Taming the wildfire infosphere in Interior Alaska: Tailoring risk and crisis communications to specific audiences

Zoe Garbis [a], Audrey Cox [a], Robert W. Orttung [a, *]

[a] *George Washington University, 1957 E St NW Suite 412, Washington, DC, 20052, USA*

ARTICLE INFO

ABSTRACT

Increasingly frequent wildfires are affecting residents in the wildland-urban interface in Interior Alaska. How might fire communicators convey risk and crisis information to meet growing concerns about wildfire impacts among a diverse audience of residents? This research draws on focus group data to map residents' understandings of the infosphere of Interior Alaska throughout the stages of wildfire events. Residents' different information-seeking habits reflect their particular concerns related to family and work, levels of trust in government and media, and personal networks. Fire communicators can best cater to these audiences by using a tailored approach. To explore what this might look like, we employ portraiture methodology to form composite portraits of four example audiences for wildfire information: residents who are energetic information seekers, those too busy to actively seek out information, residents who are off the grid, and those who are part of Indigenous communities with strong interpersonal networks. Using portraiture methodology allows us to capture the richness and nuance of the contexts in which risk and crisis information-seeking takes place while contributing to filling a knowledge gap on how best to tailor information to specific audiences. Risk and crisis communications designed with the diversity of these portraits in mind might more effectively reach their intended audiences with the most relevant information.

1. Introduction

Approximately 80% of Alaskans live in areas at risk for wildland fire [1], a situation that presents increasing difficulties, particularly since many Alaskans live in the expanding wildland-urban interface (WUI) [2,3]. In order to maintain public safety before, during, and after wildfire events, fire communicators must effectively transmit risk, crisis, and recovery information to the region's residents, recognizing that this audience is comprised of a diverse public whose various information-seeking habits are informed by factors such as property size, family status, business obligations, trust, personal networks, and levels of digital and physical connectedness [4–7]. Previous research has demonstrated that "undifferentiated communication with a general population is costly and ineffective," [8] and fire communicators can do more to tailor messages and modes of delivery to their audiences. This research therefore seeks to investigate the following questions: What are the key components of the wildfire infosphere in Interior Alaska? How do residents there seek and/or receive information about wildfires? How might fire communicators better tailor their messaging to meet the needs of a diverse audience of residents?

This research maps the wildfire infosphere in Interior Alaska and examines how residents interact with it. The "infosphere" is a system encompassing all knowledge or information and the networks through which these data are communicated [9,10]. The "wild-

fire infosphere" therefore describes all information relating to wildfires as well as the actors who hold or communicate it and the channels through which it travels between actors.

In addition to working within a complex infosphere, fire communicators in Interior Alaska perform their duties within the framework of a complex institutional structure. In Alaska, three governmental agencies are responsible for wildland fire management: the Bureau of Land Management Alaska Fire Service, the Alaska Division of Forestry, and the U.S. Forest Service [1]. The Alaska Interagency Fire Management Plan determines their fire protection strategy while two interagency groups coordinate statewide wildfire response. The Alaska Wildland Fire Coordinating Group brings together federal and state agencies with village council presidents and Indigenous leaders to oversee planning and implementation. Among its working groups is one to address fire education and prevention. The Alaska Interagency Coordination Center assists state and federal agencies with initial attack resource coordination, logistical support, and predictive services. Many of the firefighters come from village-based crews [1]. Additionally, specific agencies reach out with particular purposes; for example, the Alaska Department of Environmental Conservation provides air quality advisories, forecasts, and recommendations for safety precautions and activities levels. Communication between these agencies and residents is key to success in protecting lives and property. Within this system of many different parts, our research can best assist communication officers tasked with informing the public about fire events as well as jurisdictional officials, including mayors, Indigenous leaders, and incident management teams [11].

To achieve our objectives, this article begins with a brief survey of existing literature on wildfire communication in Alaska. Next, it presents a conceptual framework that explores the components of the wildfire infosphere and the factors that influence how individuals interact with it throughout the course of wildfire events. It then discusses the focus group methodology used to gather data and the portraiture approach employed to present visualizations of the data. In the discussion of the results, the article describes four archetypal portraits that illustrate how to conceptualize the diversity of information consumers in Interior Alaska. The conclusion explains how fire communicators can tailor communications to reach a diverse audience using the portraits and examines areas for future research.

2. Fire communication literature on Alaska

Existing literature on wildfires in Alaska has not sufficiently mapped the related infosphere. Instead, it primarily examines co-production of knowledge in the fire science space, particularly the work of the Alaska Fire Science Consortium [12], ecological knowledge differences among communities, managers, and scientists and their impacts on forestry management [13], and the public's risk perception of wildfire in the Kenai Peninsula [14]. To the authors' knowledge, no previous research has mapped Interior Alaska's infosphere with regard to wildfire, paying particular attention to residents' changing information-gathering behavior as their needs evolve throughout the course of a wildfire event. To fill this gap, our research aims to construct the infosphere from the information receiver's perspective by mapping the sources and transmitters residents consult and the content of information they receive or seek. It then uses these data to develop portraits of the diverse audiences in Alaska for wildfire information and tools to assist communicators reach these audiences.

3. Conceptual framework

Fire communicators work throughout the course of wildfire events to increase individuals' resilience and maintain public safety by encouraging residents to prepare strategically and facilitating coordinated public action [15–17]. Wildfire events occur in cyclical temporal phases, with communication efforts concentrating on risk preparedness prior to a fire [18–21], crisis management during a fire [22–24], and re-occupation or recovery as the threat to life and property dissipates [25]. Disruptions in risk and crisis communication, such as a failure to reach a particular audience, the dissemination of erroneous information, or public distrust in information sources, can endanger residents and thereby disturb public safety [26].

In order to ensure that the correct information reaches the appropriate audience, communicators must understand the components of the infosphere, differences in information-seeking behavior among residents in fire-prone areas [27], and which messages get through and how they are received. Tailoring messages and disseminating them through the infosphere with an understanding of the various information-seeking behaviors of different audiences improves the effectiveness of wildfire communication.

3.1. Components of the infosphere

Renn provides a useful conceptualization of a hazard infosphere as consisting of a network connecting senders, messages, and receivers [28]. Senders generate data via observation and collection, analyze its validity, and assign it a degree of significance, while transmitters broker a message between its source and its receivers [28]. In reality, this relatively simple structure involves a high degree of complexity as actors can serve in several roles–for example, as both transmitters and receivers–and information is often distorted or modified as it travels among one or more transmitters before reaching a receiver [21,29–32].

Along its journey from sources, through transmitters, to receivers, social processes mediate the way a message is received [30]. The social context of an individual's community and personal psychological factors influence how an audience member responds to risk or an event [21]. Accordingly, the Social Amplification of Risk (SAR) model proposes that transmitters may adjust messages and receivers may interpret and evaluate messages, assigning meaning, value, or credibility to information according to their preferences, interests, or beliefs [21,33]. "Amplification stations," at which messages are modified, can include individuals, social groups, organizations, management agencies, news media, and personal networks, among others [21]. Vertical and horizontal exchanges of social capital among individuals and communities can also complicate the trajectory of information, as communities with a high degree of social capital can more efficiently disseminate information [34,35]. The resulting infosphere thereby becomes a complex network of

actors, information, and the social processes that shapes an audience's understanding of the hazardous situation at hand and affects their vulnerability to disasters [36].

Existing research on the wildfire infosphere identifies a range of actors from which individuals seek or receive information as well as great diversity in the content of the messages communicated [37]. Prior to wildfire events, individuals consume information from several categories of actors: public organizations with specialized knowledge, such as fire departments or state foresters, mass media, such as newspapers, TV, and radio, and community members, including neighbors, friends, or family [29,38]. This information includes levels of wildfire risk and preparedness actions that individuals and communities can take [23]. Individuals who do not seek or receive information at this stage tend to believe that wildfire events are less likely to occur compared to their information-seeking peers [29].

During a fire event, individuals report finding conversations with fire departments and other experts as well as neighbors, friends, and family to be particularly useful sources of information, and social media to be the least useful [38]. The geographical scope of an information source or transmitter plays a role in information-seeking; individuals prefer local outlets, platforms, and organizations, at times even capitalizing on informal networks or personal connections with experts on the ground [25,39]. The content of information sought and received during a wildfire event is primarily specific, real-time data about the fire itself (exact location, size, direction of movement) as well as the material damage (which homes have burned, if any) and action-oriented (whether there is a need to evacuate, which belongings to gather) [25,39,40]. At this stage, information-seeking is urgent and hurried, with little time to pursue details or context [25,40].

A growing literature examines the information sources or transmitters that individuals turn to after a wildfire event and how this information can be accumulated. Individuals seek different kinds of information after a fire event, depending on how a community has been affected, whether or not the individual's home burned down, and when reoccupation can take place [25,41]. Accordingly, asynchronous channels might be more effective at magnifying messages about recovery than synchronous ones, which prioritize urgent emergency information [42]. One clear conclusion is that there are insufficient sources of new knowledge and ways to store collective memory for many community-based organizations. Local organizations often take the lead in wildfire recovery given the variation across impacts at the community level, but often they lack knowledge about past recovery experiences or what other communities have done, a situation that can be improved with more proactive methods to share knowledge across community-based organizations [43].

