



DRR IN  
ACTION  
CASE STUDY

## Digitalizing Paper-Based Community mapping in the EVCA

### Theme of Case Study

Digitalizing community data from transect walks and focus group discussions

### Country

Colombia

### Case Study Location

In various communities in Colombia

### Background

Community mapping in paper-based formats is low-cost, technology-independent, that is easily facilitated, and adopted at the community level. However, the output can be less sustainable compared to digital map products. The digitalization of the community data comes with the loss of information and is time-intensive because the geolocation and therefore the exact location and extent of mapped elements can only be transposed to a digital format by individuals with detailed technical knowledge.

One option to digitalize paper-based community mapping is the usage of the Sketch Map Tool (SMT). This free web tool automatizes the digitalization of hand-drawn information on so-called Sketch Maps, thereby bridging paper-based data collection with digital data analysis and storage.

In 2023, the Colombian Red Cross (CRC), in partnership with the German Red Cross (GRC) and the HeiGIT gGmbH (Heidelberg Institute for Geoinformation Technology), initiated a project aiming to explore the usage of the SMT during transect walks and in group discussions in the context of the Enhanced Vulnerability and Capacity Assessment (EVCA).

#### Sketch Map Tool

The easy-to-use web tool supports Map Creation, where a Sketch Map is created, exported, printed on paper and its initial base map information is analyzed. After markings are made with pens, the tool supports their Digitalization by automatically detecting the color and geolocation.

#### Sketch Map

Sketch Maps depict freely available OpenStreetMap data at a selected scale. Sketching on these base maps aims at recording accurate georeferenced data, meaning that distances measured on the map always represent the equivalent scale-dependent distance on the ground.

Photo: Verification of capacities and vulnerabilities with community members

## What did the action seek to change?

Paper community maps are often under or not utilized because they cannot be easily shared among stakeholders, and information may not be presented in a user-friendly or legible way. They are susceptible to being irrelevant, forgotten, or destroyed, and are difficult to update in case the mapping needs to be re-done e.g., if the community experiences change over time. The digitalization of the information on analog maps provides communities, as well as National Society branches, the opportunity to create and use digital map products and their data for advocacy purposes and decision-making in disaster risk reduction planning and disaster response.

## What key actions were taken to achieve change?

Digitalization was achieved through a 2-day hands-on training exercise (covering the SMT, a Missing Maps methodology, and an introduction to the Geographic Information System (GIS) software QGIS) combined with the practical implementation. The methodology represents a collaborative and participatory mapping approach because the CRC before using the SMT conducted a Missing Maps Mapathon to improve the base map data displayed on the Sketch Maps in collaboration with remote volunteers.

The methodology is divided into four phases:

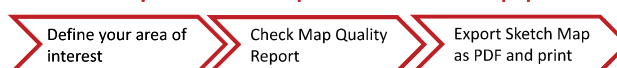
1. Tracing aerial imagery (optional)
2. Creating, analyzing, and printing Sketch Maps
3. Community mapping on Sketch Maps
4. Digitalizing information from Sketch Maps and creating digital community maps.

### 1. Organize a Missing Maps Mapathon (optional)

- Tracing of maps (e.g., buildings and roads) from aerial imagery into OpenStreetMap online with remote volunteer to create or improve base maps of the Sketch Maps



### 2. Create and print Sketch Maps to collect data on paper

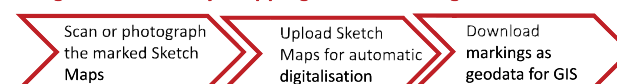


### 3. Paper-based Community Mapping

- Data collection with communities in- and outdoor with pens on paper Sketch Maps



