

Addressing the information needs of crisis-affected communities: The interplay of legacy media and social media in a rural disaster.

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Introduction

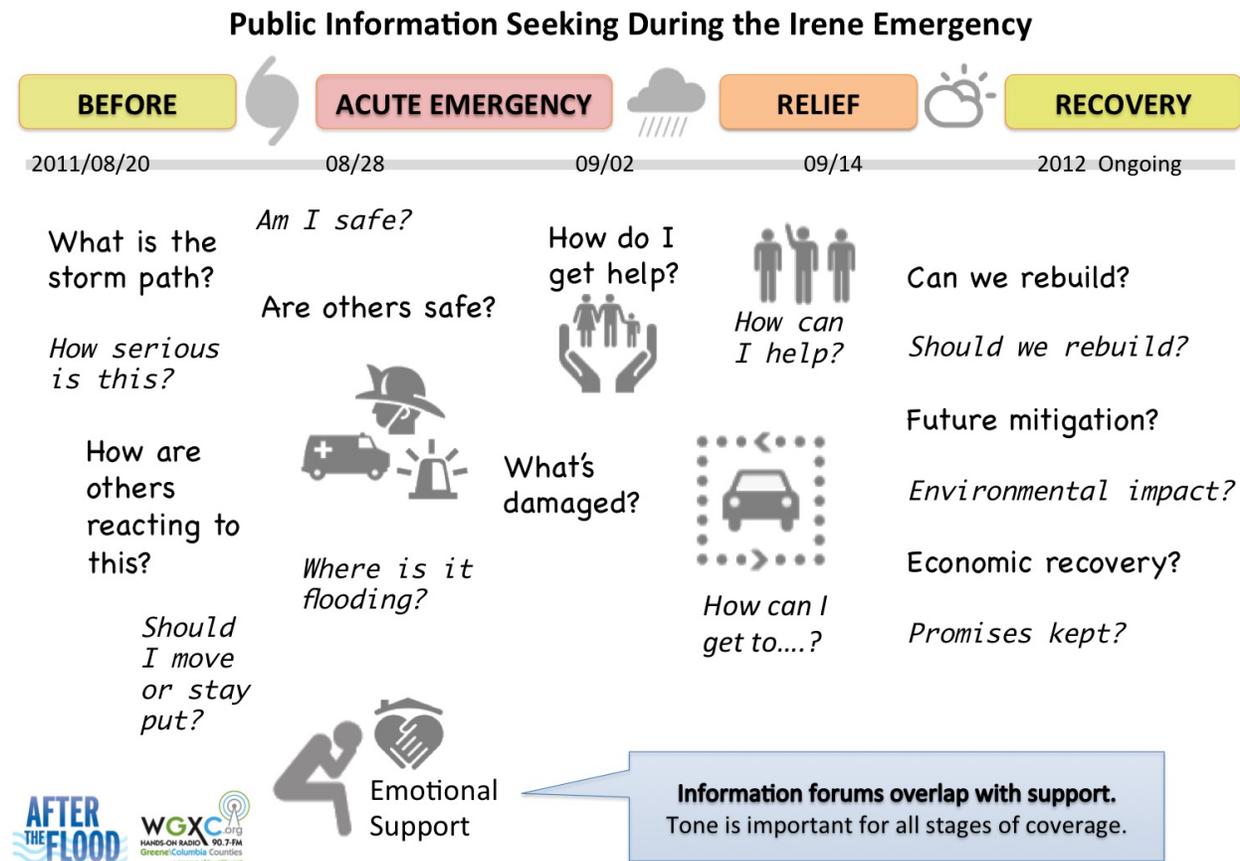
To make informed decisions about the future of our communications infrastructure in the United States, it is important to have a clear, evidence-based understanding of how the information needs of crisis-affected communities are being addressed. For this chapter, we examine the interplay between traditional “legacy” media and network-enabled Information and Communication Technologies (ICTs), such as “social media,” to explore how they together, and separately, meet the information needs of disaster-affected communities.

