

# Interdisciplinary Engagement of People and Place Around Extreme Weather

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**Abstract** Extreme weather poses many challenges regardless of the specific environment. This chapter explores how extreme weather impacts people within their particular geographies by applying a new community engagement model. It answers the question, *why consider space, place and community in the planning process for extreme weather?* This chapter examines how people and place interact to influence community responses to extreme weather. An interdisciplinary community engagement strategy is presented as the best practice to establish effective engagement (communication and interaction) with people before extreme weather strikes. This requires meaningful social networks and trust with communities before planning, action and policy can be created. The best way to achieve meaningful community engagement is by employing a place-based interdisciplinary engagement strategy that builds on local culture, strengths and knowledge.

**Keywords** Community engagement • Place • Sociospatial • Extreme weather engagement • Place-based policy • Community health • Interdisciplinary

## 1 Introduction

The original idea for a book about extreme weather, health and communities arose after spending many hours sitting on the sidelines of our son's youth football practices and games. Sitting at these events, I observed some unexpected extreme weather (heat and storms). Clearly "normal" weather and climatic patterns for Southern California were shifting in a way that many community members were unaccustomed to experiencing. For instance, while attending our son's football game one October (a traditionally cooler month in California), unseasonably hot temperatures of 104 °F emerged, but the seven and eight year olds continued

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playing football with no extra water breaks! A similar experience happened while spectating at another game as an unexpected lightening storm broke out of nowhere. Again, the youth football game was not stopped due to the extreme and dangerous weather even though lightning strikes were occurring very close to the stadium! As a parent sitting in the stands I wondered, ‘Why aren’t they calling the game due to bad weather?’ The most likely reason is that no policy for game cancellation due to lightening exists—since it rarely occurs in Southern California. Clearly, this was an example of atypical weather conditions, but local people still engaged with their surrounding physical environment based on previously established patterns and knowledge. By examining relationships between extreme weather, health, community strengths, and social networks, governments and communities can better prepare for action when extreme weather strikes.

Simply sitting and watching people’s lack of response to extreme weather day after day spurred me to think that something is changing with the weather, but people are not doing anything to adjust their daily life patterns. To me, this was dangerous.

## 2 Extreme Weather and Changing Patterns

The term “extreme weather” conjures images of withered and cracked ground, homes being washed away by rising floodwaters or swirling black tornadoes ripping through neighborhoods in a frenetic swirl and sounding like a freight train. Such images have begun to appear with increasing intensity on major news networks on a fairly regular basis!

Images of extreme weather can be very vivid but may also emerge in more subtle forms. For instance, extreme weather is a more subtle ecological forms, when temperatures soar to unseasonal highs unexpected for a particular time of year. The 2015 heat wave in various parts of India produced temperatures of 122 °F on May 26, 2015 which is one degree short of the all time record of 123 °F recorded in 1956 (Burke 2015); this was illustrated in images of melting crosswalk paint dripping across the street. This heat wave resulted in the deaths of 1,100 people.

It seems like everyone has a vivid image of what extreme weather looks like—especially as it has become more common around the world. Increasingly, society is having greater first-hand experience with extreme weather scenarios! Since January 2012, the United States alone experienced 2188 days of record heat days, 1094 days of record rainfall and 245 days of record snowfall (Natural Resources Defense Council 2015). Both domestically and globally, societies are witnessing changing physical environments in the form of extreme weather. In fact, 2015 was the hottest year on record (World Meteorological Organization 2015). Extreme weather has a major impact on how people live, build and develop their communities by altering their surrounding environmental conditions. The years (2011–2015) have been described as the “warmest five-year period on record, with many extreme weather

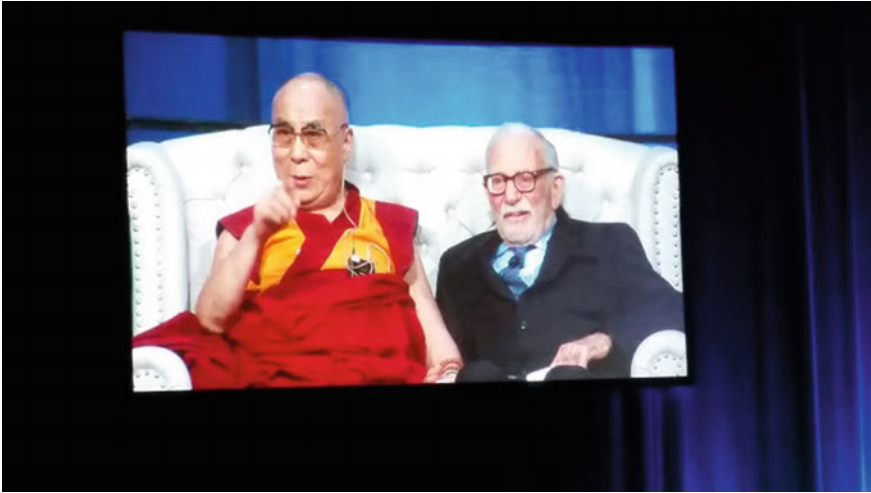
events—especially heatwaves” (World Meteorological Organization (WMO) 2015). In 2012, the United States experienced the most extreme weather since 1910, when record keeping began. Many places are beginning to face extreme weather episodes (e.g. Hurricane Sandy on the East Coast of the United States) not seen in over 100 years including Hurricane Patricia in October of 2015, which was “the strongest hurricane on record in the Western Hemisphere” (NOAA 2015). In December 2015, Chennai India experienced the effect of extreme rain and monsoon, experiencing, “the wettest December day in more than 100 years of records in Chennai” (Leister 2015a, b, p. 1).

## ***2.1 Religious Leaders Note Environmental Changes***

Major climatic changes are being noticed by the general public as well as being focused on by major global religious leaders such as Pope Francis, leader of the Catholic Church and His Holiness the Dalai Lama, a monk and more importantly the unrecognized leader of Tibet. In his *Laudato Si* “Praise Me,” the theological treatise, Pope Francis said the following, “A very solid scientific consensus indicates that we are presently witnessing a disturbing warming of the climatic system. In recent decades this warming has been accompanied by a constant rise in the sea level and, it would appear, by an increase of extreme weather events, even if a scientifically determinable cause cannot be assigned to each particular phenomenon” (Associated Press 2015, p. 1). Much of Pope Francis’s message while visiting the U.S. in 2015 centered on an ecological notion, that “everything is connected” (Cremers 2015, p. 1).

