Case Study: Lessons learned from community mapping in urban and rural areas in East Africa and Bangladesh

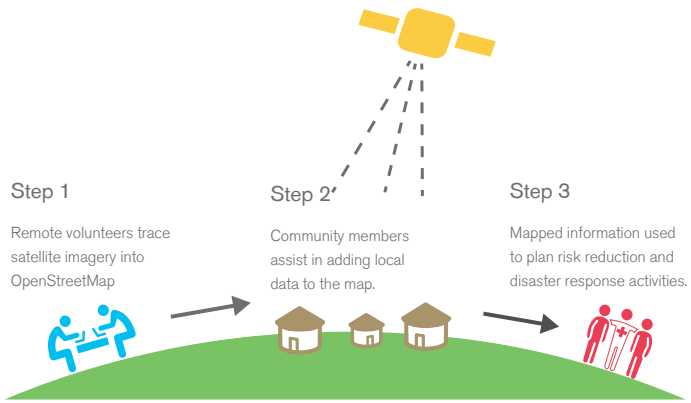
Why map communities?

Recent disaster trends indicate that people are increasingly impacted by more frequent and severe disasters particularly in vulnerable communities around the world. Humanitarian actors agree we must continue to reduce risks and build resilience so that these communities are able to better weather crises and prepare for future disasters. However, these efforts have been repeatedly and significantly hampered by the fact that disaster risk reduction experts and responders lack maps with sufficient detail to allow them to protect those in danger and get help to those in need as quickly and efficiently as possible.

The Missing Maps project aims to literally and figuratively put more than 20 million vulnerable, at-risk people on the map using OpenStreetMap (OSM) as a platform. We need to fill in these "missing maps" before the next disaster strikes ensuring the maps have detail sufficient for emergency responders to hit the ground running.

The American Red Cross, British Red Cross, Médecins Sans Frontières-UK, and the Humanitarian OpenStreetMap Team are partners in Missing Maps, however this case study is about work undertaken by the American Red Cross and the global Red Cross and Red Crescent network, in support of the larger Missing Maps partnership.

How we put communities on the map?



Since the project launched in November 2014, the Missing Maps team has been carrying out the first step of the process: remote mapping using satellite imagery made available to the OSM community. To date over 2,500 volunteers have attended a mapathon in one of 11 countries, collectively making 3.7 million edits to OSM and putting 4.5 million people on the map.

Recently we have formalized efforts on the second step of the process: traveling to multiple countries to conduct community mapping which adds local details to the map. Data collection primarily consists of road and building names, road type and quality, and building condition and material.

The team has also begun the third step: analyzing and mapping the collected community data. The validated base data is uploaded to OSM while the project-specific data is used to create maps to assist with planning and decision-making for various disaster risk reduction programs.

What have we learned? What can we do better?

The primary purpose of this case study is to elucidate our community mapping practices and lessons learned for the benefit of other practitioners. It includes a short description on our preparation for community mapping, a brief summary of the project goals in each country, and major lessons learned.

Background

Missing Maps chose locations where its partner organizations were in the early stages of conducting disaster preparedness and risk reduction activities, to facilitate the use of the collected data in planning and decision-making.

We picked four distinct communities for our initial community mapping in order to gain experience in a range of environments and refine our methodology. Locations included urban areas in Zimbabwe and Bangladesh, and rural areas in Tanzania and Rwanda.

Guiding Principles

Missing Maps uses three criteria to guide the development of community mapping projects:

- ***Engage the local community.*** In addition to the benefit of getting accurate knowledge from people who live in the area, this process brings to light major concerns of the community. The process both empowers community members and encourages them to take action themselves -- not only during the community mapping phase but into the future.

- ***Build capacity.*** A goal of Missing Maps is to build capacity and create a network of trained and experienced mappers that can continue as mapping ambassadors.

- ***Customize data collection to meet needs of the community.*** We engage and train local volunteers, residents, universities and civil authorities to create the most effective solutions based on needs they prioritize themselves.

Preparation

Identify and digitally trace area. Traced data is checked by experienced contributors and then used to create tools that allow the community to ground survey data and record additional local knowledge.

