Climate Resilience Measurement for Communities

Step by step guide to the process and software

Visit ZCRAlliance.org/CRMC

Climate Resilience Measurement for Communities

About this document

This document explains the process of using the CRMC tool and the various roles and responsibilities involved.

For more details on the conceptual application of the CRMC and how the CRMC can be used by civil society organizations, please see www.zurich.foundation/climate-change and download the CRMC overview document.[1]

Since 2013, the Zurich Flood Resilience Alliance has successfully been developing and implementing the Flood Resilience Measurement for Communities (FRMC) process, which has been used in over 400 communities globally.

The CRMC is the next evolution of the FRMC, meeting the increasing demand to measure resilience to multiple hazards in order to accelerate climate-change adaptation.

The typology has been further sharpened whilst retaining the three core elements of community centricity, hazard specificity, and development focus.

The CRMC currently includes the hazards of floods, storms, wildfires and heatwaves, but can be expanded to other climate-related hazards.

To learn more about the CRMC and find out how it can add value to your programs, please email us here: info@zcralliance.org

1 https://zcralliance.org/resources/item/the-climate-resilience-measurement-for-communities-crmc/

CRMC household surveys being conducted in Moala Village, Fiji. Photo: Cale Johnstone, IFRC

Measuring climate resilience at the community level

Why climate hazards?

As our planet warms and weather patterns change, we are seeing more frequent and intense floods, heatwaves, storms, and wildfires.

These events can take lives, cause serious injury, and inflict lasting psychological trauma. They can uproot communities, separate families, destroy livelihoods, and erase cultural heritage and sense of identity. In their aftermath, we often see ripple effects, such as increased poverty, early marriage of girls, children dropping out of school, or forced migration of men in search of work.

At the same time, they damage critical systems – such as water, electricity, transportation, and communication – and devastate homes, schools, health centres and local hospitals.

Without action to build climate resilience, the situation will get worse because of

- increasing population, urbanization, and economic development in hazard-prone areas;
- increasingly interconnected and interdependent critical systems, where impacts to one system can have cascading effects;
- increasing occurrence of compound events, where individual climate risks occur simultaneously or in rapid succession.

With climate disasters impacting communities around the world, the need for community resilience has never been greater.

Why resilience?

We find that every US$1 invested in prevention saves US$5 in future losses.[2]

But only 13 per cent of aid spending goes into pre-event resilience and risk reduction; 87 per cent goes to post-event relief.[3]

We define disaster resilience as the ability of a system, community, or society to pursue its social, ecological, and economic development and growth objectives, while managing its disaster risk over time in a mutually reinforcing way.[4]

Why measure?

Measurement enables us to assess and demonstrate the real impact of improvements. Since there was no global framework available to do this, the Zurich Flood Resilience Alliance originally developed a consistent Flood Resilience Measurement Framework and the tools to implement this framework, which has now progressed to the Climate Resilience Measurement for Communities (CRMC) framework and associated tools.

Using our measurement framework and data, we are contributing to the evidence on how to build resilience. In turn, this will help to increase social, political, and financial investment in building resilience to climate-related hazards.

Why focus on communities?

While acknowledging that national and global drivers play a significant (and essential) part in building resilience, we have chosen to focus on resilience measurement at the community level.

This is the level where impacts from climate-related hazard events are felt most immediately and where much action on enhancing resilience can be taken.

Communities are not homogeneous – they are made of people with diverse identities, needs, and vulnerabilities. By working at this level, we can better understand and address those differences, ensuring that resilience-building efforts are more inclusive and equitable.

It is also the level where we can demonstrate a tangible impact on people's lives, creating best practices in the field that can help us shape and influence policy at a higher level.

2 Mechler, R., Czajkowski, J., Kunreuther, H., Michel-Kerjan, E., Botzen, W., Keating, A., McQuistan, C., Cooper, N. and O'Donnell, I. (2014) Making communities more flood resilient: the role of cost–benefit analysis and other decision-support tools in disaster risk reduction [white paper], Zurich Flood Resilience Alliance.

3 Kellett, J. and Caravani, A. (2013) Financing disaster risk reduction: a 20-year story of international aid, ODI, London/Global Facility for Disaster Reduction and Recovery at the World Bank, Washington, DC.

