Connect the Whole Community:
Leadership Gaps Drive the Digital Divide and Fuel Disaster and Social Vulnerabilities

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Abstract—This chapter analyzes the link between the digital divide, infrastructure regulation, and disaster planning and relief through a case study of the flood in San Jose, California triggered by the Anderson dam's overtopping in February 2017 and examination of communications failures during the 2018 wildfire in Paradise, California. This chapter theorizes that regulatory decisions construct social and disaster vulnerability. Rooted in the Whole Community approach to disaster planning and relief espoused by the United Nations and the Federal Emergency Management Agency, this chapter calls for leadership to end the digital divide. It highlights the imperative of understanding community information needs and argues for linking strategies to close the digital divide with infrastructure and emergency planning. As the Internet's integration into society increases, the digital divide diminishes access to societal resources including disaster aid, and exacerbates wildfire, flood, pandemic, and other risks. To mitigate climate change, climate-induced disaster, protect access to social services and the economy, and safeguard democracy, it argues for digital inclusion strategies as a centerpiece of community-centered infrastructure regulation and disaster relief.

Keywords—Internet, Digital divide, Infrastructure Regulation, Whole Community, Vulnerability Science, Community Information Needs, Leadership, Decision-making, Disaster Planning, Disaster Response

I. INTRODUCTION, THE NEXUS BETWEEN THE DIGITAL DIVIDE, INFRASTRUCTURE REGULATION, AND DISASTER PLANNING AND RESPONSE

This chapter examines the nexus between leadership, the digital divide, infrastructure regulation, and disaster planning. The digital divide is defined as lack of access to digital and communications networks or lack of adoption of high-speed Internet services, including the absence of "meaningful" access to Internet-enabled, devices, plans, and training (Levine and Taylor 2018, p. 2-3). This chapter theorizes that regulatory leadership constructs and fortifies community and social vulnerability and drives the digital divide. Leadership and integrated planning can enable Internet infrastructure access, promote Internet adoption, enhance disaster resiliency, and increase community capacity and opportunity.

As the Internet's integration into society increases, the digital divide diminishes access to societal resources including disaster aid, and exacerbates wildfire, flood, pandemic, and other risks. Digital exclusion forms a recursive process that undercuts safety and community resiliency. The digital divide frustrates innovative Internet uses that could increase community capacity, improve disaster planning, enhance infrastructure management, and improve service delivery (*Cf.* Shah *et al*., 2019). The digital divide's role in promoting social and hazard vulnerability has to date been undertheorized.

The shift of education, work, healthcare, social services, business, and many other functions to the Internet during the COVID-19 pandemic declared in March 2020 (World Health Organization (WHO) 2020), underscores the imperative of universal Internet access. As communities, families, and individuals face a confluence of hazards—the COVID-19 pandemic, wildfires, utility-induced power shut-offs to forestall fires triggered by electric facilities, poverty, and racism—those unconnected or under-connected to the Internet "are not only at a distinct disadvantage for educational and economic opportunities, but their very public safety also is at risk because they are not online" (CETF, 2020, p. 1).

This chapter examines the nexus of infrastructure regulation, disaster, and digital divide risks through a case study of the February 2017 flood in San Jose, California. The Anderson dam's overtopping during a series of heavy rainstorms was the flood's proximate cause, leading to the evacuation of more than 14,000 in San Jose, California ("San Jose" or "the City"), the tenth largest city in America. The Anderson dam's flood inundation zone marks the confluence of digital exclusion and regulatorily-created infrastructure risks that imperil communities. Regulatory decisions created the flood's fountain and imperiled community safety.

This chapter also examines the digital divide's role in the 2018 "Camp Fire," the deadliest wildfire in a century (Martinez, 2018). Pacific Gas & Electric (PG&E) infrastructure ignited the wildfire that destroyed Paradise, California and killed 85 people. Many of the town's elderly residents never received official warning of the fire's approach that depended on digital and cellular access and prior enrollment. Failure to understand community information needs and to deploy technology to reach the community with actionable information increased the toll of death and destruction.

Unfortunately, the lessons of Paradise go unheeded. As wildfires raged in Jackson County, Oregon in September 2020, "local officials declined to activate their Emergency Alert System, leaving television and radio programs uninterrupted and sending emergency alerts only to residents who had signed up for an online notification system" (Tankersley, 2020). Poor decisions about technology deployment left thousands with little to no information, dependent on neighbors and glimpses of the orange sky for fire warnings. Closing the digital divide and improving communications strategies to address local needs can help prevent another Paradise lost.

II. Government and Regulatory Construction of Vulnerability as Climate Change Erodes Regulatory Assumptions

Regulatory decision-making can exacerbate or mitigate community and infrastructure vulnerability as we face climate change, pandemics, and other disasters. Digital inclusion strategies, disaster planning, and infrastructure regulation gain urgency as climate change intensifies flooding, hurricanes, and wildfires (U.S. GLOBAL CHANGE RESEARCH PROGRAM (GCRP), 2017). "Warmer temperatures, variable snowpack, and earlier snowmelt caused by climate change make for longer and more intense dry seasons, leaving forests more susceptible to severe fire" (Newsom 2019, p. 1). Atmospheric rivers such as the series of torrential rainfalls that predicated the Anderson dam flood in 2017 are predicted to become more frequent in California, along with rebounding drought periods (Swain *et al*., 2018; U.S. GCRP 2017, Vol. II, p. 74).

Anthropogenic contributions to climate change erode infrastructure, regulatory and social decision-making assumptions. Swain identified increased risk of climate-change induced "weather whiplash" in

California, swings between drought and periods of extreme rain (Swain *et al*. 2018, p. 427). "Few of the dams, levees and canals that currently protect millions living in California's flood plains and facilitate the movement of water" have been tested by a deluge as severe as the series of atmospheric rivers that left parts of the state in three to thirty feet of water in 1861–1862 (*Id.*, p. 431-432; Lyons 2016, p. 38-40). Precipitation whiplash could lead to "considerable loss of life and economic damages approaching a trillion dollars" (Swain et al. 2018, p. 432). In this context, outdated design assumptions and regulations fuel risk.

Government and regulatory decisions construct place-based and social vulnerability, compounding natural system hazards. "Natural processes, independent of human agency, do not produce hazards, it is only when these geophysical processes interact with human populations that hazards arise" (Cutter 2018, p. 13). "Humans create hazards by altering the natural landscape and affecting natural system processes, such as locating in floodplains and altering flow regimes and runoff through landscape modification," Cutter added "Interactions between social systems and the built environment also contribute to vulnerability" (*Id.*).

"[W]ildfires and other natural disasters tend to feed into and exacerbate existing socio-economic, political, and cultural inequalities and exact disproportionate effects upon the most vulnerable" (Clark, 2017, p. 1). This vulnerability cycle manifests "at all stages of the disaster cycle, from levels of preparedness and the initial direct and indirect impacts to the response, recovery, and mitigation stages" (*Id.*).

Intersectional analysis underlying vulnerability science informs strategies to end the digital divide. "Understanding vulnerability to hazards, especially geohazards, requires three separate, but intersecting knowledge domains: natural systems, social systems (and the built environment), and local places" (Cutter 2009, p. 13). This chapter contributes to the fields of vulnerability science and law by theorizing that regulatory decisions construct social and disaster vulnerability.

Leadership decisions mold and fortify place-based vulnerability. Locating a dam on the top of a hill above a city or town and running the dam's flood channel through populated areas typify regulatory-constructed risk. High levels of digital exclusion create information gaps that amplify infrastructure risks. The confluence of regulatory, social, and natural system vulnerability is replicated in many places susceptible to wildfire, flooding, dam inundation, or other hazards.

III. The Whole Community Approach to Disaster and Infrastructure Planning

The "Whole Community" approach to emergency management (U.S. Federal Emergency Management Agency (FEMA, 2011a); United Nations Office of Disaster Risk Reduction, 2016)), provides a model for strategies to close the digital divide. The Whole Community approach centers public participation and public need at the core of regulatory development and disaster response. This approach adopts a distributed public safety model, consistent with democracy's recognition of each person's value and agency, to protect public safety and improve collective well-being (Sandoval 2019, p. 34, 82).

Prudent disaster planning and response respects the inherent worth and dignity of every human-being (U.N. Charter, 1945).[1] "Social justice demands more than fair distribution of resources in circumstances of extreme health emergency" (Gostin and Fidler 2015, p. 469). "A failure to act expeditiously and with equal

[1] United Nations Charter, Preamble, https://www.un.org/en/sections/un-charter/un-charter-full-text/ (last visited July 23, 2020) ("We the peoples of the United Nations . . . reaffirm faith in fundamental human rights, in the dignity and worth of the human person, in the equal rights of men and women . . . .").

concern for all citizens, including the poor and less powerful, predictably harms the Whole Community by eroding public trust and undermining social cohesion" (*Id.*). "Social justice thus encompasses not only a core commitment to a fair distribution of resources, but it also calls for policies of action that are consistent with the preservation of human dignity and the showing of equal respect for the interests of all members of the community" (*Id.*). This public-centered approach should shape infrastructure regulation and digital inclusion strategies.

FEMA's Whole Community model recognizes the limits of government or first-responder centric disaster planning and response. "Government can and will continue to serve disaster survivors," Craig Fugate, FEMA Administrator in 2011, testified to Congress (Fugate, 2011). "However, we fully recognize that a government-centric approach to disaster management will not be enough to meet the challenges posed by a catastrophic incident. That is why we must fully engage our entire societal capacity," Fugate emphasized (*Id.*).

Pfefferbaum *et al*. (2015, p. 103) highlight three principles underlying FEMA's Whole Community model: "understand and meet the unique and diverse needs of the Whole Community, involve and empower all parts of the community to encourage local action and enhance local capacity, and support and reinforce effective activities and leverage existing structures and relationships for disaster response." FEMA's Whole Community model is a "community-centric approach for emergency management that focuses on strengthening and leveraging what works well in communities on a daily basis" to offer a "more effective path to building societal security and resilience" (FEMA, 2011a).

The same community members vulnerable to disaster are often stuck in the digital divide. Yet, too often, disaster, infrastructure, and digital divide planning rest in disconnected silos. Effective disaster preparation and response must account for community characteristics including digital access, adoption, Internet Service Provider (ISP) policies, and infrastructure reliability. Understanding community characteristics and information needs informs effective disaster planning (Roth, 2018, p. 93; CPRN, 2012).

