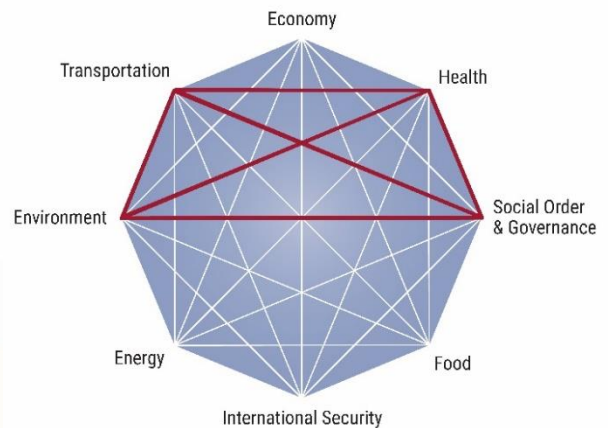Pandemic Shock: Brief #4 • July 7, 2020

Evacuating communities affected by disasters during future COVID-19 waves

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Summary

This Brief investigates the challenges of evacuating communities from disasters during possible future "waves" of COVID-19 cases. The analysis highlights wildfire evacuations, but its findings and recommendations are equally relevant to evacuation planning for floods and hurricanes during the COVID-19 pandemic.

Emerging trends

- The pandemic highlights the importance of assessing *compound risks* that arise from the interaction of simultaneous crises in unexpected ways.

- Evacuation strategies for disasters should take account of possible interactions with efforts to control COVID-19.

- COVID-19 transmission is most likely to occur during three phases of a community evacuation:

  1. the transport of evacuees from at-risk to host communities,

  2. the "merging" of households, as evacuees take shelter with family or friends, and

  3. the accommodation of evacuees in emergency shelters.

- Hotels present challenges for coordinating services, promoting physical distancing, and providing an environment conducive to mental health.

Implications for action

- Hotels should be selected in host communities with sufficient healthcare capacity and where evacuees have access to outdoor space and other services.

- Households in at-risk communities should be provided with evacuation plan templates that require them to specify a transportation plan and develop a strategy for minimizing the risk of transmission when "merging" with another household.

- Where possible, evacuation via private cars and light trucks should be prioritized. Rental cars and taxis can be marshalled to minimize reliance on buses.

- COVID-19 testing should be prioritized for those relying on buses or flights. Care should be taken to separate vulnerable people from others—even if doing so requires chartering additional buses or airplanes.

About the Cascade Institute

The Cascade Institute is a Canadian research center addressing the full range of humanity's converging environmental, economic, political, and technological crises. Using advanced methods for mapping and modeling complex global systems, Institute researchers identify *high-leverage intervention points* in cognitive, institutional, and technological systems that, if effectively exploited, could rapidly shift humanity's course towards fair and sustainable prosperity.

The Institute is located at Royal Roads University in British Columbia, a leader in training professionals to apply creative solutions to entrenched problems.

About the Inter-Systemic Cascades (ISC) Project

The Cascade Institute's *Inter-Systemic Cascades Project* maps causal routes through which the COVID-19 pandemic could sequentially destabilize associated national and global systems, causing cascades of change. This series of Briefs focuses on the pandemic's implications for the eight key systems highlighted around the adjacent octagon, and each Brief maps a possible causal route of destabilization among these systems. Cascades may be either "pernicious" (socially harmful) or "virtuous" (socially beneficial).
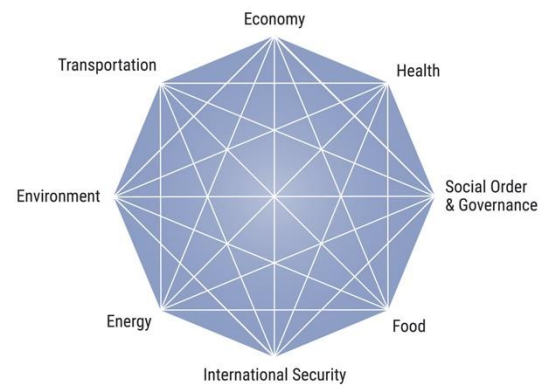
The analysis in this series starts from the assumption that societies are organized around cohesive sets of worldviews, institutions, and technologies (WITs), where:

- **Worldviews** are mental networks of concepts, beliefs, and values—often emotionally charged—that allow people to interpret things around them and plan their actions.
- **Institutions** are a community's rules governing social behaviour, including formal rules (constitutions, laws, and contracts), informal rules (customs and norms), and mechanisms of enforcement.
- **Technologies** are problem-solving tools that people create by harnessing phenomena of their physical and social environments.