4 Keating, A., Campbell, K., Mechler, R., Magnuszewski, P., Mochizuki, J., Liu, W., Szoenyi, M. and McQuistan, C. (2017) 'Disaster resilience: what it is and how it can engender a meaningful change in development policy', Development Policy Review 35(1): 65–91. https://zcralliance.org/resources/item/disaster-resilience-what-it-is-and-how-it-can-engender-a-meaningful-change-in-development-policy/

Use of the CRMC in Peru identified the need for improved river monitoring to keep communities informed of potential risks. Photo: Giorgio Madueño, Practical Action

The Climate Resilience Measurement for Communities (CRMC)

The CRMC comprises two parts: the Alliance's conceptual framework for measuring community resilience to a set of climate-related hazards, and an associated tool for implementing the framework in practice.

The second component of the CRMC – the tool – is a practical hybrid software application comprising an online web-based platform for setting up studies and analysing the data, and a smartphone- or tablet-based app that can be used offline in the field for data collection.

The CRMC process is often part of a wider community disaster risk reduction and/or development programme and does not stand alone. Certain parts of the process, such as project set-up and community engagement, are meant in the wider sense of community programming and are not just about implementing the measurement using the tool.

For more information on the conceptual framework, please see the CRMC overview document.

In this publication we take you through the process which links the framework and the tool together to implement the CRMC in practice at community level.

The CRMC process

1. **Set up the project**
2. **Select a site**
3. **Define and understand the community**
4. **Recruit fieldworkers**
5. **Set up a study** (either T-line or post-event)
6. **Plan the data collection**
7. **Collect data in the community**
8. **Grade the sources** (or outcome variables)
9. **Analyse the results**
10. **Share the results**
11. **Implement interventions**
12. **Assess the interventions**
13. **Continued user and content validation**

- Set up measurement activities
- Select data collection methods
- Send assignments to fieldworkers' smartphones

- Collect data based on assigned methods
- Store the data offline
- Send the data to the web application when the job is complete

- Consolidate all data for the assessment
- Assign grades using the assessment methodology

- Visualise and analyse the measurement results
- Access guidance on how to interpret the results

- Store the resilience measurement results for comprehensive analysis and validation

Roles and responsibilities

Fieldworker

Responsibility: Interact with the community to collect data and conduct interviews.

Tool tasks: Use the CRMC mobile app to enter data from the field surveys.

Local project lead

Responsibility: Coordinate the process and efforts to connect to a community; facilitate the grading process and the analysis of the results to support decision-making as part of the wider project.

Tool tasks:

- Create, modify, grade, and score studies for assigned communities.
- Assign fieldworkers to a study.

Researcher

Responsibility: Support the validation.

Tool tasks: Access the data cockpit and download data.

Interventions manager

Responsibility: Manages interventions in the CRMC.

Tool tasks:

- Input interventions into the CRMC and keep records up to date.
- Ensure interventions are linked during the Evaluation phase.

Administrator

Responsibility: Support the effective functioning of the tool.

Tool tasks:

- Create trainer user profiles.
- Can delete studies or users and change the status of studies if required.
- Can perform all other roles' functions.

Trainer

Responsibility: Monitor the progress of the programme at the country level.

Tool tasks:

- Create and modify communities.
- Assign local project leads to communities.
- Create and manage local project lead and fieldworker user profiles.

User management tasks

Responsibility: Trainers

- **User creation:** Set up a new user.
- **Set credentials:** Change the email address and password of an existing user.
- **Delete user:** Only an administrator can delete a user.

Community management

Site and community selection criteria

- Gather the information required for the selection process (hazard maps, vulnerability assessment; initial engagement with the community to gauge their openness to the work). Review and verify that this information is correct and complete.
- Select communities based on the following micro- and macro-level criteria:
  1. All communities for one project are located in physical proximity (i.e. the same city, the same watershed) or share the same hazard scenario (i.e. coastal, within the wildland-urban interface).
  2. Located in an area of high hazard(s) risk (based on hazard mapping and event history).
  3. High social and physical vulnerability to the hazards.
  4. Community willingness and means to participate.
  5. Buy-in from key external stakeholders (e.g. government).

More information on site and community selection is available in the CRMC methodology manual on study and project setup and data collection.

How do you define a community?

A 'community' could be defined geographically (perhaps in rural contexts) or by administrative boundaries (which may work in more urban situations). However, no single community will 'feel' like another, and there may be cultural aspects to consider, too.

As a result we have concluded that, in reality, a community largely defines itself, whether by physical, administrative, social, or other bonds that make it form a unit. When applying our resilience measurement approach we will be measuring at the level of this self-defined community.