Prepare logistics and select volunteers. The American Red Cross works closely with our Red Cross and Red Crescent partners around the globe to organize community mapping on the ground. Local partners coordinate the logistics for training and mapping, as well as select volunteers to participate in the training and mapping activities.

We aim to have diverse representation of groups during our projects. Our guidelines encourage the inclusion of Red Cross or Red Crescent volunteers and staff who live in the mapped area, students, academic professionals, and representatives from local government.

Identify custom data requirements to make specific decisions. Community discussions lead to valuable insights that help to identify priority mapping needs. The American Red Cross also works with our local Red Cross and Red Crescent partners to better understand data requirements for decision-makers on the ground.

Customize data collection tools. Local partner requirements and local knowledge gained help to customize data collection tools which include:

- ***Field Papers.*** These are used for paper based data collection. A website that grids up the area to create an atlas with a full page map for each section for note taking in the field.

- ***Phones.*** Mobile phones are loaded with the data collection app, OpenMapKit to collect details about each feature, such as building name, number, material and condition.

- ***Large format print maps.*** The maps are used to engage volunteers through group activities where everyone adds information to the map. Volunteers start by adding major road names and points of interest which later serve as a reference when volunteers are on the ground mapping.

Cyahinda, Rwanda - Volunteers getting oriented and preparing for a day of mapping with Field Papers. Photo by Jenelle Eli, American Red Cross

Zimbabwe

Dzivarasekwa is in Harare's North District, a high density urban township. Community mapping in Dzivarasekwa was performed as part of an urban disaster risk reduction project with the goal of strengthening community safety and resilience to reduce the number of deaths, injuries, and socio-economic impacts caused by urban risks.

Community discussions and the baseline survey resulted in guided decisions about which details to collect during the community mapping activity. Volunteers in Dzivarasekwa surveyed more than 8,000 buildings across 7 square kilometers. One output of the mapping is shown below. The results showed a correlation between housing quality and building material type with concrete homes observed to be in worse condition than brick homes. When combined, this data provided the locations of residents most vulnerable to disasters such as flooding, making it easier to plan future disaster risk reduction activities.

Community mapping was conducted to complement a baseline survey and urban risk profile, and has helped to inform the activities that will be implemented in the next stages of the resilience project.

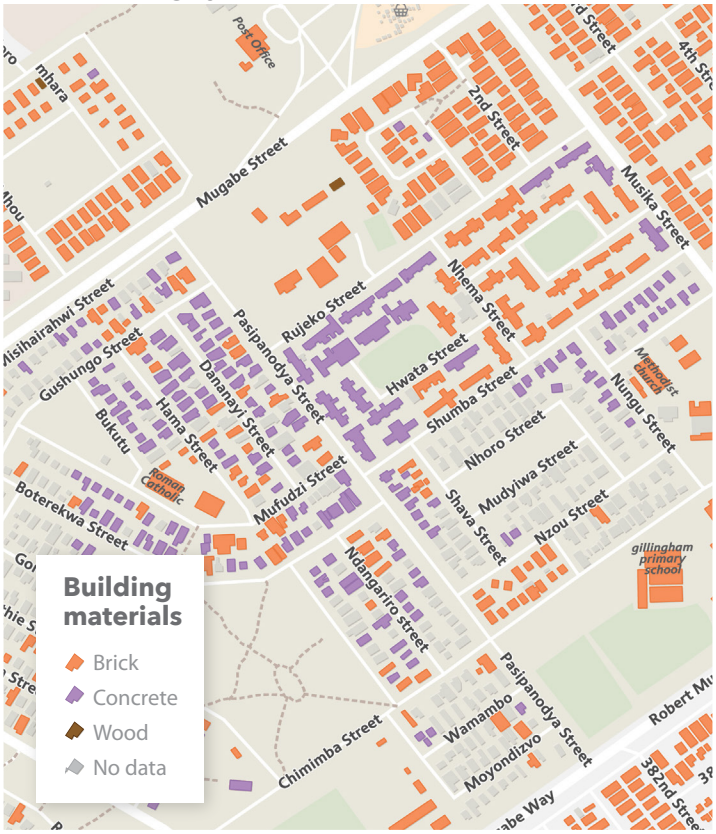
Bangladesh

Gandaria is a high density slum in Dhaka, Bangladesh. Rapid, unplanned development has forced homes close together and pathways between homes are narrow and often blocked. Community mapping in Gandaria was performed with the Bangladesh Red Crescent Society as part of a program to reduce the number of deaths, injuries and social impact caused by disasters by building safer, more resilient communities.

