptation has increasingly come to be conceptualized as a place-based social process, in large part mediated by the local cultural context. The specificity of adaptation has called for partnerships between scientific and local communities to “co-produce” knowledge of climate variability (weather) and longer-term climate change. However, this raises numerous methodological challenges, including how to elicit the representations, knowledge, and cultural meanings of weather that are tacit to people in a community, and represent them in an explicit form that can be shared in a process of “co-production”. Such work demands careful attention to the way tightly intertwined knowledge systems continuously rebuild representations of climate in a place, and how these knowledge systems are also intertwined with values and the exercise of power. This paper takes up this challenge and explores the potential offered by theories and methods of narrative. Looking at a research project “co-producing” knowledge of weather and impacts in northeast Bangladesh, this paper describes the experience of running narrative interviews with communities there, and how these narratives were analyzed along four themes to contribute to the co-production process. These themes included 1) the weather phenomena and impacts important to local communities, 2) how weather provides meaning and identity in that place, 3) how community actors produce and share weather knowledge, and 4) the climate-related narratives pervading the community. In sharing this experience, this paper seeks to fulfil a demand for more detailed practical accounts of narrative methods in climate adaptation research, particularly for knowledge co-production.

1. Introduction

The social sciences have come to conceptualize climate adaptation as a dynamic social process of collective action for adjusting to the actual or expected climate and its effects specific to a place. “In human systems, adaptation seeks to moderate or avoid harm or exploit

beneficial opportunities” (IPCC 2014, p. 5). Although the specifics of this process remain controversial, one common thread is the transformative social learning within a community (Paschen and Ison 2014) about the particular impacts of climate variability and change in a place, and the diverse capacities availing them to adapt, including 1) political leadership, 2) institutions, 3) resources and technologies, 4) infrastructure, 5) kinship networks, and 6) cultural dimensions (Adger et al. 2013;

Corresponding author: Scott Bremer, scott.bremer@uib.no

DOI: 10.1175/WCAS-D-17-0007.1

© 2017 American Meteorological Society. For information regarding reuse of this content and general copyright information, consult the [AMS Copyright Policy](http://www.ametsoc.org/PUBSReuseLicenses) (www.ametsoc.org/PUBSReuseLicenses).

Smit and Wandel 2006). This focus on culture—here defined as “the symbols that express meaning, including beliefs, rituals, art and stories that create collective outlooks and behaviours, and from which strategies to respond to problems are devised” (Adger et al. 2013, p. 112)—requires going beyond instrumental studies of adaptive strategies to understand the motivation and meaning behind them. Some have argued that such culturally embedded social learning needs to be supported by alternative modes of climate and meteorological science, “co-produced” in partnership between local and scientific communities (Armitage et al. 2011).

Co-production is increasingly prevalent in the climate adaptation literature, although the concept is employed differently across various fields of science and practice. Here co-production is discussed as an extended mode of scientific enquiry for adaptation in a place, through the deliberate collaboration between scientists and other social actors (Cash et al. 2006; Corburn 2009; Hegger et al. 2012). Scientists and nonscientists draw on their diverse expertise and knowledge toward coconstructing a shared understanding of climate and adaptation, incorporating values and criteria from both communities. Scholars and practitioners appealing to co-production as a form of sustainability science are seen to draw on innovations in post-normal, mode 2, or transdisciplinary science (Hegger et al. 2012; Kirchhoff et al. 2013), where “normal” science faces significant uncertainties, plural values, high stakes, and urgency (Funtowicz and Ravetz 1993). Co-production is an attempt to anchor science in the specificity of place, embedded in cultural and political understandings, meanings, and representations (Bremer and Funtowicz 2015), recognizing that the climate is not simply a measurable physical phenomenon, but also a socially negotiated one (Adger et al. 2013).

However, co-production presents significant methodological challenges. One central question relates to how we can make explicit the *tacit* and value-laden understandings of climate and adaptation that are inherent to an individual and the local culture (Polanyi 1967), in a form that can be deliberated in a process of co-production: how best can we elicit tacit knowledge for respectful integration with other knowledge systems, recognizing the power imbalances that complicate this? We take up this research question and explore the potential of *narrative* interviews as a method, based on our experiences in the TRACKS project (for “Transforming Climate Knowledge with and for Society”). TRACKS aims to co-produce an understanding of climate variability and impacts with communities in the northeastern Sylhet Division of Bangladesh. The focus on short-term climate variability, or weather, marks a novel departure from adaptation projects with a focus on long-term

climatic change. It also marks a departure from projects that study “adaptive capacity” as TRACKS focuses rather on assembling a body of high-quality weather knowledge, grounded in current experience, as an important precondition to subsequent local adaptive efforts.

This method paper discusses how the TRACKS project used interviews with Sylhet communities to elicit tacit understandings of local climate variability and its impacts as *narratives*. The paper further looks at how these narratives are expected to contribute to the co-production of weather knowledge that can be variously used for adaptation. The research begins from a body of literature on the cultural dimensions of climate variability, which studies how people “story” their experiences with the weather in a place, and the way this community of narratives culturally conditions how people understand and practice adaptation (Daniels and Endfield 2009; Hall and Endfield 2016; Lejano et al. 2013). In a methodological move from cultural studies to knowledge co-production, we sought to collect these weather narratives as cultural artifacts, and explore ways to analyze the tacit knowledge they embody to inform a process of knowledge co-production. In this way, the paper confronts a dearth of published material on how to practically give effect to narrative methods for co-producing knowledge of the weather (Nielsen and D’haen 2014; Paschen and Ison 2014).

Section 2 reviews the theoretical background on narratives, particularly for climate-related research, and the framework we adopt. Section 3 presents a detailed description of the interview approach we employed to elicit narratives in northeast Bangladesh, before section 4 shows how we analyzed these narratives along four themes to elicit knowledge for a process of co-production. Section 5 finishes by looking at how information from the narratives was fed into the next steps of co-production, and concludes by discussing next steps for scholarship.

2. Narratives and the co-production of knowledge on climate variability

a. *The narrative turn*

A “narrative turn” among the social and human sciences midway through the twentieth century acted to reinvigorate the study of narratives; it was appropriated by a multitude of disciplines and adapted to their particular conceptual and methodological frameworks. Accepting this diversity, there are some characteristics of a narrative that are quite common across the literature (Bruner 1991; Jones and McBeth 2010; Patterson and Monroe 1998; Polkinghorne 1991; Somers and

Gibson 1994). A narrative sets a sequence and order to events occurring in a defined place and time, often structured as beginning–middle–end. It typically depicts characters acting and interacting around these events, offering us glimpses into the intentions of characters and how intentions translate into actions that influence the world. Narratives are told from the narrator’s perspective, defining the story by including only those elements she considers compelling or dramatic for her story, and omitting the anomalous. In this way, the constituent parts of the narrative find unity in a plot that supposes causality and meaning to infer a moral or evoke emotional responses from a listener.

We can unpack a dichotomy between narrative as 1) an abstract cognitive structure or 2) a sociocultural artifact (Herman 2003). The former paradigm begins from a notion of humans as “storied animals,” employing narrative as a cognitive tool to make sense of our complex lived experience (Bruner 1991). In this sense, our stories are compiled as a sense of self: “individuals construct private and personal stories linking diverse events of their lives into unified and understandable wholes” (Polkinghorne 1991, p. 135). If we consider this phenomenon, that we all internally register our experiences as stories, it follows that we can bring forth the subjective experiences of others, and meaning attached to them, through interviews (Wiles Rosenberg and Kearns 2005). It is in this way that much (though not all) of the social science research approaches narratives.

The latter sociocultural paradigm begins from the narrative artifact, as the cultural mode of expressing and transmitting our inner stories through speech, text, images, theatre, and so on—what Herman (2003) calls the “material trace” of our narrative cognitive structures. As a social artifact, narratives guide and nurture social interaction and dialogue. As a cultural artifact, narratives are embedded in our cultures, and it is in this way that much of the research in the humanities has studied narratives (Bal 1997).

b. Narratives studied in climate-related research

Various concepts of narrative have been employed in the climate-related literature. One category of research focuses on telling the historical development of dominant, overarching climate narratives at the global scale. Some scholars have portrayed the rise of powerful scientific narratives of global climate change (Daniels and Endfield 2009; Hamblyn 2009; Hulme 2012; Liverman 2009), while others have described how the momentum of climate narratives waxes and wanes in the media (McComas and Shanahan 1999). It has also seen literature on climate fiction or “Cli-Fi” as a genre of films,

plays, art, and literature (Jackson 2015; Lowe et al. 2006; Svoboda 2016).

A second category of research critically analyses how these global, grand narratives impact public and policy discourses in particular places, often guided by frame and discourse analysis. Scholars like Bravo (2009), Farbotko and Lazrus (2012), and Hulme (2008) comment on the pervasive power of a *climate change crisis narrative* for prescribing urgent climate adaptation action in local places. Much of this critical research focuses on the influence of these dominant narratives on distributing power for adaptation at the local or national scale. They look at how apolitical and universal scientific narratives of climate touted by expert groups can clash with and displace established cultural and social understandings of weather and adaptation embodied in the narratives of local communities (see also Daniels and Endfield 2009; Liverman 2009; Lejano Tavares-Reager and Berkes 2013).

