

The Zurich flood resilience program – Phase 1 from 2013-2018

Stocktaking and impact evaluation report

This report is intended to provide a short overview of the input, output and achievements ('impacts') of the Zurich flood resilience program, including the Zurich flood resilience alliance.



Contents



Glossary	2	4.4 Influencing and advocacy	33
Executive summary	4	4.4.1 Advocacy input	33
1. Motivation	12	4.4.2 Advocacy output	33
2. Objectives	14	4.4.3 Advocacy impact	35
3. Alliance setup	16	4.5 Research program	37
4. Results	18	4.5.1 Research input	37
4.1 Overall Alliance impacts	19	4.5.2 Research output	37
4.1.1 Understanding, defining and promoting the concept of flood resilience	19	4.5.3 Research impact	37
4.1.2 Flood resilience measurement framework and tool	20	4.6 Post Event Review Capability (PERC)	40
4.1.3 Flexible, long-term programming and financing	22	4.6.1 PERC input	40
4.1.4 Creating an Alliance vision, and a spirit of sharing and learning	22	4.6.2 PERC output	40
4.2 Community programs	23	4.6.3 PERC impact	41
4.2.1 Input	23	5. Conclusions	42
4.2.2 Output	23	6. Appendix – Research publications	46
4.2.3 Community program impact	27	6.1 Scientific publications in peer-reviewed journals	47
4.3 Knowledge generation and sharing	31	6.2 Knowledge outputs	50
4.3.1 Knowledge input	31		
4.3.2 Knowledge output	31		
4.3.3 Knowledge impact	32		

Glossary



Acronyms

4R	four properties of a resilient system	MCEER	a multidisciplinary research center at the University of Buffalo
5C	five capitals: financial, human, natural, physical and social capital	MRED	Mercy Corps' Managing Risk through Economic Development program
Alliance	Zurich flood resilience alliance	NAS	United States' National Academy of Sciences
CBDRR	community-based disaster risk reduction	NGO	non-governmental organization
CDMC	Community Disaster Management Committee	NPR	Nepalese rupee
Concern	the NGO Concern Worldwide	PA	the NGO Practical Action
COP	Conference of the Parties	PERC	Post Event Review Capability
DFID	UK's Department for International Development	Plan	the NGO Plan International
DHM	Nepal's Department of Hydrology and Meteorology	SIBAT	Community-Based Action Team, in Indonesia
DRM	disaster risk management	SRACAD	Strengthening the Resilience of Afghanistan's Vulnerable Communities against Natural Disasters
DRR	disaster risk reduction	TPI	The Partnering Initiative
EGU	European Geosciences Union	UNDP	United Nations Development Program
EWS	early warning system	UNEP	United Nations Environment Program
FEWEAS	flood early warning and early action system	UNFCCC	United Nations Framework Convention on Climate Change
Foundation	Z Zurich Foundation	UNISDR	United Nations International Strategy for Disaster Reduction
FRMC	flood resilience measurement framework and tool for communities	ZFRA	Zurich flood resilience alliance (Alliance)
IFRC	International Federation of Red Cross and Red Crescent Societies	ZFRP	Zurich flood resilience program (program)
IIASA	International Institute for Applied Systems Analysis	Zurich	Zurich Insurance Company Ltd.
ISET	Institute for Social and Ecological Transformation		

Executive summary



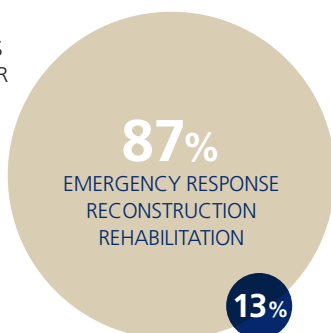
Motivation of the Zurich flood resilience alliance, its setup and objectives

Motivation

By using our risk expertise as a global insurer, Zurich helps customers and communities to reduce the devastating impacts of floods, even before a flood hits – we call this flood resilience. Floods affect more people globally than any other type of natural hazard and cause some of the largest economic, social and humanitarian losses. Loss of life and economic and insured losses are increasing in many regions, and flood risks are more interconnected and interdependent than ever.



REDUCING &
MANAGING RISKS
PRIOR TO DISASTER



Fraction of money spent on post-event versus pre-event

Pre-event risk reduction is the focus of our efforts across the Zurich flood resilience program. We know that prevention is cost-effective, but nearly 87 percent of disaster-related spending on aid goes into emergency response, reconstruction and rehabilitation, and only 13 percent toward reducing and managing the risks before they became disasters.¹

But flood resilience cannot be enhanced by one stakeholder alone, that is why we have created a multi-organizational partnership to enhance societal flood resilience in 2013. We call this the Zurich flood resilience alliance ('the Alliance').

¹ Kellett, J. & Caravani, A. 2013, "Financing disaster risk reduction: A 20-year story of international aid."



Setup

The Alliance has included the following partners since its inception. Zurich acted as the catalyst; providing human, technical and financial resources:

- The International Federation of Red Cross and Red Crescent Societies (IFRC), with programs in Mexico, Indonesia and Nepal;
- The International Institute of Applied Systems Analysis (IIASA) as a research partner;
- Practical Action, with programs in Bangladesh, Nepal and Peru;
- The Risk Management and Decision Processes Center of the Wharton Business School at the University of Pennsylvania (Wharton) as a research partner.

In 2015, we decided to invite a set of further, so-called **boundary partners**, to drive impact and scale. These were:

- Concern Worldwide (working in Afghanistan and Haiti);
- Mercy Corps (Indonesia, Nepal and Timor-Leste);
- Plan International (Nepal);
- United States' National Academy of Sciences (NAS, working in Cedar Rapids and Charleston).



Objectives

The Alliance has four primary objectives:

- Measurably enhance flood resilience in vulnerable communities across the world;
- Enhance the effectiveness of disaster risk reduction (DRR) solutions;
- Develop and promote knowledge and expertise on flood risk and resilience;
- Improve awareness and public dialogue around flood resilience and flood risk reduction solutions at national, regional and global level.

The flood resilience measurement framework and tool for communities (FRMC)

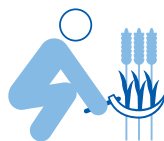
A survey conducted in 2014 for the United Nations Development Program (UNDP) concluded that:

“no general measurement framework for disaster resilience has been empirically verified yet.”

We have tried to address this gap and have built a community flood resilience measurement framework, together with the tools to practically apply it. The resulting FRMC is a decision- support tool. It combines the five capitals (5C) model from the Sustainable Livelihoods Approach (SLA) adopted by the UK’s Department for International Development, and the four properties of a resilient system (4R) developed by MCEER, a multidisciplinary research center, at the University of Buffalo.

The current FRMC version has been used in over 110 communities in 13 programs within nine countries. During its use so far, over 1.1 million data points have been created to measure flood resilience.

Community program results – inputs, outputs and impact



Input

The Z Zurich Foundation (‘Foundation’) made contributions to all partners over the course of the program, totaling CHF 36.83 million. Meanwhile, Zurich Insurance Company Ltd. (‘Zurich’) took on the cost and expense budget for approximately 2,420 work days of staff fully employed for the program, in addition to significant senior management input, as well as resources at local country level in Indonesia and Mexico where Zurich has an office presence and where programs were run.

Output

The following Alliance partners were active, alongside Zurich, in the community program: **IFRC, Practical Action, Concern Worldwide, Mercy Corps, NAS, Plan International.** Below is a summary of their main outputs:

- **IFRC** created tools and undertook community surveys which enabled dialogue with communities; helping them to prepare for, reduce the risk and respond to floods. Actions arising from these discussions included three major reforestation campaigns, the creation of waste management centers and evacuation centers, training in community first aid, community-based emergency plans, 70 community brigades and education for school-children on flood awareness;

- **Practical Action** focused on creating end-to-end early warning systems (EWS), including 11 million alert messages to communities they covered during recent flood events. They also focused on building community capacity – including initiatives around livelihood activities like farming, built physical flood protection, engaged in advocacy with global and national governments on flood risk prevention and disseminated knowledge via information sharing platforms;
- **Concern Worldwide** trained community members on flood resilience and addressed capital needs including building: physical capital such as gabion and retaining walls and check dams, human and social capital such as flood resilience committees, natural capital such as tree plantation and financial capital such as community employment in infrastructure works. Concern also undertook national advocacy initiatives, including consultations with government agencies in Afghanistan and Haiti;
- **Mercy Corps** established and strengthened disaster preparedness groups in Indonesia. They strengthened community-based waste management and flood information distribution in the country. In Nepal and Timor-Leste, Mercy Corps ran financial literacy classes and formalized savings and lending associations. They also improved EWS, physical and green infrastructure;
- **NAS** implemented disaster preparedness training to 19 nonprofit organizations. It facilitated a meeting of a diverse stakeholder set to focus on planning and financing local mitigation efforts in Linn County, Iowa. NAS also organized a Cedar Rapids Flood Resilience Symposium to address some of the community's main resilience and flood challenges identified by the results of the FRMC. Finally, NAS has advocated for the use and effectiveness of the FRMC, including in a forthcoming article to be published in the European Review Journal;
- **Plan International** worked in Nepal, with their unique child-centered approach in two communities in the Koshi river basin. Activities included training on key aspects of Disaster Risk Management (DRM), training focused on teachers and children. Plan also implemented infrastructure improvements like shelters, river embankment stabilization and elevation of critical infrastructure, as well as bringing Community Disaster Management Committees together with local government.

Impact

Through the use of the FRMC, we find that overall there is a very positive direction in resilience between the start and the end of the programs. Many communities are increasing their flood resilience, with very few exceptions, resilience measurement results have gone up in all program communities over the duration of the program. One important – but unquantifiable – impact has been the level

of collaboration, exchange and sharing of knowledge across country programs.

Even though it is difficult to quantify specific figures, we know that the Alliance's DRR activities have made a difference and benefited a great number of people. A selection of our partners have nevertheless shared the following number of **beneficiaries** in the program communities we have worked with:

<p>Concern</p> <p>Haiti: 7,279 households (36,395 individuals)</p> <hr/> <p>Afghanistan: 2,030 households (12,830 individuals)</p>	<p>Mercy Corps</p> <p>Indonesia: 3,534 households (14,136 individuals)</p> <hr/> <p>Timor-Leste: 681 households (4,290 individuals)</p> <hr/> <p>Nepal: 254 households (1,959 individuals) directly, as well as 13,821 households (77,710 individuals) indirectly through upgrades to EWS</p>
<p>IFRC</p> <p>Indonesia: 21 communities served with 128,528 direct beneficiaries</p> <hr/> <p>Mexico: 21 communities served with 10,000 direct beneficiaries</p> <hr/> <p>Nepal: 25 communities served with 42,700 direct beneficiaries</p>	<p>Plan</p> <p>Nepal: 1,034 households (5,600 individuals)</p>

The total number of direct beneficiaries of the Alliance is approximately 225,000.

In addition, our partners report the following highlights in terms of impacts:

- **IFRC:** In Indonesia, impacts include the full implementation of the early warning and early action system (FEWEAS) for Citarum and Bangawan Solo river basins. The system covers over 26 districts/ municipalities, and could reach over 40 million people;
- **Practical Action:** In Nepal, warning lead times of the EWS have increased from two-three hours, to five-seven hours lead time, and loss of lives is lower compared to river basins without EWS. In Bangladesh, long-term lead times have increased from two to five days. In 2017, there was no loss of life in the program areas in Peru during the devastating coastal El Niño flooding;
- **Concern:** The most vulnerable and marginalized in society are being reached. This is demonstrated by a better representation of those groups at committee level and in the participation of flood resilience planning and decision-making processes;
- **Plan International:** In Plan's project sites, as a result of its continuous interventions, the local government has started to budget more for flood risk reduction. Since 2015, a total of approximately NRP 4 million has been set aside for soil conservation, flood protection infrastructure and disaster prevention, a local disaster emergency fund and for livelihood diversification.

Research program

Input

The Foundation's financial input was CHF 3.4 million into the research program, split between IIASA and Wharton. Zurich's input included staff commitment equivalent to a part-time position. From IIASA, there was commitment from one professor, one Ph.D. student and several contributions from four other staff. At Wharton, there was input from three researchers, as well as executive support from the head of the school.

Output

Researchers developed and produced around 40 articles and other publications. These have been cited 897 times.

The research focused on several key questions:

1. *What is community flood resilience and how can it be measured?*
2. *Is pre-event resilience building more cost effective than post-event relief and recovery?*
3. *What incentivizes people to invest in flood resilience measures?*
4. *What is the role of financial risk transfer in building flood resilience, especially in developed countries and through the UNFCCC's loss and damage mechanism?*
5. *How can we use innovative crowd-sourcing approaches for generating relevant flood risk data?*
6. *The role of novel decision-support techniques, including serious gaming, for motivating investment into pre-event flood resilience.*
7. *How can forensic risk analysis inform DRR investments?*
8. *What are the learnings from the Alliance partnership approach?*

Impact

An early in-depth meta-study examining a variety of programs and projects working in the flood resilience space found that, on average, one dollar invested in prevention saves five in future losses, a compelling cost-benefit ratio.² In addition, the research program: supported shifts in climate negotiations on dealing with climate-related impacts and risks; shifted the narrative on DRR toward building back better and an enhanced role for resilience; helped the Alliance to achieve a gradual increase in contributions to the Natural Hazards Section of European Geosciences Union (EGU) – from contributor to co-convenor.

² Zurich Risk Nexus: "Turning knowledge into action – processes and tools for increasing flood resilience," 2015; Zurich Flood Resilience Alliance White Paper: "Making communities more flood resilient: The Role of cost-benefit analysis and other decision support tools in Disaster Risk."

Post Event Review Capability (PERC)



PERC³ analyses the root causes of why events become disasters. It tries to answer, at an event level, what worked well and where there are opportunities for further improvements. We have covered over a dozen big flood events based on our assumption that they provide a lot of opportunity for learning.

Input

Zurich's financial input into PERC has been roughly USD 350,000; as part of the overall expense and contracting budget to our PERC partner ISET-International. Additionally, invaluable volunteer time was committed by companies from the insurance, engineering and NGO sectors – simply because they were attracted by the PERC concept to provide learning.

³ More on PERC at:

<https://www.zurich.com/en/sustainability/flood-resilience/learning-from-post-flood-events>

Output

There have been 13 PERC reports produced so far.

Impact

PERC has been recognized in the scientific field of disaster forensics. This has ultimately led to the influence we have had at EGU and other scientific events. We have had several requests from other organizations both from the scientific field as well as from the private sector, to see how the PERC methodology can be applied in their contexts. There have also been requests around how PERC could be expanded from flood to other perils, for example wildfires. At local level, PERC has been solicited to be presented at national scientific or flood practitioner conferences, such as the Natural Hazards Workshop Colorado and the Flood and Coast conference in the UK. We identified a number of common lessons despite extremely varied contexts. PERC findings have been applied to easy-to-understand recommendations and risk reduction advice for the general public, for government-based decision makers as well as for risk managers and commercial customers in the insurance context.

Leveraging the work of the Alliance



Knowledge generation and sharing

In total, we have produced 341 knowledge outputs from the Alliance. These include academic journal papers, practitioner-focused toolkits and solutions, policy briefs, infographics, videos, blogs and many more. This knowledge is brokered externally through our Flood Resilience Portal available in English, Spanish and Nepalese.

Influencing and advocacy

At global level, this includes presence at flagship conferences such as the UN Climate Change Conferences and World Economic Forum initiatives. We have also co-organized our own events, such as in 2016, when Zurich co-organized (together with Wharton) the Forum on the Financial Management of Flood Risks with the OECD. At country level, the focus has been on sharing best practice learned through programing with national level forums and government departments. Our efforts have been recognized through awards such as the UNFCCC's 'Momentum for Change Lighthouse Award' in 2014 and a Convergences' 'Special Climate Prize' in 2015.

Conclusions – past success, future ambition

The flood resilience program that has run as a first phase from 2013-2018 has been highly successful. Most of our partners decided to continue with us on our journey into the second phase – a testimony in itself.

Partners were positive on their experience. They enjoyed working with – and through – others. They have said that the depth of the programs, including the flood resilience measurement framework, has made a significant contribution to the overall resilience space. And they said that, while the decision-making processes on how to prioritize flood resilience solutions is a time-consuming process, it truly works.

In particular, the long-term approach of the Alliance program has been a key factor in success. It helps to design different and more meaningful and often more innovative resilience-building interventions. Ultimately, that leads to an improved understanding of resilience across all partners and the communities with whom we work.