WITs in this Brief

Worldviews: public safety, trust in government authorities

Institutions: local governments, provincial/state governments, federal governments, evacuation strategies, physical distancing, public health authorities

Technologies: private automobiles, buses, airplanes, HVAC systems

Evacuating communities affected by disasters during future COVID-19 waves

Background

"Concurrent" and "compounding" disasters

In recent years, as Earth's atmosphere has warmed, communities across North America have begun preparing annually for possible wildfires, hurricanes, floods, or episodes of extreme heat. These preparations have always required tough decisions, but today they must also contend with a radically different social, political, economic, and public health context, as governments focus their limited attention and resources on managing the still-unfolding COVID-19 pandemic and its economic fall-out.

The term *concurrent disasters* refers to the simultaneous occurrence of two or more disasters (Quigley et al. 2020).[1] The related term *compound risk* highlights how simultaneous crises may interact in unexpected ways, often amplifying the harm each crisis would inflict individually (Phillips et al. 2020). For example, the simultaneous occurrence of a future wave of COVID-19 in North America (during which infection rates match or exceed their April 2020 peaks) and an above average wildfire season could produce aggregate harms significantly greater than those that would arise if each crisis were to occur independently. Disasters and extreme weather events will certainly happen before an effective treatment or vaccine for COVID-19 is discovered, produced, and distributed, so policy makers should anticipate and prepare for this kind of compounded crisis.

This Brief investigates the extraordinary challenge of *evacuating communities* affected by disasters in the midst of the COVID-19 pandemic—a challenge that will likely persist well into 2021 and perhaps beyond. While the analysis focuses on the interactions between wildfire evacuations and possible future waves of COVID-19, its findings and recommendations are equally relevant to evacuation planning for floods and hurricanes that occur while the pandemic persists.

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[1] A disaster is conventionally defined as a risk event largely disconnected from human action—that is, the event's likelihood is not influenced by what humans do. Examples include volcanic eruptions, near-Earth object impacts, tsunamis, tornadoes, earthquakes, wildfires, floods, droughts, and hurricanes. However, this conventional understanding is inadequate: wildfires can be started by humans, floods can be indirectly caused by human activities like deforestation, and the frequency and severity of droughts and hurricanes are increased by anthropogenic climate change.

Evacuating communities from wildfires during a pandemic

During the unprecedented wildfires in western Australia in late 2019 and early 2020, authorities organized a massive evacuation of more than 100,000 people from the affected areas (Walton 2020). The year 2020 also marks the fourth anniversary of the wildfires in Fort McMurray, Alberta, where more than 80,000 people were quickly and successfully moved from the region—the largest wildfire evacuation in Canadian history (Russell and Boynton 2020).Both times, government authorities relied on tried-and-tested evacuation strategies that included the use of buses, planes, and high-density emergency shelters (like convention centers, school gymnasiums, and hockey rinks). Evacuation is widely considered the most effective strategy for protecting personal safety when wildfires threaten communities (McLennan et al. 2019). But these conventional evacuation strategies could now cause a large jump in COVID-19 infections.

Two trends have especially troubling implications for the possible interaction between wildfire evacuations and COVID-19. First, because of warming and its effects on weather patterns, some scientists anticipate that the 2020 wildfire season will be a particularly active in several regions in North America. In Canada, government scientists have predicted that the wildfire season could be "well above average" (Russell and Boynton 2020). The pandemic has magnified this wildfire danger by disrupting governments' usual preparations, such as removal of excess brush and vegetation and the training of emergency personnel (Phillips 2020).

Second, wildfires may coincide with future waves of COVID-19 cases in mid-to-late summer in 2020, or even in the summer of 2021, if effective treatments and/or vaccines are not yet widely available. Public health experts warn of the possibility of significant spikes in case counts if governments fail to carefully monitor and manage the reopening of national and local economies (Sun 2020). The experts' warnings appear to have been validated by the surge of COVID-19 cases in US states in July 2020 that occurred in the wake of premature easing of restrictions in these states.