In June 2015, holiness the Dalai Lama participated in a three-day Global Compassion Summit which I attended at the University of California Irvine in Irvine, California. Both Pope Francis and the Dalai Lama have spoken out on a consistent basis about human impact on the environment and our need to be aware of and take action on climate change. The Dalai Lama recognizes the connection between climate change and general health. “The Tibetan Plateau needs to be protected, not just for Tibetans for the environmental health and sustainability of the entire world” (Macaskill 2015, p. 1), noted the Dalai Lama on October 20, 2015. Interestingly, the home into which His Holiness the Dalai Lama was born was situated on a hillside in a place that experienced lots of extreme weather. Here is a description of his home town, “Taktser (Roaring Tiger) was a small village that stood on a hill overlooking a broad valley. Its pastures had not been settled or farmed for long, only grazed by nomads. The reason for this was the unpredictability of the weather in that area” (Official Website of His Holiness the 14th Dalai Lama of Tibet 2015, p. 1).

In 2015 the Dalai Lama participated in the Global Compassion Summit with environmental scientists and activists that focused upon Global Climate Change. Figure 1 shows the Dalai Lama in conversation with noted professor of geophysics emeritus and Secretary of the Navy/Chief of Naval Operations Oceanography Chair at Scripps Institute of Oceanography in LaJolla, California. The fact that there are



**Fig. 1** His holiness the Dalai Lama speaking with noted oceanographer Dr. Walter Munk at the global compassion summit, July 2015. Photo taken by author—Dr. Sheila L. Steinberg

religious leaders engaging thoughtfully with scientists in a public forum illustrates an example of interdisciplinary thought and engagement. Ultimately, the integrated and interdisciplinary an approach leads to a more complete and holistic view of a real-world problem.

## ***2.2 Extreme Weather and Places***

Extreme weather is as an unpredictable and intense force that continues to threaten existing patterns of life and health in places around the globe. Extreme weather has significant social and health costs (National Academy of Sciences 2015). Communities may find themselves proximate to flooding, tornados, extreme heat, blizzards and powerful storms. People develop patterns of settlement, commerce and industry around particular places, the climate, weather and resources.

Throughout the world many cities and towns were built along coastlines or rivers to facilitate transportation, commerce and to provide easy access to energy. The geographic location of such human settlements close to water sources means that more of these population centers are at risk to flooding and powerful storms. Each year, extreme weather creates natural disaster crises around the world that exert huge social and health costs (World Health Organization 2011). Between 2010 and 2012, 700 worldwide natural disasters affected more than 450 million people around the globe (Laframboise and Loko 2012).

Within the fields of public health, meteorology, environmental science and disaster planning, being able to identify populations affected by extreme weather is

central to best preserving community health. By taking steps to understand local social and physical environments ahead of time, more effective extreme weather polices can be created. This is especially true in light of changing environmental conditions. In fact, in planning for different types of extreme weather, it is no longer adequate to simply view the “general population” as one homogenous group. Rather, there is an important call to identify vulnerable populations within a particular geography (Schmeltz et al. 2013; Ebi 2006). Every community, city or town has a diverse population, some will speak different languages, hold different values and maintain different social connections. In every community some people are more vulnerable than others due to their social class and often due to their differences.

This chapter examines the social challenges associated with extreme weather. It focuses on how to best meet communication and engagement challenges and addresses how to best preserve community health. I focus on an approach that could be useful to government leaders, policy makers, community members and scientists. This approach centers on how to adequately prepare and establish feasible plans and community structures in place before the extreme weather strikes. When extreme weather crises are on the horizon, it is important that social networks are in place, along with a socio-technologically feasible plan and messaging about how altered and changing environmental conditions will impact the community when storms strike. Such patterns of communication and understanding between scientists and the communities must be established well-before the disaster of extreme weather hits.

A question that emerges is *what can a collaboration of scientists, policy makers, and community leaders can do to take action before extreme weather strikes?* Clearly, failure to react produces negative economic results. In this chapter, interdisciplinary strategies to encourage appropriate communication, interaction and action with the diverse public are explored in light of the Extreme Weather Spatial Health Model (see Fig. 3).

### 3 Extreme Weather Community Health Model

Currently, much of the impact of extreme weather on people’s health is not known, but continues to evolve under greater scrutiny (Yardley 2011; World Health Organization 2011). Scientists are paying increasing attention to the impacts of changing climate on human health in both urban and rural environments (Barata et al. 2011; McMichael et al. 2003; Costello et al. 2009). As extreme weather continues to occur, societies face altered physical environments that challenge currently established patterns of interaction and mobility. It is not surprising that people fail to change their already established patterns of interaction with the surrounding physical environment since their mobility and interaction patterns occur more of out of habit and familiarity with a daily routine more than anything else. For example, many rural people will hunt for certain animals according to the seasons and have established expectations about animal location and migration

patterns. However, when physical changes occur in ecological environments, it alters animal mobility patterns, which then naturally leads to changed human mobility patterns around hunting. Animals that change their migration patterns may be doing so because of changing environmental conditions and in such cases would be considered an adaptation to their surroundings (Milner-Gulland et al. 2011; Cole et al. 2015). So naturally, local people who hunt these animals must adapt their patterns as well in order to thrive and to find food.

Changing weather and climates have direct consequences for negative health impacts, often simply because the extreme weather is unexpected and sometimes unprecedented in terms of impact. During extreme weather, people may face limited access to familiar, usual food sources because extreme weather makes travel difficult and even dangerous. The health and well-being of certain indigenous populations and communities such as the Inuit, are being impacted by such changes (Wilcox et al. 2012). Wilcox notes, “These changes are physically altering the local and regional landscapes around communities, and disrupt the ability of the Inuit to continue to practice and participate in culturally and socially-important land activities” (Wilcox 2012, p. 539). These activities include traditional subsistence practices such as hunting and fishing.