We know that floods remain a major, global challenge, beyond 2018 with flood risk expected to increase given socio-economic as well as climatic drivers. Now, we need to go beyond simply describing the problem (by stating how large and costly flood losses are and how much suffering they cause). We need to focus more on finding solutions to the problem. It is easy to react post-event and make funds available to recover. It is hard to find commitment to make the money available when the risk has not yet materialized – acting pre-event is difficult. This is the challenging field we are committed to tackle further.

While we have been successful and on the right track, the problem of encouraging more investment into resilience as well as the trend of increasing losses and suffering from flooding

across the globe has not been solved yet and more still needs to be done. Alliance 2.0 will run during the five-year period 2018-2023, with our core and boundary partners of Alliance 1.0 working in a fully collaborative and ‘joined-up’ setup. It has secured funding of approximately CHF 20 million from the Foundation.

We are grateful for the past five years setting up and implementing the successful Alliance 1.0 and the learning this has created, and we eagerly look forward to executing on our ambitious targets for Alliance 2.0. There, we will keep what has been positive and learn and improve from the experiences that our journey so far has highlighted.





1. Motivation

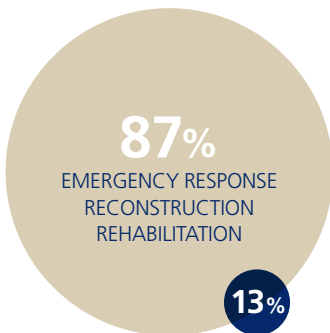


Floods affect more people globally than any other type of natural hazard and cause some of the largest economic, social and humanitarian losses. By using our risk expertise as a global insurer, we can help customers and communities to reduce the devastating impacts of floods, even before a flood hits – we call this flood resilience.

We believe in prevention; and pre-event risk reduction is the focus of our efforts across the Zurich flood resilience program. This means working with our community partners and their beneficiaries, the academic/research community, our customers and our staff. We know that prevention is cost-effective, but nearly 87 percent of disaster-related spending on aid went into emergency response, reconstruction and rehabilitation, and only 13 percent toward reducing and managing the risks before they became disasters.³ This is one of the aims we set out to change – more focus on, and investment in pre-event resilience building.

That is why we have created a multi-organizational partnership to enhance societal flood resilience in 2013. We call this the Zurich flood resilience alliance ('the Alliance'), and it forms part of Zurich's overall flood resilience program. Loss of life and economic and insured losses are increasing in many regions, and flood risks are more interconnected and interdependent than ever. Flood resilience cannot be enhanced by one stakeholder alone. This was the motivation to create an alliance of strong partners with complementary skills and expertise.

REDUCING & MANAGING RISKS PRIOR TO DISASTER



Fraction of money spent on post-event versus pre-event



³ Kellett, J. & Caravani, A. 2013, "Financing disaster risk reduction: A 20-year story of international aid."

2. Objectives



- **Measurably enhance flood resilience in vulnerable communities across the world** through effective community-based disaster risk reduction (CBDRR) programming, and innovative measurement and evaluation tools;
- **Enhance the effectiveness of disaster risk reduction solutions** by improving understanding of the barriers to more effective measures to build physical, natural, human, social and financial resilience to floods. Demonstrating and advocating the benefits of pre-event risk reduction over post-event disaster relief. Developing and delivering innovative, sustainable solutions that make communities more resilient to floods, and taking them to scale globally. Finally, developing perspectives on appropriate risk transfer and risk management solutions in flood vulnerable areas, including prerequisites for their effective functioning;
- **Develop and promote knowledge and expertise on flood risk and resilience**, translating insights into practical solutions;
- **Improve awareness and public dialogue around flood resilience and flood risk reduction solutions at national, regional and global level**, and translate insights into policy recommendations.

As the Alliance developed from 2013 to 2018, we gradually advanced and subsequently visualized the Alliance's objectives in Figure 1. This outlines our 'North Star' vision to reduce or avoid the impacts floods have on people's ability to thrive:

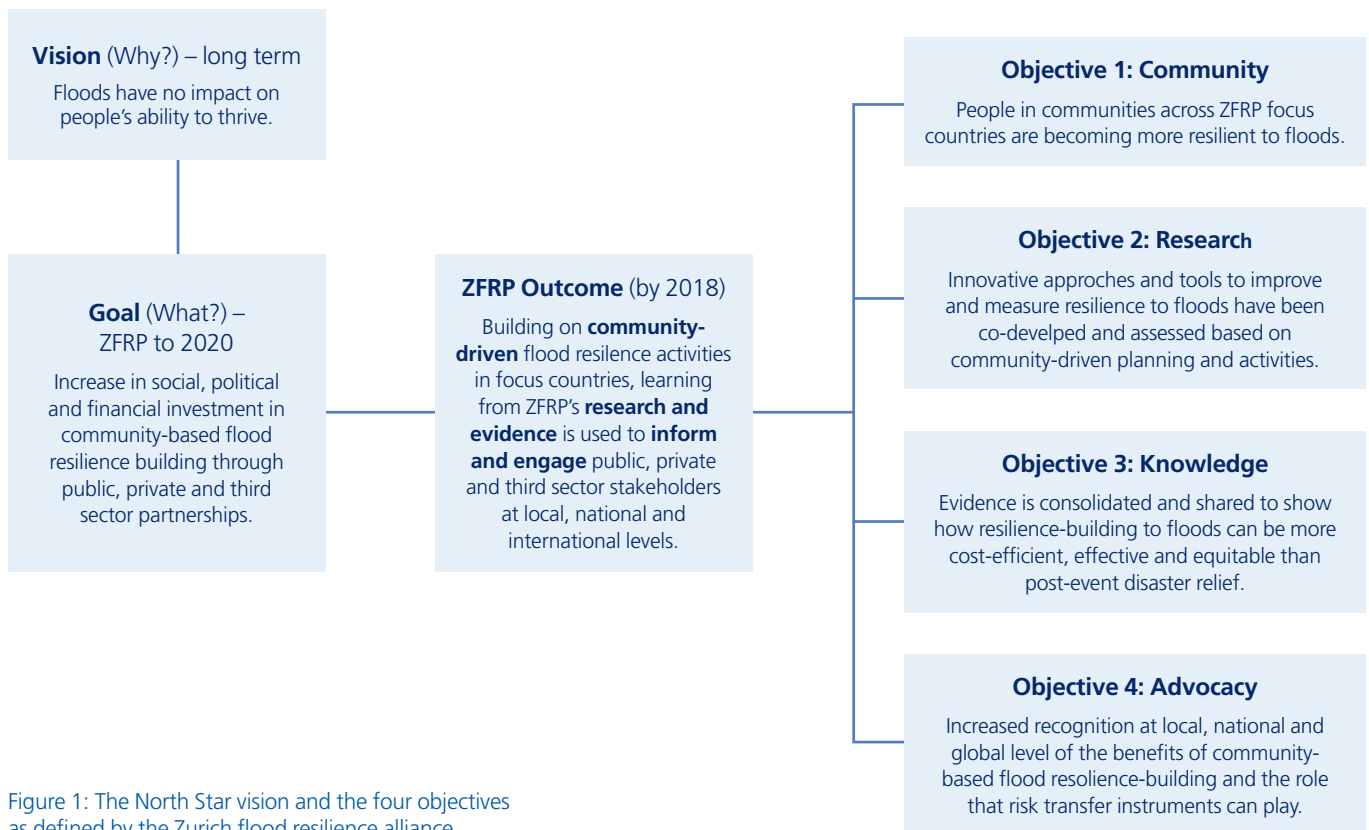


Figure 1: The North Star vision and the four objectives as defined by the Zurich flood resilience alliance.

3. Alliance setup



In order to achieve the objectives, set out on page 15, Zurich has entered into partnerships with the following organizations:

- **The International Federation of Red Cross and Red Crescent Societies (IFRC):** January 1, 2013 to June 30, 2018;
- **The International Institute for Applied Systems Analysis (IIASA)** as a research partner: July 1, 2013 to June 30, 2018;
- **Practical Action:** July 1, 2013 to June 30, 2018;
- **The Risk Management and Decision Processes Center of the Wharton Business School at the University of Pennsylvania (Wharton)** as a research partner: July 1, 2013 to June 30, 2017.⁴

The roles we envisaged for the partners are represented in Figure 2. Zurich acted as the catalyst; providing human, technical and financial resources. The financial resources came from both the Z Zurich Foundation ('Foundation') and from contributions of time, expertise and financial resources from Zurich Insurance Company Ltd. ('Zurich'). One way for the program to achieve large-scale impact was for the theoretical learnings to be turned into practical solutions and then used to inform large-scale programs. Our Alliance brought together and harnessed the strengths of specialists in each of these areas. Researchers were able to provide insight and gain knowledge from the community work on the ground, and provided modelling and general analytical capacity.

The Alliance brought together a diverse group of actors set up to jointly make a difference in the flood risk and resilience space. An analysis of this model in 2015 highlighted some of the challenges we faced. These were largely around expectations versus reality and the time it took for the model to mature. We expected cross-collaboration and shared leadership, but in many cases, Zurich's role was not enough to foster these independently. This has improved over time, and whilst Zurich retained a 'hub' and coordination role to an extent, more collaboration has been achieved in the second half of the program across and between partners. It comes after a wide consensus over our joint ambitions, the creation of the North Star vision and the enhanced objectives for the Alliance.



Figure 2: The Zurich flood resilience alliance model of combining research, community practice and private sector/insurance expertise into a cross-sectorial multi-actor alliance.

In 2015, we decided to invite a set of further, so-called **boundary partners**, for the remaining duration of the program between 2016-2018. This was based on our positive experience in the first phase of the program and our drive to accelerate the impact we were having. These new partners scaled the 'flood resilience measurement framework and tool for communities' (FRMC) and the implementation of resilience-building solutions in suitable community programs on which they were

already working. The partners comprise **Concern Worldwide** (working in Afghanistan and Haiti), **Mercy Corps** (Indonesia, Nepal and Timor-Leste), **Plan International** (Nepal) and the United States' National Academy of Sciences (**NAS**, based in Cedar Rapids and Charleston). The relationship with the Institute for Social and Ecological Transformation (**ISET**) started in 2014 through the collaboration of a Post Event Review Capability (PERC) study in Nepal and subsequently extended to deliver

various outputs as described below. It was mostly of contractual nature based on these specific deliverables. **Zurich** itself, besides a coordination and financing role, delivered PERC studies, customer risk management advice and public policy engagements. This took place in various countries and at supranational level, e.g., at the European Commission level, as part of the program. The program's geographic coverage is shown on p.21 (See Figure 3).

⁴ The relationship started 2013 based on annual memorandum of understandings extendable by a year at the end of each year for a total of four years.

4. Results



We started out the Alliance almost like an adventure, building on mutual trust across partners – a program path that developed over time and was not fully prescribed or ‘clear’ from the outset. We did not start with all of our partners simultaneously, nor did we have an integrated reporting framework from the outset. One of the reasons for this – well known in the disaster risk reduction (DRR) sector – is that we know measuring impact is hard. Even harder is integrating different work streams and partners’ efforts into one measurement framework. This report summarizes the achievements of the Alliance retrospectively. Describing the results from five years of the Alliance, we try to look back at the ‘value chain’ of input – output – impact.

The report will outline inputs – the resources that have been invested into the program. These can be of a financial nature (monetary investments, such as the contributions from the Foundation) and in terms of human resources (staff and volunteering time).

We also outline the outputs – tangible results produced with the resources that were used as an input. It is typically easier to report on and quantify outputs, such as the number of learning documents or reports produced, the number of scientific papers published, the number of communities measured in the flood resilience measurement tool, etc. We describe the outputs in order to provide an overview of the readily countable achievements of the program and to draw a few conclusions on the efficiency of the work (i.e. the ratio between output and input).

But we should not stop there – what really matters is the outcomes and impact that this work has had. In various literature they have a slightly nuanced meaning, where outcomes may be a more quantifiable result of outputs, and impacts may be less quantifiable and more of the type of ambitions and intentions. For the sake of simplicity and feasibility in this stocktaking report, we are using them interchangeably, as others do.⁵ Our definition of outcomes/impacts is what change the outputs created. Have the communities that used the FRMC and subsequently implemented resilience-building interventions improved their resilience? Have we changed the behaviors of investors that decide between pre-event risk

reduction or post-event relief investments? Have we been able to influence the thinking of what (community flood) resilience is, how the term is used and what it aims to do in the wider space of DRR? These are the types of impacts we are trying to capture. Some may be measurable, some may not, but nonetheless provide good anecdotal evidence and success stories that are equally important.

4.1 Overall Alliance impacts

4.1.1 Understanding, defining and promoting the concept of flood resilience

At the outset, we realized that resilience is a difficult term. It has become a ‘buzzword’ in the development sector that is often loosely defined or ‘hijacked’ to sell or rebrand an already existing concept. It is also too broad a concept to tackle or measure as a whole.

There are many approaches to measuring resilience which have been discussed and set out in theory over the last decade, any of which could potentially provide a model for measuring a community flood resilience approach. However, they often stay at the conceptual level – not underpinned by evidence from an applied framework. The Hyogo Framework for Action, established 10 years ago, set out an ambitious framework for addressing disaster risk. While it was successful in reducing disaster mortality globally, there has not been similar success in tackling the underlying factors. This is a goal for the subsequent Sendai Framework, which

we are trying to support with our program.⁶ Indeed, a survey conducted in 2014 for the United Nations Development Programme (UNDP) concluded that

“no general measurement framework for disaster resilience has been empirically verified yet.”⁷

We have tried to address this gap and have built a community flood resilience measurement framework, together with the tools to practically apply it. We use our own, Alliance definition of flood resilience:

“Flood resilience: The ability of a community, system or society to pursue its development and growth objectives while managing flood risk over time in a mutually reinforcing way.”

In other words, a community will be able to continue to function and grow if it is resilient, highlighting the connection between development and risk management. This definition and its thorough application throughout the Alliance has had a fundamental impact on the way our programs were run. Our joint perspectives, coming from a range of different experiences, have helped us think about and define what a community is and how to identify communities that should be included in a program. It has also shaped our understanding of the factors that could affect resilience and how we could develop suitable interventions.

⁵ In various literature, impacts are defined as “Any effects arising from an intervention. This includes immediate short-term outcomes as well as broader and longer-term effects. These can be positive or negative, planned or unforeseen.” – (e.g. <https://biglotteryfund.org.uk>); At the Charity Finance Group, the definitions of outcome and impact, respectively, are: “the difference an activity makes to those you’re trying to help” and “the overall difference you make to those you’re trying to help” – <http://www.cfg.org.uk>

⁶ Keating et al., 2016. “Development and testing of a community flood resilience measurement tool.” NHESS 2016-188.

⁷ Winderl, T., 2014. “Disaster Resilience Measurements: Stocktaking of ongoing efforts in developing systems for measuring resilience.” UNDP.

4.1.2 Flood resilience measurement framework and tool⁸ (FRMC)

We recognized the need to not only have a joint definition and understanding of community flood resilience, but also for a comprehensive measurement framework and corresponding central tool to carry out flood resilience measurements over time.

It combines the five capitals (5C) model from the Sustainable Livelihoods Approach (SLA) adopted by the UK’s Department for International Development, and the four properties of a resilient system (4R) developed by MCEER, a multidisciplinary research center at the University of Buffalo. Our measurement framework, covering 88 ‘sources of resilience’ – proxy-indicators looking at the strengths and weaknesses of community flood resilience – is not a black-box or decision-making machine

that identifies solutions automatically. Instead, it is a decision-support tool, and the results of the measurement are not the outcome but part of the process.

