

Keeping an Eye on Natural Hazards

Lessons learned to become more resilient



Relying on years of first-hand experience and extensive research working with and in communities, we have identified a number of lessons that can be used to prepare for any sort of disaster event in virtually any part of the world. Using our Post-Event Review Capability (PERC) methodology, winner of the outstanding achievement award of the National Hurricane Center in April 2019, we are able to illustrate strikingly similar challenges faced by risk managers regardless of where they operate or the particular hazards they face.

PERC = Post-Event Review Capability



1 | Introduction

PERC studies provide guidance at a time when the number of disasters and their magnitude are growing at an unprecedented rate. While there has been a decline in disaster mortality (in relative terms) over the last decade, in most places there has not been significant success in halting the substantial increase in economic losses. This results in profound knock-on effects to economic growth and development as well as to the general well-being of society.

Learning from past events in a systematic and deep manner is highly relevant. This paper, the latest update in our series, addresses compound risks and explains why a multiple-risk radar during the COVID-19 crisis is more important than ever. It provides a glimpse of our first wildfire reviews and updates our extensive series of post-flood studies.

Disasters have much in common besides the devastation of lives and property they leave behind. They all teach some of the same hard lessons, whether the losses and damages come from floods, fires, windstorms or health crises. We of course also shed light on some of the main strengths and successes that others can learn from. It should be logically clear that preventing an event from turning into a disaster is a much more effective way of reducing human misery and economic losses than post-event response. Evidence backs this up, and the narrative has evolved from a purely financial comparison of the benefits of avoiding losses against those of investments in protection to a discussion of co-benefits. Our partner researchers coined the term "*triple resilience dividend*"¹ to explain the benefits of investing in resilience.

Triple resilience dividends are realized when:

- **Disaster losses are avoided**
- **Economic activity is stimulated as a result of reduced disaster risk**
- **Investment in disaster risk management reduction leads to improvements in sustainable development, well-being and other areas.**

Our research shows that on average, investing USD 1 in resilience early helps avoid on average USD 5 in future losses – a very clear case for investing up front rather than spending money only after an event to deal with incurred losses and finance repair and recovery.

¹ <http://www.lse.ac.uk/GranthamInstitute/publication/the-triple-dividend-of-resilience/>



However, as the COVID-19 pandemic has shown, we don't seem to be making good use of this evidence that we have. Instead, we are overwhelmed by our natural human instincts, our "fight or flight" responses, so that we discount dangers that are not happening now and don't devote either sufficient time or resources to grasp the obvious mitigation opportunities to even the most existential risks to human life on our planet. Too often, action is being taken only once an event has already turned into a disaster, and the pandemic is no exception. Preparedness was proved in many cases to have been inadequate, despite the widely accepted belief that a pandemic would likely occur at some point. The role of upfront investments compared to running operation costs is a recurring topic of post-event reviews Zurich and its partners have conducted over the years.

The COVID-19 crisis is a reminder that we need to constantly update our risk radar and reflect on what's changed or is about to change and how we can better recognize the early indicators in order to prevent, prepare for and respond to an event. Otherwise, we risk being steamrolled by it. Conversely, if a steamrolling occurs, we have tended to take a myopic view of the topic at hand, forgetting how our scramble to react can have unintended consequences in areas outside of the current focus, and that there remains a broad risk landscape that demands concerted action.

This has been seen in many of our previous PERCs, teaching us:

- That the question to ask is not simply "How do we avoid another Hurricane Harvey disaster in Houston?" or "How do we avoid the second wave of COVID-19?", but, more importantly, "What will the next pandemic crisis be that could be the equivalent to, or worse than, COVID-19?"
- That we must respond to disasters without forgetting other key risks. For example, how can we ensure our reaction to the COVID-19 crisis does not undermine efforts to mitigate and adapt to climate change? Climate change was a high priority on the global policy agenda before we were hit by COVID-19, and the work towards a sustainable future remains important. In fact, such work should be a part of pandemic recovery planning that could bring communities and economies back stronger than before a crisis, which Zurich discusses elsewhere in detail².
- That we need to proactively identify likely future events, particularly near-future events, and ensure they stay on our radar.

Challenges revealed by our PERC studies include a number of repeating, universal PERC lessons that are applicable regardless of the peril or its location. For example, present investments in protection are often viewed as nothing more than costs, whereas the losses they intend to avoid are not counted as return on investment. Similarly, while we tend to see present cost of investments, we don't account appropriately for the future benefits and cost-savings they could provide, because the outcomes are uncertain – they may or may not materialize, and this may or may not be in the timeframe the decisionmaker is considering.

We need to change this perspective. It leads to the false conclusion that it is easier to wait, see what happens and then react at a much higher certain cost rather than anticipate during the conceptual, pre-event stage and reap the

resulting benefits whether a disaster event takes place in the near future or not. The approach of inaction leads to lost lives, lost income, lost jobs and a host of other problems. The consequences of such indifference became evident during the COVID-19 crisis after investments in stockpiling Personal Protective Equipment (PPE) and other equipment for healthcare services were deferred because they were seen as unnecessary costs for an uncertain future need. Unfortunately, that need materialized, at a cost that far exceeded what it would have taken to stockpile materials. Stockpiling, however, must be a part of a larger pre-event strategy to manage the risk of a pandemic. Otherwise, the PPE and other material that is available will have little use if there is no plan for deploying it.