3.2. Information-seeking throughout wildfire events

Several models attempt to understand why and how individuals seek and receive information, investigating the factors that motivate information-seeking action and what behaviors occur as a result [44–46]. These models emphasize that information seeking and processing (how that information is internalized) can be emotional rather than rational, meaning that an audience's perceptions, feelings, and needs play a role in how, why, and which information is sought [45]. By using a bottom-up approach, the RISP (Risk Information Seeking and Processing) and FRIS (Framework of Risk Information-Seeking) models examine how psychological and sociocultural factors might play a particularly strong role in informing behaviors during events such as wildfires [45,46]. Indeed, several studies employing the RISP model have found that information insufficiency (the gap between what an individual knows and what they believe they need to know) as well as subjective norms (the belief that one *should* have knowledge about a risk) motivate information-seeking [44,47–50], although others have found mixed evidence [51,52]. The complementary FRIS model adds that trust in risk-managing institutions plays a strong role in individuals' information-seeking behavior, as does perception of personal control over the risk [46]. Yet another model, Planned Risk Information Avoidance (PRIA), posits that similar factors may influence purposeful information *avoidance*, in which an individual intentionally does not seek information [53].

Institutional trust–a measure of public confidence in hazard management agencies–can inform which sources or transmitters individuals turn to, as well as what information they believe [54], and varies across cultural contexts [55]. Across studies, individuals report higher levels of trust in local and "official" sources of information, such as fire departments or agency professionals [7,38]. Similarly, social trust can guide individuals to prefer information communicated through channels with which they are familiar [44,45], rendering less targeted sources or transmitters (such as mass media) ineffective [15].

Levels of digital and physical connectedness to communication channels can also influence individual habits, especially in Alaska, where geographic distance remains a challenge to communication [56]. During hazard events such as wildfires, information needs increase quickly but communication channels may be blocked, thus creating a strong dependency on technologies such as radio, which are not dependent on cell networks or online connectedness [57]. Individuals might have particularly high information needs in such situations, which prolong emergency responses and exacerbate the consequences of the hazard [42]. These barriers are compounded by the digital divide, the inequitable distribution of digital information technologies across a population that contributes to knowledge gaps consistently disadvantaging rural and elderly communities [58,59].

These factors compound the complexity of the wildfire infosphere, especially as Interior Alaska sees an increase in social diversity [4]. Local social context and individual characteristics inform how communities respond to information about wildfire risk and crises [6,7]. In light of this diversity, risk and crisis communication must be tailored to the local context and with consideration of the unique characteristics of populations who live in wildfire-prone areas [5,50,52,60–62].

3.3. Moving risk and crisis communications forward

Given the complexity of the infosphere, the different ways individuals seek information, and the variety of sources and messages, information targeted to a specific audience can elicit behavior consistent with the intentions of the communicator [18,63]. Examining communities in Portugal, Oliveira and colleagues concluded that "Wildfire risk management strategies must address the challenges

linked to the need to tailor communication to people's conditions" [64]. Accordingly, it is necessary to "prepare different approaches for different audiences" [65]. While risk and crisis communications do emphasize rules such as "Listen to the Public's Concerns and Understand the Audience," there is often little discussion of who the audience is and how to understand the diversity within it [66]. Risk and crisis communication studies increasingly emphasize that communicators must understand the recipient perspective and have begun exploring how to categorize differences in information-seeking behavior [7,38,67]. Research shows gaps in wildfire risk perceptions between WUI residents and wildfire professionals, making it crucial that communicators better understand their audiences [68]. At the community level, Champ et al. advocate a tailored approach in addressing wildfires, noting that differences regarding communication preferences are among the factors that affect how best to define locally relevant wildfire preparation and mitigation programs [37].

Despite these advances in wildfire communication, there remains a gap in understanding the specific habits of wildfire information-consuming audiences and the ways in which fire communicators can utilize improved knowledge of their audiences to reach members of even the most remote and disconnected communities. While many previous studies recognize the need for tailored communication [37,64,65,68], existing research has not sufficiently explored what a tailored approach would look like in practice, nor how to conceptualize the diversity of the information-seeking audience beyond looking at results of quantitative analyses of demographic information and risk perception. This study contributes to filling this knowledge gap by both employing a qualitative analytical approach to data and by visualizing information-seeking audiences in an approachable and compelling way.

4. Methods

This section describes our research setting and the methods we used to collect and analyze our data.

4.1. Research setting

The growing frequency of fires and diverse population in Fairbanks, Alaska and the nearby Indigenous community of Nulato, located 300 miles by air to the west of Fairbanks, make the Alaska Interior a useful site for analyzing wildfire communication. Residents of this region include Native individuals whose families have lived in the area for thousands of years as well as settlers who have chosen to move from elsewhere for employment, recreational opportunities, or to escape the quotidian constraints of conventional society [4]. The Indigenous groups have a long history of dealing with wildfires and the inclusion of their traditional ecological knowledge, with its local details, historical context, and long-term observations of climatic change, in fire strategies and communications is essential in building trust between these communities and government agencies [14,69]. Nevertheless, despite their differences, all residents require information before, during, and after fire events. The variety of audiences for this information and the challenges in reaching them make Fairbanks and Nulato a critical case in studying and building knowledge about the wildfire infosphere [70].

4.2. Focus groups

The results of this research rely on data collected through focus groups, a qualitative method useful in answering "how" and "why" questions and teasing out motivations for complex behavior [71,72]. We conducted three focus groups using a standardized set of questions, two with residents of Fairbanks and one with residents of Nulato. The participants included urban and WUI residents affected by the fires and members of the Indigenous community whose voices are rarely present in discussions about risk or crisis communications [73].

Seventeen participants took part in our focus groups, five and six in the two Fairbanks groups and six in the Nulato group. Sixteen of these had experienced wildfire events in previous years. All participants were recruited by Information Insights, a professional research company based in Fairbanks, through its lists and contacts. From the pool of candidates who responded to the advertisements, we selected participants with diverse residences, professions, and experiences in order to encourage discussion about how different social contexts may inform different information-seeking habits. Only two participants worked for the government (in the Nulato focus group), ensuring that most participants could describe the information-seeking process rather than efforts to produce messages. For details on the participants, see Table S1 in the Supplementary Materials.

The groups were conducted virtually in October of 2020, at the end of Alaska's fire season [74]. Because Interior Alaska experienced a highly active fire season in 2019 with large tracts burned, focus group participants had fresh memories of fire events [75]. A single moderator, who worked as an employee of Information Insights, asked the questions and sought to ensure that all participants had opportunities to speak in a structured conversation. The moderator's script, which is included in the Supplementary Materials, asked participants open questions about their experiences with environmental hazards, presented a wildfire scenario to get a sense of how the participants wanted the government to respond and what kind of information they sought, queried how participants prepare for wildfires, and asked them what kind of information sources they use and which they trust. The script did not explicitly reference temporal aspects of wildfire events (before, during, after) in order to let the participants make these distinctions themselves. These focus groups provided details about what Alaskan residents are most concerned about regarding wildfires and what information they consult to respond to the fire events. The authors did not attend the focus group discussions, but they were recorded and the data are subject to the guidance of the university Institutional Review Board.

While the focus groups provided sufficient insight to build an approximation of Interior Alaska's wildfire infosphere, these methods are limited in that they present self-reported attitudes and feelings, which may not be accurate representations of behaviors and actions. Alternative methods could include one-on-one interviews or large surveys of the population; we chose focus groups as a relatively efficient way of conducting interviews simultaneously among ordinary Alaskans while providing insight into the social and cultural context that shapes behavior.

4.3. Portraiture methodology

We use a portraiture methodology to both analyze and present the data gleaned from the focus groups with the goal of expressing the complexity and context in which information-seeking takes place. Lawrence-Lightfoot and Davis describe portraiture methodology as "a method of qualitative research that blurs the boundaries of aesthetics and empiricism in an effort to capture the complexity, dynamics, and subtlety of human experience and organizational life" [76]. Our implementation of this method particularly focuses on using portraits to "capture the richness, complexity, and dimensionality of human experience in social and cultural context, conveying the perspectives of the people who are negotiating those experiences."

We applied this methodology in analyzing the focus group data, engaging in an iterative process in which we composed portraits of residents and continually revised them to ensure we captured the diversity of concerns, characteristics, and preferences discussed by focus group participants. Using the qualitative data analysis software Atlas.ti, we were able to identify how various participants described the complexity of the infosphere, the types of information-seeking behavior participants engaged in, and how participants received and interpreted fire-communication messages [77]. After developing these portraits, two of the authors revisited the focus group transcripts to gauge the frequency and significance of concerns, priorities, and needs highlighted by participants to ensure that the portraits reflected these data.

