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Health, the Environment, and Sustainability: Emergent Communication Lessons across Highly Diverse Public Participation Activities

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ABSTRACT: Most lessons about public participation are gleaned from very specific domains, yet innovative ideas often emerge when lessons across very different domains are brought together. Our public engagement efforts span health, the environment, and sustainability in rural and urban settings with long term residents as well as new immigrants. We have worked with hundreds of faculty and stakeholders in Maine, Massachusetts, and New Hampshire on topics as varied as immigrant fishing in contaminated water, shared governance of shellfish areas, remediation of lead contamination in urban areas, and shared decision making on dam removal. The diversity of these efforts offers lessons about strategies for public engagement for decision making.

1. INTRODUCTION

A strong and central focus on communication in its many forms is increasingly recognized as essential to advancing solutions to complex sustainability problems related to environmental quality and human health and well-being (cf. Cox and Pezzullo, 2016; Moser and Dilling, 2007). We see examples of this everywhere we turn, such as in a recent call from the Environmental Protection Agency (EPA) for proposals that ask for integrated research on ecosystems services and human well being that use partnership strategies based on effective communication. We see this again in news coverage about the 2015 Paris climate talks which describe how communication, and especially the development of a transparent and credible

decision making process for carbon emissions reduction, was fundamental to the purported success of these talks (Davenport, Gillis, Chan, and Eddy, 2015). And as a final example, we look no further than the Environmental Communication (EC) List curated by the International Environmental Communication Association (IECA), dated May 13th, 2016, where there are a series of posts drawn from diverse sources that describe the importance of bringing communication to bear on complex issues ranging from climate change, nuclear power development, ocean acidification, tribal justice, dryland management, and more.

Yet, one juxtaposition in this series of posts illustrates a core challenge in linking empirical insights from communication with diverse contexts (Wolf & Moser, 2011). In the first post the author describes how we must find common ground with those who may not share our views about climate change. Immediately following in the next post the authors advocate that we must find ways to change minds about climate change and they provide specific recommendations for how to do this. This single juxtaposition of best practices related to climate change communication illustrates a basic tension that we engage in our work: (1) how do we *generalize* about communication strategies when the topics that we study, our approaches to communication, and the context-dependent strategies for effective and ethical communication are so diverse, and sometimes contradictory; and in our efforts to generalize (2) how do we *avoid getting stuck* to instead remain flexible, adaptable, and ready to identify and incorporate new ideas as we encounter them? Both of these challenges—with generalizability and with stuckness (or what psychologists might refer to as functional fixedness)— are, in part, the outgrowth of underlying academic habits and are amenable to change using an array of innovation strategies successfully deployed in other fields.

As we have struggled with this tension, we have found it helpful to delve into the innovation literature in which it is argued that innovations are especially likely to occur when experiences across very different domains are brought together and compared and contrasted, essentially when they have to nudge up against each other (Easley & Kleinberg, 2010; Fox & Cooper, 2013; Marrone, 2010). In order to approach problems in fresh ways, the innovation literature suggests how crucial it is to devote efforts to finding ways to strengthen practice of learning across differences (Brzustowski, 2012; Silka, Kelly, & Ward, 2014; Van de Ven, Polley, Garud, & Venkataraman, 1999).

In this essay we illustrate what can emerge from comparing and contrasting across five elements of environmental communication: topics, disciplines, decisions, scale, and partners. These elements can serve as an interpretive framework for identifying, negotiating, and seeking new insights across differences in projects and contexts. We describe what we have learned from having had the opportunity and challenge of being immersed across contexts that vary in all these ways. Our public engagement efforts span issues with a combined focus on the environment and human well-being in health, the environment, and sustainability. Working across areas has been enormously instructive and has transformed what we do and how we think.