A third category of research looks at how narratives can be used to improve the quality of outputs produced by the climate science community. This can be both in producing the science, such as by using narratives to make future climate scenarios more “life-like” (Kok et al. 2015; Wilby and Dessai 2010), or in science communication. Some scholars have suggested that presenting climate science as narratives will make it more accessible to the broader public (Bushell Colley and Workman 2015; Kearney 1994).

A fourth tradition looks at narratives as part of the cultural context in a place, where climate adaptation is conceptualized as a social process mediated in large part by cultural dimensions (Adger et al. 2013; Hall and Endfield 2016; Lejano et al. 2013; Paschen and Ison 2014). These scholars assert that individuals “story” their experience with the weather in a place, with these narratives conditioning the way people interpret, understand, and practice climate adaptation. In this way, narratives both contribute to and reflect culture, storing, communicating, and activating climate knowledge, values, practices, and meanings (Lejano et al. 2013). Participatory research on local narratives is urged for both 1) mobilizing context-specific knowledge of climate impacts and adaptation capacities and 2) sharing this knowledge in a way that adheres to local cultural conventions, while critically challenging entrenched power structures of whose knowledge counts (Lejano et al. 2013; Paschen and Ison 2014). Paschen and Ison (2014) emphasize that the narrative interview less extracts information than contributes to the ongoing social practice of constructing local cultural understandings and meanings of climate adaptation. They argue for a genuine paradigm shift toward narrative research in support

of climate adaptation, although they regret that there is a lack of detailed literature on how to apply narrative approaches in this field: “The next challenge for pursuing this research turn is how to operationalize and institutionalise [narrative] research [...] that supports policy making supportive of climate change adaptation” (Paschen and Ison 2014, p. 1090).

c. Narratives in support of knowledge co-production: Situating the TRACKS project

The TRACKS project situates itself in this fourth tradition, and studies how we can use narrative interviews with the purpose of accessing the stories people cognitively use to understand their lived experience with the weather, set in a cultural context. Specifically, it seeks to elicit tacit knowledge in a form that can be shared and appraised as part of an organized process of co-producing knowledge of climate variability and impacts. We see the mobilization of a high-quality knowledge base, anchored in local representations, understandings, and social structures, as an important precondition to local adaptation. Steering knowledge co-production by extended norms of quality recognizes that not all understandings are equally fit for the function of adaptation, but that quality should be appraised by criteria that go beyond narrow measures of scientific robustness or usefulness alone (Funtowicz and Ravetz 1993), to include local salience, legitimacy, and credibility for instance (Cash et al. 2003) (see section 3a). We assert that some tacit knowledge, as captured in narratives, can be of high quality for supporting adaptation.

Theoretically, making tacit knowledge explicit for co-production introduces issues of elicitation and representation. As Polanyi (1967) argued, the *elicitation* or making known of knowledge about the world is more straightforward for some knowledge systems than others. For instance, the scientific community draws upon a codified and replicable procedure that is ostensibly independent from individual scientists. On the other hand, many craft, local, or traditional knowledge systems are more “tacit” to the knowledge holders, that is, internal to them and bound to their daily tasks and social practices. Tacit knowledge-holders can be unaware of the knowledge they possess, and struggle to put it into words or otherwise externalize it. For anthropologists like Orlove (2003) or Rayner (2003) eliciting tacit understandings of weather is further complicated since it is compound—a portfolio of intertwined knowledge systems mediated by experience, tradition, crafts and skills, social organization, and not least science—and dynamic, used ephemerally, contingent to the task at hand. For science and technology studies scholars like Jasanoff (2010), tacit weather knowledge is coevolving

with the growing influence of climate science in places, changing how local natural and social orders are represented. Indeed, sociologists of knowledge like Wynne (1992, 1996) have long studied the relationship between lay and scientific knowledge in modern society and institutions, and how people reflexively flip between them, including in interviews. Taken together, peoples’ weather knowledge is rarely distinctly tacit or scientific but a mixture of the two, used at different times according to their needs.

A subsequent concern is how, once externalized, tacit forms of knowledge are analyzed and *represented* in a way faithful to the cultural norms and standards of a given knowledge system, but also able to be shared and integrated with other knowledge systems. Some authors (Bremer 2013; Fernandez-Gimenez Huntington and Frost 2006; Nadasdy 1999; O’Connor 1999) highlight the danger of “scientizing” tacit knowledge by reappropriating it toward universal scientific representations of the world. Fernandez-Gimenez et al. (2006, p. 307) note how the documentation of traditional ecological knowledge (TEK) can “isolate TEK from its social and cultural contexts and interpret it through a Western science lens, constituting another form of exploitation.” Nadasdy (1999, p. 15) cautions against “integration” as intertwined with the exercise of power, noting that “[k]nowledge [...] does not exist in some pure form, independent of power relations; rather it is constituted by those relations” (see also sections 3f and 5 herein). The act of setting knowledge systems alongside each other, in a research project or another institutional setting, must account for how power relations will transpire in that setting.

Methodologically, TRACKS employed a narrative interview method inspired by social science and psychology, where there is an extensive and detailed literature on conducting and analyzing such interviews with a purpose (Connelly and Clandinin 1990; Czarniawska 2004; Fraser 2004; Josselson 2011; King and Horrocks 2010; Mattingly and Lawlor 2000; Paulson 2011; Wertz 2011; Wiles et al. 2005). The study of narratives as subjectivity marks a stark (and critical) departure from positivist social science, and introduces questions of knowledge quality for co-production. As the subjective construction of each individual, narratives cannot be verified or falsified. Their *quality* is appraised according to their verisimilitude or appearance of truth, as determined by social conventions (Bruner 1991), and according to criteria of “adequacy” and “plausibility” (Connelly and Clandinin 1990). In this way, narratives provide a unique “interpretative” knowledge—“organising and contextualising essentially contestable, incompletely verifiable propositions in a disciplined way” (Bruner 1996, p. 90)—that is different from although complimentary to the “explanatory”

scientific knowledge. Indeed, many historical and social studies of science describe scientific explanations as similarly narrative in their construction, and nested in the social context or metanarratives of their time depicted in Kuhn's scientific revolutions (Kuhn 2012).

3. Employing interviews to elicit narratives of weather and impacts in northeast Bangladesh

a. *The TRACKS Project*

The 3-yr TRACKS project was initiated in June 2014 and assembles researchers from eight institutions across Bangladesh, Norway, and the United States, with funding from the Research Council of Norway. This project aims to build a robust understanding of climate variability and its impacts on communities in four study sites in the northeast Sylhet Division of Bangladesh in order to support local adaptation. Here we use "community" as shorthand for people living in a small spatial unit (place) and sharing some common characteristics and norms related to ethnicity, religion, language, and experience with local weather, for instance. But far from an "organic whole," our notion of community begins from the diversity of social groups and institutions, and highly political interactions between them, which steer the various adaptation actions in a place (Agrawal and Gibson 1999; Blaikie 2006).

Sylhet's climate is marked as unique in Bangladesh, characterized by high annual rainfall, particularly in the summer premonsoon period. Local communities have long lived by these patterns, but in recent decades they have experienced changes in this rainfall, changes corroborated by meteorological science and potentially linked to long-term climatic change (Bashar et al. 2017, manuscript submitted to *Theor. Appl. Climatol.*). The prospect of climate change is forcing these communities to recognize the significant uncertainties and contention about the causes and impacts of this premonsoon rainfall that weakens their knowledge base for future adaptive efforts (Stiller-Reeve et al. 2015). Communities are questioning their cultural representations and knowledge of climate, and the social and natural orders based on them (Blanchard and Bremer 2015). Bremer (2017), for instance, discusses a local discourse that while the Bangladeshi calendar traditionally has six seasons, people today can only distinguish two or three. These changing representations and orders are also mediated by other influences, such as the predominantly Muslim religion, social norms that divide work between men and women, and school education where climate is in the curriculum.

Increasingly, representations of Sylhet's climate and society's adaptive response are mediated by global

climate science and science-based governance institutions. Haque et al. (2017) describe a strongly hierarchical government approach to climate adaptation, administered from the capital and implemented mainly in the form of river engineering works and agrobiotechnology research by its line agencies. In parallel, a strong network of nongovernmental organizations (NGOs) is working for adaptation at the village level, but also ostensibly according to a scientific approach. Indeed, both government agencies and NGOs are heavily influenced by international climate science and policy programs, and their inherent belief in universal or "global" science as the most powerful knowledge base for adaptation, superseding localized adaptive understanding. Seen as narratives, the dominant story of science-based adaptation is arguably marginalizing the myriad of local narratives of responding to climate variability in Sylhet communities, imbued with applied, practical knowledge of coping with local conditions. This marginalization can have maladaptive consequences (Scott 1998). Haque et al. (2017) note one example where engineering works to armor a river bank did reduce flood damage but also cut off the flood waters that irrigate the crops and refill the lakes with fish; fishing had been a local adaptation strategy during the floods.