The measurement framework and tool (the software in which the framework is applied) was built up as a truly joint effort across all partners. The current FRMC version has been used in over 110 communities in 13 programs within nine countries. These are funded directly by the Foundation, covering 255 individual measurements (note: measurements are conducted as baseline, end lines or post-flood studies to link outcomes of resilience with sources of resilience). In addition, first scaling has taken place and further communities, outside of the Zurich flood resilience program, have been using the framework as there was additional benefit to do so even without our direct funding. Our researchers found that

“designing the framework and tool in an alliance between practitioners, academics, and risk engineers has contributed to optimizing it within practical constraints.”⁹

Alliance members felt that applying the FRMC helps to “keep an open mind when it comes to selecting interventions” and to “let go of pre-conceived ideas of what interventions you think are most suitable.” The ability to look at resilience results from a variety of perspectives and through so-called ‘lenses of resilience’ were found to be one of the most useful applications of the FRMC. During its use so far, over 1.1 million data points have been created to measure flood resilience – “an unprecedented database of community level information and experience with flooding, collected in a consistent way.”¹⁰

Organization	Concern	IFRC	Mercy Corps	NAS	Plan	Practical Action
Countries	Afghanistan	Indonesia	Indonesia	US	Nepal	Bangladesh
	Haiti	Mexico	Nepal			Nepal
		Nepal	Timor-Leste			Peru
Communities	12	21	16	2	2	9
	4	21	5			5
		25	6			14

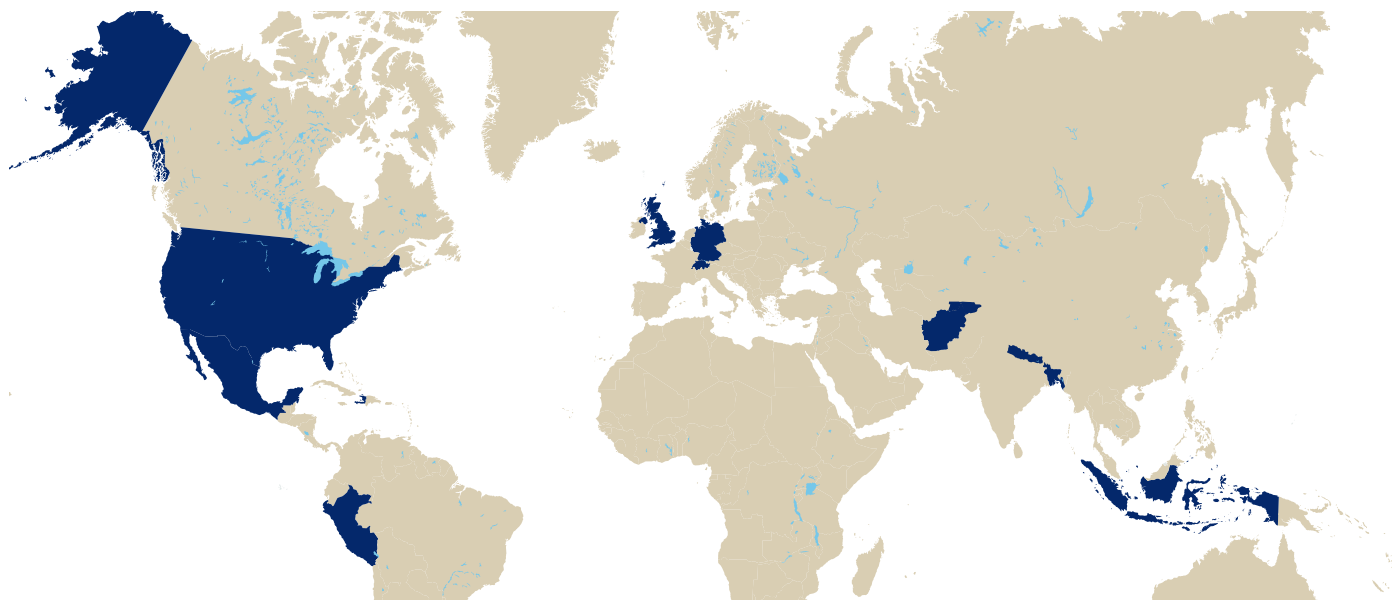
Table 1: Program communities by organization and country. Note that the scaling involved 44 additional communities beyond our programs.

⁸ See flood resilience measurement report on the issue – available at <https://www.zurich.com/en/sustainability/flood-resilience/measuring-flood-resilience>

⁹ Keating et al., 2016 “Development and testing of a community flood resilience measurement tool.” NHESS 2016-188.

¹⁰ Keating et al., 2016. “Development and testing of a community flood resilience measurement tool.” NHESS 2016-188.

Alliance members and boundary partners



International Federation of Red Cross and Red Crescent Societies Indonesia Mexico Nepal	Practical Action Bangladesh Nepal Peru	Concern Afghanistan Haiti	MercyCorps Indonesia Nepal Timor-Leste	Plan Nepal (children focused)	Resilient America United States: Cedar Rapids Charleston	Zurich Switzerland Germany Indonesia Mexico United Kingdom United States
---	--	--	--	---	--	---

Figure 3: Where we work.

Over 100 people – Alliance staff, volunteers and external people interested in the use of the tool – have been trained in the use of the FRMC. Roughly 200 dissemination workshops and meetings have taken place to distribute and discuss results of the FRMC with stakeholders, local governments, and most importantly the communities with whom we work.

Together with our Alliance research partners, external experts from the resilience, and measurement evaluation space, as well as with our software and analytics partner IBM, we have conducted significant research and data analysis to achieve the following:

- Using a five-step iterative validation process, review whether our resilience approach is valid and, as far as possible, to ‘prove’ that resilience can be measured, validate our framework;
- Review the key findings of the measurement across all programs and communities to help community partners make better informed decisions and thus improve community programs;
- Use a variety of methods including enhanced statistical analysis to facilitate the process of reducing the number of measurement points and to reduce the complexity of the measurement framework to provide an enhanced and simplified version of the measurement framework for a second phase of the Alliance. We have reduced the number of sources of resilience to be measured to 44.

Full validation will take many years to achieve, as it requires more data to be collected over time and more contexts of the application. Our research does, however, indicate that we have provided the most extensive application of a resilience measurement framework of which we are aware. It also suggests that the usability of the framework is as an important aspect as the results; and that the concept is consistent in itself. Lastly, it suggests the initial analysis of the overall dataset is an encouraging indicator that we are measuring community flood resilience – data analysis shows correlation between the sources of resilience and flood resilient outcomes.

The validation and review process, including many interactive sessions with our implementers in the field, also highlighted the potential for a number of improvements and simplifications. Following this, the Alliance has developed and built a 'next generation' measurement framework and tool that is ready for use by the start of the second phase of the Alliance in July 2018.

"There is a lot of information we needed to collect in household interviews. We were afraid this would take up too much of people's time, but in fact they appreciated that we took the time to ask about their experiences."

4.1.3 Flexible, long-term programming and financing

The resources that were invested were based on the assumption that a long-term approach, over five years, helps us achieve much more than short-term project-based funding. Funding was also flexible in the sense that it was not tied to a rigid 'log-frame' program delivery – we wanted to avoid programming based on pre-planned interventions that would be built regardless of what the actual program interaction with the communities would yield. This flexibility encouraged a step-wise approach to identify and develop suitable solutions. Testimonials for the appreciation of this approach include:

"This is almost doing programs the other way around – and the way it should be."

It also focused heavily on the interaction and process part – not just the pure results and numbers that should come out at the other end of the program. In-depth conversations around the topic of flood resilience and how it can be strengthened in local context helped bring new perspectives to both local staff and the communities:

"The process is almost as valuable as the data and results. It brings people together to think consistently about resilience. It helps us think and creates discussion that go beyond business as usual and leverage the full resilience spectrum."

This is an important finding that we heard consistently across the Alliance and one to keep in mind when trading off the resource implications of applying such an in-depth resilience measurement approach with the well-understood intent for simplification and automation.



There is space to innovate and use existing data to support and streamline the data collection process for the measurement. However, there should be a word of caution that the assessment process: grading the sources of resilience is as much a science, based on hard facts, as it is an 'engineering judgment.' This is an important social interaction that is best done with expert teams who know the community context and therefore one that should not be automated. There are automated indices and census-based algorithms already available which have their value, but they are significantly different from what we have achieved with the resilience measurement framework.

In addition, we are aware that setting up and running such a partnership model, beyond the financial commitment, is not easy and needs appropriate, dedicated resources. An intermediate learning review conducted by external contractor The Partnering Initiative (TPI) found that the setup brought about a number of structural and operational challenges and was not always efficient. Yet, as one of the partner's program manager puts it:

"In my experience, resilience in general (not just flood resilience) is not a quick fix but requires a continual cycle of awareness, planning, implementation and reflection, all of which requires time and resource. Zurich is fairly unique as a private sector organization investing time and effort in this way."

4.1.4 Creating an Alliance vision, and a spirit of sharing and learning

It takes a long time and a significant effort to build an Alliance of diverse partners that would not typically work together on a daily basis. It has taken time for all partners to understand exactly how and why each other's input help to create the outputs, which together generate the change envisioned in the Alliance's objectives. They have needed to learn about each other's strengths and weaknesses, find a common language, build clarity and gain trust both on a strategic and operational level.

Strategically, there is a significant difference between working together based on loosely aligned individual agendas and having a common vision. This requires the trust to shift outlook from an 'institutional' to 'alliance approach.' Operationally, significant trust is needed to rely on others to play their part in delivering joint outcomes. This joint vision and team spirit has emerged over the years of the first phase and culminated in the vision and problem statement outlined earlier in this report (See Figure 1 on page 15), which we believe is a major achievement.

Looking back over the last five years there have been a number of lessons learnt, including the need for structured and constant leadership. The learning review found that changes in personnel, including executive sponsors within Zurich, were seen as challenging to keep the direction and focus of the Alliance. It is also clear that Zurich is a partner, but at the same time also its instigator and funder – a potential conflict of interest that should be kept in mind when operating such programs.

4.2 Community programs

4.2.1 Input

The Foundation made contributions to all partners over the course of the program, totaling CHF 36.83 million. This included CHF 12.2 million to IFRC, CHF 9 million to Practical Action and CHF 3.44 million for research partners. In addition, the Foundation has also invested CHF 655,000 for Concern;

CHF 600,000 for Mercy Corps; CHF 600,000 for NAS and CHF 320,000 for Plan International. The Foundation supported flood projects through the Global Resilience Partnership's Water Window with an investment of USD 10 million. The Water Window is not part of this report, but mentioned here for the sake of completeness. Funding comprised staff and expense costs for partners at head office and country level, running costs for operations,

as well as costs for building and maintaining resilience interventions. These were not just physical 'grey infrastructure' type interventions, but a wide spectrum taking account of the 5C-4R resilience framework.

The Foundation's financial input into the Alliance members' community programs was CHF 28.7 million for the total of the period of 2013-2018 (in addition to the USD 10 million into the Water Window). This is split as follows:

Organization	IFRC	Practical Action*	Boundary partners	Research partners	Water Window
Financial input (in CHF)	Indonesia: 3,648,000		NAS: 600,000	IIASA: 1,94,000	USD 10 million
	Mexico: 3,595,000		Plan: 320,000	Wharton: 1,500,000	
	Nepal: 320,000		Mercy Corps: 600,000		
			Concern: 655,000		
(in CHF)	Total: 7,563,000	Total: 9,000,000	Total: 2,155,000	Total: 3,440,000	Approx. 9,900,000

* Note: The total contributions to the Practical Action, were to enable them to contribute to all aspects of the program. The numbers reported in the table, cover their inputs to community interventions, knowledge creation and advocacy work. The total contribution to IFRC was CHF 12.2 million, of which CHF 7.563 million went to community programs directly.

Zurich's financial input into the community program for the period 2013-2018 covered approximately 2,420 work days of staff fully employed for the program plus further unquantifiable cost derived from significant senior management input and participation. There was an expense budget of approximately CHF 1.25 million. This was used to build the flood resilience measurement tools (a major expense), to cover the expenses of involved Zurich staff, to host events and cover contracted PERC costs, and finally to cover consultant contracts for tasks which the Alliance lacked in-house skills. Examples included professional facilitation or the development of learning and training materials.

Zurich further committed resources at local country level in Indonesia and Mexico where Zurich has an office presence and where programs were run. This included local program liaisons, technical support by skilled employees, and corresponding expense budgets. There were also unquantifiable costs derived from significant senior management input and participation (including country CEOs.)

4.2.2 Output

The **IFRC** developed, together with the communities of the program:

- **67 community risk maps** to identify high, medium and low flood hazard areas and discuss these findings with local stakeholders for future decision-making;
- **42 community surveys;**
- **71 vulnerability and capacity assessments (VCA).** These support collaboration with community members, helping them to identify their vulnerabilities to floods and their capacities to prepare for, reduce the risk of, and respond to floods.

Following these assessments, interventions that help build flood resilience, included:

- **3 major reforestation campaigns** (12,000 trees planted);
- **67 community mitigation plans** focusing on how to manage flood risks locally;
- **Waste management centers** recycling waste and educating the public about minimizing garbage to reduce its inflow into rivers and drains who then get blocked and increase flood risk;

- **Hydroponics** in 275 locations serving 20 communities, providing a source of food during and post floods as well as potential new livelihood strategies (generating new income). 67 small-scale physical flood mitigation works such as the improvement of roads, bridges, culverts and the creation of an innovative, simple-to-build animal protection shelter during floods;
- The construction of four multipurpose **evacuation and community centers** as safe shelter during floods;
- **Community-based first response training**, with 268 local people trained in advanced first aid and approx. 23,000 people trained in community first aid;
- **70 community brigades** serving their local population as first responders. 45 brigades in Tabasco, Mexico were formally certified by the Mexican Civil Protection Agency. This was an unprecedented recognition which may act as nationwide best practice;
- **Community-based emergency plans** including emergency family plans for 15,300 families;
- **School-based education courses** on flood risk and innovative ways of raising flood awareness such as puppet theatres.



Practical Action's focus areas were on:

- **End-to-end EWS** with 12 new rain gauge stations in operation; 11 million alert messages sent to communities in the last floods, and 40,000 people who have access to local flood information. Overall, this led to more frequent and improved quality forecasts, and increased lead times for warnings and weather boards at central stations. It brought information to the local people, including the most vulnerable. In Nepal, there was a strong focus on connecting the upstream and downstream parts of the rivers to the EWS, with significant progress in establishing cross border early warning and collaboration between Nepal and India. This resulted in 400,000 people in India receiving early warning messages. Through innovative new methods including 3D printing, Practical Action Peru established five monitoring systems; 76 rain gauges and built four monitoring stations.;
- **Training of several hundred 'local resilience agents'** to support community members; and training of over 1,000 community members in first aid, search and rescue, and the use and understanding of EWS. This was in addition to the training of community brigades and the official recognition of them by government;
- **Capacity building and training** of several thousand people on farming and improved livelihood activities. The creation of 'farmer groups,' linking these to markets through dozens of farmer's field schools. Building of safe animal shelters;
- **Building physical flood protection** such as drainage ditches, safe evacuation bridges and routes, evacuation shelters and emergency equipment warehouses;
- The creation of **community based organizations** such as 89 Community Disaster Management Committees (CDMCs) in Nepal engaged in DRR, connected to the local government;
- **Advocacy at global and national level.** This contained an increased focus on flood risk prevention and the mainstreaming of the resilience topic with national governments, who wished to scale the successes in particular around the improved forecasting abilities and the increased access to good monitoring data. Practical Action Nepal worked at different scales to improve government flood early warning capacity at the national, subnational and local levels, thus ensuring greater connectivity between the various actors involved in the flood EWS. An engagement with media led two telecommunications companies to partner for EWS message dissemination. There was an agreed extension to turn this into a five years project, with 12 radio episodes talking about DRR best practices. Practical Action Peru has conducted various media campaigns, had 120 press appearances and discussions with government. This led to the creation of an integrated watershed plan in Piura, a national guide for flood prevention plans and the commitment to create a risk observatory with/in the Peruvian Congress;
- **Knowledge production and dissemination** through awareness raising and the creation of information sharing platforms. The creation and discussion of flood hazard and risk maps (since scaled out and replicated by INDECI – Peru's civil defense) and evacuation mock drills. Access to expert information and the creation of the Flood Resilience Portal¹¹ on behalf of the Alliance including local language versions in Nepali and Spanish (the Spanish portal is the largest one dedicated to the flood topic). Providing easy access to a wide range of materials on flood resilience and early warning.

¹¹ <http://www.floodresilience.net/>

Concern Worldwide focused as a boundary partner on the implementation of – and the learning from - the flood resilience measurement framework and how it can be integrated into their ongoing programs.

- In addition to the measurement implementation itself, Concern provided **training on flood resilience** to an average of 15-20 members in each program community;

Following the baseline measurement, resilience-building interventions were discussed, selected and implemented. These were diverse in nature and address all of the five capitals:

- **Physical capital** was built through flood infrastructure projects, such as safe evacuation roads, gabions, retaining walls and check dams;
- **Human and social capital** were targeted through the development of numerous flood resilience community committees or CDMCs that were available to the community before, during and after floods. There were also campaigns on DRR and first aid;
- **Natural capital** was enhanced through the promotion of sustainable technologies such as solar ovens (reducing the need to cut down wood for fuel) and the planting of trees;
- **Financial capital** was improved by generating additional income from livelihood activities such as fruit farming and community employment in infrastructure works.

Part of these outputs were funded by and/or scaled to the DFID project 'Strengthening the Resilience of Afghanistan's Vulnerable Communities against Natural Disasters (SRACAD).'