It is not surprising that extreme and changing weather patterns influence rural populations—who are closely tied to the ebb and flow of natural environments—but it is also important to recognize that extreme weather troubles urban dwellers as well. Extreme weather can upset the normal balance and pattern of interaction within the larger environment. Extreme weather alters physical environments for communities, which naturally disrupts the flow of activity within places. Extreme weather essentially disrupts people’s normal daily activities. In a very short period of time, extreme weather can dramatically alter one’s mobility pattern and access to resources for meeting basic needs, such as food, water and shelter. Access to resources may quickly and totally be disrupted throughout the entire local environment and region. For instance, when Hurricane Sandy hit New York City and New Jersey, it left many residents without access to clean drinking water, power, food, sanitation and access to services (Schmeltz et al. 2013). The extreme weather event of Hurricane Sandy put residents of two states into a marginalized situation with their surrounding natural environment. In other words—the Hurricane Sandy severely altered the local physical environment with flooding and storms, and the normal pattern of mobility within their surrounding natural environment was severely changed (Fig. 2).

In a case study of Brooklyn’s response to Hurricane Sandy, residents “experienced increased exposure to the elements and limited access to routine medical care” (Schmeltz et al. 2013, p. 800). The impact of extreme weather led to greater exposure to the elements and reduced access to health services, limited access to food and water and increased exposure to an unsanitary environment (Schmeltz et al. 2013).

Another example of how extreme weather impacts physical environment can be seen in the continent of India, with the December 2015 monsoon rains, the

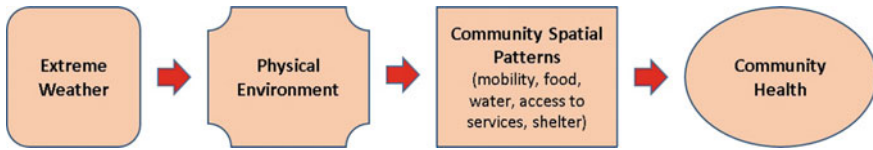


**Fig. 2** Photo of Mantoloking, New Jersey after Hurricane Sandy. *Source* U.S. Coast Guard Accessed on 12/12/15. <https://www.google.com/search?q=public+domain+photos+of+hurricane+sandy&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwjuyZbosNzJAhUU6mMKHalsBDQQ7AkIjw&biw=1920&bih=885#imgrc=2wum-4vZAFn3cM%3A>

intensity of which has not been seen in the region for over 100 years (Leister 2015a, b). The city of Chennai, India, faced, “the wettest November in more than 20 years as more than 1016 mm (40 in.) of rain fell (NOAA 2015). Major airports had to be closed, especially in the city of Chennai. Many people living in the South Indian region were put at great health risk from flooding that resulted from the storms. Extreme flooding brings disease and reduced access to clean water.

### ***3.1 Description of Extreme Weather Community Health Model***

The Extreme Weather Community Health model (see Fig. 3) presents a framework to explore health challenges of punishing weather events. The model portrays the broad impact of extreme weather on community health. Each model component is defined and this is followed by an overall model flow description. A close look at this model begs the question: what can be done to meet the challenges of extreme weather impinging local patterns of local life and mobility? No one can control the weather, but best practices and plans can be put into place to prepare for action before extreme weather strikes.



**Fig. 3** Extreme weather community health model

**Extreme Weather:** extreme weather can be defined as meteorological conditions that are life-threatening. This severe weather may take the form of tornadoes, torrential rain, blizzards or snow storms, extreme heat, or intense wind, rain and dust. Extreme weather is a concern for the general population because it presents a set of uncharacteristic and unexpected climate. When this type of weather occurs it is very challenging for people who are not used to it, not prepared for it, and may not even expect it.

**Physical Environment:** the physical environment can be defined the environment that surrounds people in a particular place. It can consist of natural and/or human created structures. Extreme weather often causes alterations and changes in the surrounding physical environment. This may come in the form of raging floodwaters, tree-toppling windstorms and destroyed built communities.

**Community Spatial Patterns:** community spatial patterns can be defined as the regular interactions and mobility of people who live in a particular place. These patterns may include where local populations hunt, engage with one another, attend school or participate in a variety of activities related to civic life and engagement. According to the extreme weather environmental health model, patterns of mobility and daily life can be severely impacted by changing weather that is both unexpected and extreme.

**Community Health:** community health may be defined as the general health and well-being of a population, and its subpopulations, that live in a particular geographic region. In this model, community health will be affected by many factors that begin with extreme weather.

### 3.2 Model Flow

As we have seen, extreme weather manifests in a variety of forms and is the main driving force (or independent variable) in the model presented here. A particular physical environment can be impacted by extreme weather, but the impact of the extreme weather event will be mediated by local landscape, topography, proximity to water and degree of urbanization. Extreme weather is increasingly a force that is challenging many populations which reside in diverse physical environments. Physical differences exist, such as between urban and rural, or marine and coastal, environments. For example, snow many melt faster in a more urban, heat island, environment (Semadeni-Davies and Bengtsson 1998) than in a more rural, and less built and paved, urban environment.



When extreme weather and flooding destroys homes and businesses, for example, people's mobility is curtailed and household budgets go toward recovery while spending priorities, and the local economy and community services suffer. Once an altered physical environment emerges, attention must be given to the impacts on local community health.

Human health is impacted by extreme weather in many ways, including direct physical injuries, illnesses that result from polluted post-extreme weather environments, water-and-food-borne diseases, infectious diseases, death amongst the very young and the very old and malnutrition and mortality (Barata et al. 2011). Whether someone lives in the city or in the country, there will be daily patterns of interaction and mobility, for example around established home ranges. A home range is a term often used in biology to describe the mobility patterns of animals. The concept of home range can also be applied to people. Everyday people have natural patterns of movement in a particular locale. As we have seen, we go to work and school, we shop for food, and we participate in community activities. During an extreme weather event, people often lose access to these fundamental needs. Usually what follows is a lingering impact on community health. This can be especially important for the elderly, the very young, the poor and members of the community with special needs who already face challenges of mobility. Research by Reckien (2014) found that level of income directly determines the type of impact a population will experience from extreme weather. Reckien (2014, p. 1) from her research in Hyderabad, India explains, "rainstorms affect low-income residents more than heatwaves, while the opposite is true for medium-income respondents" who, she notes, "tend to be less seriously affected by extreme weather in general" (2014, p. 1).

