
Informing the Network: Improving Communication with Interface Communities During Wildland Fire

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Abstract

An interagency research team studied fire communications that took place during different stages of two wildfires in southern California: one small fire of short duration and one large fire of long duration. This "quick-response" research showed that pre-fire communication planning was particularly effective for smaller fire events and parts of that planning proved invaluable for the large fire event as well. Information seeking by the affected public relied on locally convenient sources during the small fire. During the large

fire, widespread evacuations disrupted many of the local informal communication networks. Residents' needs were for "real-time," place-specific information: precise location, severity, size, and direction of spread of the fires. Fire management agencies must contribute real-time, place-specific fire information when it is most needed by the affected public, as they try to make sense out of the chaos of a wildland fire. Disseminating fire information as broadly as possible through multiple pathways will maximize the probability of the public finding the information they need.

Keywords: fire, communication, wildland urban interface, quick response research, sense-making

Introduction

Increases in the severity and frequency of wildland fires during recent drought years in the West have coincided with growth in both housing developments and recreation in wildland areas (Rudzitis 1999). The results of such convergence in 2003 were large composite wildfires, especially in southern California, that damaged communities, strained fire fighting resources, necessitated evacuations from many cities and towns, and caused several deaths. The intensity, size, and proximity to populated areas of these wildfires required unprecedented levels of communication among agencies and between agencies and the general public.

During natural disasters, such as wildfire, the affected public seeks information in their attempt to understand the disaster and its dangers, to make sense of a chaotic and frightening situation. They try to obtain information from official sources, such as agencies, but also from informal sources such as family, friends, community members, and websites (Fitzpatrick and Mileti 1994). During a crisis, the most critical communication role for the managing agency is to respond quickly with accurate, timely information in open communication (Dougherty 1992; Barton 1993; Fitzpatrick and Mileti 1994). Disaster managers have a legitimate and often mandated interest in encouraging public behavior that increases public and firefighter safety and reduces fire costs and losses. Disaster managers, however, must be part of the community dialogue so that their views and perspectives contribute to the construction of the plausible stories emerging from communities trying to make sense of the disaster situation. Furthermore, the messages that agencies send to the public must be ones that the public can understand. This entails using everyday language, instead of government acronyms, jargon, or "officialese" and distributing information through many communication channels (Fitzpatrick and Mileti 1994; Waugh 2000).

This study focused on communication at all stages of wildland interface fire because this topic represents a gap in both the fire social science and disaster response research literature. Social science researchers of natural resource fire have studied public knowledge of wildfire (Cortner et al. 1990) and public perceptions of risk, responsibility, and blame (Taylor and Daniel 1984; Gardner et al. 1987; Carroll et al. 2000). A study, closely related to this one, looked at how blaming behavior affects communication between agencies and the public during wildfire (Kumagai et al. 2004). However, very little research has studied information-seeking behavior during and immediately after a wildfire event.

The purpose of this study was to begin to better understand how communities communicate and seek information to cope with the threat of disaster, specifically wildfire in the wildland urban interface where flammable wildland vegetation intermingles with people and their property. Sense-making theory guided the questions asked and the interview methods used.

In organizations, as for the individual and the community, sense-making involves a continuing search, on the part of individuals, the community, and within organizations, for plausible stories that create order out of a chaotic situation and serve as a foundation for action (Weick et al. 2005). "Sense-making begins in Chaos," (Weick et al. 2005, 411) when one or more people recognize a situation that is confusing, attracts curiosity, and may be perceived as potentially dangerous. Danger elevates emotional arousal. When high arousal is combined with an anticipation of injury or loss and a sense of lacking control over what is happening, people experience negative emotions of fear or anxiety (Mehrabian 1995; Mehrabian and Russell 1974).

To control growing fear or anxiety, people can find ways to impose order and structure on the chaos and make it more predictable. Seeking information helps. However, before it can be used, the information has to be constructed into a plausible story or theory that explains what is happening. Constructing the plausible story is a social process achieved through communication among the members of the community (Weick et al. 2005). In disasters, getting the story right and doing so quickly can mean the difference between safety and injury or death and the protection or loss of property or other significant values-at-risk.