Failure to adopt a Whole Community approach to disaster planning and communication, infrastructure management, and digital inclusion resulted in death and destruction in the 2018 Camp Fire Pacific Gas & Electric (PG&E) caused (*see* Newberry 2019; California Department of Forestry and Fire Protection (CalFire) 2019). Eighty-five people, many of whom were disabled and elderly, perished in the Camp Fire that incinerated most of the town of Paradise, California (Newberry, 2019). "[O]lder adults face the greatest relative risk of dying in a fire. In 2016, older adults had a 2.5 times greater risk of dying in a fire than the population as a whole" (U.S. Fire Administration, undated). Social isolation, poverty, age, and disability increase death risk during a fire (Newberry 2019).

Digital exclusion fuels fire mortality risk. As the Camp Fire raged toward Paradise in October 2018, Butte County officials sent cell phone-based alerts which required prior signup (Todd, Tratter, McMullen, 2019). Many elderly Paradise residents had not signed up for cell phone alerts (Krieger, 2018(b)). As towers that supported cell phone service lost power and lines burned, thousands never received warning notices. Attempts to issue broader alerts failed as the fire grew. Consequently, no warning notice interrupted local radio and television programming.

Understanding community information access and needs is a predicate to effective emergency communication and community capacity building. Older adults, Hispanic Americans, African-Americans, Native Americans, and those living in rural or tribal areas with limited Internet access remain highly reliant on television and radio for news (Shearer, 2018, Krieger, 2018a; Flores and Lopez, 2018). "Age is the second powerful predictor of Internet use," and has a negative relationship with "basic skills required to operate Internet technology" and "literacies to seek information" on the Internet (van Deursen and van Dijk, 2015, p. 381). The California Emerging Technology Fund (CETF), a non-profit organization that works to close the digital divide in California, found 23% of Californians age 65-74 and 33% of Californians over 75 were unconnected to the Internet in 2019 (CETF, 2019, p. 6). Age, education levels, income, gender, disability, race, or ethnicity, and speaking a language other than English are each associated with Internet access and usage (*Id.*, p. 382; Jackson *et al*. 2008; Prieger, 2015, p. 383; Anderson and Perrin, 2017; Statistica, 2017).

The large number of elderly and disabled persons in the Camp Fire's death toll spotlight the need for more inclusive disaster, infrastructure, and communications planning. "Understanding the way seniors process and react to wildfires is key to protecting them," L. Vance Taylor, Chief of the Office of Access and Functional Needs at the California Governor's Office of Emergency Services observed (Newberry, 2019). Consistent with the Whole Community approach to disaster planning, Taylor advocates including a diverse range of community members to develop effective disaster response plans. "Who's at your planning table?" is the key question Taylor poses (*Id.*). Inclusive planning enhances community resilience.

Pfefferbaum *et al*. (2017, p. 104) describe resilience as "adaptation following disruption, or the capacity to recover, integrate the disturbance, and accommodate." "Community resilience is a systems-level concept" (*Id.*). "Like personal resilience, community resilience is a characteristic or property of the community, a dynamic process, and a potential outcome" (*Id.*, citing Chandra *et al*. 2011). Ungar (2011, p. 1742) defines community resilience as "social capital, physical infrastructure, and culturally embedded patterns of interdependence that give it the potential to recover from dramatic change, sustain its adaptability, and support new growth that integrates the lessons learned during a time of crisis.'' Resilience and wildfire risk come into relief at community scale, influenced by wider "socio-ecological systems" (Clark, 2017, p. 24, 26).

Strategies to promote infrastructure access and adoption require a community approach to build infrastructure and make it affordable. Individual choice is ineffective where infrastructure is absent or the lack of competition or appropriate support render adoption infeasible.

The Internet and electricity are interconnected infrastructures that exemplify the need for leadership to direct investment in unserved and underserved areas (Sandoval, 2018(a), p. 172). Sandoval observed that on many U.S. Native American reservations, "[e]nergy infrastructure poverty is community poverty stemming from federal, state, and private sector decisions that excluded many Native American reservations from 'universal service' policies" (*Id.*). "Strategies focused on individual rights, or on alleviating individual or family poverty, are insufficient to provide the resources needed to build the electric grid to households and institutions that lack such access" (*Id.*).

Likewise, Internet adoption depends on infrastructure availability. The COVID-19 pandemic underscores the need for widespread, robust Internet access, as well as strategies to promote adoption and training. Connecting the Whole Community to reliable Internet and telephone access promotes universal service that improves access to emergency services, increases infrastructure management options, and enhances community resiliency.

Universal service principles form the bedrock of communications policy, recognizing that the network is stronger as everyone is connected and served (Sandoval 2019, p. 36). The "universal service objective is founded on the concept that all subscribers to a telephone company's basic service network benefit when another person joins that network. Therefore, the entire network is more valuable because of the addition of the new subscriber."[2] An inclusive communications network provides an accessible platform that benefits the whole community, the economy, society, and public safety.

Metcalfe's Law predicts a communications network's value increases in proportion to its users (Metcalfe 1995, p. 53; Metcalfe 2013, pp. 26, 31). Its author described Metcalfe's Law as a "vision thing" pointing to "a critical mass of connectivity after which the benefits of a network grow larger than its costs" (Metcalfe 2006). Tongia and Wilson (2011) characterize network exclusion as the flip side of Metcalfe's law. Just as a network becomes more valuable with more users, the cost of network exclusion increases. Tongia and Wilson (2011) argue that network exclusion costs are significant and able to rise exponentially for almost any type of network with positive network values. If "we assume a disutility of *not* being in the network, then everyone outside the network faces a growing disparity (or "cost") of exclusion" (*Id.*, p. 668).

The digital divide reinforces network exclusion costs. As more functions migrate to the Internet (Sandoval 2018b, p. 45), the digital divide increases the social, economic, and safety costs of exclusion. Adoption or access gaps affect the Whole Community, not just the person or family unconnected or underconnected to the Internet or without network access. When those excluded from communications networks live in a dam's flood plain, high wildfire danger zone, or other vulnerable area, community vulnerability increases along with disaster response challenges.

IV. Communications as Aid

Humanitarian and disaster assistance organizations increasingly recognize *communications as aid* (Cheney 2017). Oliver Lacey Hall, Head of the United Nations Regional Office for the Asia & Pacific for the UN Office of Coordination of Humanitarian Affairs, distinguished between "messaging" and "two-way communication. "Messaging is simply getting your agency's message out—informing people about where they can go to get vital services, how a particular distribution mechanism works; effectively maintaining control" (Lacey-Hall 2012*,* p. 6). "Two-way communications in a humanitarian environment can, if done well, be a pre-cursor to effective recovery," Lacey-Hall urged (*Id.*).

For refugees and disaster victims, mobile network access and phone charging resources provide vital aid. Refugees and disaster victims need to connect with friends, family, aid resources, schools, jobs, insurance agents, and others. As the number of refugees arriving in Europe increased in 2015, "aid workers and volunteers quickly recognised that many refugees not only had smartphones, but saw them as a critically important tool for organising their journey and staying in touch with friends and family" (GSMA 2017, p. 3). "So important were mobile phones that, on arrival, many refugees asked for Wi-Fi or charging services ahead of food, water, or shelter" (*Id.*).

Pre-positioning strategies place communications and emergency power assets at strategic locations such as fair grounds where public safety personnel or the public may congregate during a disaster (California Department of Food & Agriculture 2010, p. 4). Fairgrounds were used as Wi-fi hot spots and charging stations in California's 2017 fires (Morrison & Foerster LLP., 2017, p. 65). In addition to supporting basic

[2] Texas Alarm & Signal Ass'n v. Public Utility Commission, 603 S.W.2d 766, 770; Public Utility Com'n of Texas v. AT & T Communications of the Southwest, 777 S.W.2d 363, 372–373.

shelter needs (in a socially distanced manner during the COVID-19 pandemic), disaster centers should provide Internet access to help evacuees file and monitor insurance claims, support school for children and classes for adults, online work, family, and network connections that sustain social capital and resources.

Tasic and Amir (2016, p. 396-397) offer the concept of "informational capital" to improve disaster governance and response. Information can enable action, a critical resource during a crisis (*Id.*, p. 395). Yet, "information itself does not guarantee executing an action" (*Id.*, p. 396). Disaster plans often assume Internet access and adoption, without assessing access gaps. Ahmed *et al*. (2012, p. 3) observe SMS text warning systems, social media solutions, and the like may "fail to adequately consider input from the community in the development or dissemination of these systems."

Internet access and adoption gaps hamper humanitarian and disaster aid, particularly when warning, information systems, or relief are Internet-based. Mapping the digital divide with other vulnerability layers such as location in a high-wildfire danger zone, flood plain, or dam inundation zone is imperative as climate change increases fire and flood risks. Closing the digital divide will make disaster response and infrastructure regulation more effective, increase community resilience, and save lives.

V. Regulatory Construction of Disaster Risk

Much of the academic analysis of social vulnerability to disaster focuses on individual or community characteristics, coupled with geographic location and hazard proximity as risk drivers. Gotham *et al*. (2018, p. 347) described risk perceptions in New Orleans as arising "from the interplay of social-demographic characteristics of individuals, local geophysical conditions (proximity to a hazard), and people's direct experiences with particular hazard events." "Social vulnerability," Cutter contends, "describes those pre-existing characteristics of groups or conditions within communities that make them more susceptible to the impacts of hazards, in other words, those factors that shape the social burdens of risk (Cutter 2009, p. 25). "[V]ulnerabilities based in physical systems interact with social conditions to produce hazard vulnerability" (*Id.*, p. 26).

This chapter theorizes government and regulatory decisions as engines that construct and maintain social and community vulnerability. San Jose's 2017 flood manifested this vulnerability cycle.

The Anderson dam looming above San Jose is a Federal Energy Regulatory Commission (FERC)-licensed dam authorized to produce up to 0.8 megawatts of power, an amount of power a college campus solar carport can produce.[3] Federal dam management standards are calibrated to prevent catastrophic dam collapse. A "breach of Anderson Dam at full capacity could have catastrophic consequences, including inundation of surrounding land more than 30 miles northwest to San Francisco Bay, and more than 40 miles southeast to Monterey Bay."[4] "In the worst case, a complete failure of Anderson Dam could send a wall of water 35 feet high into downtown Morgan Hill [a suburb of San Jose] within 14 minutes, and eight feet deep into San Jose within three hours" (Rogers, 2019).