Our next section presents a strategy for how to combat extreme weather including how to prepare and create meaningful interaction and engagement with local populations.

## **4 Extreme Weather Interdisciplinary Community Engagement**

This section presents a strategy for extreme weather engagement, through discussing the important role of context. People's culture, geographic location, occupation and social status within a community all impacts how they interact with the surrounding natural environment. The best way to achieve effective community engagement is to employ that builds on local culture, strengths and knowledge about the local environment.

One learns from past life threatening weather events like Hurricane Sandy. In times of extreme weather, local people often first rely on themselves to respond to the event. This is especially true in more rural environments. Between 21 and 23 December, 1964, a major "thousand year flood" hit Northern California and specifically hard hit was Humboldt County, California where this author once lived (McGlaughlin 2014). "The '64 flood was caused by a deadly combination of

weather events that dumped massive amounts of snow in the mountains, followed by warm rains that melted the snow and inundated local watersheds in a matter of hours” (McGlaughlin 2014, p. 1).

The Great Christmas Flood of 1964 happened a few years before I was born, but it was well-discussed in the local lore of Humboldt County. Descriptions of community geography and water levels from the flood are still documented to this day by signs along the U.S. 101 highway. Here is one Humboldt County survivor’s brief description of the flood of 1964, “We were a family of 10 ... sitting on two pieces of plywood in the attic of our home while the Eel River swirled around us and roared in our ears. A log came through the window and other logs shook the house” (Nunes 2014, p. 1).

Having lived in rural Humboldt County for about 11 years, I became keenly aware that in smaller, remote communities, people often help each other when there is a crises or a need—especially in relation to weather-related events. For life in a rural area, when disaster strikes, people pull together. As one survivor of the 1964 flood, who was 12 at the time noted, “It’s funny how people come together in times of need and do extraordinary things. In our case, my family and our neighbors family worked together.” She described how her father and a neighbor ventured out into the dangerous flood to bring “his family and his hired hand’s family” to safety because it was safer with more than one person going alone. This same survivor notes, “At that point, we were all just one big family trying to get through an enormously stressful situation” (McGlaughlin 2014, p. 1). The fact that helping behavior emanates from within the community is great, but often true recovery means that a community also needs to rely on help from outside the community.

Therefore, if potential helping linkages within and between communities could be created ahead of time, prior to a weather disaster, it would translate into faster response when extreme weather hits. A major part of developing such a response can occur through reaching out to the populace in a particular area or region. In other words, community engagement become tantamount to successful extreme weather response.

#### ***4.1 What Is Community Engagement?***

So what does the term community engagement mean? The term means a two-way interaction with people who live in a particular place. This type of interaction can occur through a variety of means such as face-to-face, online, using the radio and texting. Past efforts to reach out to populations concerning hazardous weather have often been one-way, that is, the relevant weather service has sent out a message to the public and does not necessarily expect an interaction or even a reply. For engagement to be most effective, a two-way flow of communication is best because this requires acknowledgement and engagement from member of the population. The challenge with enacting a two-way flow of communication is that it is more labor intensive and takes more pre-planning and thought.

## 5 Why Interdisciplinary?

Interdisciplinary means drawing from a variety of different perspectives with participants having some understanding of most, if not all, the other perspectives or disciplines involved. Interdisciplinary problem solving is very useful because it enables different angles and viewpoints of the problem to be applied simultaneously. One might ask the question: Why does effective problem solving necessitate interdisciplinary thinking? The answer is simple, because using an interdisciplinary perspective provides a better, more comprehensive understanding of the problem.

The notion of interdisciplinary thinking and approaches to extreme weather engagement naturally benefits from the inclusion of various perspectives. This ultimately helps craft a more holistic solution, based on environmental, social and economic systems, which are interdependent. When one thinks about the challenge of extreme weather and health, one realizes just how multi-faceted the issues are. So for instance, the issue of extreme weather can be approached through a variety of disciplines such as Sociology, Geography, Anthropology, Political Science, Meteorology and Environmental Studies. Each of these perspectives highlights a different aspect of the challenge, but each perspective, or field, or discipline, brings valuable understanding and focus. Because multiple disciplines are important to consider, we have settled on the notion of interdisciplinary engagement, which means that a variety of approaches and people with diverse skill-sets and backgrounds are incorporated into the engagement and solution.

It will be important to discuss some terms as we look at this notion of engagement. First of all the term interdisciplinary engagement means working with people using a variety of approaches that consider who they are and where they are geographically. It means engaging with people in the context of their potential role and place. It means that before engaging you must know and understand the population. If this does not occur the result will be unsatisfactory. It is almost impossible to work with people before establishing some sort of normed two-way flow of communication and interaction with them. The goal is to establish important networks that can be put into operation when an extreme weather event strikes.

The most important thing to recognize about engagement is that whatever engagement strategy is selected, it should fit the needs of the population being reached. One may start by asking, ‘Who is the local population in a particular geographic area or place?’

## 6 Place

We define the term “place” as a geographic location that has meaning to a person or group of people. It too may exist physically or conceptually (Steinberg and Steinberg 2008). The definition of place can vary, but one overarching theme throughout is that the term “place” implies that they are all spaces which people

have made meaningful (Cresswell 2004, 7). What does this mean? It means that one must be aware of the geography, lay of the land- and more importantly, what physical aspects of the environment are important to local communities. Examining the notion of “place” is important in the study of how changing physical environments due to extreme weather impact people. We consider place when trying to create effective engagement because “emphasizing place highlights climate change’s effects where they are felt most acutely, where local strengths are best understood” (Hess 2008, p. 476).

It is important to begin with a discussion of space and place, since these two definitely impact the nature of human interaction with the surrounding environment. Space and place are important factors as one tries to understand a community in the context of its surrounding local environment. The terms “space” and “place” are terms often used interchangeably, but mean different things. The word “space” can be conceptualized as “the distance between places” (Steinberg and Steinberg 2015, p. 12) and is often used to determine position (Steinberg and Steinberg 2008). This is a construct that can be applied both conceptually and in-practice to real geographic distances.