Communication needs emerge rapidly and change quickly during a wildfire event, therefore research that takes place during the event is crucial. This type of research has been termed "quick response" by investigators of other natural disasters (Michaels 2003). Quick response research is conducted during and closely following a disaster event. Preplanning and rapid implementation of this kind of research is important to ensure that events critical to the study are captured, but without interfering with emergency response teams or jeopardizing public safety. This quick response research study of two wildfire events in the San Bernardino Mountains in southern California evaluated the communication needs of the public in this wildfire context and explored current agency responses to those needs.

Background

The San Bernardino National Forest (SBF) experienced an extreme drought over at least five years that resulted in tree mortality from insects and disease (Dietrich 2003). In

agement Agency, and the Forest Supervisor's office. The information was organized, verified, and then distributed by the JIC to its community phone-bank, media contact lines, evacuation centers, and legislative staff. Generally, the information sources supplying the JIC continued to also distribute information through their own channels. The JIC was not always notified first or even at the same time when events or plans changed. As a result, people operating the public phone lines sometimes had incomplete or out-of-date information.

"Some channels (disaster information channels) had the same information up for 15 hours and it was too generic." Running Springs resident: Sept. 12, 2003

"The Fire Information phone line (recording) is not updated during the day. FS updates at 6am and 6pm, not enough for people who are affected." Running Springs resident: Sept. 10, 2003

"County Fire had a switchboard that you were supposed to be able to call. Unfortunately, it was busy, but when you would get into the switchboard...they didn't have manpower to update the information." Lake Arrowhead resident: March 23, 2004

This lack of up-to-date information was also reported by phone operators. Many callers wanted to know if their homes had burned, but it was not possible for phone operators to provide that information. People were unhappy when they could not get information about whether or not the fire had reached their communities. That lack of up-to-date, site-specific information from official sources was a consistent concern heard throughout this fire communication study. Sometimes callers had more up-to-date information than the phone operators, leaving the operators unable to verify what the callers had heard. It was demoralizing when operators later discovered that the caller had been correct.

"Being at the JIC was almost more frustrating than doing nothing. The amount of information was limited—the official agency information is sterilized, sanitized to reduce liability." Resident volunteer, Running Springs: March 24, 2004

In addition, operators reported that they occasionally overheard informative conversations among other JIC personnel, but were not allowed to release the overheard information immediately. Since the operators' function was to keep the public as informed as possible, such delays—necessary perhaps for the JIC to verify information—appeared to undermine the confidence of both the operators and the callers.

Fire maps were helpful to both JIC staff and the public as a communication tool. Environmental Systems Research

Institute⁹ (ESRI) had personnel stationed within the JIC to interact with fire personnel and provide quick-time map production. In discussions with residents a few months after the fire, community members reported great interest in seeing fire maps that provided sufficient detail as to which specific neighborhoods had been hit or spared by the fire. Very few of the fire-affected public we interviewed knew about the ESRI maps and even fewer knew how to access them. At the airport hangar evacuation center, one local evacuee attempted to improve access to real-time information by setting up a web-linked projection of the fire-map site on the wall.

"You should be able to go someplace and find a map, hour by hour, of how the fire progressed." Lake Arrowhead resident: March 23, 2004

The JIC was able to overcome some of the difficulties of getting timely and useful information to people in communities at risk. The JIC encountered some difficulties, in part because it was activated after the fires were already underway. Some cooperating agencies were slow to shift their information functions to the JIC. Other cooperators did not always provide the center with critical information but continued to disseminate information primarily through their separate channels without coordination with the JIC. Even the special efforts to rapidly validate information could not always provide information close enough to real time to satisfy residents' needs.

In both the Bridge Fire and the Old Fire/Grand Prix Fire Complex, it was apparent that public interest in fire information changed focus over time, but it did not lessen in urgency. Through the call-in lines and at public meetings, residents expressed frustration with the fact that updates on the fire came quickly at the beginning of the fire event but slowed considerably once the fire was under more control. Even if the fire movement was slowed, fire information still needed to keep pace with public requirements. The Incident Management Teams and the Joint Information Center worked together to gather intelligence and report it back to the JIC at the end of the day. This worked well, although the time-lag from intelligence gathering to reporting to the public appeared to be too long from the residents' perspectives.