With funding from the National Science Foundation (NSF), the National Institutes of Health (NIH), the EPA, and many foundations, we have sought to develop solutions-focused stakeholder-researchers partnerships aimed at increasing collaborative research, solving real-world problems, and strengthening decision-making. Communication is at the heart of these. The three authors (an environmental communication scholar, a sustainability scientist, and a social and community psychologist) in our individual and shared activities have worked with hundreds of faculty and stakeholders in Maine, Massachusetts, New Hampshire, and Rhode

Island on topics as varied as immigrant fishing in contaminated waters, shared governance of shellfish areas, remediation of lead contamination in urban homes and gardens, and shared decision making about the future of dams. Dozens of projects have been completed (e.g., Hart et al. 2014) where we continually recognize the need to generalize across contexts and, at the same time, find strategies that fit with the particulars of a specific context. We have struggled with how to go about arriving at generalizations without losing the specificity. We have given much thought to how to take what we have found in one place and use it somewhere else when so many elements are so different.

In the upcoming sections, we provide examples that illustrate some of the differences across topics, disciplines, scales, decisions, and partners we have encountered and that have become a recurring challenge to our efforts to find solutions that translate across a variety of environmental situations. Through these illustrations our goal is to make visible the diversity of human and environmental situations likely to require innovative efforts if learning across differences is to accrue. We describe examples of strategies we have used and recommendations for adapting these strategies for use in other contexts in ways that help generalize and maintain openness to new insights.

2. FINDING COMMONALITY ACROSS DIVERSE TOPICS

Environmental topics vary so greatly and the dimensions of difference are so wide ranging that it can be hard to envision an approach for learning across the differences. How do we find the nuggets that are applicable for devising communication strategies, how do we select the ideas that are usable, and how do we decide which approaches on one topic might work for another? Consider two water-related environmental topics: vernal pools and contaminated rivers. Both concern water so it might seem natural that comparable public participation approaches could work to reach people with these environmental concerns.

In Maine, Aram Calhoun and her colleagues team have completed prodigious amounts of research designed to improve the management of vernal pools (e.g., Calhoun & Reilly, 2008; Calhoun et al. 2014; Jansujwicz, Calhoun, & Lilieholme, 2013; McGreavy, Calhoun, Jansujwicz, & Levesque, in press). Vernal pools are small wetland habitats that remain inundated for only a portion of each year. Because of their ephemeral nature, small size, and frequent occurrence on private lands in Maine, their central role in ecosystem and landscape processes has often been underestimated. They turn out, however, to be an essential habitat in the life cycle of many amphibians. For example, the eggs of several frog and salamander species are laid in the pools, after which larval and adult stages migrate across the terrestrial landscape to feed and overwinter. Land use changes such as urbanization and agriculture can disrupt dispersal routes from the pools to these terrestrial habitats. Calhoun and her interdisciplinary team began by examining how decisions were made, and how various science "gaps" constrained the development of decisions that effectively balanced environmental protection with economic development (Levesque, Calhoun, Bell, & Johnson, in press). This process led to a profound recognition that science *per se* is rarely sufficient to ensure the effective management of vernal pools. In particular, they learned that their work was more likely to be used in decision-making processes when the research: 1) addresses the needs and concerns of stakeholders (Calhoun et al., 2014); 2) has undergone peer-review to ensure its technical validity (McGreavy et al., in press); 3) is part of a stakeholder participation process that is perceived as inclusive, transparent, and fair (e.g., Cash et al. 2003, Hart & Calhoun

2010). Not surprisingly, communication was central to ensuring that stakeholders had access to weigh in, sufficient information about the ecology and possible economic impacts, and the ability to influence choices in the development of the research and policy (Senecah, 2004; Walker, Senecah, & Daniels, 2006). The consistent attention to communication and effective participation of key stakeholders promoted the team's ability to conduct research that resulted in "usable knowledge" (Clark et al. 2016).