Our analyses are based upon our empirical research looking at how information was created, shaped, and shared in several recent disasters. We give an extended example of how a specific information need was addressed in 2011 in rural upstate New York, when Hurricane Irene devastated several local communities. In the last week of August 2011, Hurricane Irene struck New York state, followed a week later by Tropical Storm Lee. The combined damage of the two storms became the state’s largest natural disaster and the second most-costly. Of sixty-two New York counties, thirty-eight were declared disaster areas (NY Office of the Governor 2012). We describe several key resources that were important to surfacing and sharing useful, actionable information in the New York’s Catskills region, an area hard-hit by these storms. We find that the interplay between traditional legacy media organizations and a crowd empowered to act through social media is not a simple one. Rather, useful, actionable information comes to light through the complex and not entirely new interplay between these media and the public. Likewise, while the trend among organizations (including regional legacy media) appears to be an increasing reliance on ICTs, evidence suggests that legacy technologies continue to play an important role in the diffusion of information. Further, different communities addressed the same information needs in somewhat different ways, highlighting the importance of fostering infrastructures that enable dynamic and flexible information-sharing structures in disaster-affected communities.

This empirical account of how people get actionable information during a disaster illustrates how networked ICTs enable people to produce and share critical information. It highlights the diversity of approaches to meeting an information need that are extant even within the same disaster. This example of successful, yet diverse, problem-solving in rural areas affected by Hurricane Irene raises the question of how policy can support the plurality of approaches enacted by those working within a disaster affected region. The increasing reliance of networked ICTs also raises some questions. As information work within disaster-affected communities becomes increasingly reliant on third-party networked services, the role that those services have in shaping information, as well as practical matters such as remuneration for increased network traffic and the quality of networked infrastructures, become increasingly important considerations.

Before we walk through our example of how a specific information need was met in a recent disaster, we lay the groundwork for our analysis. First, we briefly define what we mean by “information need” and offer some context for considering information needs in disasters. We then introduce our framework for making meaningful comparisons between different kinds of resources that are called into play in meeting information needs in disaster-affected communities—our particular notion of how social and technical infrastructures come together to facilitate information work in crises. After giving an example of how such infrastructures come into play to address a particular information need, we conclude with some considerations for policy makers that follow from our findings.

The spectrum of information needs in disasters



[FIGURE 1: Examples of information needs in the Catskills over the course of the Irene crisis]

To understand how actionable, useful information is created, shaped, and diffused in a crisis, our first task is to identify what information is *needed* by members of the affected public, as opposed to general information in circulation about the event. In a newsworthy, large-scale crisis, such as a hurricane that is destined to sweep over the homes of 65 million individuals, discerning need-to-know information from good-to-know information is a non-trivial task. For example, when we review Twitter data about a crisis, it is not unusual for the most-shared tweets to be non-actionable news items. We do not dismiss the importance of raising general awareness about current events. We only wish to refine our understanding of the value of general information by distinguishing it in our analysis from information that an affected public needs to

have to make decisions in the disaster context. Such *actionable information* includes evacuation warnings, calls for assistance, and practical information about giving or receiving aid. Thus, to understand *information needs*, we strive to distinguish the affected publics from the public-at-large and to distinguish the specific diffusion pattern of particular kinds of information. We are able to make these distinctions by triangulating data derived from intensive interviews, site visits to disaster-affected communities, and extensive reviews of publicly available digital trace data such as collections of tweets, liveblogs chats, news sites, Facebook pages, YouTube videos, Wikipedia pages, Reddit threads, and so forth. We use these data to determine empirically what constitutes an information need during a specific event.

The chart above (Figure 1) gives an example of some information needs that community members identified in the relation to Hurricane Irene’s impact in one impacted region, the Catskill Mountains in New York State. The chart illustrates how different information needs are associated with each phase of the disaster. Once we identify a specific information need, we can then look for evidence of how it was addressed, by whom, and with what resources. As the chart illustrates, a disaster response requires timely, actionable information of many different kinds. The resources employed in creating, shaping, and sharing each specific kind of information will likely differ. Patterns of diffusion will likely also be distinct for each one.