- Concern also undertook **national advocacy initiatives**, including consultations with government agencies such as the Afghanistan National Disaster Management Authority (ANDMA) and the Afghanistan Directorate of Rural Rehabilitation and Development (DRRD), the Haitian Civil Protection Directorate, and with district governors and others. This had the dual benefit of creating support for the Alliance within the government authorities and securing necessary permits for program implementation. And it worked with a consortium of NGOs such as Afghan Aid, Action Aid, UNEP and others working under SRACAD in Afghanistan and with Care, Solidarité Internationale, Goal Haiti, the French Red Cross and others in Haiti.



Mercy Corps facilitated the implementation of the FRMC and supported related community-level activities in Indonesia, Nepal and Timor-Leste:

- In **Indonesia**, the implementation was accompanied by local research organizations such as with 12 researchers from local partner Initiatives for Regional Development and Environmental Management (IRDEM). Together, they developed a very comprehensive, locally contextualized and supported process to disseminate and discuss measurement results with the communities along the Semarang City West Flood Canal. This also built a solid basis for **decision-making**, as well as advocacy for support and investments from key city government offices for community-driven solutions to build floor resilience. These efforts were beyond the scope of the Zurich program but still worth implementing. Using the results from baseline study, Mercy Corps' implementing partner, the Initiative for Urban Climate Change and Environment (IUCCE) assisted 16 communities to develop community-based disaster risk management plans. They helped these communities to socialize priority actions with government representatives and helped them align with ongoing government programs and city priorities. Mercy Corps implemented as part of the Zurich program interventions including:
 - Establishing and strengthening the disaster preparedness groups;
 - Strengthening community-based waste management to reduce flood risk caused by garbage that disrupts drainage systems;
 - Strengthening networks for the dissemination of flood related information through online media information platform that enables residents to share and access information and through WhatsApp groups;
 - Media for flood related information sharing.

- In **Nepal and Timor-Leste**, the program field staff aligned the implementation of the FRMC with the 'Managing Risk through Economic Development' (MRED) program. This is one of Mercy Corps' regional **flagship resilience initiatives**. MRED applies a 'nexus' approach, with the aim of reducing the human and economic losses associated with climate and ecological shocks and stresses by incentivizing DRR measures through market-based initiatives. Program teams were able to synchronize MRED's implementation plans with the objectives of the Zurich program. The measurement results helped the teams in Nepal and Timor-Leste better understand and analyze the resilience sources that were most closely linked to flooding. The baseline results were then aligned with the community priorities outlined in the Community Disaster Risk Management Plans (CDRMP), with each district determining mitigation actions to implement as part of the FRMC. Mercy Corps implemented as part of the Zurich program the following interventions:

- **Financial literacy classes** and formalization of Village Savings and Lending Associations (VSLA) to support savings toward emergencies and flood resilient, productive investments, benefiting 981 individuals in Nepal and 1,856 in Timor-Leste. In addition, local savings and credit groups received institutional management training, to ensure they provide better services to their clients. In Timor-Leste, this led to VSLAs supporting 275 members to generate CHF 33,587 of savings, and access CHF 4,941 in loans;
- Community-based first aid training and mock drills directly included 166 individuals in five communities in Nepal, but benefited the entire community population;
- **Improvement of EWS** such as gauge reader training, the installation of flood displays in central places accessible to the communities, improving the quality of river monitoring data at gauge stations, and the development of an EWS app; in Nepal, this app benefited 15,542 households (77,710 individuals);
- Improving physical infrastructure for flood protection and response, including evacuation routes for 47 households (390 individuals) in Nepal, and construction of gabion flood walls that benefited 207 households (1,324 individuals) in Timor-Leste;

- Use of **green infrastructure** such as green dikes, reforestation of deforested areas and the plantation of bamboo. The population that benefited from protected lands included 649 households (4,088 individuals) in Timor-Leste, and 254 households (1,959 individuals) in Nepal;
- Government awareness and capacity-building, including working closely with the local Disaster Management Cluster to support revitalizing and strengthening local disaster preparedness and response plans in two Nepalese districts.

The **National Academy of Sciences' outputs included:**

- **Two communities** participated in the program: Linn County, Iowa and Charleston County, South Carolina;
- **Three NAS staff trained;**
- **Disaster preparedness training** taught by the San Francisco Community Agencies Responding to Disaster (SF Card) to 19 nonprofit organizations;
- **Meeting between Linn County/Cedar Rapids stakeholders** (from local, county and state government; nonprofits; and academia) and representatives from the federal interagency working group Mitigation Framework Leadership Group (MitFLG). This focused on planning and financing local mitigation efforts.

Planning of a **Cedar Rapids Flood Resilience Symposium**, held June 19, 2018, which commemorated the 10-year anniversary of the 2008 flood. For this event, the NAS team organized a one-day symposium to address some of the community's main resilience and flood challenges identified by the results of the FRMC. Specifically, the NAS expects to organize panels around: watershed management, vulnerable populations and disaster preparedness, local government flood

preparedness and mitigation efforts, incentivizing flood resilience, and/or social networks and disaster preparedness in rural communities. The City of Cedar Rapids will kick off the 10-year event with the unveiling of the Federal Emergency Management Agency's (FEMA) high-water mark sign. One of NAS' ground team members who is an active member of Linn Area Partners Active in Disaster (LAP-AID) was inspired by its July 2017 NGO disaster preparedness training event. Not only has she revamped her organization's (United Way) preparedness documents and implemented emergency operations training for her staff, but she is also going to organize additional NGO capacity building training during the 10-year commemorative anniversary for the LAP-AID partners.

In both Cedar Rapids and Charleston, NAS' work has focused on implementing four key recommendations from the 2012 National Research Council report, "Disaster Resilience: A National Imperative, for building community resilience:"

- Understand and communicate risk;
- Measure resilience in communities;
- Build or strengthen partnerships with vested stakeholders;
- Share and get access to information, tools, data and relevant experts or expertise.

Beyond the implementation of the FRMC, which helped achieve recommendations two and four above, the NAS also completed a post-flood analysis of the September 2016 flood along the Cedar River. This crested at about 6.7 m (22 feet), the second-highest level in Cedar Rapids' history. The catastrophic 2008 flood in Cedar Rapids crested at about 9.4 m (31 feet). The NAS also completed the post-flood analysis of the October 2016 Charleston flood. Hurricane Matthew made landfall just north of Charleston bringing strong storm surge and heavy rain.

Scaling/advocacy opportunities by the NAS included:

- A presentation at the September 2017 **Joint Annual Conference of Academia Europaea and ALLEA** in Budapest, Hungary about the Resilient America Roundtable pilot community program and flood resilience work in Charleston and Linn County using the FRMC;
- A presentation at the October 2017: **NIST Community Resilience Panel Meeting** in Minneapolis, Minnesota on Resilient American Roundtable's flood resilience work in Charleston and Linn County using the FRMC;
- Working with Charleston stakeholders including the **Charleston Resilience Network (CRN)**, to organize knowledge exchanges. CRN is very interested in building relationships with other communities that experience floods and partnerships with other local stakeholders;
- A forthcoming article to be published in the **European Review Journal** about the Resilient American Roundtable pilot community program and flood resilience work in Charleston and Linn County using the FRMC.

Plan International worked in Nepal and has implemented the following activities, working with their unique child-centered approach in two communities in the Koshi river basin:

- **Integral training** on key aspects of disaster risk management (DRM), such as DRM planning, first aid and community-based early warning systems;
- **Training teachers and children** through curricula and competitions;
- **Livelihood trainings** with a focus on agricultural/cooperative training;
- **Infrastructure measures** like shelters, river embankment stabilization and elevation of critical infrastructure for flood protection;
- **Convening of and networking with CDMCs** and local government;
- **Mock flood emergency drills;**
- Campaigns to set up a **community flood disaster fund.**

4.2.3 Community program impact

Has flood resilience been strengthened in the communities in which we worked? Using the FRMC in all our program communities, we find that overall there is a very positive direction in resilience between the start and the end of the programs. Many communities are increasing their flood resilience in all five capitals and many more in four out of the five capitals. With very few exceptions, resilience measurement results have gone up in all program communities over the duration of the program. This is a very positive trend. Relative increases between baseline and end line scores, while consistently trending upward, have quite a wide variance. The same is true of the absolute values. It is beyond the scope of this report to present details for each country program or

community, but positive changes in scores are commented on in several individual program impact sections.

One important – but unquantifiable – impact has been the level of collaboration, exchange and sharing of knowledge across country programs. This may not become clear from the individual impact sections below. However, at Zurich, facilitating and moderating workshops and peer-group events with practitioners, users of the measurement framework, and program leaders was always a delight and we believe the level of interaction, and subsequent identification of similarities and synergies, across programs and organizations was outstanding. This is corroborated by consistently high feedback scores on the quality and usefulness of these events for participants.

<p>Concern</p> <p>Haiti: 7,279 households (36,395 individuals)</p> <hr/> <p>Afghanistan: 2,030 households (12,830 individuals)</p>
<p>IFRC</p> <p>Indonesia: 21 communities served with 128,528 direct beneficiaries</p> <hr/> <p>Mexico: 21 communities served with 10,000 direct beneficiaries</p> <hr/> <p>Nepal: 25 communities served with 42,700 direct beneficiaries</p>

<p>Mercy Corps</p> <p>Indonesia: 3,534 households (14,136 individuals)</p> <hr/> <p>Timor-Leste: 681 households (4,290 individuals)</p> <hr/> <p>Nepal: 254 households (1,959 individuals) directly, as well as 13,821 households (77,710 individuals) indirectly through upgrades to EWS</p>
<p>Plan</p> <p>Nepal: 1,034 households (5,600 individuals)</p>

Funding leveraged

Funding leveraged from governments to invest more in flood resilience-related activities, plans or infrastructure:

Organization	Concern	IFRC	Mercy Corps	NAS	Plan	Practical Action
Currency/value leveraged	–	CHF 850,000	Indonesia: CHF 711,056	not quantified ¹²	~ NPR 4 m	NPR 1 m; plus 5% of local budgets to DRR

In addition, Mercy Corps was able to scale implementation of the FRMC from Semarang City to upstream areas in the Garang Basin, through the Foundation-funded GRP-TRANSFORM Program, amounting to a total value of CHF 936,570.

¹² In Cedar Rapids, a comprehensive flood control system is under construction as part of the city's wider flood resilience efforts, and Linn County has issued a USD 40 million conservation bond to improve water quality.



Partner Impacts:

IFRC

Since 2013, the country programs in Mexico, Nepal and Indonesia have **combined local community knowledge with humanitarian and private sector expertise to enhance flood resilience across flood-prone communities**. The program's operations built on the yearly gains achieved to facilitate diverse connections between people, communities, and the systems that support them. Country teams focused on working in partnership with multiple actors as well as through local champions to strengthen opportunities for positive change.

In Mexico, this included the establishment of formal linkages with the Mexican Civil Protection agency and the certifications of all Alliance community-based brigades. This supported more than 10,000 people living in flood-risk communities. In addition, it included the internal development of the Red Cross National Societies, who now have resilience experts and have expanded their area of work much more from response to resilience. The Mexican Red Cross has formed a resilience expert committee and is planning to expand the program's approach to other states beyond Tabasco. In the last 12 months they have also developed their first national resilience strategy.

In Indonesia, impacts include the full implementation of the early warning early action system (FEWEAS) for the Citarum and Bangawan Solo river basins. The system covers over 26 districts/municipalities and could reach over 40 million people. Other impacts include the construction of two evacuation buildings with a capacity of sheltering several hundred people during annual flood events, as well as a flood resilience innovation conference in Jakarta with over 130 people from more than 30 organizations participating. The conference showcased the 18 best innovative projects identified through an innovation challenge and lead user process.

Practical Action

Leveraging the flood resilience investment case. As a result, local government bodies have allocated 5 percent of their total resource budget to DRR; two municipalities are committing more funds to DRR and unions have set aside a separate disaster fund specifically for disasters. Trainings have measurably enhanced the income farmers make and can set aside for emergencies, for example through a flood-tolerant rice variety and other, flood-diversified livelihood activities. And several municipalities have provided land and funding to build community centers jointly with the program. Some 30,000 people now use weather and climate services for their agricultural planning; and flood is now formally prioritized as the number one hazard in several districts of Practical Action's program;

Improved warning times and subsequent reduction of loss of life and damage from the work on EWS. In Nepal, warning lead times of the EWS have increased from two to three hours, to five to seven hours lead time, and loss of lives is lower compared to river basins without EWS. Practical Action is now nationally recognized as a leader in floods EWS development, supporting government to integrate EWS into the overall disaster risk management cycle and to link weather and climate forecasts to EWS and disaster response planning. In Bangladesh, long-term lead times have increased from two to five days. In Peru, communities in the Piura region are able to monitor the danger of flooding and activate a response plan to protect lives and belongings. This enabled communities to respond effectively to reduce the loss of lives and material damage during the 2017 flooding. There was no loss of life in the program areas during the devastating coastal El Niño flooding;

Leveraging best practices and success cases from Practical Action's programs. Local partners have replicated several best practices in other donor funded projects, and governments have adopted and officially recorded the resilience activities communities have performed;

An improved health status of the population with lower disease numbers, in particular related to water- and flood-borne diseases due to the water and sanitation hygiene (WASH) campaigns, compared to other communities;

The empowerment of communities, who are now more aware and in control of their flood risks. They have been trained and feel competent in safe behaviors before, during and after floods. They possess and understand hazard and risk maps (many of which have been digitized through innovative crowd-sourcing and 'hackathon' approaches together with IIASA). They have access to safe evacuation routes and shelter and were able to successfully implement and test their flood protection infrastructure, including improved drainage and more stable and/or naturalized river banks;

Overall; there has been a **shift in attitude** in the population and local governments from disaster response to proactive planning and actions for DRR. Communities have taken on more responsibility and are more involved in disaster response. For example, this has had local and national political implications in Peru. There, community demands are informed by greater knowledge and ability to shape disaster risk management.

Concern

One major learning has been that community programs should not be considered as 'stand-alone'; they should be integrated as far as possible into other aspects of the organization's DRR activities to enhance their impacts. This approach increases the relevance and understanding of the program within the implementing organization. Secondly, it is important to invest the necessary time in training up front. Third, learnings should be shared across communities, whether they are Concern's partners or those with whom other Alliance partners work.

The main impacts have been:

A very encouraging direction of travel of the flood resilience for the program communities. This includes the increase in flood resilience scores for most if not all capitals, and the ownership taken on flood resilience activities. Community members feel better prepared and demonstrate better knowledge on the subject. And the sense of collaboration is demonstrated by the highest increases in social capital scores;

Successful implementation of resilience-building interventions. This is demonstrated by a preliminary analysis of the measurement increases, in sources targeted by relevant interventions compared to other sources of resilience. In addition, there has been a demonstration of innovation and adaptive capacities in the communities. These are an important component of resilience;

Reaching the most vulnerable and marginalized, as demonstrated by a better representation of those groups at committee level and in the participation of flood resilience planning and decision-making processes. They and the entire community have also been provided with improved access to services such as markets, institutions and infrastructure;

Improved natural environment due to less uprooting and cutting of fire wood and a sense of conservation, as well as the planting of fruit trees and seeds.

At program level for Concern, there were significant differences between the intervention-design approach adopted as part of this program and other programs implemented with private sector support. With many private-sector supported programs, data collection and analysis takes place and interventions are designed **prior** to a funding

application, whereas in this case Zurich provided very significant scope for Concern and the other partners to carefully consider the most appropriate interventions/solutions **after** the funding was approved. The value of this approach cannot be underestimated and the level of trust that Zurich provided to its partners in this regard is significant. This is reflected in the project design process; whereby extensive data collection, analysis, reflection and community engagement informed the overall objective and outcomes of the project. This process gave staff the opportunity to design a project that was appropriate and based on much reflection and deliberation between key project staff. This also led to an improved understanding of resilience with Concern and the communities with whom they work. The scope and nature of the Alliance was such that it has helped to build the understanding of resilience throughout the organization. The program requires a high degree of collaboration within and beyond the organization, both within Concern and with other partners. This has had the effect of building our capacity within the area of flood resilience, something that we see as critical due to the significant impact that flooding has on the communities with whom we work.

Plan International

There is a strong feeling that the project has left a positive impact, including the following achievements:

The project has contributed **to enhancing knowledge on flood risk management, and skills for life saving.** It also enhanced skills for alternative income generation which leads to improved capacity to access better resources. It improved preparedness for rapid action and strengthened knowledge and skills. Working with Plan's unique children-centered and school-based approach increased children's knowledge of flood risk management and therefore, the preparedness of one of the most vulnerable groups of society during disaster events.