In Massachusetts, some of our colleagues have studied contaminated rivers (Steinberg, 1991). Unlike vernal pools which are small, too rarely noticed, and often confined to a discrete location and of limited geographical range, rivers and their watersheds are often highly salient, pass through many zones, and are multiple use resources. The Merrimack River, which flows through New Hampshire and Massachusetts on its way to the Atlantic Ocean, has figured in much of the history of the region and has suffered for several centuries from heavy pollution resulting from unregulated industry and dumping from the mills that were the engines of growth for the regional economy (Malone, 2009; Marion, 2014). New populations of refugees and immigrants with strong traditions of subsistence fishing have moved to the area and have begun to fish the waters of the Merrimack (Pho, Gerson, & Cowan, 2008). The dangers of eating the fish and the importance of avoiding fishing have been a focus of environmental agencies because of these contaminated water bodies. The environmental agencies wanted to know how to communicate with these new families, how to assist them in understanding the pollution, and how to keep them from eating the fish. Although large scale policy could be the focus for environmental communication, here the environmental communication issue was how to reach individual families doing something that was not just about fishing but was very much a part of re-establishing family traditions from their home countries (Silka, 2002a; Silka, 2002b).

These are but two illustrations of the hundreds of topics encountered in efforts aimed at public participation and environmental communication (Cox & Pezzullo, 2016; Depoe, Delicath & Elsenbeer, 2004). Separately each suggests particular ways to go about environmental communication. It is by juxtaposing the topics against each other, one becomes cognizant of the characteristics that are not salient when the focus is solely on one topic: variations in the nature of problem that might suggest new possibilities for framing; the scope or size of the environmental focus; the target for change: policy, individual behavior; the degree to which the focus is interlinked with other issues such as health or development; and how upstream the sources of the problem are. Reflecting on one in comparison with the other can make new possibilities come to light (Hofstadter & Sander, 2012). Learning through the process of 'compare and contrast' can enlarge the range of possibilities. And it can help us see some things that might transcend topics such as public participation through the act of storytelling. The same actions can't be taken in every case but the topic can be viewed differently and in enlarged ways.

Practitioners often comment on the difficulty of drawing lessons from each other's case studies because the differences can be so sizable. If one is trying to design a public participation strategy in the Western U.S., for example, the land ownership patterns (i.e., much of the land is under federal jurisdiction) are such that it can be hard to see how to learn from a successful public participation approaches in the East where land is more typically under private ownership. The process of comparing and contrasting two very different case studies can promote innovative problem solving that moves beyond rejecting the differences to more

systematically analyzing differences and producing new insights from them (McGreavy, Druschke, Sprain, Thompson, & Lindenfeld, in press; Sprain & Timpson, 2012).

3. LEARNING ACROSS DISCIPLINES

The innovation literature indicates that many innovations happen, not when everyone working on a problem comes from the same area of expertise, but from when they bring related expertise from different disciplines together (Van de Ven, Polley, Garud, & Venkataraman, 1999). Given all the studies on interdisciplinarity, one might assume that the steps to successful interdisciplinarity would by now have been entirely established and that the roadmap for success would be firmly in place. Certainly there has been no absence of pronouncements about the urgency in environmental efforts of combining disciplinary perspectives (Miller et al., 2008; Palmer 2012; Pretty, 2011). But it is still far from the case that such efforts have yielded the full range of anticipated benefits. To the surprise of many, efforts to bring disciplines together often fall flat, even on the very problems to which each discipline has devoted substantial intellectual resources (Newell, 1998). Too often interdisciplinary collaborations exact formidable transaction costs for little visible result. So why attempt interdisciplinarity at all? What could make it work? How can it be done differently?