While portraiture methodology has previously been used as a form of collecting data, here we use it primarily as an analytical tool, allowing us to develop archetypes of different audiences based on participants' information-seeking behavior and how their respective contexts might influence their actions. Contexts in this sense refer to "physical, geographic, temporal, historical, cultural, [and] aesthetic" settings [76], elements of which were drawn from across participant experiences and compounded to form each archetypal portrait. In this sense, none of the portraits represent real people; rather, they are intended to illustrate the diversity of the audiences and the contexts which influence behaviors, presenting a synthesis of the participants' characteristics and their responses in the focus groups.

In addition to serving as a method of analysis, the resulting portraits enable us to visualize data in a more compelling way than the graphs and charts that are typical of quantitative approaches. The portraits are designed as heuristics to convey a large amount of data about linkages between information-seeking strategies and the contexts of the people seeking the information. The goal of presenting data in the form of four portraits is to give fire communicators an idea of the different audiences to whom they should direct their messages. In theory, if fire communicators can reach these four audiences, they likely would be reaching the majority of residents in the area.

Unlike experimentalist social science approaches, which favor randomized controlled trials to eliminate context in identifying causes in treatment and control groups, these portraits emphasize that people live within complex social environments that influence how they seek and receive information [76,78]. By employing techniques similar to storytelling, we use the portraits to illuminate the "complex factors that guide individual decision-making" [79,80].

Of course, this methodology has potential downsides. While the usual purpose of data visualization is to be as parsimonious as possible, here we worked with artists to present a view of the data that makes clear the link between individual and community social context and information-seeking behaviors [81]. The artists who prepared our portraits were Leah Silinsky, a graduate student at George Washington University, who developed the three settler portraits, and Holly Wofford, an Indigenous artist with ties to Fairbanks and Nulato, who drew the portrait of the Indigenous leader. Given the possibly limited representativeness of the focus groups and the subjective nature of the artist renderings, other researchers could come up with a different set of four portraits. Further research will be required to determine if these four portraits are sufficient to provide an accurate representation of the kinds of audiences in Interior Alaska or if more are needed.

5. Results

The data collected in the focus group discussion fill in and illuminate our conceptual framework which highlights the complexity of the infosphere, featuring a large variety of actors and messages, the different information-seeking behaviors of the residents, and the social contexts of the residents that make it possible to develop portraits of the different audiences.

5.1. Infosphere complexity

5.1.1. Sources and transmitters

Participants identified a range of communication platforms through which they seek and receive information, at times distinguishing between the original source of information and the transmitter(s) through which the information reaches them. While the majority of participants reported consuming information mediated via a transmitter, some seek information directly from a source. Table 1 displays three categories of sources that participants indicated as providing first-hand or original information: government, non-governmental organizations (NGOs) and community-based, and eyewitness accounts. Government sources include federal, state, and local levels, representing agencies and offices with relatively extensive resources to monitor hazards or risk and make information available to other actors or the public. NGOs and community-based sources primarily offer information about preventative actions that communities and individuals can take to reduce risk ahead of a wildfire event, while eyewitness accounts provide first-hand observations of the environment ahead of and during wildfire events.

Table 1 lists the information sources identified by focus group participants. However, it is not comprehensive and lacks specificity; for example, it does not include information generated through academic research, nor does it indicate the relationships between sources that may share or exchange data prior to publicizing information. While Table 1 presents three distinct categories of sources, many platforms or actors may overlap, collaborate with, or oversee others. For example, governmental actors such as public

Table 1

Wildfire information sources identified by residents of Interior Alaska.

Federal, State, and Local Government
Federal
U.S. Forest Service (USFS)
Bureau of Indian Affairs (BIA)
Bureau of Land Management (BLM)
U.S. Fish and Wildlife Service (USFWS)
U.S. National Park Service (NPS)
NOAA's National Weather Service
State
Alaska Department of Natural Resources, Division of Forestry & Fire Protection
Alaska Department of Environmental Conservation
Alaska Department of Fish and Game
Local
City of Fairbanks
Fairbanks North Star Borough
Tribal Council
NGO and Community-Based
Fire Safe
FireWise
Community Wildfire Protection Plans (CWPPs)
Eyewitness Accounts
Residents
Emergency First Responders
Journalists

land managers and state foresters may contribute to or sign off on Community Wildfire Protection Plans (CWPPs) [16]. Alternatively, emergency first responders, who fall under the category "Eyewitness Accounts" may include actors deployed by governmental agencies.

Several focus group participants acknowledged that the information they seek or receive has likely traveled through a complex network of transmitters before reaching them. For example, one participant uses *"radio and media"* but knows that these platforms are *"fed information from the agencies."* Another participant knows to go *"right to the source of where the information is coming from"* after receiving an initial alert through a specialized emergency communication service. Yet another believes that *"social media is a good place to get [information] out as long as that information is coming from a trusted source like a government organization."* Participants indicated that they are often unaware of how many transmitters information has passed through, if any at all. As is later explored, this complexity can facilitate the distortion of the original message and cause doubt among residents that the information is trustworthy.

Table 2 lists the participant-identified transmitters in six categories: governmental, information aggregators, specialized emergency communications, mass media, neighborhood/community, and social media. This table helps illuminate our conceptual framework by making clear the complexity of the wildfire infosphere.

One participant mentioned not using any specific transmitter to seek information, but rather relying on a digital search engine, such as Google, to take them directly to the source or transmitter with the most recent and pertinent information. This approach is favored by people who do not constantly scan media for information, but seek out details if they receive notification of a fire near them.

When discussing these transmitters, some participants mentioned a factor unique to Interior Alaska that informs why some residents rely particularly heavily on neighborhood or community transmitters: the high proportion of residents living in rural areas or areas not accessible by roads. In such places, neighbors are *"quite often the first line of defense [that] people have"* because emergency

Table 2

Wildfire information transmitters identified by residents of Interior Alaska.

Governmental *public entities with knowledge of federal, state, and local government directives*	**Information Aggregators** *websites that present fire, air quality, and other data from federal and state government sources*	**Specialized Emergency Communications** *channels utilized by various actors exclusively during crisis events*
- State Troopers - Fairbanks Memorial Hospital - Fairbanks Police Department - Fort Wainwright Directorate of Emergency Services	- UAF Smoke (http://smoke.alaska.edu/) - Alaska Wildland Fire Information (https://akfireinfo.com/) - Alaska Interagency Coordination Center (https://fire.ak.blm.gov/)	*Community* - Amateur/ham radio - VHF Radio - Alert services (Nixle[a], Pulse Point) *Government* - Fairbanks Northstar Borough Emergency Operations' on-demand text service
Mass Media *broadcasting, digital, and print media that may report on wildfires*	**Neighborhood/Community** *interactions between residents in informal settings*	**Social Media** *websites and applications on which residents post, circulate, and comment on information*
- Fairbanks Evening News on Channel 11 (TV) - Fairbanks Daily News Miner (newspaper) - KUAC (public radio)	- Word of mouth (in person, phone calls, text messages) - Community fora (meetings, physical/digital message boards) - Physical maps	Facebook (community groups and pages, official pages of local government offices and officials)

[a] The Alaska State Troopers replaced Nixle with a more targeted service, Rave Mobile Safety, in 2022 [82].

services are unlikely to arrive as quickly as they might in urban areas or because connectivity to other transmitters is limited (for example, poor cellular data coverage or lack of wireless networks).

While Tables 1 and 2 present sources and transmitters as distinct spheres of information dissemination, many actors may serve in both roles. For example, individual residents may function as a source of information in the form of an eyewitness account of wildfire conditions, but also transmit information to other residents via word-of-mouth communication with family or by posting an update on social media.

Fig. 1 lays out the fire infosphere in all its complexity, with concentric circles showing time frames, sources, transmitters, and information receivers. This complexity becomes especially difficult for participants to discern throughout the course of a wildfire event, in which some sources disseminate information in all three stages (before, during, after the fire event), while others are present only in specific stages. Throughout these stages, transmitters are also disseminating information sourced from an array of actors (including both sources and other transmitters), complicating the trajectory of information. Fig. 1 displays these trajectories at the level of knowledge held by participants. For example, participants distinguished between the sources that are consulted at different stages of wildfire events, but did not generally place transmitters on the same timeline. This is partially due to the fact that participants do not know how many transmitters a message has passed through, and also that they seek or receive information from most transmitters at all stages of wildfire events. Participants only indicated knowledge about the placement of two transmitters along this temporal continuum: mass media, which is particularly slow at disseminating real-time information during fire events, and specialized emergency communications, which are deployed almost exclusively during wildfire events. This complexity is illustrated in Fig. 1 through the many arrows present in the "Transmitters" sphere, which indicate the circulation of information among transmitters throughout the different stages of wildfire. While the categories of information sources are placed along this temporal continuum, the transmitters are not.