² <https://www.zurich.com/media/magazine/2020/climate-issues-will-shape-pandemic-recovery>

1 | Introduction

Also challenging is the need to adequately and comprehensively present the costs and benefits of protection interventions. The process of how costs and benefits are calculated needs to be revised so it does not unduly favor physical infrastructure. Costs and benefits can be calculated in a more modern way, through integrating intangible benefits such as quality of life improvements into decision-making processes and incorporating the positive effects of 'green' solutions (as opposed to only grey, hard infrastructure effects). It is not the hospital alone that saves lives in the COVID-19 crisis, and it is not just the mile-long and mile-high levee that protects people from the hurricane. It is the additional 'intangibles' – the planning, the behavior, the social decision-making.

A challenge in the decision-making process and getting agreement across classes and groups in society is that unfortunately those who take upfront action are not necessarily those that benefit the most, and those who don't take action are not necessarily those who suffer the most from unprotected risks. We need to take a more system-level view and see what's good overall, not just what's good for the individual company, or government, but an approach that

truly addresses the *"the tragedy of the commons,"* or, as Mark Carney put it in his memorable pre-COP 21 speech in 2015, *"the tragedy of the horizons."*

Disasters do not respect jurisdictional boundaries, which means pre-planned coordination among governments is essential. There have been success stories, such as the one revealed by a 2014 PERC study of flooding in the Balkans. In that case, response was well-coordinated within Serbia. At the same time, however, Bosnia and Herzegovina suffered from strong internal divisions that led to a far less efficient response.

A lack of cross-jurisdictional coordination can also hamper efforts to enhance disaster resilience.

Hurricane Florence revealed lax regulations that led to environmental issues with coal ash waste and hog waste in North Carolina. Flooded sites released heavy metals and animal waste into rivers, killing thousands of fish.

Global risks such as climate change and infectious diseases also know no borders. Often, though, efforts to build resilience against

these risks face opposition from nationalist and populist interests that decry support of organizations that help mitigate the threats.

PERC, as an open-ended, forensic process based on semi-structured discussions and interviews, highlights addresses another oversight: Even where learning from past disasters takes place, it often focuses only on what went wrong and what should be improved. Positive lessons are missed and we therefore fail to learn from good practices that could be applied elsewhere. Disaster risk managers can become better at sharing good practices and what has worked well in particular situations.

There is also the surprise of the unlikely, the unexpected, and the *"black swan."* Analysis of past disasters has clearly outlined that we need to think much more about the unprecedented. Nowhere was this clearer than in our recent PERC Idai and Kenneth study, which made it clear both from the location of these events and from talking to climate experts and modelers that increasingly, natural hazard events are appearing where they have not previously appeared.



This leads to the following takeaways from the topic of *"think about the unprecedented"*:

- 1) Just because an event has not yet happened in a particular location does not mean it couldn't. In March 2019, Cyclone Idai hit central Mozambique. Category 2 winds severely impacted the port city of Beira, and torrential rains created an inland ocean miles across. Yet, though these particular events in these locations were unprecedented, this type of storm and its impact were not unthinkable. It is reasonable to assume that a hurricane awareness and preparation program would also be wise for areas further south along the coast, including the capital of Mozambique, Maputo.
- 2) We must continue to revise our language around event probabilities and timelines. A common and potentially devastating misunderstanding can be heard in the often-repeated statement: *"Because there was a 1-in-100-year event five years ago, there will not be another of that size for another 95 years."* What the statement '1-in-100 years' really means is that an event has a 1% chance of occurring each year. Experiencing back-to-back 100-year events is not unusual.
- 3) It is inadequate to focus solely on precedent or at least statistically calculable 100-year events. The 100-year event was chosen as an engineering design standard on the assumption that it was unnecessary and/or unrealistically expensive to plan more severe events. It says nothing about whether

more severe events will occur or the damage they'll do. We are increasingly building up assets in known risk areas at the same time that climate change is changing the frequency and intensity of climate hazard events. We need to recalculate our financial and human risk profiles to reflect our new realities.

- 4) Don't be fooled by the *"black swan"* fallacy. Coining an event a black swan is often used as an excuse to explain away unpreparedness. A black swan event is something that could not be imagined in terms of the situation arising nor the consequences from it, and a probability cannot be reasonably calculated or attributed to it, but it can be explained in hindsight. It is called a black swan event because evidence suggested that all swans are white and there was no indication that a black swan could exist. This is significantly different from the probability of rare extreme weather events like Cyclone Idai, or the Fort McMurray or California wildfires, all of which are discussed in this latest document. These events are exactly what they suggest: Events for which historic evidence exists and for which there is an understanding of the physical processes that allow us to imagine these events taking place. While they are rare events, they still appear somewhere on the probability distribution curve. Black swans they are not.

PERC's Cumulative Key Findings

Zurich's PERC analysis of global disasters left no doubt that disaster risk management professionals all face several universal truths when it comes to attitudes and actions around preparing for and responding to natural hazards.

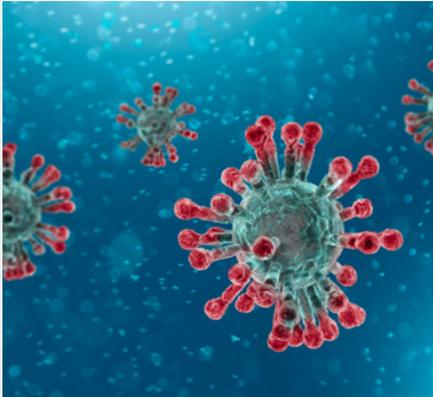
The research clearly shows that:

- Disaster risk management is continuing to play catch-up to an increasingly larger exposure to natural hazards.
- Globally, spending on response is far greater than investment in pre-emptive risk reduction strategies. Where money is invested in prevention, it typically goes to protecting physical structures rather than more cost-effective system-based, holistic disaster risk management such as environmental planning and implementing 'green' and 'nature-based solutions'.
- Infrastructure protection already in place – levees, for example – can produce a false sense of security.
- Few incentives exist to encourage 'building back better' and including resilience into the rebuilding process.
- The most vulnerable and marginalized in society are often neglected before and after disasters. They sometimes have not been able to recover from one event when the next one strikes, and are hit hardest in compound disasters like monsoon-induced floods during COVID-19.