Community management tasks

Applicability: Trainers and project leads

Find or sort communities: Use the filter functionalities for inputted communities.

View community details: Go through the details entered for specific communities.

Applicability: Trainers

Create a new community: Set up a new community with the requisite details.

Allocate a project lead: Allocate a project lead from the user list for the new community.

Edit details: Edit community name, geocodes, and number or average size of households for existing communities.

Harvesting pumpkins, Bangladesh. Photo: Practical Action

Planning data collection

How can we collect data?

Household surveys:
Household data collection takes the form of a structured interview between the local field team and individual households, usually held in the interviewee's home.

Household surveys can be conducted online. Please refer to the Using Online Data Collection guide for more information.

Focus group discussions:
A focus group session consists of a number of invited respondents (ideally no more than 20) participating in a structured conversation. The discussion is moderated by the local fieldworker.

Key informant interviews:
In-depth interviews with people who have specialist knowledge about the community and the subject.

Secondary sources:
Secondary source data has already been collected or is readily available. This may include:

- Information from prior projects or other organizations.
- Census data.
- National or international data including online or offline government data.
- Data from hazard/vulnerability assessments and risk maps.

Eva from a local partner organization interviewing community member in San Mateo, Peru as part of data collection. Photo: Giorgio Madueño, Practical Action

Abel from Practical Action interviewing Consuelo who lives in San Mateo, Peru as part of data collection. Photo: Giorgio Madueño, Practical Action

Setting up the study

Responsibility: Project leads

Prerequisites:

- Community has been set up by the trainer.
- Project lead has been allocated to the community by the trainer.
- Any previous studies are complete.

Create a study: Create a new T-line study to collect data on and measure the sources of resilience (at time 't'). For more information on the sources of resilience, please refer to the CRMC overview[5].

The CRMC includes 26 generic sources (universal and applicable to all hazards) and 24 to 26 hazard-specific sources, with some only applying to a single hazard. The total number of sources assessed varies depending on the hazard(s) selected for a given study. For example, measuring resilience to heatwave alone involves 50 sources of resilience, a flood-only T-line study comprises 52 sources, etc.

The CRMC can now be run for floods, heatwaves, wildfires or storms or any combination of these four hazards at the same time.

Name of study: The first T-line study you create for each community will be automatically called T0, the second will be T1, and so on. T-line studies do not need to be named manually.

Number of household interviews: Enter the number of household interviews to be conducted. The suggested number of households for 99 per cent confidence level will be displayed. Based on context on the ground, this number can be adjusted.

Planning the data collection

Responsibility: Project leads

1. Select the data collection method(s) for each source of resilience.
2. Allocate fieldworkers to the data collection methods and corresponding household surveys, key informant interviews and focus group discussions.
3. Decide whether you need to have any local questions added to the study.
4. Preview the questionnaires as they will appear on fieldworkers' smart devices.
5. Decide if you need to save the study as a template.
6. Click the **Activate** button to set the study to active.

Post-event study:

A post flood, heatwave, wildfire or storm event study is conducted following a disaster event in the community to learn about the disaster impact, to assess if any measures were effective, and to compare hazard outcomes with sources of resilience.

The process works very similarly to T-line studies but can only be conducted one hazard event at a time (not multiple hazards simultaneously).

5 https://zcralliance.org/resources/item/the-climate-resilience-measurement-for-communities-crmc/

Fieldwork

How do we conduct the fieldwork activities?

1. Questionnaires are created for each data collection method based on the project lead's selections.
2. The project lead allocates data collection tasks to fieldworkers for that community.
3. The fieldworkers receive the allocated work on the mobile app.
4. The project lead meets with the assigned fieldworkers to plan the execution of the tasks.
5. The fieldworkers conduct the interviews and input the data in the mobile app.
6. The fieldworkers submit the data once the tasks are completed, and the data is uploaded to the online tool.
7. The project lead completes the secondary source data and community context question sections in the online tool.
8. Once all the work steps are complete, the status of the study will move from **Active** to **Grading**.

Data collection in the app

Responsibility: Fieldworker

Fieldworkers have received work on their mobile device and need to complete the questionnaire.

1. Enter username and password, and select the preferred language. Log into the app. (Data connection required for first login.)
2. Synchronize the app to check for new work. (Data connection required.)
3. Go through the work allocated to you and understand who you need to meet to get the data.
4. Choose a data collection method, and start collecting the information and answering the questions. Once you are done with all the questions, that method will display a tick mark.
5. Continue until all the data collection methods are completed and all the boxes are ticked.
6. Return to the community study screen, which also should be ticked. Synchronize the app to upload the data.
7. Where online surveys have been used, project leads monitor progress and provide help to invited respondents as needed.