Focus group participants identified a range of gaps in this infosphere, which concern the way in which information reaches them. Some participants indicated that there exists no true *"one-stop shop"* site that provides clear information on the location of wildfires, air quality information, and predictions about where the fires are headed. These participants desire a central place to find out *"what the need is, and when to jump at that,"* perhaps in the form of a web or mobile application. Along these lines, participants expressed desire for a *"place to go where you can get updates and [have] the updates be more frequent and more clear."* Overall, there was a sense that the communication system did not connect with its audiences. As one participant noted, the communication system *"seems like it's there, it just needs to be a little bit more clear and quicker in the response,"* because *"there just doesn't really seem to be a strong and meaningful and efficient way to let us know how bad things are until they get bad."* In this sense, the overall system seems to work but does not go
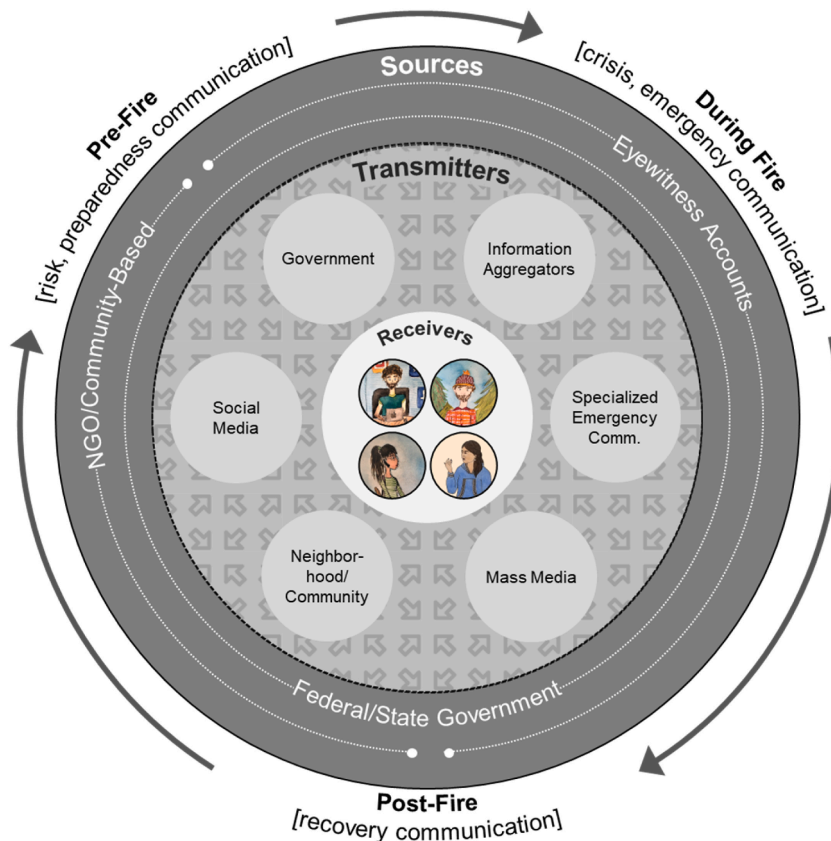

Fig. 1. The wildfire infosphere in Interior Alaska.

the last mile of connecting with the WUI residents. Of course, no infosphere will meet all the needs placed on it. Previous research in the risk and crisis communication fields has repeatedly found that no single source or transmitter can reach every resident and the wildfire infosphere therefore needs to feature multiple channels of information across temporal stages [25,39,42,83,84].

5.1.2. Content of messages sought or received by residents

In addition to listing the sources and transmitters from which they seek or receive information, participants discussed the content of messages communicated to them throughout stages of a wildfire event. Prior to fire events, participants consume harm-reducing risk information relating to air quality, burn bans, fire risk warnings (posted on road signs), digital maps, data visualizations, and specific actions they can take to prepare for fires or defend their properties, which usually entails consulting existing community plans or a professional surveyor [46,50]. During fire events, participants view information announcing the start of the fire, describing its location and progress, and identifying clean-air refuges and evacuation routes [16,85]. At this stage, participants may also receive evacuation orders and instructions. Beginning during fire events and extending into the post-fire stage, participants engage with reports on fire duration and impacts, including which properties have been damaged and which fire fighting services have been involved in managing the fire, primarily communicated via mass media.

Participants identified several issues with or gaps in the content they currently seek or receive, primarily occurring before and during wildfire events. Before fire events, there is insufficient information about where fires might happen, which restricts potential recreational activity or travel. Participants indicate that during fire events, specific and technical information can be unhelpful because it does not contain straightforward communication about the speed, movement, or intensity of a fire. Additionally, one participant mentioned that information about air quality gets more attention than information about risk and other consequences during fire events. Lastly, some participants have encountered misinformation, particularly on platforms such as Facebook, where local leaders cannot respond to rumors or assumptions *"because they [themselves] don't really know the truth."* Countering misinformation was particularly emphasized, with one participant calling on fire communicators to *"really get the facts straight before rumors start … [because rumors] get people into a panic."* Providing wrong or insufficient information could result in people *"taking it upon themselves … to just act"* in ways that might counteract fire managers' desired outcomes.

In order to fill these gaps in information content, participants discussed a range of possible solutions. Prior to fires, participants would like to see historical data about wildfires in the region and receive information about solutions to home air quality issues, such as where they might get help purchasing or replacing air filters.

Participants identified five types of information they believe they would find helpful during fire events. First, they would like to have access to an interactive map with information about the fire location, predictions about its movement, location of fire breaks, wind direction, and fire size. Ideally, such a map would also include an air quality index. One participant would also like to see levels of fire risk on such a platform, so that he does not have to drive by a physical sign to access this information. Second, participants would like straightforward evacuation instructions, including information about evacuation routes and locations of shelters for both people and animals. Such instructions could also indicate if there are supplies or resources available to support their evacuation. Third, participants express that *"it is important for people, especially in this age of information, to know what [fire managers] don't know."* Otherwise, the public might be frustrated that they have been misinformed, *"when in reality, it was just an unknown."* Fourth, participants seek information about who is responding to a fire and whether there is a response at all, especially because fire managers often *"just let them burn"* in Alaska. In Nulato in particular, participants would like to know whether a response will include federal actors or any sort of relief, since there are no evacuation routes by road, only air and water, which may require additional coordination. Fifth, participants would prefer to receive information about how to handle long-term smoke episodes, especially ones that last multiple weeks or longer and interfere with regular activities such as going to work and spending time outside. Participants did not identify any particular types of information that they lack in the aftermath of a fire event beyond continuing to have access to air quality information. Although other studies acknowledge gaps in the infosphere, such as a lack of agency-community communication prior to fires [13,86] and overall insufficient information-sharing during fires [16], the results of this study contribute significant detail about preferences specific to the Alaskan audience.

5.2. Information-seeking behavior

Focus group participants indicated that they seek information in a variety of ways. Some actively search for information online and make use of a wide number of resources. Such individuals are in a position to help others gain access to information. One participant, for example, expressed the importance of *"understanding your community around you and the people who you also care for, knowing that your neighbor down the road doesn't have Internet either … doesn't have cable or doesn't have a TV and they're probably not going to have access to that information."* Others are busy meeting their day-to-day concerns and only receive information in a passive way. One participant noted, for example, that they rely on one of their *"coworkers that keeps really good track of these things"* to stay informed. A third group proudly announces that they do not use social media or go online, so *"if something big were happening, [they] may not really know."* Another relies on *"word of mouth and folks talking"* to receive information. Even the most connected participants sometimes struggle to access information that is exclusively available online because of frequent power outages or overall lack of reliable connections, which is only worsened during wildfire events. During a wildfire event, one participant recalled having *"no service, …no phone, no long-distance, no Internet for a few hours."*

The discussion in the Indigenous community of Nulato was qualitatively different from that in the Fairbanks area. In the Nulato community, residents are more likely to be familiar with each other. In this community, residents know who to ask to receive specific kinds of information. This was not the case with the residents of Fairbanks, who could not always identify the best sources for information.

5.2.1. Social context

The participants also had different reasons for seeking wildfire information. Earlier research has shown that concerns, such as "smoke impact likeliness" [61] are important in shaping the information-seeking habits of residents in wildfire-prone areas and that the types of concerns change during and following fire events [25]. Our research applied a broader angle to understand the social context for WUI resident concerns about wildfires. Nearly all participants, regardless of age or pre-existing conditions, mentioned consequences for health followed closely by consequences for recreation as the most concerning. In comparison, concerns about financial loss and property damage were less frequent.

Participants worried that smoke would affect their health overall and that it limited them from engaging in outdoor activities, such as bike riding or allowing their kids to play soccer. For example, one participant mentioned implications for his family: *"as a parent, we really consider which school my kid goes to and where they go to school … some schools have worse air quality than others."* Another is considering leaving Alaska altogether: *"if the patterns of smoke and the weather systems change, and if the summers aren't as enjoyable, if there's more smoke and it is pretty consistent, I probably won't continue to stay in Alaska."* Participants stated that projections of smoke conditions and information about air quality were therefore particularly important, as well as the locations of "clean air" spaces during extended periods of smoke.