It has helped **scale the flood resilience knowledge** beyond the Zurich program. The flood resilience framework has been transferred to other projects, such as ongoing child-centered DRM (CCDRM) projects and in gender transformative community resilience projects in Nepal. In addition, the project has disseminated the knowledge through orientation to other thematic areas of our NGO partners.

Leveraging investments in community flood resilience: In Plan's project sites, as a result of its continuous interventions, the local government has started to budget more for flood risk reduction. Since 2015, a total of approximately NRP 4 million has been set aside for: soil conservation, flood protection infrastructure and disaster prevention, a local disaster emergency fund, and for livelihood diversification. This led to the general empowerment of the communities to interact more with governments and request required protection budgets.

CDMCs have been institutionalized from the project motivation in both program communities, with high local community participation. In addition, brigades have been set up and trained to help in search and rescue, first aid and emergency communication.

Improvements of natural capital include the greening of river banks, e.g., by planting native species. This also led to behavioral changes. For example, where river banks are often encroached for settlement, people learnt that river banks can be used for the restoration of the riverine ecosystem. These also provide ecosystem services against flooding and are a valuable community resource to be protected.

Improved physical infrastructure including the communities' school buildings, as well as the creation of a solid waste management process. In addition, safe shelters resistant to various hazards have been constructed, alongside three culverts for improvement of access to school for children.

Mercy Corps

Activities can be viewed through the positive change in community resilience scores, particularly with respect to the specific indicators the program addressed. This is true both through the Zurich program, and partner programs that applied results and analysis from the tool. In addition, in each Mercy Corps' country, there was considerable impact from:

- Government institutions' buy-in into key activities and processes highlighted by the application of the FRMC baseline and subsequent decision-making process;
- Leveraging and connecting funds with other programs. This included leveraging existing programs to support and scale the Zurich initiative, or using the application of FRMC to advocate for increased funds.

Importantly, not all of the increases can be attributable to the Zurich program interventions alone. Many simultaneous interventions related to flood resilience. This included Mercy Corps' partner programs, which were working in the city simultaneously. However, some of the greatest increases can be connected to the Zurich program interventions. **In Indonesia**, the 16 sub-districts along the West Flood Canal of Semarang City where Zurich intervened showed a considerable improvement in resilience scores, across all frameworks. **In Nepal**, a number of the communities in which Zurich intervened already had relatively high

resilience scores, due to the interventions of its Managing Risk through Economic Development (MRED) program. Nonetheless, an increase can be seen in combined resilience scores across all communities. This was due to the joint work of the MRED and Zurich programs in community implementation in 2017 and 2018.

In Timor-Leste, the impact is quantified by the large, positive increase in resilience scores across all six program communities.

National Academy of Sciences

National Academy of Sciences (NAS) took a different approach to utilizing the FRMC, leveraging this work with other initiatives being funded, and connecting the data analysis to wider efforts of the 'Resilient America Roundtable.' They have had a positive impact, especially in influencing local government resilience planning, creating opportunities for creative thinking around solutions to resilience challenges, and bringing together diverse stakeholders.

The process of the data collection itself and the assessment brought stakeholders together that may not have opportunities to exchange information and learn from each other. In U.S. communities, there are often multiple organizations and people working on resilience issues in one of the five capitals. However, disciplines tend to be siloed in a particular area and miss chances to leverage each other's work for broader impact. By bringing together

diverse decision makers and community representatives, new relationships were made and participants engaged in discussions around their resilience challenges and creative ways that they could start to address these challenges. In at least one instance, the collected data was used to support a local organization in applying for a grant that would help build resilience in vulnerable populations of the community. In addition, the data and process have been presented by community stakeholders at workshops and other meetings to support broader resilience initiatives and goals. The process of building resilience through cultivating relationships, identifying challenges and priorities, and engaging the entire community in discussions is an important act of strengthening resilience. The FRMC is a great tool for engaging the community and bringing stakeholders from diverse sectors to the table to discuss common challenges. While the data is certainly important and useful, the process was equally valuable and provided a foundation for helping communities to have a productive conversation about their issues and potential solutions.

Becoming more resilient requires a culture shift and that shift starts at the local level. One observation was that sometimes even the most committed communities need a catalyst. Using the FRMC as a foundation helped the roundtable serve the role as catalyst.



Transforming communities through inclusive DRM activities (Plan International in Nepal)

During the whole project cycle, a special emphasis was put on the inclusion of the most vulnerable groups of society in the two communities – Kritiman, Letang Municipality and Pulthegauda-Jabdi, Barahchhetra Municipality. In particular, this meant women, children, marginalized groups like Dalit and ethnic minorities like Janajati.

Successful examples of Plan International Nepal, implemented through the local partner FORWARD Nepal, were the formation of the CDMCs and its search and rescue and first aid sub-committee. Here, women and children were actively represented. Expressing her happiness about the work atmosphere, Mrs. Mina Majhi, Joint-Secretary of CDMC of Kirtiman tole, Letang municipality-3, in the Morang district said: "Our Community Risk Management Committee (CRMC) is accepting concerns of women with due importance. Similarly, voices of children are also considered attentively in the committee." Based on the proposal forwarded by women in the meeting of the CRMC, it has implemented a Duna-tapari business as an initiative for livelihood. Similarly, based on the proposal presented by children, a culvert has been constructed over a small stream branched out of the Chisang river. Without the culvert, children were facing problems in crossing that stream while going to and coming from school.

This is a long and challenging process that needs well targeted facilitation. There will be a key role for social mobilization, discussions at different levels as well as ensuring the active participation of women and children and other marginalized groups in the risk assessment. This will highlight their high vulnerability in disaster situations. Creating positive role models is another vital part of the change process: Documentaries were screened showing popular female figures who are active in their communities. This brought a feeling among community members that women can also actively contribute. Additionally, the mobilization of female facilitators e.g., a female instructor from the armed police force, encouraged female participants to actively participate in the search and rescue training and in the sub-committee.

In addition to the pure numbers and the narrative on impact in this report, please watch our flood resilience journey video, highlighting some of the change we have achieved over the five years of the program.



4.3 Knowledge generation and sharing

4.3.1 Knowledge input

Over the course of the last five years, there has been increasing focus on how the Alliance generates and shares knowledge. In addition to the work that Practical Action has done on the Flood Resilience Portal (as part of their funded program), the Alliance has:

- Introduced a shared resource – the Flood Resilience Knowledge Catalyst – to coordinate production and dissemination of knowledge products;
- Made investments into joint knowledge products such as a series of policy briefs that support our advocacy positions.¹³

Neither of these necessitated additional financial input from the partners.

4.3.2 Knowledge output

While all partners were able to contribute to the generation and dissemination of knowledge, Practical Action, through their dedicated subsidiary Practical Answers took the most strategic responsibility. As the program progressed, it became clear that we needed to coordinate efforts in order to capture all of the lessons that we were learning on the ground. This led to the recruitment of our knowledge catalyst, jointly funded by all partners and housed in Practical Action. The delivery of knowledge outcomes has been significantly accelerated in the last two years through this role, which focused on both intra-Alliance communications (how we

shared and developed knowledge together) as well as external knowledge management.

In total, the Alliance produced **341 knowledge outputs** aimed at a wide variety of different audiences. These outputs included academic journal papers, practitioner-focused toolkits and solutions, policy briefs, infographics, videos, blogs and many more.

Internally, the creation of a useable document management platform was a key challenge. After a number of false starts, we developed a platform, which allows the storage of common documents across the Alliance as well as a space for creation of joint materials. The knowledge catalyst also developed the process and format for internal newsletters. These captured what was happening with all partners, and shared in both English and Spanish. Around 40 to 50 percent of recipients consistently opened the newsletters, and the feedback received from both the head office and field staff was positive, indicating that this helped bridge the gap in information flow from the Alliance.

During the last two years, the knowledge catalyst has convened quarterly program manager meetings across all partners to share processes, to ensure knowledge is produced consistently and to capture lessons learnt. One important output from this process was the creation of a series of policy briefs. These have been used with potential stakeholders, for example at the United Nations International Strategy for Disaster Reduction (UNISDR) Global Platform in Mexico in 2017.

The core focus for external knowledge brokering has been the creation, development and maintenance of the Flood Resilience Portal. These are available in English (on the global site), Spanish (primarily aimed at Latin America) and Nepalese:

Global: www.floodresilience.net
Spanish: www.infoinundaciones.com
Nepal: www.floodresilience.net/np

The sites are a collection of ‘curated’ resources, drawn from Alliance members and others, focused around the single issue of floods. Alliance content comes from blogs, news, research findings and practical solutions individually published by the partners but reviewed and discussed, as appropriate, jointly at Alliance level. This material facilitates and enhances collaboration and shared learning, and is localized on the relevant portal. The portals are aimed at those who are likely to achieve change on the ground for vulnerable communities, such as governments, NGOs, community based organizations (CBOs) and potential funders.

Where we have been less successful is in building a high public profile or communicating the common findings and recommendations of the Alliance more widely. The production of more general Alliance communications materials (for example infographics) has been sporadic – largely because of the lack of a commonly owned and agreed communications strategy.

¹³ <http://www.floodresilience.net/resources/item/investing-in-risk-informed-infrastructure-to-support-flood-resilience>
<http://www.floodresilience.net/resources/item/flood-resilience-through-community-driven-action-and-partnerships>
<http://www.floodresilience.net/resources/item/pre-event-financial-protection-is-key-to-flood-recovery>
<http://www.floodresilience.net/resources/item/improving-accuracy-timeliness-and-access-to-flood-early-warning>
<http://www.floodresilience.net/resources/item/measuring-flood-resilience-the-zurich-flood-resilience-measurement-tool>



Each organization also produced their own materials based on the work of the flood resilience program. For example, a total of 51 videos were produced by **Practical Action** and **IFRC** (available on YouTube) across the period. Practical Action in Nepal also provide materials and support for grassroots ‘information nodes.’ These enable local people to get advice on a wide range of topics, including flood management issues.

Concern produces a quarterly publication, which offers practice-relevant analysis relating to their work. The winter issue in 2017 focused on community resilience. It included an extensive article on their experience of using the FRMC in Afghanistan.

In Indonesia, the local Red Cross Society (**Palang Merah Indonesia – PMI**) in their role working with IFRC, have written a book published in both English and Bahasa. It describes the outcomes of their work for the program and lessons learnt. **Red Cross Mexico** hosted successful media workshops with major news and radio stakeholder. There was also a field level campaign visit with newspaper and magazine reporters to disseminate flood resilience messages to an audience of more than 750,000 people.

4.3.3 Knowledge impact

We believe that implementing a knowledge collaboration process across so many diverse organizations and sectors is an impactful success in itself that should not be underestimated. Early on, we noticed that there is a fair degree of competition in the DRR space. This is often not very productive, and can lead to knowledge siloes and missed opportunities when learning or solutions could be shared. A lack of willingness to share amongst DRR experts and practitioners – even sometimes a ‘prohibition’ to work or talk together – is an unnecessary friction loss. What is in fact needed is to establish a culture of shared values, shared learning and thus shared and maximized impacts.

A key impact of the knowledge produced by the Alliance has been in providing credible evidence to support the partners’ advocacy work, which in turn has had direct impact on the policy and practice. **Practical Action** worked with researchers on developing new research on probabilistic flood forecasting; this led to the Nepal Department of Hydrology and Meteorology (DHM) adapting its EWS to take this into account. Wharton worked with New York City authorities on which types of flood risk management measures are cost-effective.

Knowledge from the Alliance has helped build resilience at community level also, for example, the majority of the partners carried out trainings and provided ‘how to’ guidance (solutions) on livelihood diversification.

The Flood Resilience Portals are aimed at sharing this knowledge beyond the communities in which the program works so that it contributes to a wider body of knowledge on how to build flood resilience at community level.

The soft launch of the Flood Resilience Portal (in English) took place at the end of 2015, but it took another year for the English and Spanish portals to come online fully. In the final six months of the program, the average number of users of the sites had grown to:

Global	486
Spanish	1,044
Nepali	137 (in 5 months)

In total, since the sites came online fully, there have been more than 5,000 downloads and views of information (between Jan 2017 – Mar 2018)

	Download	External	Video	Total
Global	1,262	550	267	2,079
Spanish	1,544	908	147	2,599
Nepali	39	92	316	447
Total	2,845	1,550	730	5,125

There are various options for people to engage directly as a community of practice with the portal – from uploading their resources to asking questions, as well as social media channels and a quarterly newsletter.

4.4 Influencing and advocacy

4.4.1 Advocacy input

Over the course of the program, each partner was engaged with a variety of advocacy efforts. Some of these involved the organization of specific events. Some involved taking part in other people's events. Some were more local level staff engagement. No further investments were made from the program, but staff time across all partners was leveraged for these events.

In 2014, Practical Action, Zurich and IFRC co-organized an event in the Asia Pacific region

on resilience. In 2015, Practical Action organized an event on EWS in the South Asian region, and one on the role of the private sector in responding to climate change. In addition, local advocacy was driven by the project teams in Bangladesh, Nepal and Peru. Local stakeholders were engaged either through individual discussions/meetings or through local and regional events. The number of meetings with individual stakeholders is too numerous to document individually and has been reported separately in annual partner reports. The number of local and regional events that Practical Action organized (not simply participated in) is:

	Multistakeholder platforms	National	Regional	Grassroots
Bangladesh	2	-	-	-
Peru	6	3	3	1
Nepal	-	1	-	-
Total	8	4	3	1

Advocacy and influence strategies for the Red Cross Mexico and Indonesia country programs focused on advocating for and raising public awareness of policies and decisions that reduce risk and vulnerability for in-country flood-prone communities. The main areas of action prioritized over the length of phase one of the Alliance were:

- Influence local, state, and national decision-makers and opinion leaders to recognize the interests of vulnerable people in Mexico and Indonesia;
- Strong visibility for and public understanding of Alliance goals and activities in Mexico and Indonesia;
- Sharing lessons learned for effective private and humanitarian partnerships when responding to the needs of vulnerable people.

Over the course of the past five years, the Red Cross represented the Alliance in over 30 major conferences and forums, including the Regional Latin American Housing Forum, the Regional Latin American and Asia-Pacific Consultation for the World Humanitarian Summit, Indonesia and Mexico National DRR Days, and Association of Southeast Asian Nations.

At country level, the programs were present at the past five National Mexican Red Cross Conventions. Key results include presenting the program's objectives, results, and impact to five different areas of the Mexican Red Cross (youth, women volunteers, disaster management, volunteers and the senior management team), exhibiting key information about the Alliance via our interactive booth, and a community resilience presentation by community representatives. In Indonesia, national community-based disaster preparedness (SIBAT) gatherings allowed over 1,200 SIBAT members to share best practices across diverse communities.

Amongst others, in 2016 Zurich co-organized (together with Wharton) the Forum on the Financial Management of Flood Risks together with the OECD. The forum gathered over 100 regulators, insurers and academics, and positioned Zurich as the go-to insurer for insights on flood risk and resilience. In 2015, the CEO of Zurich North America participated in White House meetings on climate resilience and extreme weather events. He presented our approach to measuring resilience, which led to further meetings regarding the role the insurance sector can play.

A member of Zurich's EMEA public policy team supported the advocacy effort, by engaging directly with EU policymakers. In particular, the employee connected to the Rhine Commission in Germany and to the European Commission in Brussels. This equated to around 0.2 full-time equivalent 'seconded' during the final two years of the program.

4.4.2 Advocacy output

The Alliance and the program's work were presented to a variety of platforms over the five years. In particular (selected list, not exhaustive) to:

- The International Community Based Adaptation Conference (2014, 2015 – Practical Action);
- Understanding Risk Forum (2014 and 2018 – all partners);
- European Evaluation Society (2014 – Practical Action along with IFRC);
- American Evaluation Association (2014 – all partners);
- UN Climate Change Conference (2014, all partners);
- Adaptation Futures (2014 and 2016 – IIASA with Practical Action);

- Integrated Disaster Risk Integrated Disaster Risk Management (IDRIM) Society (2014 to 2018);
- World Conference on DRR in Sendai (2015 – Practical Action and IFRC hosted side events);
- Joined Rockefeller’s Community of Practice on Resilience Measurement – IFRC, Practical Action and Zurich were all invited as individual members (by invitation only);
- UNISDR Global Platform (2017 – Zurich was part of the organizing committee and the official Swiss government delegation, all partners collaborated in organizing a side event);
- Resilient America Roundtable (2017 – NAS and Zurich);
- United Nations High Level Experts and Leaders Panel on Waters and Disasters (‘UN HELP’ – since 2017, Zurich);
- Various events at the World Economic Forum (2017 and 2018 – IFRC and Zurich).