For example, individuals in the Catskills were first warned about Hurricane Irene about a week before it arrived in the area. Those we interviewed learned of it by monitoring traditional news sources and from discussions with friends, coworkers, and family. Ultimately, the news outlets were reporting information that came from the National Hurricane Center (NHC), a government agency that monitors hurricane activity. Thus, in this instance, we might consider that warning information was diffused from the “top down,” first originating from an authoritative source (the NHC), then reaching members of the public primarily through news organizations, and diffusing to a wider public through discussion of the news reports.

While the “top down” hurricane warnings helped the public in the Catskills to prepare for a potential disaster, once flooding and wind damage occurred, the pattern of information diffusion changed. Described in more detail below, damage assessment information filtered up from affected areas. Instead of one source, like NHC, information from perhaps thousands of individuals was collated into a coherent picture of where damage was greatest. Thus, in the acute emergency, the diffusion pattern of actionable information was, to some extent, an inversion of that in the warning phase. Information was moving from the “bottom up,” originating from countless sources of those on the ground, then making its way through regional hubs to national actors who synthesized disparate bits of information into a broader understanding.

Our research focuses on information behaviors in the acute emergency phase of crises. Yet, we find, similar to Shklovski et al. 2010, interviewees rarely report that their disaster-related information work has concluded with the end of the emergency.¹ Pressing information needs persisted long after Irene. Difficult-to-answer questions about where to rebuild (or not), how to rebuild, how to resource rebuilding, and accountability around the resources needed to rebuild lingered long after the emergency. How these information gaps were addressed and their subsequent patterns of information diffusion look very different from those associated with the other phases of the disaster.

¹ Based on thirty-six intensive interviews with those doing various forms of information work during two disasters.

How are information needs addressed in disasters?

It is true that crowds empowered through social media and related ICTs can do important information work during crises (e.g. see Starbird and Palen 2013). Yet, it is also true that legacy media has a strong presence on social-media platforms. To clarify the relationship between traditional media and the ICT-enabled crowd, we seek to identify the key resources that support essential information work in crises. That is, we aim to disaggregate the technologies, social arrangements, individual skills, expertise, and relations that are commonly conflated by the word “media” so that we may make meaningful comparisons about specific arrangements such as “legacy media” or “social media.” Our approach to such disaggregation is empirical. Starting with a data-derived information need, we attempt to identify specific resources that came into play to fulfill that need.

Once we identify key resources, we need a way to clearly describe the relationships between these resources when they exist and to clearly delineate where relationships do not exist. We consider any resource for which we have evidence for having contributed to closing an information gap to be part of an information infrastructure that addressed that gap. Following other scholars in Infrastructure Studies, the infrastructures we describe are dynamic and reflexive (Star and Ruhleder 1996). Our infrastructure models are reflexive in the sense that they describe how specific information needs were addressed in specific crises. That is, we consider only those resources that we see evidence for having contributed to closing an information gap to be a part of the infrastructure that addressed that gap. While the resulting analysis often yields a complex picture of how a given information need was addressed, it simplifies the analysis in that many potential resources that did not come into play are left out of the empirical model.

What remains available for analysis are any tools, technologies, practices, skills, knowledge, or human relationships that contributed to bridging an information gap. These assets can be examined through two perspectives that highlight their different components: as technical infrastructures and as social infrastructures. Though analytically it can be helpful to consider social and technical infrastructures separately, in practice, it is the interplay between them that culminates in an information need being addressed.