Several possible interactions between wildfires and the COVID-19 pandemic have recently received attention, including:

- potential outbreaks in firefighter basecamps (Phillips 2020; Russell and Boynton 2020),
- governments' inability to source firefighters from other countries, because of pandemic travel restrictions (Pierre-Louis 2020);
- the strain imposed by acute respiratory illness (from smoke inhalation) on the same healthcare resources needed to combat COVID-19,
- increased morbidity from smoke inhalation among COVID-19 patients (Phillips 2020; Aqil 2020), and
- exploitation of the COVID-19 crisis by countries like Brazil to lift environmental regulations that help protect forests from wildfires (Chávez 2020).

A norovirus outbreak that affected over 100 people at a shelter during the 2018 California wildfires showed that conventional evacuation strategies can accelerate the transmission of contagious disease (Pierre-Louis 2020). In the context of the current pandemic, evacuation shelters will need to be significantly larger to accommodate

physical distancing, and officials will need to develop procedures to safely evacuate COVID-infected patients (Phillips 2020).

The compounding effects of disaster evacuations and future COVID-19 waves

Lessons from disasters during the pandemic

The disasters that have occurred in the last few months provide a useful starting point for analyzing the potential harm-compounding effects of wildfire evacuations and future COVID-19 waves. In May, a massive cyclone hit the eastern coast of India, killing 77 people in West Bengal—the Indian state that has been the hardest hit by COVID-19 (Rajaram et al. 2020). The use of small, crowded shelters—many of which were already quarantining COVID-19 patients—is believed to have contributed to a spike in COVID-19 cases in the region (Ghosal 2020). This case shows how, during an emergency, concerns about immediate personal safety will tend to trump those about physical distancing. It also illustrates the value of having in place *before* an emergency the accommodation plans that make physical distancing possible, particularly in poor communities that have few resources for alternative accommodation.

When community leaders of the Kashechewan First Nation in northern Ontario were planning for spring flooding, they had to consider alternative evacuation shelters, because under their existing plan, evacuees were to be sent to the Porcupine region—an "epicenter" of the virus in northern Ontario (Dunne 2020). Either or both the evacuee community and the host community might be concerned about how an evacuation could spread COVID-19, as each would be worried about the prevalence of the disease in the other.

During spring floods this year, authorities in Fort McMurray, Alberta, relocated affected people to hotels instead of more crowded emergency shelters. Later, public health officials observed that communities struggled to maintain physical distancing as people returned to their homes and began to rebuild (Yourex-West 2020). The risk of transmission does not end after evacuation orders are lifted.

Currently, the east coast of the US is bracing for a potentially severe Atlantic hurricane season with anywhere from 13 to 24 "named" storms expected this year (Milman 2020). Policy makers and disaster-preparation consultants are considering adjusting current evacuation strategies by, for instance, reserving large numbers of hotel rooms for emergency shelter and replacing buses with ride hailing services like Uber and Lyft (*Ibid.*).

A simple model of the interactions between wildfire evacuations and COVID-19

Figure 1 presents a simple model that describes the key system components linking wildfire evacuations and COVID-19, as well as the causal relationships between these components. The model shows that wildfire evacuations, whose primary purpose is to prevent deaths, may contribute to an increase in COVID-19 cases and a decrease in health system capacity, thereby significantly increasing the total number of deaths.