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This would be followed by attempting to best understand the local, social environment, or to “define the community of interest” (Steinberg and Steinberg 2015, p. 205). The idea is that one wants to first understand and then define who lives in the community of interest. Good initial sources for U.S. data are compiled by the U.S. Census Bureau (U.S. Census 2015). One may also talk with local leaders (Steinberg and Steinberg 2015, 208), consult local commercial data sources and perhaps historical records from local government agencies, newspapers, business groups, schools and places of worship.

More information can be found through establishing relationships with local leaders from various sub-groups of the community. In any community, there are going to be leaders who step forward and are visible, but there are also going to be local ethnic and cultural groups that are not overtly visible and may be missed when people are trying to first communicate with people in a particular place.

## ***6.1 Sociospatial Strategies for Place-Based Policy***

A great way to better understand a local population is through a strategy that contextualizes people where they live, in their place. In other words, this can be

described as place-based policy. The ability to develop place-based policy is dependent on sociospatial understanding of the community. The term sociospatial means that one must consider space, place and social indicators in a holistic fashion (Steinberg and Steinberg 2009, 2015). Sociospatial communication means that space, place and social indicators are part of the communication design process. A major challenge when dealing with extreme weather boils down to the simple act of communication. Communicating about extreme weather is clearly not one size fits all! A Sociospatial community engagement strategy occurs through a series of steps that work together to create a holistic strategy of space, community and place. Basically, the approach addresses the role of people within the context of their space and place.

Sociospatial strategies help facilitate place-based engagement. Being able to use a sociospatial perspective helps to enable interdisciplinary understanding of a place and the people who live there. It allows researchers, policy-makers and weather outreach personnel to better understand the larger population within a particular geography.

It is important to understand the role that local populations and physical geographies play in determining potential extreme weather situations and appropriate reactions/responses to these situations. A more important factor to examine is the method or approach used for data capture. To effectively capture the picture or story of people within the context of a particular place/environment requires skills with different methodologies and perspectives. The approach is multi-methods, iterative and involves the knowledge and experience of people who are local or indigenous to a place. It is based on a broad methodological approach called Sociospatial Grounded Theory (Steinberg and Steinberg 2006, 2015). In that approach, people begin to understand a place from the ground up, and based around local characteristics of the environment.

For communication and messaging about extreme weather to be truly effective it must be considerate of the local population and it's culture. So, for instance, if you are trying to communicate to people in a rural area without an extensive Internet service and weak wireless connections, depending on an Internet communication strategy is not likely to succeed. However, another major means of communication that many rural people use—the radio—might be a better strategy for communicating. In many rural communities-the local radio stations often is regional communications hub for many people in the region, especially if it is locally owned and operated. Hence, one must consider the type of population and subpopulations that are under threat of extreme weather events, because “one-size fits all” does not apply! Those who make policy related to extreme weather notification and response should have the motto, *know your people, know your place, before you choose to act*. The strategies that work to communicate with some people in one place may not work in another place simply given the geography and local culture.

## 6.2 *Understanding People Community/Culture*

Establishing “community” means generating a sense of oneness or general holism. Community is definitely tied to place. This only evolves through meaningful interaction, which should be two-way, and is based upon trust. Too often, important information tries to be communicated to a certain particular sector of the population, but without prior footwork to establish a solid base and connection.

It is also important to consider stakeholder diversity—part of the process of creating solid place-based policy. Place-based policy means that decisions or actions are created in sync with a particular geography or place (Steinberg and Steinberg 2015, p. 372).

Cultures are shared norms and practices of a people or group. And different cultures definitely exist within a community. It is important to consider the role of culture and how it can vary greatly within a particular place. Culture will also be a mediating factor that influences how different community members will react and respond to extreme-weather.

Place is central to managing health related consequences of climate change (Wilcox et al. 2012). Wilcox et al. (2012) has explained the importance of place being “consider the importance of place ... to manage the health-related effects of climate change in locally-appropriate and culturally-relevant manner, and ... acknowledging that different groups and populations require different approaches to healthcare programs and service in response to changing climatic and environmental conditions depending on place and geographic location” (Wilcox et al. 2012, p. 54).

Throughout this chapter we have focused much on the concept of community. What do we mean when we say the word “community”? Community is being used to describe a group of people who are situated within a particular geography and who interact with one another on a consistent basis. This group most likely has shared norms, values and language. It should be noted that within a particular geographic region there can be multiple communities. There can be a dominant community with many sub-populations and sub communities; there can be wealthier and poorer members of the population as well. It is very important to be aware of all of these different groupings within a particular geography. If emergency planners, policy makers and scientists reach out to one particular group within the geographic region the other groups will be left behind. This in turn creates further vulnerability for populations that do not speak the same language as the message that is being conveyed. Additionally, it extends beyond language, to also include the populations that may lack certain means of high-tech communication as well.

One might be thinking, why is it important to consider community? It is important because recognition of the population characteristics gives a better sense for how best to best communicate and engage. This is understanding people in a

particular place. Community engagement is the vehicle through which this can occur. In identifying the local culture and community, some things to consider are:

- Who are the local populations within a particular geographic area?
- What are the cultural attitudes and values? What were their past practices related to extreme weather responses?
- How do the local populations communicate? What is the best media for communication—face-to-face, email, phone, radio?
- What are local norms and practices for interacting with the weather?
- How do local norms and past experiences with weather translate into action?

By asking these questions ahead of time, scientists, emergency planners and community leaders can be more effective and inclusive in their outreach efforts.

### ***6.3 How Context (Space or Proximity) Influences Outcome***

This section examines the challenges to place-based communication and action based around extreme weather. Extreme weather by its nature is a threat to effective and appropriate action and communication around these events. As noted earlier, the unique interdisciplinary engagement approach draws on multiple disciplinary approaches that span both the physical and social sciences. Know the people, know the place, and if you understand risk—one can be prepared for extreme weather. It all hinges on being correctly networked with local people and having a solid plan of action.