Technical infrastructures: Like many rural areas in the United States, the Catskills has a relatively uneven telecommunications infrastructure. Several areas lack cell service, Internet service, or both (Cairns 2015; Reischel 2015). County emergency managers have been slowly improving emergency radio service as grant monies become available. Internet outages frequently accompany inclement weather due to the aging electrical grid.² These gaps were exacerbated by Irene, which knocked out power and telecommunications for an extended period in several parts of the region. Given the patchwork nature of infrastructure in the area, it should be no surprise that interviewees from the region reported relying on different kinds of technical infrastructures to share and receive information. Depending on the individual involved, technical infrastructures included emergency services radio, terrestrial radio, Internet over cellular network, Internet over cable network, SMS, cable television, landline phone, and cellular phone. Another layer of technical infrastructure that was also important were the many network-enabled

² This summarizes information Dailey learned during interviews with the Greene County Emergency Manager for the WGXC’s Forum on Flood Coverage in 2011, interviews with local infrastructure experts for the Broadband Adoption in Low-Income Communities study for the FCC in 2010, and from being on the WGXC work team during planning and build-out of the station.

services that many (but not all) people employed. A non-exhaustive list of these services includes social-media services, such as Twitter, Facebook, YouTube, and Google Maps, as well as news, government, and aid websites.

Social infrastructures: Actionable information is typically the result of individuals working in a coordinated fashion. The non-technical resources that close information gaps in crises are even broader and more diverse than the many technologies involved. Two of the most visible kinds of social infrastructures are organizations and professional practices. While news organizations can be quite different from one another, our notion of what constitutes a news organization is based upon shared conceptions of the purpose they serve and how they work. For example, “reporters” typically work with “editors.” The work of an “editor” is different than that of the “reporter.” The difference in job title denotes established professional practices. Social infrastructures also include the contributions made by individuals — their knowledge, skills, practices, and relationships to others.

We examined several of the social infrastructures that appeared to play a significant role in meeting public information needs in the Catskills after Irene. This included several media organizations within the affected region or just outside of it. The media landscape of the Catskills is being shaped by the same financial pressures as the rest of the United States. Like many rural areas, there were comparatively fewer media professionals working in comparatively fewer news organizations prior to Irene than a decade before.³ The region has a patchwork of relatively small outlets mostly covering one town or one county, respectively. The larger outlets are on the periphery of the region. Television news outlets and papers from the more populated areas adjacent to the Catskills — the Albany and Hudson Valley markets — make coverage forays into the Catskills. The financial pressure on newsrooms in recent years has made these forays less frequent. However, throughout the 2000s, even as traditional newspapers in Catskill towns closed their doors, the demand for news coverage instigated several new media outlets in the region. These new outlets introduced different technical, social, and financial arrangements to news coverage in the region. For example, the Watershed Post, a commercial online-only “information hub” run by two former print editors, Lissa Harris and Julia Reischel, grew from a Twitter account that aggregated news outlets throughout the region. Two community radio stations were launched shortly before Irene, WIOX and WGXC. Both were attempting to use volunteers to produce news. Whether new or old, it is in such small, lightly resourced organizations where much of the day-to-day public information work in the region takes place.

Emergent infrastructures: We normally think of information work as occurring within organizations. However, in the acute emergency phase of a disaster, information work is highly diffused. Nearly everyone in an affected area is typically assessing the situation in their vicinity, seeking information, and sharing what they know in order to act accordingly. In such circumstances people come together in temporary and novel arrangements to fill information gaps (Dynes, 1970). These emergent social infrastructures are dynamic and amorphous. They often come together just long enough to fill a gap, and then dissolve once the need is deemed resolved. Such temporary infrastructures can draw on the resources of more established and visible social infrastructures (e.g. see Lee et al. 2006).

³ This summarizes Dailey’s impressions of the media environment based on interviews with media professionals in the region for the WGXC’s Forum on Flood Coverage in 2011, four years of participatory community research leading up to WGXC launch in 2011, and the FCC’s Hudson Valley hearing on November 21, 2006.

In the Catskills after Irene, we see evidence of such emergent infrastructures forming to fill information gaps (Dailey and Starbird 2014a and 2014b). Similar to what takes place in traditional organizations, individuals take on specific kinds of work that fill different niches. For example, a remote volunteer can moderate an Internet forum, while another may post information about damage in their immediate area. Yet another might collate the moderated information into a map. Yet another might embed the map onto a web page where it is likely to reach a wider audience who can use it. Still another may tweet a link to that website. Like work that occurs in traditional organizations, where individuals take on distinct and complementary kinds of work, the act of each individual in the network-enabled crowd contributes to the whole.