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[3] Anderson Dam, (Project No. 5737), Hydro Review, https://www.hydroworld.com/ferc/5300-6399/anderson-dam-power-5737.html (accessed May 28, 2019). *Cf.* YUBA COLLEGE AND BORREGO SOLAR SYSTEMS CELEBRATE OPERATION OF 1 MEGAWATT SOLAR CARPORT PROJECT, BORREGO SOLAR, https://www.borregosolar.com/press/yuba-college-and-borrego-solar-systems-celebrate-operation-of-1-megawatt-solar-carport-project (accessed May 28, 2019).

[4] C1: Anderson Dam Seismic Retrofit, Valley Water, https://www.valleywater.org/anderson-dam-project (accessed May 28, 2019.

FERC uses the U.S. Bureau of Reclamation's (Reclamation) flood severity method that classifies dam-induced floods as either low, moderate, or severe (FERC 2014, p. 7). Reclamation classifies a "low severity flood" as one in which "an able-bodied adult would be able to wade out of harm's way. Safe havens such as home would still be intact and could be used for shelter" (*Id*.). "Severe flooding is generally deep and fast flowing water that would be capable of exceeding the structural integrity of a perceived safe haven, be it the second story of a home or a tree" (*Id*.).

Federal dam flood safety standards appear wildly misaligned with public understanding of a flood "shelter." Federal standards imagine trees as a "safe haven" in a dam-induced flood (*Id.*). Clinging to a tree may be a last resort in a flood. Indeed, in the 2017 San Jose flood, first responders saved several people clinging to trees, many of whom were homeless (Redell, 2017; SCVWD 2017, p. 22). Many community members would not classify a tree as appropriate flood shelter. Categorizing a tree as a flood safe-haven or a "low" severity dam-induced flood as one an able-bodied adult could wade out of neglects the needs and abilities of vulnerable populations including the disabled, elderly, those who are sick or frail, pregnant women, and children. Prudent infrastructure management and emergency planning cannot rely on escape plans that exclude the elderly, the disabled, and vulnerable populations.

Wading through floodwaters risks encounters with hazards lurking in the water. In San Jose's 2017 flood "[r]escue crews and residents had to be rinsed off to prevent them from being sickened by floodwaters that had traveled through garbage, debris and over sewer lines" (Bender and Sanchez, 2017). In disasters such as Hurricane Harvey, Texans reported snakes, alligators, fire ants, downed power lines, and other hazards in the water (Dalbey and Patch Staff, 2017). Reclamation's "low" flood severity classification fails to account for pollutants, waterborne hazards, and vulnerable populations.

Hazard vulnerability is constructed by regulatory decisions, laws, and jurisdictional fissures. Individuals cannot readily avert risks created by government policy and regulatory decisions. People living in a dam flood inundation zone face place-based vulnerability created by rules governing the man-made hydro-electric facility. The digital divide creates information chasms that exacerbate vulnerability.

VI. The Triple Disaster: the Digital Divide, Dam-Induced Flooding, and Limited Information Flows; The San Jose, California 2017 Flood

California faced five years of deep drought during "water years" October 2012-September 2016. (Stevens and Chong, NOAA, undated). By September 2014, 82% of California was in extreme drought with 54% of the state in exceptional drought (*Id.*). After years of drought, during the first 11 days of January 2017, an atmospheric river delivered rain equivalent to 25% of California's average annual rainfall (*Id.*). "Atmospheric rivers are narrow regions of strong winds and large amounts of moisture in the atmosphere that help transport water and can dump inches of rain or feet of snow," and cause flooding (*Id.*).

More than a decade earlier, in 2008 the Anderson dam was identified as at risk of failure in an earthquake measuring 6.6 on the Richter scale or higher (SCVWD, 2017, p. 13). The local water agency, the Santa Clara Valley Water District (the District or SCVWD), kept water levels below full capacity to reduce earthquake stress (*Id.*). In January-February 2017, rainfall from atmospheric rivers exceeded the Anderson dam's capacity.

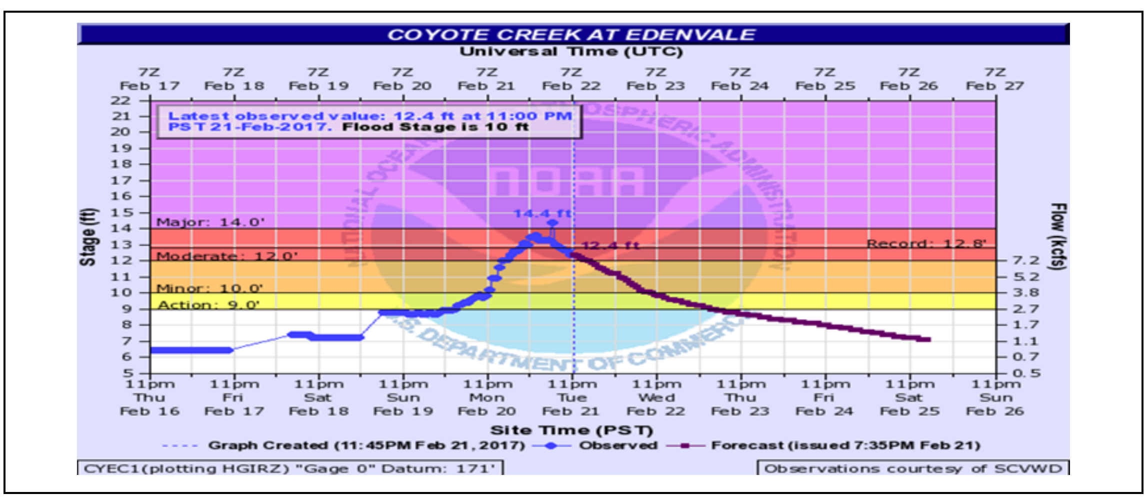
As rains filled the Anderson dam, in January 2017, SCVWD began releasing water into the FERC-approved flood channel, the Coyote Creek to protect the dam's integrity and public safety. The dam's drainage outlet was selected in the 1950's, long before San Jose's population exceeded 1 million. That channel follows the topology from the hill where the Anderson dam is located, through the normally tame Coyote Creek, to the San Francisco bay. That path now travels through a densely populated and richly diverse area. Low-income, diverse communities with large Vietnamese and Spanish-speaking populations, as well as well-off, highly educated, predominantly white neighborhoods, line the Coyote Creek's banks. San Jose's largest digital exclusion zone lies in the flood zone's path.

When the dam overtopped its banks on February 18, 2017, it looked like a segment of Niagara Falls suddenly appeared in the hills above suburban homes. NOAA and Water District sensors in Coyote Creek broadcast data posted on the Internet at 15-minute intervals. Coyote Creek river gauges showed flood stage approaching by Sunday, February 19. The National Weather Service (NWS) issued a Coyote Creek flood warning on February 20 as river levels rose. After NWS flood warnings, the City opened shelters but failed to issue evacuation orders even as river gauges showed rising waters (*Id.*, 22).

As conditions deteriorated, the City announced some evacuation alerts through the County's AlertSCC system which requires prior Internet sign-up for those without a landline phone (Kurchi, 2017). The Anderson dam's outlet transformed the Coyote Creek into a rapids. The City of San Jose posted flood warnings on the Internet through locally oriented website NextDoor, as well as Facebook, and Twitter (SCVWD, 2017, p. 7). NextDoor facilitates neighborhood communication, often featuring posts about lost cats, dogs, turtles, and other animals. Users hoping to receive safety alerts through NextDoor must filter through a daily barrage of lost pet and other neighborhood news. Leaders must evaluate whether NextDoor is an appropriate place for disaster warnings and consider sources that reach a broader range of the public including radio and television. Failure to develop a disaster communication plan accounting for the Whole Community's information needs contributed to destruction and damage.

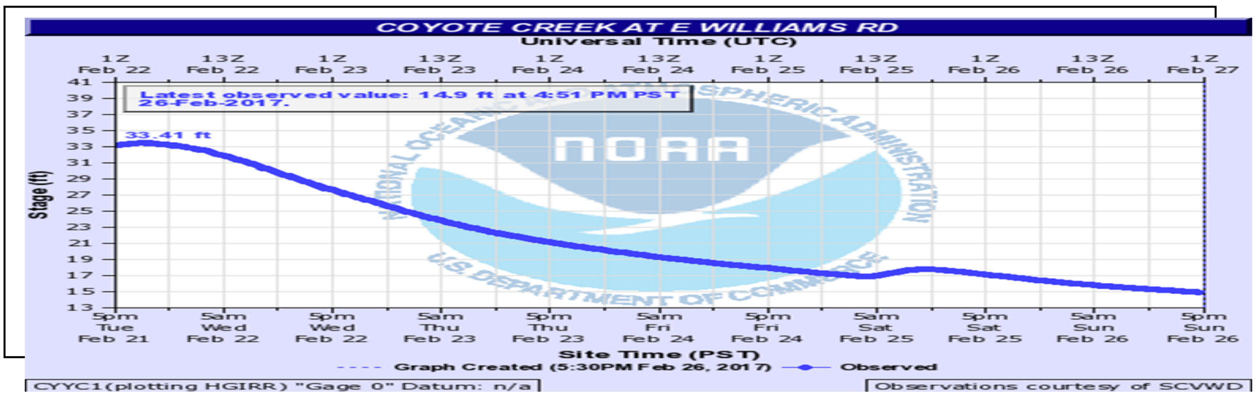
On Monday, February 20, the river's height reached and then exceeded 10-foot flood levels at the Edenvale gauge near the Anderson dam. The District's Edenvale gauge alerts "action" as water levels rise, and marks flood stage. Yet, neither the City nor the Water District promptly initiated public evacuation or other actions to protect public safety and mitigate property damage.

Figure 1. Coyote Creek River Gauge at Edenvale, February 2017 as Floodwaters Approached, Source: National Oceanic and Atmospheric Administration (NOAA), National Weather Service, Advanced Hydrological Prediction Service



The gauge under the Williams Street Bridge near the community where 14,000 people were eventually evacuated, reports river height every 15 minutes without any flood stage indicator. People following this gauge online would not know when flood stage approaches. Neither would they know what action to take based on the other gauges. Data alone is insufficient to create actionable information. Granular data with markers such as "prepare for evacuation" and "flood stage" warnings with timeline estimates would provide residents, infrastructure managers, and public officials with meaningful and timely information.