Tracking progress in the online tool

The overall study status will move from **Active** to **Grading** once all the work steps have been completed. The project lead can review the status of the work products using the **Status Overview** button.

Questionnaires:

When a fieldworker completes a questionnaire on the app and uploads it to the server, it is set to a Completed status and remains in this status indefinitely.

Community questions:

The community questions need to be completed by the project lead online.

Secondary source data:

The secondary source data needs to be entered in the online tool by the project lead.

Grading

How do we measure the sources of resilience?

We grade each source of resilience based on the quantitative and qualitative data points and the benchmarks for best practice. There are two types of sources:

- General sources looking at vulnerability and critical systems. They are only graded once.
- Hazard-specific sources which measure similar concepts that differ by hazard, with some being unique to a single hazard only. These sources are graded once for each hazard.

The grading scale

A	Best practice for managing the risk
B	Good industry standard, no immediate need for improvement
C	Deficiencies, room for visible improvement
D	Significantly below good standard, potential for imminent loss

How do we grade the post-event study?:

The post-event study outcome variables are graded exactly the same as the sources of resilience, except for the initial ones which measure the hazard intensity itself – for detailed instructions see the guide for post-event studies.

The grading process

1. Representatives of the field team attend a group meeting to discuss the findings.
2. The group works together to arrive at grades for each source of resilience:
   a. Review the data from the various questionnaires to get a 'gut feel' for where it stands.
   b. Compare with the definitions of A, B, C, and D for that source of resilience to see where the data stands in terms of the scale.
   c. Consider the generic scale of A, B, C, and D, if required.
   d. Select a grade.
3. The project lead inputs the grade choice into the tool.
4. The project lead explains why that grade was chosen.

Grading tasks

Responsibility: Project leads (in collaboration with the team)

- **Grade each source of resilience:** Pick the correct A, B, C, or D grade based on the definition provided.
- **Explain rationale:** Provide a short explanation as to why that grade was selected.
- **Indicate confidence and relevance:** Tick 'Yes/No' to input your estimation.
- **Explain differentials:** Tick reasons for updated grades (after the T0 study).

Interpreting the study results

Viewing the results analysis in the tool

Applicability:
Project leads, trainers, researchers

- Use the **Results** button from the context menu in the community details screen to view the overall score and category-based scores for a study.
- Use the **Data Cockpit** to select and view the results from completed studies graphically and numerically.

Parvati, Flood Gauge Reader, at Karnali Chisapani Station, Nepal.
Photo: Michael Szönyi, Zurich Insurance Group

The scoring method

Each source of resilience is scored based on the assigned grade:

A	B	C	D
100	66	33	0

First, the overall scores for each of the hazards are presented, followed by a general resilience subscore.

The linear average of scores from all sources in each capital (see below) forms the capital score for each hazard.

The linear average of all general sources and all hazard specific sources for a given hazard together form the total hazard score.

CRMC uses a number of different lenses through which to look at resilience. These are outlined in the following sections.

To find out more about the sources of resilience and how they relate to the other lenses, read the CRMC overview[6].

6 https://zcralliance.org/resources/item/the-climate-resilience-measurement-for-communities-crmc/

The 5C-4R framework

The five capitals (5Cs) lens:

Human: education, skills, health

Social: social relationships and networks, bonds that promote cooperation, links facilitating exchange of and access to ideas and resources.

Physical: the built environment and infrastructure, such as buildings, roads, utilities and communications systems, that support the functioning of the community.

Natural: natural resource base, including land productivity and actions to sustain it, as well as water and other resources that sustain livelihoods.

Financial: level, variability and diversity of income sources and access to other financial resources that contribute to wealth.

The four properties (4Rs) lens:

Robustness: ability to withstand a shock, for example, housing and infrastructure designed to endure a storm, or measures to protect a household from heatwaves.

Redundancy: functional diversity, for example, having multiple evacuation routes and diversified sources of energy supply.

Resourcefulness: ability to mobilize when threatened, for example, a group within a community that can quickly mobilize to convert a community center into a flood shelter.

Rapidity: ability to contain losses and recover in a timely manner, for example, quick access to sources of financing to support recovery.

The seven themes lens

Assets: physical assets in the community, such as buildings and their contents, productive assets, land, and infrastructure.