Anytime one tries to understand a demographic group it is important to consider where geographically this group is located, especially their proximity to other places, people and political boundaries. For instance, Branton et al. (2007) examined the contextual factors affecting voting patterns on highly charged U.S.-based propositions related to immigration. In the United States, the issue of immigration is hotly contested, especially in states along the U.S.-Mexico border. Anti-immigrant sentiments often prevail in these geographic areas. Studies have indicated that a person's spatial proximity to the border influenced how they vote. The closer one was to the U.S.-Mexico border, the more likely they would support anti-immigrant or "nativist" propositions and policies (Branton 2004). Their study also revealed that Anglo (White) Democrats living closer to the border were more likely to vote in favor of the policies targeting immigrants than Anglo Democrats living further away from the border. Their study also found that Republicans, no matter where they are located are likely to support anti-immigrant policy and legislation (Branton 2004). From these voting examples, one can see that place, space, geography and location matter in terms of social perspectives.

## 7 Knowledge About the Local Environment

We tend to call the experience and understanding of the local community, local knowledge. In other words, what people do in their community depends on geographic location, surrounding physical environment, type of community, social, ethnic and economic make up of the place. Many times, people who live in a local community possess the best knowledge about their surrounding natural environment. But often the extensive local knowledge is kept inside people's heads and is unfortunately not shared with others. People may think of a 'what if' scenario-such as, 'where will everybody go if a flood or tsunami comes?' But more likely than not, local people who live in a particular place have developed a particular understanding and knowledge about their surrounding environment knowledge and data which they will put into place to make quick decisions and to take action when extreme weather strikes. This is especially true if they are responding to extreme weather situations that they are familiar with and have experienced in the past. It becomes more challenging to react and respond to extreme weather when it is unfamiliar to the local community and may not have already been woven into the local knowledge about place, space and weather. Sippel et al. (2015, p. 225) note, "Dialogue between the parties, therefore, not only allows the science to be framed within one context, but also helps to situate the science in a range of contexts, providing parties with an equal stake in the knowledge construction." Science will be better understood if it is framed within the local context of place and environment, which is usually a part of community knowledge and experience.

When I was a U.S. Peace Corps Volunteer in Guatemala in the early 1990s, I was impressed at how, without access to any formal description of the weather, villagers were keenly aware of local weather patterns and signs for what kind of weather was coming! This was especially true in the case of rain, an important necessity for the farmers who lived in my village. After living in Guatemala for a certain period of time, I learned to recognize some of the weather related signs too. What I realized through my U.S. Peace Corps overseas experience is that people living in a particular place really do develop an understanding for their environment and local weather patterns. In those remote, rural, small place, people did not rely upon a centralized form of communication to understand what was happening with the weather, they simply made their own observations. This occurs often out of necessity for maintaining their local livelihoods, especially they are involved in agriculture. Or it could just be a natural skill, developed over time as people live in a particular environment.

What such rural remote villages don't have is the science to back up their actions. What they do have is the best understanding of two important things, (1) regular patterns of the local geography/environment in a particular place and (2) a solid understanding of local people or community members and their patterns and (3) a general understanding of normal weather patterns for their community. Why is this important? It's important because if someone wants to develop policy to combat the challenge of extreme weather, they first need to know



something about people in the place and how they interact with their local environment, under both normal and abnormal, extreme weather conditions. Additionally, it will be important to draw in local people's knowledge and experience with their surrounding natural environment as part of the extreme weather planning and policy process.

It should be noted that a community member's past experience and interaction with the local environment naturally directs future attitude, action and response to environmental change. Therefore, it is important to identify physical factors of the context (e.g. rural/urban or desert, woods, or seaside). Higgenbotham et al. (2014) found that in a study of environmental behaviors in Australia, the rural population "was attuned to conditions affecting agricultural productivity: they worried about drought and heat, saw trees dying and changes to seasons and natural rhythms" (2014, p. 699).

## ***7.1 Geographies and Community Type***

In any community there are going to be areas physically vulnerable to extreme weather. There can be vulnerable areas in both rural and urban areas, but the nature of the vulnerability will be different. The goal is to be able to understand the structure of the local physical environment and the people who live within these specific place boundaries. One question to consider is what are the biggest threats to the local population? For instance, who lives in a coastal zone? Who lives on a hillside and what happens to that community when it rains? Traditionally, wealthier residents are more fortified and have the resources to cope with the unexpected challenges that emerge through extreme weather, but the general public and poorer populations often lack that choice. When agencies and weather experts begin to realize the diversity of stakeholders living in a community they can better understand what to consider as part of a best strategy for engagement and education with the local people. One must first be able to understand the local physical challenges associated with living in a particular place before actively doing something, like planning for extreme weather. Adopting an interdisciplinary approach enables one to understand policy issues from a number of various perspectives.

Different geographies (e.g. urban, rural, suburban) consist of different types of people and cultures. People will know something about the environment in which they live, and what they need to do to survive there. Their knowledge about their surrounding natural environment usually comes over time and through experience dealing with bad environment under various circumstances.

It has become more common to recognize the important role of local knowledge in defining and understanding a particular emergency situation (Elwood and Leitner 2003; Hoeschele 1998; Sieber 2003; Robiglio et al. 2003; Robbins 2001, 2003). Local response and interpretation of an event boils down to perception, an understanding of the local environmental situation or problem that is occurring based on extreme weather. People who have spent a lot of time in a particular

geographic locale, are going to have a fairly good understanding of the ebbs and flows of local and regional climate and weather patterns. This knowledge and understanding of weather in a particular place is something that comes through interaction, persistent and ongoing interaction, with the surrounding natural environs. Unfortunately, many times the knowledge and understanding of the local people who live in a particular place is not effectively drawn upon.

## 8 Importance of Community Engagement

Scientific experts and leaders of various emergency response organizations often fail to recognize the extremely important local knowledge. What are local knowledge structures and how does one develop them? Perhaps the easiest example is of an American Indian tribe that makes its living through hunting and fishing in a particular coastal climate. The tribe that subsists on the surrounding natural resources will, organically over time, develop a very solid understanding of regional weather patterns and the geographic presence of particular animals and ecological species.

When extreme weather occurs over some length of time, noticeable changes begin to occur, such as animal migration and the presence or absence of ecological elements. Recently, in Southern California where I live, a marked increase has occurred in the number of different shark species that perpetually hang around various populated beaches in Orange County, California. This situation is unique in that these types of sharks (Hammerhead and Great White) have never appeared on a regular basis so proximate to the Orange County Beaches. Scientists have tried to explain their presence by noting that ocean temperatures have warmed and the fish that the sharks feed on have moved into the area. This creates a health hazard in the sense that if you go swimming in the ocean these days in Orange County, not only do you have to watch out for rip tides but you also must be on the look out for sharks as well! This is a good example of local climate and environment physically changing, with consequences for shark food sources, and overall mobility patterns of the sea creatures.

