Crowdsourcing for Flood Risk Management
Harnessing Community Data and Local Knowledge

Moderators

Speakers

Sinafekesh Girma

Water Youth Nerwork

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Project Officer, WMO

Anjali Lohani

Head of Climate, Global Water Partnership

Crowdsourcing and flood management: global perspectives
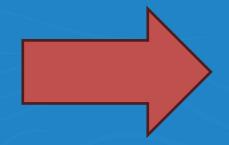
Ramesh Tripathi
APFM, WMO

Crowdsourcing and flood management: global perspectives

Traditional interventions of flood control rather management

- *Emphasis on 'Control' rather than 'Management'*

- *Problem primarily addressed based on engineering solutions (monodisciplinary)*

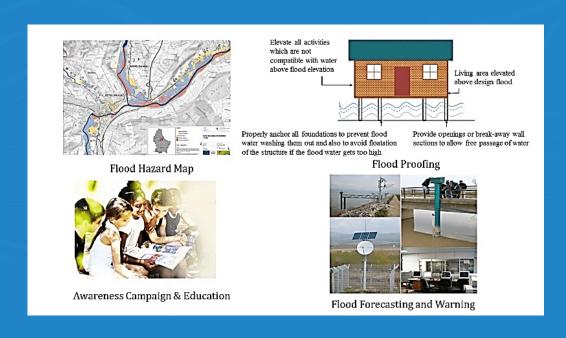- *Structural measures generally disturb eco - system balance and give a false sense of security to people*

From Control / Ad - hoc to Integrated Flood Management

- *From defensive to pro - active approaches;*

- *Towards a culture by managing flood risk & living with floods;*

- *Balancing flood risk and achieving sustainable development needs;*

- *Change in decision making processes to include risk management approaches.*

Community Involvement in the IFM

How citizen science/crowd sourcing can support in better flood management

- Involvement in hydrological and meteorological monitoring (data collection)
- Data collection related to social and structural information (exposure, vulnerability etc.)
- Warning communication and dissemination (social media and traditional approach)
- Crowdsourcing for disaster response- needs and activities

Enhances the participatory process

It is both a bottom-up participation (citizens voluntarily send data and information) and a top-down participation (citizens are solicited to do so)

Flood Management Tool Series, Technical Document No. 26 ¦ 2017

THANK YOU.

WORLD
METEOROLOGICAL
ORGANIZATION

Global Water
Partnership

ASSOCIATED PROGRAMME
ON FLOOD MANAGEMENT

Crowdsourcing for Flood Risk Management
Harnessing Community Data and Local Knowledge