Livelihoods: the means through which community members make a living, including people's capabilities, income, and activities required to secure the necessities of life via income or subsistence.

Natural environment: the living and non-living components that occur naturally (are not made by humans), including natural features such as rivers, ecosystems, and the ecosystem services they provide.

Life and health: the protection of human life and supporting human physical health.

Lifelines: essential systems or critical infrastructure that provide the necessities for meeting the community's needs.

Governance: formal/official and informal/unofficial organizations and institutions, and their operations, that govern life in the community.

Social norms: informal agreements that govern people's behaviour.

Flooding along the Elbe river in Germany. Photo: Michael Szönyi, Zurich Insurance Group

The Resilient Cities Network resilience characteristics

A new lens has been added to the CRMC, including the seven resilience characteristics the Resilient Cities Network is using. They comprise these seven elements: **flexible, redundant, robust, resourceful, reflective, inclusive** and **integrated.**

Flexible

Ability to adopt alternative strategies, operate differently, able to change, evolve, adapt.

Redundant

Back-ups, multiple options, spare capacity, diverse, varied functionality delivered in multiple different ways.

Robust

Well-conceived, well-constructed, well-managed, yet designed to fail safely.

Resourceful

Ability to adaptively use resources to meet needs or achieve goals.

Reflective

Learn from experience – Required to respond effectively to uncertainty and change; supports better decision-making and governance.

Inclusive

Supports collective action, shared ownership, joint vision; transparent, open, fair, equitable.

Integrated

Interconnected, allows for shared information and resources, mutual support.

Binary views

Community context view

Community level:
Within the sphere of influence of the community

Enabling environment:
Outside the direct sphere of influence of the community

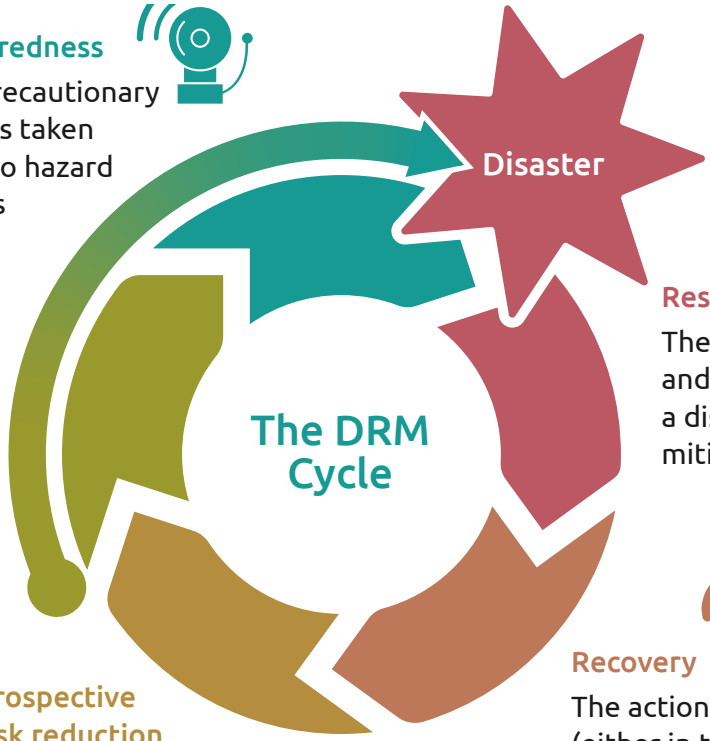
Political score

Score based on political aspects of community resilience

GAID score

Average disaggregation score according to gender (G), age (A), inequity (I) or disability (D)

The disaster risk management cycle lens



Preparedness
The precautionary actions taken prior to hazard events

Response
The actions taken during and immediately after a disaster to contain or mitigate disaster impacts

Recovery
The actions taken after a disaster (either in the short or long term) to help people cope with disaster impacts

Prospective risk reduction
The actions taken to avoid the build-up of new or increased risks

Corrective risk reduction
The actions taken to reduce risk to already at-risk assets

Maria Luisa, Silvia, and Eva, members of Carosio community brigade, participating in a national mock drill. Photo: Giorgio Madueño, Practical Action

Designing, implementing, and assessing interventions

1. Assess the grading results as a team

- Use all lenses to assess CRMC results and identify community needs and opportunities.
- Review individual sources to better understand results.
- Define criteria for interventions and assess their feasibility.

