Increasing community resilience through community-based disaster risk management

Impact Evaluation – Final Report



EPFL | Swiss Red Cross



In memory of Claudio Stauffer 1956–2018
SRC country coordinator in Honduras from 1999 – 2018, Mastermind and unremitting promoter of the SRC CBDRM approach.

This impact evaluation has been co-funded by Swiss Agency for Development and Cooperation SDC and implemented by École Polytechnique Fédérale de Lausanne EPFL.

EPFL-Researchers:
Silvia Hostettler, Deputy Director CODEV-EPFL
Alfredo Kägi, Scientific Collaborator CODEV-EPFL
Maria Sarabia, Research Associate CODEV-EPFL
Anthony Davison, Professor of Statistics, EPFL

Impressum

Graphic design and print:
graphic-print, Swiss Red Cross

Wabern, December 2019

Picture cover page:
Community training on local hazards and risks, Olancho, Honduras.
© Swiss Red Cross

Table of contents

1. Executive Summary 5

2. Introduction 10
2.1 Institutional set-up 10
2.2 Studied Intervention 10
2.3 A brief theory of change 11
2.4 Knowledge gap addressed 14

3. Impact Evaluation 15
3.1 Objective of the impact study 15
3.2 Evaluation questions and indicators 15
3.3 Data collection 15
3.4 Sampling strategy 16

4. Study Design 17
4.1 Definition of the projects' counterfactual 17
4.2 Propensity Score Matching 17
4.3 Propensity Score Weighting 18
4.4 Choice of matching variables 18
4.5 Choice of outcome variables 20
4.6 Analysis of Natural Hazards and Risks 22

5. Evidence: Results, Discussion, Conclusions and Recommendations 25
5.1 Results and Discussion 25
5.2 Conclusions 34
5.3 Recommendations 36

6. Ethical issues 37

7. Limitations of the impact evaluation 38

8. Relevance of the study 39
8.1 Implementation: from evidence to practice by the NGO and the development community 39
8.2 Feasibility for scaling up 39
8.3 Use for policy dialogue 40

9. Lessons learned 41

10. Annexes 43

11. Bibliography/References 44

12. Finance Report 50

Abbreviations

ATET	Average treatment effect on the treated
CBA	Cost-benefit analysis
CBDRM	Community-based disaster risk management
CODEV	Cooperation and Development Center at EPFL
CODEL	Local Emergency Committee
CODEM	Municipal Emergency Committee
COPECO	Honduran Permanent Contingency Commission
CDF	Cumulative Distribution Function
EPFL	Swiss Federal Institute of Technology Lausanne
ETHZ	Swiss Federal Institute of Technology Zürich
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EWS	Early Warning System
GIS	Geographic Information System
HRC	Honduran Red Cross
IE	Impact Evaluation
IFRC	International Federation of Red Cross / Red Crescent Societies
INETER	Center for Territorial Studies of Nicaragua
MET-ALARN	Local Analysis of Natural Hazards and Risks Methodology
NADEL/ETH	Center for Development and Cooperation at ETHZ
NGO	Non-Governmental Organization
NRM	Natural Resource Management
OFAV	Swiss Federal Office for the Environment
SDC	Swiss Development Cooperation
SINAGER	Sistema Nacional de Gestión de Riesgos
SRC	Swiss Red Cross
TOC	Theory of Change

1. Executive Summary

In international cooperation, policy-makers, donors, elected authorities, practitioners and beneficiaries are consistently confronted with the question of what works and what does not. Impact evaluations (IE) are one of many approaches that support evidence-based policy. They aim to identify changes in target populations and to draw causal relationships between these changes and specific previous interventions. The main question underlying an IE concerns attribution and how to isolate the effects of one intervention from those of others.
In August 2017, the Swiss Development Cooperation Agency (SDC) in cooperation with ETHZ/NADEL, provided funding for the Swiss Red Cross and the Cooperation and Development Center at EPFL's (CODEV) joint proposal to undertake an impact evaluation of the Swiss Red Cross' Community Based Disaster Risk Management program in the department of Olancho, Honduras, Central America.

The study project

This community-based disaster risk management program aims to strengthen disaster resilience among vulnerable communities. The program started in 2005 following several emergency and relief operations, building up and rolling out CBDRM. Currently, the program is implemented in 75 communities in three municipalities, with plans to extend to 25 additional communities. Through a community-based approach, community committees are organized, trained, equipped, officially recognized and linked to the National Disaster Management System. The other main building blocks of the intervention are: disaster preparedness, prevention, mitigation and risk transfer. In disaster preparedness – typically the first step in CBDRM – communities and partners are trained and supported in contingency planning, early warning, search & rescue, evacuation, logistics, health services in emergency situations, and shelter/relief operations. Prevention and disaster risk mitigation builds on risk studies (geological, hydrological, geomorphological and meteorological), in complement with traditional risk knowledge and communities' own coping strategies. Based on this combined knowledge, prevention and mitigation measures are defined, prioritized and established in a participatory way. Measures include "green" ecosystem-based measures as well as "grey" infrastructure. All measures are relatively expensive in terms of material costs and/or human resources. Capacity building also takes place at the level of local government, whose members are trained and supported in organizational processes. Risk studies serve as an instrument for risk-orientated decision making and are officially recognized and integrated in the municipal development and investment plans.

Research questions

This impact study aimed to provide evidence for the following research questions:

Main Research Question:

Did the Swiss Red Cross CBDRM program have an impact in the communities in Olancho, Honduras? In technical terms, is the program impact different from zero?

Specific Research Questions:

1. Is there a difference in the resilience level of the communities where the SRC intervened, versus those where no intervention took place?
2. To what extent do soil-bioengineering techniques allow for cost-effective mitigation of flooding/landslide events in the study area?
3. To what extent are communities ready and prepared to appropriately respond to flooding/landslides events in the study area?

Methodology

Between October 2017 and September 2019, the Swiss Red Cross and CODEV collaborated within a technical and scientific framework with the aim of elucidating how the SRC's community-based disaster risk management program had contributed to strengthening community resilience in disaster-prone areas. Specifically, the IE's objective was to provide insight into whether there were differences between the resilience levels of communities where the program had intervened versus those where no intervention had taken place, and to better understand how prepared communities were to appropriately respond to flooding/landslides events in the study area.
After calibrating the survey and refining the sampling methodology, a team of field coordinators and enumerators collected data at the household level from 102 communities in seven municipalities in Olancho, administering 810 questionnaires and 17 expert interviews. The data was analyzed by applying statistical techniques and methods that facilitated the isolation of the average treatment effect on the treated communities based on the programs' defining characteristics. The results were validated through several robustness checks using different matching algorithms and propensity score weighting.

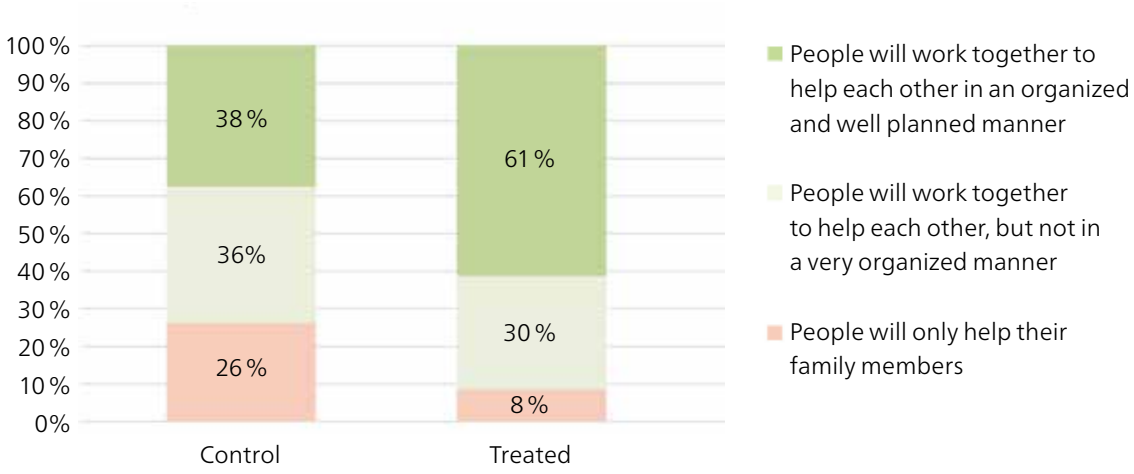
Results

Specific research questions 1 and 3:
The results revealed a positive and significant outcome in terms of level of preparedness knowledge for communities that were part of SRC's CBDRM program in Olancho. This included the ability to correctly identify the existing hazards to which the communities were exposed and knowledge of existing EWS, evacuation routes and shelter.

Outcome (Y) related to preparedness knowledge	ATET	Bias	Std. Err.	[95 % Conf. Interval]	
Hazard	0.23	-0.01	0.06	0.11	0.35
Early Warning Systems	0.24	0.00	0.04	0.16	0.31
Evacuation	0.24	-0.01	0.06	0.12	0.36

The IE also found significant evidence that supports the program's positive effect in the way communities regard their level of preparedness to react to possible disaster-scenarios, versus those same impressions in control communities.

Community collaboration in the event of a disaster



Finally, the IE also shed light on the program's positive impacts on how communities managed their natural resources. There was a significant difference in terms of the use of firewood: a reduction of 1.91 logs per person per day (in 558 fewer logs used per person per year, totaling ~2,200 fewer logs per family per year) was observed. This also had the positive effects on health indicators, reforestation and household savings.

Specific research question 2:

Both cost benefit analyses (CBAs) conducted by an external expert based on a methodology developed by Swiss Development Cooperation (SDC, 2015) showed that the bioengineering measures implemented were cost-effective. One analysis looked at flood and landslide risk protection for a school using contour planting, pile walls with plants, drainage fascines and an improved drainage system based on civil engineering techniques (hybrid approach). The cost-benefit ratio was evaluated at 4.5. The other analysis concerned flood and landslide risk protection for two exposed homesteads. It used similar soil-bioengineering techniques and had a cost-benefit ratio of 6 (a cost-benefit ratio between 2 and 5 is considered cost efficient, and a cost benefit ratio over 5 is considered highly cost efficient (SDC, 2015)). This is largely due to the fact that soil bio-engineering measures are relatively easy technologies to implement, that the vegetative material used is available locally, and that landowners are systematically involved in the development of the sites and responsible for their maintenance.

Conclusions

The findings show a positive and significant effect on the treated communities in three important areas of resilience:
1. Knowledge and preparedness (e.g. existence of early warning system);
2. Social cohesion (e.g. community institutions) and;
3. Management of natural assets (e.g. firewood consumption).

Moreover, soil bioengineering measures not only decrease the risk of landslides, but also provide multiple benefits (e.g. the opportunity to plant fruits and vegetables, create medicinal herb gardens, firewood, rainwater harvesting and a vermicompost).
The program has enhanced the communities' capacities to prepare for future risks and respond in the event of an emergency. Moreover, the program's community-based focus is central for reinforcing community cohesion through the establishment of community committees.
Some of the key elements found for ensuring effectiveness of resilience-building were:

- Carefully fostered collaboration with communities
- Long-term duration of projects: contact with communities for 5–10 years
- Scientific risk studies combined with participative and inclusive mapping
- Use of an integrated approach wherein disaster risk mitigation measures provide multiple benefits
- An excellent cost-benefit ratio of the measures implemented
- Establishment of community disaster management committees
- Requiring contributions from the community (labor, planting material) builds commitment
- Capacity building in leadership at the community level fosters ownership
- Reliable delivery of promised services and regular visits builds trust
- A link to municipal-level development plans contributes to long-term sustainability

The community-based approach empowers communities by building self-confidence so that they may ultimately take responsibility for their own destinies and strengthen their capacities for resilience.