Communication during Reoccupation

At the JIC, the cooperating agencies worked out a procedure for timing and announcing community re-entries that allowed an orderly return when each community area was declared safe. The San Bernardino County Sheriff's Office, one of the cooperating agencies, held the final authority to allow residents back in to their communities. Part of this procedure included notifying police officers in charge of highway access to the mountains. But, re-entry to mountain communi-

ties was perceived to be a problem by many people. Since re-entry had not been as clearly outlined by the MAST as the evacuation, the various authorities appeared to be operating under different rules, resulting in confusion over how and when to allow residents to return home. Some residents reported receiving instructions such as, "Go to such and such location and get a permit sticker. Then go to the closure gate on the highway and the California Highway Patrol (CHP) will let you go through," only to be turned away by the officers at the roadblock.

"So we get to the CHP and the CHP is not going to let us up because they didn't get the code." Big Bear FSC member: March 25, 2004

Communication during Transitions in Management Authorities

Disruptions in information and communication can also come when fire management changes authority, which often occurs near the same time as containment and community re-entry. Fire fighting teams are restricted by safety policy in how long they can work on a fire before being relieved. Also, as fire conditions change, the flow of action and money shifts to different management authorities. Authority for fire information moves between an IMT to a Burned Area Emergency Recovery (BAER) team and then back to the National Forest or other land management unit during the course of the fire, containment, and post-fire mitigation. As offices debate who will take responsibility for the communication system, the public may realize serious interruptions in the flow of needed information. Sometimes to avoid breaks in information flow the National Forest, or other land management agency, may retain fire information authority. In the case of the Old Fire/Grand Prix Fire Complex, the JIC was allotted the authority for the flow of information to the public, but it was not kept in place beyond containment. Although the IMTs and the BAER teams overlapped, here the residents reported an interruption in the flow of information.

Communication and the Mass Media

Problems in fire communication were also apparent in the media. Because there were few local news media sources, regional media, based in Los Angeles and San Diego, provided most of the reporting. Information disseminated through the mass media was perceived to be frequently inaccurate, emphasizing the sensational over the practical, and shifting away to new topics before the local need for information was met. As a result, people expected agencies to provide up-to-date, real-time, accurate information that the regional media sources were not providing. Most of the regional media did, however, supply relevant agency contact in-

formation in the beginning. An exception was a local radio station which dedicated programming to coverage of the fire with information collected locally and directed to local information needs.

Phone operators reported a large proportion of calls complaining that the regional news media gave incorrect information. Community residents estimated that about 50% of media reporting was in error. Callers who reached the community phone bank expressed relief that they had found a source of reliable information. Phone bank personnel were frustrated that media outlets were using multiple sources of information, indicating some probable sources of inaccuracy. Gathering news from multiple sources is viewed as important by journalists because they can draw from the most available, up-to-date information, albeit of varying levels of accuracy and authenticity. Journalists also rely on multiple sources to establish the veracity of information they report.

Residents reported that regional television and newspapers provided little information that was locally specific and useful. In conversations with residents and emergency personnel, people reported that television commentators often talked without knowledge of where they were or of the real fire situation. Residents stopped watching because of what they perceived as sensational repetition.

"Then when we get down the hill, and you're away from the radio and you're watching TV and seeing pictures . . . when they (the media) are west of Running Springs saying they're in Big Bear, you know, they're still 25 miles away and you realize that . . . you're not going to get good information this way." Rebuilding Mountain Hearts and Lives, Lake Arrowhead residents: March 23, 2004

"I saw mine [house] burning on one Channel. I saw my house burn on TV. As a matter of fact, I saw my house burn over and over . . . Over and over and over! Because they do that. They say: 'Oh, this is our best shot.' You know, 'use this one.' And then people who were affected by that, they watch that thing just happen, kind of on into the night—it's just awful." Rim Family Services member: March 25, 2004

A local news producer in the San Bernardino Mountains said that fire in the mountain communities only had "entertainment value" for Los Angeles television audiences.

"There's a new generation of news people. They were more interested in entertainment. They understand it's ratings that makes the money and keeps their job and it has nothing to do with getting the information right."

"But to describe one person's disaster as another person's entertainment; and I think it is really true in the Los Angeles market, because you've got approximately 12 million people and maybe 200,000 people were affected here, so it's not a very big percentage that they're worried about getting information right for. They're interested in getting entertainment right for the rest of the 11 and a half million people who were watching the TV, to try to get ratings." Big Bear FSC member, March 25, 2004

In public meetings after the fire, residents applauded the local radio station for providing useful and up-to-date information during the evacuation. The station manager said that as a small, local radio station, he had an obligation to the community. Thus he went out of his way to get information and to update it frequently. When the station manager had to evacuate, he continued providing fire information via the radio station website.