At country level, the focus was on sharing best practice learnt through programing with national level forums and government departments. The emphasis was on improving government actions on DRR measures generally, but particularly on EWS and the dissemination of weather and flood information. In Nepal, for example, Practical Action joined events with the country’s National Planning Commission seeking to include DRR and climate change adaptation in development planning. They also took a prominent role in joint programs with organizations in India. Events were held to enhance cross-border cooperation, including several specific meetings with the head of the South Asian Association for Regional Cooperation (SAARC) to broaden discussion on this issue.

In Peru, the focus was on supporting government agencies to adopt practical approaches to the implementation of well-defined policy. This approach involved playing a prominent role bringing together other NGOs into a DRR network – engaging with the country’s Centre for Estimates, Prevention and Disaster Risk Reduction agency (CENEPRED) and its National Water Authority. For example, the Practical Action team supported the implementation of the UNISDR Resilience Scorecard in the areas where they operated. The team also took a regional

approach, being a prominent member of a network with key regional experts and developing the debate on key topics such as how to take a basin approach to DRR.

A Zurich public policy strategy was created for the EMEA region in 2016. This followed the creation of a global public policy strategy for flood resilience. The global policy informed policy makers of the findings of the flood resilience program and sought more investment in pre-event resilience measures. The EMEA strategy identified important policy makers with regard to flood resilience at EU level and in cross-border European regions. It also identified relevant ongoing policy projects in that area. This included evaluation of the EU Climate Adaptation Strategy, of which action eight addresses insurance against natural hazards.

In 2017, Zurich developed common speaking points on flood resilience and insurability of floods, alongside colleagues from different functions and business units. An example where the speaking points were used was to share knowledge with environmental consultants from Ramboll. At the time, Ramboll was working on behalf of the European Commission, on a study on ‘insurance and natural disasters.’ This study also looked into the contribution that the insurance industry could make to foster resilience. It was published in October 2017.

Throughout 2016-2018, Zurich attended several events at national and European level. These ranged from working group meetings to public events. They were hosted in locations including Brussels, at German federal ministries and at the UK parliament. We shared lessons learned from the flood resilience program, including recent PERC reports and our knowledge on floods and flood insurance. The aim was to inform the public policy debate, strive for more pre-event risk reduction and foster insurability. The lessons learned have further led to new or enhanced services in our risk engineering offers to help customers understand and protect themselves from risk. These include specific flood-related in-depth risk assessments, technical guidance and best-practice information sheets. In addition, a free, public natural hazard and risk assessment platform for individual and small-business homeowners has been built by Zurich’s business unit in Switzerland – the Natural Hazards Radar. The advice and best-practice protection tips of this tool were scaled to other business units and translated into various languages.¹⁴

Under the banner of the Zurich flood resilience alliance, IFRC and Red Cross national societies, advocacy and influence strategies were directly about changes that improve conditions for vulnerable people living in flood at-risk communities. Advocacy initiatives in the country programs in Indonesia, Nepal and Mexico prioritized speaking in support of community members, as well as working with and supporting community members to speak for themselves. All country teams advocacy approaches are based on practical field experiences and ensured efforts closely aligned with and complemented field actions. In Indonesia, the Red Cross program not only trained and equipped 21 local community-based first response teams (locally known as SIBAT), but also effectively brokered relationships between SIBAT teams and local governments. By formalizing this relationship with the National Indonesian Disaster Response Agency (BPBD), local SIBAT teams gained access to added financial, technical and information technology resources to support them with not only emergency response, but key prevention and preparedness campaigning as well.

Researchers supported advocacy on pre-event risk reduction and resilience building, in particular for highly vulnerable communities by organizing sessions at climate and DRR summits, invited speakers and facilitators. As one example, the IASA facilitated a roundtable on risk retention at the May 2017 intersessional negotiations in Bonn as part of the so-called Suva dialogue. Researchers have been invited several times to brief climate negotiators on building resilience against climate-related loss and damage. A IASA researcher was the lead author of the highly expected Intergovernmental Panel on Climate Change’s (IPCC) special report on the impact of global warming of 1.5 °C (SR1.5) on the topic of climate loss and damage. In 2016, the United Nations Framework Convention on Climate Change’s (UNFCCC) Forum of the Standing Committee on Finance dealt with innovative financial instruments that address the risks of loss and damage associated with the adverse effects of climate change. This forum discussed insurance and other innovative finance instruments for dealing with climate-related losses and damages. Alliance researchers helped shape the debate as invited speakers.

¹⁴ <http://zurich.ch/naturalhazards>



4.4.3 Advocacy impact

An innovative Alliance approach

The global discourse and climate change programming increasingly recognizes the importance of innovative partnerships (e.g. including private sector, academia and NGOs) in designing and implementing resilience building activities. The Alliance has contributed toward this change through promotion of the innovative model we have adopted. This has led to several specific global awards including:

- The UNFCCC’s ‘Momentum for Change Lighthouse Award’ in 2014;
- A Convergences’ ‘Special Climate Prize’ in 2015;
- Finalist in the BITC International Disaster Relief Awards 2015.¹⁵

In addition, the program has also been cited in a number of local awards and recognitions:

- Zurich Indonesia won a Corporate Responsibility award for its involvement in the flood program at the Indonesia Insurance Awards in 2016;
- PODER ‘Think Tank of the Year’ award for Practical Action’s work on low cost EWS during the 2017 floods and landslides in Lima, Peru;

- Recognition by CEFIM in Mexico on cross-sectorial collaboration of the Alliance.

The partnership approach (especially the involvement of multiple sectors) provided many more opportunities to engage with debates at a global level, than could have been achieved by individual organizations – it helped to open doors to participation. This includes the Conference of the Parties (COP) held in 2014 to 2017; the UNISDR Global Platform held in 2013, 2015 and 2017; the World Conference on DRR in Sendai in 2015.

The Alliance’s model and the knowledge and lessons emerging from the program are reaching a wider audience through participation in high-level practice groups working on resilience issues, such as the Rockefeller Measuring Resilience Group, where Practical Action is part of its steering committee. IIASA has led a book chapter on the partnership approach, which has been presented at international fora and to German development organization GIZ.

The ongoing engagement of Alliance researchers and practitioners in climate negotiations, in particular the loss and damage discourse has led to an important shift in the international policy deliberation. This includes considering a critical role of

insurance in building resilience and its integration with comprehensive risk management and resilience building. Practical Action has also seen increased recognition from DFID of the lessons that program has generated about understanding resilience programming, practice and measurement. Gaps and needs from ongoing work on flood forecasting and EWS have fed directly into technical advice Practical Action provided to DFID on their GBP 145 million regional climate service program. WWF is now rolling out case studies from Bangladesh and Nepal in their trainings in a number of their countries, using examples from Practical Action on community-based EWS.

In Bangladesh, the efforts have resulted in changes to government approaches. For example, government has agreed to install weather boards in all the country’s local government offices and strengthen disaster action plans based on best practice from the work. The NGO CAFOD has also engaged with the team to extend the approach into their own work.

In Nepal, there has been similar success with influencing changes with government. There is a particularly good relationship with, the Department for Meteorology and Hydrology (DHM). DHM has adopted forecasting approaches from the program nationally to improve early EWS, a service they now provide around the clock. This information has also been proactively shared with organizations across the border in India to improve warning for 400,000 vulnerable people. In addition, advocacy with two national telecommunications providers led to an agreement for them to provide flood warnings through free SMS. In 2017 they both agreed to extend this support for another five years. The teams are also able to provide technical support and advice to all levels of government, helping to shape national DRR policy and implementation. In particular, gaining support for allocation of budgets at the municipal level to implement DRR measures. At a regional level, Practical Action have provided input to the Asian Ministerial Conference on DRR committing governments to invest in cross-border warning systems. Nepal and Indian governments have promised to facilitate information sharing as a result. The World Food Program has engaged with a view to adopting forecast-based approaches.

¹⁵ <https://www.bitc.org.uk/campaigns-programmes/environment-sustainability/global-goals/international-disaster-relief>

In Peru, key examples of success in influencing government were:

- National Ministry of Education, provided access for Practical Action to work with young people in schools;
- The municipality of Lima was persuaded to support the initiative to install low cost early warning equipment;
- The municipality of Lima is replicating Practical Action's DRR training;
- The draft DRR law we helped draw up and advocate for was officially presented to the Congress;
- Due to our involvement, risk maps for our communities are included in the portal of the National Water Authority.

We are recognized as a player in the field of DRR – both as Zurich as well as the Alliance. Zurich contributed to several major forums and bodies focused on reducing disaster risk and/or drafting public policy on disaster risk reduction and mitigation. Zurich represented the private sector as a member of the Swiss government's delegation at the UNISDR Global Platform in Cancun, Mexico in 2017. The Global Platform is the main global forum that reviews and supports systematic approaches used to manage and address disaster risks. Zurich participated in discussions on the importance of insurance in financial risk transfer, and the role of the overall insurance industry in helping to reduce disaster risk. Zurich took part in research projects and discussions on incentives and barriers to reducing disaster risk at the European Commission in Brussels. In addition, we shared our expertise in community resilience with a Swiss NGO platform on DRR and with the Swiss Development Corporation (SDC).

At Zurich, we received positive feedback from both policymakers and other stakeholders with regard to our contribution to above-mentioned events. This was also confirmed by further invitations to events and requests to share knowledge and provide our resilience expertise.

We believe that previous to the creation of the public policy strategy, European policy makers were not familiar with the flood resilience program or its tools such as the FRMC methodology or the PERC. In particular the latter received much attention and recent PERC reports with regard to floods in Germany and the UK provide relevant information. With regard to resilience measurement, we were delighted to see that the above-mentioned Ramboll report recommended a study to define and quantify resilience at EU level, to understand which risk-reduction measures are cost effective. Zurich staff have offered assistance, should this recommendation be put into practice.

A final observation is that Zurich believes that there is increasing attention for risk reduction, as opposed to, or in conjunction with, risk re-distribution through insurance in the European policy debate. Given the increasing

flood risk due to climate change and the increasing cost of natural hazards in general, this is, in our view, a positive development. Insurability can only be improved through more and better risk reduction. The insurance industry is often focused on the classic 'policy-for-premium.' We should explore a **'non-traditional' role** of insurance to make residual risk insurable rather than try and increase the absolute amount of insured losses. This will help close the natural hazards protection gap by lowering the total economic losses (avoiding losses) rather than bringing the curve of insured losses up. After all, a transferred risk is not yet a reduced risk, and as we know risk reduction and avoidance is cost effective by a factor of 1:5 – for every dollar invested in prevention, five dollars are saved in terms of avoided losses. Zurich staff have had success in sharing the view that there is a bigger role the insurance sector can play.

The Mexican National Resilience Strategy development

Since 2015, there has been significant work in the development of a first National Resilience Strategy (NRS) for the Mexican Red Cross based on IFRC resilience guidelines, best practices from the Alliance, and broader insights from Red Cross/Red Crescent Movement colleagues. The NRS places additional focus on key areas of social inclusion and health, while directly promoting integrated programming initiatives, enhanced impact measurement, and positioning the Mexican Red Cross not only as an active partner for vulnerable communities but also as a key facilitator and catalyst for change. Overall, the NRS leverages key learnings and the overall in-country momentum from the Alliance and creates a broader, national platform for pre-event actions.



4.5 Research program

4.5.1 Research input

The Foundation's financial input into the research program was CHF 3.44 million for the total of the period of 2013-2018 and split as shown:

Zurich's input into the research program include staff commitment to the program, equivalent to a part-time position. These employees' tasks included managing the relationships and supporting development of workplans for the research program. They also conducted technical review of these workplans, and supported the organization of sessions at the European Geophysical Union (EGU), an important research platform for DRR.

From IIASA, there was commitment from one professor, one Ph.D. student and several contributions from four other staff. At Wharton, there was input from three researchers, as well as executive support from the head of the school.

4.5.2 Research output

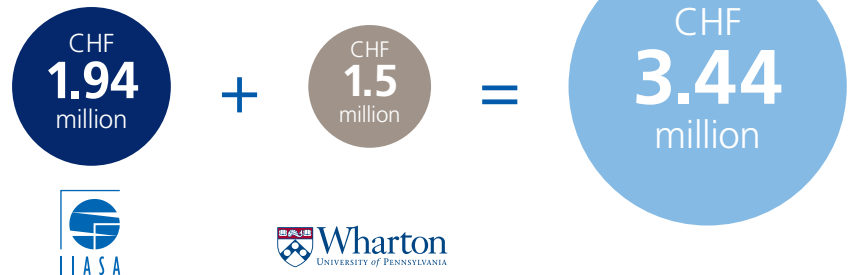
Over the course of the partnership, researchers developed and produced around 40 articles and other publications. These have been cited 897 times.¹⁶ The research output can be split into the following categories:

- Scientific publications in peer-reviewed journals;
- Articles in review;
- Publications in the public space driven by the research partners, but not in peer-reviewed journals.

For a complete list of publications, please refer to the appendix.

The research focused on several key questions:

1. What is community flood resilience and how can it be measured?
2. Is pre-event resilience building more cost effective than post-event relief and recovery?
3. What incentivizes people to invest in flood resilience measures?



4. What is the role of financial risk transfer in building flood resilience, especially in developed countries and through the UNFCCC's loss and damage mechanism?
5. How can we use innovative crowd-sourcing approaches for generating relevant flood risk data?
6. The role of novel decision-support techniques, including serious gaming, for motivating investment into pre-event flood resilience.
7. How can forensic risk analysis inform DRR investments?
8. What are the learnings from the Alliance's partnership approach?

In addition to academic publications, researchers (alongside other Alliance members) participated at important platforms as shared in section 4.4. In addition to those already mentioned, IIASA was a key contributor to the European Geophysical Union events (between 2014-2018) and the Integrated Disaster Risk Management Conferences (IDRIM) held between 2014-2018. IIASA was also asked to present its work at the UNFCCC's Standing Committee on Finance in 2016, the UNFCCC's Executive Committee on Loss and Damage, between 2015-2018 and the EU Commission Workshop on Adaptation, Brussels, in 2016.

A key benefit of the program was in the development of personnel capability. At IIASA:

- One Ph.D. candidate successfully completed her degree through the research work for the flood resilience program (at the Vienna University of Economics and Business, 2017);
- One researcher successfully completed his habilitation through the research work for the flood resilience program (at the Vienna University of Economics and Business, 2017);
- One Ph.D. student expects to graduate in 2020 (at IIASA);
- Two Masters students at Vienna University of Economics and Business contributed to the research on resilience and the Indonesia program.

4.5.3 Research impact

One of the fundamental questions relates to the value pre-event investments have over pure post-event relief and recovery. An early in-depth meta-study examining a variety of programs and projects working in the flood resilience space found that, on average, one dollar invested in prevention saves five in future losses, a compelling cost-benefit ratio.¹⁷

¹⁶ Citations according to Google Scholar until the end of April 2018

¹⁷ Zurich Risk Nexus: "Turning knowledge into action – processes and tools for increasing flood resilience," 2015; Zurich Flood Resilience Alliance White Paper: "Making communities more flood resilient: The Role of cost-benefit analysis and other decision support tools in Disaster Risk."

Supporting shifts in climate negotiations on dealing with climate-related impacts and risks under the UNFCCC

Researchers, also closely working with the NGO partners, have strongly contributed to shaping an enhanced role of insurance in building resilience, as well as integration into comprehensive risk management and resilience building for climate-related risks (flooding most prominent risk considered). The shift was generated through publications in high-level journals, running side events at COPs and international conferences as well as personal engagement in the deliberations (expert testimony, facilitator of roundtables)

Shifting narrative on DRR toward building back better and an enhanced role for resilience as part of the Sendai Framework for Disaster Risk Reduction (SFDRR)

The SFDRR, adopted by UN member States in March 2015, is the international compact that will inform governments' actions on DRR up to the year 2030. Its Priority 3 is: Investing in disaster risk reduction for resilience suggests that

"Public and private investment in disaster risk prevention and reduction through structural and non-structural measures are essential to enhance the economic, social, health and cultural resilience of persons, communities, countries and their assets, as well as the environment. These can be drivers of innovation, growth and job creation. Such measures are cost-effective and instrumental to save lives, prevent and reduce losses and ensure effective recovery and rehabilitation."