Figure 2. Coyote Creek River Gauge, Williams Rd., Feb. 21, 2017, Source: NOAA, NWS, AHPD



Neither was river gauge data linked to an action plan. While data flowed, actionable information did not, limiting situational awareness about the coming flood. No plan was in place to encourage residents to move relatives or valuables to higher ground. No instructions were given to prepare for the coming floodwaters. Yet in a disaster, speed is life.

NWS issued a flood warning on February 21, 2017 but local public safety officials took no action to evacuate or issue special warnings to those near the creek (Gomez, 2017). Water levels crested at 14.4 feet at the Edenvale gauge, hours before San Jose officials finally issued mandatory evacuation orders.

On February 21, 2017, five feet of water broke through doors and windows of homes and flooded streets near San Jose's Coyote Creek. Over 14,000 residents were evacuated, many by fire boat (Kurhi, 2017). Many residents said the fire department boats' arrival was their first notice of the rising flood waters (Kurhi, Giwargis, Gomez, 2017).

The Anderson dam flood should not have been a surprise. Flooding was a foreseeable consequence of water release when river water levels rose, and previous heavy rainfall saturated riverbanks. When earthen buffers such as parks become saturated by storms, water flows onto streets instead of percolating into the ground (National Severe Storms Laboratory, undated).

Low-income residents, those lacking insurance or with limited insurance, disabled, elderly, and immigrant populations were hit hard by San Jose's flood. Many residences became uninhabitable for months. Landlords and homeowners struggled to clean flooded apartments, mobile homes, and houses. This process increases upward pressure on rents, driving more people into poverty. Losing a substantial amount of personal or real property to disaster can be devastating. Disasters' aftermath can also be dangerous.

Disaster and displacement heighten risks for undocumented people and families whose immigration status may make them ineligible for government aid or disaster relief. Many undocumented residents including families with mixed immigration status are afraid to ask the government or non-profits for help. Many fear going to shelters due to concerns about immigration enforcement or being accused of being a public charge potentially subject to deportation under Trump Administration policies (Hiltzik, 2018; Department of Homeland Security v. New York, 140 S.Ct. 599 (2020)) (allowing the Trump Administration to enforce the public charge rule pending appeal). The digital divide limits information access, compounding isolation and vulnerability.

Through grace and good luck no one died during San Jose's 2017 flood, but property damage measured over $100 million. For low-income people with no or limited insurance, losing their car to flood waters creates obstacles to getting to work, school, or medical appointments. With adequate warning and an action plan, elderly, disabled, and young family members, as well as cars, computers, and valuables susceptible to water damage could have been moved a few miles to higher ground. These strategies can protect public safety and maintain solvency after a disaster. The insurance industry should support initiatives to reduce claims for personal injury and property damage in flood and fire zones. "Since 2000, the US has spent over $107 billion on the damages caused by floods," $60.7 billion of which was spend in 2017, the year of the Coyote Creek flood in San Jose (Dezfouli, 2020).

In February 2020, FERC ordered the SCVWD to drain the Anderson dam to protect the public from catastrophic flooding following a major earthquake near the dam (FERC, 2020). The dam was drained in December 2020, triggering a 10-year reconstruction period to improve the dam's earthquake safety and build a 1,700-foot-long tunnel to provide a new dam drainage outlet (Rogers, 2020). This project should reduce the risk of flooding in Coyote Creek and improve community safety, though a potential flood inundation zone will remain.

Sensors that connect information about the dam's facilities and floodplain, including image-based sensors such as appropriately placed cameras, can reduce flood risk, save lives, and protect property. While privacy concerns must be evaluated in planning sensor camera placement, leadership should prioritize protecting human life from flooding's harmful and potentially deadly consequences. San Jose's initiatives to close the digital divide will enable use of more Internet-based resources for disaster warning and response, and more effective evacuation and infrastructure management plans.

VII. GAUGING EFFECTIVE DATA

In the wake of the 2017 flood, San Jose and the District collaborated with Santa Clara University to improve river data collection and analysis. This project recognized that "Santa Clara Valley" where San Jose is located, "needs a reliable and economical way to warn its citizens ahead of time about this growing safety issue" (Groot and Dezfouli, 2018).

Under the direction of Dr. Behnam Dezfouli, students at Santa Clara University's School of Engineering created Flomosys, a more accurate river water level monitoring system using sensors, nodes, and a cloud-based communications system. "Sensor Nodes are deployed out in the field, under the bridges designated by the City of San Jose and Santa Clara Valley Water District. They communicate with Base Stations through a sub-GHz [gigahertz] wireless technology that offers low-power, reliable, and long-range links" (*Id.*). Flomosys gathers water level information and communicates that data to Santa Clara University located about 4 miles from the Anderson dam flood plain. The system's sampling rate increases as the water level rises, informed by the last-measured water level (Dezfouli, 2020). Sensor data is "forwarded to the Cloud Application, where it is processed and delivered to the interested parties" (Groot and Dezfouli, 2018).

The Flomosys river flood-warning sensor network provides an example of a data infrastructure pre-positioning strategy. Internet of Things (IoT) devices such as sensors can provide information that enables better infrastructure management and disaster planning. Data and broadband networks create "opportunities to improve health care, education, public safety, job training, energy use, among other public services," merging with the "Civic Internet of Things" (Levin, 2015, p. 297).

Governor Newsom's Wildfire Strike Force report argued for deployment of sensor networks and technological systems to detect fire danger and ignition (Newsom 2019, p. 12). During the 2016-2019 fire seasons, California's AlertWildfire camera network provided critical information for over 1000 fires (AlertWildfire, 2020). IoT resources, supported by monitoring including crowdsourcing, can provide timely information that helps fight fires, supports evacuation, and saves lives (Chamings, 2020).

The Internet, mobile devices, and apps that use video, photos, text, and Geographical Information Systems can collect disaster or public safety data through citizen volunteers, helping emergency response (Erskine & Gregg, 2012; CPUC, 2020b (ordering PG&E to develop an app that enables citizens to submit photos of PG&E infrastructure to promote safety)). Community members are also digital creators who can use the Internet to increase public safety as they communicate about local conditions including fire, flood, and evacuation hazards (Sandoval, 2019, pp. 2, 39). Training on how to access, interpret, contribute to, or respond to data from sensor and warning networks is key to protecting public safety.

Effective IoT systems such as Flomosys or fire networks must be part of a public communication, infrastructure regulation, and disaster planning ecosystem. It is not enough to gather data or send it to the cloud. Data must be connected to civic decision-making to enable data to inform action that safeguards the whole community, regardless of whether community members have Internet access or subscribe to social media platforms.

Digital inclusion enables communication, not just information dissemination (*Cf.* Lacey-Hall, 2012*,* p. 4). Closing the digital divide makes data available to the public including vulnerable community members who often face evacuation challenges.

VIII. DIMENSIONS OF DIGITAL EXCLUSION

As part of its strategy to "promote equity, improve educational outcomes, promote job acquisition and advancement, improve mental and physical health options, and allow businesses to be more efficient and effective" the City of San Jose commissioned studies to clarify the extent and causes of the city's digital divide (San Jose, 2017). Despite its Silicon Valley location, approximately 100,000 San Jose residents out of its population of more than one million, were not connected to the internet at home in 2017 (*Id*.).

San Jose's digital divide mirrors California's digital fault lines. CETF's 2019 state-wide survey found a total of 12% of Californians were unconnected to the Internet, while another 10% were underconnected (CETF 2020, p. 16). CETF defines those with only mobile phone Internet access as underconnected due to device and data plan limits (*Id.*). "With data caps, miniature keyboards, small screens, and less than full versions of word-processing and other essential programs, smartphones fail the test to meet the definition of an appropriate computing device" developed by Levine and Taylor (2018, p. 3-4). In California households with annual incomes less than $20,000, 30% were unconnected to the Internet, as are 21% of people with disabilities (CETF 2020, p. 2.) In California's Spanish-speaking Latinx households, 20% were unconnected to the Internet in 2020 (*Id.*).

Los Angeles County was home to the highest numbers of households living in California's digital divide with 16% unconnected and 10% underconnected to the Internet; in the San Francisco Bay Area, 12% of households were unconnected and 7% were underconnected (CETF 2019, p. 3). In 2020, approximately 95,000 San José residents "are not connected to high-speed Internet service at home, and many lack computing devices and the digital literacy skills to access the full benefits of the technology developed in the region" (CETF 2020, p. 30.)

Income inequality and affordability are primary drivers of digital exclusion in San Jose (Beckel 2018). Lack of Internet affordability yields a material access gap, an inability to afford "expenses for hardware, software, and services" (van Deursen and van Dijk, 2015, p. 380). San Jose's income inequality gap is significant and widening. Adults with a bachelor's degree or higher earn "an average of $88,000 more than those with less than a high school diploma" (Lopez, 2019). The gender pay gap in San Jose is vast; men with a bachelor's degree or higher earn 43 percent more than women with the same level of education (*Id*). San Jose's Latinx and African American residents experienced poverty at a rate nearly three times higher than its white residents (*Id.*).

San Jose's digital exclusion is most pronounced in neighborhoods that share layers of characteristics that affect digital access: a large Spanish-speaking population with low incomes and less than a college degree. Likewise, CETF found low incomes, disability, levels of education, and Spanish spoken in the household exemplify those unconnected or underconnected to the Internet (CETF, 2019).

California worked to narrow the digital divide through its Lifeline program, expanded in 2014 under then-CPUC Commissioner Sandoval's leadership to include support for Internet access and more voice minutes (CPUC 2014, p. D4). Paired with federal Lifeline, California's state Lifeline program enables more than 1.7 million low-income Californians to access voice services through a wireless or wireline phone, and access data and text through wireless service (Petek, 2019). Only 40% of eligible households are enrolled in Lifeline, requiring more analysis of enrollment rates as Lifeline supports free or significantly reduced voice and Internet service (*Id*). Levine and Taylor (2019, p. 35) recommend states support device costs and digital training as part of state Lifeline programs. Many California Lifeline providers offer free, low-cost, or bring your own devices, supporting access through mobile phones, not computers. Public-private partnerships to provide affordable, reliable Internet options, device access, and training in a variety of languages and accessible to people with disabilities and the elderly will foster digital inclusion.

CETF and the City of San Jose measure Internet access by focusing on access *at home* (CETF 2020, p. 16; San Jose, 2017, p. 1). The COVID-19 pandemic exposed the shortcomings of policies that relegated children and families to the status of "Internet migrants," relying on schools, libraries, and coffee shops for Internet access (Sandoval, 2020). As civic and business institutions closed during the pandemic, families drove children to fast-food parking lots to catch Wi-Fi access to support homework (Sandoval, 2020; EdTrust West, 2020; *see* Anderson and Perrin, 2018). Sitting in a fast-food parking lot or in front of library steps to use the Internet is neither sufficient for disaster preparation nor for daily school, work, economic, or health access.