PERC report name	Country	Event date
Central European floods, 2013: A retrospective	Germany (focus), Austria, Czech Republic, Switzerland	June 2013
Floods in Boulder, 2013: A study of resilience	United States	September 2013
After the storm: how the UK's flood defenses performed during the surge following Xaver	United Kingdom	December 2013
Balkan floods of 2014: Challenges facing flood resilience in a former war zone	Bosnia and Herzegovina, Serbia, Croatia	May 2014
Emmental, Switzerland floods of July 2014: On a hot, sunny day, a flood alert!	Switzerland	July 2014
Urgent case for recovery: what we can learn from the August 2014 Karnali River floods in Nepal	Nepal	August 2014
Morocco floods of 2014: what we can learn from Guelmim and Sidi Ifni	Morocco	November 2014
Columbia and Charleston floods, South Carolina	United States	October 2015
PERC Cumbria	United Kingdom	December 2015
PERC Flash Floods	Germany	May/June 2016
PERC Peru "non-event"	Peru	2016
PERC Peru El Niño Costero	Peru	2017
PERC Houston – Hurricane Harvey	United States	August 2017
PERC Florence – Building resilience for the new normal	United States	September 2018
PERC Fort McMurray Wildfire - Learning from Canada's costliest disaster	Canada	2016 – 2017
PERC California fires: Building resilience from the ashes	United States	2017 – 2018
PERC Idai / Kenneth	Malawi, Mozambique, Zimbabwe	March – April 2019
PERC Tasmania wildfire (in preparation)	Australia	

2 | In today's world, compound disasters have become more common and are straining risk management



Storm season arrives every year as expected. With spring comes tornadoes in the U.S., followed by the June start to Atlantic hurricane season that runs through November. In other parts of the world, these are active months for typhoons and cyclones, with the risk of severe flooding during the monsoon season of Southeast Asia. And, in addition to extreme weather risks, there is the need to keep attention on potential hazards from climate change.

If all of this isn't enough to keep risk management professionals busy, add to it the unexpected arrival of the coronavirus pandemic. The result is a compounding and interdependency of risks that creates potential severity rarely seen. Already stretched thin with the known risks they traditionally face, businesses and communities are forced to fight on an additional front against the COVID-19 crisis. There is no question that a holistic approach is the only way to address such an accumulation of threats.

How do we maintain a focus on climate change and ongoing management of extreme weather risk while responding to and recovering from the coronavirus pandemic?



The challenge is made particularly difficult because the pandemic must be managed from two directions. There is the immediate need to ensure the health of populations, coupled with the longer-term considerations of economic security. Both are costly and require enormous numbers of people and resources to tackle the challenge. Thus we are left with the dilemma: How do we make investments in the recovering economy that also contribute to achieving the commitments in the Paris Agreement?



Financing the threat of compound disasters

The pandemic cannot be the sole risk management focus. Though the pandemic demands immense financing for response, bolstering economic activity and recovery, if we lose sight of, or redirect funds from the climate crisis, it will ultimately cost more in responding to climate-induced natural hazard events. Consequently, we must take an integrated, multiple-risks approach, even as the pandemic demands attention and resources.

In particular, the international community must:

- Fully fund the pandemic response while keeping in place financial commitments to climate change mitigation and adaptation.
- Immediately raise funds for disasters that are likely to occur in coming months and support flexible funding that allows partners to plan for and respond to current and future risks.
- Synchronize efforts, both to avoid creating collateral new risk in some areas while reducing risk in others, and to leverage opportunities to create co-benefits so that investment addresses both pandemic and climate change needs. The aim is to reduce multiple risks related to pandemics and natural hazards.

To understand the unique complexities of this problem, consider that the pandemic has in some ways improved the state of the climate, if only temporarily. Lockdowns of populations that have reduced or stopped economic activity, removed vehicles from roadways and cut activity from factories and other operations have served to reduce carbon emissions and the resulting pollution in cities. A quandary appears, however, when it becomes apparent that the funding of stimulus programs that are helping people return to work and ramp up production as lockdowns end is also revitalizing

an economy that potentially creates more pollution than before. Cases of relaxing environmental rules have been seen in the recovery from earlier crises and this must be avoided in this recovery.

In a brief on the subject of moving from pandemic containment to recovery, the Organisation for Economic Co-operation and Development (OECD) said government efforts to support economic recovery are “essential but should not undermine action to limit the threats from climate change and environmental degradation, which could be as destabilizing to societies and economies as COVID-19 but are on a different time scale.”

Stimulus measures and policy responses need to be aligned with ambitions on climate change, biodiversity and wider environmental protection, the OECD recommends. “The window of opportunity to take strong action on climate is closing fast and short-term economic measures will have a significant impact on the ability to meet global goals.”