Case Studies Presenters

Yessica De Los Rios Olarte

UNGRD Colombia

Gabriele Quinti

Knowledge & Innovation

Martijn Kwant

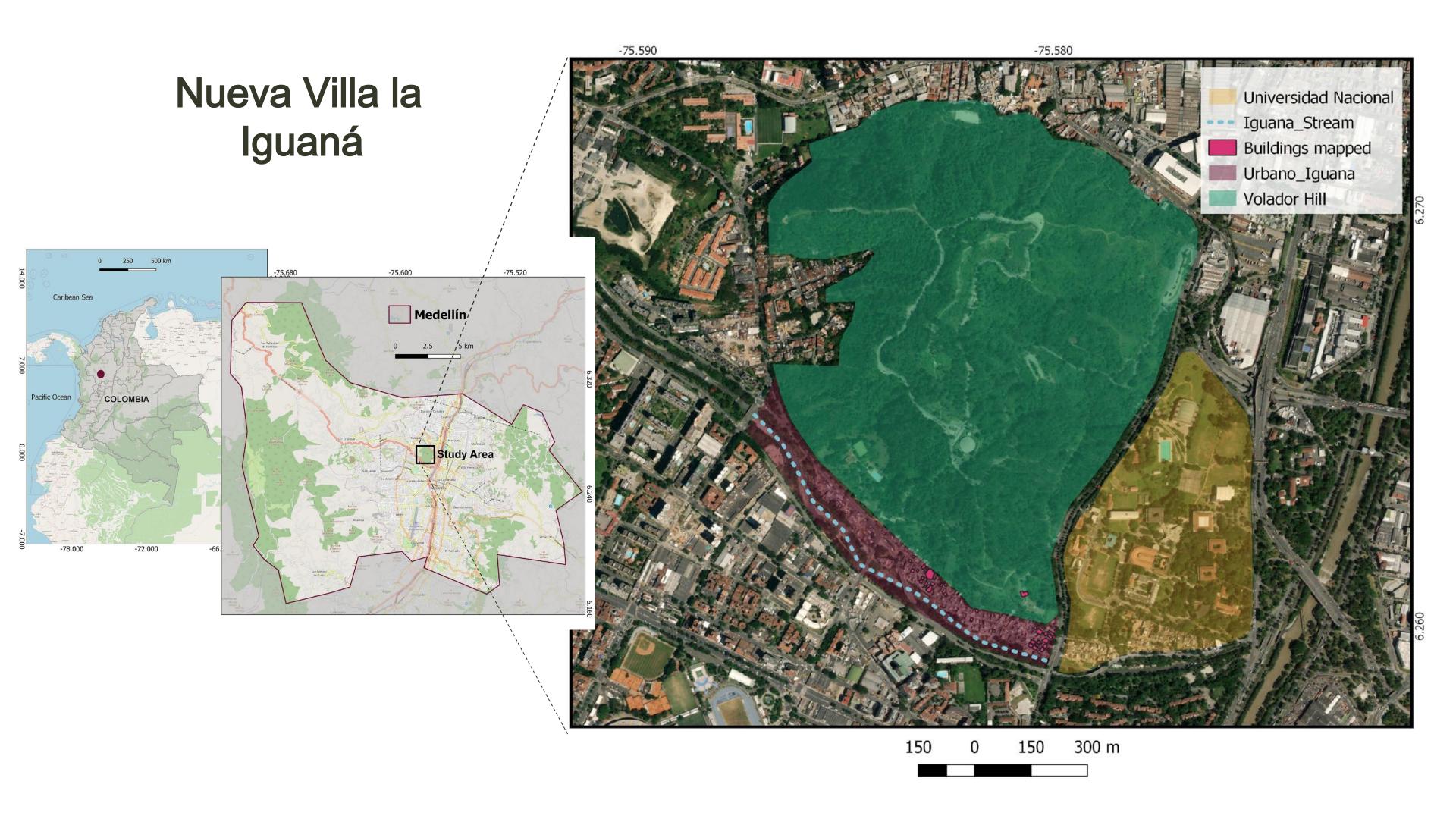Deltares

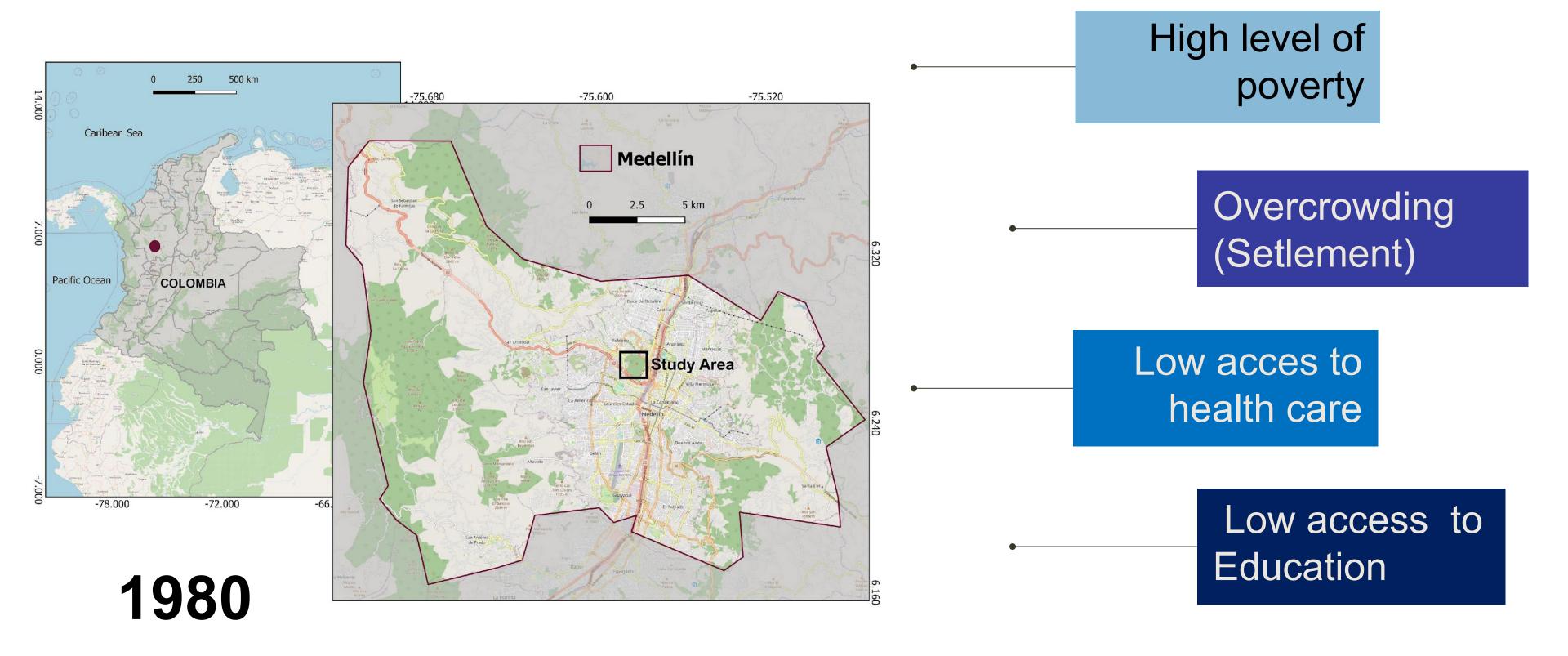**Jan Seibert**

University of Zurich

Collaborative Mapping to Flood Resiliencience
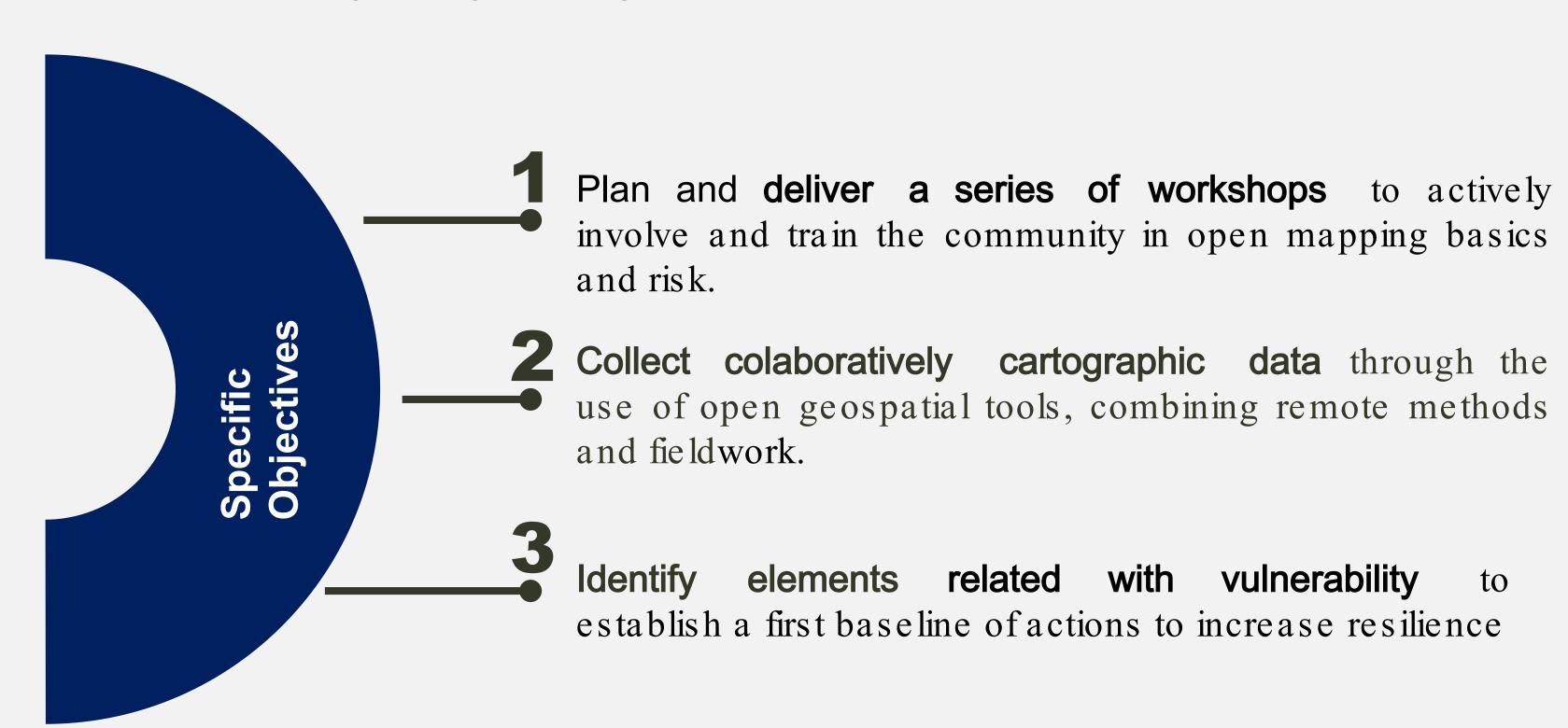
Nueva Villa La Iguaná (Medellín, Colombia)

Global integrated flood and drought management competition for youth-lead projects 2023

Nueva Villa la Iguaná

Nueva Villa La Iguaná

1980

High level of poverty

Overcrowding (Setlement)

Low acces to health care

Low access to Education

General goal: Contributing to flood resilience through collaborative mapping using open geospatial tools
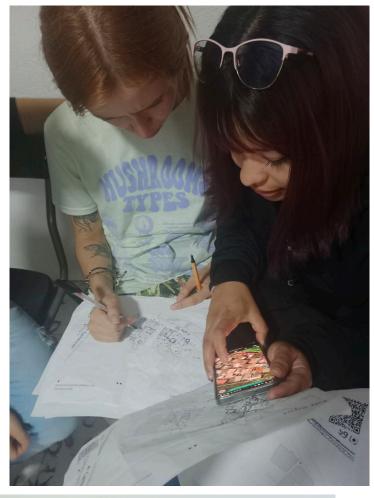
Specific Objectives

1 Plan and **deliver a series of workshops** to actively involve and train the community in open mapping basics and risk.

2 Collect colaboratively cartographic data through the use of open geospatial tools, combining remote methods and fieldwork.

3 Identify elements **related with vulnerability** to establish a first baseline of actions to increase resilience

Deliver a series of workshops

STEP BY STEP PROCESS

OpenStreetMap

Trainings in OSM basics

By Yéssica De los ríos
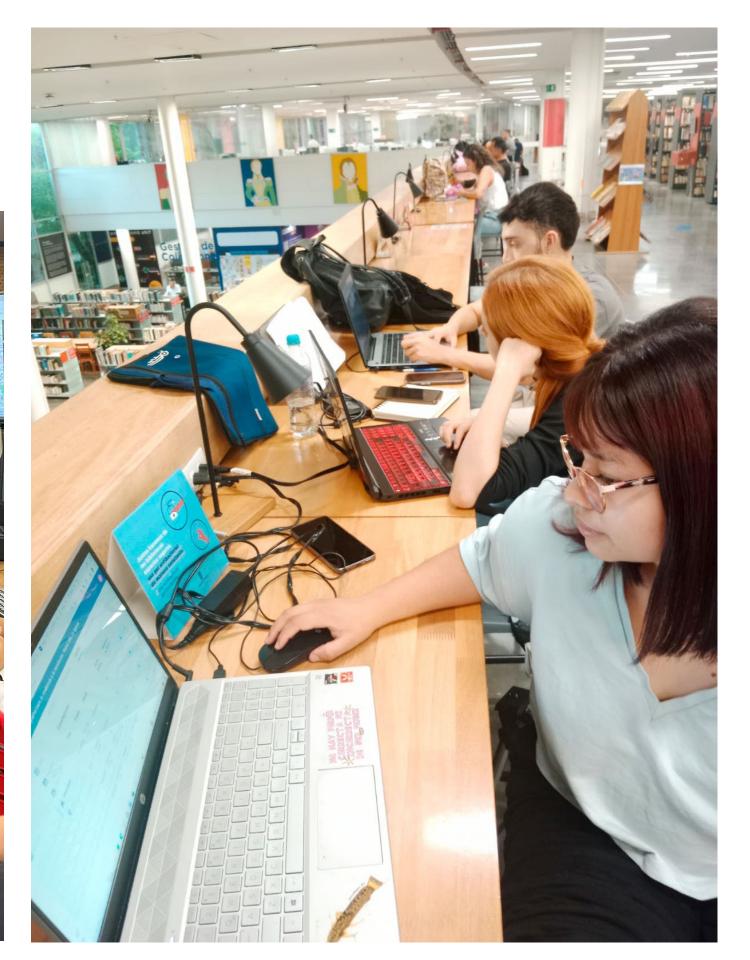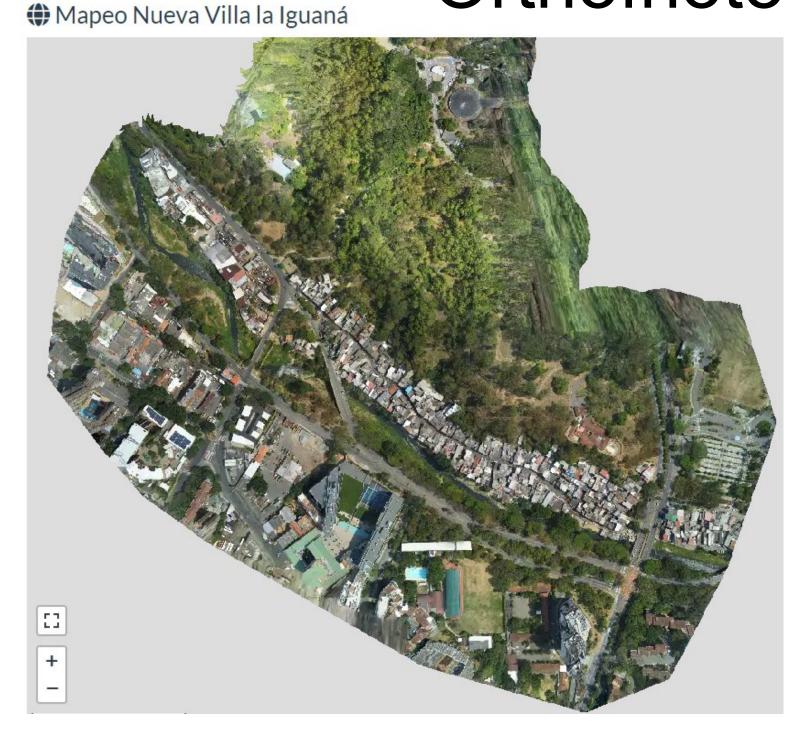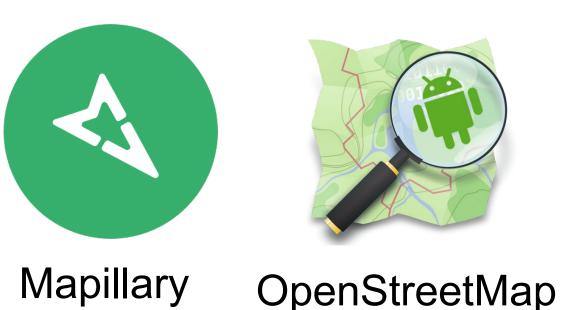
Collect colaboratively cartographic data