Recommendations

At the program level:

- The CBDRM program in Olancho should be scaled up and continued
- There is a need for the SRC's continued long-term involvement
- The SRC should design an exit strategy that guarantees the communities' empowerment
- The program should promote the participation of all household members in training & capacity building in order to guarantee a deep appropriation at the community level

At the institutional level:

- As a point of institutional evaluation policy, the SRC should embed IE during the initial stages of program and project design in order to guarantee availability of human, information and financial resources.
- IE outcomes should be used to identify and upscale promising approaches, inform decision making and support the design of evidence-based policy.
- The participatory and holistic approach led to a well-rooted, locally-adapted program. However, this also means that there is a certain lack of consistent, robust data that would be required for rigorous impact evaluations.

2. Introduction

2.1 Institutional set-up

In May 2017, the SRC approached CODEV to establish a strategic partnership and participate in the Impact Evaluation Call (Impact Award 2017) published by the Swiss Development Cooperation Agency (SDC) in cooperation with ETHZ/NADEL. In August 2017, SRC-CODEV's impact evaluation proposal was one of the two impact evaluation projects selected to receive funding, from among the 30 proposals submitted. This led to the forging of a formal research partnership between the SRC and CODEV. The SRC extended a mandate to CODEV as a research partner to provide the following support for:

1. Study and survey design
2. Systematization of existing data
3. Guidance and supervision of data collection
4. Selection of enumerators, training and survey pilot testing/calibration
5. Data collection and analysis
6. Authoring of a final report
7. Publication and presentation of scientific findings

Additionally, during the project's fieldwork phase, the SRC provided logistical coordination in collaboration with the Honduran Red Cross (HRC) and insured the safety for all participants.

2.2 Studied Intervention

The Honduran and Swiss Red Cross' (HRC/SRC) CBDRM program in the department of Olancho, Honduras, aims to strengthen resilience in the area's most vulnerable communities. The program began in 2005, after the SRC became involved with several emergency and relief operations following extreme weather events in the area. Its main goal is to reduce the devastating consequences of natural disasters and improve the health status of the vulnerable population in this rural area.
Up until 2018, the HRC/SRC implemented this program in 75 communities in three municipalities (Catacamas, San Esteban and Dulce Nombre de Culmí). The SRC plans to extend the program to 25 additional communities in the municipalities of Dulce Nombre de Culmí and San Francisco de la Paz. The total population covered will potentially increase from 25,000 to 32,000 people. This initiative will ultimately translate into 200,000 indirect beneficiaries of risk-oriented decision making by local authorities and capacity building at the community level.

Using its CBDRM approach and conceptual/organizational bases, the HRC/SRC starts by forming and training local emergency committees (CODELs) and then links them to the National Disaster Management System of Honduras (SINAGER). Additional building blocks of the program include disaster preparedness, prevention and mitigation. In order to prepare themselves for possible disaster events, communities and key stakeholders are trained and supported in contingency planning, EWS, search & rescue, evacuation, logistics, health services in emergency situations, shelter and relief operations.

Prevention and disaster risk mitigation (DRM) are based on comprehensive hazard and risk studies (geological, hydrological, geomorphological, and meteorological), in complement with traditional risk knowledge and coping mechanisms. Based on this combined knowledge, prevention and mitigation measures are defined, prioritized and established in a participatory way.

Measures include structural and non-structural interventions. The former can be ecosystem-based "green" measures and "grey" infrastructure (re)construction (e.g. check dams, drainages). Local authorities are also involved in this initiative, receive capacity building and are trained and supported in organizational processes. Hazard and risk studies are shared with local authorities to serve as decision-making tools. In line with the program's institutional strengthening and up-scaling objectives, risk studies are increasingly being recognized by local authorities and integrated into municipal development and investment plans.

2.3 A brief theory of change

The program aims to strengthen community resilience by limiting the poverty trap resulting from disaster events and by strengthening communities' rebound capacities. This requires the reduction of disaster-induced loss and damage, injuries and fatalities, the protection of local livelihoods against disasters, and reducing existing resource degradation. Project activities contribute to this aim at two levels: at the community/community committee level and at the level of the local government.

Theory of Change –Effectiveness of CBDRM Measures

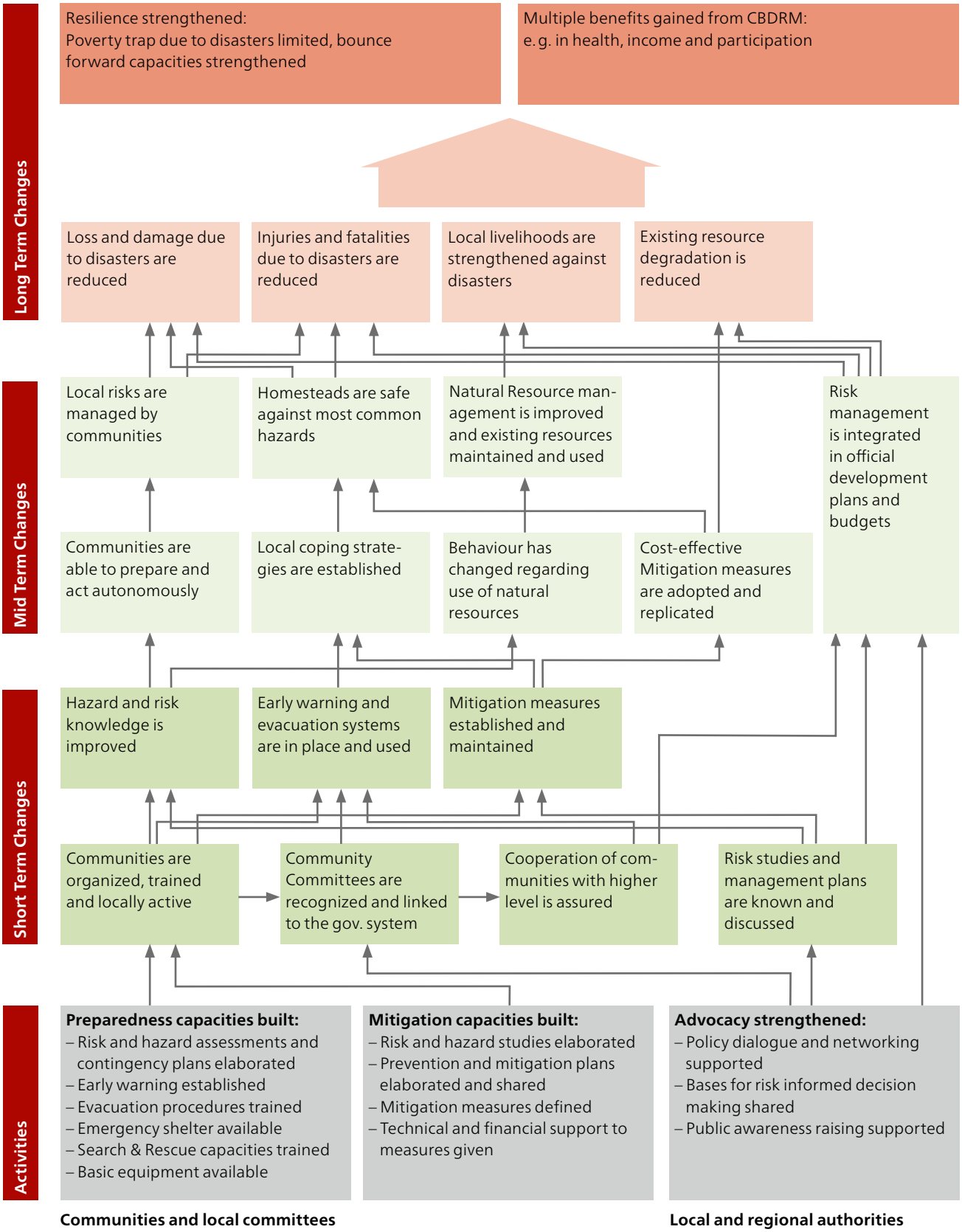


Figure 1: SRC's CBDRM Theory of Change Program

The TOC program focuses on community/local-level pathways and an evaluation of the following logical progression (short-, middle- and long-term changes):

1) The target population lives in a fragile, hazard-exposed context and lacks effective governance and public services → Communities need to be strengthened and empowered in order to act independently.

   Main assumption: Community migration rates are stable; the Red Cross, as neutral actor, is accepted and has access.

2) Communities are organized, trained and recognized, and are locally active; mitigation measures are defined and implemented jointly → ownership and increased knowledge is established locally.

   Main assumptions: capacity building and accompaniment/support lead to behavioral changes; traditional knowledge is insufficient for DRM in current climate change scenarios; local government turnover does not change from the present turnover rate.

3) Cost-effective mitigation measures are adopted and replicated; hazard and risk management practice is improved → homesteads are safe against most common hazards; and local capacities are strong enough to manage local risks independently.

   Main assumptions: cohesive communities working together for common goals (connectors) are better prepared to handle social conflicts; DRM-strengthened communities are able to leverage risk-oriented public investments; successful examples are auto-replicated; improved risk knowledge influences risk-oriented decision-making by local political and economic actors (scaling up).

4) Reduced loss, damage and fatalities as a consequence of disasters; livelihoods better protected → resilience is strengthened

2.4 Knowledge gap addressed

Disaster risk mitigation is increasingly gaining importance in development cooperation, yet robust evidence on the effectiveness and efficiency of this approach are lacking. Our study aims to establish causal relationships between the implementation of community-based disaster risk mitigation measures and the degree to which these measures minimize the effects of hazards on vulnerable communities. This approach will help analyze and evaluate the effectiveness of the different measures and up-scale promising approaches. The study will contribute to: 1) examining the potential of community-based processes by gathering hard evidence using rigorous scientific approaches to establish how effective they are in reaching the desired impacts; 2) explore different ways of incorporating evidence-based decision making to help steer programs and projects toward the desired results and behavioral changes; and 3) test a methodological approach relative to how to conduct empirical impact evaluations in the field of disaster risk reduction, thus contributing to the growing body of knowledge on evidence-based decision-making.

Additionally, few studies in the field of disaster management and disaster risk reduction interventions have conducted an impact evaluation based on a counterfactual (OXFAM, 2013; Patnaik & Das, 2017). McConnachie et al., (2016) provide further insight into the challenges of using of quasi-experimental design and counterfactuals to evaluate the cost-effectiveness of an invasive species eradication program. The present study focuses on improving the effectiveness of disaster mitigation by establishing causality, and provides a valuable opportunity for applying a quasi-experimental design and establishing a counterfactual.

3. Impact Evaluation

3.1 Objective of the impact study

The objective of this impact evaluation is to bring evidence to the question whether or not community-based DRM contributes to strengthening community resilience in disaster-prone areas.

3.2 Evaluation questions and indicators

Main Question: The main question for this evaluation was: did the Swiss Red Cross DRM program have an impact in the communities in Olancho, Honduras? In technical terms, is the program impact different from zero?

Specific Research questions:

- Is there a difference in the resilience level of the communities where intervention took place, versus those where no intervention took place?
- To what extent do soil-bioengineering techniques allow for cost-effective mitigation of flooding/landslide events in the study area?
- To what extent are communities prepared to appropriately respond to flooding/landslides events in the study area?

3.3 Data collection

In early 2018, during the first phase of this research project, 87 questionnaires were piloted (23 from control communities and 64 from communities where intervention occurred) and 8 expert interviews conducted. After calibrating the survey and refining the sampling methodology, the second phase of fieldwork was rolled out between January 14, 2019 and February 9, 2019. A team of field coordinators (3) and enumerators (9) collected data from 102 communities in seven municipalities in Olancho, implementing 810 questionnaires and 17 expert interviews.