To co-produce a high-quality knowledge base, accommodating science and local knowledge systems and narratives, TRACKS is designed according to a "post-normal science" approach (Funtowicz and Ravetz 1993). This approach sees international climate scientists collaborating with diverse local community actors as part of an "extended peer community." This peer community is charged with mobilizing and critically appraising the *quality* of available knowledge systems (from science to local, traditional, or craft knowledge) for supporting local adaptation action. They ask what knowledge is "good enough" to enable (sometimes rapid) judgements of high (not perfect) accuracy about how to respond to local weather. The members of the peer community collaborate to identify areas for further research, and to design a portfolio of weather and impact indicators that they themselves will measure over two years as "citizen scientists." The peer community pays careful attention to including actors from across different social groups, exposed to different climate impacts, for their diverse perspectives. This diversity is proposed to provide more comprehensive understanding of weather, lend social legitimacy to the work, and allow citizens to apply their learning in different settings: the teacher in her classroom, the government officer in her agency, the farmer in his fields. Establishing this peer community meant creating a new,

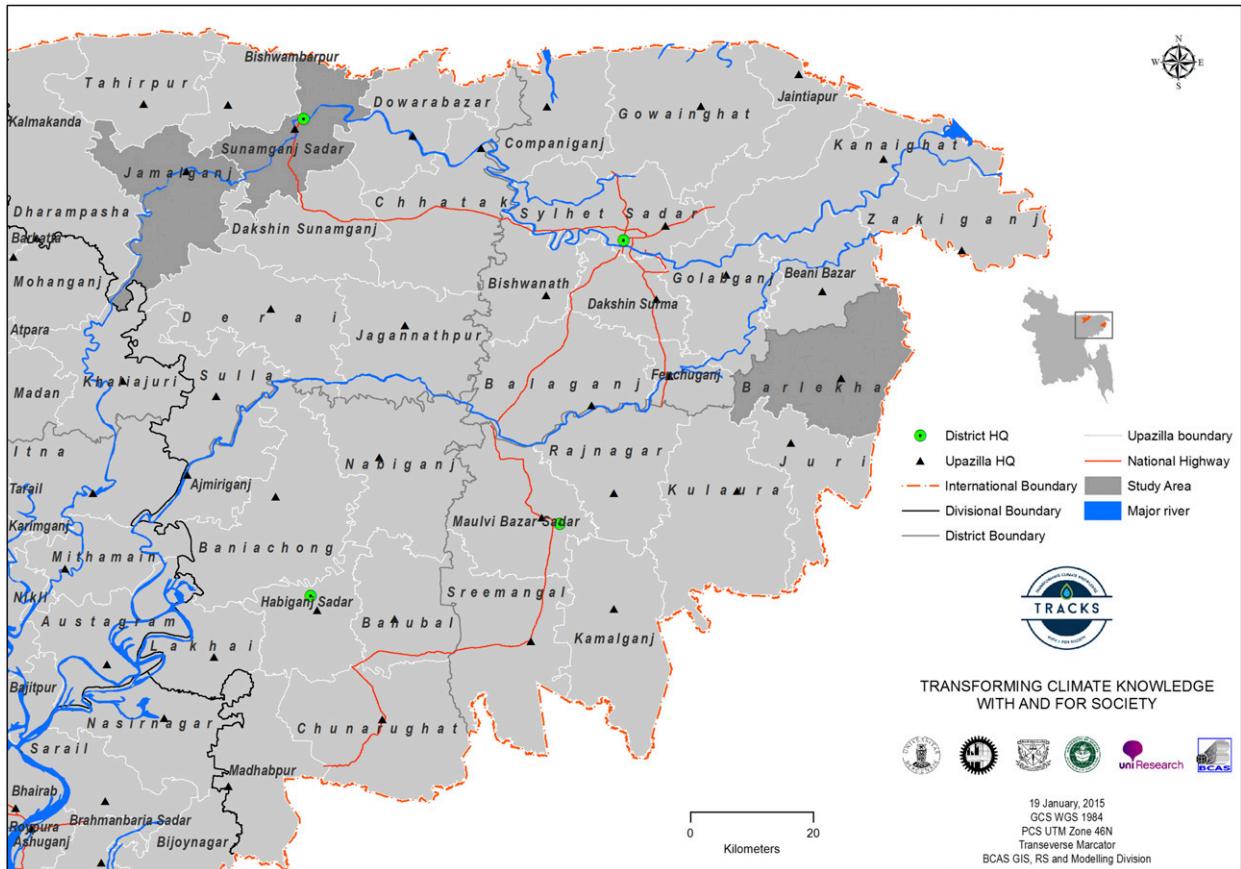


FIG. 1. Map of the four TRACKS study sites in Sylhet Division, indicated in dark gray (Sunbeam Rahman).

synthetic institutional setting that in some ways bracketed the power dynamics between people and knowledge systems out in the wider community (Maloney 1986). But this bracketing work itself demanded an exercise of power from project scientists and arguably led to some confused power relations, with disparate community actors unaccustomed to working as peers.

Before the participants became citizen scientists, they were all respondents in the narrative interviews. The project implemented 234 semistructured narrative interviews across four study sites in late 2014, with the purpose of initiating and supporting knowledge co-production within the extended peer community. They also helped narrow down a group of local actors that could later form part of the extended peer community. In designing and conducting the interviews, we were guided by the social science literature discussed above, and we progressed in four phases.

b. Phase 1: Location and stakeholder mapping

The first phase was about defining 1) how many actors we would interview, 2) which locations of Sylhet

Division to use, and 3) whom to interview. We chose to interview between 200 and 240 actors to elicit a diversity of perspectives that reflected the specificities of the communities in study sites. It was not our intention that the number or composition of participants be statistically representative, but we saw that a larger sample would lend itself better to a mixed-method analysis, including both qualitative and quantitative approaches. However, this high number of interviews also had its shortcomings, as we discuss in section 3f.

Study sites were selected that shared the same particular premonsoon rainfall conditions of Sylhet Division but experienced different impacts and vulnerabilities according to their unique geography. We decided on four study sites clustered as two groups of two locations (see Fig. 1) and sought 50–60 interviews in each study site:

- 1) Sunamganj Sadar: an urban community in the low-lying *haor* (wetland) area on the Surma River,
- 2) Jamaiganj: a rural community in the low-lying *haor* area on the Surma River,

TABLE 1. Stakeholder mapping exercise from the “government group” at the kick-off meeting in Dhaka. It displays the three most important impacts for this group.

	Flash flood	Inundation/flood	Thunder storm/lightning
Influential actors	Dept. of Disaster Management Dept. of Agricultural Extension NGOs Local government Ministry of Environment and Forestry Bangladesh Power Development Board UNDP Early Recovery Facility	Dept. of Disaster Management Dept. of Agricultural Extension NGOs Local government Ministry of Environment and Forestry Bangladesh Water Development Board UNDP Early Recovery Facility	Dept. of Disaster Management Dept. of Agricultural Extension NGOs Local government Ministry of Environment and Forestry Bangladesh Water Development Board UNDP Early Recovery Facility
Affected actors	Farmers Fishermen Day laborers School children Commuters	Schools and school children Markets Mosques/temples Community people	Farmers Fishermen School children Women/housewives Commuters

- 3) Barlekha: a rural community in the hill country, including tea gardens and rice farms, and
- 4) Hakaluki *haor*: a rural community on the banks of the permanent *haor* of high ecological value near Barlekha (west in the shaded Barlekha area on the map).

In defining whom to interview, we drew on the literature on stakeholder analysis and adopted the process presented by Reed et al. (2009), which broadly consists of 1) defining an issue or phenomenon, 2) identifying actors who are affected by or can affect the phenomenon, and 3) prioritizing actors for involvement in research.

1) DEFINING THE ISSUE: CLIMATE VARIABILITY AND ITS IMPACTS

Most stakeholder mapping begins by defining a discrete issue (Reed et al. 2009), but TRACKS deliberately maintained a broad perspective, looking at the pervasive impacts of current climate variability (the weather) on the lives of different individuals in four communities. However, given the ubiquitous influence of the climate on a community, all of its members become possible “stakeholders” in different aspects of their lives. Our goal was to elicit perspectives from people in diverse social groups, who uniquely experience and know the weather according to the particular impacts that affect them. These diverse lived experiences were the subjectivities that we sought to access, but how could we begin to codify a near infinite list of impacts and experiences? We began to narrow our focus around a set of climatic impacts and associated actors embodied in the six thematic areas of the Bangladesh Climate Change Strategy Action Plan (BCCSAP) (MoEF 2009): 1) food security, social protection, and health; 2) comprehensive disaster management; 3) infrastructure; 4) research and

knowledge management; 5) mitigation and low carbon management; and 6) capacity building and institutional strengthening. Thus we began to split communities into impact-based categories to access a diverse sample.

2) IDENTIFICATION OF ACTORS IN THE STUDY SITES

Beginning from the BCCSAP, the TRACKS stakeholder analysis progressed in two stages. The first stage was a desktop review to identify actors based on the six thematic areas of the BCCSAP. This categorization was further structured using an approach from Howlett and Nagu (1997), who distinguish between “influential” and “affected” actors. Influential actors have power, resources, and influence to more easily cope with weather impacts themselves, and also determine the direction of collective adaptation, which may further favor their situation. Affected actors have little power or resources to respond to weather impacts or steer adaptation to their benefit, and must accept their losses. In this way we further categorized communities relative to vulnerability.

The second stage engaged experts working with climate variability and adaptation in stakeholder mapping exercises at two project kick-off meetings in September 2014: a national meeting in Dhaka, and a local meeting in the city of Sylhet. The meetings had the dual purpose of presenting TRACKS to key end users and soliciting their help in framing the project. The Dhaka meeting hosted 49 participants who sat in five homogenous groups according to their position in research, government, NGOs, and donors. Groups first identified climate impacts in the study sites, before selecting the three most important impacts and identifying the influential and affected actors for each (the results from the government group are displayed in Table 1). The Sylhet

meeting followed the same format, hosting 29 participants who sat in four homogenous groups according to their positions in research, government, NGOs, and other local experts like schoolteachers and journalists.