At Santa Clara University, located near San Jose, "[m]any SCU students, like millions of Americans living in the digital divide, regularly went to campus, libraries and coffee shops to access Wi-Fi and lacked Internet access at home except through a cell phone" (BBIC, 2020). "The shift from in-person classes and an open campus to 100% online education left students, faculty, and staff dependent on the mass market wired or wireless Internet connections at their shelter in place residence. This has resulted in range of Internet speeds, access methods, and problems" (*Id.*).

In Spring 2020 as the COVID-19 pandemic raced across the world, "8,574 students in San Jose lack[ed] connectivity" and needed Internet or device support such as a hot spot to participate in distance learning (Lopez, 2020). In California, 1 in 6 school-age children in 2020 lack home Internet access (Ed Trust-West, 2020). ISPs who reserve contractual rights to slowdown mobile data plan users who consume data equivalent to one to two weeks of work or study through video conferencing can compromise Internet access, reliability, education, health, and economic opportunity (BBIC, 2020, p. 14, 19, 45). With the Internet's increasing integration into education, work, healthcare, and civic participation, lack of robust Internet access and government tolerance of ISP slowdown policies has long-term sociological effects. These policies perpetuate poverty and contribute to digital exclusion.

IX. The Digital Divide Marks a Disaster Divide

San Jose mapped areas of digital exclusion through local resident "street surveys." The surveys identified four areas of high digital exclusion in 2017 (City of San Jose, 2017). Each digital exclusion zone lies in the Anderson dam's inundation zone (SCVWD, 2016). What could go wrong? The geographic confluence of the digital divide and infrastructure risk zones makes closing the digital divide imperative to public safety, disaster, and infrastructure planning.

"Vulnerable communities often bear the brunt of natural and human-made disasters, in part because these populations are frequently located nearest or exposed to a variety of hazards within their environmental setting (*e.g*. floodplains, industrial waste facilities, etc.)" (Ahmed, *et al*. 2012, p. 1). In San Jose, many low-income, limited English-speaking, diverse communities, and vulnerable populations, as well as some moderate and affluent communities, suffered flood damage and were evacuated in this digital divide and dam inundation confluence zone.

The digital divide undermines disaster prevention and response. Koch *et al*. (2017, citing Fothergill *et al*. (1999)) observe "language barriers, housing patterns, community isolation, less disaster education, limited natural disaster insurance, and cultural insensitivities" affect disaster response. Disaster vulnerability, they argue, is marked by "pre-event, inherent characteristics or qualities of social systems that create the potential for harm" (*Id*., p. 32, citing Cutter *et al*., (2008)). "[G]eographical vulnerabilities, such as proximity to hazardous facilities and elevation differences, which are often found in lower socioeconomic neighborhoods" also increase hazard vulnerability (*Id*., p. 32, citing Ahmed, *et al*. 2012).

The digital divide adds another layer of community vulnerability. Professor Sandoval's observation about the high level of overlap between San Jose's digital divide's epicenter and the Anderson dam inundation zone link Ahmed *et al.*'s focus on the geographic characteristics of populations vulnerable to disaster, and the language barriers, housing patterns, and other vulnerability factors Fothergill identified. Sandoval adds the digital divide as a disaster vulnerability factor. The digital divide also reflects government policy and business decisions that discourage Internet adoption. In many U.S. rural areas including Native American tribal lands, lack of Internet infrastructure drives the digital divide.

Native Americans living on tribal lands are the Americans least connected to high-speed Internet networks (Wang, 2018), a status primarily due to lack of infrastructure access, rather than adoption issues (Sandoval 2018a, p. 172, 190). "Lacking electricity and communications facilities and services, Native

American tribes are structurally locked out of opportunities made available to most other American communities by the mid-twentieth century" (*Id.*, p. 172).

Davies (2018, p. 7) identified Native Americans living on tribal lands as having the highest levels of wildfire risks. "[W]ildfire vulnerability is spread unequally across race and ethnicity, with census tracts that were majority Black, Hispanic or Native American experiencing a 50% greater vulnerability to wildfire compared to other census tracts" (*Id.* p. 8). "Native Americans are highly overrepresented in all of the most vulnerable areas" for wildfire risk (*Id.* at p. 7). Clark's review of the literature on indigenous people and disaster risk found that "Indigenous peoples are more vulnerable to disasters than are non-indigenous peoples," yet indigenous people are "often overlooked in disaster recovery and mitigation plans" (Clark, 2017, p. 1). Many of the high wildfire risk areas on Native American lands also lack Internet access, a factor that increases disaster vulnerability.

Lack of Internet access reduces communications channels for disaster preparedness and response. "Lack of communications services makes the job of emergency responders more difficult as their responsibility includes communication and coordination" (CPUC 2016, p. 72-73). CalFire Deputy Guerro observed at the CPUC's 2019 Communications Grid *en banc* that commercial networks in fire zones were not reliable due to lack of site hardening, lack of battery power, or were not deployed in many high-fire danger areas (CPUC, 2019a). Absence of communications networks in rural areas, Native American reservations, and high wildfire danger zones, and lack of resilient networks drives the digital divide and public safety gaps.

Public safety is not just about first-responder access to communications networks. The ability to use the Internet to send and receive information, warnings, and encourage appropriate action depends on access to functional networks and devices to receive that information. Leadership drives or mitigates the digital divide.

Resilient networks support community safety. The California Public Utilities Commission (CPUC) defined resiliency for wireless service providers "as the ability to recover from or adjust to adversity or change through an array of strategies including, but not limited to: backup power, redundancy, network hardening, temporary facilities, communication and coordination with other utilities, emergency responders, the public and finally, preparedness planning" (CPUCa, 2020, p. 1). During the 2017 and 2018 California wildfires, wireless service outages endangered public safety, hampering evacuation, firefighting, disaster relief delivery and recovery. During the Camp Fire, "56 percent of the 4,272 emergency alert calls in first hours of Paradise blaze failed, and the lack of power at the cell towers is a prime suspect in that failure" (Krieger, 2019). In 2020 the CPUC adopted a "72-hour backup power requirement for the wireless providers' facilities, to ensure minimum service coverage is maintained during disasters or commercial grid outages" (CPUCa, 2020.)

The CPUC's wireless power backup decision followed fourteen years of federal reluctance to adopt power backup rules and reversed the state's 2008 decision to defer federal regulation. Following Hurricane Katrina in 2006, the FCC initially adopted a 24-hour power backup requirement for wireless providers but dropped those rules after procedural challenges to the FCC's comment and data collection process (*Id.*, p. 9-12). After years of federal and state resistance to mandating wireless service power backup, wildfire outbreaks between 2017 to 2020 impelled the CPUC to provide the state-wide leadership to enable local communications resiliency. CPUC Rulemaking 18-03-011 examines whether to extend power backup requirements to wireline communications providers at the network and customer level. Power backup will also help those reliant on mobile telephones and wireline systems for Internet access.

Prior to emergencies, officials must understand community information needs and media usage (*see* Waldman, S. 2011). Government leaders need to meet with vulnerable communities such as those in flood zones in advance of hazardous incidents. Listening informs leadership (Safir, 2020).

Such dialogue will inform leaders about information channels used in the community and highlight differences in radio, television, Internet, print, or social media use, language differences, disability issues, and other trusted messenger sources for emergency alerts such as the church or civic organizations. Leaders must recognize that social media warnings are inaccessible to residents living on the wrong side of the digital divide.

Consistent with FEMA's and the United Nations' Whole Community approach to disaster preparation, identifying community information needs and sending messages designed to effectively reach the community can save lives during emergencies when seconds and preparation matter (FEMA, 2011; Knight Commission, 2011, p. 10; Dawkins, 2019). Understanding, for example, the role of a Spanish or Vietnamese-language radio station, television station, newspaper, or website in the community, and building relationships with and providing support for that media ecosystem, will improve coordination and disaster response.

Communities, governmental and non-profit organizations, as well as the media, must also be made aware of warning channels in advance of emergencies. During the 2017 San Jose flood, local officials sent out alerts to an imagined community, highly connected to the Internet, and capable of filtering warnings from the detritus of Twitter feeds, Facebook posts, and Nextdoor notices. In the process, officials failed to inform the community they served of the coming danger.

X. Integrating Digital Inclusion Strategies with Disaster Planning, Response, and Recovery

In 2019 the City of San Jose and CETF agreed to collaborate to connect San Jose households to the Internet. CETF will manage the City's estimated $24 million in grants for digital inclusion programs. Revenue from fees telecommunications companies pay to upgrade broadband networks to 5G technologies will support the fund. The authors are members of CETF's Board of Expert Advisors. They and Paul Lamb Co-Chair CETF's Emerging Technology Committee. The authors are not part of the CETF/City of San Jose grant development, award, or execution team and have received no compensation from the City of San Jose or CETF for this research.[5]

The City of San Jose's Digital Inclusion Fund seeks to ensure residents have access to appropriate technology for homework, career opportunities, healthcare, and other needs. San Jose's digital inclusion strategy aims to close broadband access and device gaps, create awareness about digital inclusion programs and resources, build digital literacy, and create innovative pilots (San Jose, 2019). The San Jose/CETF partnership aims to connect 50,000 unconnected households in San José to the Internet at speeds of at least 25 Mbps download/3 Mbps up over 10 years (CETF, 2019; San Jose Digital Inclusion Fund).

The San Jose Digital Inclusion Fund ramped up as the COVID-19 pandemic gripped the world (WHO, 2020; White House, 2020, (COVID-19 disaster declarations)). COVID-19 is a slow-moving, elongated disaster. Viral pandemics challenge disaster recovery paradigms that imagine a relatively short-term incident such as an earthquake or a tornado that quickly shifts to recovery mode.

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[5] The authors received a modest honorarium from the California Emerging Technology Fund in 2019 recognizing their work as co-chairs of CETF's Emerging Technology Committee.

During the Spanish Flu of 1918, first identified at Ft. Funston, Kansas, "[e]lectricity was not widely available, telephone services were in their infancy, and the Internet would not be developed for more than fifty years" (Sandoval *et al*. 2020). A century later, as the COVID-19 pandemic gripped the world, twenty-first century Internet access enabled vast sectors of global society to shift to online work, education, business, health, and social services, but left those unconnected or underconnected to the Internet at a tremendous disadvantage.