Our approaches to environmental communication have taken on new forms as a result of integrating disciplines with an emphasis on incorporating each other's generative concepts. Given the importance of innovation, we wanted not so much to put our approaches together as to start by putting generative ideas together. What we have done that diverges from what many others have done is to come together around generative concepts brought to collaborations from individual disciplines. Often as we tackle a concrete problem such as solid waste management, we frequently find ourselves proceeding at the level of drawing generative concepts from each other's disciplines rather than putting together our disciplinary research approaches or empirical data. From her discipline, McGreavy brings "boundary spanning" and "use of metaphors." From his discipline, Hart has brought to the conversation such concepts as "coupled social-ecological systems," "knowledge systems," and "resilience." From her discipline, Silka has brought "community-university research partnerships" and "attitude-behavior links." Our work has been transformed by the back and forth conversations that occur, by the form the concepts take when they are brought out of our disciplinary contexts and into the interdisciplinary arena. As a result of this process, our ideas don't just touch at the corners. They confront each other. They interrogate each other. They become generative and spark innovation. The concept of resilience has been important to an understanding of ecosystems but has its own body of research in psychology in terms of theories and studies of how individuals become resilient in the face of circumstances that typically create psychological damage. What does the research indicate about what produces resilience at the individual level? Can this offer insights into what might be important to look at in resilient ecosystems? Can these two very different disciplinary formulations about resilience help each other? Can they be understood within a framework of coupled human-natural systems? The focus is not on exact transference but on generativity. And the goal is not to reify a particular discipline's concept or framework but rather to see how putting concepts together might allow us to come at a "wicked problem" (Brown, Harris, & Russell, 2010) in more productive ways.

And the disciplines of communication, ecology, and psychology are by no means the only involved: there have been many others (economics, education, engineering. history). Each brings generative concepts that can prompt new ways of looking at familiar problems. Our

work has been reshaped by becoming familiar with each other's disciplinary journals (and looking at our own journals through others' disciplinary lenses) and by attending each other's disciplinary gatherings (and looking at our own events differently when our team members from other disciplines attend). The strength of this approach is the way it can reduce the "silos" of our disciplines without devaluing what disciplines bring to the conversation.

4. LEARNING ACROSS SCALES

Environmental work ranges across multiple scales. An entire watershed has sometimes been the focus of attention and, at other times, the efforts have been directed at a single pond or stream. Sometimes the focus has been on solid waste practices across an entire state or region; at other times a single school's approach to the waste created in their facility has been the emphasis. A whole state or region or watershed or a whole forestry landscape has been the focus of some of the environmental efforts. Sometimes the focus has been had a much small scale: the single woodlot owner, a single shellfish bed, a single small rural community. In a new project focused on the future of dams (http://umaine.edu/mitchellcenter/road-to-solutions/new-england-sustainability-consortium/the-future-of-dams-nest/), we are particularly concerned with communication and participation processes that influence how decisions (e.g., to remove or repair an aging mill dam or relicense a hydropower dam) are made at the scale of individual dams as well as across thousands of dams that are present throughout New England. For example, the removal of a single dam may yield no benefits for the restoration of sea-run fisheries such as salmon or river herring if downstream dams remain in place that block fish migration. Thus, decisions about individual dams can often benefit from multi-scale analyses that consider the tradeoffs of different decision options across a network of dams (Owen & Apse, 2014).

This issue of scale and how efforts in small areas can be scaled up to larger areas for greater impact has been the focus of many sustainability deliberations (Cash et al., 2006; Gismondi, Connelly, Beckie, Markey, & Roseland, 2016; Kates et al., 2001). Analysts have noted that features may emerge at a larger scale that did not occur at a smaller scale. And considerations have been given to tipping points at various scales, where scale is a factor in terms of points at which disruptions of ecosystems are great enough that prior states cannot be re-established. Processes of resilience may occur in different ways at different scales. Scale issues could interact with environmental communication in significant ways. In addition to ecosystems processes possibly behaving differently as a function of scale, the means of communication also differ and are often richer and more complex in small areas such as communities. The factors that make for more impactful in communication (e.g., higher similarity, higher trust, sense of control, opportunities to personalize message) are in greater abundance at the local level. At the community level, one can interact with individuals and issues can be discussed face-to-face. Yet the levers for change may be outside the small area or community where the face-to-face environmental communication is an option. Broadening the scale may also reveal where there are overlapping jurisdictions: local, county, state. The overlapping jurisdictions may have contradictory rules.