Disaster risk reduction lessons help manage the pandemic

The Zurich Flood Resilience Alliance³, funded by the Z Zurich Foundation, draws on a number of disaster risk reduction lessons, such as those around the value of early warning systems, that can guide the pandemic response. Many communities already have warning systems that alert residents of impending natural hazard events. These can be adapted to include messaging around public health measures and potential outbreaks. Such information can help front-line workers and governments manage COVID-19 and avoid duplicating efforts, saving time, resources and lives.

Disaster risk reduction and resilience-building emphasizes community engagement to build trust and mutual understanding among residents, public health officials and governments. Doing so ensures communities incorporate recommended health and preparedness practices. The outcome will be lighter burdens on health care facilities and quick identification of misinformation in a time of potential chaos.

Community health groups must be strengthened to withstand the demands

³ <https://www.zurich.com/flood-resilience>

of managing the pandemic and other disasters that might arrive at the same time. The COVID-19 crisis has shown that many community health systems lack resources, and personnel are stressed in the fight against the virus. To be effective, they should be stocked with adequate supplies, properly funded and provide appropriate training for their workers. Contingency plans on how to prepare for and operate during a disaster should be in place and followed. Support for health care workers should include necessities such as meals and child care to ensure continuity of services in the event that additional disasters coincide with the pandemic.



The problem of sheltering

Preparing for natural hazard events is made more difficult because the coronavirus is easily transmitted through crowds. That makes sheltering risky for populations that are affected by floods, fires, or other disasters. It will likely be unsafe to use traditional sheltering practices during the pandemic, complicated by the fact that some shelters have been repurposed to house COVID-19 patients.

Ideally, evacuees would be tested for symptoms of the illness before entering the shelter and those who show indications need to be separated from others who show no indications of the virus. At the very least, evacuees would be provided with hygiene resources and facemasks, given enough space to separate family groups, and screened regularly for symptoms. To accomplish this, shelters must be stocked with thermometers and other medical supplies, soap and water, and personal protective equipment.

Procedures should clearly address how low- and high-risk populations should shelter during a disaster as the pandemic is ongoing, considering such restrictions as physical distancing. Are low-risk people, for example, expected to shelter-in-place at home if waters are rising? Where can high-risk people find shelter that will keep them safe in an event and protected from COVID-19?

National governments and humanitarian agencies can help communities provide temporary shelters that adhere to public health pandemic guidelines such as those provided by the Inter-Agency Standing Committee, a humanitarian forum of the United Nations system.

3 | A wildfire medley: Three events reveal a changing hazard

While awareness and planning for floods, windstorms, earthquakes and other natural hazard events have become more sophisticated and widespread in recent years, there is a lag in such work as it relates to wildfires. Effective strides in reducing the risk have been made, but much more can be done.

Zurich and partnering organizations for the first time in 2019 applied the PERC methodology to understand how wildfire hazards have turned into community disasters in Alberta, Canada, California, U.S.A and Tasmania, Australia. The studies highlight that the PERC methodology is equally applicable to flood and wildfire events — both potentially very dangerous and destructive rapid onset events where the hazard is changing because of climate change and the risk is increasing due to changes in human exposure, the vulnerability of societies, and the buildup of assets in high-risk environments.

Even considering the geographic differences of the three wildfires, the three 2019 studies found striking similarities that can help businesses and communities globally to build more resilience to wildfires and take active roles to achieve it. Here, we consolidate these findings to highlight the common threads that tie these fire events together, discuss the lessons we have learned and provide recommendations on how to apply them to build resilience. Our aim is to broaden the perspective on wildfire risk management beyond solely wildfire management, moving beyond post-event reactions such as emergency response to identify adaptation requirements across the disaster risk management cycle.

We see that, overall, fire hazard and fire risk is changing around the world. As mentioned in our past publications, the science is clear on the increasing frequency and severity of climate hazards, especially extreme precipitation and storm surges. The same is also true for wildfires under future climate scenarios. We find that climate change is resulting in longer and more severe fire seasons. Climate change is also shortening the window for fuel reduction burning and is creating fire weather conditions that reduce the effectiveness of fuel reduction burns. Risk to communities and economies is highest at the wildland-urban interface (WUI) — an area where man-made development



meets wildland and wildfire impacts are far-reaching and long-lasting. If we want to improve our understanding of fire risk and take timely and appropriate action, we must realize that relying on historical data is not enough to understand and manage future fire hazard and risk. Instead we must integrate forward-looking climate change scenarios into disaster risk reduction planning.

Wildfire risk management, like risk management for any natural hazard, is a team effort that calls for coordination among community members, institutions and political and administrative boundaries. Fires respect no borders, and at Zurich we know that prevention is key in any risk management strategy. It is important to take an integrated resilience approach to wildfires and not just look at wildfire mitigation and response to fires that are already burning.

Wildfire is a particular peril that allows actions by a citizen or business to have a tremendous effect on the resilience of the overall community. That's because fire behavior can be influenced by the way a single property interacts within the WUI, a decisive zone to understand where fires halt — or spread. Building materials, landscaping maintenance and the choice and positioning of combustible buildings, operations and vegetation are key determinants that highlight the importance of the role of individuals and how the community acts together. This aspect of community member engagement needs to be considered much more closely when managing the risk of wildfire. To encourage the uptake, land zoning and building standards / codes play an important role.

Each of the fires examined in the PERC studies was extreme in its own way, whether it was the size of the burned area, the duration or the speed with which acreage was burned, and or when and how the fires developed. In Tasmania, climate change has caused fires to burn significantly larger areas and they are indirectly affecting society, tourism and agriculture in ways that have not been seen before. The Fort McMurray wildfire was Canada's costliest disaster to date, with CAN \$ 9-10 billion in economic damage and CAN \$ 3.7 in insured losses.