Open Spatial Tools

Orthofhoto

Mapeo Nueva Villa la Iguaná

Mapillary

OpenStreetMap

OpenAerialMap

Field Papers
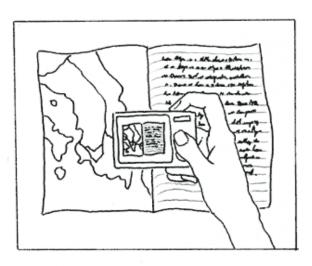
Kobo Toolbox

Open StreetMap

Platform (database) to add or update cartographic information in a digital map that you can download.
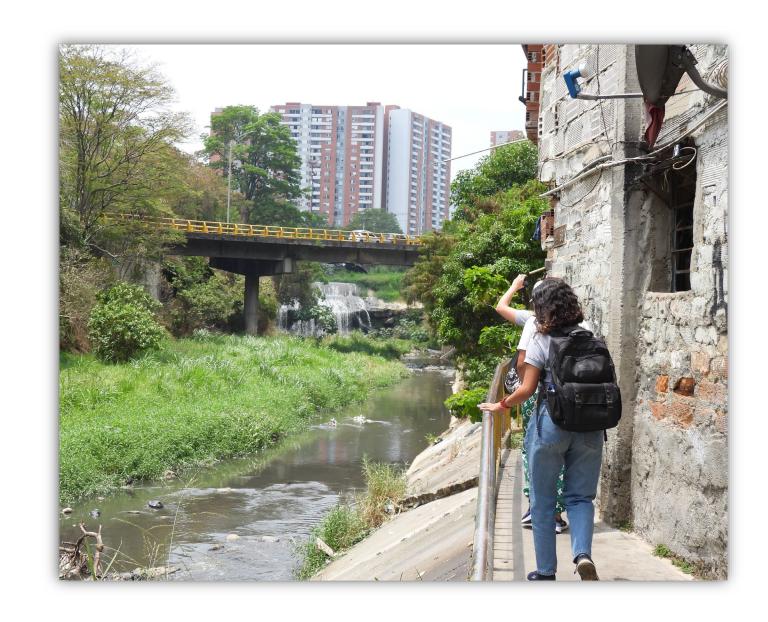
1rst Mapping:
The shape of buildings, streets, alleys, body of Waters (Whithout other features).
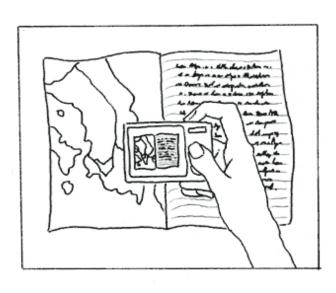
Mapillary

Recording sequences of georeferenced images at street level in the neighborhood.
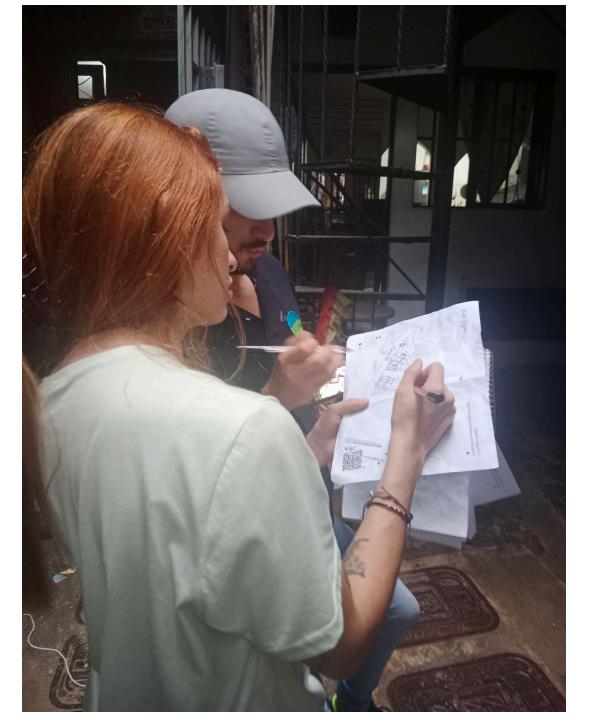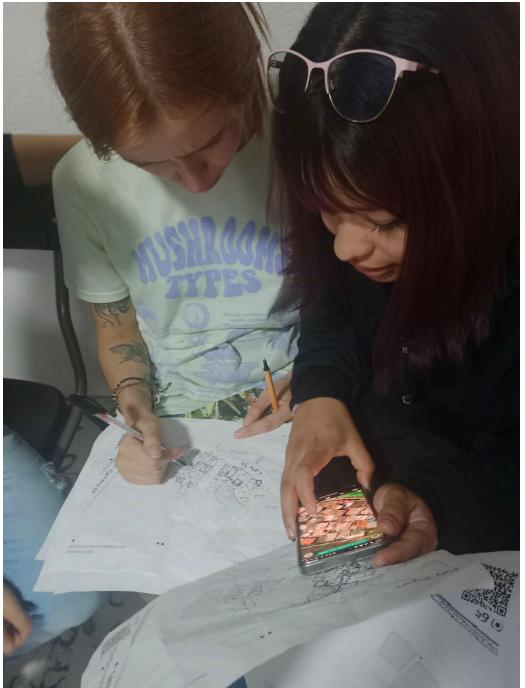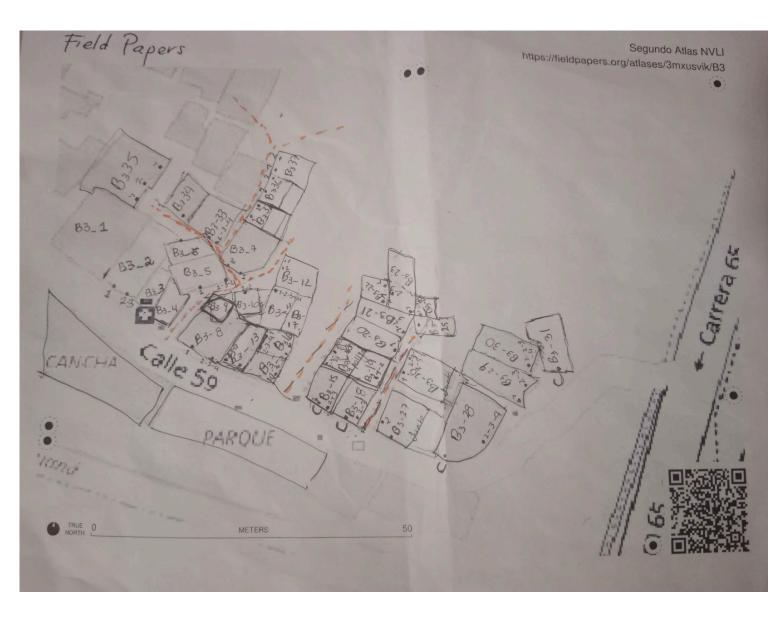
Field papers

Tool to make a **paper atlas** in which you can annotate or draw your observations.
We use this to confirm data about buildings
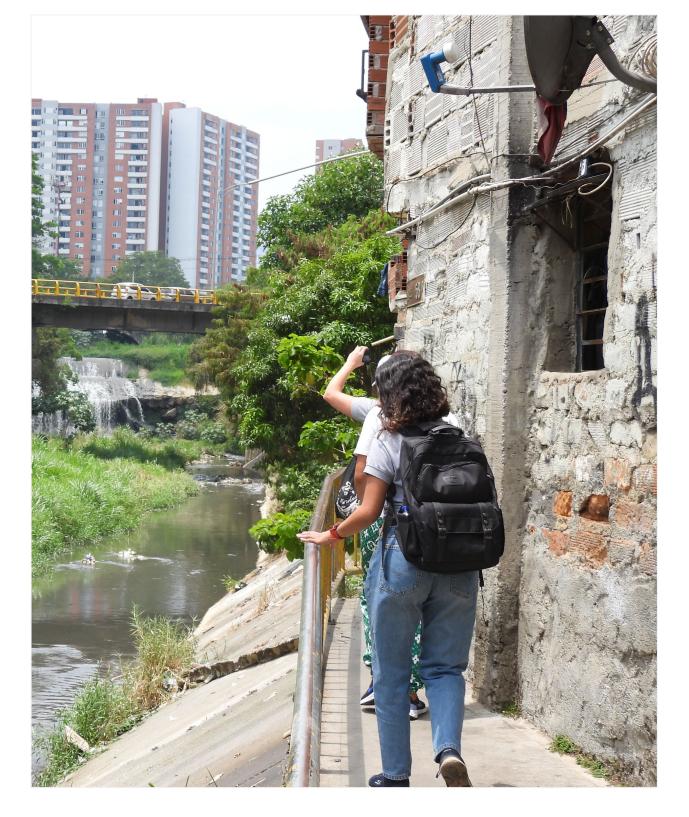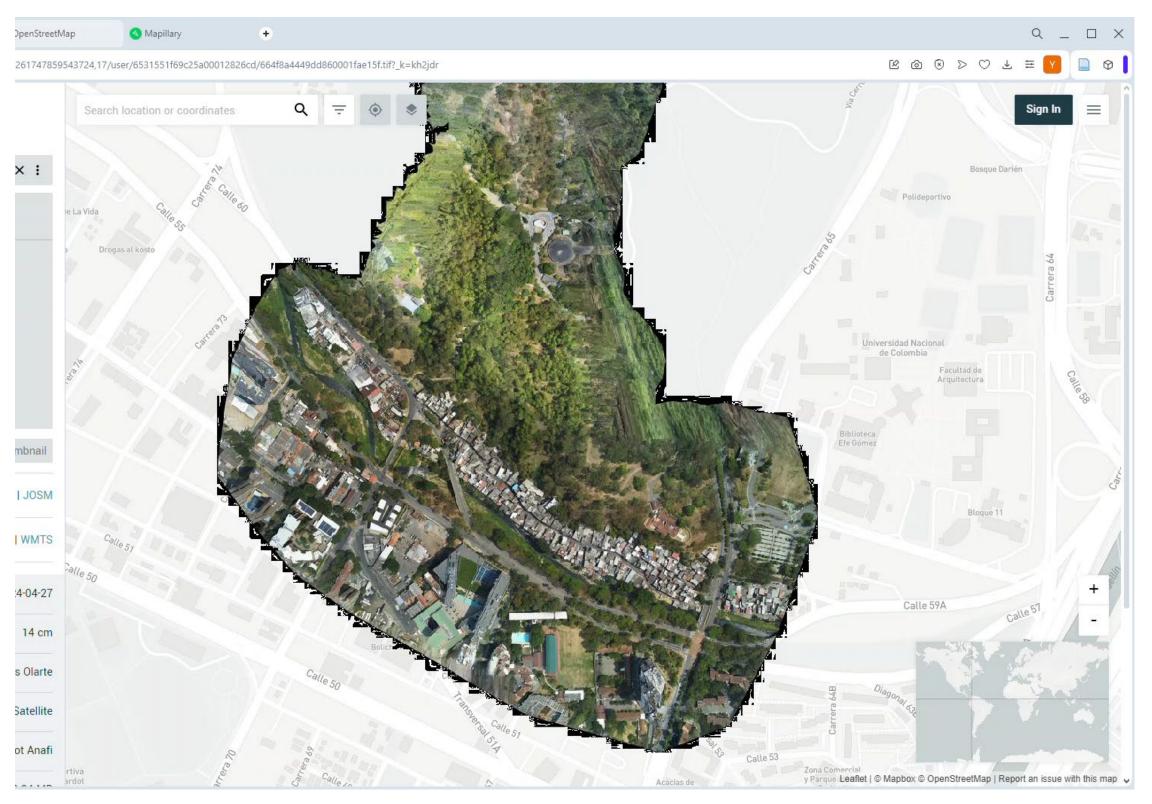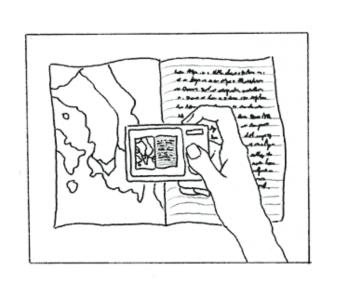
Mapping information gathering