Financial concerns extended to costs for businesses and subsistence activities. Smoke and wildfire events have a *"major impact on not only our local businesses and the health of our local citizens, but even on tourism."* One participant's *"family's business relies on the tourism industry and people don't necessarily want to come up here during wildfire situations where it's really smoky … It's just hard to sell people on the great outdoors that we offer. Naturally if there's a ton of smoke, they don't want to hang out in it."*

Participants in the focus group conducted in Nulato specifically identified changes to lifestyle and subsistence food gathering as important reasons to seek information about fires. Many families rely on being able to hunt, fish, and collect berries. One noted that they *"couldn't pick berries for a couple of years"* after a large fire in 2015. The emphasis or importance placed on each concern differed among individual participants.

Participants who have pre-existing health conditions, those with children, and those with businesses reliant on good air quality, such as tourism, were most the most likely to seek information about fires and how they might affect their lives, yet every participant expressed concern about at least one consequence of wildfires.

5.2.2. Trust

Focus group participants reported varying levels of trust in the sources and transmitters that they identified. When it came to sources, participants indicated trusting "official" actors more than others, because federal, state, and local government agencies *"align [with] each other and communicate a unified message and then get that out in whatever ways possible to reach people as efficiently as they can in a short period of time."* Of the transmitters they identified, participants reported greatest trust in two information aggregators–UAF Smoke and AK Fire Info, two specialized emergency communication platforms–Fairbanks Northstar Borough Emergency Operations' on-demand text service and Nixle, and two mass media outlets–the KUAC radio station and the website for the local newspaper, the Fairbanks Daily News-Miner. One participant stated that they trust the News-Miner more than other transmitters because they have personal relationships with some of the journalists working there, through which they have learned that the website is updated every few minutes during wildfire events.

Views of whether social media is trustworthy varied across our focus groups. Participants in the Fairbanks focus groups did not see Facebook or other social media platforms as reliable. For example, one participant noted that they *"don't trust some social media because feelings get involved,"* explaining that people may insert opinions into information that they communicate under the guise of being a fact. However, in the focus group conducted in Nulato, participants indicated that they trust information posted in community groups on Facebook because they have personal connections with the residents who are posting information. Since they know the people posting the information online, they feel comfortable assessing its validity. (Research suggests that whether residents trust social media during disaster events depends heavily on context - WUI residents in Washington State reported a lack of trust in social media [37] while foreigners living in Japan relied on it for information [87]).

Participants noted several transmitters that they did not trust to deliver accurate or reliable information. For some, these included the mass media platforms Fairbanks Evening News (TV) and the print newspaper from the News-Miner, because they sometimes broadcast or publish *"days old news."* Mass media transmitters could also be untrustworthy because of a high turnover in journalists and reporters, a lack of comprehensive reporting, or reporting of information that is not specific enough to be helpful to residents. Others identified word-of-mouth as untrustworthy because they are *"potentially the seventh person to hear [information] in a row,"* making it more likely that the original message has been distorted or changed.

6. Discussion

These results contribute to existing research about information-seeking habits while helping to advance our theoretical understanding of wildfire communication. Our data builds on previous research which shows that in order to ensure appropriate public response, the content of the information communicated must be made personally relevant to residents [46,50,88], for whom social context and individual characteristics play a strong role in shaping information-seeking behavior [52,61]. As such, fire communicators must design and execute communication strategies that can reach diverse audiences, including socially and geographically distinct groups, with messages tailored to their circumstances [89]. In order to do this, communicators must be able to identify who their audiences are and how these audiences differ in their habits and preferences.

We answer the call for more bespoke communication approaches by employing a portraiture methodology that more fully captures the richness of the contexts in which information-seeking takes place while presenting examples of portraits that capture the diversity of the information-seeking audience. The application of this methodology advances existing risk and crisis communication research by contributing a qualitative approach to analyzing the factors that contribute to this audience diversity. Rather than relying on a slew of graphs and tables, the portraits presented here will be more effective in helping fire communicators think about and address these audiences.

Our data illustrate considerations fire communicators might make in tailoring their communication modes and message content to local residents' unique needs. Fig. 2 presents four portraits of specific audiences with diverse social and demographic characteristics,
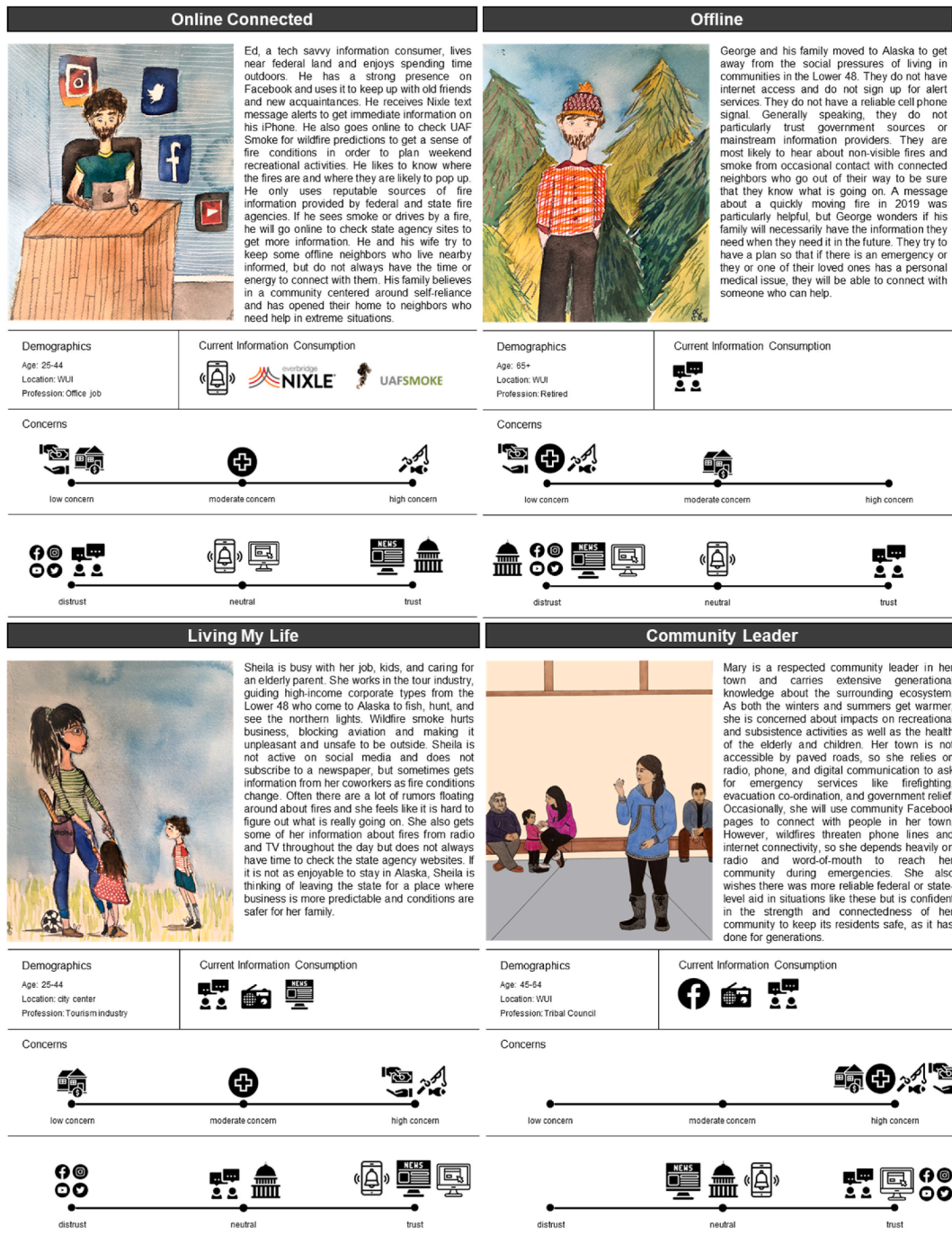

Fig. 2. Portraits of four potential audiences for wildfire information in interior Alaska.

concerns, and information consumption patterns. Each portrait serves as a data visualization that describes what information each of these individuals needs and how fire communicators can best reach them. In addition to the pictorial representation, each portrait synthesizes the qualitative data presented in the results by crafting a narrative about how the social context and personal characteristics unique to each audience might inform their information-seeking habits. These characteristics include demographic factors (such as age, location of their home, and profession), concerns about the impacts of wildfires, and levels of trust in sources of transmitters of information.

The four portraits emphasize the information-seeking behavior of individuals who are online and connected, offline, passive consumers due to other concerns, and community leaders. The online individual actively seeks out information from a wide variety of sources and shares what he learns with others, including offline neighbors. The offline individual has little trust in the government and media and relies on neighbors to get the information he needs. The mother and businesswoman has little time to seek out information actively, so relies on what colleagues and neighbors tell her. Finally, the community leader is deeply concerned about her neighbors and uses a variety of sources of information to learn about fires and communicate to her relatives and friends. The portraits frame each of the different types of information gathering strategies as composite individuals with specific sets of concerns, trusts, and links to the infosphere. No one portrait necessarily represents a real-life individual; rather, each serves as a composite of characteristics so that, when all portraits are taken together, most concerns and needs will be accounted for.