Often when scientists or “experts” define a situation, the local knowledge and perceptions are left out or ignored. To best prepare and respond to extreme weather, it is central to incorporate any local or “indigenous” knowledge about the places where they live into the planning process. One way to do this is through using an approach called Public Participation Geographic Information Systems (PPGIS). It is a great method to engage local people in defining their situation spatially, where they become involved. The term GIS is an acronym for the word Geographic Information Systems which is really computerized mapping. Local people know their local area and will sense when things start to look a little different and are out of sorts.

This community engagement approach is not without its challenges. It can sometimes produce differing perceptions of the context based on who the observers are and observer bias (Robbins 2003). In his study environmental knowledge in India, Robbins (2003) found that both animal herders and professional foresters

viewed the natural resources based on their cultural backgrounds. Basically, local perceptions of a natural resources were influenced by an individual's occupation and experience with the resource. After this study, the researcher noted the need to have a more targeted approach to bring together differing versions of spatial data (e.g. GIS expert versus local indigenous expert).

### ***8.1 Interdisciplinary Teaming for Engagement***

The term “interdisciplinary” brings together various aspects and approaches and integrates them into a larger whole. Different approaches for engagement with the public can be assembled, depending on the type of population being focused upon. Is it rural, urban, suburban or a combination? Interdisciplinary team strategies focus on creating teams of people from different backgrounds and areas of expertise that can work together. It also means that different sectors of the local population will be engaged in the conversation.

The question emerges, what is the value of using interdisciplinary teams to manage extreme weather responses and to increase positive health outcomes? Interdisciplinary teams work because there are people on the team with different areas of expertise, some who speak different languages and who bring overarching different skills to the team. Interdisciplinary teams create a better chance of success because the community is being approached through a multi-pronged and more robust process that facilitates more points of possible contact and engagement with the local community. Ultimately that is the greatest strength of an interdisciplinary approach.

To effectively assess a community's environment/health interaction it is imperative to have interdisciplinary approaches. This can help to account for challenges in transportation, mobility and ultimately in different levels and types of health expertise. Extreme weather will bring a variety of physical, environmental and social impacts, therefore a group of people is needed who can best understand and communicate with the public, and listen and react to the experience and ideas that the lay public and communities share. Sippel et al. (2015, p. 225) note, “a mutual exchange of information can support decision-makers' understanding.”

## **9 Place-Based Interdisciplinary Approaches for Extreme Weather Engagement**

Place-based Interdisciplinary approaches are built around the local environment and the people who inhabit it. Because local geography and environment often impact the way local people live on a daily basis, including their patterns of mobility, is extremely important when considering place as a design strategies for engaging extreme weather.

When planning local engagement around extreme weather, it is important to engage with communities using place and geography as a focus. This is because people who live shared geography are experiencing similar environmental conditions and extreme weather threats.

A goal of place-based interdisciplinary engagement is health action, taking action that will benefit people's health. This can take many different forms, from administering vaccine to moving people to higher ground if flooding is a threat.

In the field of public health there is the term, "adaptive capacity," which "reflects the ability of health systems to address, plan for, or adapt to adverse climate-related health outcomes and take advantage of new opportunities and benefits" (Berrang-Ford et al. 2012, p.1068). When planning for extreme weather, the same strategy can be employed.

## ***9.1 Navigating Local Geographies***

It is important to recognize that there are different levels of people and place. We refer to these as different geographies. The geographies that people operate in are diverse: there are social geographies defined by the boundaries and social networks that groups establish between themselves; conceptual geographies based upon groups' definitions of what places mean; and actual physical geographies or features of the physical environment that influence people and their interactions.

This chapter has presented an interdisciplinary model to understand people and extreme weather and communities in which they live. It is clear that the most successful engagements are built around interdisciplinary approaches that actively consider people in the context of their place—the culture, the local strengths, and their surrounding physical environment. Best practices for creating place-based effective communication strategies are presented next. The following precepts offer recommended actions to help create place-based communications and engagement. From a policy standpoint, if these rules are followed it will present more opportunity for effective action and response to extreme weather.

## ***9.2 Interaction, Establish Consistent & Ongoing Interaction***

One should create various opportunities for interaction that will resonate with people (e.g. create activities that foster interaction and sharing). According to the Interactional Theory of Community the definition of community is based upon interaction. The interactional perspective of community is based around the Community Field Theory (Wilkinson 1991). Community Field Theory is relevant to our discussion of interaction because it posits that community consists of three important elements: a locality, a local society and a process of locality oriented social interaction (Wilkinson 1991). The locality can be described as the place

where people live and “meet their daily needs together.” (Wilkinson 1991, p. 2). The best way to create community is to establish a regularity of patterned interaction. This is where the challenge of geography might come into play. However, within any community there are always places where face to face interaction happens.

Interaction is a shared nature of exchange that people have with one another. The term implies a two-way flow of information in general. This could consist of speech, communication, emails, sign language and other means. It is important for any engagement and communication effort to Establish Connections/Interaction with vulnerable populations. Create and vary opportunities for interaction that will resonate with local people (e.g. allow for communication via a variety of channels, face to face, online, and on radio and television).

Unfortunately, many times the knowledge that scientists possess and attempt to share is not adequately adopted or used by the general public (Sarawetz and Pielke 2007). But why? The most likely answer is because this information has been created in a manner that has not taken the local people or stakeholders into account. In other words the science may lack perspective. Then, too, the information may be too esoteric or jargon filled for a lay public to understand. Klos et al. (2015, p. 239) note, “although end user and expert engagement has been conducted at national and regional scales, there is a need for targeted engagement at finer scales to address the needs of local end users”.

### ***9.3 Know Your Culture/Community***

It takes effort, time, trust and interaction to establish a culture of trust among scientists, policy-makers and the broader community. Once established, further effort is needed around interaction and trust to keep the already established relationship going. Take time to nurture community and culture, and communication/interaction among scientists, policy-makers and the public can occur in a variety of arenas, such as the workplace, the classroom and the clubs and service groups within the community. If scientist make interaction and communication with local people a priority then better overall channels of communication will be established and a better understanding of stakeholders will occur.