Open StreetMap
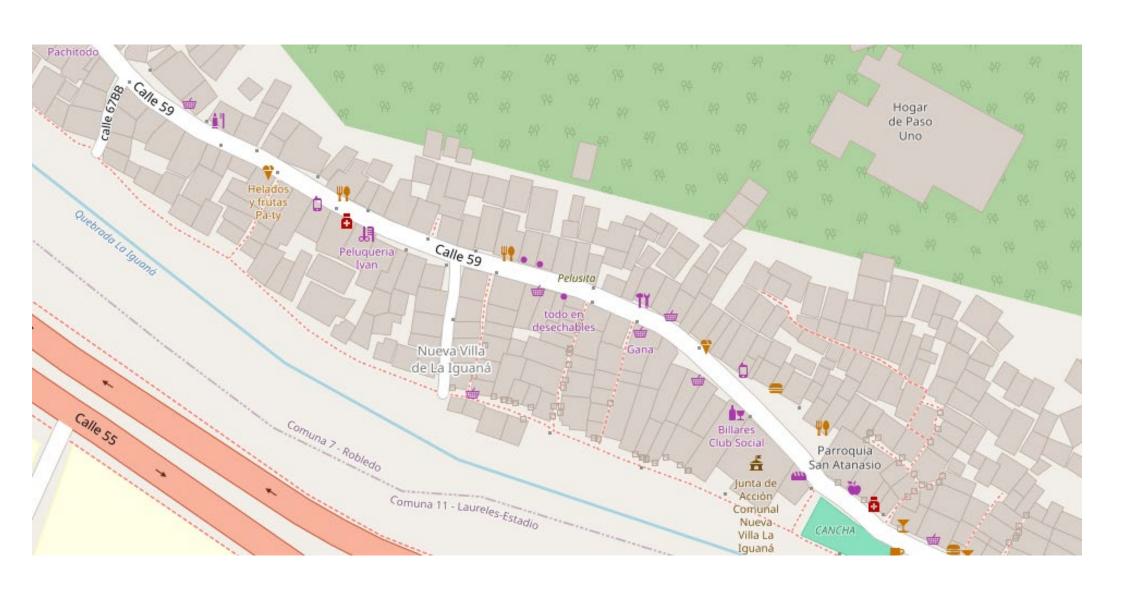
Building the map of the neighborhood in an open platform from sources such as Field Papers and Mapillary
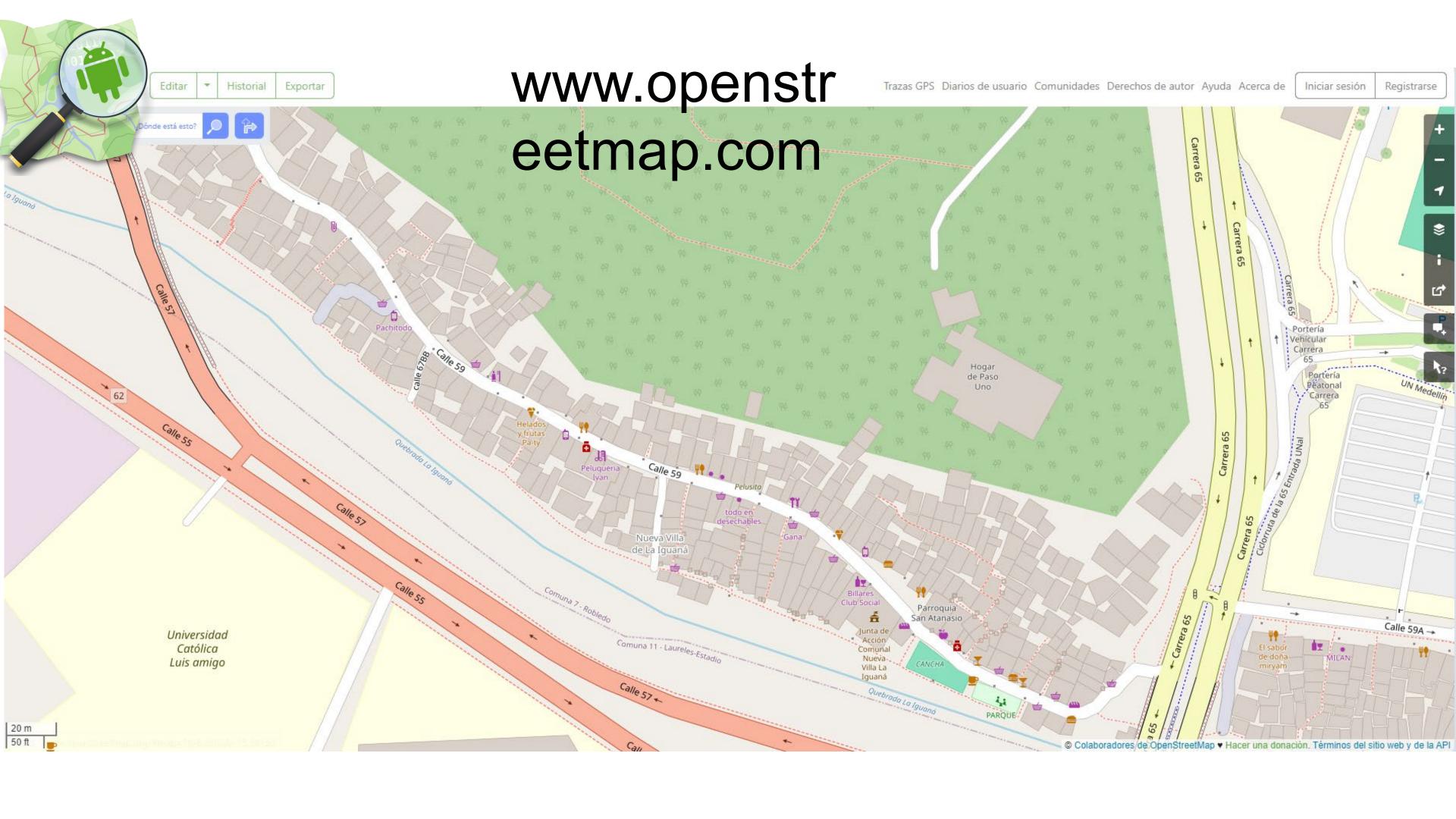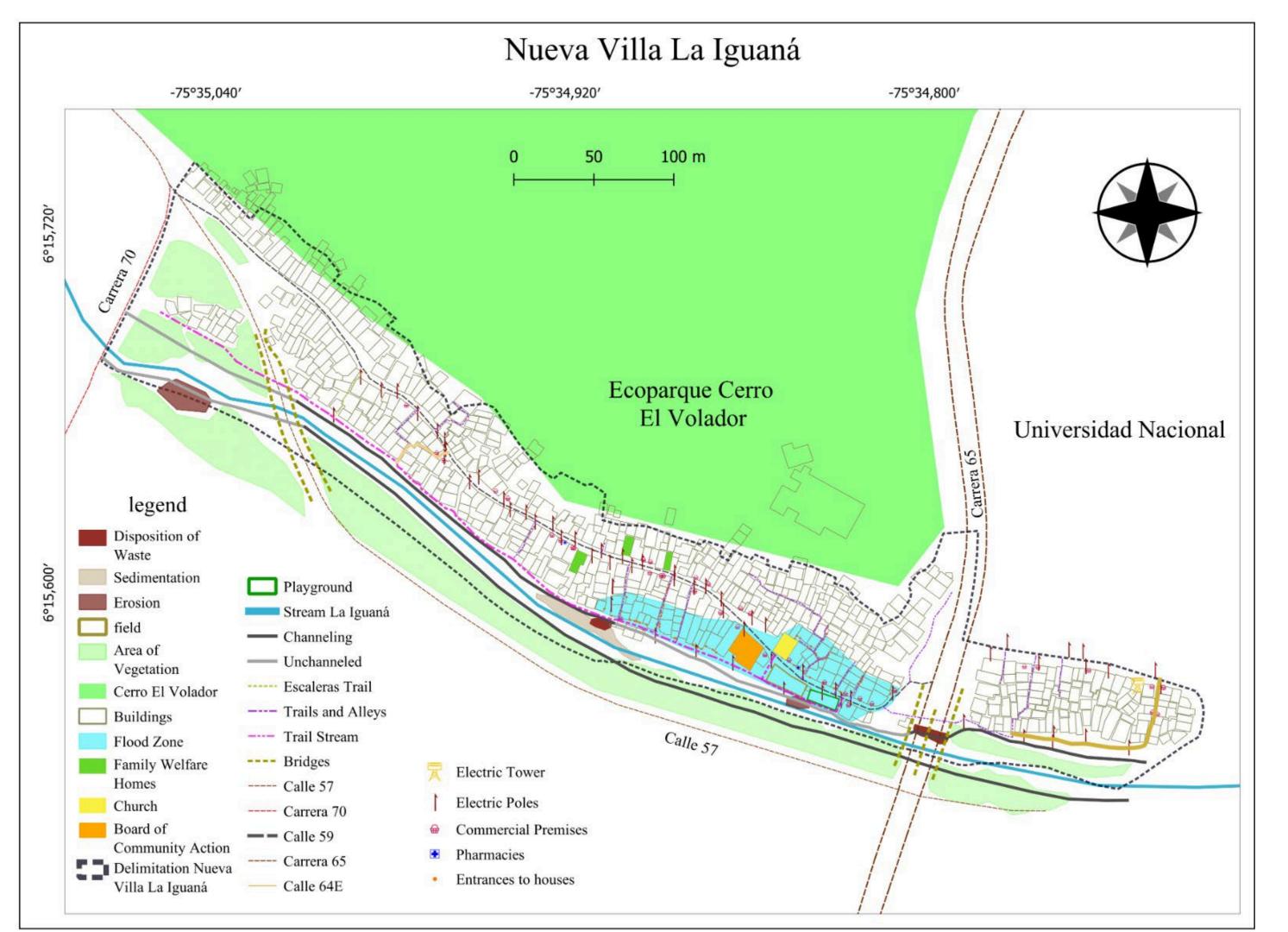
We are adding to the map:

buildings: type (residential, comercial, religious, health). Number of levels, material.