### 4. Digital Community Mapping: Automatic digitalisation

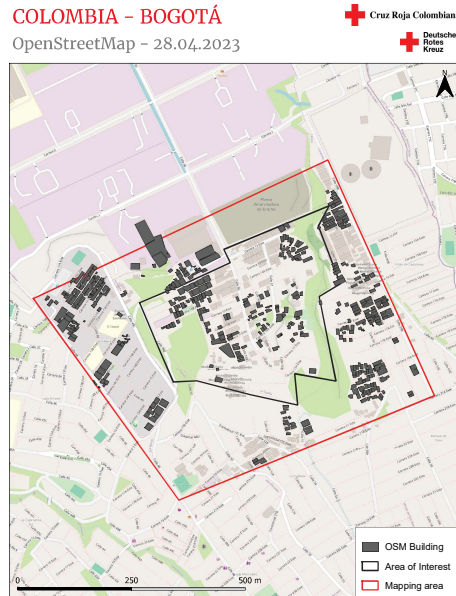
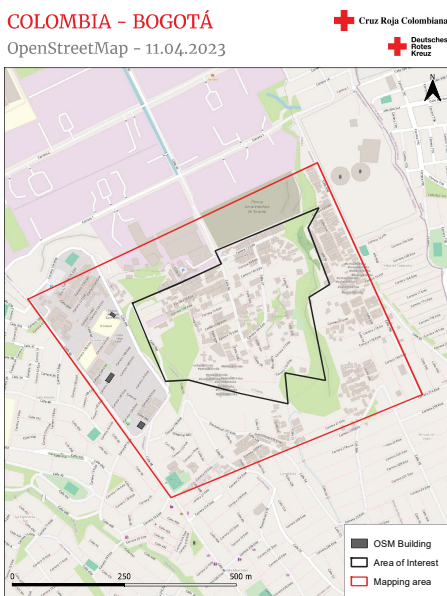


#### Tech Tip

If the OpenStreetMap data existing before the first phase is already sufficient for community mapping and orientation on the map, the tracing of maps can be skipped. -> Consult the OpenStreetMap website or the SMT's Map Quality Check Report (Phase 2).

### 1. Tracing Maps

During the first phase, groups of volunteers and National Society staff collaboratively trace aerial imagery (e.g., from satellites) to create a basic digital base map of the community in OpenStreetMap. The tracing is facilitated in the context of the Missing Maps project using the HOT Tasking Manager and can be done during organized events called “Mapathons”, where on-site and remote volunteers convene to create initial base maps. Depending on the project community and the required level of detail, these base maps can only show road or building outlines or local details, such as landmarks and the type of building.



Date: 04.03.2024, Scale: 1:5000, Datum: Bogotá 1975 / Colombia Bogota zone, EPSG: 22897

Data Source: Falkenberg Had Chou, © OpenStreetMap (and contributors), CC-BY-SA

Disclaimer: The boundaries, names and designations used in this map do not imply official endorsement, nor express a political opinion on the part of the ICRC or IRC, and are without prejudice to claims of sovereignty over the territories mentioned.

Date: 04.03.2024, Scale: 1:5000, Datum: Bogotá 1975 / Colombia Bogota zone, EPSG: 22897

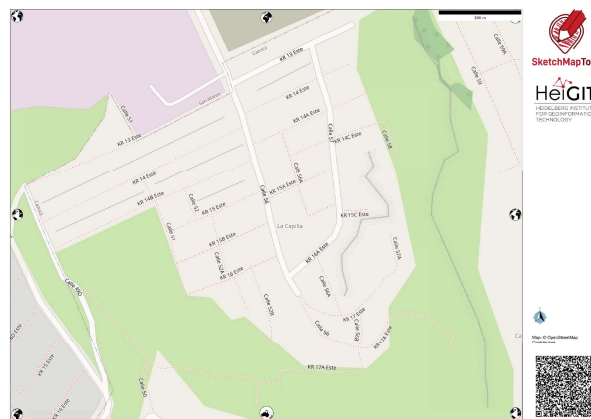
Data Source: Falkenberg Had Chou, © OpenStreetMap (and contributors), CC-BY-SA

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Result of tracing maps in the HOT Tasking Manager with a Missing Maps Mapathon

### 2. Creating, analyzing, and printing Sketch Maps

In the second phase, the SMT website is used before the community mapping activity to select an area of interest (e.g., community boundaries) and to evaluate the data quality of the OpenStreetMap base map regarding its suitability for participatory mapping. The tool provides users with the Sketch Map ready for printing in various paper formats and orientations. During the Sketch Map generation, users can choose what will be printed by the Sketch Map and how. Users can insert coordinates of the area of interest, search places by names, or zoom in and out. Additionally, the extent and level of detail of the base map (map scale and resolution) can be adjusted. Several paper formats and orientations can be selected depending on the use case.



coordinates of the area of interest, search places by names, or zoom in and out. Additionally, the extent and level of detail of the base map (map scale and resolution) can be adjusted. Several paper formats and orientations can be selected depending on the use case.