Millions were left behind in the mass shift to online services and education. "COVID-19 is making the digital divide worse," the San Jose's Digital Inclusion Fund reported (San Jose Digital Inclusion Fund, undated). "For San José residents lacking internet and devices at home, continuing to learn, work and receive essential services remotely is virtually impossible" (*Id*.). "During the COVID-19 pandemic Internet access has become crucial to safety of life, the public welfare, and preservation of the viability of our health care system. Health care providers are encouraging the public to seek telemedicine consultations first instead of going to see the doctor or going to an urgent care clinic or emergency room to limit COVID-19 exposure" (BBIC, 2020, p. 16).

To enable home Internet access for students and families, San Jose's Digital Inclusion Fund plans to deploy $24 million over 10 years, giving grants of $1-2 million per year to community organizations working to promote digital inclusion in San Jose. The Fund follows a five step process to assess low-income family Internet support needs and promote adoption and training: 1) deploy outreach strategies and tools to inform low-income San Jose families about the fund; 2) identify unconnected households and documents digital needs using a digital access survey; 3) engage unconnected households to complete the intake, pre-assessment and household adoption plan; 4) verify Internet connection by observing the first new customer notice or first bill and ensure the family has a computing device, and; 5) verify digital literacy training conducted by grantee organizations through a post-assessment survey (Digital Inclusion Fund, CETF, 2020).

As CETF, the City of San Jose, and community partners work together to increase digital inclusion, this program must be integrated into disaster planning, as well as social and community services strategies. The Fund and the City should focus on closing the digital divide in neighborhoods vulnerable to floods such as those in the Anderson dam's flood plain. Doing so requires coordination with the Water District to ensure that the drainage design after the 10-year project to increase the dam's earthquake resiliency also protects the community from flooding. Integration of sensors and civic IoT devices in flood plains and dam facilities, and development of systems to convert information into action can protect communities by design.

Closing the digital divide will facilitate disaster preparation and response, and enable daily and long-term economic, educational, health, and civic opportunity. Understanding community information needs and gearing emergency alerts to platforms communities use (in languages appropriate to the locality) will save lives. Aligning data collection systems such as flood sensors with community digital inclusion efforts and training on data interpretation and contribution can convert data into effective action. Doing so requires leadership that connects efforts to close the digital divide with disaster preparation and response and community capacity building. Safety, resiliency, and respect for every person requires infrastructure regulation and emergency planning that puts the Whole Community at its center.

XI. Conclusions and Recommendations

Leadership gaps construct and reify the digital divide. Leadership can also close the digital divide and mitigate disaster risk. This chapter's examination of disaster planning and infrastructure management failures in San Jose and Paradise, California informs efforts to address the digital divide. This chapter argues that ending the digital divide is a predicate to effective disaster planning and response, humanitarian relief, infrastructure resource management, and community capacity building. It argues for digital access and inclusion strategies to improve infrastructure and disaster management, protect public safety, and enhance community capacity, safety, and resiliency.

As the Internet's integration into society increases, collective costs of digital exclusion escalate. Addressing the digital divide will open new avenues for infrastructure regulation, hazard management, and disaster preparation and response.

Digital inclusion strategies must do more than support cell phone service or hot spots for residents living in a dam inundation zone, wildfire danger area, or those who need to take classes online. Leadership mediates data and action. Building access to robust Internet services, and promoting adoption, affordability, and training is critical to public safety, health, opportunity, and equity. Connecting the Whole Community builds capacity, fosters equity, increases resilience, and must be a twenty-first leadership priority.

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References

AlertWildfire. (2020). http://www.alertwildfire.org/about.html.

Anderson, M. and Perrin, A. (Oct. 26, 2018). Nearly one-in-five teens can't always finish their homework because of the digital divide, *Pew Research Center*, https://www.pewresearch.org/fact-tank/2018/10/26/nearly-one-in-five-teens-cant-always-finish-their-homework-because-of-the-digital-divide/.

Anderson, M. and Perrin, A. (2017, April 7). Disabled Americans are less likely to use technology, *Pew Research Center*, https://www.pewresearch.org/fact-tank/2017/04/07/disabled-americans-are-less-likely-to-use-technology/.

Chandra, A., *et al*. (2011). *Building community resilience to disasters. A way forward to enhance national health security.* Santa Monica, CA: RAND Corporation.

Ahmed, S., Nelson, D.A., Biedrzycki, P.A., Sandy, M.G., Opel, S., Franco, Z. (2012). Community engagement for translational disaster research: fostering public, private & responder group partnerships. *Proceedings of the 9th International ISCRAM Conference — Vancouver, Canada*, L. Rothkrantz, J. Ristvej and Z. Franco, (Eds.)

Beckel, D. (2018, Aug 21). Addressing Digital Inequality in San Jose, *FUSE Corps*, https://medium.com/fuse-corps/addressing-digital-inequality-in-san-jose-c55cdf7b8c72.

Bender, C., and Sanchez, M. (2017, Feb. 21). Hundreds rescued from California floodwaters in San Jose, *AP*, https://www.apnews.com/71158e8b1b1a4ccba5e873fc67c002d0.

Bouabdellah, K., Kechar, N., Noureddine, H., Larbi, S. (2013). Using Wireless Sensor Networks for Reliable Forest Fires Detection, *Procedia Computer Science* 19, 794 – 801, https://www.sciencedirect.com/science/article/pii/S1877050913007126.

BBIC (Broadband Institute of California @ Santa Clara University). (2020, April 20). Comments, In the Matter of Internet Freedom, WC Docket Nos. 17-108, 17-287, 11-42, https://ecfsapi.fcc.gov/file/104211478729214/BBIC%20Comments%20FCC%20Net%20Neutrality%20Mozilla%20remand%20final.pdf.

California Department of Food & Agriculture. (2011). *Support of Disasters and Catastrophes, California Department of Food & Agriculture*, Division of Fairs & Expositions, Sacramento, CA, https://www.cdfa.ca.gov/Fairs_&_Expositions/Documents/FCERP/CA_Fairground_Disaster_Support_Final_Web.pdf.

CalFire. (2015, May 15). *CAL FIRE Investigators Determine Cause of the Camp Fire, CalFire Press Release* [Press Release], http://calfire.ca.gov/communications/downloads/newsreleases/2019/CampFire_Cause.pdf.

CETF. (2020). *Quest for Digital Equity, Profess Report in Closing the Digital Divide*, https://www.cetfund.org/wp-content/uploads/2020/09/CETF_2020_Progress_Report-1.pdf.

CETF. (2019, Aug. 14). *San Jose and CETF Name Digital Inclusion Director*, [Press Release], https://www.cetfund.org/san-jose-and-cetf-name-digital-inclusion-director/.

CPRN (Communications Policy Research Network). (2012). *Review of the literature regarding critical information needs of the American public*. Federal Communications Commission. https://www.fcc.gov/news-events/blog/2012/07/25/reviewliterature-regarding-critical-information-needs-american-public.

CPUC. (2014, January 16). D. 14-01-036, *Decision Adopting Revisions to Modernize and Expand The California Lifeline Program*.

CPUC. (2016, Dec. 15). D. 16-12-066, *Decision On Rural Call Completion Issues, Other Call Completion Issues And Call Initiation Issues Including Lack Of 911 Access And Dial Tone*.

CPUC. (2017, Dec. 14). D.17-12-024, *Order Instituting Rulemaking to Develop & Adopt Fire-Threat Maps & Fire-Safety Regulations*.

CPUC. (2019a, May 20). *The Future of California's Communications Grid*, http://adminmonitor.com/ca/cpuc/en_banc/20190520/.

CPUC. (2019b, April 26). Public Discussion on Pacific Gas and Electric Forums on Governance, Management, and Safety Culture, Part II: Forum on Governance, Management, and Safety Culture, http://www.adminmonitor.com/ca/cpuc/workshop/20190426/.

CPUC. (2020a, July 16). D. 20-07-011, *Decision Adopting Wireless Provider Resiliency Strategies*, Rulemaking 18-03-011.

CPUC. (2020b, Oct. 8). D. 20-10-003, *Decision Approving Pacific Gas And Electric Company's Mobile Application And Supporting Systems Pilot*.

Cutter, S.L., Barnes, L., Berry, M., Burton, C., Evans, E., Tate, E., Webb, J. (2008). Place-based model for understanding community resilience to natural disasters. *Glob. Environ. Chang*. 18 (4), 598–606.

Cutter, S.L. (2009). Social Science Perspectives on Hazards and Vulnerability Science. In T. Beer (Ed.), *GEOPHYSICAL HAZARDS, MINIMIZING RISKS, MAXIMIZING AWARENESS*, 13 (Springer, 2009).

CHAMMINGS, A. (2020). See the exact moment 3 California wildfire cameras were consumed by flames, *SF GATE*, https://www.sfgate.com/california-wildfires/article/northern-california-bay-area-wildfire-cameras-15498978.php.

Cheney, C. (2017, March). Communications as aid: Key takeaways from the Humanitarian ICT Forum, *Devex*, http://www.devex.com/news/communication-as-aid-key-takeaways-from-the-humanitarian-ict-forum-89898/amp.

Dalbey, B., and Patch Staff. (2017). Hurricane Harvey: Houston Floods Dredge Up Alligators, Snakes, Fire Ants, Aug. 27, 2017, *Patch*, https://patch.com/texas/meyerland/hurricane-harvey-houston-floods-dredge-alligators-snakes-fire-ants.

Das T., Maurer E.P., Pierce D.W., Dettinger M.D., Cayan D.R. (2013). Increases in flood magnitudes in California under warming climates. *Journal of Hydrology*, 2013; 501:101–110.

Davies, I., Haugo, R., Robertson, J., Levin, S. (2018). The unequal vulnerability of communities of color to wildfire, *PLOS ONE* 13(11): e0205825, https://doi.org/10.1371/journal.

Dawkins, J. (2019, Sep.). Meeting People Where They Are: How Lowering Barriers To Participation Helps Reach Beyond The Loudest Voices In The Community And Build Trust. *Public Management*, VOL. 101 ISSUE 8, P49-53.

Department of Homeland Security v. New York __ U.S. __, 140 S.Ct. 599 (2020).

Dezfouli, B. (2020). Flomosys, *Benjamin Dezfouli's Home Page, Santa Clara University*, https://www.cse.scu.edu/~bdezfouli/flomosys.html.