In California, changes in the timing of strong winds relative to rainfall, coupled with hotter, drier summers, is increasing the potential for wildfire ignition. In 2017 and 2018, the result was extreme wildfires in terms of the extent of destruction, damage and lives lost. Firefighters were battling several simultaneous fires, straining the allocation of assets to the proper locations. This is proving to be a new topic that must be discussed at state or supra-regional levels to ensure the allocation of adequate resources to multiple crises at the same time, or during cascading events that might easily spiral out of control without proper availability, coordination and sharing of resources.





Systematic planning for and response to wildfires has lagged behind intensifying wildfire risk

Fires are burning longer, stronger, faster, bigger, hotter, and in multiple locations at the same time. However, firefighting and wildfire risk management strategies overall, beyond intervention, have not yet adapted to that reality. Thinking must shift from consideration of singular fires to multiple fires that can overwhelm search-and-rescue, firefighting equipment and resources, and from current burn regimes to move to new burn regimes as suppression of fires is increasingly inadequate as a strategy alone. New management strategies should include controlling and living with necessary, smaller fires, considering this in the land use planning and making WUI infrastructure more fire resistant. For fire intervention, emphasis must be on providing adequate response capacities, strategies and tactics by pertinent authorities.

Post-wildfire risk management parallels in some ways the cautious recovery from the COVID-19 crisis. As lockdowns are being removed in phases as a way to snuff out the virus, a careful eye is kept on the disease to spot potential flare-ups. That same vigilance is required at a time when wildfires may appear to be extinguished, but early warning systems must remain active and on full alert. With COVID-19, business has an important role in testing and tracking in the workplace and training contact tracers as a way to mitigate the risk. The same approach can work with wildfire risks, charting a responsible way forward to ensure a safe workplace and build confidence in society overall.



Increasingly extreme fires are leading to cascading physical, social, and economic consequences

Apart from the intensity of the fires, all three studies highlighted the knock-on, secondary and tertiary effects that have far-ranging

implications beyond the area burned and the direct losses. This not only includes physical and social impacts of mass-evacuations (e.g. in Canada), a downturn of the economy, issues with recovery of critical infrastructure such as water and power (as in California), smoke and subsequent health issues, but also the impact on industries such as tourism and viticulture (in Tasmania) and subsequent natural hazard events such as mudslides and floods, which are far more prevalent in many fire-denuded landscapes. The systemic nature of wildfire risk means that the approach to wildfire risk management must be expanded to include long-term industry- and community-scale climate change adaptation planning.



Functioning critical infrastructure is vital to an effective response and recovery

Infrastructure for evacuation and reconstruction is key. In Fort McMurray, the evacuation of the town's 88,000 residents was only possible because the single access road to the town remained functional and had recently been upgraded, and because the fire moved slowly enough to allow time for evacuation. Paradise, California was less fortunate; many of the deaths occurred when people attempting to escape the fast-moving fire were overtaken by flames when the primary egress route became backed up. For both communities, alternative routes would provide redundancy, a key element of resilience.



Build back better

The phrase "building back better" has become a staple of the disaster risk management community. Common sense dictates that rebuilding to the same level of risk after a disaster would be futile and a wasted opportunity to strengthen resilience. In particular, any rebuilding of structures

that have been destroyed by fire needs to be in a location that is less fire-prone and/or is carried out with fire resistant material and according to the latest fire codes and technologies. However, though the idea is well-understood, achieving it is not without challenges. Principle among these are sacrificing improvements in the name of 'getting back to normal' as quickly as possible, and balancing 'build back better' versus the financial reality that building back at all still entails, for most people, a financial loss. There is often no ability to build back better even if the desire and knowledge are there, and financial compensation, whether from insurance or the government, needs to support longer-term rebuilding that is better and safer.

PERC studies recommend that "building back better" should be a general part of the risk management strategy of any business or agency. That way, a desire to be up and running quickly and minimize business interruption does not get in the way of a recovery that will ensure facilities and their operations are strengthened before they are reopened. This also means implementing a build-back-better strategy and making it part of the recovery plan before the recovery needs to happen. In other words, develop your recovery plans well ahead of any events requiring you to implement them.



How and where we develop are critical to reducing fire risk

The key determinant in how fires interact with society is mostly determined in the WUI. This zone has seen rapid development in recent years. Communities, and businesses within them, must begin thinking through, in detail, what the reality of a wildfire event looks like and what they can do between now and the next inevitable fire to increase their resilience. Fire risk is increasing, but much of that increase is due to factors that we can control – where we build, how we build, and how we maintain our properties.



4 | Floods: Lessons from Africa to the U.S.



Extreme weather events are occurring more frequently. This is resulting in increased river flooding, increased coastal storm-surge-related flooding and increased rainfall-induced flooding as rains overwhelm local drainage. Also increasing are infrastructure failures, as drainage and flood protection systems built for smaller volumes of water are overwhelmed, allowing regions to be inundated with water. As PERC reports have revealed, the impact of these natural hazards can be managed with a proactive risk reduction approach. Solid investment in planning is sound risk management.