Locally operated websites dedicated specifically to the Old Fire were often cited as sources of valuable information for affected communities, both before and after evacuation. The websites most frequently cited were given locally recognized or fire-specific names, e.g., "fireupdate" and thus were easily found and dedicated to giving real-time, place-specific information to mountain residents.

"Fireupdate.com was established by a mountain resident, 'Ranger Al,' [pseudonym] who refused to evacuate. Ranger Al checked on a friend's house and once word was out about what he did he was inundated by phone calls. His son set up the website so that Ranger Al could post addresses of houses that had burned and those that had not. Although (he felt) the fire officials did not want the information he had collected, the public did." Rim Family Services: March 25, 2004

In focus group discussions, residents reported that, among the mass media available to them, only the locally based broadcast media plus a few selected websites were considered useful and credible sources during the prolonged evacuation and confusing re-entry period.

Discussion

Communities at-risk of wildland fire would benefit from developing communication plans before a fire strikes. These could be developed as part of community wildfire protection plans. Local, informal information pathways were effective at keeping large numbers of people informed during the Bridge Fire and worked well to quickly mobilize people to attend community meetings. Communication plans should

specifically address means of activating local networks and keeping them informed with timely and useful information. Fire Safe Council members, especially in southern California, are organizing themselves to be qualified and "red card" trained so they can serve, providing local expertise, during wildland interface fires. Other local residents may want to follow this lead. These contributions could fill a vital information gap, if accepted and supported by fire managers.

Although there is a tendency by many organizations and government agencies to hope for control over the quality of information that travels through the media and informal networks in a natural disaster situation such as a wildland fire, it is neither an achievable nor even a desirable goal. Instead, by establishing a goal of "informing the network" fire information professionals can focus more on their responsibility as providers of up-to-date, accurate and real-time fire information. Special attention to communication efforts during evacuation, times of management transition, and reoccupation will be particularly important for the affected public.

Inform the Network

Wildland interface communities are served by relatively complex information networks that go well beyond traditional media. Those include websites of local businesses and organizations, interpersonal networks, and a variety of local media. Residents rely on these networks heavily during fires. They seek information from the networks and add information to the networks (Gillette et al. forthcoming). The need for fire officials to relay warning messages through multiple channels, in order to increase comprehension and encourage residents to take needed action, has been well documented in the hazards communication literature (Turner et al. 1981). The social-psychological processes in fire communication are reflective of the processes that occur in other risk communication systems. This study found that the use of multiple information pathways is especially important during evacuation and re-entry periods. Fitzpatrick and Mileti (1994) emphasized that the most effective forms of risk communication respond to the desire of those at-risk for personalized warning messages and to receive consistent messages from multiple sources. In addition to the traditional media mix, citizens are adding their own news accounts of the wildfire event through cell-phone networks, internet websites, and email lists (Gillette et al. forthcoming). The lack of adequate crisis information in the regional media further emphasizes the need for agencies to provide that information and to find methods for sending it more effectively through local media and informal information pathways.

Implications:

- Official messages are in competition with many other channels, messages, and sources. If the official mes-

sage is to succeed, it must be useful, credible, and timely.

- Arrangements can be made to map the informal information networks used by the public and to find ways to provide these pathways with accurate and timely information.
- Even when rapid response information is provided, special efforts are apparently necessary to plug into the networks community residents use. This will require knowledge of the networks used by community residents and active efforts to link to those sites.
- Advanced communication technologies, such as cell phones with Internet and photo capabilities, can be incorporated along with bulletin boards, community meetings, and mass media for communication.

Real-Time Information

Residents of communities near wildfires feel an urgent need for timely site-specific fire information that will help them cope with the threat to their families, lives, safety, and property; to help them construct their sense-making out of the chaos of the natural disaster. Agencies need to expand and reinforce those fire information functions that provide information to communities near the fire, especially those where residents perceive a direct threat from fire and smoke. For wildland interface fires, the first and most important fire information role must be to provide residents and others whose families, lives, safety, property, and other values are potentially endangered, with timely but accurate information needed for them to cope effectively with the threat.