Sketch Map of the case study location

### Tech Tip: Sketch Map Generation

The scale and map details shown on the Sketch Map depend on the mapping objective (e.g., capacities/risk drivers), disaster context, and hazard type (e.g., rural river flooding/urban flooding), while the mapping activity (e.g., transect walk/group discussions) impact the choice of paper format.

### Caution

On the Sketch Map, markings can only be done on the base map. The globes and the QR code must not be marked or damaged because this disables the SMT's digitalization function.

### Tech Tip: Legend

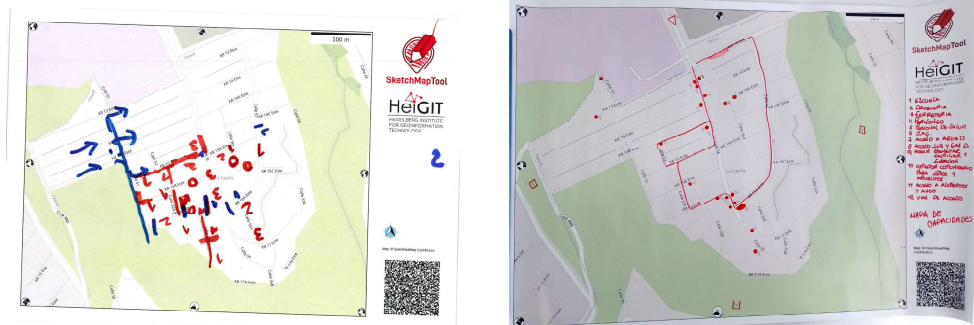
A legend on the side of the map can help to keep track of the methodology and analyze the output. Numbers or different colors can be used to visualize the intensity or year of a hazardous event, different ranks (e.g., low, medium, or high), or types of elements (e.g., capacity or vulnerability).

### 3. Community mapping on Sketch Maps

The third phase, community or "field" mapping, is where community members add details to the Sketch Map by drawing on it. About the EVCA, this is when community members use their local knowledge and perceptions to identify exposed areas (e.g., past flood extent), capacities (e.g., health facilities), vulnerable elements or groups (e.g., improper constructions, children, elderly, etc.) and underlying risk drivers (e.g., environmental degradation in the external environment). Communities can also visualize, communicate, and discuss their aspirations and development priorities for example on so-called "dream maps" to plan community DRR actions.

Before community mapping, discuss which routes to take during the transect walk, what topics to map, and agree on a methodology (e.g., use of different colors, numbers, types of markings (points, lines, areas, symbols)). It is recommended to create a legend on the side and to focus on one topic per Sketch Map to be able to analyze the results.

The community of La Capilla in Soacha, which first tested the approach, is part of the Flood Resilience project implemented by the CRC with the support of the Z Zurich Foundation. For revising the EVCA, members of the community with the support of the CRC carried out a transect walk and three focus group discussions around a table. Locations and areas were marked on the Sketch Maps and specified in legends on the side of the base map. On 15 small-scale Sketch Maps (A4) information on flood perception was collected. Participants indicated the perceived location of past flooding events on the road network with lines and areas and the perceived flood level with numbers. On two large-scale Sketch Maps (A2) information about the geolocation of community resources and "dreams" was recorded with lines, points, and symbols during group discussions.



Sketch Maps of 1) Perception of flooded areas (lines) and estimated flood level (numbers), and 2) Resources

### Tech Tip: Geodata formats

The GeoTIFF is a geodata format, which represents a georeferenced "picture" of the marked Sketch Map (also called a raster image). The GeoJSON is a geodata format, which provides the user with the georeferenced and color-detected markings only without the base map in the background (also called vector layer).

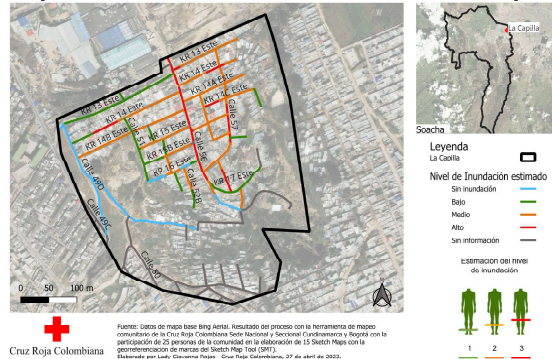
### 4. Digitalizing information from Sketch Maps and creating digital community maps

During the fourth phase, the SMT website is used for a second time for the automatic digitalization (color detection and georeferencing) of the markings on the maps. Georeferencing means that the markings of the paper maps will be displayed at the corresponding spatial location on the computer. First, save the pictures or scans of the marked Sketch Maps digitally with the most important information (e.g., who created it, when and where, and with what purpose), then upload these to the website. The digitalization results are provided in two data formats (GeoTIFF and GeoJSON), which can be imported, edited, and visualized in any GIS software for creating digital community maps.