3) PRIORITIZING KEY ACTORS FOR THE NARRATIVE INTERVIEWS

The desktop analysis and mapping exercises helped to prioritize certain groups of actors as having a particularly important relationship to climate variability relative to certain impacts (such as crop loss) and helped assemble a list of potential interviewees. Over 40 different types of actors were identified, ranging from influential political leaders to affected rice-field laborers. The resulting list (calculated on a total number of 200 interviews) acted as a loose quota for TRACKS interviewers, more indicative than prescriptive, helping them choose whom to approach at each location (see [Table 2](#)). Within this quota, interviewers were to organize some interviews in advance, with government officials for instance, and conduct other interviews opportunistically, with individuals that they came across. Within these loose quotas, a snowballing approach helped identify other knowledgeable and interested actors.

In prioritizing interviewees, we faced a number of challenges. Gender balance is a challenge in Bangladeshi communities, where men are overrepresented in the public sphere and are more likely to offer themselves as interviewees. Actively seeking out women for interviews was important for us, and we aimed for at least 30% female interviewees. Accessing a diversity of individuals by work category was also a challenge, with fishermen and farmers not as accessible as shopkeepers or teachers for example, particularly in different seasons. Autumn (roughly November–December) was singled out as advantageous since it is drier and most actors are available. Finally, there was a discussion about whether interviews should be individual or collective. Traditional narrative research focuses on the individual as the primary unit of analysis, but a strict isolation of individuals is not always feasible in the Bangladeshi village context, or indeed desirable; some individuals might be uncomfortable with one-to-one interviews. A decision was made to permit some collective interviews.

c. Phase 2: Designing the narrative interview protocol

In parallel with mapping the actors, we held a two-week workshop in Bergen (Norway) in August 2014 to design the narrative interview research method and protocol. This interdisciplinary workshop brought together 11 TRACKS partners from natural, social, and

human sciences. Most of the researchers were based in Bergen, with two coming from Bangladesh. For many, the narrative theory and method was novel. Workshop participants discussed the meaning and aims of narrative interviews, what information was important for the TRACKS co-production purpose, and how this information could be elicited. Through this workshop we also engaged the Bangladeshi expatriate community living in Bergen for input on how narrative interviews could work in the Bangladeshi context (see [section 3d](#)). In line with TRACKS' overall aim of methodological pluralism, TRACKS researchers decided to analyze interviews both qualitatively and quantitatively, according to four research questions:

- 1) Which weather phenomena are most important to the local community, and how do they impact on the community and the landscape?
- 2) How does the weather give meaning and identity to the local place?
- 3) How does the local community produce and share knowledge of weather in support of adaptation?
- 4) Which weather narratives are dominant within the community, and how has this changed over time?

A significant amount of time was spent developing the interview question protocol. Following other published narrative methods ([Mattingly and Lawlor 2000](#); [Paulson 2011](#)), we developed an interview protocol for “narrative interviews with a purpose” to address the four main research questions. We designed the protocol to encourage an episodic rather than a life-history approach, focusing on individuals' episodes with the weather and its impacts. The protocol took a semistructured form in three sections: [section 1](#) collected a minimum of demographic background information with closed questions, [section 2](#) employed open-ended questions to elicit narratives (see [Table 3](#)), and [section 3](#) finished by asking if interviewees would participate further in the project, and whom else we could interview. The open questions were to be followed, if needed, by prompts asking for narratives of particular instances rather than general statements. To further support storytelling, interviewers were to note interviewees' episodes on a Bangla calendar, which could be referred back to during the interview.

The workshop turned its attention to the practical implementation of the interviews. It was agreed that interviews would be conducted in teams of two researchers, where one researcher would lead the interview talk and digitally record it, while the second would take field notes. Interviews would be conducted in Bangla, structured but not governed by the interview protocol, and kept under 45 minutes long. The

TABLE 2. Distribution of the actors as a guideline for narrative interviews by study sites.

	Study site 1		Study site 2	
	Urban flooded area (Sunamganj Sadar)	Rural flooded area (Jamalganj)	Hilly tea garden region (Baralekha)	Region of the Hakaluki haor (Baralekha)
Total sample size $N = 200$	$n = 50$	$n = 50$	$n = 50$	$n = 50$
A. Influential actors				
Government office for meteorology	1	1	1	1
Government office for the environment	1	1	1	1
Government office for agriculture	1	1	1	1
Government office for livestock	1	1	1	1
Government office for fisheries	1	1	1	1
Government office for water development	1	1	1	1
Government office for disaster management	1	1	1	1
Local Government Engineering Department	1	1	1	1
Government office for social welfare	1	1	1	1
Government office for health	1	1	1	1
Red crescent	1	1	1	1
Researchers (agricultural sciences)	2	2		2
Researchers (tea farming research)			2	
Political/community leader	1	1	1	1
Union <i>parishad</i> (local government) office	1	1	1	1
Local NGOs or donors	2	2	2	2
Journalist	1	1	1	1
Total (A)	18	18	18	18
B. Affected actors				
Students	3	3	3	3
Teachers	2	2	2	2
Religious leader (Hindu)	1	1	1	1
Religious leader (Muslim)	1	1	1	1
Rice farmers	4	4	2	4
Tea garden managers			2	
Tea garden workers/tribal people from India			5	
Rice-field/day laborers	2	2	1	2
Rice input (chemicals, pesticides, fertilizers) suppliers	1	1		1
Tea input (chemicals, pesticides, fertilizers) suppliers			1	
Rice processing plant workers (chatal)	1	1	1	1
Aquaculture farmers	1	1	1	1
Fishermen	3	3	1	3
Fish retailers	1	1	1	1
Poultry farmers	1	1	1	1
Dairy farmers	1	1	1	1
Fish and poultry input suppliers	1	1	1	1
Boatmen	1	1		1
Transport workers	2	2	1	2
Day labor workers (stone/brick/sand workers)	2	2	2	2
Local folk singers (<i>baol</i>)	1	1	1	1
Museum curators	1	1	1	1
Local traditional doctors (<i>kabiraj</i>)	1	1	1	1
Club members (e.g., bird watchers)				
Tourism guides	1	1	1	1
Total (B)	32	32	32	32

interviewers would begin by introducing themselves and the project, allowing interviewees the time to ask questions, and giving them an ethical statement in Bangla with details of contact persons and stating their right to withdraw at any time. It was agreed that in order to

maintain a holistic appreciation for the interview text and facilitate analysis by Europe-based researchers, each Bangla transcript should be translated into English in full. In this way, each interview was recorded in 1) field notes, 2) an audio recording, 3) a full Bangla

TABLE 3. Open questions from section 2 of the narrative interview protocol.

- 1) Please explain how the weather changes with the seasons in this area over a typical year.
- 2) Looking at recent years, which of these weather events have the biggest impact on your life, and why?
- 3) Looking at these impacts, what signs do you use to know that this weather is coming?
- 4) Looking at these impacts, how do you prepare for this weather, and how do you deal with the impacts afterward?
- 5) Who or what do you trust for giving you weather information, and why?
- 6) Who do you discuss the weather with? Do you know how other people in the area share information about the weather?
- 7) Looking back on these impacts, which weather information would be useful for you?
- 8) What is your idea of the worst weather event that could happen to you, and why is it the worst?
- 9) How might the changing weather impact your children's generation?
- 10) Is there anything else you think we should know for conducting our project?

transcript, and 4) an English translation completed by independent professional translators.

d. Phase 3: Pilot testing

We pilot tested the interviews in both Norway and Bangladesh. In Bergen, while developing the protocol (phase 2), we organized two interviews with Bangladeshi expatriates. These parallel interviews, in the same private home, were conducted in Bangla by the two Bangladeshi researchers present. After the interviews there was a collective debriefing where interviewees gave their impressions on the relevance and intelligibility of the questions in a Bangladeshi context. In Bangladesh, a group of five Norwegian and seven Bangladeshi researchers ran a series of nine pilot interviews across the study sites (see Table 4) in September 2014. These interviews helped to further test and refine the interview protocol and recruitment approaches, and familiarize Bangladeshi researchers with the narrative interview techniques. Two people conducted each pilot interview with observers taking notes, and at the end of each day there was a collective debrief session where lessons learned were noted in a journal. This journal was later used to develop a list of 25 detailed guidelines, moving step by step through the interview; from respecting ethical guidelines, to creating a relaxed environment, using the local vernacular, or the importance of silence

for letting interviewees talk. These guidelines were translated into Bangla and given to all members of the field research teams as part of their training.

Overall, the pilot interviews showed that the interview protocol was both feasible and useful for eliciting narratives that spoke to the research questions, for the purpose of supporting a co-production process. They also allowed us to identify other categories of actors, such as poets and tourist guides, as a complement to the stakeholder mapping work.

e. Phase 4: Conducting the narrative interviews

The narrative interviews were conducted in December 2014. We mobilized eight field teams, each comprising two interviewers, drawing on graduate students from various disciplines including social sciences, environmental sciences, and agriculture. Project partners at the Bangladesh Centre for Advanced Studies (BCAS) trained these research teams for three days according to the guidelines elaborated over the pilot work. In addition, one Norwegian and three BCAS researchers accompanied the fieldwork teams to observe the interviews. The teams spent about two weeks in the field conducting 234 interviews across the four study sites, with around 60 interviews in each site. They were able to engage with most of the actors listed in the stakeholder guideline (Table 2). Most interviewees were approached

TABLE 4. Interviewees in pilot interviews across the four study sites.