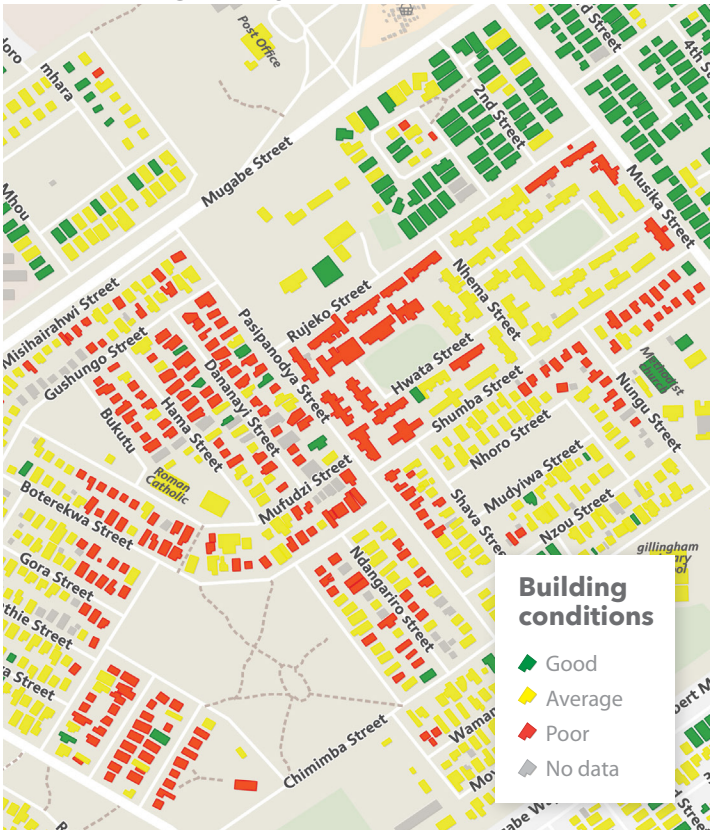
The mapping of Gandaria was challenging due to the extremely dense urban setting. There are many mixed-use buildings, structures sharing walls, and connecting roofs. Paths between structures can be narrow and partially covered by overhanging roofs making them difficult to trace from satellite imagery and decreasing GPS reliability.

Due to the large number of volunteers needed to map Gandaria we conducted a preliminary training for experienced mappers. These experienced mappers then assisted with training other volunteers and acted as team leaders. Volunteers benefited from more individual attention. This was also beneficial since mapping in Dhaka was complex and took more time. A greater level of investment was needed to train survey teams to be able to comfortably and accurately map the area.

Housing Type - Dzivarasekwa, Zimbabwe



Housing Quality - Dzivarasekwa, Zimbabwe



Tanzania

Ushirombo is a predominantly rural area in northwest Tanzania with about 84% of the residents relying on agriculture as the primary livelihood source. The rest depend on activities such as small-scale gold mining, lumbering, and informal micro-enterprises.

Community discussions and a baseline survey revealed waterborne and water-related disease is one of the primary issues in this region because most of the residents are dependent on collecting water from traditional wells and natural springs that are neither clean nor safe. Therefore, recording water and sanitation points was a priority during community mapping .

Mappers collected data in Ushirombo quickly because buildings are within close proximity to each other on flat terrain. However, many challenges still hindered the collection process, such as the lack of road names and formal building addresses. Old satellite imagery also contributed to the problem since the base maps on Field Papers and OpenMapKit app did not match the reality on the ground.

Despite these challenges, the participation of community leaders in the community mapping process led to the success of mapping Ushirombo. Leaders such as village chiefs joined the field mapping expeditions to help navigate and manage community relationships. This aided data quality and collection efficiency because mappers were able to continue collecting data while community leaders spent time answering questions from residents.