An important part of doing this means that “stakeholder diversity” must be considered. What does this mean? Stakeholder diversity means that, “at the beginning of any policy-making process, it is best to develop an understanding of your stakeholders, their cultures, orientations, responses, practices, and reactions” (Steinberg and Steinberg 2015, p. 373). The best way to understand stakeholder diversity is to consider social and demographic data on a particular place. Such data are usually readily available from a government-developed census. In the United States, a U.S. Census is conducted by the U.S. Department of Commerce every 10 years. Doing so enables both government and anyone with an interest in this topic to access this publicly available information about their communities.

## ***9.4 Understand General Population and Sub-populations***

Identify socio-cultural and socio-economic factors (e.g. ethnic culture, social class, first generation student, immigrant). What method is used to identify, understand, engage with and communicate with the stakeholders? What people are impacted by the extreme weather? It is important to recognize that a population's vulnerability varies with geography and social status. The health and well being of people who live in different physical environments is likely going to be impacted differently by extreme weather and climate. The International Monetary Fund has found that, "people in developing economies are more likely to live in high-risk areas, and those countries have a weak infrastructure" (Lafamboise and Acevedo 2014, p. 1). Furthermore, this same study found that "the most vulnerable members of society, both in high- and low-income countries are the major victims of natural disasters."

## ***9.5 Establish Trust***

If a particular community group or governmental agency is able to reach out to various sub-communities in a region before the extreme weather strikes it will foster better results for a sustainable period of time. Building trust is another reason for identifying the most appropriate modes of communication for a particular region. As mentioned earlier in the chapter, usually for poorer and more rural regions radio, word of mouth and face-to-face communication are the main way that communication occurs.

Trust means the ability to count on one another and to have faith in the communication and norms of the interaction. Various researchers have noted the importance of trust as central to the communication and engagement process (Cash et al. 2003; Kahan et al. 2012). The common understanding and agreed upon norms of communication and solid interaction is what leads to trust. The best way to establish trust is, as with other tenets, to first understand local community strengths.

A very solid way to create trust is to involve in the process well-respected leaders from all the different communities and sub-communities being engaged. Doing this early on in the engagement process will ensure that those who may be hesitant to interact with an outsider or outside agency will do so if respected leaders are already on board with the team.

## ***9.6 Engage Using Interdisciplinary Teams with Different Sectors of the Community***

One goal is to make sure that the teams selected to work together are diverse across gender, age, ethnic and length of time with the company standpoints. Greater diversity of teamwork will produce overall better results. Interdisciplinary teams

will explore and test different approaches to communication, and to thinking about important factors, priorities and the order in which they must be addressed in order to ameliorate the impacts of extreme weather events.

It is important to think about engaging with different sectors of the community no matter which of your communication and engagement strategies are employed. This is because different sectors will respond differently to extreme weather challenges. Responses will take form because of different geographic location, different values, and different access to information and understanding about how local events are unfolding. But always, local people will have their networks and strategies for communicating with one another. A good strategy is to tap into some of these already existing local networks to try to achieve the best and most effective communication possible.

One should establish a regularity of patterned interaction. This interaction can occur through a variety of media. But the beginnings of such interaction should be face-to-face, and then branch out to other means, such as digital media and radio.

### ***9.7 Create Two-Way Place-Based Communication***

When designing effective stakeholder communication one wants to ensure a solid understanding of the local population and sub-populations before attempting to communicate. A successful model of communication and engagement is about creating meaningful in-roads and social connections with the public. It's also about being able to consider culture as a designing principal for communication. Scientists and weather experts have important knowledge, but the packaging and sharing of that knowledge with people in various places needs to be examined, especially in light of the usual one-size-fits-all approach to communication. When that happens, communications fall short and fail to be effective.

### ***9.8 Choosing a Reasonable Plan for Stakeholders***

When it comes to developing local policy there are many things that an organization can put its efforts into. It is important to choose actions that can be accomplished by the team and within the resources available. Once a good strong understanding of people has been developed, including perceptions of cultural norms and values, and their own interaction with the physical environment, the population at risk can be engaged to jointly develop steps for action. If a clear understanding of the population and sub-populations is established, a more efficient use of resources can be made to cope with weather and climate extremes.

It is never too early to plan for extreme weather. Unfortunately, because of competing challenges for communities around the world, such as meeting basic needs of survival, the notion of planning for an extreme weather event often gets lost. However, past practice has shown that being ready, and having a plan in place

is the best strategy for effective response to extreme weather. Some questions to answer as part of the extreme weather planning process are: (1) What kinds of extreme weather is expected to be encountered? (2) Where, geographically, is the extreme weather expected to strike? (3) Who will be affected? (4) Where are people going to gather for safety in case of extreme weather?

It is necessary to create an Extreme Weather Community Network before the extreme weather strikes. It is important to think about taking action **before** the extreme weather strikes. Such a network may consist of local community leaders, scientists who understand the local extreme weather threats, and local weather and health agency people who understand what needs to happen for the local population to stay safe or to seek help. It could also include teachers and educators from the local community, along with local media people who understand how to reach people throughout the affected regions.

## 10 Conclusion

This chapter has laid out a series of challenges and steps for extreme weather community engagement. An attempt has been made to model the various factors that explain how extreme weather effects the community and local public health. Furthermore, an interdisciplinary engagement strategy has been constructed around best practices for scientist/community interaction and engagement. Extreme weather will continue to impact many people and places around the world. It is important to be ready for these evolving climate shifts and any resulting extreme weather.

Ultimately, the best practice is to engage early and often to establish trust and to create solid communication networks with communities before an extreme weather crisis. When extreme weather hits it is often swift and with a severe impact. Therefore, meaningful local networks and place-based plans need to be established prior to the occurrence of extreme weather. Using interdisciplinary engagement strategies will enable the consideration of people in the context of their place as part of the policy process. It is generally good policy (Steinberg and Steinberg 2015). This approach, along with considering stakeholder diversity and actively considering socioeconomic and physical-science data about places, will ultimately lead to more effective action and prevention against extreme weather.

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