Streets and paths: nomenclature, road condition, alleyways.

Editar | Historial | Exportar

Trazas GPS Diarios de usuario Comunidades Derechos de autor Ayuda Acerca de Iniciar sesión Registrarse

¿Dónde está esto?

Calle 57

Pachitodo

Calle 67BB

Calle 59

UN Medellín

Carrera 65

Carrera 65

Portería Vehicular Carrera 65

Hogar de Paso Uno

Portería Peatonal Carrera 65

UN Medellin

62

Calle 55

Quebrada La Iguaná

Helados y frutas Pa-ty

Peluquería Ivan

Calle 59

Pelusito

Calle 57

todo en desechables

Gana

Nueva Villa de La Iguaná

Comuna 7 - Robledo

Billares Club Social

Parroquia San Atanasio

Calle 59A

Universidad Católica Luis amigo

Calle 55

Comuna 11 - Laureles-Estadio

Junta de Acción Comunal Nueva Villa La Iguaná

CANCHA

Carrera 65

El sabor de doña miryam

MILAN

Calle 57

Quebrada La Iguaná

PARQUE

Carrera 65

Calle

20 m
50 ft

© Colaboradores de OpenStreetMap ♥ Hacer una donación. Términos del sitio web y de la API

Nueva Villa La Iguaná

-75°35,040' -75°34,920' -75°34,800'

0   50   100 m

Ecoparque Cerro
El Volador

Universidad Nacional

Carrera 70

Carrera 65

Calle 57

legend

- Disposition of Waste
- Sedimentation
- Erosion
- field
- Area of Vegetation
- Cerro El Volador
- Buildings
- Flood Zone
- Family Welfare Homes
- Church
- Board of Community Action
- Delimitation Nueva Villa La Iguaná

- ▭ Playground
- — Stream La Iguaná
- — Channeling
- — Unchanneled
- ··· Escaleras Trail
- -·- Trails and Alleys
- -··- Trail Stream
- --- Bridges
- --- Calle 57
- --- Carrera 70
- --- Calle 59
- --- Carrera 65
- — Calle 64E

- Electric Tower
- Electric Poles
- Commercial Premises
- Pharmacies
- Entrances to houses

Cartographic information

Neighboorhood: **6,5 ha** aprox.

Flooding area (last year): aprox. **1 ha.**

Percentage of buildings flooded: **30%**

People: Aprox. **3200**

People being flooded: **180**

Identify elements related with vulnerability

Kobo Toolbox

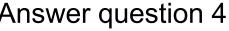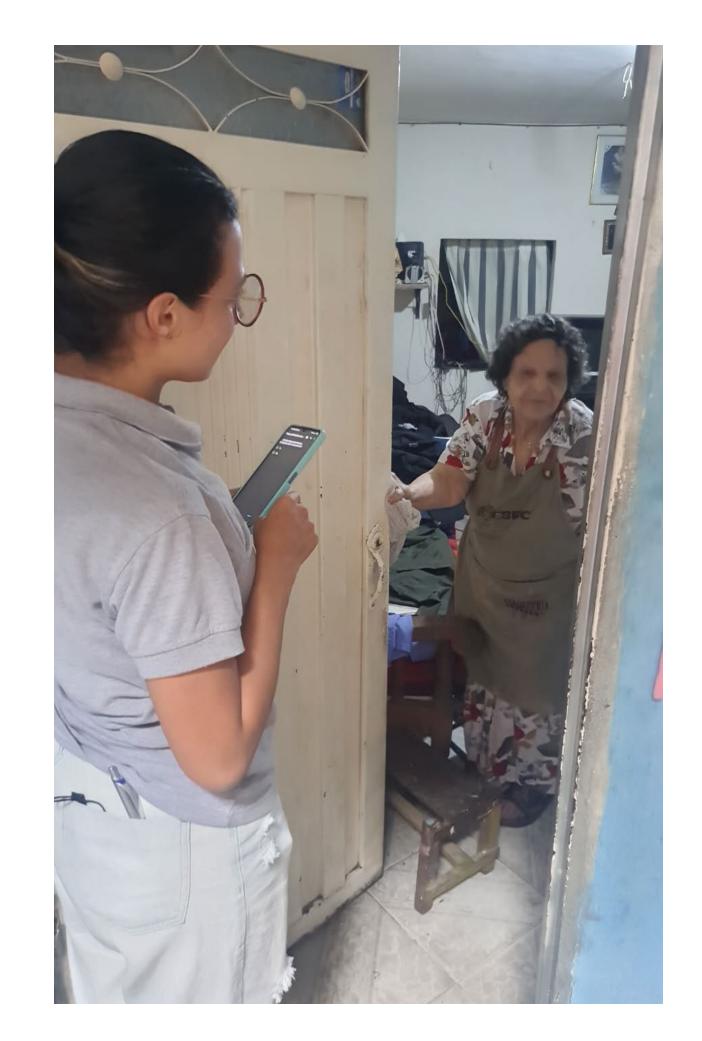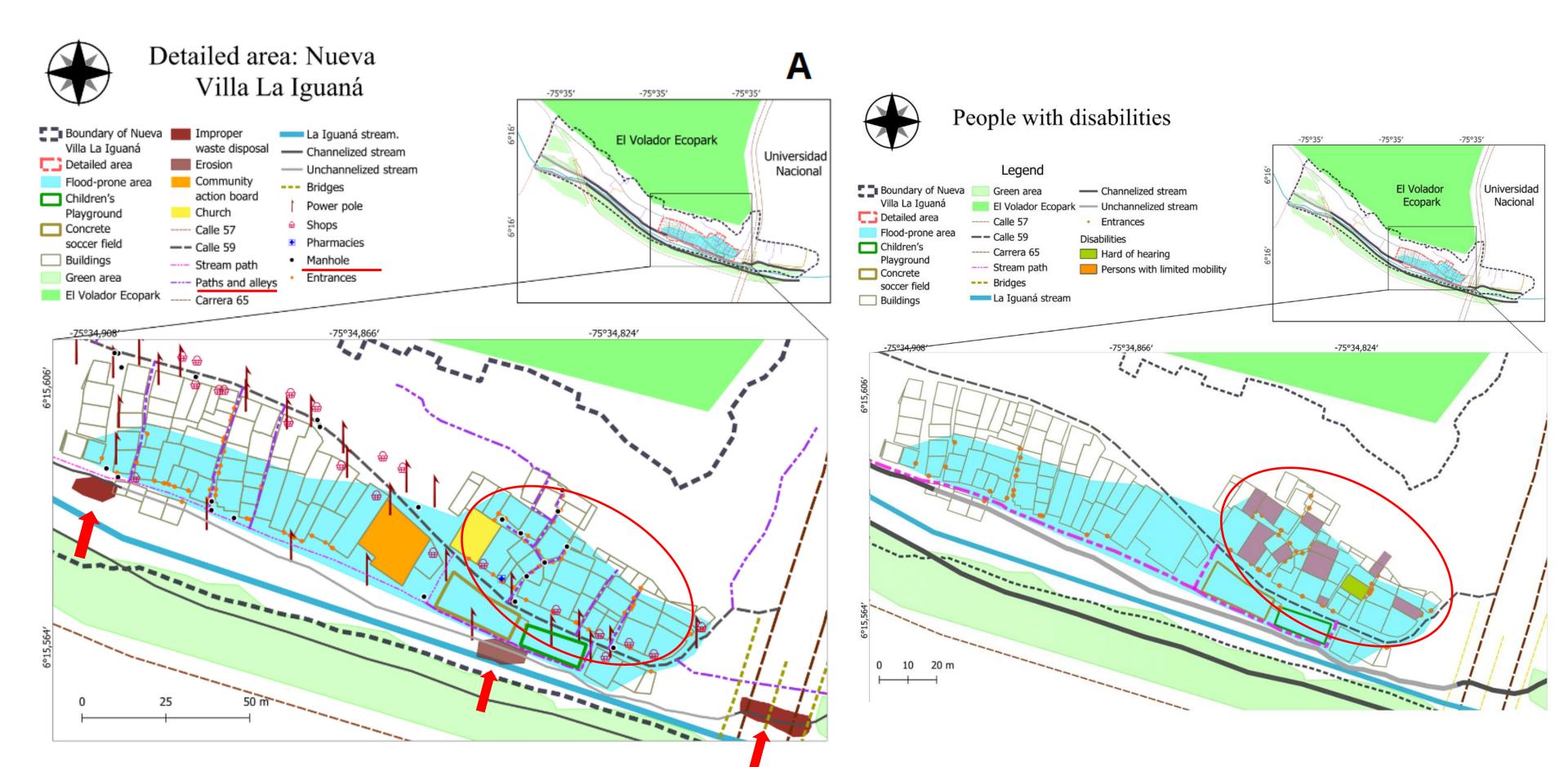**geo-referenced surveys** to collect information related to vulnerability of the population

