POLICY BRIEFS SERIES

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Technology Has Enriched the Lives of Americans with Novel Communication Choices. It Has Also Made It More Difficult to Reach Everyone in Emergencies.

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HARVARD Kennedy School
ASH CENTER
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By any measure, California's deadliest wildfire was unusual. The blaze, which killed 85 people in and around the town of Paradise, California, on November 8, 2018, was sparked by the failure of aging electrical equipment that ignited dry brush after more than 200 days of drought and excessive heat. Wind gusts of up to 50 miles an hour propelled embers through the air.

But this unusual tragedy provided knowledge that can help all communities save lives. Federal and state laws aim to alert all residents of approaching fires, floods, hurricanes, and other emergencies. Yet people continue to die because they lack timely information. Traditional warnings via landlines and broadcasts no longer reach everyone, and Cold War-era sirens have been dismantled. Newer digital alerts fail when internet service is patchy, phones are turned off, or approaching fires or floods disable cell towers and electrical cables. During this digital transition, officials' jobs have become more difficult. No single means of communication is sufficient to alert all residents in life-threatening emergencies. The challenge is to understand the strengths and limitations of each communication strategy and employ multiple approaches to reach everyone.

Paradise Prepared

Perched on a pine ridge in the foothills of the Sierra Nevada mountains, Paradise, a town of 26,000 residents in Butte County, California, had many strengths. Its bike paths, hiking trails, and Mediterranean climate made it a popular destination for low- to moderate-income retirees, some of whom lived in the town's mobile home parks. About a quarter of its residents were age 65 or older in 2018, compared with a statewide average of 14%.

The community had taken steps to prepare for emergencies. After the Humboldt fire destroyed or damaged 94 Paradise homes in 2008, officials held town meetings, practiced emergency alerts, and conducted evacuation simulations.

In 2017, Butte County contracted with a private company for CodeRED, a digital system that could send emergency alerts to registered residents directly via phone, text, email, and devices for deaf people.

The Federal Emergency Management Agency (FEMA) had also approved the county to participate in the national Integrated Public Alert and Warning System (IPAWS). Best known for its familiar AMBER Alerts, the system could send wireless warnings and instructions via cell phones and radio and television broadcasts.[1]

Failed Warnings

At about 6:20 a.m. on November 8, 2018, a Pacific Gas & Electric Company (PG&E) employee driving through the area reported seeing fire beneath electrical transmission lines on a ridge above the Feather River, about seven miles from Paradise. Lacking cell phone reception, he used his PG&E radio to report the fire.

The California Department of Forestry and Fire Protection (Cal Fire) responded quickly. By 6:35 a.m., two Cal Fire engines were on the way. However, fire fighters found the fire's location and wind speed stymied containment. Just over an hour later, at 7:44 a.m., the fire reached the town of Paradise.

Emergency managers also responded quickly. Beginning at 7:57 a.m., county officials started issuing evacuation warnings and orders through the new digital CodeRED system. However, those alerts failed to reach most residents. CodeRED was an opt-in system, and only about a third of Paradise's residents had registered to receive emergency notifications. In addition, most cell phone and email alerts did not reach even the registered users. CodeRED logs indicated that up to 60% of alerts to registered users failed to connect, a *Los Angeles Times*' investigation concluded. Phones were turned off, notifications silenced, or numbers were out of date. Also, at some point that morning, cell phone towers

and phone and electricity cables burned. Some residents reported losing AT&T and Verizon cell phone service at about 10:15 a.m. Parts of Paradise had never had strong cell service.[2]

Like many small towns, Paradise did not have a large staff of emergency officials on duty. That morning, three or fewer dispatchers struggled to respond to 911 calls.

The national alert system also failed, perhaps due to a combination of choice, technical difficulties, and the destruction of cell phone towers.

Social media did not provide accurate and timely information. Both town and county officials made efforts to provide updates via official Facebook and Twitter accounts. But posts did not keep pace with the fire's rapid spread and were sometimes inconsistent with other alerts. Crowd-sourced social media posts suffered from similar limitations.

Neighbors and Loudspeakers

As cell phones, landlines, and 911 calls failed, residents and officials turned to alerts that did not rely on technology. Neighbors knocked on doors and offered rides to stranded residents. Police officers drove through neighborhoods with loudspeakers. A later federal government assessment noted that neighbor-to-neighbor communication was critical to alerting Paradise residents of the danger. The *Los Angeles Times*, *The New York Times*, *The Sacramento Bee*, and other media recounted numerous residents' stories of learning about the fire from neighbors, friends, and relatives.[3]

Fire fighters continued to battle the Paradise fire for two weeks. It burned 153,336 acres and destroyed or damaged more than 85% of the town's buildings.

The fire disproportionately killed those who were older or had physical or mental limitations. More than three-quarters of the people who died were over the age of 65 or had disabilities. News reports suggested that seven of those who died were found in their cars and five were fleeing on foot. The majority, 73 individuals, were found still in their homes.[4]

Learning from Tragedy

The Paradise tragedy provides knowledge that can help all communities save lives. Community residents now use many novel ways to gain information for their everyday lives, including tablets, wearable technology, smart speakers, gaming consoles, and social media. Some continue to rely on more traditional sources, including television, radio, family, and friends.

After the fire, Paradise worked to create multiple communication strategies to reach everyone. Alerts would need to find people however and wherever they were able to receive information. A first step was to strengthen digital communication. The county replaced the CodeRED system with a more advanced digital alert platform, Rave 911. The Rave system could provide information about users' medical and functional needs, issue alerts in more languages, and operate with greater reliability.