2. Present results

- Present and discuss results in an appropriate format with the community.
- Invite or separately meet with other relevant stakeholders.

3. Brainstorm potential interventions

- Explore potential 'solutions' and learning from previous interventions that build community resilience to select hazards, including on the Zurich Climate Resilience Alliance portal https://zcralliance.org/solutions/

4. Select interventions

- Use the criteria that you defined previously to prioritize options.
- Define whether the interventions can be implemented by the organization directly or need support from a wider network of practitioners, the community itself, local governments, etc.

5. Develop an action plan

- Define the activities needed to implement the selected interventions, their timeframe, responsibilities, and necessary resources.
- Find more information in the guide *From results analysis to intervention planning* at https://zcralliance.org/wp-content/uploads/protected_documents/CRMC-results-to-intervention.pdf

Flood safe shelter, Bangaun Village, Nepal. Photo: Archana Gurung, Practical Action

Evaluating the CRMC framework

The CRMC framework provides a system and a set of definitions to measure the sources of community resilience.

The framework allows researchers to:

- Look at information within and across communities to better evaluate our resilience measurement approach and the framework.
- Explore how sources of resilience are interconnected as a way of identifying potential co-benefits of interventions.
- Track changes in resilience over time and explore how a change in one of the 5Cs affects a community's overall resilience in one or several hazards.

Post-event studies to assess resilience in action

An essential method of evaluating resilience and how a community can be resilient is to measure the impact of an actual disaster event using post-event studies. If we have implemented interventions in the community, this data helps us see if the impacts have been reduced because of the community's increased resilience. This data is also critical for assessing the combination of sources and outcomes of resilience. This will help us to come closer to verifying the sources of resilience as a proxy for resilience itself, and better understand the linkage between interventions and resilience increases.

Book for recording gauge levels in Nepal.
Photo: Michael Szönyi, Zurich Insurance Group

Post-event studies use the same process as T-line studies:

Set up a study

Decide how to gather data

Collect data electronically

Grade the information

A post-event study is conducted following a flood, heatwave, wildfire or storm event in the community that qualifies locally as a "disaster". The process is very similar to T-line studies, measuring a set of outcome indicators following data collection. There is one difference: a post-event study can only be conducted one hazard event at a time (not multiple hazards simultaneously).

Post-event study variable types

- **Post-event study trigger:** An overview of why this event was deemed a disaster (not graded).
- **Hazard trait:** The size and type of disaster (not graded).
- **Event sources:** Impacts from the disaster event (graded A-D). A post-event study is always based on a hazard-specific event that has taken place. As such, only the generic post-event indicators plus the corresponding hazard-specific sources are shown. You cannot conduct a multi-hazard post-event study.

For more information see the CRMC guide for post-event studies.

Climate Resilience Alliance

Climate Resilience Measurement for Communities

Keep in touch...

Write to info@ZCRAlliance.org, visit ZCRAlliance.org/crmc or follow us on LinkedIn.

Intellectual Property note:

a) Since 2013, the Alliance has successfully been developing and implementing the Flood Resilience Measurement for Communities ("FRMC") approach, which includes the underlying framework for measuring community flood resilience, the software to apply the framework (the FRMC tool) and associated training materials, which has been used in over 400 communities globally.
The development and writing of the training materials including the user guides has been the joint work of the Alliance.

b) The Climate Resilience Measurement for Communities ("CRMC") is the next evolution of the FRMC, meeting the increasing demand to measure resilience to multiple hazards in order to accelerate climate change adaptation. The typology has been further sharpened whilst retaining the three core elements of community centricity, hazard specificity and development focus. The CRMC has been developed as a product of the Alliance.

c) The software: The FRMC and CRMC software has been developed and is maintained by Zurich. Currently, the software includes the four hazards developed for the framework and implemented by Zurich through the software provider, floods, heatwaves, storms and wildfires, and can be amended from time to time as appropriate as new technology becomes available or further climate-related hazards are added.

d) The data: All data are collected in accordance with ethical data collection practices, and are anonymous at the individual and household levels. The data within the tool ultimately are controlled by the organizations that collected it. As a condition of using the framework, all organizations have agreed that data will be stored in a central database and be used for research purposes. User organizations can download all of their data at any time.

e) Use-rights: The Foundation and the Alliance are keen for the CRMC to be used as widely as possible. Existing partners are encouraged to expand use of the tool within the remit of their work.

Front cover: *Inundaciones en Piura, Peru.* Photo: Rodrigo Rodrich, Practical Action

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