Some questions we did:
1. Number of people in the building
2. Height that water reaches
3. Presence of children, older adults or people with disabilities
4. Flood mitigation measures
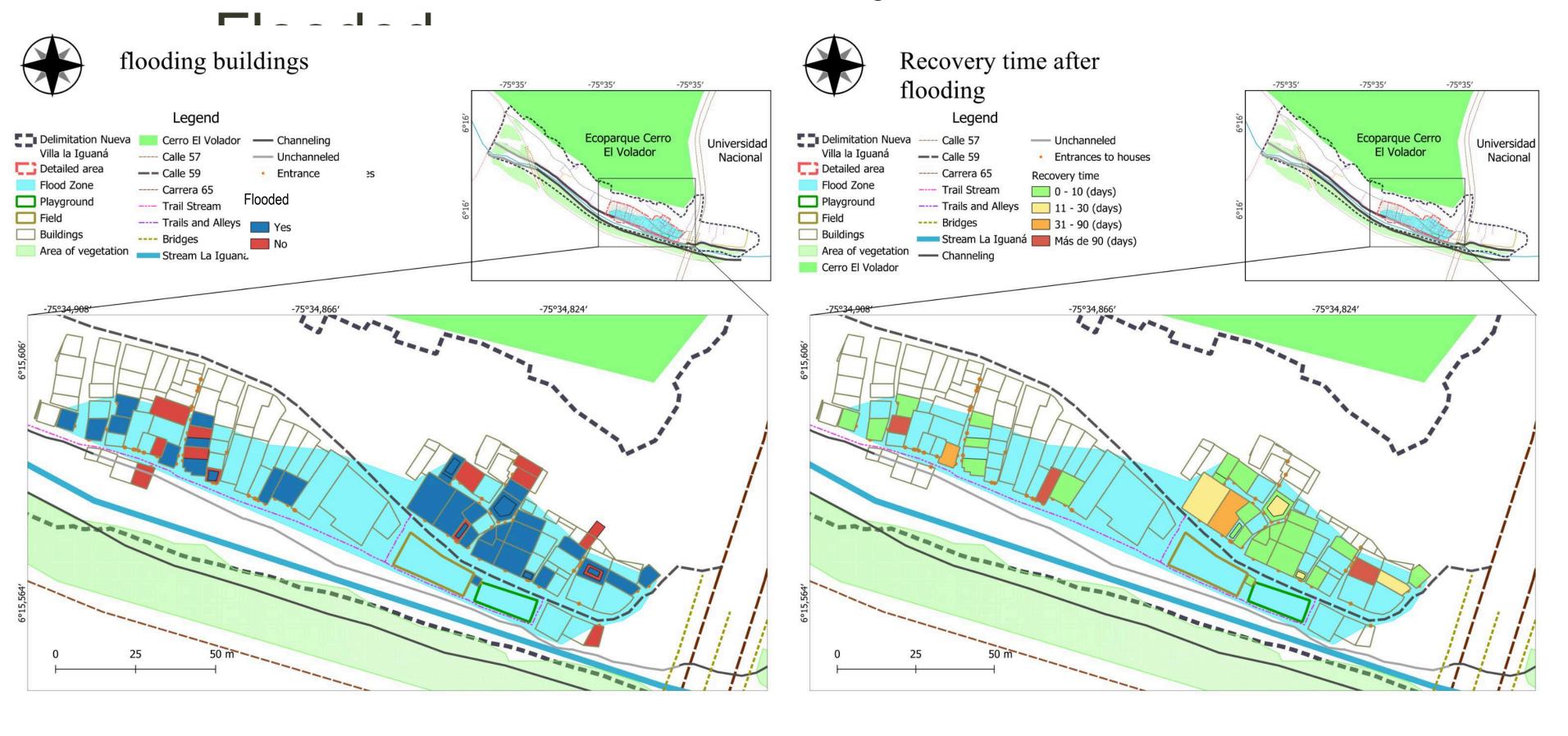5. Health insurance
6. Material of the buildings

Sí

No

Answer question 4

Detailed area: Nueva Villa La Iguaná

A

Legend:
- Boundary of Nueva Villa La Iguaná
- Detailed area
- Flood-prone area
- Children's Playground
- Concrete soccer field
- Buildings
- Green area
- El Volador Ecopark
- Improper waste disposal
- Erosion
- Community action board
- Church
- Calle 57
- Calle 59
- Stream path
- Paths and alleys
- Carrera 65
- La Iguaná stream.
- Channelized stream
- Unchannelized stream
- Bridges
- Power pole
- Shops
- Pharmacies
- Manhole
- Entrances

El Volador Ecopark

Universidad Nacional

People with disabilities

Legend:
- Boundary of Nueva Villa La Iguaná
- Detailed area
- Flood-prone area
- Children's Playground
- Concrete soccer field
- Buildings
- Green area
- El Volador Ecopark
- Calle 57
- Calle 59
- Carrera 65
- Stream path
- Bridges
- Channelized stream
- Unchannelized stream
- Entrances
- Disabilities
- Hard of hearing
- Persons with limited mobility
- La Iguaná stream

1) Flood-prone conditions in the area 2) minor drainage system is insufficient

Vulnerability

Flooded

flooding buildings

Legend

- Delimitation Nueva Villa la Iguaná
- Detailed area
- Flood Zone
- Playground
- Field
- Buildings
- Area of vegetation
- Cerro El Volador
- Calle 57
- Calle 59
- Carrera 65
- Trail Stream
- Trails and Alleys
- Bridges
- Stream La Iguaná
- Channeling
- Unchanneled
- Entrance

Flooded
- Yes
- No

Ecoparque Cerro El Volador

Universidad Nacional

Recovery time after flooding

Legend

- Delimitation Nueva Villa la Iguaná
- Detailed area
- Flood Zone
- Playground
- Field
- Buildings
- Area of vegetation
- Cerro El Volador
- Calle 57
- Calle 59
- Carrera 65
- Trail Stream
- Trails and Alleys
- Bridges
- Stream La Iguaná
- Channeling
- Unchanneled
- Entrances to houses

Recovery time
- 0 - 10 (days)
- 11 - 30 (days)
- 31 - 90 (days)
- Más de 90 (days)

Ecoparque Cerro El Volador

Universidad Nacional

Information related with vulnerability was shared with community and entities of DRM

This project is a reference for institutions and goverment, to **colaborate** in risk reduction using open data (low cost).
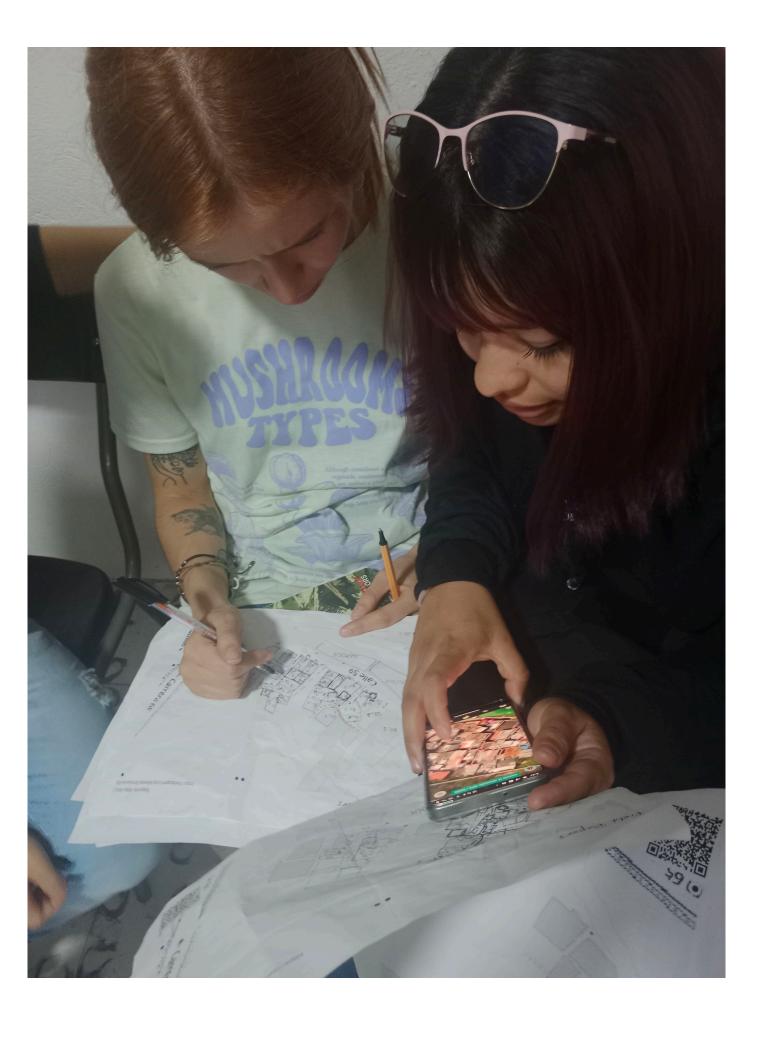
We produce a **data base** for local planning and decision making (community and local DRM officials)

This exercise can scale into a community driven- development initiative if the local community sustain organization, active participation and clear governance structure.

This approach can lead to self-reliance. People can plan by themselves strategies to address mainly where the scope of the government is insufficient

Information that did not exist, now exist.