The *interplay* between emergent infrastructures and established ones is an important success factor in complex large-scale collaborations (Lee et al. 2006). In our study of the infrastructures that served the Catskills public after Irene, the most commonly identified information resources tended to be “information hubs” that played a role both in accumulating information from the public and in diffusing it to them. These information hubs were local and regional media organizations. Yet, the information that was accumulated and diffused through these hubs was often the result of emergent efforts that bridged specific information gaps.

One information need, many maps

To illustrate the interplay between legacy media and social media in terms of meeting information needs in a crisis, we now give an extended example of how one specific information need was addressed in the Catskills after Irene. We briefly introduce a few of the solutions that emerged in the Catskills to address this particular information challenge.

Among many forms of damage, thousands of miles of New York roads and hundreds of bridges incurred obstructions and damage. Thus, one pressing information challenge for all those in the region and all those drawn into the response was to identify passable roadways. For the first few weeks of the crisis, this was a very dynamic information need. On one hand, debris was continuously being pulled from roadways, making them passable, while on the other hand, as engineers deployed to inspect bridges made their way through the area, they declared seemingly passable roads and bridges to be structurally unsound. In the nearby state of Vermont — which was also severely impacted by Irene — the state partnered with Google to provide a single, publically available map identifying all obstructed roadways in the state (VT Office of the Governor 2011). No single resource was available for all of New York State. In the Catskills, some counties published damage maps, while others did not. In lieu of an official resource, a patchwork of localized solutions appeared. For example, the Red Cross developed and maintained their own map of the region.

From audience member to crisis mapper

One of the most frequently mentioned — and lauded — information resources respective to the acute crisis in the Catskills was a crisis map instigated by a GIS professional. His story exemplifies many of the patterns that we have observed across several disasters, illustrating how concerned individuals identify and then move to address an information gap, bringing their specific skills and resources to bear upon it. Don Meltz is a GIS consultant who has worked for several towns in the Catskills. By monitoring news outlets via Twitter on the night that Irene arrived in the Catskills, he learned that damage in the region was expected to be severe. Though he lives outside of the region, his personal and professional connections to the area drove him to follow the storm’s progress in the Catskills in real time. He sought a reliable source that could

give more in-depth information specific to the Catskills as the crisis developed. This led him to discover the Watershed Post’s Twitter account, which was aggregating information from around the region in collaboration with journalists from several other regional outlets. Though he was not familiar with the Watershed Post before that night, by following the Twitter feed for several hours he determined that it was the best information available for the Catskills. The following morning after flooding and heavy winds had hit the region, Meltz observed that many members of the public were posting into a liveblog chat forum run by the Watershed Post. These posts included requests for information about what roads were passable or not passable. Meltz used his knowledge of the government agencies that might produce maps and his personal connections within those agencies to assess whether official maps were likely to become available. Once he determined they would not become available, he contacted the Watershed Post and offered to create a map that they could publish.

The Watershed Post was acting as an aggregator for several media outlets around the Catskills. During the storm, many of the respective audiences of those hyperlocal outlets had also found their way to the Watershed Post and were alternatively seeking or sharing information about road closures in a liveblog forum hosted by the Watershed Post. The Post’s editors used the forum and Twitter to request volunteers work with Meltz. Some participants in the liveblog forum or in hashtag curated conversations on Twitter helped to curate, share, and verify information about road closures. Others worked directly with Meltz, coordinating the work of verifying and vetting information for the map through private, direct-messages over Twitter.