When researchers work at environmental communication at only one scale, they may come up with one set of conclusions about best practices in environmental communication that might not hold for other scales. When one's work moves back and forth across scales, it may be more apparent that one size does not fit all. It will be easier to see how vehicles for

communication may differ (e.g., social media versus face-to-face), and the many things that complicate environmental communication may be more evident when comparing across scales. All of this affects the viability of a communication strategy. Questions of the environmental scale of the problem in many cases link to how many people need to be reached if an environmental problem is going to be successfully dealt with.

The book *Scaling Up* (Gismondi, Connelly, Beckie, Markey, & Roseland, 2016) nicely captures the importance of attending to scale:

> The innovations discussed in this book have been proven to work at the local level, but the question remains of how to deepen and broaden their extent—how to scale them up and out so as to create structural and societal change. *Scaling Up* means escalating the impact of a particular innovation within the sector in which it operates, from community to city, from region to nation. *Scaling out* means taking innovations that have proven effective in one place, extending their impact through diffusion and adaptation into new geographical locations and new sectors.

5. LEARNING ACROSS THE TYPES OF DECISIONS TO BE MADE

One central goal of research on environmental communication is to promote learning for informed decision making (Daniels & Walker, 2001). Ideally, environmental communication research will arrive at generalizable approaches that can be implemented across a range of contexts and that are not held hostage to the vagaries of any one situation. The problem is that different situations create highly different decision scenarios (Beierle & Cayford, 2002). They differ in terms of who is making the decision, the nature of the topic, the type and availability of relevant information, including the degree to which that information can be brought together to create a coherent picture of the problem and potential solutions. With the problem of arsenic in private wells—a very significant problem in a rural state like Maine where a large percentage of homeowners obtain their water from private wells--it is the individual landowner who must ultimately assess their arsenic exposure risk and decide on potential options for risk reduction. In contrast, many land use decisions in New England - including those involving vernal pools - are mediated by communication processes between private landowners and municipal governments, with considerable input from state and federal agencies. A region may be trying to develop a framework for development so as to anticipate future environmental issues. State policy makers may be attempting to decide about whether to restrict shellfishing areas because of contamination. Dam removal may be being considered with attendant issues about fisheries, power production, flooding, recreational use and so forth. The ecological health of entire watershed may be the issue and so many decision makers at many levels from many jurisdictions may be involved.

In short, the decision contexts differ greatly. It could be individuals versus groups who are faced with the difficult task of making the environmental decisions. The decisions could be about short term environmental issues or issues that are much longer in their emergence or impact. The decisions could be for a geographically small area or a much larger one. Given all of these differences, how do we arrive at a robust, transferable, generalizable communication strategy? Is there anything that can transcend all these variations?

When different contexts are compared and contrasted, one element nearly all share in common is the overwhelming amounts of information that must be brought together and sorted through in deciding what to do. As Gismondi et al. (2016) note:

How can we respond quickly and effectively to this sustainability change? Information is not enough, that much we know. We cannot just put information in front of decision-makes and wait for them to make the right decisions. (p. 8)

In short, something needs to happen if the communication of large amounts of complex, potentially disparate, and sometimes conflicting information is to be transformed into an effective process for arriving at solutions. One promising strategy for responding to such challenges is the development of decision support systems, which include a wide range of analytical approaches and tools for examining the tradeoffs and uncertainties of alternative decision options (Ahmadi et al. 2015). In our experience, such tools work best when they are carefully designed to reflect the multifaceted nature of real-world problems and decision-making contexts, include diverse stakeholders in their development and use, and are based on robust methods to ensure their reliability and validity (Waring, 2012).

Together with our partners, we have developed used such decision support tools in such diverse contexts as land use planning, the regulation of coastal fisheries, and renewable energy development. For example, Spencer Meyer and his colleagues have worked with communities, businesses and citizens to create a decision-support tool called the Maine Futures Community Mapper (http://www.mainelandusefutures.org/) that facilitates the development of strategies that balance more effectively the often-conflicting goals of promoting urbanization, working forests, agricultural production, and environmental conservation (Meyer et al., 2014).