3.4 Sampling strategy

In keeping with the methodology that will be discussed in Section 4, we used a matched sampling sample design (Guo & Fraser, 2010; Rubin, 2006). This strategy ensures matches by sampling in accordance with the hazard level of the treated communities. This is important because there is an a priori balance in the hazard variable, both in the treated communities and in the control groups, so that the two groups are comparable.

The steps taken in selecting the sample are detailed below:

Step 1: Selection of 50 communities out of the 74 treated communities.
This involved applying convenience sampling, or selecting communities with more at-risk households, versus those with few at-risk households. The latter would have been too costly in terms of time and resources. Furthermore, security concerns and regulations imposed by the HRC/SRC were taken into consideration in selecting the communities.

Step 2: Selection of households in treated communities.
Through stratified random sampling using strata to represent the different levels of hazard (high, medium and low), 400 of the 805 exposed households in the treated communities were selected, with a desired sampling rate of almost 50 %.
The final sample represented fewer households because not all of the households were available at the time of the survey. The general rule was that if a household was not available, the next household on the list with the same hazard level (ordered randomly from a uniform distribution) was contacted. In some communities, however, there were very few households available. As such, it was necessary to replace them with households from different levels.

Step 3: Selection of 50 control communities.
Two specialists, a geologist and a GIS specialist, made field visits to identify and select 50 control communities exposed to hazards and comparable to the 50 treated communities. Once the 50 communities were identified, the specialists carried out a hazard assessment following the same methodology the HRC/SRC applied to the treated communities, to obtain the households' hazard level.

Step 4: Selection of the households in the 50 control communities.
The households were selected by stratified random sampling, using the proportions of level of hazard and type of hazard from the treated communities to ensure matches. Out of the 477 households in the sample of control communities, 47 households exposed to high levels of hazard were removed in order to ensure a balance with the sample of treated households[1].

1 This was done for the sample used in the household level propensity score weighting. To remove the households, additional households were reviewed for each community and those that had the highest random numbers in the original sampling plan were removed.

4. Study Design

4.1 Definition of the projects' counterfactual

The key to causal inference is to estimate what the outcomes would have been had the treated units not been treated (Morgan & Winship, 2007). This is called a counterfactual, as it cannot be observed. In this study, a community was either treated as part of the HRC/SRC program or it was not. An ideal study design would divide a set of untreated communities into pairs that are as similar as possible, randomly allocate treatment to one community of each pair and, after a determined period, assess the treatment effects by comparing the treated and control communities in each pair. Any significant effects could then be securely attributed to the impact of the treatment. In the present case, however, it was impossible to implement such a matched-pair design. Instead, we attempted to use characteristics of the communities that would be unaffected by the treatment so as to identify untreated control communities that resembled the treated communities to the greatest extent possible (except for their treatment status) (Gertler, Martinez, Premand, Rawlings, & Vermeersch, 2011), and to compare each treated community with its counterpart(s) in the control group.

An additional issue was the inconsistent availability of robust baseline information (i.e., pre-treatment data) from which to identify the impact of the HRC/SRC CBDRM program and on which to base matching with control communities. The main reason for this lack of information was the reactive genesis of the project; the initial focus of the emergency intervention was to act quickly and to establish participatory, needs-based planning processes. In this context, the use of propensity scores was justified as other techniques could not be applied[2].

In order to overcome the lack of randomization, the present evaluation uses the statistical techniques of propensity score matching and propensity score weighting. Both are based on propensity scores, which are the probability that a unit with given observable characteristics is treated.[3] Propensity scores are used to ensure comparability between the treated and control group, thus yielding a reliable estimate of the treatment effect.

4.2 Propensity Score Matching

Propensity score matching consists in finding units in the comparison group that have the same characteristics as the treated group and can therefore serve as a match. The idea is that the treatment and control communities should be comparable. When few characteristics exist, the matching can be done directly by using those characteristics. However, when there are many characteristics on which to base a match, finding matches becomes more difficult due to the exponential growth of combinations. This is known as the "curse of dimensionality". In order to resolve this issue, Rosenbaum & Rubin, (1983) propose matching based on propensity scores. Subsequently, the outcome is compared between the treated sample and their matched, but untreated, counterparts.

2 Two common approaches are difference in difference and regression discontinuity. These were not suitable in this study because the former approach requires a consistent baseline for both the treated and control groups and the latter requires a continuous index for eligibility around a cutoff point (P. Gertler, Martinez, Rawlings, Premand, & Vermeersch, 2016).

3 For the present evaluation, propensity scores were estimated by a probit regression with the treatment dummy D_i as the dependent variable and the covariates in vector X_i as independent variables, i.e., $P(D_i=1|X_i)=\Phi(\beta' X_i)$, where Φ was the standard normal cumulative distribution function (CDF) and β' was the transpose of the vector of parameters.

Given that the program was mainly implemented at the community level, the data was aggregated using estimates of the mean of the outcome variables and covariates, taking into account the sampling design through the use of weights. Hence, matching was done at the community level rather than at the household level.[4] The dataset was then converted into estimates rather than observed values. The use of data aggregated over the sampled households versus all communities introduces measurement error, but a more detailed analysis found the effects on the results were negligible .

4.3 Propensity Score Weighting

The second approach used to compensate for the lack of randomization was propensity score weighting, whereby the propensity scores are used to weight the observations so as to account for the differences between the treated and control groups. This has the advantage of not dismissing certain observations, as commonly occurs with the matching approach (Guo & Fraser, 2010). This was important for our study as there were only 102 communities, and moreover eliminated the need to perform matching. However, the estimates can have high variability when many of the propensity scores are close to 0 or 1 (Frölich & Sperlich, 2019). The basic intuition is that in the treated group, the values of X, for which $p(X_i)$ is large, may be overrepresented in the treated group, while those for which $p(X_i)$ is small may be overrepresented in the control group. These variations are corrected using weights based on the propensity scores (Frölich & Sperlich, 2019).[5]

4.4 Choice of matching variables

In order to choose the matching variables or the covariates to be included in the propensity score regression, it is important to bear in mind the following assumptions:

1) Conditional independence assumption: The potential outcomes are independent of the treatment, conditional on the covariates: $(Y_1, Y_0) \perp D \mid X$

Or, as Heinrich, Maffioli, & Vázquez (2010) explain, "after controlling for X, the treatment assignment is "as good as random".

2) Overlap condition: For each value of X, the probability of receiving treatment is between 0 and 1: $0 < P(D = 1 \mid X) < 1$

This pertains to the fact that there must be enough overlap in the characteristics of the treated and untreated groups (common support) so that adequate matches can be found.

4 Kernel matching was done using the Epanechnikov kernel. Subsequently, different algorithms including the Gaussian kernel and nearest neighbor matching were tested as robustness checks of the results.
5 For more details on the weights, see the annex.

Additionally, it is important to take into account the criteria for choosing the matching covariates. The latter should: 1) simultaneously affect the treatment participation and outcome and, 2) not be affected by the treatment (Caliendo & Kopeinig, 2005). This is why baseline (or pre-treatment) data is useful even in the context of propensity score matching, since matching variables are generally pre-treatment variables. Since this information was not consistently available, the present study had to rely on other variables.

Considering that the evaluation focused mainly on the program's impact, one of the main matching variables was the level of hazard to which households were exposed.[6] The importance of this variable depends on the degree to which it affects the potential outcomes in terms of preparedness and knowledge about DRR. Thus, 50 communities were selected for the control group after an in-situ analysis confirmed that the following selection criteria were respected:

1) The communities were exposed to natural hazards (e.g. slope instability, flooding)

2) The communities had not been previously subjected to any intervention by the SRC or any other agency.

The level of hazard was available for all of the treated communities, as the hazard assessments were carried out before the interventions. This was not the case in the control communities. Considerable time and effort was therefore spent determining the level of hazard to which households were exposed in the latter and ensuring consistency with the methodology used in the treatment group. This was done using the **Local Analysis of Natural Hazards and Risks Methodology** (MET-ALARN) (INETER, COSUDE, 2005), the same methodology used to determine the hazard levels in the treatment group. The same geologist who had worked on the hazard assessments in the treated communities was hired to carry out these assessments. The rest of the matching variables were selected based on the expert interviews and considered the assumptions that were discussed earlier. The initial matching variables are presented in **Table 1** below.

6 Ideally, we would have used the level of risk, which is composed of the level of hazard and vulnerability. However, the pre-treatment level of vulnerability was not available for all of the treated communities.

4.5 Choice of outcome variables

The outcome variables are those on which the effect of the program will be studied. The aim of the program was to improve resilience. Therefore, the impact evaluation should ideally assess the program's effect on resilience. However, this concept is multidimensional and, according to the IFRC framework, has the following components:

– Knowledge and health

– Social cohesion

– Economic opportunities

– Well maintained and accessible infrastructures and services

– Management of natural assets

– Connectedness

The scope of this concept was too broad to capture the program's effects on all of the dimensions, especially given that these dimensions were interrelated; some were highly affected by other factors that were foreign to the program (e.g. health and economic opportunities). Hence, the evaluation concentrated on a set of indicators pertaining to knowledge of natural hazards, preparedness, social cohesion and management of natural assets. To capture the treatment effects, it was necessary to compare the control communities with the treated communities. The outcome variables were therefore selected based on variables that pertained to both treated and control communities. These are presented below in **Table 1**. Further analysis was carried out on other variables pertaining only to control communities, although the treatment effect was not estimated.

Outcome Variables (Y)	Matching Variables (X)
Knowledge of natural hazards and preparedness	Type of hazard (% of households exposed to landslides)
Hazard Knowledge	Level of hazard (% of households exposed to a high level of hazard)
Presence of Early Warning System	**Education**
Evacuation knowledge	% of respondents with at least one year of education
Subjective level of preparation at the HH Level	Average number of adults with primary education in the household.
Subjective level of preparation at the Community Level	**Proximity**
Household level measure: List of telephone numbers	Average time needed to reach the community center (community shelter, center of emergency coordination).
Household level measure: Important documents stored in one place	**Wealth and income**
Household level measure: Emergency food	Average household expenditures per capita (as proxy for income)
Household level measure: Emergency bag	% of households exposed to some type of deprivation (flooring, assets, sanitation)
Household level measure: Safe meeting point	**Entertainment/Distractions**
Household level measure: Evacuation route	% of households who owned a TV at baseline
Household level measure: Defined shelter	**Health**
Household level measure: Insurance policy	Average subjective level of health
Household level measure: Family emergency plan	
Knowledge of bioengineering measures	
Implementation of bioengineering measures	
Social Cohesion	
Availability of community preparation plan	
Community reaction in case of emergency	
Emergency committees (CODELSs) active in the community	
Community has participated in drills	
Organization in the community in response to hazards	
Management of natural assets	
Use of firewood per person per day	
Adequate waste management	

Table 1: Outcome and matching variables

4.6 Analysis of Natural Hazards and Risks

In 2005, the Swiss Agency for Cooperation and Development (SDC) and the Center for Territorial Studies of Nicaragua (INETER) developed the MET-ALARN methodology with the aim of promoting the standardization of hazard map criteria and legends for slope instability. The process, which began in 2003, was designed to be participative, inter-institutional and multidisciplinary. It produced a methodological repository that integrates ideas, experiences and inputs by experts, specialized institutions and projects to provide a practical tool whose application is feasible, flexible and contextualized to local limitations (costs, available information and existing cartography) (INETER, COSUDE, 2005). Given the contextual similarities that exist between Honduras and Nicaragua, the SRC was successful in applying this methodology to assess the type and hazard levels of communities in the department of Olancho.
Following the guidelines and recommendations of the MET-ALARN, the process of determining the type and hazard levels of the control group was divided into three main stages :

1) An analysis of an area's geomorphological characteristics

2) An analysis of an area's susceptibilities to hazards (slope instabilities/landslides and floods)

3) Definition of the hazard level

The methodology of the present study was chosen because of the lack of consistent baseline data, especially in the control communities, mainly due to the strong ethical concerns of the HRC/SRC with regard to entering communities where they do not intend to implement programs.