The CRC used the digitalized results for analyzing and visualizing the community information based on the legend description on the side of each Sketch Map, while creating digital community maps for flood perception, capacities, and "community dreams" with the QGIS software. Alternatively, information collected on several individual Sketch Maps, such as areas of individual risk perceptions or location of vulnerabilities and capacities, can also be visualized on one digital map for example as

overlapping areas or different colored icons. GIS software also enables the analysis and visualization of data collected on Sketch Maps in combination with other data sources (e.g., authority data, data

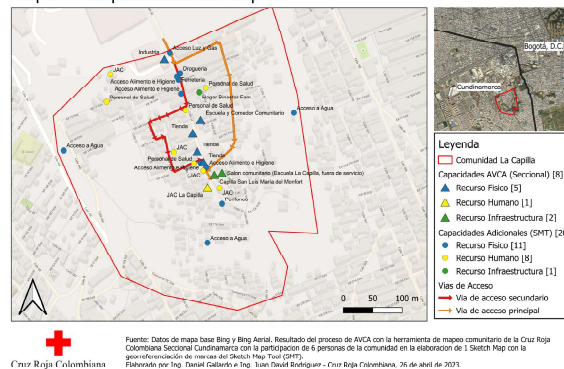
### Mapa de amenaza de inundación estimada - La Capilla



collected in surveys). Optionally, local details collected and digitalized such as capacity information can be uploaded into OpenStreetMap to create a richer online map (see box about data protection).

The final community maps were shared with the community for disaster risk management activities (e.g., drafting contingency plans, local urban development planning, and advocacy with stakeholders for example on infrastructure and services). The CRC can use the information on the digital maps to plan adaptation, preparedness, and response activities.

### Mapa de Capacidades La Capilla



Digital community maps of 1) Flood perception, and 2) Capacities after the digitalizing and analysis in GIS

### Tech Tip

For focus group discussions a Sketch Map in large paper format (e.g., A2, A1) can be useful, while smaller paper formats (e.g., A4, A3) are easier to carry along a transect walk. Sketch Maps which display the entire extent of the community including its external environment may help to visualize the relationship of the community with its surroundings, enabling the assessment of semi-urban areas or identification of risk drivers of disasters. Sketch Maps with a more detailed extent of the community, such as a particular neighborhood can be useful for analyzing capacities or urban disaster contexts, such as urban flooding.

## What are the essential steps?

Community mapping on Sketch Maps during transect walks and focus group discussions takes about 1 day to complete but office work is required beforehand for preparing the activity (steps 1, 3-6) and for organizing a Mapathon if needed (step 2). The creation of the final digital community maps in GIS software (step 10) after the digitalization of the community information with the SMT (steps 8 and 9) needs additional time.

Phase 1	Step 1	OpenStreetMap/ SMT: Verify the suitability of base map data for community mapping via the OpenStreetMap website or SMT website (Step 5).
	Step 2	OpenStreetMap: Hold a Missing Maps Mapathon where volunteers and staff trace buildings and roads from aerial imagery into OpenStreetMap to create or improve base maps for subsequent usage of the SMT. Additional points of interest can be added with the online editor ID Editor, enhancing the orientation on the Sketch Map.
Phase 2	Step 3	SMT: Conduct SMT introductory training (≈ 1-2 hours) for facilitators of community mapping (e.g., EVCA ToT training module) and advanced training (≈ 4 hours) for those involved in creating digital community maps with GIS software (e.g., SMT's Help site). Hold a stakeholder engagement meeting to determine what should be mapped and how (possibly with a legend on the side of the map).