Although such decision support tools can be helpful, it is important that they not be reified or viewed as a substitute for active, iterative, and inclusive engagement with diverse stakeholders. Instead of asserting that a particular decision support tool is the only way to approach the problem, the boundary object literature can be drawn on to show how decision support tools can be used as a boundary object that brings diverse groups together for productive analysis (Guston, 2001; McGreavy, Hutchins, Smith, Lindenfeld, & Silka, 2013). The innovation possibilities inherent in emerging work on decision support tools are tremendous. It might be said that a decision support tool can be one step in taking the wickedness out of wicked problems.

6. LEARNING ACROSS TYPES OF PARTNERS

It is a given that as a maturing field we need to emerge with a set of overarching rules that can be passed on to others about effective structuring of environmental communication. Yet we are also advised that environmental communication strategies need to be tailored to those we want to reach and to the particular environmental decisions they will confront. And, these types of decision makers vary across an increasing complex range of characteristics. These partners can be individual decision makers, small groups, or an entire community. The partners could be policy makers, business leaders, or position holders at the local, state, or national level. They could be a collection of people who are in agreement with each other or a community in which individuals hold vastly different views. They could be people well-versed on the environmental issue in question or those who have not yet had opportunities to immerse themselves in the complexities of the issue. They could be people who have grown up in the area where the environmental problem is making itself felt or they could be individuals who are newly immigrated to the area. They could be people who live near each other in urban areas or people who are highly dispersed and unable to talk together or be reached in a face-to-face context.

Too often what we have learned in working with one type of partner does not translate into successful collaborations with another.

There is a fundamental conundrum here: *what* can we take from efforts with one kind of audience and *how* can we apply to new ones? In some instances the differences may be so stark that there can be a tendency to conclude that nothing can be learned from any guiding rules developed for a very different group than those we are trying to reach and thus we resort to starting from scratch. In other cases, people simply apply the overarching rules as if the rules were unquestionably generalizable. In the former case, we are left with ignoring what has come before and trying to generate new rules for each new type of partner; in doing so, we inevitably find ourselves playing catchup because it is often it too late by the time we figure out what will work with new partners. In the latter case, we are adopting guidance that we assume is a good fit but may not be. We are back to the conundrum of how do we generalize from specific instances but not over generalize or apply what might be unsuitable?

Part of the problem is that often what is offered in terms of what to do with partners is too general, too often taking the form of truisms: 'be sure to keep your audience's views in mind,' 'understand where people are starting,' 'keep in mind that individuals behave differently than do groups.' As we have worked across very different environmental communication partnerships, we have tried to see if there is more thoughtful way to envision partners. We offer two examples here: working with new immigrants and working with solid waste partners.

Immigrants are one kind of partner for environmental communication. Many different environmental communication strategies were implemented in Massachusetts with new immigrant communities (Silka, 2002c). Consider some examples of the rich complications in working on environmental communication in partnership with newcomer communities (Silka, 2007). With Environmental Protection Agency funding, an environmental television show was created in which Southeast Asian youth interviewed their Buddhist elders and environmental officials (Chao & Long, 2004; Silka, 2002a). This approach was adopted because in the Southeast Asian culture it is not appropriate for youth to be the knowledge holders yet young people were the ones who were learning the information (Silka, 2002a). The communication strategy took this into account. This was also taken into account in building a communication strategy around a Southeast Asian Water Festival that recreated on the Merrimack the traditions on the Mekong but added environmental themes. Lowell's housing stock is old with much in the way of contaminants in available housing (Coppens, Silka, Khakeo, & Benfey, 2000). Other communication strategies were built around identifying who were the highly respected communicators in the Southeast Asian community (Grigg-Saito, Leong, Och, Silka, & Toof, 2008). Some communicators turned out to be local Southeast Asian women who operated their own home daycare centers; they became the ones to teach families with young children about how to recognize and address environmental threats in their homes in their new community. Similarly, English as a Second Language (ESL) courses were a community resource: many newcomers were taking ESL to learn English and the instructors were in need of content and so it was possible to build lessons around environmental air quality in the homes right into the curriculum. As noted earlier, fishing in the contaminated river was an urgent problem and environmental officials were calling for fishing advisories to be translated and handed out to Southeast Asian families. This wasn't enough. It was important to understand the centrality of fish and fishing and to understand the multiple reasons immigrant newcomers were fishing and would continue to fish. Visiting Buddhist temples provided information about