What does this brief example tell us about the interplay between traditional legacy media and social media? What does it say about the infrastructures that support the flow of essential information in a crisis? In terms of technical infrastructure, we see how networked ICTs can enable a concerned individual outside of an affected area to make a significant contribution to a community’s response. The individuals who helped Meltz to curate, verify, and update crisis information formed an emergent infrastructure (both social and technical) that relied on coordination of individuals outside of a traditionally organized structure. However, these emergent efforts benefitted in several ways from more persistent social infrastructures. As a GIS professional, Meltz had observed the work of other “crisis mappers” who contributed their expertise in a similar fashion in other disasters. This is but one example of the professional practices that he drew on to create the Catskills crisis map. The map also benefitted from direct collaboration with the Watershed Post editors and their “information hub,” which spread across their website, a liveblog chat forum, Twitter, and Facebook. Several features of this “hub” enabled it to become one of the primary information resources about the crisis for those in the region. This included the journalistic practices its editors had honed over years of reporting and editing, specific knowledge of the Catskill region and its audiences, and established relationships the editors had with other media outlets in the region and with the official responders in their county. In turn, the Watershed Post’s ability to serve their community was enhanced by emergent infrastructures (social and technical) that sprung up around them to address specific information needs like how to route around damaged roadways.

While the Watershed Post itself may not be characterized as a “legacy” media organization, it draws on legacy media organizations in two important ways. First, its editors were trained and worked in print publications for many years before they started the Watershed Post. We detail elsewhere how they diverged from traditional news practices to better fit into the current media environment to meet the information demands of the Irene crisis. Nevertheless, an intensive interview with one of the editors revealed that they continue to draw on the concepts of

the traditional newsroom for their notions of what good reporting is and how to achieve it. That is the starting point for their innovation.

A second, less directly obvious way that legacy media was involved in this collaboration is that many individuals associated with legacy outlets were active members of the online crowd, both following and being followed by people directly contributing to the crisis map. For example, Ivan Lajara, who was the social media editor at *The Daily Freeman* — one of the larger newspapers to cover a portion of the Catskills — was aware of the crisis map and became one of the most active participants in social media in the region throughout the event. His knowledge and awareness of the map contributed to the *Freeman*'s most visited Irene-related story, a simple text list of road closures.

The less connected and most affected

While networked ICTs are a powerful tool for coordinating information work in disasters, it is important to recognize their limitations. As has been observed in many other crises, we have ample evidence of individuals in the Catskills who appear to be sharing directly observed information about damage as it occurred through network-enabled ICTs. However, there is reason to suspect that even widely useful and widely disseminated information resources like Meltz's crisis map do not always reach the most affected portions of a community. For example, other researchers have pointed out that those who are most affected by a disaster are least likely to have access to networked ICTs (Burns 2014). Conversely, those who do have access to networked ICTs and contribute information through them may be different in important ways from those who are affected (Crawford and Finn 2014, Crutcher and Zook 2009, Shelton et al. 2014). Further, it has been suggested that much online data is inherently biased against rural users (Hecht and Stephens 2014), likely due to the fact that rural communication patterns have been shown to differ in many ways from urban ones (e.g. Gilbert et al. 2008; 2010). However, it should be noted that these observations about affected publics are still provisional. There is much work to do to relate the users of particular online platforms to specific populations or even specific demographic characteristics (Hargittai 2015; Tufekci 2014). With these limitations in mind, we offer a second example of how another important information hub addressed the same information gap in somewhat different ways. By offering another example from the same crisis, we hope to highlight the importance of assuring that telecommunication infrastructures are designed around the expectation that disaster-affected communities will need to scaffold site-specific solutions based on hyperlocal needs and resources at hand.

WRIP is a commercial FM radio station that played a very important role in the area of the Catskills that was most intensely impacted by Irene. Described by Operations Manager and DJ Joe Loverro as an “industry dinosaur,” WRIP in many ways squarely embodies the characterization of a “legacy media” outlet. Its terrestrial broadcast reaches the more rural Catskill Mountain portion of Greene County, New York (population 49,221). It relies entirely on advertisers in its listening area. Most broadcast hours are devoted to music meant to appeal to full-time residents and tourists. Its small staff of two and a handful of part-time DJs regularly broadcast at community events, such as fire station fundraisers. All live in the area they serve. The station takes seriously its public service role during emergencies. For example, Loverro described sleeping under his desk so he could be in the studio to announce a snow day. While it is still true that emergency-oriented announcements can be imposed on terrestrial broadcasters by government response organizations, changes in the broadcast industry over the last several decades have led to less outlets that are demonstrably committed and capable of playing this role.