Location	Descriptor	Age	Gender	Group/individual
Sunamganj Sadar	Boatman	30–40	Male	Individual
	Two school teachers	30–40	Female	Group interview
Jamalganj	Union office secretary	30–40	Male	Individual
	Three rice farmers	60+	Male	Group interview
Hakaluki haor	Shopkeeper	20–30	Male	Individual
Barlekha	Local government officer	30–40	Male	Individual
	Homemaker	20–30	Female	Individual
	Rice farmer and politician	50–60	Male	Individual
Sylhet Sadar	Environmental scientist	40–50	Male	Group interview

opportunistically, with interviews conducted there and then in fields, homes, offices, or tea stalls, and lasting from 30 minutes up to one hour.

f. Challenges to conducting the narrative interviews, and power relationships

The significant number of interviews meant work was delegated to fieldwork teams, introducing methodological and practical limitations. Apart from the BCAS training session and the detailed interview guidelines, the fieldwork teams were not extensively trained or experienced in conducting narrative interviews. As a result, the interviewing was not always optimal, with interviewees not always invited to expand on their thoughts or provide examples, for instance. A related issue, despite an emphasis on collecting people's stories in full, is that the transcripts were sometimes condensed or summarized. Finally, the translation of transcripts introduces the normal limitations of conducting narrative analysis on translations. If we were to conduct these interviews again we would consider 1) reducing the number to 50–100 interviews, permitting more attention to interview quality while still providing a diverse sample; 2) having an experienced narrative interviewer present at all interviews; 3) having word-for-word transcription completed immediately after interviews are completed; and 4) using phased fieldwork, to guard against researcher fatigue and allow time for organizing interviews with hard-to-find actors.

To the extent that told narratives are cultural artifacts, they are embedded in the social and cultural structures of Sylhet communities, including its unique geography, history, postcolonialization and independence movement, religion, and language (Maloney 1986). Sylhet Division possesses its own dialect that brings its own idiosyncrasies. Accessing these narratives therefore meant engaging with these social and cultural structures, and imbedded power hierarchies. We noted (section 3a), for instance, how a *techno-scientific narrative* of climate adaptation increasingly dominates these communities, endorsed by powerful government, NGO, research, and donor institutions, and marginalizing other local representations.

Power hierarchies can hide marginalized counter-narratives held by weaker groups from the research. Dominant actors, and dominant narratives, are likely to be more visible, even given efforts to include influential and affected actors. For example, while we aimed at 30% female interviewees, we ended up with just under 20% (46 women) because in rural areas women remain underrepresented in public. We also saw tension between encroaching scientific narratives of climate and competing traditional representations,

sometimes within the same interview. One Barlekha teacher captured this modernization, noting, “You won’t believe that we used to get indicators of natural disasters using the ponjika (traditional calendar). But now we watch TV to get updates on the weather.”

Power hierarchies also became manifest in the interview setting itself, shaping the stories told. The interviews were undertaken against the backdrop of competing stories about local weather, and TRACKS researchers were unavoidably associated with the powerful techno-scientific narratives of climate, which possibly influenced how interviewees related to interviewers. Interviewees may have omitted things that they felt went counter to scientific narratives, or retold their experiences in terms that fitted better within this scientific framing. For example, in his interview the Barlekha teacher discussed above at one point admits, “In fact, I also trust the ponjika,” then a few lines changes his mind, perhaps feeling that it is more proper for a teacher to believe in scientific explanations, and concludes “Actually, I don’t believe in the ponjika.” The relationship between researcher and interviewee can also be seen in terms of interpersonal power dynamics, connected with a want to please the interviewer, for instance, or forms of intimidation related to people’s place in society, with this going both ways. Some less confident interviewees were intimidated to speak with a researcher, feeling “they didn’t have anything to say.” Conversely, researcher teams were also intimidated to approach some interviewees, like government officials, so that we interviewed only about half of the 72 influential actors identified.

Finally, it is important to recognize the colonializing attitude of scientific concepts and ask to what degree our interviews, as social practice and a site of knowledge production, challenged or reinforced the dominant techno-scientific narrative of climate adaptation. On one hand, the interviews were designed as a critical challenge to scientific framings, encouraging a reflexive focus on the quality of other understandings. Reference to scientific concepts of climate were absent from the protocol, and interviewees were encouraged to think on their own experiences. On the other hand, the interviews were undertaken by researchers under the auspices of a scientific project, which inevitably drew interviewees and onlookers into a form of scientific setting. Consciously or not, interviewees addressed their perspective to a scientific audience, with an inherent comparison of scientific and nonscientific views. As such, the widespread interviews quite likely stimulated further reflection on scientific narratives of climate change in the communities, but hopefully in a critical way.

4. Analyzing narratives to elicit knowledge for a process of co-production

This section turns from looking at how we conducted interviews to look at how we analyzed the narratives in the interview talk, eliciting knowledge about climate variability and its impacts, to inform a process of co-production. We do not provide a detailed analysis of the results here but rather focus on how we were able to make sense of these narratives along certain themes corresponding to the research questions (see [section 3c](#)), and make some brief comment on how this information contributed to discussions and action within the TRACKS extended peer community.

The interviews resulted in 234 transcripts, representing a messy corpus of narratives. Some transcripts were rich with short narratives, while others read more like a questionnaire, with a few words in response to each question. It was necessary to order and analyze these stories to distil representations, knowledge, values, and meanings that could be deliberated in a co-production process. In taking this analytical step we were mindful of not “scientizing” this knowledge, and strove to share it in a way that maintained the integrity of the narrator’s perspective. In analyzing narratives this meant leaving stories intact as coherent, meaningful wholes, and communicating them using media that retain this coherence. For instance, nine of the interviews were filmed and presented as short films representative of a body of similar stories (see [section 5](#)).

The large corpus of narratives was suited to a mixed methods analysis, combining qualitative and quantitative approaches in four layers corresponding to four themes around the research questions. Each layer of analysis highlighted a different dimension of the narratives. In this way, we followed scholars like [Hernadi \(1987\)](#) [as cited in [Czarniawska \(2004\)](#)], whose “hermeneutic triad” recommends moving through phases of analysis and interpretation in rereading a text. The first three themes were mainly approached using qualitative techniques, drawing on the rich literature on narrative analysis in the social sciences and psychology, discussed in [section 2c](#). The fourth theme invited quantitative text analysis methods ([Grimmer and Stewart 2013](#); [Tvinnereim and Fløttum 2015](#)), including concordance analysis and bigram frequency counts.

a. Weather phenomena and impacts that are important to the community

Interview narratives recounted interviewees’ unique experiences with weather phenomena. This lends itself to a more phenomenological layer of analysis, collecting

and condensing descriptions of experiences ([Wertz 2011](#)). This content analysis suspends or brackets any a priori scientific framings and judgements, faithfully reproducing interviewees’ own experiences and how they explain these experiences, the causes and impacts of the weather, and how it is changing over time in Sylhet Division. Employing this layer of analysis, we could gain insights into interviewees’ understandings of the weather and the particular signs they use in knowing the weather.

To the extent that the interview questions started from seasons, this did impose some structure to recounting experience. The narratives provided diverse descriptions of weather phenomena over the seasons, including heavy rainfall, extreme heat, and thunderstorms in summer; strong winds and continuous rain during the monsoon; cold spells and lingering fog in winter, and the light breezes and sunny days of spring. By the frequency at which they were mentioned and the weight people attached to stories, certain phenomena emerged as more important to our interviewees, having a significant impact on their lives and demanding special efforts to cope. One rice farmer in Jamalganj discussed his experience with summer thunderstorms according to the natural signs he uses to predict their approach, the frightening effect of the lightning on the people, and the terrible consequences:

In day time, when the sky becomes black with clouds, when the herons are flying here and there vigorously to take shelter in their houses, and when it is cloudy in certain areas of the sky, then we return to our homes; a thunderstorm is coming. During the storm there is lightning, and our eyes cannot work properly. People are moving around frantically to take shelter. After the weather cools down, then we come out from our houses. We see if anyone has died in the thunderstorm, and we warn others if the storm is heading their way.

Subjective experiences and understandings of weather like that above can be an important complement to scientific research as part of co-production under uncertainty. As noted ([section 3a](#)) there are significant uncertainties undermining the scientific understanding and prediction of rainfall in Sylhet Division, including knowledge gaps about the mechanisms causing the rain. From the farmer’s story we can see how farmers use observations of the sky and birds to predict storms, as a complement to scientific forecasts. These cloud observations are also important to improving the quality of scientific models of rainfall and storms for the area, such as the wind direction preceding a storm.