If the need for real-time information is not fulfilled by the agencies, people are more likely to rely on alternate, less formal information networks, fed by both trusted sources and public rumors. If a Joint Information Center (JIC) or an alternate fire information structure is able to provide more immediate information from its multiple sources, frequently and episodically and to assure that their fire information is distributed among different networks, more people are likely to rely on fire agency contact points as their most reliable information source during a fire event. Specially trained information officers and/or community liaison personnel could be deployed to the fire to gather real-time information and immediately communicate it to the JIC for dissemination to the communities at risk.

Implications:

- Effectively embedding, into IMTs, information officers whose sole responsibility is to communicate detailed information about the fire to the information center for immediate dissemination to communities at risk will be of most value. Updates should be made at

hourly intervals or whenever significant changes occur.

- Information needs of residents of communities at risk require rapid response to their changing situation. Telephone call-in systems can be an important source of this information, but phone infrastructure—particularly in rural areas—can easily become overwhelmed. Augmenting phone banks with online information can relieve congestion (Carr 2005).
- Publicly accessible, updated fire maps are needed, but the descriptive comments need to be updated by information technology specialists working with the fire or JIC.

Evacuation

Studies on warning communication for pre-impact evacuations in response to natural disasters have been fairly extensive. Researchers have reviewed the key structural, psychological and social factors that affect people's responses to evacuation warnings (Aguirre 1991; Fitzpatrick and Mileti 1991; Baker 1995; Atwood and Major 1998; Dow and Cutter 1998; Balluz 2000; Bateman and Edwards 2002; Stein 2004). Others have looked at warning and communication processes and evaluated their effectiveness under different organizational scenarios (National Research Council 1980; Aguirre and Anderson 1991; Burkhart 1991).

Evacuation creates serious communication problems, disrupting informal and traditional information networks. When power fails even an evacuation notice can be disrupted. With evacuation, residents' information needs change and intensify just as communication becomes more difficult. Achieving an interactive exchange of information that is reasonable and effective can be especially challenging when the communities involved have vastly different socio-economic and cultural contexts (Vaughan 1995). Evacuation centers and shelters proved to be effective locations to communicate fire information to residents who used them, although relatively few evacuees in our study stayed in shelters.

To better communicate with the public, information centers can serve as the coordinated point source of official, validated information. However, in the San Bernardino Mountain communities some difficulties were encountered that need attention. When tens of thousands of people are threatened, a few dozen emergency information phone lines do not meet the demands for information. The JIC website was a valuable source of information, but could have been even more effective had it been more broadly advertised. Active dissemination of information through the existing informal networks and websites could help overcome bottlenecks that can occur in emergency information centers.

The JIC and phone bank operators also need improved

training and resources for dealing with greatly traumatized callers. Often, these callers did not want to be "shunted off" to a counselor at a different phone number. Further systematic research on call communication during a fire could help direct improvements in call-taker/caller interaction. Tracy (1997) identified differences in emergency caller and call-taker expectations regarding information provision, geographic location, and time elapsed before police arrived. These differences contributed to the use of conflicting frames of reference that led to misunderstandings and heightened tension. Similar research on call communication during a fire could help identify ways to improve call procedures during a wildfire event. If phone bank operators asked callers what information they needed, they could inform fire information officers, while also demonstrating to the callers their concern.

Past research has indicated that mass media can make useful contributions during the initial stages of a crisis event. Broadcast media can act as the primary distributor of immediate news, conveying information to citizens about the emergency and local emergency management organizations (Wenger and Quarantelli 1989; Burkhart 1991). However, when the public service function is subjugated to focus on the primary media market, television and newspapers can lose the function of informing a crisis situation. Hazards communication research has found that residents are more likely to turn to social networks or officials in order to confirm information about a hazard (Burkhart 1991) and to other information sources, such as the Internet, when media coverage is considered insufficient (Bucher 2002). Although information officers need to meet the demands of the traditional commercial print and electronic media, they should not rely on those media to relay essential information to affected residents during a fire. Those two audiences demand different kinds of information and have different deadlines. Incident managers and information officers can clearly separate the two fire information functions of serving the media and serving communities at risk. Specialized training needs to be developed and provided to information officers who will manage community information functions. Information-seeking behavior during these stages of a wildfire event may indicate a shift from the traditional concept of public media consumption to a more nuanced notion of mediation of information from different communication channels by the public itself (Mokros and Aakhus 2002).