Quotes:

*“The Sketch Map Tool allows for improving the community maps resulting from EVCA community exercises, improving their visualization and digitization for better decision making as well as for later consultation and use. In addition, to hazards, these allow contrasting the community’s perception with the hazard maps of official institutions.”*

*Eduard Giovanni Ruiz Morales,  
Risk Knowledge Manager at  
Colombian Red Cross*

	Step 4	SMT: Create a Sketch Map for the community (and its external environment) in a suitable paper format and orientation on the SMT website.
	Step 5	SMT: Download the Map Quality Check Report and follow recommendations if the suitability of OpenStreetMap base map data is unsatisfactory for participatory mapping (consider St
	Step 6	SMT: Download and print the Sketch Map(s).
Phase 3	Step 7	Paper-based community mapping: Community members use the paper Sketch Map(s) to record exposed areas and elements, capacities, vulnerabilities, or “community dreams” during transect walks or focus group discussions.
Phase 4	Step 8	SMT: Scan or photograph the Sketch Map(s) and upload them on the SMT website for the automatic digitalization of the markings.
	Step 9	SMT: Download and store the georeferenced and color-detected results, namely the markings, on the computer.
	Step 10	Digital community mapping: Import, analyze, and edit the digitalized community data in GIS software. Use the legend descriptions (in the case created on the side of the Sketch Map) to label or visualize the collected information and create digital community maps.
	Step 11	Sharing maps: Print digital community maps and provide them to the communities for their community DRR action planning and contingency planning.

### Data Protection

Any data traced or collected that is public knowledge (E.g., schools, health centers, etc.) can be added to OpenStreetMap. All private or sensitive information (non-public data), such as vulnerability information, should be stored with the National Society. The digitalization of the information on the Sketch Maps is securely processed on servers of HeiGIT.

### What were the Achievements and Impacts?

The digitalization of the community mapping, transect walk, and focus group discussion tools of the EVCA has contributed to:

- The digitalization function of the SMT saves time compared to the manual digitalization of hand-drawn maps because the colors and geolocation of information drawn on the Sketch Maps are automatically detected. Thereby, the SMT combines benefits from paper-based community mapping and digital mapping.
- Sketch Maps help to overcome the challenges of paper-based community mapping as the results can be easily digitalized, increase accuracy, be longer-lasting, and be more easily updated and shared. The collaborative mapping on Sketch Maps can stimulate and help record group discussions about DRR actions. The visual output of this process can also be easily digitalized for further planning.
- Due to the participatory nature of the tool, all ages, genders, and groups can participate in the exercise.
- The analog and digital map products as well as the digital data repository, which includes

the geolocation of capacities, community plans, and the extent of past flood exposure, are useful for planning local disaster risk management and climate change adaptation, for advocacy with stakeholders, and as a reference during emergency responses.

- The publicly available online map of the community on OpenStreetMap is improved. Holding a Missing Maps Mapathon can be a useful addition for the SMT methodology.

Additionally, the training about the digitalization of the EVCA tools and its implementation has contributed to:

- The CRC familiarized themselves with all steps of the SMT and can harness its full potential, namely the paper-based data collection, automatic digitalization of the hand-drawn information, and the analysis and visualization of the information on digital maps products for decision making.
- The CRC gained technical skills in using Geographic Information System software and in holding Missing Maps Mapathons which will enable them to: create accurate base maps; and to use open geographic data from OpenStreetMap in conjunction with digitalized community information from Sketch Maps for digital map products for disaster preparedness and response. New collaborations between CRC, HeiGIT, YouthMappers, and the Open Mapping Hub - Latin America and the Caribbean of the Humanitarian OpenStreetMap Team have been formed to support this process.

Quotes:

*"The Sketch Map Tool .was very useful because it is a guide in the neighborhood, it serves as a guide to recognize needs and infrastructure."*

*Community members of La Capilla, Soacha, Colombia*

## What digital tools are being used in EVCA?

The CRC used the following digital tools while conducting the community mapping in the EVCA:

1. SMT: This is a free, open-source web tool, which generates and analyzes base maps with OpenStreetMap data on so-called Sketch Maps. CRC printed these Sketch Maps in various formats and used them for paper-based community mapping. Afterward, the pictures or scans of the Sketch Maps were uploaded to the website. The tool automatically detects the colors and geolocation of the hand-drawn information and provides users with the results for download in various geodata formats for further analysis and visualization on the computer. No installation or registration is needed.
2. OpenStreetMap: This is a free, open-source digital world map, which is editable. CRC conducted a Missing Maps Mapathon where the base map was improved by tracing objects from aerial imageries with the help of volunteers and staff. Tools used included: learnOSM, and HOT Tasking Manager, if local information is planned to be added to OpenStreetMap, an editing tool, such as the iD Editor is needed.
3. GIS Software QGIS: The free, open-source Geographic Information Systems (GIS) software. It has been used by the CRC to create, analyze, edit, and visualize the digitalized hand-drawn information of the Sketch Maps to create layered, digital maps.