Although the small number of study-group participants do not constitute a sufficient sample size with which to categorize these audiences accurately, we provide an example of what they *might* look like. These generalizations are not necessarily indicative of the reality in Interior Alaska and other focus group participants, researchers, and artists might generate different results. Of course, some individuals in Alaska's population may find their characteristics represented in more than one of these audiences; a degree of overlap is possible, and perhaps likely.

While information-seeking habits and needs might differ greatly at the individual level, the purpose of presenting four audiences is to capture multiple points of diversity through composite portraits. Communication designed with reference to the differences among these audiences may therefore be better equipped to reach Interior Alaska's diverse population because it would address the reasons why or ways in which messages have not reached their intended audience in the past. In particular, focusing on these audiences would allow communicators to better tune their messages to the information-seeking habits, concerns, and sense of trust in a diverse set of audiences.

In order to further ensure that the most relevant information actually reaches its intended audience, communicators might consider which transmitters of information each audience has access to and is most likely to consult. Fig. 3 visualizes the transmitters most closely associated with each of the portraits, ranging from using the full panoply of transmitters, to a select few, and just neighbors.

Practically, residents need a robust and effective infosphere that disseminates information through a variety of channels while addressing their multiple concerns about the consequences of wildfires. A fire communicator who takes into account the priorities of each audience, whether it is the health impacts of smoke on young children, how fires will affect the tourism business, or simply a desire to understand how the natural environment is evolving, may be able to more effectively and consistently reach a larger share of the public.

7. Conclusion

Based on data collected from focus groups with a small yet diverse pool of participants, this research examines the current components of the wildfire infosphere in Interior Alaska and identifies gaps in both the ways in which information reaches residents and the content of the information communicated. With their varying sets of concerns, the residents are interested in different types of information, rely on disparate transmitters and sources to obtain information, and extend varying levels of trust to these channels. The findings corroborate previous research that emphasizes a need to move beyond depictions of the audience as a general public and focus more closely on the diversity among the audiences that comprise the public. This research therefore develops exemplary portraits of four information-seeking audiences whose concerns, habits, and preferences differ. Fire communicators who consider the diversity among these audiences may be able to tailor their communications to more effectively reach residents whose characteristics align with one or more audiences across the temporal stages of wildfire events. The use of a portraiture methodology helps convey a large amount of contextual information about the different audiences through pictorial heuristics that can help fire communicators improve their efforts to reach out to these audiences.

Better taking into account this diversity among Alaskan residents can enhance wildfire communication by targeting the greatest concerns, using the most trusted sources, and understanding that messages coming from government agencies will likely be mediated through various broadcasters, social media, and personal contacts. Emphasizing health or business considerations in communications will ensure that they reach the intended audience who might be concerned most about the safety of their family or their economic well-being. Clarifying the message and making it shareable with the understanding that it will go through several transmitters before reaching the final consumer will promote the greatest success. By mapping the infosphere and highlighting who might not be reached, we open a path for future research about how to best accommodate these audiences. The pitfalls of the approach are that the portraits we have developed based on our focus group data may not accurately reflect the actual nature of the audiences in Alaska. While we made efforts to collect information from a diverse group of respondents, the data are limited and the portraits therefore seek to present our best interpretation in a way that summarizes the most salient points based on our analysis.

This research raises a host of questions for future study. First, do the examples of the four portraits adequately and sufficiently encapsulate the diversity of factors informing information-seeking habits and preferences? If they do, what proportion of the population
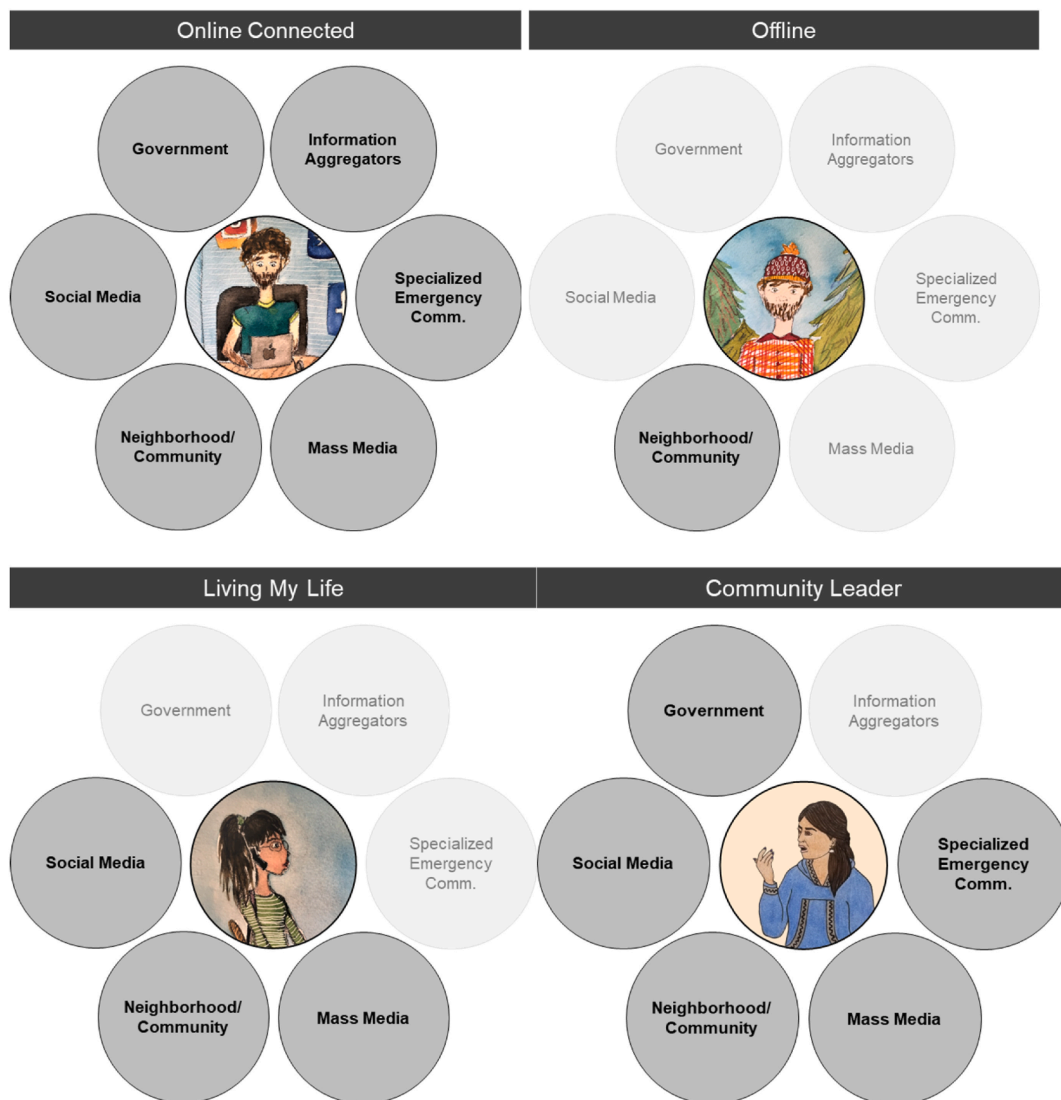
Fig. 3. Transmitters accessible to and consulted by each audience.

does each of the profiles represent? Gathering strong data to answer this question would require representative surveys of the population and developing actor based models. If they do not, how can we better summarize and portray the nature of the different audiences for fire information in Interior Alaska? Second, is the audience portrait approach transferable to non-Alaskan contexts, where social contexts differ and geographical factors impact connectivity differently? If so, how significantly will results diverge? Finally, given the increasing number of fires in Alaska, a new area of research will likely have to examine areas of overload and how information consumers make sense of vast quantities of data bombarding them, how they sort through it, and how they make decisions about how to respond.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Acknowledgements

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijdrr.2023.103682.