Rwanda

The focus in Rwanda was Cyahinda, an agricultural region in the Nyaruguru district near the Burundi border. Low-density villages and collections of buildings are spread across hills terraced for small-scale farming, connected by dirt roads and tracks.

Community discussions and a community needs assessment in Nyaruguru district revealed several key challenges facing the district including poor health and sanitation, environmental degradation, and disaster risks related to landslides and drought.

The team faced a technology error in the field. We originally planned to use OpenMapKit. However, last-minute errors prevented the app from functioning properly, and we resorted to using paper-based methods instead.

Field mapping in Cyahinda's rural setting was also slower than other mapping projects due to the size of the area, wide distribution of buildings, and tiring walks through the hilly terrain.

To combat this challenge, we determined which parts contained buildings and created a strategic plan to divide the areas into manageable sections. Volunteers were assigned adjacent field papers to reduce the amount of walking and traversing of hills. The planned approach enabled the team to survey 2,200 buildings in less than a week across 25 square kilometers.

Mapping Results

	Zimbabwe Dziverasekwa	*Tanzania* Ushirumbo	*Rwanda* Cyahinda	*Bangladesh* Dhaka
Project Location				
Area Mapped	*2.7 miles²*	*3.9 miles²*	*9.7 miles²*	*0.6 miles²*
Buildings Mapped	*5,380*	*3,800*	*2,200*	*1,100*
Fieldwork Length	*5 days*	*5 days*	*4 days*	*5 days*
Field Volunteers	*20*	*20*	*20*	*35*

Lessons Learned

Practical field training is more beneficial than classroom training. Volunteers learned how to use Field Papers and OpenMapKit faster through practical trainings focused on hands-on experience of mapping areas. This allows the team to re-group and answer questions before traveling into the field.

Community discussions should guide mapping. We held open sessions for trainees to tell us about their communities and talk about issues important to them. These discussions led to valuable insights that helped us focus on priority mapping needs.

Build trust. Trust between the community and various participants is important for the process to be effective. If there is no trust, people will disengage from the process. We built trust through various group activities and community discussions creating an environment for open communication between participants.

Bigger is better. Large format print maps helped to engage trainees. Small groups of trainees added details to the map. This helped kick-start insightful conversations about differences in perception and began to clarify boundaries, major roads, and landmarks which helped during field mapping.

Focus on teaching map literacy. Even with the use of GPS and reference maps, map literacy was a major challenge in every country. We attached the large reference maps to a vehicle and checked in with groups to verify that volunteers could correctly identify their location.

Mapping is hard work. Exposure to the elements while collecting data for hundreds of features in a day can be overwhelming and it is essential to plan breaks, provide food and water, and most importantly keep volunteers motivated and happy.

Complete the process in the field and verify data. Volunteers generally record a large number of complex notes in different ways unless time is spent introducing and enforcing standards and work flow. Remote digitization of Field Papers is easier if there are standards for commonly occurring edits such as: adding missing roads, adding missing buildings, and splitting or combining incorrectly traced buildings. We had volunteers write their names on the Field Papers so each would be able to add the data from their own notes to OSM. Spend time verifying and checking during the whole process, especially before uploading. We noticed many errors included spelling mistakes in the data and it is much easier to fix them before uploading.

Having recent, clear imagery is vital when tracing. Many challenges were encountered in the field when buildings and roads were inaccurate or missing. Satellite imagery generally suffered from one or more of the following issues: atmospheric haze, off-nadir (oblique), outdated information, or poor contrast. In urban areas, image quality issues were exacerbated by: the density of development, wide variance in building heights, rapid change in the form of both demolition and construction, and lack of planned development such as no gridded streets. Ways to mitigate these challenges in order to gain accurate and usable data include: working ahead of time to get better quality imagery and adding more time for mapping to account for the complexities encountered while providing solutions to the volunteers on how to respond to the challenges.

Redundancy keeps activities on track. In Rwanda we originally planned to use OpenMapKit. However, last-minute errors prevented the app from functioning properly, and we needed to use paper-based methods instead. The error has since been fixed, but this experience highlights the importance of contingency tools and plans in case things do not go as expected during field work.