Bucking this trend, WRIP has a long-standing trusted relationship with local government. Prior to Irene, the county legislature purchased back-up generators for WRIPs transmitters and studio. When Irene struck, emergency radio towers in the most impacted region the Catskills were washed away as damage to roadways made those areas difficult to reach. It took three days to reach the most affected areas. Fortunately, nearby WRIP was able to maintain broadcasting. County Emergency Services Director John Farrell described WRIP as the “primary communication” with the most-affected area in the seventy-two hours when emergency service communication was lost. In this critical period, responders and community members converged on WRIP studios for information, and broadcasts became a hybrid of official emergency communication and the traditional emergency communication that stations like WRIP have performed for decades.

While performing two important communication roles simultaneously from an intensely impacted area, it may not be surprising that those at WRIP were too busy to learn of the existence of Meltz’s crisis map. Instead they relied on a map that someone taped to the door of the studio. It was marked and re-marked with pen and pencil as information made its way into the studio through visitors, landline phone calls (the station has three), or through Facebook posts. Though its staff strongly associates with legacy media, like most legacy media outlets, they maintain a presence on multiple platforms. They have a website that is maintained by someone outside the listening area. The website has primarily static information but does help people connect to a webstream that occurs through a third-party platform. These services typically charge stations by the number of listeners. Like most small outlets, WRIP caps the number of people who can listen to their streams to reduce costs. Thus, to get information into or out of this important information hub beyond the immediate area took some improvisation.

The Watershed Post made a plea for people participating in their liveblog or on Twitter who were also able to hear the WRIP terrestrial broadcast to listen and report back what they heard. Though Loverro reported that one computer in the studio was open to Facebook at all times, those in the studio had little time to consistently monitor or contribute to the requests for information occurring through their Facebook pages. Observing that this was creating an information gap, Alex Tighe, a local woman following WRIP’s Facebook page, took on the work of moderating it and responding to questions. As we have observed in many instances of successful information work in crises, the person who stepped out of the crowd to fill this information gap brought specific skills to the task. In this instance, Tighe is a public relations professional who specializes in social-media communication. Tighe drew on both her knowledge of the community in which she lived and her knowledge of effective communication through social media to make WRIP’s Facebook page more useful to information seekers and sharers in the days after the disaster. Through Tighe’s involvement, we can see the significant amount of work that is involved in diffusing information to multiple publics across multiple platforms. Diffusion happens through the effort of many helping hands.

Though it may be relatively new for Facebook to scaffold the social infrastructures populated by Tighe and other spontaneous volunteers, the work that Tighe took on is a very old part of disaster response. Spontaneous coordination between community members in crisis contexts is a feature of disaster response regularly observed since the earliest sociological studies of disasters 100 years ago. What is new is that such work is now more visible to researchers and to an extended audience of observers — and potential collaborators — on these platforms.

In this example, we see the same *kinds* of infrastructures contributed to the diffusion of actionable information, but the particular arrangements differed due to differences in need and

differences in resources. When emergency radio communication was washed away by the storm, WRIP's combined socio-technical infrastructure was called upon to act as emergency communication until official response channels could be re-established with the most intensely impacted areas. This was possible because of the strongly established relationships in place between local responders and the station — and the station's ability to take on this additional role. This aligns with other research that demonstrates how information sharing in crises flows most easily among those with established, trusted relationships (e.g. see Tapia and Moore 2014). However, along with these established relations, new human infrastructures sprung up to aid the flow of information into and out of WRIP in the form of volunteer moderators who helped to communicate to individuals on WRIP's Facebook page and even individuals who took on the work of listening to its terrestrial broadcasts and tweeting what they heard.