Focus group establishment	• Identifying "ideal" features, engage population and find motivations
Limited technological skills	• Creativity in cartographic literacy tools and recognition of limitations
Support- médium term	• Increase the potential to a community-driven development project with accionable plans
Self-management	learn and develop the necessary skills to secure sources of financing.
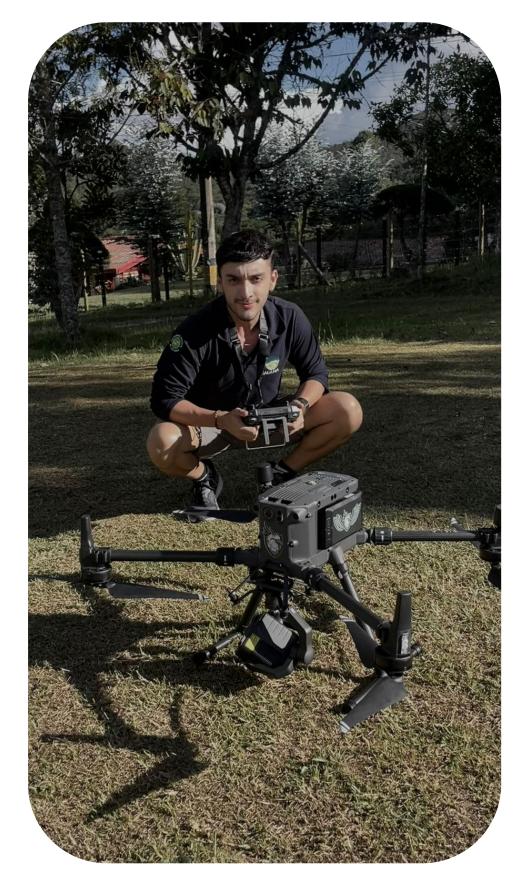
Limited financial capability

Installed capacity ⟶ resilience actions
requires time (years of work)
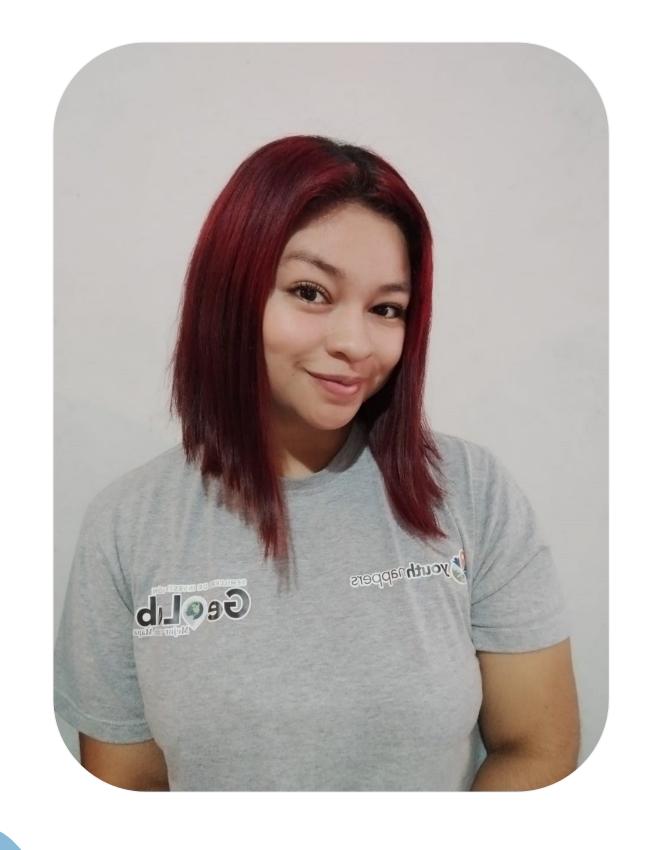
Our Allies and Team
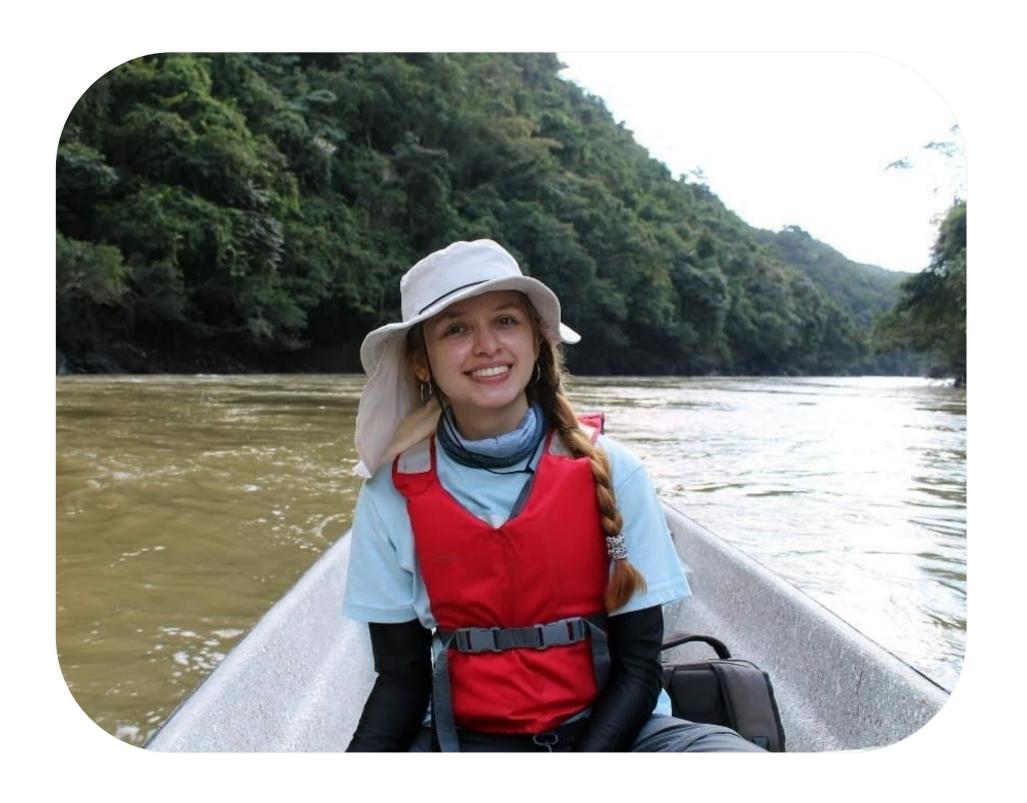
Camilo Castaño
(Student, Universidad Nacional)

Paulina Rendón
(Student, Universidad de Antioquia)

Sara Berrío
(Student, Universidad de Antioquia)

Estefanía Garcés (Student, Universidad Nacional)

Yessica De los ríos, biologist, leader),
(Universidad de Antioquia)

Project
Page

Project
Report

Thanks !

✉ yessica.delosrios@udea.edu.co

Global integrated flood and drought management competition for youth-lead projects 2023

Organizers

SÅGEMÅ
SEMILLERO
ANÁLISIS GEOESPACIAL
& MEDIO AMBIENTE

SEMILLERO DE INVESTIGACIÓN
GeoLab
Mejor con un Mapa

Sponsors

WATER
YOUTH
NETWORK
Connecting you(th) on water issues

INTEGRATED DROUGHT
MANAGEMENT PROGRAMME

ASSOCIATED PROGRAMME
ON FLOOD MANAGEMENT

youth mappers

HOT Humanitarian
OpenStreetMap
Team

Giving value to Popular Knowledge for assessing vulnerabilities and risks — **What is it?**

- The social/local actors have a knowledge of the territorial area they live; then, they have a knowledge of natural risks (e.g. flood) and their characteristics.

- The level of knowledge is also based on their historical memory (this is particularly true for flood and drought)

- Popular knowledge is the hub of information of the different actors; more is achieved through a confrontation between these actors

- Popular knowledge is not technical information; however, it is it is useful information to integrate to the technical one

Popular knowledge — Which sources?

People living in the area, asking them about recent hazards (e.g. flood, drought) and related phenomena (e.g. vulnerability) of the last years/months

- common citizens
- "key informants" (health officials, forest guards, municipal police, etc.)

Available local documents (including municipal documents, historical archives, etc.)

Popular Knowledge – Who are the best?

- **Elders:** main depositories of historical memory
- **Women:** they take particular care of the social context and the social impact of the risks
- **People with high levels of instruction** (e.g. teachers, professionals, students...)
- **People with specific functions (**doctors, police officers, etc.)
- **House-owners**
- **Group leaders** (CBFM committee leaders, youth associations / women groups...)

From popular knowledge to risk (flood) mapping
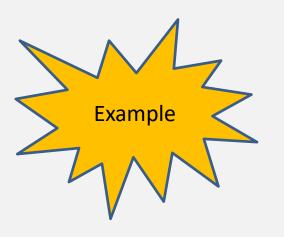
COLLECTING INFORMATION

- Starting with local documents consultation (if available)

- Consulting people; consultation entailed confrontation of the different points of view and memories (as far as possible multilateral and interactive) through:

  - Focus group(s)

  - Key informants' interviews (for core key informants unable to participate in the focus group/s)
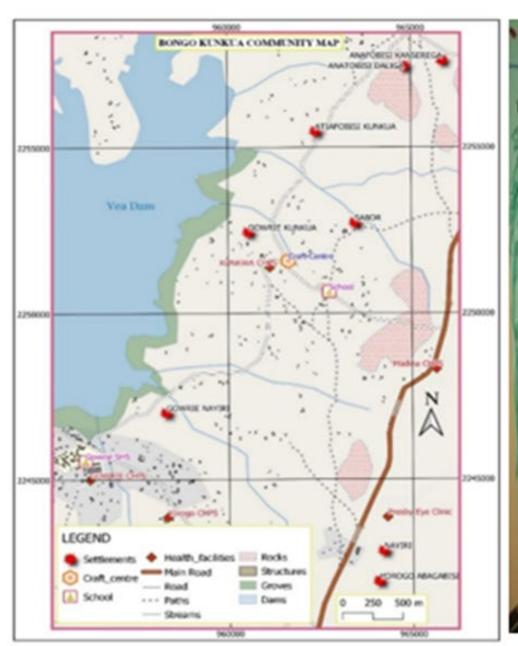
LOCALIZING PHENOMENA (E.G. FLOOD) ON MAPS