Narratives can also corroborate or challenge scientific understandings of climate, or indeed, by prioritizing

certain phenomena, steer climate science in new directions. Indeed, as shown by [Stiller-Reeve et al. \(2015\)](#), Sylhet experiences of premonsoon rain can call into question wider scientific theories about the movement of the monsoon. In the TRACKS extended peer community, one important realization was that the majority of interviewees saw rainfall in the premonsoon summer months of Boishakh-Jyoishtho (mid-April to mid-June) as the most important weather phenomena. On this basis, while most other climate research in Sylhet Division focuses on the monsoon (mid-June to mid-August), TRACKS knowledge co-production focused on premonsoon rainfall. This much noted, the negotiation between scientific and subjective experience can also surface well-entrenched power hierarchies. Up against a dominant techno-scientific narrative of climate adaptation, subjective and nonscientific experience is easily dismissed as mere perception by scientists and government officers. These expert communities are loath to give up their privileged access to climate knowledge.

b. Weather as providing meaning and identity to a place

Rereading the narrative descriptions of weather phenomena and impacts, we could interpret the underlying meanings told through these stories, glimpsing how people make meaning from their experiences with the changing weather, and to what effect. This implies a hermeneutic exercise in interpreting how and why the narrative says what it does, according to a hermeneutics of faith, and seeking to restore the original meaning to the text ([Czarniawska 2004](#); [Josselson 2011](#)). Interpreting these meanings is important to the TRACKS co-production process insofar as it is concerned with embedding knowledge mobilization in the cultural context of a place. We wanted to situate the representations, knowledge, values, and meanings generated through co-production relative to the de facto meanings in Sylhet Division, with some appreciation for these coming through the interviews.

For example, our analysis of 25 interviews with rice farmers interpreted a common theme of “vulnerability” to the premonsoon summer rainfall, which is unique to Sylhet Division, and provides an identity to this place. Many perceived a trend toward less rainfall in this period, which for some had positive consequences, although others saw it as negative. As one Barlekha farmer said, “[w]hen it does not rain regularly the rice does not come out from the paddy. It becomes viscid.” We could see how farmers’ narratives were told to impart a message of their vulnerability to the interviewers, to different effect; some farmers seemed to

emphasize their coping strategies, while others emphasized helplessness. This made us reflect on why these farmers wanted to impart this moral to us and how we could address it in our co-production process—by conveying meanings of empowerment, for instance, which emphasize the diverse knowledge and resources farmers have for coping with variable rainfall. It is important to recognize that narratives are told with a purpose, and that purpose can be strategic. Vulnerable sectors of Bangladeshi society are the focus of aid and support from governmental and NGO agencies, such that claims of vulnerability can constitute a claim for support. This had to be considered relative to the TRACKS extended peer community: membership was voluntary, based on their interest in learning, not in financial gain.

As another example, a fisherman in Hakaluki Haor talked about a tension between new technologies of weather prediction, and associated meanings of planning and control, and long-held meanings of the inherent chaos and unpredictability of the weather. This helped the TRACKS co-production process approach themes like predictability and uncertainty:

One month, ten months or one year... you can give forecasts as you wish. But we go by guessing. We always observe the conditions of the sky, storm, rain and sun. We have connections with thunderstorms, and what happens after such events. We know what will be good for us, and what we should be doing and when.

c. Producing and sharing weather knowledge

A third layer of analysis we employed looked at how interviewees connect their personal experiences and understanding of weather with the experiences of others, linking the personal to the social. It focuses on how interviewees narrate their interaction with others relative to weather phenomena ([Fraser 2004](#); [Josselson 2011](#)), and can offer insights into shared experiences and reliance on others.

The narrative interviews allowed glimpses into how interviewees interacted with others to learn more about the weather and share their own understandings in the local weather knowledge economy. They helped to understand which groups in a community are in possession of which types of climate knowledge, why some forms of knowledge are more highly valued and trusted than others, how knowledge is shared or traded in a community, and what knowledge is demanded. The interviews also provided insights into the institutions, social structures, and power imbalances associated with who possesses information and who does not, with implications for the vulnerability of social groups. For

example, while some local government interviewees discussed a working knowledge of scientific forecast information, some of the affected actors, like a female poultry farmer from Barlekha, have limited access to weather information: “I get weather information from my husband [...] and I believe in my husband’s words. [...] I discuss this information with the women next door and my family.” Understanding this economy is fundamental to the TRACKS co-production process, to help us generate knowledge that meets community needs, is trusted as legitimate and credible, and is readily able to be shared.

Looking more widely, most interviews showed a strong reliance on televised weather forecasts across all categories of actors, in all locations. This information was variously trusted because it is 1) generated by “respected people,” 2) according to scientific methods, 3) under the auspices of government departments, and 4) made widely available via an open source, and 5) usually reliable. But many interviewees also talked about how few televisions there are in their neighborhood, so that forecasts are more widely disseminated through informal discussion with friends and in public places. As a boatman in Jamalganj said, “We get weather information from the radio and TV and then we discuss it. By sharing the news with each other, everyone gets the news.” These narratives turned our focus toward working more closely with the Bangladesh Meteorological Department and their televised forecasts, and exploring other user-friendly forecasts available over the Internet (including those generated in Norway), as increasing numbers of Bangladeshis have access to the Internet through smartphones.

d. Encompassing narratives in the community

A quantitative analysis of the interview transcripts helped uncover the underlying structures that were often repeated across narratives. This work sought to identify some of the overarching narratives that pervade Sylhet communities, which individuals draw on in making sense of their own experience. One example of an encompassing narrative was already discussed in [section 4b](#), where we noted a common sense of “vulnerability” pervading the narratives of rice farmers. We also discussed how farmers drew on this narrative to different effect in telling their own stories, with some emphasizing their helplessness in the face of variable premonsoon rainfall while others saw this vulnerability as a challenge to be confronted.

We sought to understand these overarching stories because we saw them as both steering and embedded in the institutions and social structures that shape how a community knows and copes with the weather. As

scholars like [Bremer and Funtowicz \(2015\)](#) note, certain narratives can come to dominate institutions like local government, with implications for what counts as legitimate knowledge of nature and society in a place. As discussed in [section 2b](#), many scholars see a powerful scientific narrative of global climate change taking hold in places, and marginalizing local stories expressing natural and social orders ([Jasanoff 2010](#)). Indeed, the work of [Haque et al. \(2017\)](#) showed how government departments in Sylhet Division privilege scientific models and an engineering approach to risk at the expense of local understandings in designing river protection works in Sunamganj.

In the quantitative text analysis, after having standardized different forms of the same word (e.g., “rain,” “rainy,” “raining”) and having removed frequent words such as pronouns and prepositions (stop words), we used bigram and concordance analysis. Looking at bigrams first—that is, combinations of two words where one follows immediately after the other—the most frequent combination was “rain season.” This indicates that interviewees were most eager to recount their experiences with premonsoon and monsoon rainfall and storms, and hints at an overarching narrative on the unique identity this rainy season lends to the community. We also saw that bigram frequencies related to whether interviewees are classified as influential or affected. Specifically, affected individuals were more likely to use the bigrams “rain less” and “doesn’t rain” as well as “crops damage” and “people suffer[ing],” with a focus on vulnerability to variable patterns of rainfall. By contrast, influential individuals were more likely to use the bigrams “flash flood,” “heavy rainfall,” and “huge loss,” showing a greater focus on storms and extreme events. We can question to what degree influential narratives of extreme events have a dominant effect on how the community conceives climate variability and adaptation.

Second, we conducted a concordance analysis, which consists in identifying patterns of words occurring near each other. This analysis revealed “rain in the month of Boishakh” as a theme frequently brought up by the interviewees. Our concordance analysis helped us to further explore whether interviewees had seen a change over time in the Boishakh rainfall, by focusing on the responses where “rain” and “Boishakh” were no more than four words apart. This yielded 42 sentences, with 10 (24%) of the selected responses specifically noting that the rain in Boishakh had decreased, whereas none had noted an increase. The remaining responses stated no change or did not address the topic of change at all. This hints at a wider understanding in Sylhet communities about a reduction in premonsoon rain.

5. Conclusions: Next steps for knowledge co-production

In this final section we briefly look at how the narrative interviews fed into the next steps in the TRACKS co-production process, and conclude with comments on how our experience might guide next steps in the scholarship on co-production for climate adaptation.

a. *Next steps in the TRACKS project*

The narrative interviews were not only instrumental in eliciting tacit knowledge to inform co-production; they actively initiated the process of co-production itself. As social practice (Paschen and Ison 2014), sharing narratives through interviews was a first step in helping interviewees to bring up, reflect on, and organize their own understanding of the weather, in a public setting (with interviewers and onlookers). Their storytelling arguably acted as a rehearsal for subsequent interaction with TRACKS scientists and others in the community, preparing interviewees for dialogue as part of the co-production process. Finally, the interviews began a process of relationship building between project researchers and the communities, a process that continued through subsequent interaction within the extended peer community.

Following the interviews, a subset of the interviewees were invited to work with TRACKS scientists as members of an extended peer community, with one peer group set up in Barlekha/Hakaluki Haor (Barlekha) and another in Sunamganj Sadar/Jamalganj (Sunamganj). Analyzing the interviews, we identified likely candidates according to their level of knowledge, enthusiasm, openness, and place in the community's "weather knowledge economy," with an intent to include diverse perspectives. In November 2015 we invited 31 interviewees in Barlekha and 23 interviewees in Sunamganj to form two groups in workshops in March 2016.