Implications for Notification:

- Evacuation notification delivered with as much lead time as possible will allow residents sufficient time to prepare.
- Evacuation announcements that are as considerate as possible will avoid upsetting recipients who are already traumatized. Reverse 911 call systems are ef-

fective, but they need to repeat information, include a "call-back" number for residents to get additional information, and include cell phones in their network.

- More Spanish-speaking (or other alternate language) information officers and volunteers with knowledge of the affected area can facilitate communication between agencies and the non-English-speaking media and community.

Implications for Evacuee Information Access:

- Early on, people away from home and without access to their usual informal networks need local media information that can be easily accessed.
- The American Red Cross can establish multiple assistance and information sites throughout the area to which evacuees go for briefing. If evacuees know the locations of satellite assistance and information centers before they evacuate, they may seek them out to keep up-to-date on events and conditions in their evacuated communities.
- Mental health professionals should be available and accessible to the phone banks to help operators who must convey information in a manner that can satisfy people who are having difficulty dealing with the traumatic emotions tied to a wildfire event. This applies equally to shelter situations.
- Organizations, such as Fire Safe Councils in communities not currently affected by the fire, could be incorporated into the information network. Information officers can provide such sites with specific information and with telephone links to the JIC and position field information officers where they can respond to questions from residents.
- Phone banks need to be maintained, but also need to be reinforced with other accessible media, such as websites. Websites need public-intuitive names, such as "OldFireupdate" rather than official names such as "IncidentCommand."

Implications for Message Content:

- During evacuation, regularly collected and communicated information about structures and other amenities at risk will be of great value to residents. Information at the community level can be broadly and quickly disseminated.
- Homeowners need to be told, as soon as possible, whether or not their homes and structures have burned. Information at this personal scale needs to be relayed privately and with mental health workers present to help families who have lost their homes. Procedures for these sensitive communications have been

developed by the American Red Cross, with the help of psychologists, and can be easily adapted for use on fire disasters.

- Evacuation centers can also establish sign-up bulletin boards so evacuated parties could voluntarily leave forwarding/contact information. This has been used quite effectively on some wildland interface fires.

Implications for the Media:

- Local radio stations are more willing than regional or national media to focus on specific fire information that is relevant to the affected communities and residents. Thus, local media outlets can be more effective at providing residents with useful information.
- Traditional commercial media can be asked to broadcast information about where accurate and timely fire information can be found (i.e. by providing radio frequencies, Internet addresses, TV stations, phone contacts, etc.). If these links to accurate information sources are established before the fire, then these locations can be broadcast immediately.
- A dedicated broadcast specific to the fire event can be established similar to the Weather Alert System. Fires should be coordinated with the Emergency Broadcast System, especially evacuation orders (Carter 1980). The National Weather Emergency system was used to warn of flooding and debris-flow dangers post-fire, thus that system could also be used during the fire.

Information during Transitions in Management Authority

When wildland fires change in status and scope, authority, function, and personnel change as well. The new team in charge is often starting from scratch to try to build community information pathways. In spite of the formal transition between the team leaving and the one taking over, the community perceives a disruption to reliable information sources and channels. Particular attention is needed when fire fighting teams leave and fire information authority passes to a BAER team.

Implications:

- In the interest of continuity of community information throughout the incident, local line officers may wish to reserve the information function under their direct supervision, especially when there are multiple fires and several IMTs will be communicating with the same communities over time.
- When transitions are made, each fire team needs to examine the information flow to the public in the unique situation of transition. Previous communication oper-

ations must be examined in light of the incoming team's assessment of changing community information needs.

Reoccupation

Reoccupation following an evacuation needs to be planned as carefully and completely as the evacuation itself. Safety information may be needed if vegetation, structures, power lines, water systems, roads, and other infrastructure have been damaged. Residents will face a wide range of urgent problems when they return, including acquiring food and fuel, assessing fire damage to their structures, disposing of spoiled food, encountering injured wildlife or pets, and caring for heat-stressed vegetation. Although extensive research has been done on natural hazard evacuation communication, much less has been done on re-entry into the impacted area. Furthermore, little has been studied of either evacuation or re-entry related to wildland fire. More research is needed on information-seeking behavior during the evacuation, re-entry, and recovery periods of wildfire events.