Many stakeholders informed the comprehensive compact. Alliance research and partners through publications and presence at the venue (including participation in the Austrian government delegation) supported the shift toward policies that focus on building back better (rather than rebuilding the same vulnerabilities) and broadly building resilience through structural and non-structural interventions. The measurement approach strongly built on this framing and well supports the shift in policy perspectives.

Gradual increase in contributions to the Natural Hazards Section of EGU, from contributor to co-convenor

Alliance members, including researchers, have made strong contributions to shaping the research and practice field of disaster forensics with methodological contributions around the PERC reports. This progressed significantly over time and went from oral and poster presentations to expert workshops and finally chairing and co-convening entire sessions at the annual European Geosciences Union (EGU) conference, the main scientific venue for this theme.¹⁸

The role of serious gaming in building flood resilience

In order to provide decision-support to country teams working with communities, the research partners have experimented with a broad variety of decision-support methods and tools (from formal cost-benefit analysis to participatory methods). Serious gaming, using social simulation tools that combine computational models and participation of real actors, has emerged as an important method for engaging a wide variety of stakeholders to identify and implement options for building resilience.

Games that engage participants have been shown to be very successful and powerful dissemination instruments – with broader outreach than traditional reports or other formal methods. Serious gaming approaches become relevant and have been tested and applied in the work when actions are contested and broad participation required. The information-action gap inherent in providing expert input to working with local, national and international stakeholders for selecting options is well known. Failures to produce useful insight have often resulted from an over-reliance on biophysical data and inadequate appreciation of the diversity of ways decisions are made at all levels of society.

In addition, understanding and analysis of complex policy issues is often hampered by the high costs of gathering data about how various members of society actually think and decide such issues. Similarly, scientists and policy makers must often invest years to gain experience critical to managing systems that change and evolve, without undertaking real risk. This raises the question: How can we lower the costs of learning through experience?

¹⁸ See also section 4.6 on PERC



Application of the flood resilience game provoking discussion at an NGO workshop in Jakarta, Indonesia

‘Serious gaming’ and policy exercises (also known as open simulations) have emerged to fill this gap. Serious games mediate collaboration between actors and scientists in analyzing how problems emerge in complex systems and where points of policy intervention may lie. Because they are experienced as something that feels real, more information is retained, learning is faster, and an intuition is gained about how to make real decisions and improve policies. The sophistication of the approach allows even non-trained actors to engage in highly complex decisions.

The researchers developed the Flood Resilience Game, currently set up as a board-game played by eight to 16 players, who each take on a role as a member of a flood prone community. The direct interactions between players create a rich experience that can be discussed and analyzed

in the structured debrief session, leading to concrete conclusions and actions. This allows players to explore vulnerabilities and capacities ... citizens, local authorities and NGOs together ... leading to an advanced understanding of interdependencies and the potential for working collaboratively. The game draws on research from the Zurich flood resilience alliance on the complex challenges of reducing flood risk and fostering sustainable development. It allows players to experience, explore, and learn about the flood risk and resilience of communities in river valleys. Players experience the impacts of flood damage on housing and infrastructure, as well as indirect effects on livelihoods, markets and quality of life. It lets them experience the effects on resilience of investments in different types of ‘capital’ – such as financial, human, social, physical and natural.

Players explore the complex outcomes on the society, environment and economy from different long-term development pathways. This highlights the types of decisions needed to avoid creating more flood risk in the future, incentivizing action before a flood through enhancing participatory decision-making. There were several field tests in Jakarta and Lima with staff from the NGOs Practical Action, Red Cross Indonesia, the International Federation of Red Cross and Red Crescent Societies, Mercy Corps, Plan International and Concern Worldwide. The game is now being refined and further application in phase 2 is planned.

4.6 Post Event Review Capability (PERC)

PERC¹⁹ is a flexible method that analyses the root causes of why events become disasters. It tries to answer, at an event level, what worked well and where there are opportunities for further improvements. It is a unique forensic investigation that Zurich has built and that aims to support learning at societal level. It puts people at the heart with flexible input (i.e. guiding questions) and output (i.e. report). We have covered over a dozen big flood events based on our assumption that they provide

a lot of opportunity for learning. With this, the Alliance is supporting the Hyogo/Sendai framework's mission to generate and share learning, avoid repeating the same experience with disasters over and over again and to make society more resilient. In particular, there is an urgent need for enhanced learning and understanding of disasters, particularly in relation to the trends in drivers of increasing risk.²⁰

4.6.1 PERC input

Zurich's financial input into PERC has been roughly USD 350,000; as part of the overall expense and contracting budget to our PERC partner ISET-International. In addition to the paid time by ISET experts supporting or driving PERC studies, invaluable volunteer time was committed by companies from the insurance, engineering and NGO sectors - simply because they were attracted by the PERC concept to provide learning. An overview of the conducted PERC studies and the input provided by additional partners is found in Table 2 below:

4.6.2 PERC output

PERC report name	Country	Contributors	Event date
Central European floods 2013: a retrospective	Germany (focus), Austria, Czech Republic, Switzerland	Zurich flood resilience program staff, secondee from Zurich's public affairs team	Jun 2013
Floods in Boulder: A Study of Resilience	US	conducted by ISET-International	Sep 2013
After the storm: how the UK's flood defenses performed during the surge following Xaver	UK	Zurich flood resilience program staff together with Zurich UK business unit	Dec 2013
Balkan floods of May 2014: challenges facing flood resilience in a former war zone	Bosnia and Herzegovina, Serbia, Croatia	Zurich flood resilience program staff	May 2014
Emmental, Switzerland floods of July 2014: On a hot, sunny day, a flood alert!	Switzerland	Zurich flood resilience program staff	Jul 2014
Urgent case for recovery: what we can learn from the August 2014 Karnali River floods in Nepal	Nepal	ISET, Practical Action Nepal, Zurich flood resilience program staff	Aug 2014
Morocco floods of 2014: what we can learn from Guelmim and Sidi Ifni	Morocco	Contractor in Morocco, Zurich flood resilience program staff	Nov 2014
Columbia and Charleston floods, South Carolina	US	ISET, Zurich flood resilience program staff, AON voluntary time commitment	Oct 2015
PERC Cumbria	UK	Zurich flood resilience program staff, JBA voluntary time commitment, Zurich UK business unit	Dec 2015
PERC Flash Floods	Germany	Zurich flood resilience program staff, Zurich Germany business unit	May/Jun 2016
PERC Peru 'non-event'	Peru	IIASA, Practical Action Peru, Zurich flood resilience program staff	2016
PERC Peru coastal floods	Peru	ISET, Practical Action Peru, Zurich flood resilience program staff	2017
PERC Harvey	Houston, US	ISET, IFRC, Zurich flood resilience program staff, Zurich North America, Greenwood Strategic Advisors voluntary contribution	2017/2018

¹⁹ More on PERC at: <https://www.zurich.com/en/corporate-responsibility/flood-resilience/learning-from-post-flood-events>

²⁰ Keating et al., 2016 "From event analysis to global lessons: disaster forensics for building resilience." NHESS 16-2016

Further PERC publications:

Title	Publication	Link	Year
PERC manual	Zurich Risk Nexus	https://www.zurich.com/en/corporate-responsibility/flood-resilience/learning-from-post-flood-events	Jun 2013
PERC book chapter	Flood Damage Survey and Assessment – Wiley	http://eu.wiley.com/WileyCDA/WileyTitle/productCd-111921792X.html	Sep 2013
PERC consolidation	Zurich “PERC Medley”	https://www.zurich.com/en/knowledge/articles/2018/06/how-hard-lessons-strengthen-resilience-against-disasters	Dec 2013

Table 2: PERC studies conducted between 2014-2018

4.6.3 PERC impact

PERC is an attractive concept for learning from disasters that has been recognized in the scientific field of disaster forensics. This has ultimately led to the influence we have had at EGU and other scientific events. The PERC book chapter was solicited based on an invitation from Wiley scientific publishers, highlighting the value of the PERC methodology. We have had several requests from other organizations both from the scientific field as well as from the private sector, to see how the PERC methodology can be applied in their contexts. There have also been requests around how PERC could be expanded from flood to other perils, for example wildfires.

PERC has attracted further interest in the form of voluntary contributions and collaboration across various studies as outlined in the table above. All of these were based on the identification of a common interest to learn from events where Zurich was providing the methodology and partner organizations provided the various skills and expertise based on their context. One additional event review is currently being conducted by one of our partners without any further investment from us, because they found the methodology would yield the knowledge and insights they were looking for – another example for scaling.

In addition, PERC has made a significant scientific impact at the second-largest congress on geosciences, the EGU, held annually in Vienna. PERC has moved from being a contributor to the topic of forensic analysis of natural hazards events – to becoming a convener of the forensic sessions. The approach of PERC has made an impact to drive the forensic space ahead. At local level, PERC was solicited to be presented at national scientific or flood practitioner conferences, such as the Natural Hazards Workshop in Boulder, Colorado or the Flood and Coast conference in the UK.

At a meta-level, the over one dozen individual PERC studies and ensuing discussions and exchanges with experts in the field have led to the cross-consolidation of flood lessons learnt and key challenges identified.²¹ We identified a number of common lessons despite extremely varied contexts. These have been applied to easy-to-understand recommendations and risk reduction advice for the general public, for government-based decision makers as well as for risk managers and commercial customers in the insurance context.

²¹ Keating et al. 2016. “From event analysis to global lessons: disaster forensics for building resilience.” NHESS 16-2016; and “Lessons for reducing risk and increasing resilience,” Zurich 2018.

5. Conclusions



We started out with a vision at Zurich that a foundation can do more than just provide money. We decided to focus on flood resilience as a societal problem that needs cross-sectorial tackling. We built the flood resilience program that has run as a first phase from 2013-2018 and we believe has been highly successful. Most of our partners decided to continue with us on our journey into the second phase – a testimony in itself. More than that, the program has consistently been mentioned as a very attractive partnership that allows space and flexibility to explore innovative approaches and work in-depth on flood resilience, going further than traditional programs.

In recognition of our cross-sector collaboration model, and for our approach to flood resilience, we have received various prizes since the program was established in 2013. This includes the prestigious UNFCCC's 'Momentum for Change Award' in 2014. In 2017, in Peru, the Alliance won the PODER 'Think Tank of the Year' award – together with our implementing partner Practical Action. In Mexico, the Mexican Center for Philanthropy (Cemefi) recognized our flood resilience program model, based on working through cross-sector alliances that make the most of knowledge and expertise shared among different areas of specialization.

An external learning review by The Partnering Initiative contracted by Zurich found that: [...] "the Alliance is an innovative model at the leading edge in the field of flood resilience. It provides a prototype for multi-stakeholder initiatives" [...] in the field of disaster resilience. It further found that "The model and funding have enabled innovative approaches at global and country-level [...] and strong working relationships have been built between partners, who are fulfilling their ambition to be pioneers and thought-leaders in resilience building."

Partners have provided positive feedback on their experience. This includes the fact that working with – and through – others works well. They have noted that a lot of cross-learning has taken place by frequently bringing together various peer groups to exchange with and learn from each other. The depth of the programs, including the flood resilience measurement framework, has made a significant contribution to the overall resilience space. The decision-making processes on how to prioritize flood resilience solutions is a time-consuming process, but it truly works. As one partner said:

"This is almost doing [DRR community] programs the other way around – and the way it should be."

Many of our partners confirmed that there are significant differences between our program-design approach and other programs. The most important difference is the long-term approach – with a comprehensive design process using extensive data collection, analysis, reflection and community engagement. All of this helps to guide the overall objective and outcomes of the program. This provides opportunities to design different and more meaningful and often more innovative resilience-building interventions. Ultimately, that leads to an improved understanding of resilience across all partners and the communities with whom we work:

"The scope and nature of the Zurich flood resilience program is such that it has helped to build the understanding of resilience within the organization and communities with whom we work."

We conclude that the main enabling factors for the success of Alliance 1.0 were:

- the commitment of significant, flexible and long-term guaranteed funding;
- the quality and diversity of partners with a wide range of complementary knowledge;
- expertise and influence combined with a common vision;
- and a shared, strong sense of commitment to the still emerging field of resilience.

Our drive to produce outputs has enabled progress on new contributions to flood resilience knowledge in the applied practitioner's field (through the Flood Resilience Portal) as well as the science field (through our academic publications).

Lessons to be learned and main constraining factors include:

- the high absolute and relative (friction) costs for setting up and running such an alliance and managing relationships;
- the time (and thus the patience and persistence) it takes to develop a common vision, language and operating model to then put into practice;
- difficulties in understanding and accessing each partner's strengths and core interests;
- the insufficient allocation of staff resources especially to the operational management of the activities and ensure their alignment and coordination;
- and the lack of a joint impact assessment framework and reporting process that is set out at the beginning of the Alliance phase.

We know that floods remain a major, global challenge, beyond 2018 with flood risk expected to increase given socio-economic as well as climatic drivers. However, the entire DRR sector has clearly stated the problem both quantitatively and qualitatively. We now need to go beyond simply describing the problem (by stating how large and costly flood losses are and how much suffering they cause). We need to focus more on finding solutions to the problem.

In particular, the main challenges we need to tackle are:

- How to better incentivize risk reduction so that we can shift the needle from post-event relief and recovery to pre-event resilience and risk reduction investments;
- How to ensure we are closing the flood protection gap through innovative solutions rather than try and provide the same answer that does not fix the problem;

- We have made the case that flood resilience is cost-effective and on average brings a 1:5 cost-benefit ratio. To make the increase in resilience investments a reality, we need to better understand the asymmetry of who invests and profits from these investments, and then bring these interest groups to one table;
- It has been shown that DRR and climate adaptation need to be integrated with development investments, particularly in communities that are at low development levels. How can communities, countries, the private sector, donors and multilaterals be convinced of the development co-benefits of flood resilience?;
- We all tend to forget that we do not run DRR programs for the sake of the donor, or the implementing NGO in the field – we do it for the impact on well-being in society, and this requires more open collaboration and sharing.

We know that flooding is an asymmetric problem both in space and time. It is easy to react post-event and make funds available to recover. It is hard to find commitment to make

the money available when the risk has not yet materialized – acting pre-event is difficult. This is the challenging field we are committed to tackle further.

Ultimately, the creation of Alliance 2.0 is the proof of the success of Alliance 1.0 and the trust in our leverage. Alliance 2.0 will run during the five-year period 2018-2023, with our core and boundary partners of Alliance 1.0 working in a fully collaborative and ‘joined-up’ setup. It has secured funding of approximately CHF 20 million from the Foundation. This is also proof that, while we have been successful and on the right track, the problem of encouraging more investment into resilience as well as the trend of increasing losses and suffering from flooding across the globe has not been solved yet and more still needs to be done.

We are therefore both grateful for the past five years setting up and implementing the successful Alliance 1.0 and the learning this has created. We now eagerly look forward to execute on our ambitious targets for Alliance 2.0. There, we will keep what has been positive and make those aspects better that our learning journey has highlighted.