Stage 1: Geomorphological Method Analysis

- **Step 1. Compilation and analysis of historical information:** When available, general information on the communities was collected and analyzed. This included project documents and studies of the area.
- **Step 2. Analysis of the corresponding topographic map for each zone at a scale of 1:50 000:** By analyzing the topography of the area, each of the sites exposed to slope instability phenomena and/or flood zones were identified.
- S**tep 3. Digitization and interpretation of topographic maps of the communities at a scale of 1:5000:** Indicative elements of potential landslides, flows, floods and/or geological faults in each community were identified and mapped.

7 For details on the evaluation of the hazard level, see (Hostettler et al., 2019)

– **Step 4. Field visits to map observed slope instability phenomena and evaluate additional sites:** During field visits, known historical sites that present slope instability phenomena and those obtained from the analysis described in the previous steps were verified and documented.

– **Step 5. Slope instability and hazard maps:** Slope instability and hazard maps were generated by integrating previous analyses and the information obtained during the field survey. This included, among other things, the typology of all slope instability phenomena, identification of the trajectories of breakage of material, volume of displaced material, frequency of occurrence and the areas where the material had accumulated.

Stage 2: Evaluation and Mapping of Susceptibilities[8]

– **Step 1. Mapping of the results of the comparative analysis (thematic maps):** A comparative analysis between areas affected by past and potential slope movements (represented in the slope instability and hazards map) and the characteristics of the terrain that condition these movements (represented in different thematic maps) were developed.

– **Step 2. Calculating and mapping areas of susceptibility:** After the areas affected by slope movements (historic and potential) and the conditioning factors characterizing the terrain were determined (slope, deforestation, geologic characteristics, erosion, etc.), the degree of influence of each of these factors on the formation of slope movements was established. This degree of influence allowed for the calculation of the area's susceptibility to generate slope movements.

– **Step 3. Zoning of susceptibilities:** The classification of the susceptibility values in different intervals of the map made it possible to establish zones according to the degree of susceptibility to slope movement within the study areas.

8 Within the present methodological framework, susceptibility is understood as the ease or propensity of a terrain to generate slope movement

Stage 3: Determining the hazard level of susceptible areas

Determining the hazard level of slope instabilities identified using the geomorphic and susceptibilities methods depends on two main factors: the frequency and the intensity of the event. The MET-ALARN methodology recommends use of three frequency classes: Less than every 10 years (high frequency), every 10 to 50 years (medium frequency) and every 50+ years (low frequency). Three classes of intensity are also recommend (low, medium and high). The calculations of intensity are based on the volume and velocity of the mass displaced (**Table 2**). Once the event's frequency and intensity had been determined, the MET-ALARN matrix (**Table 3**) was used to determine the level of the threat (low, medium or high) (Hostettler, et al., 2019).

Volume (m^3)	**Velocity (cm/year)**		
	>10	**2–10**	**< 2**
> 100'000	High	High	Medium
50'000 – 100'000	High	Medium	Low
5'000 – 50'000	Medium	Low	Very low
< 5'000	Low	Very low	Very low

Table 2: Landslide intensity matrix (mainly rotational landslides) (INETER and COSUDE 2005)

Intensity	**High**	High	High	Medium
	Medium	High	Medium	Low
	Low	Medium	Low	Low
	Frequency (return period in years)	High 1–10	Medium 10–50	Low 50–200
Frequency				

Table 3: Matrix to determine threat level (INETER and COSUDE 2005)

5. Evidence: Results, Discussion, Conclusions and Recommendations

5.1 Results and Discussion

The Average treatment effect on the treated (ATET) was estimated based on propensity scores. Both approaches – weighting and matching – provided similar results and bore comparable levels of significance.

5.1.1. Knowledge on preparedness and protection at the household level

The results revealed a positive and significant outcome in terms of the level of knowledge about preparedness. This includes the ability to correctly identify the hazards to which a community is potentially exposed and knowledge about existing Early Warning Systems (EWS), evacuation routes and shelters. In order to compare them with the control group, only knowledge – not functionality – was studied, as such questions were not applicable to non-treated areas (see **Graph 1**).
Within the treated communities, 66 % of the individuals responded that they knew what hazards were, compared to 43 % in the control communities. For those who answered positively, there was a follow-up question regarding what a hazard was, in order to determine whether the respondent knew the answer clearly. After correcting for this, the percentage of households who appeared to clearly know what a hazard was represented 60 % for the treated communities and 37 % for the control communities. Upon further analysis, respondents were asked about the type of hazard they were exposed to. 65 % identified the hazard correctly in the treated communities, versus 59 % in the control communities. This difference is statistically significant. This difference increased when respondents were asked whether they had EWS in place. None of the households in the control communities reported having EWS versus 21 % in the treated communities. This captured whether the households had knowledge of EWS presence and not the actual presence of these systems in the community. When looking at the subsample of respondents who had a family member that was part of a CODEL, 32 % responded that there were EWS in place. When looking at the smaller subsample of respondents that reported having participated in the development of the Community Prevention and Preparation plan, 40 % reported EWS presence in their community. When asked about the Red Cross's main contribution to the community, a member of the CODEL in the San José del Guano community explained:

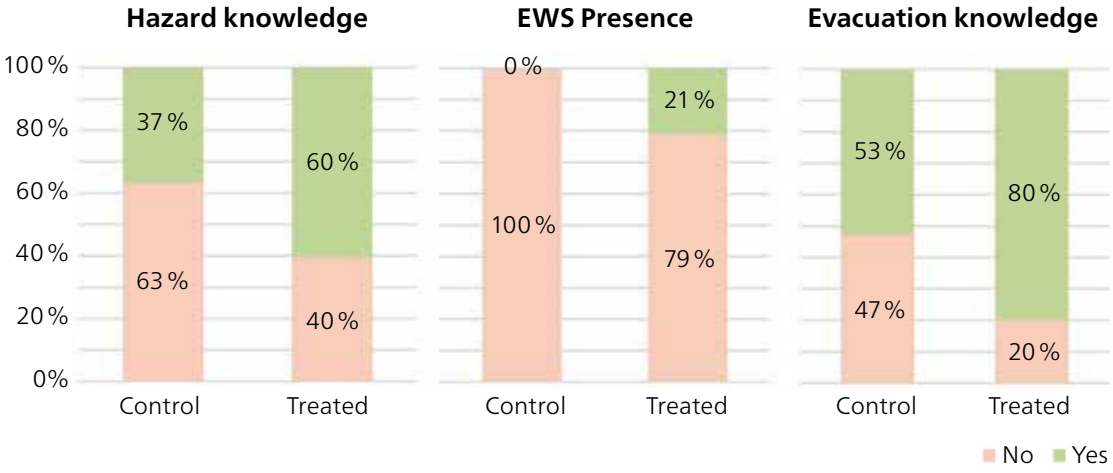
> "For us, the impact of the Red Cross has been very important because they have provided us with training to establish shelters and early warning systems in case of disasters, for us to know how to communicate in case of an emergency…
> We now know where to go and what to do. They have also contributed in terms of infrastructure, for example in the school and in the health center."

Finally, 80 % of the households from the treated communities reported knowing when to evacuate compared to 53 % of those in the control communities. Additionally, respondents were asked whether there was a reason why they or a member of their family would not evacuate if a hazard was forecasted and evacuation recommended. 93 % of the respondents from the

High vulnerability and high exposure affecting many housholds in Olancho / Honduras.



treated communities reported that they did not perceive a reason for them to evacuate at any moment, versus 82 % in the control communities. This shows that households in treated communities may take hazards more seriously and show a high acceptance of the early warning and evacuation systems, which were defined in a participatory way and regularly tested.



Graph 1: Knowledge and preparedness measures in sample of treated and control households.

As for the impact attributable to the program, the ATET was 23 percentage points for knowledge of hazards and 24 percentage points for the presence of EWS and evacuation knowledge. This means that among the treated communities, treatment increased the percentage of households with hazard knowledge, EWS presence and evacuation knowledge by more than 20 percentage points.

Furthermore, a positive and significant treatment effect was identified in the adoption of several preparedness measures at the household level. These measures are defined in the family emergency plan, as well as in the community prevention and preparation plan. Although the effect of having a family emergency plan in place was quite small (6 percentage points) and

only 6 % of the treated households claimed to have such a plan in place, the effects on different aspects of the plan differ. Some measures were more widely adopted than others. The most significant treatment effects were having a defined shelter (an ATET of 47 percentage points), having a safe meeting point, having important documents stored in one place (both with an ATET of 31 percentage points) and having an evacuation route (an ATET of 24 percentage points). The measures of emergency food and emergency bag were also statistically significant, but their ATET magnitude was quite small.

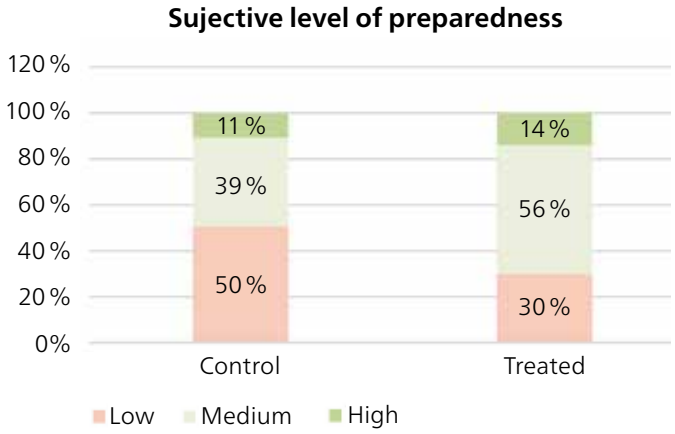
Measure	ATET	Std. Err.	[95 % Conf. Interval]	
List of telephone numbers	0.02	0.06	-0.10	0.15
Important documents stored in one place	0.31	0.09	0.14	0.48
Emergency food	0.09	0.03	0.04	0.14
Emergency bag	0.04	0.01	0.02	0.07
Safe meeting point	0.31	0.04	0.22	0.39
Evacuation route	0.24	0.05	0.14	0.34
Shelter	0.47	0.04	0.39	0.55
Family emergency plan	0.06	0.02	0.02	0.09

Table 2: ATET for household preparedness measures

These results indicate which topics the training sessions should stress and could therefore potentially feed back into the HRC/SRC programming. During field work, it was observed that not all of the household members participated in the training. This can be observed by comparing the answers of heads of households and non-heads of households, since heads of households or their spouses were more likely to be involved in the training sessions. 73 % of the heads of households reported knowing what a hazard was within the treated communities, compared to 57 % among the non-heads of households. It is important to note that these results capture whether the respondent knows about these measures, and may differ from whether the measures have actually been implemented by the household. For example, it is possible that some measures have been implemented but the respondent was not aware of it. However, the results are still valid because it is important to assess whether the household members know about these measures, so that they can react accordingly in case of an event. This shows the importance of transmitting training to all household members rather than household heads alone. Based on the qualitative analysis, the Red Cross is now trying to get young people more involved, which will be helpful in this endeavor.

Furthermore, the qualitative interviews with the Red Cross staff and community members revealed that emigration was an important factor and may affect the program's impact. This aspect is also reflected as assumption in the program's theory of change, but under the current

circumstances may be a risk: as training is a key component of the program, migration is an important challenge and results in a kind of "brain drain" due to the volatile, fragile nature of the context. The qualitative interviews offered concrete examples of communities where the CODEL were active in the past, but as most of the members had left, this was no longer the case.
In terms of **subjective level of preparedness**, households in the treated communities expressed a greater sense of preparedness compared to their non-treated counterparts (see **Graph 2**). This was assessed using a question regarding how prepared the respondent would feel in the event of a disaster (landslide or flooding) on a scale from 1 to 10, 1 being not prepared at all and 10 being completely prepared.
The graph below highlights how a higher percentage of the respondents from the control communities responded having the lowest levels of preparation, with 50 % of the respondents falling into the bottom three levels versus 30 % of the respondents from the treated group.