Implications:

- A communication plan needs to be part of the reoccupation plan. Information officers need to prepare methods to alert all evacuees of the reoccupation and provide instructions on how and when to return.
- An information program needs to be in place and active to help returning residents cope and return the community to normal as soon as possible.

Conclusion

The conclusion of this paper is that disaster communications will be most effective in meeting both the information users' goals and those of disaster managers by devising communication systems that inform the informal, ad hoc networks that arise in communities during disasters with real-time information that helps people understand the threat, make decisions, and take actions. It is recognized that information is used for more than protecting life and property. Information is also used to control anxiety, to maintain and restore a sense of control over one's life, and to cope with loss. It recognizes that information is processed by users, not transmitted to receivers from experts.

It is also recognized that disaster managers have a legitimate and often mandated interest in encouraging public behavior that increases public and firefighter safety and reduces fire costs and losses. Disaster managers must be part of the dialogue so their views and perspectives contribute to the construction of the plausible stories emerging from community sense-making.

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8. ICS 209 forms are filled out by the IMT to keep track of pertinent information about the fire and how many and what kind of resources are assigned. The forms are typically produced twice a day. They are often used by IOFRs (Fire Information Officers) to prepare news releases, but that is not the principal purpose for which the forms are maintained.
9. Environmental Systems Research Institute (ESRI), a prominent Geographic Information Systems (GIS) producer, has focused their expertise on developing fire progress maps and other tools of immediate importance to fire IMTs. ESRI is headquartered nearby in Redlands, CA and thus was able to deploy a GIS mapping team into the JIC.

References

- Aguirre, B. 1991. Evacuation in Cancun during hurricane Gilbert. *International Journal of Mass Emergencies and Disasters* 91, 31-45.
- Aguirre, B. and W. Anderson. 1991. *Saratoga, Texas, tornado, May 22, 1987: An evaluation of the warning system*. Washington, D.C.: National Academy Press.
- Atwood, L.E. and A. Major. 1998. Exploring the 'Cry Wolf' hypothesis. *International Journal of Mass Emergencies and Disasters* 16, 279-302.
- Baker, E. 1995. Public response to hurricane probability forecasts. *Professional Geographer* 47, 137-147.
- Balluz, L. 2000. Predictors for people's response to a tornado warning: Arkansas, 1 March 1997. *Disasters* 24, 71-77.
- Barton, L. 1993. *Crisis in Organizations: Managing and Communicating in the Heat of Chaos*. Cincinnati: South-Western Publishing Co.
- Bateman, J.M. and B. Edwards. 2002. Gender and evacuation: A closer look at why women are more likely to evacuate for hurricanes. *Natural Hazards Review* 3, 107-117.
- Bucher, H.J. 2002. Crisis communication and the Internet: Risk and trust in a global media. *First Monday* 1-10.
- Burkhardt, F.N. 1991. *Media, Emergency Warnings, and Citizen Response*. Boulder, CO: Westview Press.
- Carr, T.L., III. 2005. Personal communication. Thomas L. Carr III, George Washington University.
- Carroll, M., A. Findley, K. Blatner, S. Mendez, S. Daniels, and G. Walker. 2000. *Social Assessment for the Wenatchee National Forest Wildfires of 1994: Targeted Analysis for the Leavenworth, Entiat, and Chelan Ranger Districts*. Portland, OR: USDA Forest Service.
- Carter, T.M. 1980. Community warning systems: The relationships among the broadcast media, emergency services agencies, and the National Weather Service. In National Research Council, *Disasters and the Mass Media: Proceedings of the Committee on Disasters and the Mass Media Workshop, February 1979*, 214-228. Washington, D.C.: National Academy of Sciences.
- Cortner, H.J., P.D. Gardner, and J.G. Taylor. 1990. Fire hazards at the urban-wildland interface: What the public expects. *Environmental Management* 1, 57-62.
- Dervin, B. 2001. What we know about information seeking and use and how research discourse community makes a difference in our knowing. Background paper prepared for *Health Information Programs Development, National Library of Medicine*, Bethesda, MD. Available online at: <http://communication.sbs.ohio-state.edu/sense-making/art/artabsdervin01nlm.html>.
- Dietrich, M. 2003. Personal communication. Michael Dietrich, Fire Management Officer, San Bernardino National Forest.
- Dougherty, D. 1992. *Crisis communications: What every executive needs to know*. New York: Walker and Company.
- Dow, K. and S. Cutter. 1998. Crying wolf: Repeat responses to hurricane evacuation orders. *Coastal Management* 2, 237-252.
- Fire Safe Council. 2005. <http://www.firesafecouncil.org>. Last visited 20 April 2005.
- Fitzpatrick, C.M. and D.S. Mileti. 1991. Motivating public evacuation. *International Journal of Mass Emergencies and Disasters* 9, 137-152.
- Fitzpatrick, C.M. and D.S. Mileti. 1994. Public risk communication. In R. Dynes and K. Tierney (eds.) *Disasters, collective behavior, and social organization*, 71-84. Newark: University of Delaware Press.
- Gardner, P.D., H.J. Cortner, and K. Widaman. 1987. The risk perceptions and policy response toward wildland fire hazards by urban homeowners. *Landscape and Urban Planning* 14, 163-172.
- Gillette, S.G., J.G. Taylor, D. Chavez, and R. Hodgson. Forthcoming. Citizen journalism in a time of crisis: Lessons from a large-scale California wildfire. *Electronic Journal of Communication* Jan/Feb 2007.
- Kumagai, Y., S.E. Daniels, M.S. Carroll, J.C. Bliss, and J.A. Edwards. 2004. Causal reasoning processes of people affected by wildfire: Implications for agency-community interactions and communication strategies. *Western Journal of Applied Forestry* 19, 184-914.
- Mehrabian, A. 1995. Framework for a comprehensive description and measurement of emotional states. *Genetic, Social, and General Psychology Monographs* 121, 3, 339-61.
- Mehrabian, A., and J.A. Russell. 1974. *An Approach to Environmental Psychology*. Cambridge, MA: MIT Press.
- Michaels, S. 2003. Perishable information, enduring insights? Understanding Quick Response Research. In J. Monday (ed.) *Beyond September 11th: An Account of Post-Disaster Research*. Boulder, CO: University of Colorado, Natural Hazards Center.
- Mokros, H.B. and M. Aakhus. 2002. From information-seeking behavior to meaning engagement practice: Implications for communication theory and research. *Human Communication Research* 28, 298-312.
- National Research Council. 1980. *Disasters and the Mass Media: Proceedings of the Committee on Disasters and the Mass Media Workshop, February 1979*. 214-228. Washington, D.C.: National Academy of Sciences.