A key relationship is the link between "health system capacity" and "deaths." The negative valence (-) attached to the arrow connecting these two components indicates that a *decrease* in health system capacity corresponds to an *increase* in deaths (and an *increase* in health system capacity corresponds to a *decrease* in deaths). The two bold diagonal lines running through the arrow connote the nonlinear nature of this relationship. While decreases in health system capacity may initially result in a proportional increase in the number of deaths, once the supply of ventilators fails to keep up with demand or if infection rates spike among doctors and nurses, an abrupt, non-linear increase in deaths is likely to occur, as was the case in Italy in March (Horowitz and Kirkpatrick 2020).
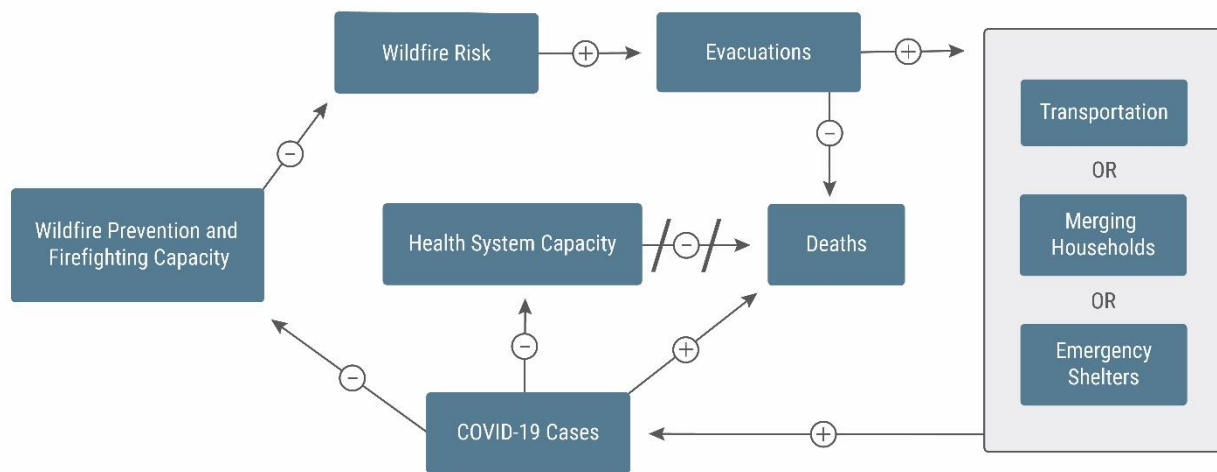

Figure 1: interactions between wildfire evacuations and COVID-19

The model also identifies three system components linking wildfire evacuations to an increase in COVID-19 cases: transportation, emergency shelters, and the merging of households. These three components, which make up the core of any community evacuation strategy, are shown in a box at the far right of the diagram. The "or" relationships between the components mean that each component is *independently sufficient but unnecessary* to produce a large increase in COVID-19 cases. In other words, each of these dimensions could, on its own, cause a spike in the prevalence of the disease. So modified evacuation strategies must address all three.

Transportation

For communities that may be affected by wildfires in which the majority of households own their own car or light truck, such vehicles are the most desirable transportation mode, because they allow households to remain isolated until they arrive at an emergency shelter.[2] But some percentage of the population will still rely on buses, where physical distancing is much harder. Even if households are able to space themselves out inside a bus, the vehicle may not provide enough ventilation for a long drive (Mintz 2020)—especially if ambient wildfire smoke makes it impossible to open the bus's windows. The safe relocation of elderly or vulnerable people, as well as the relocation of individuals already infected with COVID-19 or suffering from other health problems, will be particularly challenging.

These logistical problems will be far worse for remote communities that rely entirely on chartered flights. These flights will pose a degree of unavoidable transmission risk, particularly if measures are not taken to space households apart and provide extra protection to elderly and vulnerable people. Such considerations are important, too, when evacuees return to their communities on planes or buses after evacuation orders have been lifted, because evacuees may have contracted the virus in emergency shelters or in the homes of family and friends.

Compounding effects of transportation and COVID-19:

- Evacuees that own private automobiles cannot carpool with other households.
- Buses and chartered flights pose a non-negligible risk of coronavirus transmission.
- Elderly, vulnerable, and hospitalized people may need to be evacuated alongside individuals infected with COVID-19.

Merging households

Given the choice, most evacuees will almost certainly seek to stay at the home of a family member or friend living in a safe zone. But this practice could also lead to COVID-19 transmission, either from the evacuee to the host or vice versa. The policy of allowing two households to associate with each other—sometimes referred to as a "double bubble"—has now been implemented in most Canadian provinces (Rocca 2020). Under the policy, two households are permitted to ignore physical distancing guidelines with members of the other household. Ideally, households planning to merge with one another should self-isolate for a time before merging. In the event of a wildfire evacuation, though, evacuee households may have to join another household on short notice, forcing both households to make tough decisions, particularly if one or more people exhibit symptoms.