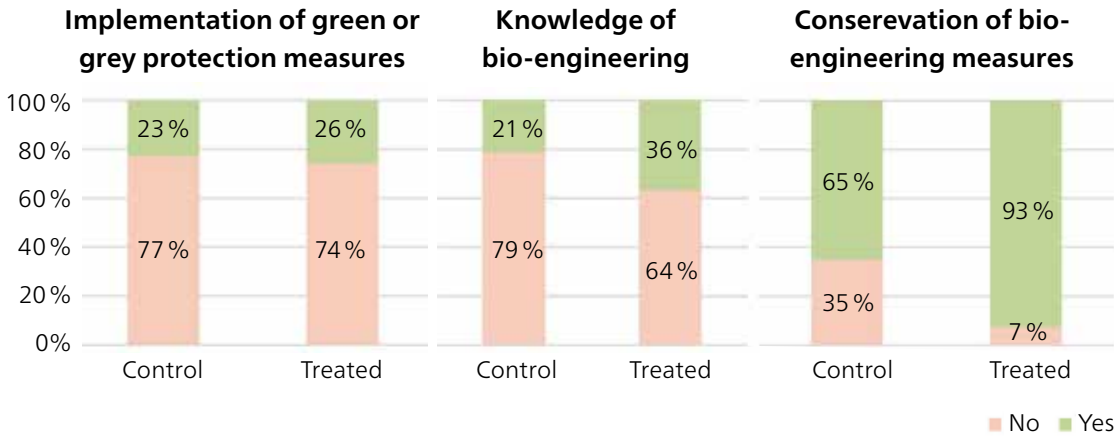


Graph 2: Subjective level of preparedness levels in sample of treated and control households.

When analyzing the ATET, a positive and statistically significant effect was found for the level of preparedness. The magnitude of the increase is slightly greater than one.

Finally, as mentioned earlier, another important component of the HRC/SRC intervention consisted in better protecting households and communities from specific hazards through "green" and "grey" measures. "Green" measures are of particular interest because they are a practical solution for controlling soil degradation and slow landslides, and can be easily replicated by other households due to their lower costs compared to grey infrastructures . Moreover, they also offer important "co-benefits" with regard to additional planting plots. Thus, the research aimed to determine whether there was a household effect on awareness of these soil bioengineering measures and on their adoption. We found a significant positive ATET of 13 percentage points in terms of the percentage of people who knew about bioengineering. However, in terms of implementation, the effect was not statistically significant because, for example, the use of izote plants to stabilize the soil is quite common in the area independent of Red Cross projects. Hence, the effect did not appear as significant, as several households in

the control group also reported having adopted these measures. This was not further analyzed in the study. However, it should be mentioned that the soil-bioengineering measures used by the HRC/SRC are tailored to each household's level of exposure and combine various measures that do not simply consist in planting izote plants. Also, it was interesting to discover that a higher percentage of households reported doing maintenance to the bioengineering measures in the treated communities than in the control communities (85 % and 71 % respectively), as can be seen in **Graph 3** and that generally speaking, the bioengineering measures were better maintained in the treated communities (93 % versus 65 %).

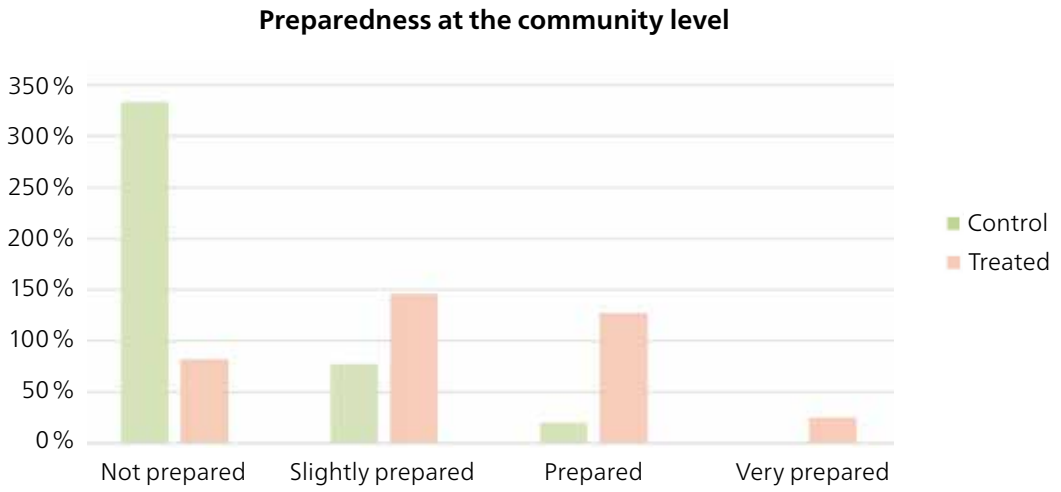


Graph 3: Protection measures, bioengineering knowledge and conservation

From the qualitative data, it was clear that communities perceived the positive effects of the bioengineering measures.

5.1.2. Social organization and cohesion for community preparedness

Another important characteristic of the program is that it is highly community-based: the community organization, whereby committees are empowered to act and are trained according to the community's main needs/risks, is the basis of the intervention.
With respect to these characteristics, the study found that respondents from the treated communities generally felt that their communities were more prepared compared to those in the control communities. In the control communities (see **Graph 4**), 77 % of the respondents said that they felt their communities were not prepared, versus only 22 % of the respondents in treated communities. The ATET of the level of preparedness was positive and statistically significant.



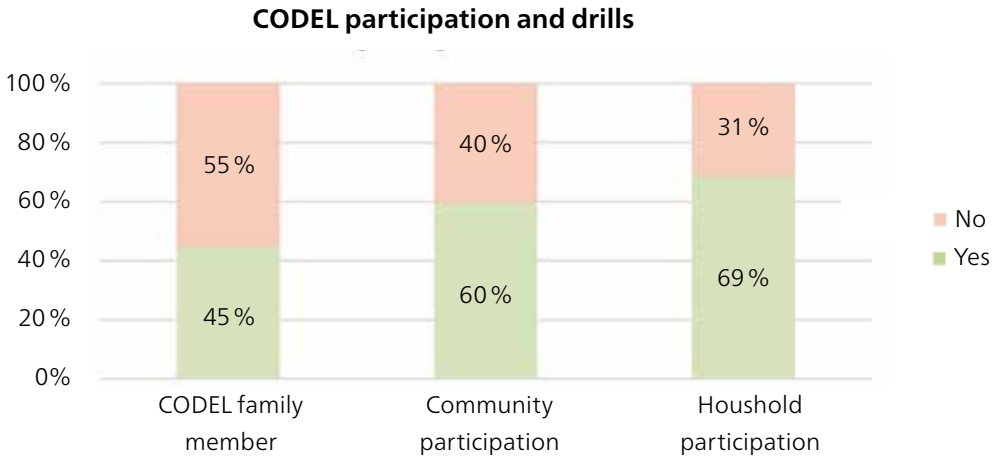
Graph 4: Subjective level of preparedness at the community level

Another key finding was the ATET for the percentage of households that reported that the emergency committees (CODELs) were active (79 percentage points). Supporting the organization, training, equipping and recognition of the CODELs, with whom the program works closely, are key components of CBDRM programs. These results reflect the fact that individuals within the community know of the existence of these emergency committees and consider them to play an important role in terms of disaster preparedness. When asked with whom they would coordinate response measures, in case of an emergency, only 2 % from the control communities considered the emergency committees, whereas 43 % of respondents in the treated communities answered that they would coordinate with either local, municipal or national emergency committees (CODEL, CODEM or COPECO). Due to methodological requirements, only community members' awareness of the committees – not their degree of activity or performance, as no active committees existed in the control areas – could be analyzed.



© Swiss Red Cross

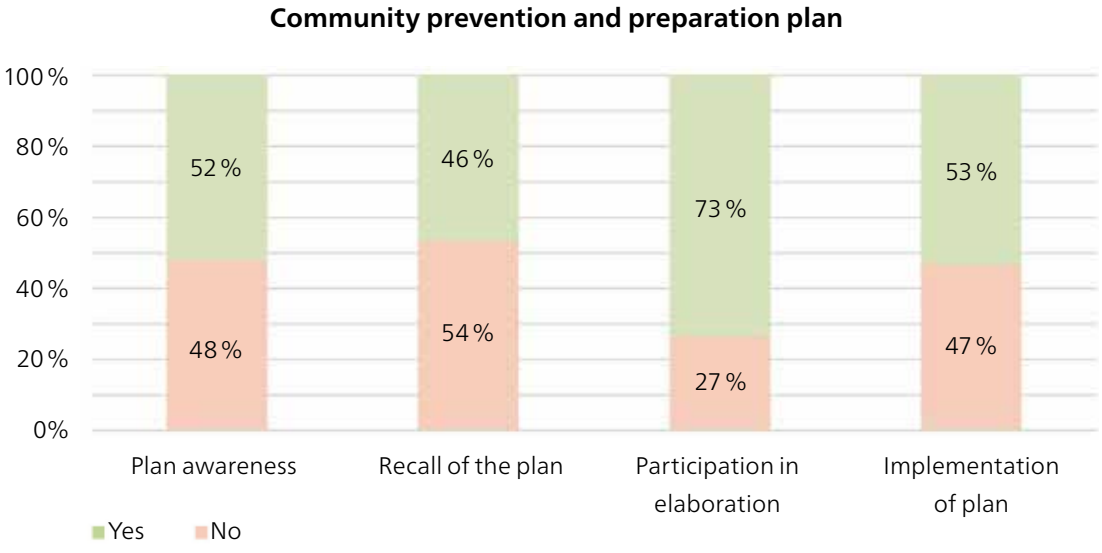
Continuing training of committee members as important component of sustainable programming.



Graph 5: CODEL participation and drills

Looking further into the CODELS and community participation in the treated communities, we found that 55 % of the households reported having a family member that was part of a CODEL. As for the participation in drills over the last 10 years, 40 % of the respondents indicated that the community had participated in a drill, and 31 % reported that someone in their household had participated in the drill (see **Graph 5**). This indicates that some measures may be implemented at the community level, but may not have the participation of all households, as the latter depends on their role in the committee.

As for the community preparation and prevention plan the Red Cross co-developed with the communities, it is interesting to note that 52 % of the households affirmed that this plan existed and that, of this subsample, 44 % recalled at least one topic described in the plan. Furthermore, out of the subsample of households that responded that the plan existed, 73 % indicated that a family member had participated in developing the plan, while 53 % indicated that the plan had been implemented to manage a hazard situation (see **Graph 6**). Again, this is in line with the previous findings on households' participation in community-level activities and measures.