The two-day workshops facilitated collaboration between scientists and community actors toward mobilizing high-quality knowledge about local rainfall and its impacts. The focus on rainfall came from the analysis of important weather phenomena and impacts in the narratives, with premonsoon summer rainfall and storms emerging as having the greatest impact and meaning for communities across all sites. The workshops began by retelling some narratives that emerged in the interviews back to participants as three short documentary-style films, to initiate workshop discussions. The first film followed a rice farmer with an underlying theme about the many different forms of weather information; the second followed the local meteorological department

scientist with a theme about uncertainty, and trust in information; the third film followed a schoolteacher and student with a theme about sharing weather information. As a reflexive step these films sought to 1) engage participants, 2) situate the co-production process in the local context, 3) recognize and accept the plural representations, knowledge, and meanings of weather in their community, 4) inform a collaborative process of knowledge building, and 5) invest discussions with a critical attitude; everyone was invited to appraise the knowledge offered by others and themselves.

This is not the place to expand further on the workshops, but as a result of that work the extended peer community identified areas for further research on rainfall and impacts, and designed a common portfolio of 10 indicators that are being measured by peer groups across both study sites, as citizen scientists. In this way, some of the original interviewees still work with us, voluntarily measuring indicators as diverse as rainfall and temperature, the density of mango tree buds, and the movement of insects. They meet for lunch every 1–2 months, and share information in an open-access "online laboratory." We hope they will continue to collaborate with us, learning about local rainfall and impacts, until May 2018.

b. *Next steps for the scholarship of co-production*

This paper situated itself broadly in the literature on climate adaptation as a social process, and focused on processes of co-producing weather knowledge through collaboration between scientific and local communities in a place, as an extended mode of science. We took up the methodological challenge of how to *elicit* local peoples' tacit knowledge in an explicit form able to be shared in a process of co-production for adaptation, and explored the potential offered by theories and methods of narrative. We presented our experiences in running narrative interviews with communities in Sylhet Division, Bangladesh, and how analyzing these narratives along certain themes contributed to our process of co-producing knowledge of climate variability and impacts in that place. In this way, we aimed to contribute to an as yet underdeveloped body of practice on 1) how narrative interviews can be employed in support of climate adaptation broadly, and specifically 2) how narrative interviews can be used as a first foundational phase in a co-production process. Our experience in Bangladesh saw some promise in the approach and there are opportunities for other scholars and practitioners to further explore narrative methods to these ends, as an interesting avenue for theory building.

Acknowledgments. The authors thank the respondents who shared with us their fascinating stories. Acknowledgements must also go to the 16 members of the research field teams, the employees of BCAS, and in particular Sunbeam Rahman, who helped with the interviews and with logistical issues. Thank you also to the TRACKS project colleagues in Bergen who lent their time and enthusiasm to designing the interviews, and the Bangladeshi community in Bergen who welcomed us into their homes and agreed to be our first interview subjects. We extend our thanks also to Madeleine Midtgaard, whose master's thesis took her from the interview design workshop in Bergen to the field in Bangladesh, and enriched our research along the way. Finally, this research would not have been possible without the funding of the Research Council of Norway under the KLIMAFORSK programme (Grant 235613). As research sponsor, the Research Council of Norway did not have any direct involvement in designing the study, in the collection and analysis of data, or in the writing of this article. All six co-authors made material contributions to the empirical research presented in this article and to the article itself.

REFERENCES

- Adger, W. N., J. Barnett, K. Brown, N. Marshall, and K. O'Brien, 2013: Cultural dimensions of climate change impacts and adaptation. *Nat. Climate Change*, **3**, 112–117, doi:10.1038/nclimate1666.
- Agrawal, A., and C. C. Gibson, 1999: Enchantment and disenchantment: The role of community in natural resource conservation. *World Dev.*, **27**, 629–649, doi:10.1016/S0305-750X(98)00161-2.
- Armitage, D., F. Berkes, A. Dale, E. Kocho-Schellenberg, and E. Patton, 2011: Co-management and the co-production of knowledge: Learning to adapt in Canada's Arctic. *Global Environ. Change*, **21**, 995–1004, doi:10.1016/j.gloenvcha.2011.04.006.
- Bal, M., 1997: *Narratology: Introduction to the Theory of Narrative*. 2nd ed. University of Toronto Press, 254 pp.
- Blaikie, P. M., 2006: Is small really beautiful? Community-based natural resource management in Malawi and Botswana. *World Dev.*, **34**, 1942–1957, doi:10.1016/j.worlddev.2005.11.023.
- Blanchard, A., and S. Bremer, 2015: Climate change and agricultural knowledge: Bangladesh through a mirror and magnifying glass. *Know Your Food: Food Ethics and Innovation*, D. E. Dumitras, I. M. Jitea, and S. Aerts, Eds., Wageningen Academic Publishers, 387–393.
- Bravo, M. T., 2009: Voices from the sea ice: The reception of climate impact narratives. *J. Hist. Geogr.*, **35**, 256–278, doi:10.1016/j.jhg.2008.09.007.
- Bremer, S., 2013: Mobilising high-quality knowledge through dialogic environmental governance: A comparison of approaches and their institutional settings. *Int. J. Sustain. Dev.*, **16**, 66–90, doi:10.1504/IJSD.2013.053791.
- , 2017: Have we given up too much? On yielding climate representation to experts. *Futures*, doi:10.1016/j.futures.2017.01.008, in press.
- , and S. O. Funtowicz, 2015: Negotiating a place for sustainability science: Narratives from the Waikaraka Estuary in New Zealand. *Environ. Sci. Policy*, **53A**, 47–59, doi:10.1016/j.envsci.2014.11.006.
- Bruner, J., 1991: The narrative construction of reality. *Crit. Inq.*, **18**, 1–21, doi:10.1086/448619.
- , 1996: *The Culture of Education*. Harvard University Press, 224 pp.
- Bushell, S., T. Colley, and M. Workman, 2015: A unified narrative for climate change. *Nat. Climate Change*, **5**, 971–973, doi:10.1038/nclimate2726.
- Cash, D. W., W. C. Clark, F. Alcock, N. M. Dickson, N. Eckley, D. H. Guston, J. Jäger, and R. B. Mitchell, 2003: Knowledge systems for sustainable development. *Proc. Natl. Acad. Sci. USA*, **100**, 8086–8091, doi:10.1073/pnas.1231332100.
- , J. C. Borck, and A. G. Patt, 2006: Countering the loading-dock approach to linking science and decision making: Comparative analysis of El Niño/Southern Oscillation (ENSO) forecasting systems. *Sci. Technol. Human Values*, **31**, 465–494, doi:10.1177/0162243906287547.
- Connelly, F. M., and D. J. Clandinin, 1990: Stories of experience and narrative inquiry. *Educ. Res.*, **19**, 2–14, doi:10.3102/0013189X019005002.
- Corburn, J., 2009: Cities, climate change and urban heat island mitigation: Localising global environmental science. *Urban Stud.*, **46**, 413–427, doi:10.1177/0042098008099361.
- Czarniawska, B., 2004: *Narratives in Social Science Research*. SAGE, 157 pp.
- Daniels, S., and G. H. Endfield, 2009: Narratives of climate change: Introduction. *J. Hist. Geogr.*, **35**, 215–222, doi:10.1016/j.jhg.2008.09.005.
- Farbotko, C., and H. Lazrus, 2012: The first climate refugees? Contesting global narratives of climate change in Tuvalu. *Global Environ. Change*, **22**, 382–390, doi:10.1016/j.gloenvcha.2011.11.014.
- Fernandez-Gimenez, M. E., H. P. Huntington, and K. J. Frost, 2006: Integration or co-optation? Traditional knowledge and science in the Alaska Beluga Whale Committee. *Environ. Conserv.*, **33**, 306–315, doi:10.1017/S0376892906003420.
- Fraser, H., 2004: Doing narrative research: Analysing personal stories line by line. *Qual. Soc. Work*, **3**, 179–201, doi:10.1177/1473325004043383.
- Funtowicz, S. O., and J. R. Ravetz, 1993: Science for the post-normal age. *Futures*, **25**, 739–755, doi:10.1016/0016-3287(93)90022-L.
- Grimmer, J., and B. M. Stewart, 2013: Text as data: The promise and pitfalls of automatic content analysis methods for political texts. *Polit. Anal.*, **21**, 267–297, doi:10.1093/pan/mps028.
- Hall, A., and G. Endfield, 2016: “Snow scenes”: Exploring the role of memory and place in commemorating extreme winters. *Wea. Climate Soc.*, **8**, 5–19, doi:10.1175/WCAS-D-15-0028.1.
- Hamblyn, R., 2009: The whistleblower and the canary: Rhetorical constructions of climate change. *J. Hist. Geogr.*, **35**, 223–236, doi:10.1016/j.jhg.2008.09.006.
- Haque, M. M., S. Bremer, M. S. B. Aziz, and J. P. Van der Sluijs, 2017: A critical assessment of knowledge quality for climate adaptation in Sylhet Division, Bangladesh. *Climate Risk Manage.*, **16**, 43–58, doi:10.1016/j.crm.2016.12.002.
- Hegger, D., M. Lamers, A. Van Zeijl-Rozema, and C. Dieperink, 2012: Conceptualising joint knowledge production in regional climate change adaptation projects: Success conditions and levers for action. *Environ. Sci. Policy*, **18**, 52–65, doi:10.1016/j.envsci.2012.01.002.