Designing technical infrastructures to support the disaster-affected

We describe several key resources that were important for surfacing and sharing useful, actionable information in an affected rural area in the immediate aftermath of a disaster. These resources were intentionally arranged into socio-technical infrastructures — some established, some emergent and temporary. We find that *interplay* between *traditional legacy media organizations* and the *crowd empowered to act through social media* is not a simple one of displacement. Actionable information comes to light through specific kinds of interplay between these groups. Affected people are searching for (and in some cases finding) needed actionable information through these *resources in combination*. This suggests that the socio-technical infrastructures relied upon for disaster response need to be designed to support a plurality of potentially different arrangements. Our research supports the view that information actors — those sharing, seeking, and processing information — in affected communities are, in a real sense, also designers (Pipek and Wulf 2009; LeDantec and DiSalvo 2013) who dynamically and tactically bridge technical, social, and information gaps through the arrangements they create.

When considering the communication infrastructures that support communities in crisis, telecommunications policy often focuses on meeting the needs of official response organizations. This case study illustrates the important interplay between community response (including formal and informal actors) and official response. The creation and distribution of a crisis map and the use of a radio station for official emergency communication are two examples of community resources filling a pressing gap in the official response. This suggests the need to evaluate community preparedness in light of technical infrastructures that are specific to the formal response along with those that serve the general public. For the Catskills, this means continued improvement to emergency radio services, cellular, and broadband services.

A patchwork of different technologies were used after Irene. The reliance on legacy technologies like terrestrial broadcasts and landline phones raises several questions about the relationship between legacy infrastructures and broadband for crisis communication. For example, would WRIP have been able to play the role it did if it was online-only? Yet, even legacy media outlets like WRIP are increasingly reliant on networked ICTs. One computer in their broadcast studio was dedicated to Facebook. They maintain a website and use a third-party service to stream audio to web listeners. Other than a landline phone, the Watershed Post's entire operation is dependent on networked services.

As networked ICTs take an increasingly prominent role in crisis communication in disaster-affected communities, their position in the broad socio-technical infrastructure deserves closer inspection. At the network level, there are questions around how to quickly scale the

amount of bandwidth needed to keep pace with the demand for information from such local information hubs during an emergency. Scaling has both logistical and cost implications. Can logistical support be set up in advance for local hubs? If not, can those shaping traffic in real-time identify these “bottom-up” resources? Who should pay for the surge in service?

Third-party services were woven into the information work of individuals and organizations throughout this emergency. The Watershed Post was able to act as a community-based information hub through its website (which relies on a hosting service), the social media platforms Twitter, Facebook, and CoverItLive, a liveblog service that was a core tool for communicating with the affected public. The reliance on third-party services raises an additional set of concerns. Many of these services are not designed for use in crises. As business needs change, web services change their offerings. This can happen quickly and without notice. At the time of Irene, CoverItLive offered a free, ad-supported version of their service, but they no longer do. Now they charge by the viewer/reader load. This is also the case with webhosting services and webstreaming services, which means that an emergent, community-based information hub in a disaster that is doing its job to fill information gaps by using such services is likely to see many costs rise simultaneously. The more important their role, the more expensive it becomes. For this reason, the Watershed Post’s editors are uncertain if they would be able to play the same role in future crises that they played during Irene.

We end by pointing out a limitation of our research. We focus on information behaviors in the acute emergency phase of crises. Yet, interviewees rarely report that their disaster-related information work has concluded with the end of the emergency. Post-emergency information needs tend to be resource-intensive to address. Though there are many experiments that aim to crowdsource portions of investigative journalism (e.g. Aitamurto), so far these efforts have not been demonstrated to fill post-disaster information gaps. As community news organizations become leaner and sparser, we see the need to proactively identify and support social and technical solutions that can fill important, yet resource-intensive, post-disaster information gaps.

Note: We thank interviewees and community members who participated in this research. Initial research took place through WGXC Hands-On Radio. Thanks to Amirah Najid and Ying-Yu Chen for early reviews of this chapter.

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