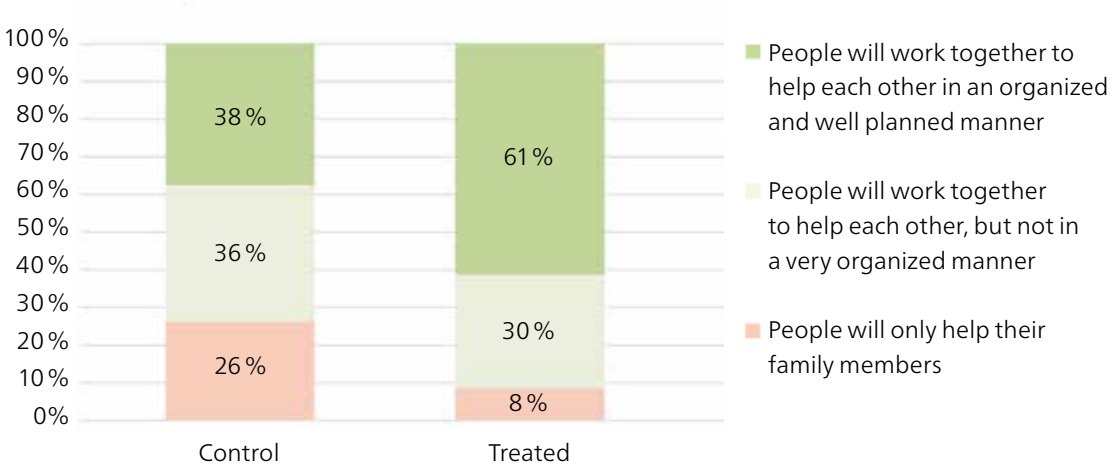


Graph 6: Community prevention and preparation plan

Based on the qualitative interviews, it can be inferred that the HRC/SRC has reinforced structures to deal with disasters within the community. This is fundamental, since not everyone in the communities has knowledge pertaining to hazards and how to react to them. CODEL members do have significantly more knowledge in this area. This was confirmed both by the quantitative data comparing CODEL members and non-members, as well as the qualitative interviews with the former. There is substantial evidence that communities have been empowered by these committees, since they are now organized and can act/react more appropriately at the community level in case of disasters.

In terms of social cohesion, the study has found evidence that there was a greater degree of social cohesion in the treated communities (see **Graph 7**). When asked how the community would act in case of an emergency, 26 % of respondents from the control communities believed they would only help their family members, versus only 8 % from the treated communities who said the same thing. Furthermore, only 38 % of respondents from the control communities believed that community members would help each other in an orderly manner, whereas in the treated communities, this percentage was significantly higher (61 %). The ATET was, in this sense, also positive and statistically significant.

Community collaboration in the event of a disaster



Graph 7: Perception of community collaboration in case of a disaster in the sample of treated and control communities.

5.1.3. Management of Natural Resources

Finally, another component of the HRC/SRC intervention was the management of natural resources. As part of the program, in addition to other measures for NRM such as water management, reforestation and reduction for soil degradation, environmentally-friendly, economic stoves ("ecofogones") were promoted and introduced in many homes in order to reduce the amount of firewood required to cook. This measure has contributed to improving health indicators by reducing the respiratory diseases and accidents generally linked to the use of traditional woodstoves. This is clear from the descriptive statistics as, in the control communities, the average number of logs used per person per day to cook was 6.8, versus treated communities that used 4.9. The estimated ATET is a decrease of 1.91 logs per person per day, which is not only statistically significant but also economically and environmentally important. This means a reduction of 558 logs per person per year. For a family of four, this is a reduction of more than 2,500 logs per family per year.

With regard to waste management, there was a positive and statistically significant effect, although the magnitude was negligible. The HRC/SRC raises awareness about reducing and recycling waste and burying their remaining garbage at the household level. However, only 6 % of the households in the treated communities reported this option. Their explanation for this had to do with the lack of waste management options in the areas of study. In this rural setting, there are no formal waste collection systems. Hence, the cheapest/most practical solution is to burn or throw waste away, with 79 % and 13 % of the total sample opting for these options respectively. However, based on the qualitative interviews, many CODEL members indicated that, thanks to the Red Cross's interventions, one of the activities they carry out is community cleaning: "In the past, maybe people did not understand that it was not okay to throw garbage anywhere. Now that they [the Red Cross] have come and provided training, we do cleaning campaigns without them having to come," expressed one CODEL member from the El Jobo community. This is in keeping with the Red Cross program's goal to create sustainable behavioral change. The objective of the intervention is to have a lasting impact, and for the communities to continue the activities even once the intervention is complete.

Qualitative interviews provided evidence of the HRC/SRC's role in terms of reforestation and the sustainable use of natural resources. According to respondents, the HRC/SRC have encouraged the communities to plant trees and implement agroforestry systems as part of their crop production. The HRC/SRC also supported the treated communities in declaring watersheds as protected areas. This process has encouraged community members to become more involved and feel empowered, as stated by the head of the CODEL in the Río Frío community regarding the declaration of a protected area:

> "This is something that one believes is impossible, but with their help [the Red Cross] we accomplished it and we now believe we can achieve more."

5.2 Conclusions

In order to frame the conclusions, it's important to revisit the research questions that guided the present impact evaluation.

Main research question:
Did the Swiss Red Cross CBDRM program impact the communities in Olancho, Honduras? In technical terms, is the program impact different from zero?

Specific research questions:

1) Is there a difference in the resilience level of those communities where SRC intervened, versus those where no intervention tool place?
2) To what extent do soil-bioengineering techniques allow for cost-effective mitigation of flooding/landslide events in the study area?
3) To what extent are communities ready and prepared to appropriately respond to flooding/landslides events in the study area?

In relation to the main research question and specific research questions 1 and 3, the evidence clearly indicates that the Red Cross' CBDRM program in Olancho, Honduras, has indeed had a positive and significant effect in the treated communities, enhancing their ability to respond to and prepare for future hazards and emergencies at both the household and at community levels in three important areas of resilience

1) **Knowledge and preparedness:** a significant difference with regard to the level of knowledge and preparedness was observed in treated communities at the individual, household and community levels. Not only did the treated communities have greater knowledge of the type(s) and level of the hazards present in their communities overall, but they are also better prepared to evacuate and coordinate response measures in case of an event than were the control communities.
2) **Social cohesion:** creating and strengthening community structures was the basis of this intervention and has significantly strengthened the treated communities' social cohesion. This approach ultimately empowers the communities, building their self-confidence so that they can take responsibility for their own destiny and strengthen their capacities for building resilience, preparing and responding.
3) **Management of natural assets:** community-based and community-shared knowledge pertaining to the risks and hazards and the related measures to mitigate them also leads to more conscientious management of natural assets (e.g. firewood, water), which are important components of a community's resilience.



Adapted variety of green mitigation measures leading also to co-benefits.

Furthermore, and relative to **specific research question 2**, the implementation of soil bio-engineering measures has proven not only to be highly cost-effective and successful in reducing the risk of landslides, but also provide additional benefits. For example, it creates an opportunity to plant fruits and vegetables (improving food security), establish medical herb gardens, firewood, harvest rainwater and vermicomposting.

The key elements that have been identified as the program's cornerstone for ensuring effectiveness in strengthening resilience are the following:

1) Carefully fostered collaboration with communities
2) Long-term project duration: contact with communities for 5-10 years
3) Scientific risk studies combined with participative and inclusive mapping
4) Choice of an integrated approach wherein disaster risk mitigation measures provide multiple benefits
5) Implemented measures have an excellent cost-benefit ratio
6) Establishment of community disaster management committees
7) Requiring contributions from the community (labor, planting material) builds commitment
8) Capacity building in leadership at the community level builds ownership
9) Reliable delivery of promised services and regular visits builds trust
10) Link to municipal-level development plans contributes to long-term sustainability

In conclusion, the findings of this impact evaluation indicate that the Red Cross's intervention program has had a positive and significant effect in treated communities, enhancing their ability to prepare for future hazards and to respond in case of an emergency at both the house-

hold and community levels. It also demonstrates that the program has empowered the communities by enhancing their capacities to prepare for future hazards and to respond in case of an emergency at both the household and community levels. Bioengineering measures have proven to be cost-beneficial and have provided benefits in addition to soil stabilization, such as improved food security, vermicomposting and water harvesting. The community-based focus of the program is a central element for reinforcing community cohesion through the establishment of community committees. Strengthened organizational structures and capacities for self-managing them, as well as training in how to run community institutions, has allowed the communities to connect to the municipal level and engage in related community development programs in fields such as health and education, thereby further strengthening overall community resilience.

5.3 Recommendations

Based on the analysis of the results and expert interviews, the following recommendations have been formulated:

At the program level:

1. The CBDRM program in Olancho should be scaled up and continued.
2. The need for SRC's continuous, long-term engagement.
3. The SRC should design an exit strategy that guarantees the communities' empowerment.
4. In case of an extreme weather event wherein treated and control communities in the intervention area have been affected by landslides or flooding, the SRC must be ready to collect all the data needed to assess these communities' capacity to bounce back/bounce forward.
5. The program should promote the participation of all household members in training & capacity building in order to guarantee deep appropriation at the community level.

At the institutional level:

6. As a point of institutional evaluation policy, the SRC should embed IEs during the initial stages of program and project design in order to guarantee availability of human, information and financial resources.
7. IE outcomes should be used to identify and upscale promising approaches, inform decision making and support the design of evidence-based policy.

6. Ethical issues

To implement an impact evaluation, a baseline would ideally be carried out both in the treated and control groups **before** the treatment. This baseline would serve to control for differences between the groups in order to capture the effect of the program when comparing them. Also, it would allow the use of different impact evaluation techniques to test the robustness of the results, such as propensity score matching, difference in differences, or a combination of both. In this case, a consistent baseline was not available for two reasons. Firstly, the Red Cross has strong ethical concerns regarding entering and gathering information from areas where they do not intend to do work. To overcome this concern, in the present evaluation, the partnership with EPFL was useful as enumerators entered the communities as part of a university rather than as part of the Red Cross in order not to raise any expectations. Secondly, the program focus was on participatory and needs-based planning, according to the guiding principles of SRC/HRC with regard to community engagement and accountability. The implementation and repetition of a consistent baseline was neglected in order to act flexibly.

7. Limitations of the impact evaluation

In line with the previous issue, it was not possible to control for many pre-treatment characteristics in the present report. Consequently, this restricted the variables that could be analyzed through this evaluation. For example, had pre-treatment variables of income and health been available, the program's effect on these variables could have been estimated. However, as this information was not available and since these variables are highly interrelated and are affected by other factors that are hard to control for, it was not possible to capture the treatment effect.

The fact is that the real world is not a lab. Moreover, this long-term program has a holistic approach and works in a multi-stakeholder context; many variables at play can affect the outcomes of interest. For example, a road was built through one treated community that strongly promoted its development. This can greatly bias the results if it is not controlled for, as the program's effect can be confused with that of the road. As more information becomes available, it will be possible to better capture the program's effect on different variables. However, in this case and to avoid these issues, the evaluation focused on DRR and used a sample of communities where no other NGOs had worked.

8. Relevance of the study

8.1 Implementation: from evidence to practice by the NGO and the development community

The SRC has a great deal of experience in CBDRM programming. According to the history and the traditional role of Red Cross Societies, preparedness and response remain among its main focuses. In a context of increasing fragility and increasingly unpredictable patterns of natural hazards due to climate change, disaster risk reduction has gained importance throughout the development community as a standalone intervention or mainstreaming measure (to prevent losses and damage due to hazards, thus hindering development). In recent years the resilience concept has also gained importance in the Red Cross movement. Hence, the additional components of CBDRM – especially prevention and risk mitigation – have likewise gained importance. As the study does not focus solely on the program's preparedness components but rather on different components of the whole CBDRM chain, the results are highly relevant and confirm the SRC's implementation of CBDRM in a more holistic way.

The recommendations of this impact evaluation will be taken into account for further program development. Future institutional decisions will thus be defined in a management response to these recommendations. The study provides important insight into the weaknesses to be addressed in the future: at the implementation level, reconsidering target people for local capacity building to ensure that not only heads of households but all household members are trained and enabled. At the same time, taking closely into account emigrational rotations of committee members, especially in areas where migration rates are high; at the institutional level, to create more robust monitoring systems and more systematic monitoring of data collection to better track the effects of the intervention and prepare the base for future evaluations.