Early warning systems are among the best investments that can be made to manage the risk of flooding. A single example shows how early warning, awareness and preparation can make a big difference in keeping people safe and property protected. When Cyclone Xaver struck the United Kingdom in 2013, a flood emergency and contingency plan that had been put in place on Zurich's recommendation was triggered before the storm arrived, allowing residents and critical equipment to be moved safely upstairs. An estimated USD 10,000 invested in flood defenses and costs for the contingency plan yielded savings of around USD 135,000. This is a single example that is part of a much wider collection of evidence showing that for every USD 1 invested in resilience building before an event, on average USD 5 are saved in future losses.

Cyclones reveal weaknesses

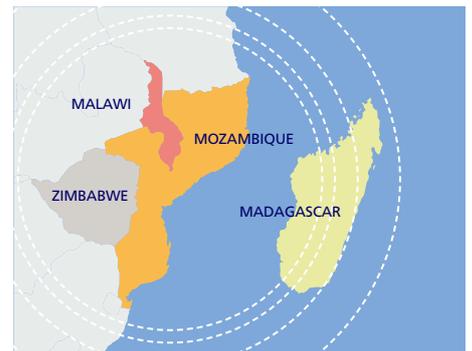
Cyclones Idai and Kenneth ravaged Malawi, Mozambique and Zimbabwe in 2019. The impacts of these two storms underscored

the importance of ensuring that early-warning systems are in place throughout regions that face potential flooding and that residents understand how to act when the alerts sound. The storms caused more than 1,300 deaths and affected more than 3 million people. Damages were more than USD 2 billion and humanitarian needs were still pressing long after the storms subsided.

Idai, in particular, revealed gaps in early warning systems and community awareness and preparedness for natural hazard events in areas that are not regularly impacted by such events. In Zimbabwe, for example, weather forecasting and alert systems exist but are weak in areas such as Chimanimani and Chipinge, where climate disaster declarations are rare. Even though communities in those areas received early warnings about Cyclone Idai, many lacked knowledge on how to respond, leaving them vulnerable.

While PERC studies show that early warning systems save lives, the presence of a system is not enough to ensure that it functions as it should. It must be designed to properly consider and communicate the threat of a disaster to those in harm's way and provide them with clear messages on what to do and when.

Similar PERC lessons were seen in the United States, where Hurricane Harvey's impact in Houston and Hurricane Florence's impact in the Carolinas were also mostly water-related. Much of the damage was from storm surge and riverine flooding rather than direct wind losses, indicating that warning populations through messages relying on the Saffir-Simpson hurricane scale alone is inadequate.



Hurricane warnings presented similar challenges. In some cases, warnings, particularly regarding the potential flood risk from the storms, was lacking. In other cases, people received risk warnings, but failed to understand the potential severity or how to act based on the information they received.

Lessons from Idai and Kenneth

All of the PERC studies conducted to date explore not just the events themselves, what happened and why they turned into disasters. They also delve into successes and consider how to leverage them. Even in a disaster on the scale of that experienced in Malawi, Mozambique and Zimbabwe, there were clear, strong successes with Cyclones Idai and Kenneth. Disaster management institutions created before the storms in Mozambique and Malawi were credited with preventing wind and flood impacts from being even more deadly and costly. Coordination before and immediately after the cyclones facilitated the allocation of

resources and post-disaster assessments. And all three countries hit by the storms saw clear successes from water, sanitation and hygiene (WASH) programs, which helped contain cholera and other diseases.

However, though the humanitarian response rightfully focused on short-term efforts that would save lives and alleviate suffering, funding was too short-term to integrate with broader disaster risk reduction and development practices and programs. That meant time-sensitive opportunities to recover more resiliently were lost.

The PERC report following the cyclones concluded, among other things, that:

- Proactive investment in disaster risk reduction is insufficient, particularly for poor and climate vulnerable communities, leaving both cyclone-impacted communities and those not impacted at risk. World Bank and other donor investments in resilience-building are a start, but more is needed and governments and donors must be more proactive in the face of growing climate-related risks.
- Climate change will continue to make conditions worse. More people will be affected, humanitarian costs will grow, and progress in development will shrink. Stakeholders at all levels must be stirred to act.
- Disaster risk reduction investments in climate change adaptation must reach local levels. Most current investment is at national, regional and provincial levels, creating a gap at the local level that results in lives and livelihoods being destroyed by extreme events.
- Protection of critical infrastructure in the areas affected by cyclones was inadequate and needs to be strengthened. As seen in many other post-event reviews across Germany, the Balkans, Nepal and the U.S., damage to infrastructure that provides essential services, such as water, sanitation, communications and transportation, leads to devastating cascading effects such as the loss of emergency communications, the inability to transport and provide recovery equipment or critical food supplies, and the crippling of the basic functioning of a region's economy.

The report also noted that donors, governments, international humanitarian and development organizations, non-governmental organizations and communities must become more proactive about incorporating climate change adaptation and disaster risk reduction into response and recovery planning. Otherwise, people will remain vulnerable and likely will continue to suffer, increasing the likelihood that they will need further humanitarian aid in the future.

Shift from grey to green or green-and-grey protection approaches

Grey infrastructure usually focuses on a single purpose or benefit only (i.e. a flood wall keeping water away from people and infrastructure) and may not be useful to provide other, more diverse benefits. It also can often provide communities and individuals with a false sense of security. People trust flood barriers to protect them from floods completely, meaning if, or rather when, the barrier fails, they are underprepared and struggle to cope with the effects. This so-called levee effect also leads to valuable assets or infrastructure such as homes, schools, and even hospitals being built in vulnerable areas, with the expectation that they will be protected by grey infrastructure when they are in fact not fully protected to the extent expected.