- Herman, D., 2003: Stories as a tool for thinking. *Narrative Theory and the Cognitive Sciences*, D. Hernan, Ed., CSLI Publications, 163–192.
- Hernadi, P., 1987: Literary interpretation and the rhetoric of the human sciences. *The Rhetoric of the Human Sciences*, J. S. Nelson et al., Eds., University of Wisconsin Press, 263–275
- Howlett, D., and J. T. Nagu, 1997: Agricultural project planning in Tanzania: A handbook on cycles and sequences, participation, identification, planning and design, economic and financial analysis, and environmental assessment of agricultural projects. The Development and Project Planning Centre at the University of Bradford, 89 pp.
- Hulme, M., 2008: The conquering of climate: Discourses of fear and their dissolution. *Geogr. J.*, **174**, 5–16, doi:10.1111/j.1475-4959.2008.00266.x.
- , 2012: ‘Telling a different tale’: Literary, historical and meteorological readings of a Norfolk heatwave. *Climatic Change*, **113**, 5–21, doi:10.1007/s10584-012-0400-1.
- IPCC, 2014: *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects*. C. B. Field et al., Eds., Cambridge University Press, 1132 pp. [Available online at http://www.ipcc.ch/pdf/assessment-report/ar5/wg2/WGIIAR5-PartA_FINAL.pdf.]
- Jackson, M., 2015: Glaciers and climate change: Narratives of ruined futures. *Wiley Interdiscip. Rev.: Climate Change*, **6**, 479–492, doi:10.1002/wcc.351.
- Jasanoff, S., 2010: A new climate for society. *Theory Cult. Soc.*, **27**, 233–253, doi:10.1177/0263276409361497.
- Jones, M. D., and M. K. McBeth, 2010: A narrative policy framework: Clear enough to be wrong? *Policy Stud. J.*, **38**, 329–353, doi:10.1111/j.1541-0072.2010.00364.x.
- Josselson, R., 2011: Narrative research: Constructing, deconstructing, and reconstructing story. *Five Ways of Doing Qualitative Analysis*, F. J. Wertz et al., Eds., Guilford Press, 224–242.
- Kearney, A. R., 1994: Understanding climate change: A cognitive perspective on communicating through stories. *Climatic Change*, **27**, 419–441, doi:10.1007/BF01096270.
- King, N., and C. Horrocks, 2010: *Interviews in Qualitative Research*. SAGE Publications, 256 pp.
- Kirchhoff, C. J., M. C. Lemos, and S. Dessai, 2013: Actionable knowledge for environmental decision making: Broadening the usability of climate science. *Annu. Rev. Environ. Resour.*, **38**, 393–414, doi:10.1146/annurev-environ-022112-112828.
- Kok, K., I. Barlund, M. Florke, I. Holman, M. Gramberger, J. Sendzimir, B. Stuch, and K. Zellmer, 2015: European participatory scenario development: Strengthening the link between stories and models. *Climatic Change*, **128**, 187–200, doi:10.1007/s10584-014-1143-y.
- Kuhn, T., 2012: *The Structure of Scientific Revolutions*. 4th ed. University of Chicago Press, 217 pp.
- Lejano, R. P., J. Tavares-Reager, and F. Berkes, 2013: Climate and narrative: Environmental knowledge in everyday life. *Environ. Sci. Policy*, **31**, 61–70, doi:10.1016/j.envsci.2013.02.009.
- Liverman, D. M., 2009: Conventions of climate change: Constructions of danger and the dispossession of the atmosphere. *J. Hist. Geogr.*, **35**, 279–296, doi:10.1016/j.jhg.2008.08.008.
- Lowe, T., K. Brown, N. Dessai, M. de Franca Doria, K. Haynes, and K. Vincent, 2006: Does tomorrow ever come? Disaster narrative and public perceptions of climate change. *Public Underst. Sci.*, **15**, 435–457, doi:10.1177/09636625060063796.
- Maloney, C., 1986: *Behavior and Poverty in Bangladesh*. Dhaka: The University Press.
- Mattingly, C., and M. Lawlor, 2000: Learning from stories: Narrative interviewing in cross-cultural research. *Scand. J. Occup. Ther.*, **7**, 4–14, doi:10.1080/110381200443571.
- McComas, K., and J. Shanahan, 1999: Telling stories about global climate change: Measuring the impact of narratives on issue cycles. *Commun. Res.*, **26**, 30–57, doi:10.1177/009365099026001003.
- MoEF, 2009: Bangladesh Climate Change Strategy and Action Plan (BCCSAP). Ministry of Environment and Forests (MoEF), Government of Bangladesh, 76 pp. [Available online at <http://www.bcct.gov.bd/index.php/publications-downloads>.]
- Nadasdy, P., 1999: The politics of TEK: Power and the “integration” of knowledge. *Arctic Anthropol.*, **36**, 1–18.
- Nielsen, J. Ø., and S. A. L. D’haen, 2014: Asking about climate change: Reflections on methodology in qualitative climate change research published in *Global Environmental Change* since 2000. *Global Environ. Change*, **24**, 402–409, doi:10.1016/j.gloenvcha.2013.10.006.
- O’Connor, M., 1999: Dialogue and debate in a post-normal practice of science: A reflexion. *Futures*, **31**, 671–687, doi:10.1016/S0016-3287(99)00026-9.
- Orlove, B., 2003: How people name seasons. *Weather, Climate, Culture*, S. Strauss and B. Orlove, Eds., Berg, 121–140.
- Paschen, J. A., and R. Ison, 2014: Narrative research in climate change adaptation—Exploring a complementary paradigm for research and governance. *Res. Policy*, **43**, 1083–1092, doi:10.1016/j.respol.2013.12.006.
- Patterson, M., and K. R. Monroe, 1998: Narrative in political science. *Annu. Rev. Polit. Sci.*, **1**, 315–331, doi:10.1146/annurev.polisci.1.1.315.
- Paulson, S., 2011: The use of ethnography and narrative interviews in a study of ‘cultures of dance.’ *J. Health Psychol.*, **16**, 148–157, doi:10.1177/1359105310370500.
- Polanyi, M., 1967: *The Tacit Dimension*. Doubleday, 108 pp.
- Polkinghorne, D. E., 1991: Narrative and self-concept. *J. Narrat. Life Hist.*, **1**, 135–153, doi:10.1075/jnlh.1.2-3.04nar.
- Rayner, S., 2003: Domesticating nature: Commentary on the anthropological study of weather and climate discourse. *Weather, Climate, Culture*, S. Strauss and B. Orlove, Eds., Berg, 277–290.
- Reed, M. S., and Coauthors, 2009: Who’s in and why? A typology of stakeholder analysis methods for natural resource management. *J. Environ. Manage.*, **90**, 1933–1949, doi:10.1016/j.jenvman.2009.01.001.
- Scott, J. C., 1998: *Seeing like a State: How Certain Schemes to Improve the Human Condition Have Failed*. Yale University Press, 445 pp.
- Smit, B., and J. Wandel, 2006: Adaptation, adaptive capacity and vulnerability. *Global Environ. Change*, **16**, 282–292, doi:10.1016/j.gloenvcha.2006.03.008.
- Somers, M. R., and G. D. Gibson, 1994: Reclaiming the epistemological “other”: Narrative and the social constitution of identity. *Social Theory and the Politics of Identity*, C. Calhoun, Ed., Blackwell, 37–99.
- Stillier-Reeve, M. A., M. A. Syed, T. Spengler, J. A. Spinney, and R. Hossain, 2015: Complementing scientific monsoon definitions with social perception in Bangladesh. *Bull. Amer. Meteor. Soc.*, **96**, 49–57, doi:10.1175/BAMS-D-13-00144.1.
- Svoboda, M., 2016: Cli-fi on the screen(s): Patterns in the representations of climate change in fictional films. Wiley

- Interdiscip. Rev.: Climate Change*, **7**, 43–64, doi:[10.1002/wcc.381](https://doi.org/10.1002/wcc.381).
- Tvinnereim, E., and K. Fløttum, 2015: Explaining topical prevalence in open-ended survey questions on climate change. *Nat. Climate Change*, **5**, 744–747, doi:[10.1038/nclimate2663](https://doi.org/10.1038/nclimate2663).
- Wertz, F. J., 2011: A phenomenological psychological approach to trauma and resilience. *Five Ways of Doing Qualitative Analysis*, F. J. Wertz et al., Eds., Guilford Press, 124–164.
- Wilby, R. L., and S. Dessai, 2010: Robust adaptation to climate change. *Weather*, **65**, 180–185, doi:[10.1002/wea.543](https://doi.org/10.1002/wea.543).
- Wiles, J. L., M. W. Rosenberg, and R. A. Kearns, 2005: Narrative analysis as a strategy for understanding interview talk in geographic research. *Area*, **37**, 89–99, doi:[10.1111/j.1475-4762.2005.00608.x](https://doi.org/10.1111/j.1475-4762.2005.00608.x).
- Wynne, B., 1992: Misunderstood misunderstanding; social identities and public uptake of science. *Public Underst. Sci.*, **1**, 281–304, doi:[10.1088/0963-6625/1/3/004](https://doi.org/10.1088/0963-6625/1/3/004).
- , 1996: May the sheep safely graze? A reflexive view of the expert-lay knowledge divide. *Risk, Environment and Modernity: Towards a New Ecology*, S. Lash, B. Szerszynski, and B. Wynne, Eds., SAGE, 44–83.