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[2] However, the 2016 Fort McMurray evacuation illustrated how car evacuations can result in gridlock, long delays, and car accidents—one of which resulted in two deaths (Lamoureux 2016).

Compounding effects of merging households and COVID-19:

- Coronavirus transmission may occur from the evacuee household to the host household (or vice versa).
- Communities may be forced to evacuate with little warning, preventing either household from taking extra steps to decrease the risk of transmission, such as imposing a period of self-isolation prior to merging.

Emergency shelters

During an evacuation, people from remote communities, as well as households that do not have the option of staying with family members or friends in safe zones, must seek shelter in emergency accommodations provided by government authorities. Conventional strategies tend to rely on some combination of hotels and large shelters such as convention centers, community centers, schools, or even hockey rinks (without ice). Large shelters are much cheaper than hotels and are better suited for efficiently coordinating emergency supplies and services. Yet the high rates of COVID-19 transmission in emergency shelters after the recent cyclone in India, and similarly in many refugee camps around the world, illustrate the dangers arising from high-density group shelters during an outbreak.

The pandemic presents many new challenges for evacuation strategies, but one unexpected benefit is low hotel occupancy. As of June 10, six out of ten hotel rooms in the US were empty (AHLA 2020). But obliging evacuees to live for a month or more in a hotel room poses additional logistical and mental health challenges that a spike in COVID-19 cases will only exacerbate. For instance, evacuees may lack access to large, safe, outdoor areas to exercise and socialize with other members of their community; and interaction inside the hotel will raise the risk of transmission. Further, evacuees require access to nutritious food, yet many hotels are not near grocery stores and restaurants. When choosing hotels, officials should also consider how an influx of evacuees may further strain essential services for the residents of the host community, including local health care and the supplies of prescription drugs, food, and public transportation. Many evacuees will confront mental health crises stemming from the loss of their homes, a hardship of the evacuation, and efforts to maintain physical distancing in an unfamiliar environment.

One additional complicating factor is the still unresolved question of the importance of airborne or aerosolized transmission of the SARS-CoV-2 virus that causes COVID-19. While epidemiologists and public health experts agree that transmission occurs through large droplets generated by coughing, sneezing, talking, singing, and even breathing (Zhang et al. 2020), new research suggests that the infection can spread through much smaller droplets (under 5 microns) in an aerosol. Compared with large-droplet transmission, where the particles quickly settle to the ground or a surface, aerosol particles can travel much further and remain airborne for minutes or even hours, possibly spreading across rooms or through a building's ventilation systems (Allen and Marr 2020).[3]

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[3] Allen and Marr (2020) argue that the droplet-aerosol distinction is a false dichotomy because "virus-containing droplets that are released by breathing, talking, and coughing span a continuum of sizes, from 0.01 to hundreds of microns."

The World Health Organization (2020) has maintained that airborne transmission has contributed little to the spread of COVID-19, but that position is now under broad attack (Mandavilli 2020).

Compounding effects of emergency shelters and COVID-19:

- Large communal shelters pose a significant risk of COVID-19 transmission.
- While hotel accommodations may make physical distancing easier, authorities must resolve issues such as access to nutritious food, outdoor space, and other essential services that the pandemic may affect.
- Evacuees will face a wide range of mental health challenges stemming from the potential loss of their home, the evacuation, and the pandemic itself.

Other considerations

Evacuees could face different rules around physical distancing and accessing essential services in the host community than they did in their own community. Evacuees arriving in host communities not only require up-to-date information about the local public health context and physical distancing guidelines, but they also need resources and support to live comfortably and with dignity during what is likely to be among the most difficult experiences of their lives.

Also, members of the host community may react negatively to an influx of people from another community who could carry the coronavirus. There have been incidents of hostility towards outsiders in recent weeks, such as vandalism of cars with out-of-province license plates in British Columbia (Stewart 2020). This type of hostility could extend to evacuees, so government messaging and policy should proactively address host community concerns.

Many regions vulnerable to wildfires in Canada are home to indigenous nations and communities that have a fraught history with the provincial or federal governments that claim (at least some) jurisdiction over their territories. While indigenous and government authorities have sometimes worked together effectively to coordinate evacuations, evacuation orders fundamentally involve forced (albeit temporary) resettlement and implementation of procedures determining how evacuees should live. Disaster evacuations are thus entangled with the legacy of forced resettlement, residential schools, and other colonial institutions. For this reason, special efforts must be made to align evacuation strategies with the principles of reconciliation (TRC 2015).