Building in these hazardous areas kept "safe" through levees, inhabited by communities

unaware of the risk, increases the long-tail risk of flooding: low probability but severe effects. When grey infrastructure fails, it often fails colossally, with catastrophic consequences. With evidence that floods are getting more severe as a result of climate change, these failures are going to increase.

Unlike grey infrastructure, green or nature-based approaches have benefits far beyond flood protection. Climate smart adaptation or disaster risk reduction approaches can provide additional mitigation effects. For example, mangroves planted to reduce coastal erosion are also useful in binding CO₂. Additionally, green spaces, cleaner air, and access to water provide mental and physical health benefits and can reduce summer heat island effects in inner cities. One of the strengths of green approaches is that they can be used both as alternatives and complements to traditional grey infrastructure. It does not have to be one or the other.



These four approaches should be considered:

- Promote nature-based solutions when building new infrastructure. Nature-based solutions and green/blue approaches should be the first consideration when implementing integrated climate resilience and risk management approaches. These can replace the need for (or at least complement) grey infrastructure when implementing flood risk reduction.
- Reassess the way costs and benefits of grey and green projects and developments are carried out. Factor in the co-benefits beyond flood risk reduction which green infrastructure provides (improved air or microclimate quality, biodiversity, improved water percolation, water quality, erosion reduction, etc.). Realistically assess the negative consequences that hard infrastructure such as levees often have and incorporate those consequences fairly and transparently into cost-benefit analyses. Ideally, these new cost-benefit models should also highlight the "cost of inaction" or not investing in ex-ante measures, compared to dealing with the aftermath of flooding.
- Avoid creating new risk (don't build more assets in hazard-prone areas). This reduces the cost and reduces total risk compared to an approach where new risk is created and (expensive) grey infrastructure has to be built to protect these risk-prone assets.
- Nature-based solutions programs should include a long-term assessment component. There is emerging evidence that ecosystem solutions to protect against natural hazards and to build climate resilience are outperforming grey-only solutions, but a consistent and more comprehensive approach to the assessment is necessary.

5 | Conclusion

Beware of repeat events

Like the compounding of hazard events, where a flood occurs during or after a pandemic, our PERC studies also show that societies can be vulnerable to repeated events and may still be recovering from one when the next one strikes. Many communities around the world are regularly faced with this challenge. North Carolina's experience with Hurricane Matthew in 2016 and Hurricane Florence two years later, and California's severe back-to-back fire years in 2017 and 2018 illustrate this pattern. To overcome this challenge we need to become quicker in identifying and learning the critical lessons these events can teach us and implement them before the next event strikes.

Interconnectivity of risks creates potential vulnerabilities

The COVID-19 crisis has removed any doubt about the importance of understanding supply chain vulnerabilities and interconnected risks. PERC studies have consistently emphasized the value of considering potential points of failure within a wider system, whether supply chain or other, and the importance of contingency planning in the event of an interruption. The crisis served to reveal weak spots for many businesses and organizations, which can be strengthened through proper planning in the event of a future pandemic.

Insurance bolsters financial resilience

Well-thought-out insurance coverage will speed recovery from flooding and other extreme events by providing funds to aid in rebuilding. Multi-hazard policies serve businesses well, providing coverage for damage from floods, fires, sewage backup and other hazards. Without such coverage, losses could be heavy and could include not just damage to property but the potential cost of being unable to operate for an extended time while repairs are underway.

Insurance does have limitations and even companies with coverage will find that it is unlikely to cover all costs. Taking steps ahead of time to mitigate the risk and facilitate recovery can help lower post-event costs.

As such, insurance should be considered one element of financial resilience. It is just as important to have plans in place for retaining a customer or supplier base that will help maintain an income stream. Without a plan to continue at least partial operations, re-attracting clients will be difficult and lost revenues will mount. Floods and storms in countries such as Germany and the U.S. all illustrate how well-insured communities recover faster than those that are not as well-protected by insurance.

To learn more about PERC capabilities and access previous reports, visit the [Flood Resilience Portal](#).⁴



⁴ <https://www.zurich.com/flood-resilience>

Developing a business resilience strategy – what to consider

In developing a natural hazards resilience strategy, a meticulous check of data quality should precede the conventional risk management approach of a catastrophe modeling analysis. Special attention should be given to location (preferably latitude and longitude, rather than address) and age of the site. A hazard assessment, using global hazard maps, and a deterministic scenario-based approach may be used for those regions and perils not covered by the catastrophe models.

Besides information pertaining to accumulated annual loss, exceedance occurrence probability and other parameters used to design an insurance policy, high-risk single locations as well as concentrations of locations that could potentially be impacted by a single event should be identified.

Prioritization of these locations for the next step of the resilience strategy is based on the definition of “critical” in the organization. For example, “critical” may designate a location or region that fulfills one or more of the following criteria:

- **High concentration of values at one location**
- **Long replacement time for equipment or stock at a location**

- **The location is a significant contributor to the group value chain or revenue**
- **Large concentration of occupants**
- **A large area around the site could be impacted environmentally**
- **Multiple locations could be impacted by a single event**

Such a review and analysis pertains to operations or locations within the stakeholder’s own responsibility. Ideally, suppliers and critical infrastructure would be included in the analysis.

Insurance and resilience

For those locations defined as critical, a deterministic scenario-based loss estimate should be developed, based on detailed information regarding site vulnerabilities both physical and organizational. Such an analysis is an essential component of the resilience strategy and would include an onsite assessment of the reliability and effectiveness of emergency response and business continuity plans, any peril-specific protection measures (seismic gas shut-off valves, mobile flood protection elements, etc.), quality of structures and other assessments.