Diffenbaugh, N., Swain, D. & Touma, D. (2015). Anthropogenic warming has increased drought risk in California. *Proc. Natl Acad. Sci. USA* 112, 3931–3936.

Dinan, T. (2017). Projected Increases in Hurricane Damage in the United States: The Role of Climate Change and Coastal Development, 138 *Ecological Economics* 186, 186.

Ed Trust-West. (2020). Education Equity in Crisis: The Digital Divide, *Education Trust*, https://west.edtrust.org/resource/education-equity-in-crisis-the-digital-divide/.

Erskine, M., Gregg, D. (2012, May 1). Utilizing Volunteered Geographic Information to Develop a Real-Time Disaster Mapping Tool: A Protype and Research Framework, Association for Information Systems, International Conference on Information Resources Management (Conf-IRM), at: Vienna, Austria, (PDF) Utilizing Volunteered Geographic Information to Develop a Real-Time Disaster Mapping Tool: A Prototype and Research Framework (researchgate.net).

FEMA. (2011a). *Whole Community Approach to Emergency Management; Principles, Themes, and Pathways for Action*, FDOC 104-008-1, https://www.fema.gov/media-library-data/20130726-1813-25045-0649/whole_community_dec2011__2_.pdf.

FEMA. (2011b). *Business continuity and disaster preparedness planning patterns and findings from current research. Citizen Preparedness Review: Community Resilience through Civic Responsibility and Self-Relianc*e, Issue 7 (Winter), https://www.fema.gov/media-library-data/20130726-1854-25045-6573/businesscpr.pdf.

FERC. (2014). FERC Engineering Guidelines Risk-Informed Decision Making, Chapter R22, Estimation of Life Safety Consequences, 7, Draft 2014.

FERC. (2020, Feb. 20). Letter from David E. Capka, P.E. Director, Division of Dam Safety and Inspections, FERC, to Christopher Hakes, Deputy Operating Officer, Dam Safety and Capital Delivery Division, Santa Clara Valley Water District.

Flores, A, and Lopez, M.H. (2018, Jan. 11). Among U.S. Latinos, the internet now rivals television as a source for news, Pew Research Center, https://www.pewresearch.org/fact-tank/2018/01/11/among-u-s-latinos-the-internet-now-rivals-television-as-a-source-for-news/.

Fothergill, A., Maestas, E.G., Darlington, J.D. (1999). Race, ethnicity and disasters in the United States: a review of the literature. *Disasters* 23 (2), 156–173.

Gotham, K.F., Campanella, R., Lauve-Moon, K., Powers, B. (2018). Hazard Experience, Geophysical Vulnerability, and Flood Risk Perceptions in a Postdisaster City, the Case of New Orleans, *Risk Analysis*, Vol. 38, No. 2, 345.

Fugate, C. (2011, March 30). Administrator, Federal Emergency Management Agency, Testimony before the United States House Transportation and Infrastructure Committee, Subcommittee on Economic Development, Public Buildings, and Emergency Management at the Rayburn House Office Building, https://www.dhs.gov/news/2011/03/30/administrator-craig-fugate-federal-emergency-management-agency-transportation-and.

Gafni, M., and Peele, T. (2018, Dec. 7). It was originally built in 1919. What failed on PG&E tower at heart of Camp Fire probe? *San Jose Mercury News*, https://www.mercurynews.com/2018/12/07/it-was-originally-built-in-1919-what-failed-on-pge-tower-at-heart-of-camp-fire-probe/.

Gomez, M. (2017, Feb. 21). San Jose: Flood Warning for Coyote Creek, *Mercury News*, https://www.mercurynews.com/2017/02/21/san-jose-flood-warning-for-coyote-creek/.

Gostin, L. & Fidler, D. (2007). Biosecurity Under the Rule of Law, 38 *CASE W. RES. J. INT'L L.* 437, 469.

GSMA. (2017). *The Importance of Mobile for Refugees*, https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2017/02/The-Importance-of-mobile-for-refugees_a-landscape-of-new-services-and-approaches.pdf.

Groot, T. and Dezfouli, B. (2019). *Flomosys*: A Low-Cost, Reliable, and Low-Power Flood Monitoring System, Internet of Things Research Lab, Santa Clara University, Santa Clara University, School of Engineering, 2019 Research Showcase, 2018 Research Showcase Posters, at 14, https://www.scu.edu/media/school-of-engineering/pdfs/2019-Research-Showcase-Posters-PDF.pdf.

Hiltzik, M. (2018, Aug. 24). A punitive Trump proposal stokes panic among immigrants — even before it's official, *Los Angeles Times*, https://www.latimes.com/business/hiltzik/la-fi-hiltzik-public-charge-20180824-story.html.

Jackson, L. A., Y. Zhao, A. Kolenic, H. E. Fitzgerald, R. Harold, and A. Von Eye. (2008). Race, gender, and information technology use: The new digital divide. *CyberPsychology & Behavior* 11 (4):437–42.

Knight Commission. (2009). Informing communities, Sustaining Democracy in the Digital Age, https://knightfoundation.org/wp-content/uploads/2019/06/Knight_Commission_Report_-_Informing_Communities.pdf.

Koch, H., Franco, Z., O'Sullivan, T., DeFino, M., Ahmed, S. (2017). Community views of the federal emergency management agency's "whole community" strategy in a complex US City: Re-envisioning societal resilience, *Technological Forecasting & Social Change* 121, 31–38, 32.

Krieger, L. (2018a, Dec. 16). Camp Fire: Paradise residents say they received no mass cellphone alerts to evacuate, or to warn of fires, *San Jose Mercury News*, https://www.mercurynews.com/2018/11/13/camp-fire-paradise-residents-say-they-received-no-mass-cellphone-alerts-to-evacuate-or-to-warn-of-fires/.

Krieger, L. (2018b, Dec. 16). Camp Fire Created a Blackhole of Communication, In Disasters our High-Tech Communities are Reduced to 1940s Responses, *San Jose Mercury News*, https://www.mercurynews.com/2018/12/16/camp-fire-created-a-black-hole-of-communication/.

Kurhi, E. (2017, Aug. 1). San Jose flood response: An 'A' in aftermath, 'F' in foresight, *San Jose Mercury News*, https://www.mercurynews.com/2017/08/01/san-jose-flood-response-an-a-in-aftermath-f-in-foresight/.

Kurhi, E., Gomez, Giwargis, R., Gomez, M. (2017, Feb. 24). San Jose mayor: Clear 'failure' led to record flooding, San Jose Mercury News, https://www.mercurynews.com/2017/02/22/san-jose-flood-mayor-clear-failure-delayed-warning/.

Kurhi, E. (2017, March 6). San Jose flood: Silicon Valley behind the curve in implementing alert system, *San Jose Mercury News*, https://www.mercurynews.com/2017/03/06/san-jose-flood-silicon-valley-behind-the-curve-in-implementing-alert-system/.

Krieger, L. (2019, June 2). Cell phones useless amid wildfire: Camp Fire failure prompts call for statewide action, *San Jose Mercury News*, https://www.mercurynews.com/2019/06/02/6091556/.

Lacey-Hall, O. (2012). *Communication as Aid*, Remarks at the Asian Disaster Reduction And Response Network 10th Anniversary Annual General, Phnom Penh, Cambodia, Feb. 8 – 10, 2012, https://www.unocha.org/sites/dms/Documents/OLH%20ADRRN%20Speech%20-%20Phnom%20Penh%20090212.pdf.

Lanthier, P. (2015). *From Chaos to Synergy via a Whole of Society Approach*, Presentation to the Federal-State Joint 706 Conference, Nov. 19, 2014, in notice of ex parte communication, Federal Communications Commission, GN Docket No. 14-28, Feb. 3, 2015, retrieved from https://ecfsapi.fcc.gov/file/60001026237.pdf.

Levin, B. (2015). Net Neutrality at 10+; National Broadband Plan at 5; Civic Internet of Things at Birth: Lessons in Government Action in A Changing Landscape, 23 *CommLaw Conspectus* 289, 297.

Levine, L., and Taylor, M. P.H. (2018). Closing the Digital Divide: A Historic and Economic Justification for Government Intervention, *UCR SPP Working Paper Series*, May 2018-WP=18-05, March 23, 2018, retrieved from https://spp.ucr.edu/sites/g/files/rcwecm1611/files/2019-04/closing_digital_divide.pdf.

Lopez, N. (2020, May 5), San Jose approves plan to expand internet access to all students, *San Jose Spotlight*, https://sanjosespotlight.com/san-jose-approves-plan-to-expand-internet-access-to-all-students/.

Loudenback, T. (2019, Feb. 27). What life is really like in the most expensive place in the US, where the typical home costs $1 million and it feels like everyone works in tech, *Business Insider*, https://www.businessinsider.com/san-jose-most-expensive-place-silicon-valley-life-2019-2.

Lyons, C. (2016, April). The Great Western Flood, 36 *Wild West*.

Lopez, N. (2019, Feb. 13). Growing inequality: A look at the 2019 Silicon Valley Index, *San Jose Spotlight*, 2019, https://sanjosespotlight.com/growing-inequality-a-look-at-the-2019-silicon-valley-index/.

Martinez, G. (2018, Nov.14). The California Fire That Killed 48 People Is the Deadliest U.S. Wildfire in a Century, *Time*, https://time.com/5453710/california-camp-fire-deadliest-wildfires-us-history/.

National Severe Storms Laboratory. (undated). Severe Weather 101, Floods, https://www.nssl.noaa.gov/education/svrwx101/floods/ (accessed May 30, 2019).

Newberry, L. (2019, Feb. 10). Poor, elderly and too frail to escape: Paradise fire killed the most vulnerable residents, *Los Angeles Times*, https://www.latimes.com/local/lanow/la-me-ln-camp-fire-seniors-mobile-home-deaths-20190209-story.html.

Newsom, G. (2019, April 12). *Governor's Strike Force, Wildfires and Climate Change, California's Energy Future*, https://www.gov.ca.gov/wp-content/uploads/2019/04/Wildfires-and-Climate-Change-California%E2%80%99s-Energy-Future.pdf.

Metcalfe, R. (2013, Dec.). Metcalfe's Law After 40 Years of Ethernet, *COMPUTER*. Vol. 46, No. 12, p. 26-31, Dec. 2013, doi: 10.1109/MC.2013.374.

Metcalfe, R. (1995, Oct. 2). *Metcalfe's Law: A Network Becomes More Valuable as It Reaches More Users,* INFOWORLD, p. 53.