cultural practices and dietary traditions. In looking to understand the centrality of fish in diets, stories were gathered. Story telling around favorite recipes for the many cultures in Lowell took place. The stories and recipes were then put together to illustrate how all groups in Lowell share a tradition of fish; these stories were linked to fish advisories but also with information about actions that could be taken. In short, culture was central and was an important organizing strategy in many ways with these partners (Silka, 2007; Silka 2002d).

Imagine a very different context with very different partners. Solid waste throughout the rural state of Maine has become an increasingly important environmental issue that is of great concern to highly varied partners: town officials, state policy makers, community members, schools and universities, businesses and industries that pay fees for getting rid of their trash, that collect trash, and that recycle and repurpose what otherwise might end up in landfills that are increasingly near capacity (Blackmer et al., 2015; Isenhour, et al., 2016; Isenhour et al., 2015). Towns are devoting ever larger portions of their scarce budgets to waste costs and to managing rapid changes in the toxicity of the waste stream. And the various partners do not necessarily share the same views, have the same needs and goals, or have access to the same resources and information. Discussions and planning are frequently contentious. And there have been lots of troubled experiences in the past. As a result of all of the above, various participants in the solid waste arena are struggling with learning from each other, learning across their differences, and devising strategies that provide new opportunities for dealing with a range of issues and challenges. Environmental communication issues in partnership contexts such as these are strikingly different from the case of new immigrant communities in urban areas of Massachusetts.

Partners and partnerships come in so many forms that the variation can be dizzying as we attempt to learn across differences. The communication researcher Bieluch is one scholar who has begun to explore ways to learn across differences by articulating what those differences might be. In her studies of researcher-stakeholder partnerships, for example, she has completed detailed investigations of what different partners in the municipal realm regard as valuable in engaging with researchers (Bieluch et al. 2016). Such efforts to compare and contrast partner preferences hold promise in providing data for analyzing differences in ways that could generate innovative solutions for learning from these differences and thereby contribute to the development of effective environmental communication practices.

7. DISCUSSION, IMPLICATIONS, AND NEXT STEPS

Each of the five highlighted areas illustrates an important variation in environmental contexts that has implications for building effective and generalizable programs of environmental communication. By no means do these spotlighted areas capture the only ones that could be important. Nor do they always occur independently. Often they can be interlinked. At large scales, particular topics may be more likely to be the focus. Some topics may be more likely to be associated with specific kinds of partners. Particular kinds of decision support tools may have particular value when certain kinds of disciplinary knowledge are brought into the arena. And all of this is rife with complicating paradoxes. The need for solutions may sometimes be greatest at large scales (e.g. the need to reduce the global emission of greenhouse gases), but the local problems may be those for which actors experience the highest motivation and sense of control to solve.

In all of this, the place of environmental communication cannot be overstated. Issues of environmental communication too often in the past have been seen by various disciplines involved in environmental studies as something that comes into play once the science has been completed and the results need to be communicated. Such a view misses the fact that studies of communication processes need to be deeply integrated throughout the research process. The discipline of communication has a central role to play in moving environmental research and policy beyond its current state. In fact, the theories and practices well understood by communication scholars are central to the generation of knowledge: using metaphors, using analogies, using storytelling (Kahneman, 2011).