- Rudzitis, G. 1999. Amenities increasingly draw people to the rural west. *Rural Development Perspectives* 14, 9-13.
- Stein, M. 2004. The Critical Period of disasters: Insights from sense-making and psychoanalytic theory. *Human Relations* 57, 10, 1243-1261.
- Sturtevant V., M.A. Moote, P. Jakes and A.S. Cheng. 2005. *Social science to improve fuels management: A synthesis of research on collaboration*. Gen. Tech. Rep. NC-257. St. Paul, MN: USDA Forest Service, North Central Research Station.
- Taylor, J.G. and T.C. Daniel. 1984. Prescribed fire: Public education and perception. *Journal of Forestry* 82, 361-365.
- Taylor, J.G., S.C. Gillette, R.W. Hodgson, and J.L. Downing. 2005. *Communicating with Wildland Interface Communities during Wildfire*. Reston, VA: U.S. Geological Survey, Open File Report 2005-1061, www.fort.usgs.gov/products/publications/21411/21411.asp.
- Tracy, K. 1997. Interactional trouble in emergency service requests: A problem of frames. *Research on Language and Social Interaction* 30, 315-343.
- Turner, R.H., J.M. Nigg, D.H. Paz, and B.S. Young. 1981. *Community Response to Earthquake Threat in Southern California, Part 10, Summary and Recommendations*. Los Angeles: Institute for Social Science Research, University of California.
- Vaughan, E. 1995. The significance of socioeconomic and ethnic diversity for the risk communication process. *Risk Analysis* 15, 169-180.
- Waugh Jr., W.L. 2000. *Living with Hazards, Dealing with Disasters*. New York: M.E. Sharpe.
- Weick, K.E., K.M. Sutcliffe, and D. Obstfeld. 2005. Organizing and the process of sensemaking. *Organization Science* 16, 409-421.
- Wenger, D. and E.L. Quarantelli. 1989. *Local Mass Media Problems and Products in Disasters*. Newark: University of Delaware, Disaster Research Center.