Metcalfe, R. (2006, Aug. 18). Guest Blogger Bob Metcalfe, Metcalfe's Law Recurses Down the Long Tail of Social Networks, *VC Mike's Blog*, https://vcmike.wordpress.com/2006/08/18/metcalfe-social-networks/.

PRIEGER, J. (2015). The broadband digital divide and the benefits of mobile broadband for minorities, *J Econ Inequal*, 13:373–400, DOI 10.1007/s10888-015-9296-0.

Pfefferbaum, B., Van Horn, R., Pfefferbaum, R. (2017). A Conceptual Framework to Enhance Community Resilience Using Social Capital, *Clin Soc Work J*. 45:102–110, 103.

Rogers, P. (2019). New Study Shows Massive Earthquake Could Cause Anderson Dam To Fail, *San Jose Mercury News*, Jan. 5, 2019, https://www.mercurynews.com/2009/01/05/new-study-shows-massive-earthquake-could-cause-anderson-dam-to-fail/.

REDELL, B. (2017, Feb. 21). Five Homeless People Rescued From Flooded San Jose Golf Course, *San Jose Mercury News*, retrieved from https://www.nbcbayarea.com/news/local/san-jose-fire-rescue-several-homeless-people-trapped-on-las-lagos-golf-course-near-coyote-creek-414358253.html.

Rogers, P. (2020, Dec. 16). Video: Anderson Reservoir is drained as part of earthquake project to rebuild 240-foot Anderson Dam, *Mercury News*, https://www.mercurynews.com/2020/12/16/video-anderson-reservoir-is-drained-as-part-of-earthquake-project-to-rebuild-240-foot-anderson-dam/.

Roth, M. (2018). A Resilient Community Is One That Includes and Protects Everyone, *Bulletin Of The Atomic Scientists*, Vol. 74, NO. 2, 91–94, https://doi.org/10.1080/00963402.2018.1436808.

Safir, S. (2017, May). Learning to Listen, *Educational Leadership*., Vol. 74, Issue 8, p.16-21.

Sandoval, C. (2018a). Energy Access is Energy Justice: The Yurok Tribe's Trailblazing Work to Close the Native American Reservation Electricity Gap. In R. Salter, C. G. Gonzalez, M. H. Dworkin, R.A. Mastor, E. Kronk Warner (Eds.) *Energy Justice, International and U.S. Perspectives*, 166-207, Cheltenham, U.K.: Edward Elgar.

Sandoval, C. (2018b). Net Neutrality Powers Energy and Forestalls Climate Change, 9 *San Diego J. of Climate and Energy*, 1.

Sandoval, C. (2019). Net Neutrality Repeal Rips Holes in the Public Safety Net, 80 *U. Pittsburg L. Rev.* 953.

Sandoval, C. (2020). U.C. Berkeley Tech. Law J. and Fed. Comm. Law J. Symposium, *Technology Law as a Vehicle for Antiracism.* Keynote speaker, *Net Neutrality, Communications Policy, and Their Impact on Minority Populations*, Nov. 2020, Event Recordings | Berkeley Law, at 1:12:36-2:32-17.

San Jose. (2017). *Broadband and Digital Inclusion Strategy, Gaps & Opportunities Assessment*, http://sanjose.granicus.com/MetaViewer.php?meta_id=686006.

San Jose. (2019, Feb. 12). *San José Launches Digital Inclusion Fund to Close the Digital Divide*, http://www.sanjoseca.gov/DocumentCenter/View/82743.

San Jose. (undated). *Planning, Building, and Code Enforcement*, San Jose.ca.gov, http://www.sanjoseca.gov/index.aspx?NID=2044 (accessed June 15, 2019).

San Jose Digital Inclusion Fund. (undated). About, https://www.sjdigitalinclusion.org/.

San Jose Digital Inclusion Fund, CETF. (2020, Sept.) Digital Inclusion: Adoption At-A-Glance, on file with the author, Catherine Sandoval.

SCVWD. (2017), FLOODING REPORT, https://www.valleywater.org/sites/default/files/2017%20Flood%20Report.pdf.

SCVWD. (2016). LEROY ANDERSON DAM FLOOD INUNDATION MAPS, https://www.valleywater.org/sites/default/files/Anderson%20Dam%20Inundation%20Maps%202016.pdf.

Shah, S.A. *et al.* (2019). *Towards Disaster Resilient Smart Cities: Can Internet of Things and Big Data Analytics Be the Game Changers?*, 7 IEEE ACCESS 91885, https://ieeexplore.ieee.org/document/8759905.

Shearer, E. (2018, Dec. 10). Social media outpaces print newspapers in the U.S. as a news source, *Pew Research Center*, retrieved from https://www.pewresearch.org/fact-tank/2018/12/10/social-media-outpaces-print-newspapers-in-the-u-s-as-a-news-source/.

Statistica. (2017). Internet usage of Hispanics in the United States - Statistics & Facts, Statista Research Department, Internet usage of Hispanics in the United States - Statistics & Facts | Statista.

Stevens, A. and Chong, W. (undated). *California Drought, 2011-2017, NOAA, Modeling, Analysis, Predictions, and Projections*, undated, https://noaa.maps.arcgis.com/apps/Cascade/index.html?appid=0307d687789c4d1cbec397d0abc2fffc (last visited Nov. 7, 2020).

Swain, D.L., Langenbrunner, B., Neelin, J.D., and Hall, A. (2018, May). Increasing precipitation volatility in twenty-first century California, *Nature Climate Change*, 8, 427–433 (2018). https://doi.org/10.1038/s41558-018-0140-y.

Tasic, J. and Amir, S. (2016). Informational capital and disaster resilience: the case of Jalin Merapi, *Disaster Prevention and Management*, Vol. 25 Issue: 3, pp.395-411, https://doi.org/10.1108/DPM-07-2015-0163 Permalink, https://doi.org/10.1108/DPM-07-2015-0163.

Todd, Z., Trattner, S., McMullen, J. (2019, Oct. 25). Ahead of Camp Fire Anniversary, New Details Emerge of Troubled Evacuation, *PBS Frontline*, https://www.pbs.org/wgbh/frontline/article/camp-fire-anniverary-new-details-troubled-evacuation/.

Tankersley, J. (2020, Oct. 7). Some in the Path of Oregon's Wildfires Never Got Evacuation Alerts*, New York Times,* https://www.nytimes.com/2020/09/25/us/fires-oregon-evacuation-alerts.html.

Tongia, R., and Wilson, E. (2011). The Flip Side of Metcalfe's Law: Multiple and Growing Costs of Network Exclusion, *International Journal of Communication* 5, 665–681, 665-666, https://ijoc.org/index.php/ijoc/article/view/873.

Ungar, M. (2011). Community resilience for youth and families: Facilitative physical and social capital in contexts of adversity, *Children and Youth Services Review*, 33(9), 1742–1748. doi:10. 1016/j.childyouth.2011.04.027.

United Nations. (1945). Charter, Preamble, https://www.un.org/en/sections/un-charter/un-charter-full-text/ (last visited July 23, 2020).

United Nations Office of Disaster Risk Reduction. (2016). Robert Glasser, Special Representative of the UN Secretary-General for Disaster Risk Reduction and Head of the UN Office for Disaster Risk Reduction, *Opening Ceremony of the First Meeting of Ministers and High Level Authorities on the Implementation of the Sendai Framework for Disaster Risk Reduction in the Americas 2015-2030*, https://www.unisdr.org/files/49160_openingspeechparaguay.pdf.

U.S. Department of the Interior Bureau of Reclamation. (2014). *RCEM – Reclamation Consequence Estimating Methodology, Guidelines for Estimating Life Loss for Dam Safety Risk Analysis*.

U.S. Fire Administration. (undated). U.S. fire deaths, fire death rates, and risk of dying in a fire, https://www.usfa.fema.gov/data/statistics/fire_death_rates.html (accessed, May 28, 2019).

U.S. Global Change Research Program. (2018). *Fourth National Climate Assessment*, https://nca2018.globalchange.gov/.

van Deursen, A.J.A.M. and van Dijk, J.A.G.M. (2015). Toward a Multifaceted Model of Internet Access for Understanding Digital Divides: An Empirical Investigation, *THE INFORMATION SOCIETY*, 31:379–391, DOI: 10.1080/01972243.2015.1069770.

van Dijk, J. A. G. M. (2005). *The deepening divide: Inequality in the information society*. London, UK: Sage.

Waldman, S. (2011). *The information needs of communities: The changing media landscape in a broadband age*. Report Submitted to the Federal Communications Commission, www.fcc.gov/infoneedsreport.

Wang, H.L. (2018, Dec. 6). Native Americans On Tribal Land Are 'The Least Connected' To High-Speed Internet, *NPR*, retrieved from https://www.npr.org/2018/12/06/673364305/native-americans-on-tribal-land-are-the-least-connected-to-high-speed-internet.

White House. (2020, March 13). Proclamation on Declaring a National Emergency Concerning the Novel Coronavirus Disease (COVID-19) Outbreak, Executive Order of President Donald J. Trump, https://www.whitehouse.gov/presidential-actions/proclamation-declaring-national-emergency-concerning-novel-coronavirus-disease-covid-19-outbreak/.

Williams, A. P. *et al*. (2015). Contribution of anthropogenic warming to California drought during 2012–2014. *Geophys. Res. Lett.* 42, 6819–6828, https://doi.org/10.1002/2015GL064924.

WHO. (2020, Mar. 11). *WHO Director-General's opening remarks at the media briefing on COVID-19 - 11 March 2020*, https://www.who.int/dg/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19---11-march-2020.

Woolfolk, J. (2020, Nov. 1). Coronavirus: Failing grades spike in Bay Area schools with distance learning, *San Jose Mercury News*, https://www.mercurynews.com/2020/11/01/coronavirus-failing-grades-spike-with-fall-term-distance-learning/.

Yoon, I., Noh, D., Lee, D., Teguh, R., Honma, T., H. Shin. (2012, March). Reliable Wildfire Monitoring with Sparsely Deployed Wireless Sensor Networks, *2012 IEEE 26th International Conference on Advanced Information Networking and Applications* (AINA), 460-466.

Zoom, FAQ: Zoom Basics and Troubleshooting, (last visited November 8, 2020), https://testersupport.usertesting.com/hc/en-us/articles/115003711252-FAQ-Zoom-Basics-and-Troubleshooting#1.