Other compounding effects of evacuations and COVID-19:

- Evacuees may face a radically different public health context and physical distancing guidelines in the host community than what they are used to.
- Members of the host community may be hostile to evacuees.

Implications for action

Many governments are already taking actions to reduce the number and severity of wildfires, which of course decreases the risk that entire communities will be evacuated. Still, the likelihood that communities will be evacuated in 2020 or 2021 remains high. The following recommendations for policy makers and community leaders reflect the challenges that will emerge around transportation, merging households, and emergency shelters.

Transportation

- **Promote the use of private automobiles and light trucks, if they are available.** If a community has road access but the rate of car ownership is low, rental cars and taxis could be marshalled from other communities. The chaotic evacuation in Fort McMurray in 2016 illustrates, additionally, the importance of coordinating road traffic to avoid gridlock and accidents.

- **Prioritize testing for individuals relying on buses, public transit, and flights.** Vulnerable individuals, even those with negatives tests, should be transported separately.

- **Arrange extra buses and flights as necessary to permit physical distancing.**

- **Require individuals to wear masks on buses and flights.** Non-surgical masks should be provided by authorities and required for people evacuating via bus or airplane.

- **In at-risk regions, create a mechanism that allows households to submit their transportation strategies in advance.** Doing so will help authorities anticipate emergency demand for buses, airplanes, and public transportation. Governments should consider requiring each household to submit such a plan (see the next recommendation on Evacuation Plans).

Merging households

- **In at-risk regions, require each household to produce an Evacuation Plan.** Local or municipal governments of at-risk communities, with the support of provincial or state governments, should distribute an Evacuation Plan template to every household. Existing templates, such as the British Columbia government's "Fill-in-the-blanks Home Emergency Plan" (Province of British Columbia 2020), can be modified for this purpose.

  Household plans should:
  - specify the host (receiving) household,
  - indicate that the host household has agreed to act in that role, and

- outline how the households will communicate with each other in the weeks or months when the risk of a disaster is high.

- **Encourage households, after their merger, to self-isolate for a period of 14 days.** This action will reduce the risk of spreading the virus to the host community.

Emergency shelters

- **Select host communities based on their COVID-19 case count and their capacity to accommodate evacuees.** Since these numbers may fluctuate, government authorities should consider identifying in advance multiple potential host communities.

- **Shelter evacuees in hotels instead of large communal shelters.** Where possible, government authorities should try to arrange emergency accommodations *exclusively* in hotels, where individual households can maintain physical distancing.

- **Select hotels based on their proximity to outdoor space, grocery stores and restaurants, and other essential services.** Families should be provided with sufficient space and resources to entertain or homeschool their children, work (for those that can work remotely), exercise, and safely socialize with other members of their community.

- **Ensure that evacuees have access to mental health services.** These services will increase compliance with physical distancing guidelines and decrease the risk of COVID-19 transmission.

- **Ensure that hotels have modernized HVAC systems that have been optimized to decrease airborne transmission.** HVAC systems can be programed to run continuously and avoid recirculating air; also, windows can be opened to increase the flow of outside air (REHVA 2020).

Other considerations

- **Provide information to evacuees on the public health guidelines in the host community.** Guidance should focus on the key differences between the evacuee community and the host community.

- **Publicize to members of the host community the precautions taken during the evacuation.** Assuaging the fears of members of the host community will generate a more compassionate and empathetic response.

- **Appoint liaisons to respond to the evolving needs of evacuees staying in government accommodations.** Governments should ensure that there is an open and responsive channel of communication maintained between evacuees and the government authorities coordinating the evacuation.

- **Encourage the coordination of local, provincial/state, and federal governments in the months leading up to an evacuation order.** Disaster responses and evacuations are often led by provincial or state governments. However, to date local authorities have shouldered much of the responsibility for responding to spikes in COVID-19 cases (Phillips et al. 2020). Especially for indigenous nations, evacuation strategies must incorporate the input and concerns of local governments of both evacuee and host communities.

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About the author

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