To reach more residents, the town used state and federal grant funds to install 21 "smart sirens," high-tech descendants of the air-raid sirens that California cities gradually de-commissioned after the Cold War. Smart sirens do not rely on cell phone reception or user registration. They feature a high-low tone audible throughout the town and instructional voice messages that can be live or recorded. Mounted on fire- and heat-resistant towers, they include battery backups and solar charging. When tests revealed that sirens could not always be heard indoors, the town added home plug-in devices that also had flashing lights to warn those hard of hearing.[5]

Further advances held promise for more reliable communication. National initiatives were underway to create future fire and flood warning systems through direct alerts from satellites to cell phones and other digital devices. In 2026, some cell phones could already send emergency calls via satellite

from hikers or other users when networks were unavailable. But phones could not yet generally receive emergency alerts via satellite. AST SpaceMobile, SpaceX, Apple, Amazon and other firms were competing to provide satellite-to-device communication that did not rely on cell phone towers, electricity, or telephone cables. Testing was underway, with limited trials during Hurricane Helene and Hurricane Milton in 2024.[6]

Congress began to consider adapting laws and regulations for satellite communication in emergencies. In March 2026, the House Energy and Commerce Committee reported out a bill that would allow commercial providers to send emergency alerts by satellite. "When disaster strikes, communication infrastructure is often the first thing to fail, and in rural districts like mine, cell service can often be unreliable or unavailable altogether. That is why timely, satellite-enabled alerts can mean the difference between life and death," noted Rep. August Pfluger (R-TX) in January 2026, explaining his bill to include satellite-to-device communication in the national Wireless Emergency Alert system. Other ideas to employ advanced technology included sending wildfire alerts directly to drivers' car screens and tracking fires with shared Ring camera footage.[7] In Europe, the European Union Agency for the Space Programme (EUSPA) was testing an Emergency Warning Satellite Service to provide alerts with instructions.Congress and federal agencies considered other measures. In 2025, Rep. Kevin Mullin (D-CA) introduced a bipartisan bill to provide $30 million a year through 2035 for FEMA to help local officials train and test emergency alert systems, noting, "Emergency alerts are an essential part of keeping people safe and the federal government has a moral obligation to help local communities become better prepared." In August 2025, the Federal Communications Commission (FCC) requested public comment on a more general modernization of the nation's alert systems. And in January 2026, a Senate proposal called for all state and local governments to include the needs of older residents and those with disabilities in their disaster planning.[8]

Understanding Limitations

Nonetheless, in 2026, each alert system still had limitations. Digital alerts remained constrained by reliance on cell phone towers, landline cables, electrical lines, and resident sign-ups. To use the new Rave system, Paradise residents still had to register, provide personal information, keep that information current, and have their cell phones turned on. Cell phone towers and electricity remained vulnerable in a fire. Low enrollment remained a problem. As of January 2026, the new Rave platform had only about a quarter of the registered users that the CodeRED system had had, according to the Butte County Sheriff's Office.[9]

Federal warning systems also had serious limitations. AMBER Alerts and similar wireless warnings were not available to as many as one-third of U.S. counties. Participation required application and approval by FEMA. FEMA required communities to install specific software and meet other requirements. Communities with limited resources often lacked the funds to purchase this software and finance the necessary training. In a 2025 survey by Argonne National Laboratory, 82% of emergency managers reported that lack of funds was among their greatest challenges.[10]

Smart sirens returned to the nation's Cold War approach, amended with technology, to reach more residents. But they, too, were mounted on towers and required electricity.

A careful analysis in 2023 by the National Institute of Standards and Technology attributed the low rate of digital notification during the Paradise fire to both the opt-in system and the large number of calls that failed to connect. The report noted more broadly that any system that relied on phone, internet, and electrical services would have limitations, citing the "loss of cell towers and electrical utilities during the fire."[11]

Satellite alerts hold promise for the future but have limitations as well, including weak signals, limited spectrum, and line-of-sight requirements.

"This has been a growing issue with emergency communications – fostered by transition to more and more people using cellphones and other systems that are reliant on fiber," Catherine Sandoval, a law professor at Santa Clara University School of Law and former state utilities commissioner, told Lisa Krieger of the *Chico Enterprise-Record* after the fire. "As you lose both power and telephones, what you end up with is a situation that takes us back to the 1940s where heroic responders drive up and down streets, taking their lives in their hands, using bullhorns."[12]

Conclusion

Alerting community residents in emergencies remains at the core of the nation's commitment to an informed public. The Paradise fire serves as a reminder that Americans continue to die because they do not receive timely information that could help protect them. California guidelines state: "It is the inherent responsibility of local government organizations and officials to keep members of the public informed about natural, human-caused, and technological disasters, and what actions they need to take to protect themselves and their families."[13]

Disaster communication has never been simple. Floods, fires, and hurricanes disrupt communications as they disrupt communities. Preparing for rare catastrophic events has always been politically and strategically difficult.

The most important lesson during this digital transition is that communities need multiple communication strategies to alert all residents in emergencies. As the report by the National Institute of Standards and Technology stated: "[n]o single notification method will reach every person, and combinations of different tools are necessary to improve the reach and timeliness of alerts." The challenge for each community is to understand its residents' diverse communication needs and choices and to design strategies that reach everyone.[14]

Notes

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