## Can the digital tools be used outside of the EVCA?

The SMT (paper-based data collection and digitalization tool), OpenStreetMap (freely editable online map) and QGIS software (digital mapmaking tool) are tools that the CRC can use in non-emergency settings (for data collection for design and planning of community-based DRR and climate change adaptation projects) as well as for impact or needs assessments required for informed decision-making in emergency responses. Besides focus group discussions and transect walks, the SMT can also be used in interviews or paper-based questionnaires and for community feedback mechanisms for project monitoring and evaluations.

Quotes:

*"The Sketch Map Tool helps to locate and identify risk areas."  
Community members of La Capilla,  
Soacha, Colombia*

Quotes:

*"The Tool helps to identify evacuation routes or other places [useful] at the time of an emergency."  
Community members of La Capilla,  
Soacha, Colombia*

## What are Key Lessons Learned?

### Mapathon before Sketch Map Tool - yes or no?

As the SMT generates paper map layouts with the available OpenStreetMap data, Sketch Maps of remote, rural, or unmapped areas might not have sufficient information, such as infrastructure or landmarks, displayed. This can seriously impact the community members' ability to read, orientate, or sketch anything on the map. By improving the OpenStreetMap base map quality through holding a Missing Maps Mapathon (Step 2), roads, buildings, waterways, etc. can be traced based on aerial images. This increases the level of detail and accuracy of the subsequent paper-based mapping with Sketch Maps during transect walks or focus group discussions. Reviewing the SMT's Map Quality Check Report (Steps 1 and 5) for the community area can be very useful in determining if a Mapathon should be conducted beforehand. If possible, involve more community members in 'crowdsourcing' the base map during a Mapathon as their local knowledge and the diversity of participants increase the quality of the result.

### Group composition and map literacy

Not everyone in a community is familiar with reading and orientating on a geographic map. Instead of teaching each one individually how to read the OpenStreetMap base map, organize the groups for transect walks or focus group discussions based on varying map literacy. Some community members are used to reading maps and can walk others through them using landmarks and points of interest to locate themselves. It can be useful to start by identifying the house of each group member and marking it with a point on the map. The group composition based on residency is also relevant during transect walks or focus group discussions to ensure that participants have local knowledge about the area to be mapped.

### Mapping strategy and conventions

Before assessing within the community, a stakeholder engagement meeting can help determine what should be mapped and how (mapping strategy and conventions). Additionally, everyone has to be made aware that the globes and the QR code must remain intact for the SMT's digitalization function to work. Numbering the Sketch Maps, writing the date, location, participants' names/numbers, topic, and other metadata on the top of the base map, and creating a legend template together before the mapping activity, facilitate the digital mapmaking afterward. If community members capture (risk) perceptions or preferences on individual maps, this information is required to analyze and compare the output.

### Further development of the SMT for broader/extended applications

With the support of German Federal Foreign Office funding, planned developments include an alternative base map option, improved software quality, multiple language options, and extended learning and training material. This will increase the potential of the tool to be used in more contexts and by more National Societies and non-experts. It will facilitate the integration of the natural environment and climate change aspects in local assessments. The investigation of risk drivers such as population growth, land use processes and patterns, as well as environmental degradation and ecosystem services depletion on maps will help to discover how the effects of disaster root causes such as inadequate land use planning and urban development translate into unsafe conditions for communities.



Quotes:

*"It's just a relief because I was doing it [manual digitalization] by myself. It saves time, I can engage with people and you get important data and information out of the process."*

Klaus Wiese (Information  
Management Officer for German  
Red Cross Delegation in Central

## What were the Good Practices arising from this action?

The CRC was able to implement a digital methodology for facilitating and analyzing paper-based community mapping with the SMT in an urban community. This approach can be easily embraced by facilitators and communities because neither technical equipment nor knowledge nor GIS-specific skills are required "on the ground", ensuring a quick adoption and broad participation at the community level.

The automatic digitalization of hand-drawn information subsequently allows sophisticated spatial analysis and sharing of map content in online and offline formats with relevant stakeholders. While community members are given an easy way to visualize, communicate, and discuss spatial local knowledge and perceptions on a paper map while walking through their community or sitting around a table, the approach enables local staff (with GIS knowledge) to create digital map products and data repository within their National Society. Both these support disaster risk management and climate change adaptation, such as planning nature-based solutions to reduce

## References for this Case Study

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