Cross-disciplinary uses of generative concepts, pursued in innovative ways, will help move the field beyond approaches and practices that have tended to be constraining, problematic, and rate limiting (Larson, 2011). There is another way to learn, one that we have argued will serve better and has greater promise because it provides a bridge across differences. This other way, moreover, can be a prompt for innovation. We have argued that it is better to learn from each other through the use of emerging generative concepts. We need not look far for these concepts. As we have indicated, environmental and sustainability research is replete with overarching concepts that show great promise in stimulating cross-context learning. Throughout this paper we have touched on a few such generative concepts, but they are part of a whole host of potentially generative concepts: 'wicked problems,' 'boundary spanning,' 'resilience,' 'honest broker,' 'the loading dock problem,' 'the commons,' 'knowledge co-production,' 'citizen science,' 'stakeholder-researcher partnership,' and 'developing knowledge that is salient, credible, and legitimate.' These concepts are not directives. They are not roadmaps. They are not best practices. Rather, they serve to stimulate reflection processes that often prompt innovation (Silka, 2014). One might say, 'here is a wicked problem in an urban setting and, given this wicked problem, here is what we tried to do to strengthen environmental communication.' Rather than applying the original approach unchanged to a rural setting, by using generative concepts we are prompted to think innovatively about what constitutes a wicked environmental problem in a rural setting and what this suggests we might need to do to create effective environmental communication in that rural setting.

Differences can seem insurmountable. When people look from the perspective of their rural setting at what was done in the urban setting, they might be tempted to say, 'we can't do what they did. We don't have the same resources, and things are different here than in cities.' People sometimes talk as if there are no lessons to be drawn on because the rural-urban differences are just too great. When we move the analysis to emphasize generative concepts, the conversation has the potential to change. Consider the generative concept of citizen science: it has been used to foster bringing together scientists and community people who lived near each other. Citizen science in an urban area may involve participants being able to have considerable face time together. If we were to do citizen science in highly dispersed areas it could still be done but would likely need to take a different form. How might people think through what would work to achieve the overarching goals? Conversations could involve asking which aspects of citizen science are important: how people come together, who controls the coming together, how they communicate with each other, and so forth. The overarching concept of citizen science could surmount differences. Similarly, the overarching concept of 'honest broker' (Pielke, 2007) could be used to move beyond a focus on rural-urban differences. Those in rural areas might say that there seems to be certain kinds of contributors

in urban areas that play a neutral role and help negotiate differences in environmental views, and we do not have these same kinds of contributors in our rural area. But bringing in the honest broker analysis might provide opportunities to innovate by thinking not about the exact type of contributor but the overarching role. An honest broker in the urban context might look different from an honest broker in a rural context. Using the concept can be a way to learn across differences and innovate.

Overall, the point of this paper is how important it is to find an approach that works across highly diverse contexts. When moving across topics, what would the use of overarching concepts as bridging frameworks look like and how can this be a way to foster the development of a corpus of useful environmental communication knowledge? The concept of citizen science was shaped by the challenge of involving citizens in collecting data that track shifting bird distributions. A very different topic is the emerging environmental problem of solid waste, with questions being raised about the rapid increase in trash production and how to get the message out about the need to reduce waste. This topic of trash has little in common with that of birds; thus, it can be hard to see how people studying birds can learn from people studying trash. But placing the focus on the overarching concept of citizen science can move beyond the specifics and help in envisioning how to involve people in assessing the magnitude of solid waste so as to lead to effective environmental communication. Rather than encouraging exactly the same strategy, the point here is to use the concept of citizen science to innovate around involvement and communication. Citizen science has worked for "sexy" topics like the study of rare birds, polar bears, whales, and the like. Trash is far from being such a topic. Using the concept of citizen science can lead to new ways to think about waste but also new ways to imagine the uses of citizen science in a broad range of unexpected contexts.

Finally, what is being pointed out here is that there is a place for research but it may not be the role that is often envisioned. A corpus of usable knowledge is emerging, but that knowledge will not culminate in facts of the "how to" type. Research on environmental communication is unlikely to provide us with the data to tell us exactly what to do in the vast and puzzling array of contexts we face. That does not mean that we are inevitably starting from scratch. Research could help to produce a set of generative concepts that can serve as prompts for the process of problem solving across complex environmental communication. Thus, our knowledge goal is best understood as that of developing a body of generative concepts that then must be actively "interrogated" to arrive at possible solutions to the challenges of learning from each other across complex, different situations.

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