Although the study clearly confirms **that** it works, it does not show in detail **how** it works. An important evidence gap can be filled with these results, which will be shared beyond the SRC. At the national level, it will feed into the learning and knowledge management loops of the Swiss DRR NGO platform, the unique network of Swiss civil society organizations working in DRM at national and international levels. It will also be shared in the IFRC through its standing working groups for DRR and PMER, as both the evidence for CBDRM programming and the methodological aspect of the impact study are of great interest.

8.2 Feasibility for scaling up

Currently, although the Olancho program is the most developed and comprehensive, the SRC is already implementing various CBDRM programs in different countries together with its partners. The impact evaluation provides the SRC with important evidence to promote mitigation as an essential pillar on par with preparedness, in community-based action. It will support the expansion of successful interventions.

Given the absence of government-supported services and resources, community-based action is seemingly the most cost-effective, sustainable approach to development. If proven effective, community-based mitigation measures have a high potential for scaling up and replication by communities or any other stakeholder in this field. This is particularly the case for preparedness and soil-bioengineering measures, as they are relatively low tech and low maintenance, and are based on the use of locally prevailing species.
As the SRC always works in partnership with National Red Cross Societies and can only scale up this successful approach together and in accordance with its partners and the IFRC, this study will also allow evidence-based advocacy within the Red Cross movement. This is especially important in countries where the Red Cross/Red Crescent Society focuses primarily on disaster management program – a traditional strength of the Red Cross Movement – but not (yet) on Disaster Risk Reduction.

8.3 Use for policy dialogue

The results of this impact study confirm the effectiveness of community-based disaster risk management programs based on long-term involvement, combining capacity building with structural, non-structural and specifically organizational measures at the community level.
The conditions for the holistic, lasting commitment needed to achieve these goals are increasingly under fire, as effective, sustainable and rapid results are required by international development cooperation donors. This evidence provides important arguments for long-term partnerships and underpins the effectiveness of capacity building processes, which take time and commitment.
Furthermore, the study also clearly shows the positive, cost-effectiveness ratio of preventive interventions. Investing in the prevention of disasters that will not necessarily happen is not self-evident for beneficiaries or for the donor community. While the argument of direct co-benefits of actively participating in a CBDRM program are often key for beneficiaries at the local level, evidence and cost-effectiveness are important arguments in the policy dialogue and in dialoguing with public and private donors.
The SRC will share the results by drawing up a policy brief and will support policy to advocate for risk reduction resources and promote evidence and evidence-based guidelines/tools as part of the intervention strategy dialogue in Switzerland and other countries (Partner Red Cross National Societies).

9. Lessons learned

As part of a CBDRM program, this impact evaluation is a unique experience for the SRC and for the red cross movement as a whole. Never before has such an exhaustive study has been undertaken. According to the SRC's guiding principles and participatory approaches, the Olancho program has been developed, planned, implemented and continuously adapted according to the (changing) needs of the population, the different hazards and the available resources. It also continuously integrates the innovation of local (e.g. local institutes) and international (e.g. SDC) partners. This participatory, holistic evolution has resulted in a well-anchored, locally-adapted program with a certain lack of robust, consistent data systematically over several years that would enable rigorous impact evaluation. The baseline and monitoring data collected for the different phases reflected different time and spatial scales, and was collected using different methods. It was therefore not solid enough to fulfil the requirements of rigorous statistical analysis for impact evaluation. In the future, the SRC will pay closer attention to the development and use of consistent monitoring tools.



Hazard mapping using adapted methods in order to involve the whole population in the communities.

Due to the gaps in the pre-existing data and the fact that the impact evaluation did not start at the time of implementation, the methodology chosen required careful selection of additional control communities in an area where the SRC/HRC had no interventions either ongoing or planned. This raised ethical concerns, as the SRC/HRC usually avoids collecting data in areas where no further support or intervention is planned. It is therefore highly recommended to choose intervention areas and control areas from the outset, and to be transparent in communicating with control communities in order to earn their support and approval for future studies.

Although the SRC/HRC and EPFL-CODEV had never worked together before, the collaboration, based on mutual respect for the roles, responsibilities and professional requirements of each partner, was highly successful. The match in terms of values, open mindedness and flexibility that led to this fruitful cooperation was to some degree a coincidence, as there was little time for preparation or adjustments prior to the launch. This positive process can now be used as a basis for future cooperation for applied research. Moreover, based on this experience, lessons can be determined with regard to the choice of future partnerships with others actors.

Furthermore, it is important to mention the significant cost of implementing an impact evaluation for the scale of this program. SRC as well as EPFL had to mobilize significant additional resources. The funds provided by SDC through its management partner (ETHZ-Nadel) covered not even 20 % of the total costs of this study.This is without doubt a limiting factor in terms of widespread use of impact evaluations as a standard procedure in international cooperation. This is especially true for humanitarian actors whose first priority it must be to focus on assisting affected populations in the field.

Finally, the field is not a lab. Even though impact evaluations offer mechanisms to better understand the effects of a program on a particular population, completely isolating this effect and attributing impacts to the intervention alone remains clearly challenging.

10. Annexes

Propensity Score Weights

The weights for each observation are

$$Weight_i = \frac{D_i}{\hat{p}(X_i)} + \frac{(1-D_i)}{(1-\hat{p}(X_i))},$$

where $\hat{p}(X_i)$ represents the propensity score and D_i represents the treatment status. This means that the observations in the treated groups have weights [10] $\frac{1}{\hat{p}(X_i)}$ and those in the control groups have weights $1-\frac{1}{\hat{p}(X_i)}$. The simplest estimate of the average treatment effect of the treated (ATET) compares the mean outcome of the treated group with the potential outcome had it not been treated, and is (Frölich & Sperlich, 2019)

$$\frac{1}{n_1}\sum_{i=1}^{n} Y_i D_i - Y_i\,(1-D_i)\,\frac{\hat{p}(X_i)}{1-\hat{p}(X_i)}\,.$$

However, since the weights may not sum to unity in each subsample, a preferable estimate is

$$\frac{\sum_{i=1}^{n} Y_i D_i}{\sum_{i=1}^{n} D_i} - \frac{\sum_{i=1}^{n} Y_i\,(1-D_i)\,\frac{\hat{p}(X_i)}{1-\hat{p}(X_i)}}{\sum_{i=1}^{n} (1-D_i)\,\frac{\hat{p}(X_i)}{1-\hat{p}(X_i)}}\,.$$

11. Bibliography/References

Caliendo, M., & Kopeinig, S. (2005). Some Practical Guidance for the Implementation of Propensity Score Matching. **DIW Discussion Paper, 485**(1), 1–29. https://doi.org/10.1111/j.1467-6419.2007.00527.x

Frölich, M., & Sperlich, S. (2019). Impact Evaluation. In **Impact Evaluation.** https://doi.org/10.1017/9781107337008

Gertler, P. J., Martinez, S., Premand, P., Rawlings, L. B., & Vermeersch, C. M. J. (2011). Impact Evaluation in Practice. In **The World Bank Publications.** https://doi.org/10.1596/978-0-8213-8541-8

Gertler, P., Martinez, S., Rawlings, L. B., Premand, P., & Vermeersch, C. M. J. (2016). **Impact Evaulation in Practice.** https://doi.org/10.1109/WI-IATW.2006.145

Guo, S., & Fraser, M. W. Propensity Score Analysis: Statistical Methods and Applications., Counterfactual Framework and Assumptions 21–36 (2010).

Heinrich, C., Maffioli, A., & Vázquez, G. (2010). **A Primer for Applying Propensity-Score Matching A Primer for Applying Propensity- Score Matching Impact-Evaluation Guidelines.** (August).

Hostettler, S., Jöhr, A., Montes, C., & D'Acunzi, A. (2019). Community-based landslide risk reduction: a review of a Red Cross soil bioengineering for resilience program in Honduras. **Landslides**, (March), 1779–1791. https://doi.org/10.1007/s10346-019-01161-3

Kalif Abdi, J., Farah Photo, S., & Jansso, E.-L. (2013). **Disaster Risk Reduction Programming in Ethiopia's Somali Region Oxfam GB Adaptation and Risk Reduction Outcome Indicator.**

McConnachie, M. M., Van Wilgen, B. W., Ferraro, P. J., Forsyth, A. T., Richardson, D. M., Gaertner, M., & Cowling, R. M. (2016). Using counterfactuals to evaluate the cost-effectiveness of controlling biological invasions. **Ecological Applications**, 26(2), 475–483. https://doi.org/10.1890/15-0351.1

Morgan, S. L., & Winship, C. (2007). **Counterfactuals and Causal Inference.** New York: Cambridge Unviersity Press.

Muñoz, A. (2005). **Inestabilidad de laderas: Mapa de Amenazas, Recomendaciones Técnicas para su elaboración.** 60.

Patnaik, U., & Das, P. K. (2017). Do Development Interventions Confer Adaptive Capacity? Insights from Rural India. **World Development**, 97, 298–312. https://doi.org/10.1016/j.worlddev.2017.04.017

Rosenbaum, P. R., & Rubin, D. B. (1983). a. "The Central Role of the Propensity Score in Observational Studies for Causal Effects" Biometrika. **Biometrika**, 70 SRC-(1), 41–55. https://doi.org/10.1093/biomet/70.1.41

Rubin, D. B. (2006). **Matched Sampling for Causal Effects.**

SDC. (2015). **SDC How-to-Note Financial and Economic Analysis of Projects with a focus on Cost Benefit Analysis (CBA) and Cost Effectiveness Analysis (CEA).** Retrieved from https://www.shareweb.ch/site/EI/Documents/PSD/Tools/Resource_Box/Project Review and Evaluation/Reviews and evaluations/SDC – How to Note – Cost Benefit Analysis – 2015.pdf

Table 1: Probit regression

Probit regression

Number of obs = 102
LR chi2(9) = 49.71
Prob > chi2 = 0
Pseudo R2 = 0.3517

Log likelihood = -45.83

Treatment	Coef.	Std. Err.	z	P>|z|	[95 Conf. Interval]	
% of respondents that had at least 1 year of education	-0.16	0.77	-0.20	0.84	-1.67	1.35
Average no. of adults per HH with at least 1 year of education	0.23	0.22	1.01	0.31	-0.21	0.67
Proximity (average amount of time it takes to arrive to community center)	-0.06	0.02	-2.42	0.02	-0.10	-0.01
Average expenditure per capita	-0.35	0.24	-1.46	0.15	-0.82	0.12
% of HH with some type of deprivation (floor, assets or sanitation)	-1.29	0.64	-2.01	0.05	-2.54	-0.03
% of HH who owned a TV at baseline	0.00	3.54	0.00	1.00	-6.93	6.94
Average subjective level of health	0.50	0.41	1.23	0.22	-0.30	1.30
Level of hazard: % of HHs exposed to a high level of hazard	0.02	0.01	2.64	0.01	0.00	0.03
Type of hazard: % of HHs exposed to landslides	-0.02	0.01	-3.48	0.00	-0.04	-0.01
_cons	1.38	1.29	1.07	0.29	-1.16	3.91

Table 2: ATET using community level propensity score kernel matching with Epanechnikov Kernel