6. Appendix – Research publications

6.1 Scientific publications in peer-reviewed journals

Title	Journal	Link	Year	Citations
Integrated Participatory and Collaborative Digital Mapping for Enhancing Disaster Resilience	International Journal of GeoInformation (ISPRS)	http://www.mdpi.com/2220-9964/7/2/68	2018	
Disaster resilience: What it is and how it can engender a meaningful change in development policy	Development Policy Review	http://onlinelibrary.wiley.com/doi/10.1111/dpr.12201/abstract	2017	5
Applying recent insights from climate risk management to operationalize the Loss and Damage Mechanism	Ecological Economics	https://www.sciencedirect.com/science/article/pii/S0921800916307455	2017	1
Development and testing of a community flood resilience measurement tool	Natural Hazards and Earth Systems Sciences	http://www.nat-hazards-earth-syst-sci.net/17/77/2017/nhess-17-77-2017.pdf	2017	9
Risk-sensitizing future investment needed to achieve the sustainable development goals	International Journal of Disaster Risk Reduction	https://www.sciencedirect.com/journal/international-journal-of-disaster-risk-reduction/vol/24	2017	
Insurance, public assistance and household flood risk reduction: A comparative study of Austria, England and Romania	Risk Analysis	https://onlinelibrary.wiley.com/doi/abs/10.1111/risa.12881	2017	
Political affiliation affects adaptation to climate risks: Evidence from New York City	Climate Change	http://link.springer.com/article/10.1007/s10584-016-1735-9	2016	10
Identifying the policy space for climate loss and damage	Science	http://science.sciencemag.org/content/sci/354/6310/290.full.pdf	2016	13
From event analysis to global lessons: disaster forensics for building resilience	Natural Hazards and Earth Systems Sciences	http://www.nat-hazards-earth-syst-sci.net/16/1603/2016/nhess-16-1603-2016.html	2016	5
Technologies to Support Community Flood Disaster Risk Reduction	International Journal of Disaster Risk Science	http://link.springer.com/article/10.1007%2Fs13753-016-0086-5	2016	7
If Numbers Can Speak, Who Listens? Creating Engagement and Learning for Effective Uptake of DRR Investment in Developing Countries	PLOS Currents Disasters	http://currents.plos.org/disasters/article/dis-16-0002r1-if-numbers-can-speak-who-listens-creating-engagement-and-learning-for-effective-uptake-of-drr-investment-in-developing-countries/	2016	2
Reviewing estimates of the economic efficiency of disaster risk management: opportunities and limitations of using risk-based cost–benefit analysis	Natural Hazards	http://link.springer.com/article/10.1007%2Fs11069-016-2170-y	2016	30
Brief communication: Sendai framework for disaster risk reduction – success or warning sign for Paris?	Natural Hazards and Earth Systems Sciences	http://www.nat-hazards-earth-syst-sci.net/16/2189/2016/	2016	5
Crowdsourcing, Citizen Science or Volunteered Geographic Information? The Current State of Crowdsourced Geographic Information	ISPRS International Journal of Geo-Information	http://www.mdpi.com/2220-9964/5/5/55	2016	57
We must build resilience into our communities	Nature	http://www.nature.com/news/we-must-build-resilience-into-our-communities-1.18223	2015	7
What drives households to buy flood insurance? New evidence from Georgia	Ecological Economics	http://www.sciencedirect.com/science/article/pii/S0921800915002876	2015	32

Title	Journal	Link	Year	Citations
Examining flood Insurance claims in United States: Six key findings	Journal of Risk and Insurance	http://onlinelibrary.wiley.com/doi/10.1111/jori.12106/full	2015	32
Divergence between individual perceptions and objective indicators of tail risks: Evidence from floodplain residents in New York City	Judgement and Decision Making	http://journal.sjdm.org/15/15415/jdm15415.pdf	2015	33
The European Union Solidarity Fund: an assessment of its recent reforms. Mitigation and Adaptation for Global Change	Mitigation and Adaptation for Global Change	http://dx.doi.org/10.1007/s11027-015-9687-3	2015	4
Understanding trends and projections of global disaster losses and climate change: Is vulnerability the missing link?	Climate Change	http://link.springer.com/article/10.1007/s10584-014-1141-0	2015	58
Operationalizing iterative risk management under limited information: fiscal and economic risks due to natural disasters in Cambodia	International Journal of Disaster Risk Science	https://link.springer.com/article/10.1007%2Fs13753-015-0069-ygo	2015	7
Revisiting the 'disaster and development' debate – Toward a broader understanding of macroeconomic risk and resilience	Climate Risk Management	http://www.sciencedirect.com/science/article/pii/S2212096314000205	2014	13
Increasing stress on disaster risk finance due to large floods	Nature Climate Change	http://www.nature.com/nclimate/journal/v4/n4/full/nclimate2124.html	2014	209
Managing unnatural disaster risk from climate extremes	Nature Climate Change	http://www.nature.com/nclimate/journal/v4/n4/full/nclimate2137.html	2014	56
Advancing Methodological Thinking and Practice for Development – Compatible Climate Policy Planning	Mitigation and Adaptation Strategies for Global Change	https://link.springer.com/article/10.1007/s11027-013-9538-z	2014	20
Flood risk and climate change – global and regional perspectives	Hydrological Sciences Journal	https://www.tandfonline.com/doi/abs/10.1080/02626667.2013.857411	2013	264
Determining tropical cyclone inland flooding loss on a large scale through a new flood peak ratio-based methodology	Environmental Research Letters	http://iopscience.iop.org/article/10.1088/1748-9326/8/4/044056/pdf;jsessionid=19D0C4BA60EC4B16BEE0B850E154A623.c1.iopscience.cld.iop.org	2013	18

Articles in review

Title	Journal
Understanding disaster event causation to shape future risk: how can disaster forensics inform climate risk scenarios?	Global Environmental Change
The Flood Resilience Systems Framework: from Concept to Application	Journal of Integrated Disaster Risk Management
An overview of serious games for DRM: their prospects and limitations	International Journal of Disaster Risk Reduction

Research publications and invited contributions in books and literature in the public space

Title	Publication	Link	Year
Zurich Flood Resilience Alliance partnership	Loss & Damage from climate change (Mechler et al. Eds) Springer Publishing	https://www.springer.com/de/book/9783319720258	2018
Technology for Climate Justice: A Transparency Framework for Loss and Damage	Loss & Damage from climate change (Mechler et al. Eds) Springer Publishing	https://www.springer.com/de/book/9783319720258	2018
Integrated disaster risk management and adaptation	Loss & Damage from climate change (Mechler et al. Eds) Springer Publishing	https://www.springer.com/de/book/9783319720258	2018
After the Flood Is Before the Next Flood	Flood Damage Survey and Assessment (Eds. Molinari, D. et al.)	https://agupubs.onlinelibrary.wiley.com/doi/book/10.1002/9781119217930	2017
Managing El Niño Risks under Uncertainty in Peru: Learning from the past for a more disaster-resilient future	Report and policy brief	https://floodresilience.net/resources/item/managing-el-niño-risks-under-uncertainty-in-peru	2017
Participatory Digital Mapping	Policy brief	https://answers.practicalaction.org/our-resources/item/participatory-digital-mapping-building-community-resilience-in-nepal,-peru-and-mexico	2017
Integrated Participatory and Collaborative Digital Mapping for Enhancing Disaster Resilience		available from http://www.wateryouthnetwork.org	2017
Flood Resilience Game – explore community flood resilience	Game and Guidance	https://floodresilience.games4sustainability.org	2016
Learning from disasters to build resilience: a simple guide to conducting a post-event review	Guidelines	https://www.zurich.com/_/media/dbe/corporate/docs/corporate-responsibility/the-perc-manual.pdf	2015
Turning knowledge into action: processes and tools for increasing flood resilience	Policy brief/Risk Nexus	https://www.zurich.com/_/media/dbe/corporate/docs/corporate-responsibility/zurich-risk-nexus-iiasa-tools-and-processes-sept-2015.pdf?la=en	2015
Making communities more flood resilient: the role of cost-benefit analysis	Policy brief/Risk Nexus	http://www.iiasa.ac.at/web/home/research/researchPrograms/RISK/Risk_nexus_Making_communities_more_flood_resilient_-_the_2.pdf	2014
Operationalizing Resilience against Natural Disaster Risk: Opportunities, Barriers, and a Way Forward	White paper	http://opim.wharton.upenn.edu/risk/library/zurichfloodresiliencealliance_ResilienceWhitePaper_2014.pdf	2014
Enhancing community flood resilience: A way forward	Policy brief/Risk Nexus	http://www.iiasa.ac.at/web/home/research/researchPrograms/RISK/zurichfloodresiliencealliance_ResilienceIssueBrief_2014_2.pdf	2014

6.2 Knowledge outputs

Output	Total produced by Alliance 1.0 across all partners	Top 5	Views/downloads/references (cumulative)	Lead
Videos (YouTube views)	51	<p>“¿Cómo prepararnos frente a inundaciones? Animation: Individual / family actions to prepare for floods” (2015)</p> <p>Testimonial of the effectiveness of risk prevention through diminution of land trafficking (2017)</p> <p>Juego para la resiliencia ante inundaciones/Game for flood resilience (2017)</p> <p>Encuentro Latinoamericano de Gestión del Riesgo de Desastres / LA meeting of DRR (2016)</p> <p>Early Warning System through SMS (2017)</p>	<p>12,235</p> <p>8,800</p> <p>510</p> <p>443</p> <p>388</p>	<p>PA Peru</p> <p>PA Peru</p> <p>PA Peru</p> <p>PA Peru</p> <p>PA Nepal</p>
Journal papers (Host site downloads and citations) <i>Please note that no downloads or citations were provided by IIASA.</i>	17	<p>Evaluating Flood Resilience Strategies for Coastal Megacities (2016)</p> <p>Community-based early warning systems for flood risk mitigation in Nepal (2017)</p> <p>Political affiliation affects adaptation to climate risks: Evidence from New York City (2016)</p> <p>Development and testing of a community flood resilience measurement tool (2016)</p> <p>Adoption of Flood Preparedness Actions: A Household Level Study in Rural Communities in Tabasco, Mexico (2016)</p>	<p>4,165 downloads 154 citations</p> <p>2,724 downloads 9 citations</p> <p>2,600 downloads 10 citations</p> <p>1,820 downloads 9 citations</p> <p>17 downloads</p>	<p>Science (Wharton)</p> <p>Natural Hazards and Earth System Sciences (PA)</p> <p>Climatic Change, Springer (Wharton)</p> <p>Natural Hazards and Earth System (Alliance) Sciences</p> <p>Wharton</p>
Working papers (Host site and portal downloads) Includes following format types from pipeline: issue paper, working paper, report, Risk Nexus, technical paper. <i>Please note no download # were provided for the Nexus papers.</i>	35	<p>Sistemas de alerta temprana ante inundaciones en América Latina (2016)</p> <p>Análisis Económico de Hogares en Piura, Chulucanas y Lima (2017) Household economic analysis in Piura, Chulucanas and Lima and Lima</p> <p>Situación del hábitat en el Perú: propuestas desde la sociedad civil (2016) Habitat situation in Peru: civil society perspectives</p> <p>Análisis de los posible impactos del FEN en el sistema de mercado de la vivienda en Polvorines (2017) Impact analysis of El Nino phenomenon on household livelihoods/market access in Las Polvorines</p> <p>A Comparison of Residential Flood Insurance Markets in 25 Countries (2015)</p>	<p>837</p> <p>496</p> <p>324</p> <p>210</p> <p>4</p>	<p>PA Peru</p> <p>PA Peru</p> <p>PA Peru</p> <p>PA Peru</p> <p>Wharton</p>

Output	Total produced by Alliance 1.0 across all partners	Top 5	Views/downloads/references (cumulative)	Lead
Policy briefs (Host site and portal downloads) Includes following format types from pipeline: briefing, issue brief, policy brief	15	Sistemas de Alerta Temprana para inundaciones (SAT): Experiencias en América Latina (2016)	1,128	Wharton
		From Risk to Resilience: A systems approach to building long-term, adaptive wellbeing for the most vulnerable (2016)	90	PA Peru
		Adaptive management for resilient communities: Development in a volatile environment (2016)	48	PA UK
		Flood resilience through community-driven action and partnerships (2017)	48	PA UK
		Measuring flood resilience: the Zurich Flood Resilience Measurement Tool (2017)	43	Alliance
Blogs (views on host site)	78	Resilience – what works, what doesn't? (2016)	400	PA UK
		Pumpkins against poverty and climate change in Bangladesh (2017)	454	PA Bangladesh
		Learning from 2014 Karnali River Floods in West Nepal (2015)	456	PA Nepal
		Early warning system saves lives in monsoon-hit Nepal (2013)	976	PA Nepal
		Less is more when building a resilient community (2016)	116	PA Bangladesh
'How to' guidance for practitioners (Host site and portal downloads) Includes following format types from pipeline: How to guide, brochure, factsheet, infographic, poster, snapshot, solution, technical brief.	35	Ficha técnica: Controladores para defensas ribereñas (2015) River bank (anti-erosion) defense tools technical brief	9,832 downloads	PA Peru
		Ficha técnica: Sistema de Alerta Temprana (2015) Early Warning Systems technical brief and Lima and Lima	4,244 downloads	PA Peru
		Ficha técnica: Gestión de Inundaciones (2015) Flood management technical brief	1,740 downloads	PA Peru
		Diez lecciones para la gestión del riesgo de inundaciones en Latinoamérica (2014) 10 lessons for managing flood risks in Latin America	1,328 downloads	PA Peru
		Casos de éxito: los sistemas de alerta temprana contra inundaciones en Centroamérica (2014) Case-study: flood early warning systems in Central America	1,289 downloads	PA Peru

As an Alliance we have begun to document successful flood resilience 'solutions' from the country programs implemented. However, there have been a number of obstacles including the fact that field staff (who have the knowledge) are often too busy or do not have the writing – or English – skills to document the

experiences; there are not always the processes in place to capture and/or publish these solutions; there is no standard way of evaluating whether these 'solutions' are not only successful but scalable. Community flood resilience solutions documented in this phase have included:

Well maintenance for equitable water access	IFRC Mexico
Plecostomus exploitation for increasing family income and livelihood	IFRC Mexico
Flood shelter: the different uses of protective infrastructure	IFRC Mexico
Farm animal protection: Tapescos	IFRC Mexico
Community brigades for emergency attention before, during and after floods	IFRC Mexico
Community puppet theatre	IFRC Mexico
Community development plans	IFRC Mexico
Infiltration wells for flood mitigation (in Sewu village)	IFRC Indonesia
Community waste management scheme (in Tugu Utara village)	IFRC Indonesia
FEWEAS flood early warning app	IFRC Indonesia
Safe evacuation for community (in Tulungrejo village, Bojonegoro)	IFRC Indonesia
Grain storage in flood prone area	PA Nepal
Water source management in flood prone area	PA Nepal
Bio-dyke: construction and maintenance	PA Nepal
Safe shelter construction	PA Nepal
Vermicomposting	PA Nepal
Farmer field schools	PA Nepal
Community-based flood EWS (Piura case-study)	PA Peru
Oyster mushroom farming	PA Nepal
Banana farming	PA Nepal

This publication has been prepared by Zurich Insurance Group Ltd and the opinions expressed therein are those of Zurich Insurance Group Ltd as of the date of writing and are subject to change without notice. This publication has been produced solely for informational purposes. The analysis contained and opinions expressed herein are based on numerous assumptions. Different assumptions could result in materially different conclusions. All information contained in this publication have been compiled and obtained from sources believed to be reliable and credible but no representation or warranty, express or implied, is made by Zurich Insurance Group Ltd or any of its subsidiaries (the 'Group') as to their accuracy or completeness. Opinions expressed and analyses contained herein might differ from or be contrary to those expressed by other Group functions or contained in other documents of the Group, as a result of using different assumptions and/or criteria. This publication is not intended to be legal, underwriting, financial, investment or any other type of professional advice. Persons requiring advice should consult an independent adviser. The Group disclaims any and all liability whatsoever resulting from the use of or reliance upon this publication. Certain statements in this publication are forward-looking statements, including, but not limited to, statements that are predictions of or indicate future events, trends, plans, developments or objectives. Undue reliance should not be placed on such statements because, by their nature, they are subject to known and unknown risks and uncertainties and can be affected by other factors that could cause actual results, developments and plans and objectives to differ materially from those expressed or implied in the forward-looking statements. The subject matter of this publication is also not tied to any specific insurance product nor will it ensure coverage under any insurance policy. This publication may not be reproduced either in whole, or in part, without prior written permission of Zurich Insurance Group Ltd, Mythenquai 2, 8002 Zurich, Switzerland. Neither Zurich Insurance Group Ltd nor any of its subsidiaries accept liability for any loss arising from the use or distribution of this presentation. This publication is for distribution only under such circumstances as may be permitted by applicable law and regulations. This publication does not constitute an offer or an invitation for the sale or purchase of securities in any jurisdiction.

June 2018, Published by: Zurich Insurance Group Ltd.

About the Zurich flood resilience alliance

An increase in severe flooding around the world has focused greater attention on finding practical ways to address flood risk management. In response, Zurich Insurance Group launched a global flood resilience programme in 2013. The programme aims to advance knowledge, develop robust expertise and design strategies that can be implemented to help communities in developed and developing countries strengthen their resilience to flood risk.

To achieve these objectives, Zurich has entered into a multi-year alliance with the International Federation of Red Cross and Red Crescent Societies, the International Institute for Applied Systems Analysis (IIASA), the Wharton Business School's Risk Management and Decision Processes Center (Wharton) and the international development non-governmental organization Practical Action. The alliance builds on the complementary strengths of these institutions. It brings an interdisciplinary approach to flood research, community-based programmes and risk expertise with the aim of creating a comprehensive framework that will help to promote community flood resilience. It seeks to improve the public dialogue around flood resilience, while measuring the success of our efforts and demonstrating the benefits of pre-event risk reduction, as opposed to post-event disaster relief.

All photos by Michael Szönyi, Zurich, with exception of title page (Practical Action Nepal); p.6 top (Mexican Red Cross), center (Practical Action Nepal); p.9 (PMI); p.10 (Practical Action Nepal); p.18 (Practical Action Nepal); p.39 (IIASA); p.42 (Practical Action Peru).