While the information from a deterministic analysis does not provide detailed probabilistic information, it does define the measures to be implemented to reduce the severity of an event. In other words, the resilience strategy will include insurance, which supports the site in restoring operations after the event and the physical and organizational measures that reduce the impact of an event on the locations. With this information in hand, a medium- to long-term resilience strategy can be developed in which budgeting for capital expenditure projects (structural strengthening, flood protection measures), as well as reallocation of existing budget to such areas as maintenance of drainage systems, expert inspection of roofing systems, can be defined.

Catastrophe modeling plays a key role in strengthening resilience. By quantifying catastrophe risk with sophisticated models, Zurich gives businesses a better understanding of how they could be impacted by extreme weather events and provide capacity in line with risk appetite. The models provide an answer for extreme events that may not be in the historical record and are the basis to run what-if scenarios in the face of a changing climate.

Company toolkit

The PERC approach is available to all organizations

The PERC methodology was specifically designed to turn the lessons learned from the consequences of disasters into actions that help businesses and communities become more resilient and recover quickly from devastating events. It is not enough to understand the dynamics of disaster risk and resilience, including what went wrong and what worked well, but that is the necessary first step.

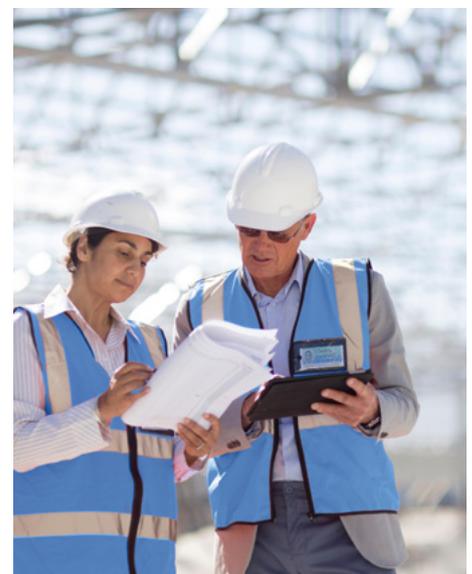
PERCs are carried out relatively quickly and inexpensively, which means they are available while attention is still focused on questions around disaster risk, decisions are being made on reconstruction and disaster policies are being closely revisited.

As new information and insights into disaster risk and resilience become available, the PERC approach can be easily adapted. Its flexibility allows it to be used for a wide range of scenarios while sticking to the core fundamentals of the approach.

For example, there are opportunities for retrospective PERCs conducted remotely, mini-PERCs focusing on specific questions and PERCs that examine multiple events. While work so far has focused mostly on floods, the methodology can be applied to other hazards.

Zurich encourages all interested parties to apply the methodology and contribute to the repository of freely available material on success and insights from around the world. PERC studies and a manual that serves as a guide for conducting PERCs are available at <https://www.zurich.com/sustainability/our-role-in-society/flood-resilience/learning-from-post-flood-events>

A searchable repository of PERC recommendations is available on the Zurich Flood Resilience Alliance knowledge portal at <https://floodresilience.net/perc>



How to conduct a PERC



Businesses and organizations that want to conduct a PERC on their own should start by conducting a desk review in order to get an overview of what has happened and where.

With the overview in hand, it is important to visit the affected area and speak with those who were involved in the disaster. Doing so provides a level of context, information and understanding that would be otherwise nearly impossible to obtain.

Interviews form the backbone of the PERC. The methodology uses a semi-structured interview process. Unlike formal interviews, which follow a rigid format of set questions, semi-structured interviews focus on specific themes, covering them in a conversational style. The loose format prompts interviewees to provide valuable information and stories that may not be anticipated by the PERC team. It also allows the interviewer to deviate from the plan to explore pertinent topics that might arise.

When an event occurs that takes society by surprise, questions arise as to how the loss might have been averted or minimized. Referred to as “downward counterfactual analysis,” it is a useful approach for PERC studies that also want to know how a loss might have been worse. It is useful in

providing insurers and risk managers with the ability to search for and analyze data that may be missed by traditional real-world event research. Such data can help identify unlikely but possible events.

Ideally, a PERC study should be conducted after the disaster response phase is over and during the recovery phase, but not so late that the momentum created by the disaster is lost. The PERC framework is not a linear process; rather, its structure helps identify and understand the different components that create a complex system and how these different components interact to generate outcomes. Conducting PERC studies means critically reflecting on information and responses from interviews and sorting them according to PERC’s logical framework.

It is important to note that this process promotes the notion of learning without assigning blame, instead fostering the idea that disaster risk is something that can be mediated through action, and giving those who hold local knowledge a voice and opportunity to express themselves.



Summary of risk management recommendations



- 1. Focus on prevention as a more effective risk management approach than recovery.** Preparing for disasters by reducing the exposure while developing strong response and building continuity plans makes businesses more resilient to the threat of potential shocks.



- 4. Review insurance coverage.** Proper multi-hazard coverage will speed recovery and allow businesses to be up and running faster, which means retaining a customer base rather than re-attracting one.



- 2. Understand high-value supply chain vulnerabilities and interconnected risks.** In managing these risks, companies lessen the chance that a disaster will cause unexpected ripple effects that could shut down operations.



- 5. Conduct a post-event review if disaster strikes.** Lessons from what worked and what didn’t will better prepare the organization for the next disaster, should it occur.



- 3. Stress employee preparedness at work and home.** This ensures employees remain safe and are in a position to help keep the business running from a remote location if needed.



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