References

[1] Z. Grabinski, H.R. McFarland, Alaksa's changing wildfire environment, in: Fairbanks: Alaska Fire Science Consortium, International Arctic Research Center, University of Alaska, Fairbanks, 2020.
[2] M.P. Calef, A.D. McGuire, F.S.I. Chapin, Human influences on wildfire in Alaska from 1988 through 2005: an analysis of the spatial patterns of human impacts, Earth Interact. 12 (2008).
[3] S.I. Stewart, V.C. Radeloff, R.B. Hammer, T.J. Hawbaker, Defining the wildland-urban interface, J. For. 105 (4) (2007) 201–207.
[4] H. Gosnell, J. Abrams, Amenity migration: diverse conceptualizations of drivers, socioeconomic dimensions, and emerging challenges, Geojournal 76 (4) (2011) 303–322.
[5] J.L. Mccarty, J. Aalto, V.-V. Paunu, S.R. Arnold, S. Eckhardt, Z. Klimont, J.J. Fain, N. Evangeliou, A. Venäläinen, N.M. Tchebakova, E.I. Parfenova, K. Kupiainen, A.J. Soja, L. Huang, S. Wilson, Reviews and syntheses: arctic fire regimes and emissions in the 21st century, Biogeosciences 18 (18) (2021) 5053–5083.
[6] J.R. Meldrum, H. Brenkert-Smith, P.A. Champ, L. Falk, P. Wilson, C.M. Barth, Wildland–urban interface residents' relationships with wildfire: variation within and across communities, Soc. Nat. Resour. 31 (10) (2018) 1132–1148.
[7] T. Paveglio, C. Moseley, M.S. Carroll, D.R. Williams, E.J. Davis, A.P. Fischer, Categorizing the social context of the wildland urban interface: adaptive capacity for wildfire and community "archetypes", For. Sci. 61 (2) (2014) 298–310.
[8] J.-N. Kim, L. Ni, B.-L. Sha, Breaking down the stakeholder environment: explicating approaches to the segmentation of publics for public relations research, Journal. Mass Commun. Q. 85 (4) (2008) 751–768.
[9] K.E. Boulding, Economics as a Science, McGraw-Hill, New York, 1970.
[10] L. Floridi, Philosophy and Computing: an Introduction, Routledge, New York, 1999.
[11] C.E. Rapp, R.S. Wilson, Factors that contribute to trustworthiness across levels of authority in wildland fire incident management teams, Int. J. Disaster Risk Reduc. 73 (2022) 102877.
[12] M.M. Colavito, S.F. Trainor, N.P. Kettle, A. York, Making the transition from science delivery to knowledge coproduction in boundary spanning: a case study of the Alaska fire science Consortium, Weather Clim. Soc. 11 (4) (2019) 917–934.
[13] L. Rist, C. Shackleton, L. Gadamus, F.S.I. Chapin, C.M. Gowda, S. Setty, R. Kannan, R.U. Shaanker, Ecological knowledge among communities, managers and scientists: bridging divergent perspectives to improve forest management outcomes, Environ. Manag. 57 (4) (2016) 798–813.
[14] J.S. Gordon, J.B. Gruver, C.G. Flint, A.E. Luloff, Perceptions of wildfire and landscape change in the Kenai Peninsula, Alaska, Environ. Manag. 52 (2013) 807–820.
[15] C. Eriksen, T. Prior, Defining the importance of mental preparedness for risk communication and residents well-prepared for wildfire, Int. J. Disaster Risk Reduc. 6 (2013) 87–97.
[16] T. Paveglio, M.S. Carroll, J.D. Absher, T. Norton, Just blowing smoke? Residents' social construction of communication about wildfire, Environ. Commun. 3 (1) (2009) 76–94.
[17] C. Wright, Functional analysis and mass communication, Publ. Opin. Q. 24 (4) (1960) 605–620.
[18] D. Every, C. Bearman, R. Matthews, A. Reynolds, P. O'Donohue, L. Clarkson, Contacts versus connectors: the role of Community Fire Safe Group coordinators in achieving positive bushfire safety outcomes, Int. J. Disaster Risk Reduc. 19 (2016) 390–398.
[19] K.K. Stephens, C.J. Powers, B.W. Robertson, L.A. Spearing, J.C. Collier, K.P. Tich, W.R. Smith, Building more resilient communities with a wildfire preparedness drill in the U.S.: individual and community influences and communication practices, J. Contingencies Crisis Manag. 31 (1) (2023) 26–38.
[20] S. Agrawal, H. Ambury, D. Parida, N. Joshi, Understanding risk communication in practice: Insights from municipalities in Alberta, Canada, Int. J. Disaster Risk Reduc. 79 (2022) 103175.
[21] R.E. Kasperson, O. Renn, P. Slovic, H.S. Brown, J. Emel, R. Goble, J.X. Kasperson, S. Ratick, The social amplification of risk: a conceptual framework, Risk Anal. 8 (2) (1988) 177–187.
[22] E.D. Kuligowski, N.A. Waugh, J. Sutton, J, T, Cova, ember alerts: assessing wireless emergency alert messages in wildfires using the warning response model, Nat. Hazards Rev. 24 (2) (2023) 04023009.
[23] L. Austin, B. Fisher Liu, Y. Jin, How audiences seek out crisis information: exploring the social-mediated crisis communication model, J. Appl. Commun. Res. 40 (2) (2012) 188–207.
[24] K.P. Hocevar, Who drives disaster communication? An analysis of twitter network structure and influence during a wildfire crisis, West. J. Commun. (2023) 1–21.
[25] J.G. Taylor, S.C. Gillette, R.W. Hodgson, J.L. Downing, M.R. Burns, D.J. Chavez, J.T. Hogan, Informing the network: improving communication with interface communities during wildland fire, Hum. Ecol. Rev. 14 (2) (2007) 198–211.
[26] P.S. Roberts, Disasters and the American State: How Politicians, Bureaucrats, and the Public Prepare for the Unexpected, Cambridge University Press, Cambridge, 2013.
[27] B. Dervin, What We Know about Information Seeking and Use and How Research Discourse Community Makes a Difference in Our Knowing, National Library of Medicine, Bethesda, MD, 2001 Background paper prepared for Health Information Programs Development.
[28] O. Renn, Risk communication and the social amplification of risk, in: R.E. Kasperson, P.J.M. Stallen (Eds.), Communicating Risks to the Public. Technology, Risk, and Society, vol. 4, Springer, Dordrecht, 1991.
[29] H. Brenkert-Smith, K.L. Dickinson, P.A. Champ, N. Flores, Social amplification of wildfire risk: the role of social interactions and information sources, Risk Anal. 33 (5) (2013) 800–817.
[30] E. Katz, P. Lazarsfeld, Personal Influence: the Part Played by People in the Flow of Mass Communications, Free Press, New York, 1955.
[31] S. McCaffrey, R. Wilson, A. Konar, Should I stay or should I go now? Or should I wait and see? Influences on wildfire evacuation decisions, Risk Anal. 38 (7) (2018).
[32] J. Sutton, L. Palen, I. Shklovski, Backchannels on the front lines: emergent uses of social media in the 2007 southern California wildfires, in: Proceedings of the 5th International ISCRAM Conference, 2008 (Washington, DC).
[33] N. Pidgeon, Risk communication and the social amplification of risk: theory, evidence and policy implications, Risk Decis. Pol. 4 (1) (1999) 1–15.
[34] D.P. Aldrich, Building Resilience: Social Capital in Post-Disaster Recovery, University of Chicago Press, Chicago, 2012.
[35] M. Bihari, R. Ryan, Influence of social capital on community preparedness for wildfires, Landsc. Urban Plann. 106 (3) (2012) 253–261.
[36] S. Hansson, K. Orru, A. Siibak, M. Back, M. Krüger, F. Gabel, C. Morsut, Communication-related vulnerability to disasters: a heuristic framework, Int. J. Disaster Risk Reduc. (2020) 51 101931.
[37] P.A. Champ, H. Brenkert-Smith, J.P. Riley, J.R. Meldrum, C.M. Barth, C. Donovan, C.J. Wagner, Actionable social science can guide community level wildfire solutions. An illustration from North Central Washington, US, Int. J. Disaster Risk Reduc. 82 (2022) 103388.
[38] T.A. Steelman, S.M. McCaffrey, A.K. Velez, J.A. Briefel, What information do people use, trust, and find useful during a disaster? Evidence from five large wildfires, Nat. Hazards 76 (2015) 615–634.
[39] J.G. Taylor, S.C. Gillette, R.W. Hodgson, J.L. Downing, Communicating with wildland interface communities during wildfire, in: Open-File Report, 2005, p. 32 Reston, vol. A.
[40] S. Vaiciulyte, L.M. Hulse, A. Veeraswamy, E.R. Galea, Cross-cultural comparison of behavioural itinerary actions and times in wildfire evacuations, Saf. Sci. 135 (2021) 105122.
[41] R.L. Ryan, E.M. Hamin, Engaging communities in post-fire restoeration: forest treatments and community-agency relations after the cerro grande fire, in: S.M.

McCaffrey (Ed.), The Public and Wildland Fire Management: Social Science Findings for Managers, U.S. Department of Agriculture, Forest Service, Northern Research Station: Madison, WI, 2006, pp. 87–96.

[42] V.S. Diwanji, L. Arpan, M.B. Ulak, J. Hou, E.E. Ozguven, R. Arghandeh, Understanding citizens' communication channel preferences during natural disasters: a synchronicity-based, mixed-methods exploration using survey and geospatial analysis, Int. J. Disaster Risk Reduc. 47 (2020) 101646.

[43] C.M. Edgeley, Exploring the social legacy of frequent wildfires: organizational responses for community recovery following the 2018 Camp Fire, Int. J. Disaster Risk Reduc. 70 (2022) 102772.

[44] S. Dunwoody, R.J. Griffin, Risk Information Seeking and Processing Model, College of Communication Faculty Research and Publications, 2015 381.