Outcome (Y)	Reps	ATET	Bias	Std. Err.	[95 % Conf. Interval]	
Knowledge of what a hazard is	100	0.23	-0.01	0.06	0.11	0.35
Signal in case of a hazard	100	0.24	0.00	0.04	0.16	0.31
Knowledge of when to evacuate	100	0.24	-0.01	0.06	0.12	0.36
Subjective level of preparation at the HH Level	100	0.85	0.01	0.32	0.22	1.47
Subjective level of preparation at the Community Level	100	1.16	0.01	0.08	0.99	1.32
List of telephone numbers	100	0.02	-0.01	0.06	-0.10	0.15
Important documents stored in one place	100	0.31	0.01	0.09	0.14	0.48
Emergency food	100	0.09	0.00	0.03	0.04	0.14
Emergency bag	100	0.04	0.00	0.01	0.02	0.07
Safe meeting point	100	0.31	0.00	0.04	0.22	0.39
Evacuation route	100	0.24	0.00	0.05	0.14	0.34
Defined shelter	100	0.47	0.00	0.04	0.39	0.55
Insurance policy	100	0.00	0.00	0.00	0.00	0.01
Family emergency plan	100	0.06	0.00	0.02	0.02	0.09
Does your community have a prevention and preparation plan	100	0.41	0.00	0.03	0.34	0.47
Community reaction: will only help family members	100	-0.12	0.00	0.04	-0.20	-0.04
Community reaction: will help each other but not very organized	100	-0.08	0.01	0.06	-0.20	0.05
Community reaction: will help each other in an organized manner	100	0.24	0.00	0.07	0.11	0.37
Is the CODEL active	100	0.79	0.00	0.04	0.72	0.87
Community participation in drill	100	0.39	0.00	0.04	0.31	0.47
Coordination of response with someone from CODEL, CODEM or COPDECo	100	0.41	0.00	0.04	0.33	0.50
Logs per person per day	100	-1.91	0.11	0.41	-2.73	-1.09
Adequate waste management	100	0.05	0.00	0.02	0.00	0.09
Knowledge of bioengineering	100	0.13	0.01	0.05	0.03	0.22
Implementation of bioengineering	100	0.04	0.01	0.05	-0.07	0.14

Table 3: ATET using community level propensity score N-nearest neighbor matching with N=3

Outcome (Y)	ATET	Std. Err.	z	P>|z|	[95 Conf. Interval]	
Knowledge of what a hazard is	0.22	0.05	4.56	0.00	0.13	0.32
Signal in case of a hazard	0.24	0.03	8.39	0.00	0.18	0.29
Knowledge of when to evacuate	0.19	0.07	2.71	0.01	0.05	0.33
Subjective level of preparation at the HH Level	1.08	0.34	3.17	0.00	0.41	1.75
Subjective level of preparation at the Community Level	1.22	0.02	59.14	0.00	1.18	1.26
List of telephone numbers	0.03	0.05	0.58	0.56	-0.07	0.13
Important documents stored in one place	0.33	0.10	3.49	0.00	0.15	0.52
Emergency food	0.08	0.03	2.74	0.01	0.02	0.14
Emergency bag	0.04	0.01	3.79	0.00	0.02	0.06
Safe meeting point	0.33	0.03	10.32	0.00	0.27	0.39
Evacuation route	0.21	0.03	6.60	0.00	0.15	0.28
Defined shelter	0.47	0.04	11.37	0.00	0.39	0.55
Insurance policy	0.00	0.00	1.06	0.29	0.00	0.01
Family emergency plan	0.06	0.02	3.65	0.00	0.03	0.09
Does your community have a prevention and preparation plan	0.39	0.01	41.90	0.00	0.37	0.41
Community reaction: will only help family members	-0.04	0.03	-1.51	0.13	-0.09	0.01
Community reaction: will help each other but not very organized	-0.22	0.03	-7.55	0.00	-0.28	-0.17
Community reaction: will help each other in an organized manner	0.29	0.04	7.20	0.00	0.21	0.37
Is the CODEL active	0.77	0.05	16.71	0.00	0.68	0.86
Community participation in drill	0.38	0.04	9.43	0.00	0.30	0.46
Coordination of response with someone from CODEL, CODEM or COPDECo	0.41	0.02	23.01	0.00	0.38	0.45
Logs per person per day	-1.97	0.33	-5.87	0.00	-2.62	-1.31
Adequate waste management	0.04	0.02	1.71	0.09	-0.01	0.08
Knowledge of bioengineering	0.11	0.06	1.98	0.05	0.00	0.23
Implementation of bioengineering	0.08	0.07	1.16	0.25	-0.05	0.21

Table 4: ATET using community level propensity score N-nearest neighbor matching with N=1

Outcome (Y)	ATET	Std. Err.	z	P>|z|	[95 Conf. Interval]	
Knowledge of what a hazard is	0.24	0.04	5.57	0.00	0.16	0.32
Signal in case of a hazard	0.24	0.03	8.20	0.00	0.18	0.29
Knowledge of when to evacuate	0.04	0.13	0.29	0.77	-0.22	0.30
Subjective level of preparation at the HH Level	1.39	0.20	7.07	0.00	1.01	1.78
Subjective level of preparation at the Community Level	1.17	0.10	11.87	0.00	0.98	1.37
List of telephone numbers	0.00	0.10	0.02	0.99	-0.19	0.19
Important documents stored in one place	0.15	0.19	0.82	0.41	-0.21	0.52
Emergency food	0.03	0.04	0.79	0.43	-0.05	0.12
Emergency bag	0.04	0.01	3.18	0.00	0.01	0.06
Safe meeting point	0.33	0.03	10.67	0.00	0.27	0.39
Evacuation route	0.24	0.04	6.10	0.00	0.16	0.31
Defined shelter	0.47	0.04	11.22	0.00	0.39	0.55
Insurance policy	0.00	0.00	1.07	0.29	0.00	0.01
Family emergency plan	0.06	0.02	3.25	0.00	0.02	0.09
Does your community have a prevention and preparation plan	0.35	0.04	7.95	0.00	0.26	0.43
Community reaction: will only help family members	-0.02	0.03	-0.54	0.59	-0.08	0.04
Community reaction: will help each other but not very organized	-0.32	0.08	-3.79	0.00	-0.49	-0.15
Community reaction: will help each other in an organized manner	0.37	0.06	6.38	0.00	0.26	0.48
Is the CODEL active	0.67	0.08	8.73	0.00	0.52	0.82
Community participation in drill	0.40	0.04	10.68	0.00	0.33	0.47
Coordination of response with someone from CODEL, CODEM or COPECO	0.37	0.05	8.11	0.00	0.28	0.46
Logs per person per day	-2.23	0.56	-3.97	0.00	-3.32	-1.13
Adequate waste management	0.06	0.03	2.17	0.03	0.01	0.11
Knowledge of bioengineering	0.03	0.10	0.30	0.77	-0.16	0.22
Implementation of bioengineering	0.13	0.09	1.54	0.12	-0.04	0.30

Table 5: ATET using propensity score weights

Outcome (Y)	ATET	Std. Err.	z	P>|z|	[95 Conf. Interval]	
Knowledge of what a hazard is	0.21	0.06	3.47	0.00	0.09	0.33
Signal in case of a hazard	0.24	0.03	7.10	0.00	0.17	0.30
Knowledge of when to evacuate	0.22	0.07	2.89	0.00	0.07	0.36
Subjective level of preparation at the HH Level	1.01	0.29	3.47	0.00	0.44	1.59
Subjective level of preparation at the Community Level	1.17	0.08	14.77	0.00	1.01	1.32
List of telephone numbers	0.02	0.06	0.40	0.69	-0.09	0.14
Important documents stored in one place	0.28	0.09	3.19	0.00	0.11	0.45
Emergency food	0.09	0.03	3.04	0.00	0.03	0.14
Emergency bag	0.04	0.01	3.50	0.00	0.02	0.07
Safe meeting point	0.30	0.04	7.20	0.00	0.22	0.39
Evacuation route	0.22	0.05	4.25	0.00	0.12	0.33
Defined shelter	0.47	0.04	10.94	0.00	0.39	0.55
Insurance policy	0.00	0.00	1.01	0.31	0.00	0.01
Family emergency plan	0.06	0.02	3.51	0.00	0.03	0.09
Does your community have a prevention and preparation plan	0.40	0.04	10.66	0.00	0.33	0.47
Community reaction: will only help family members	-0.09	0.04	-2.17	0.03	-0.18	-0.01
Community reaction: will help each other but not very organized	-0.13	0.07	-1.92	0.06	-0.26	0.00
Community reaction: will help each other in an organized manner	0.26	0.07	3.93	0.00	0.13	0.39
Is the CODEL active	0.78	0.04	20.57	0.00	0.70	0.85
Community participation in drill	0.39	0.04	9.96	0.00	0.31	0.47
Coordination of response with someone from CODEL, CODEM or COPECO	0.41	0.04	10.13	0.00	0.33	0.49
Logs per person per day	-1.90	0.47	-4.01	0.00	-2.83	-0.97
Adequate waste management	0.04	0.02	2.00	0.05	0.00	0.09
Knowledge of bioengineering	0.12	0.05	2.41	0.02	0.02	0.22
Implementation of bioengineering	0.05	0.05	1.03	0.31	-0.04	0.14

12. Finance Report

	Description	Budget CHF	Expenditure CHF
1	**Compilation of existing data (dissagregation per community)**	**4,550**	**4,100**
	Salaries (compilator)	2,000	
	Salaries (coordination/guidance)	2,500	
	Communications (telephone, email)	50	
2	**Systematization of existing data**	**7,600**	**2,589**
	Salaries (systematization)	4,000	
	Salaries (coordination/guidance)	3,500	
	Communications (telephone, email)	100	
3	**Survey creation**	**8,000**	**4,100**
	Salaries (survey developer)	3,000	
	Salaries (coordination/guidance)	5,000	
4	**Enumerator,s selection, enumerator,s training (in the field) and pilot testing the survey (in the field)**	**26,130**	**29,412**
	Salaries (coordination/preparation)	10,000	
	Salary field coordinator	2,000	
	Salaries (trainer)	2,000	
	Per diem (enumerators)	2,400	
	Implementation of traininig workhop	1,000	
	Travel (international): Switzerland-Honduras	4,000	
	National travel to communities	480	
	Accomodations (international participants)	1,800	
	Accomodations (national participants)	2,400	
	Communications (telephone, email)	50	
5	**Fine-tune questionnaire and prepare to conduct field-work**	**3,050**	
	Salaries (survey developer)	1,000	
	Salaries (coordination/guidance)	2,000	
	Communications (telephone, email)	50	
6	**Cost of data collection (including implementation of survey, direct observations, etc.)**	**46,380**	**62,280**
	Salaries (coordinator/guidance research)	10,000	
	Salary field coordinator	7,500	
	Per diem (enumerators)	6,000	

	Description	Budget CHF	Expenditure CHF
	Travel national to communities	6,000	
	Travel (international): Switzerland-Honduras (research staff)	4,000	
	In-country food / acoomodation all data collectors	12,000	
	Survey materials	780	
	Communications (telephone, email)	100	
7	**Analysis (EPFL computing time): data processing and storage**	**12,000**	**4,100**
	Salaries (computing)	7,000	
	Salaries (statistitian and modeling specialist)	5,000	
8	**Report writing (development of results and recommendations)**	**10,000**	**4,100**
	Salaries (coordination/guidance/writing research partner)	10,000	
9	**Translation, publication and presentation costs of final report and open access peer reviewed article**	**34,000**	**31,751**
	Salaries (editor and translator)	5,000	
	Salary (coordinator)	5,000	
	Travel and participation (to and from presentation events)	6,000	
	Publication costs of final report	5,000	
	Peer-reviewed article (development)	10,000	
	Publication costs of open access peer-reviewed article	3,000	
	Total	**151,710**	**142,432**

Comments:

General The finance report is based on the original budget and compiles the expenditures wich incurred by SRC and by EPFL separately. All accounting details are available on request.

5 Cost for finalisation questionaire and preparation field-work are included in Line 6.

9 The costs for the report layout and printing, the Spanish translation and the presentation in Honduras have not yet been booked when the report is submitted; they will only be incurred at the beginning of 2020. A final financial report by SRC can be submitted by february 2020.

Swiss Red Cross
Werkstrasse 18
P.O. Box
CH–3084 Wabern
Phone +41 58 400 41 11
info@redcross.ch
www.redcross.ch



Post Finance
IBAN CH43 0900 0000 3000 4200 3

EPFL | Swiss Red Cross