[45] R.J. Griffin, S. Dunwoody, K. Neuwirth, Proposed model of the relationship of risk information seeking and processing to the development of preventive behaviors, Environ. Res. Sec. 80 (1999) S230–S245.

[46] E. ter Huurne, Information Seeking in a Risky World: the Theoretical and Empirical Development of FRIS: a Framework of Risk Information Seeking, 2008.

[47] R.J. Griffin, Y. Zheng, E. ter Huurne, F. Boerner, S. Ortiz, S. Dunwoody, After the flood: anger, attribution, and the seeking of information, Sci. Commun. 29 (3) (2008) 285–315.

[48] Y. Hwang, S.-H. Jeong, Information insufficiency and information seeking:an experiment, Sci. Commun. 38 (6) (2016) 679–698.

[49] L. Kahlor, S. Dunwoody, R.J. Griffin, K. Neuwirth, Seeking and processing information about impersonal risk, Sci. Commun. 28 (2) (2006) 163–194.

[50] M. Mokry, Analyzing risk-related information seeking behavioral intention and risk perception of wildfires: the high park fire burn area. Doctoral dissertation, in: Department of Journalism and Media Communication, Colorado State University, Fort Collins, Colorado, 2019.

[51] Z.J. Yang, K. McComas, G. Gay, J.P. Leonard, A.J. Dannenberg, H. Dillon, Motivation for health information seeking and processing about clinical trial enrollment, Health Commun. 25 (5) (2010) 423–436.

[52] Z.J. Yang, L.N. Rickard, T.M. Harrison, M. Seo, Applying the risk information seeking and processing model to examine support for climate change mitigation policy, Sci. Commun. 36 (3) (2014) 296–324.

[53] M.B. Deline, L.A. Kahlor, Planned risk information avoidance: a proposed theoretical model, Commun. Theor. 29 (3) (2019) 360–394.

[54] J. Ahn, G.-Y. Noh, Determinants of environmental risk information seeking: an emphasis on institutional trust and personal control, Health Risk Soc. 22 (3–4) (2020) 214–230.

[55] J. Graham, C. Burns, Perceptions of wildfire risk and responsibility in management: a comparative analysis of Fairbanks, Alaska and los angeles, California, in: L. Heininen, H. Exner-Pirot, J. Barnes (Eds.), Arctic Yearbook 2021: Defining and Mapping the Arctic: Sovereignties, Policies and Perceptions, Arctic Portal: Akureyri, Iceland, 2021, pp. 428–436.

[56] F.C. Lunenburg, Communication: the process, barriers, and improving effectiveness, Schooling 1 (1) (2010).

[57] S.J. Ball-Rokeach, M.L. DeFleur, A dependency model of mass-media effects, Commun. Res. 3 (1) (1976) 3–21.

[58] C.J.K. Sandoval, P. Lanthier, Connect the whole community: leadership gaps drive the digital divide and fuel disaster and social vulnerabilities, in: L. Levine (Ed.), Technology vs Government: the Irresistible Force Meets the Immovable Object, Emerald Publishing, Bingley, UK, 2021.

[59] G.A. Donohue, P.J. Tichenor, C.N. Olien, Mass media and the knowledge gap: a hypothesis reconsidered, Commun. Res. 2 (1) (1975) 3–23.

[60] G.J. Martin, A. Yurukogluyz, Bias in Cable News: Persuasion and Polarization, 2017.

[61] K.M. Rose, E. Toman, C.S. Olsen, Public use of information about smoke emissions: application of the risk information seeking and processing (RISP) model, Can. J. For. Res. 47 (11) (2017) 1527–1537.

[62] T.A. Steelman, S. McCaffrey, Best practices in risk and crisis communication: implications for natural hazards management, Nat. Hazards 65 (1) (2013) 683–705.

[63] F.S. Chapin, E.U. Weber, E.M. Bennett, R. Biggs, J. Van Den Bergh, W.N. Adger, A.-S. Crépin, S. Polasky, C. Folke, M. Scheffer, K. Segerson, J.M. Anderies, S. Barrett, J.-C. Cardenas, S.R. Carpenter, J. Fischer, N. Kautsky, S.A. Levin, J.F. Shogren, B. Walker, J. Wilen, A. De Zeeuw, Earth stewardship: shaping a sustainable future through interacting policy and norm shifts, Ambio 51 (9) (2022) 1907–1920.

[64] R. Oliveira, S. Oliveira, J.L. Zezere, D.X. Viegas, Uncovering the perception regarding wildfires of residents with different characteristics, Int. J. Disaster Risk Reduc. 43 (2020) 101370.

[65] H.H. Thorpe, It's not as easy as it looks, Science 374 (6575) (2021) 1537.

[66] M.W. Seeger, Best practices in crisis communication: an expert panel process, J. Appl. Commun. Res. 34 (3) (2006) 232–244.

[67] M.C. Hano, S.E. Prince, L. Wei, B.J. Hubbell, A.G. Rappold, Knowing your audience: a typology of smoke sense participants to inform wildfire smoke health risk communication, Front. Public Health 8 (2020).

[68] J.R. Meldrum, P.A. Champ, H. Brenkert-Smith, T. Warziniack, C.M. Barth, L.C. Falk, Understanding gaps between the risk perceptions of wildland–urban interface (WUI) residents and wildfire professionals, Risk Anal. 35 (9) (2015) 1746–1761.

[69] L.A. Ray, C.A. Kolden, F.S.I. Chapin, A case for developing place-based fire management strategies from traditional ecological knowledge, Ecol. Soc. 17 (3) (2012).

[70] M.Q. Patton, Qualitative Research and Evaluation Methods, second ed., Sage Publications, Thousand Oaks, CA, 2001.

[71] D.L. Morgan, Focus groups, Annu. Rev. Sociol. 22 (1) (1996) 129–152.

[72] D.L. Morgan, R.A. Krueger, When to use focus groups and why, in: D.L. Morgan (Ed.), Successful Focus Groups: Advancing the State of the Art, Sage, Newbury Park, CA, 1993.

[73] D. Waymer, R.L. Heath, Emergent agents: the forgotten publics in crisis communication and issues management research, J. Appl. Commun. Res. 35 (1) (2007) 88–108.

[74] M. Howlett, Looking at the 'field' through a Zoom Lens: Methodological Reflections on Conducting Online Research during a Global Pandemic, Qualitative Research, 2021 146879412098569.

[75] H. Strader, E. Stevens, Fire Weather Summary 2020, Alaska Interagency Coordination Center, 2020.

[76] S. Lawrence-Lightfoot, J. Hoffmann Davis, The Art and Science of Portraiture, John Wiley & Sons, San Francisco, 1997.

[77] R.E. Boyatzis, Transforming Qualitative Information: Thematic Analysis and Code Development, Sage, Thousand Oaks, CA, 1998.

[78] A. Libman, Credibility Revolution and the Future of Russian Studies, Post-Soviet Affairs, 2022.

[79] J. Christensen, Telling stories: exploring research storytelling as a meaningful approach to knowledge mobilization with Indigenous research collaborators and diverse communities in community-based participatory research, Can. Geogr./Le G´eographe canadien 56 (2) (2012) 231–242.

[80] J.V. Maanen, Tales of the Field: on Writing Ethnography, University of Chicago Press, Chicago, 1988/2011.

[81] J. Donath, A. Dragulescu, A. Zinman, F. Viégas, R. Xiong, Data portraits, Leonardo 43 (4) (2010) 375–383.

[82] Alaska Department of Public Safety Public Information Office *Alaska State Troopers Announce New Statewide Alerts System*, 2022.

[83] T.K. Rutherford, C.A. Schultz, Adapting wildland fire governance to climate change in Alaska, Ecol. Soc. 24 (1) (2019).

[84] T. Sellnow, R. Ulmer, M. Seeger, R. Littlefield, Effective Risk Communication: a Message Centered Approach, Springer Science and Business Media, New York, NY, 2009.

[85] A.M. Stasiewicz, T.B. Paveglio, Preparing for wildfire evacuation and alternatives: exploring influences on residents' intended evacuation behaviors and mitigations, Int. J. Disaster Risk Reduc. 58 (2021) 102177.

[86] C. Höppner, R. Whittle, M. Bründl, M. Buchecker, Linking social capacities and risk communication in Europe: a gap between theory and practice? Nat. Hazards 64 (2) (2012) 1753–1778.

[87] M. Sakurai, B. Adu-Gyamfi, Disaster-resilient communication ecosystem in an inclusive society – a case of foreigners in Japan, Int. J. Disaster Risk Reduc. (2020) 51 101804.

[88] Brenkert, H., P. Champ, and N. Flores, Mitigation of Wildfire Risk by Homeowners. Res. Note RMRS-RN-25www. 2005, Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

[89] I.M. Martin, H. Bender, C. Raish, What motivates individuals to protect themselves from risks: the case of wildland fires, Risk Anal. 27 (4) (2007) 887–900.