- Areas where the worst cases ever occurred

- The most frequent flooded areas

- Roads and other communication infrastructures

- Schools, health centers, social centers

- Other places for social gathering

- Vulnerable houses / households

Participatory mapping in Kunkua (Ghana)
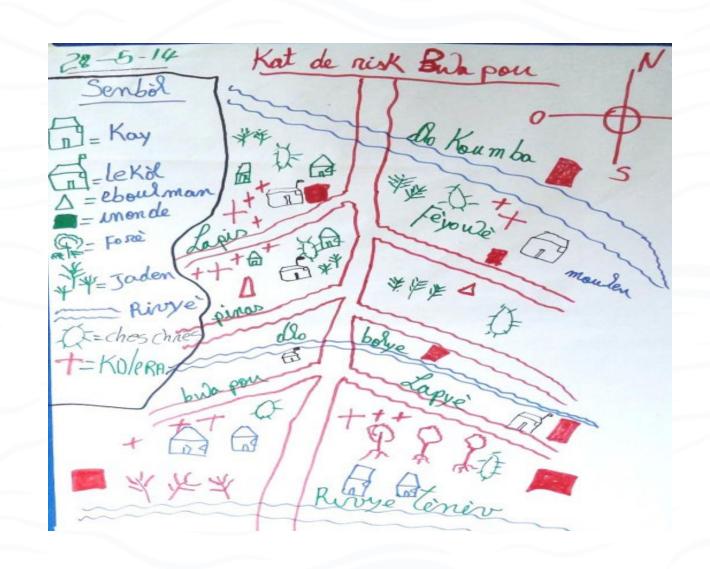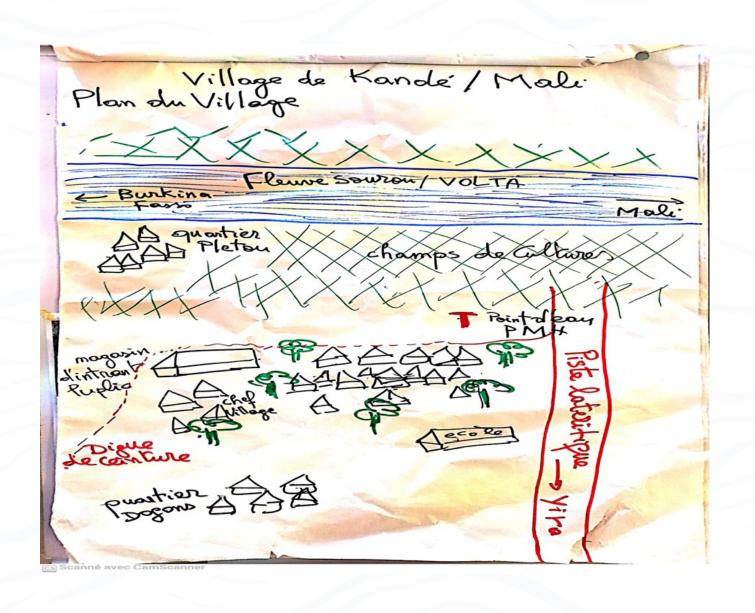
"The community actors were guided to sketch and include community key features to the map. That also includes the floods prone areas of the community, as well as houses who live vulnerable people (disabled people, elderly people, etc. who, in the event of a disaster, must be rescued). A digitized map is accompanied with the community sketched map."

Participative maps – Kandé (Mali) and Haiti

Participatory mapping in Ndakwera community (Malawi)

"Thanks to the CBFM project and support of MRC and DoDMA due to which we have the flood and risk maps for the Ndakwera area.The hazard and risk maps allow us to see which are risk and safer areas and also evacuation route in case of flooding which was previously not possible".
(Evelyn Chapenda Ndakwera VDC Chair)

"The hazard and risk maps were used in the simulation exercise which allowed us to identify evacuate route for the vulnerable individuals such as elderly, women and children."
(Prisca Vonah- Vice Chair, Ndakwera VCPC)

Benefits and Limits

BENEFITS

- Optimisation of available information
- Awareness raising of local actors about DRR/DRM
- More proactive approach instead of reactive
- Resilience enhancement / improved capacity of
  - Risk prevention
  - Management of critical situations
  - Impact Management
- Citizens' empowerment
- Flexibility, speed and cheapness
- Possible integration with the national data and system

LIMITS

- Data accuracy and possible weak reliability
- Integration with other information (i.e. with other information collection systems)
- IT Infrastructure accessibility
- Privacy, security and ethical concerns

Popular knowledge: evolution

→ From an "ancestral" approach (e.g. popular knowledge on landslides /floods collected by 30.000 citizens in Italy in 1987)

→ To Crowdsourcing: a collaborative production of knowledge, which is elaborated by multiple actors in synergy, thanks to IT - Smartphones
  - Social networks

THANK YOU.

Crowdsourcing for Flood Risk Management

Deltares – Two case studies from the UK and Ghana

Martijn Kwant

Deltares
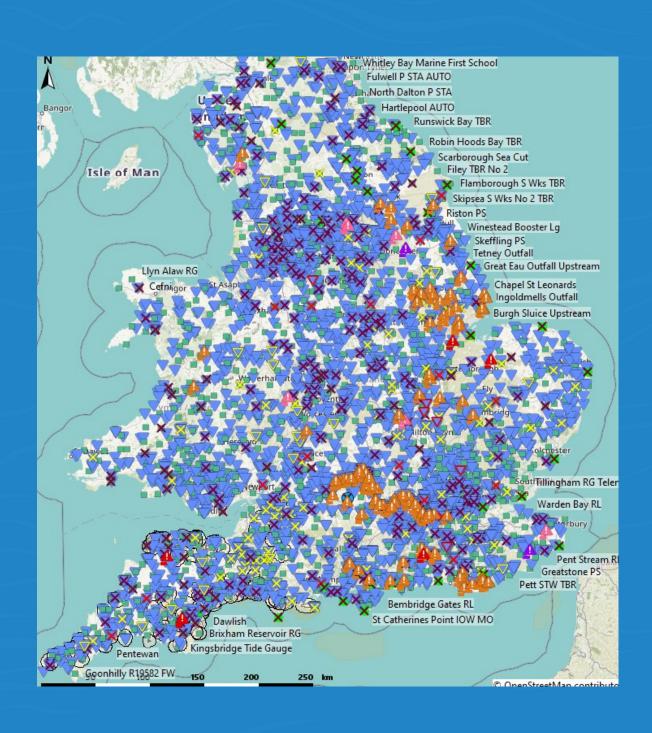
Integrating local flood risk information in EWS

National Flood Early Warning System UK

In 2004 the Environment Agency launched their first national flood early warning system using the Delft - FEWS Software.

Updated in 2021, the EA now has a single system integrating hydrological models, disaster risk data and hydro - met observations.

Automated Warnings

Warning messages are automatically send out to vulnerable population using CAP protocol.

Deltares

Flood risk data on a local level

Flood impact Areas

Impact data needs to be available on a local level. Understanding the impact of flooding on a specific place, based on historical observations.

Citizen science

Both citizens and EA experts are continuously monitoring historical flood events and collecting this information.

→ Flood risk data stored in a database for easy access

Deltares

Use of Databases

Integration
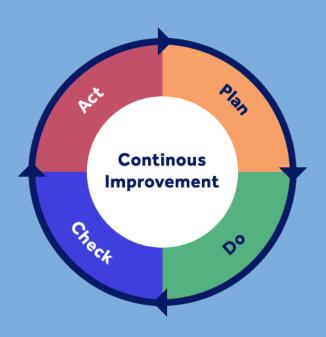
Over 20.000 local impact thresholds are automatically loaded from database and easily integrated in EWS

3.9 mALD		Water in gutters, Coton Manor. Water on B5067, Berwick Road
4.2 mALD		Water in gutters, Longden Coleham, by Pete Jones Motorcycles
4.4 mALD		Coleham Head demountable defences deployed: Carline Fields Phase 1. Wall overt...
4.4 mALD		Coleham Head demountable defences deployed: Carline Fields Phase 1 Flooding o...
4.41 mALD	7/2/2011	
4.44 mALD	10/2/2014	Highest peak
4.5 mALD		Coleham Head road crossing. Water in gutters, Raven Meadows at the bus station.
4.5 mALD		Coleham Head road crossing Water in gutters, Raven Meadows at the bus station
4.7 mALD		B4380 / old A5 lane floods & onto bridge
4.73 mALD	12/2/2002	
4.78 mALD	13/12/2000	
4.8 mALD	6/2/2004	
4.87 mALD	29/10/1998	

Continuous improvement

local citizens and communities report on the impact/response of historical flood events:

- Water in gutters
- Temporary defenses deployed
- Historical flood events (forecasted water level is as severe as the 2004 flood)

FEWS Accra

Problems with urban flooding

Urbanized area with many small streams flowing through the city
Limited drainage capacity
While experiencing heavy convective rainfall during the rainy season

Collaborative Approach

Collaboration between 4 government agencies (Gmet, HYDRO, NADMO and WRC) to improve Flood Early Warning in Accra.
- Development of a single Flood Early Warning System
- Rainfall Nowcasting and flood forecasting for short lead-times
- Co-development of Standard Operating Procedures
- Joint training and simulation exercises

Deltares

Community knowledge
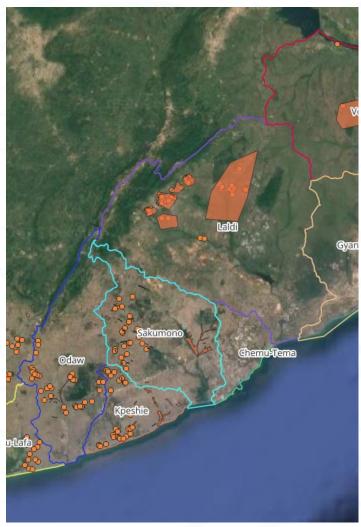
Local engagement
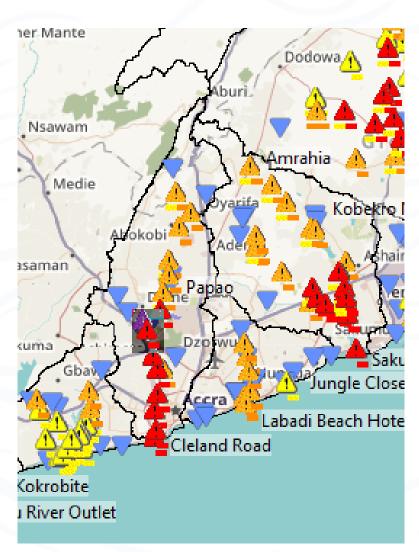
Identify key flood hotspots together with community leaders and integrate flood risk data in an operational flood early warning system.

→ Ensure that early warning information matches the experience of local communities

Dissemination of warning messages through social media and informal WhatsApp groups organized by NADMO

Deltares

Main takeaways

01 Open databases are extremely useful for enhancing accessibility of flood risk information

02 Development of flood risk information databases is a not a one-off effort, focus on continuous yearly improvements

03 Ensure that local communities are involved to connect early warning messages with experience from on the ground

04 Use joint simulation exercises to practice emergency situations and verify joint operational procedures are effective

Deltares

THANK YOU.

Water observation with the smartphone
Experiences from the Citizen Science Project „CrowdWater"

Jan Seibert
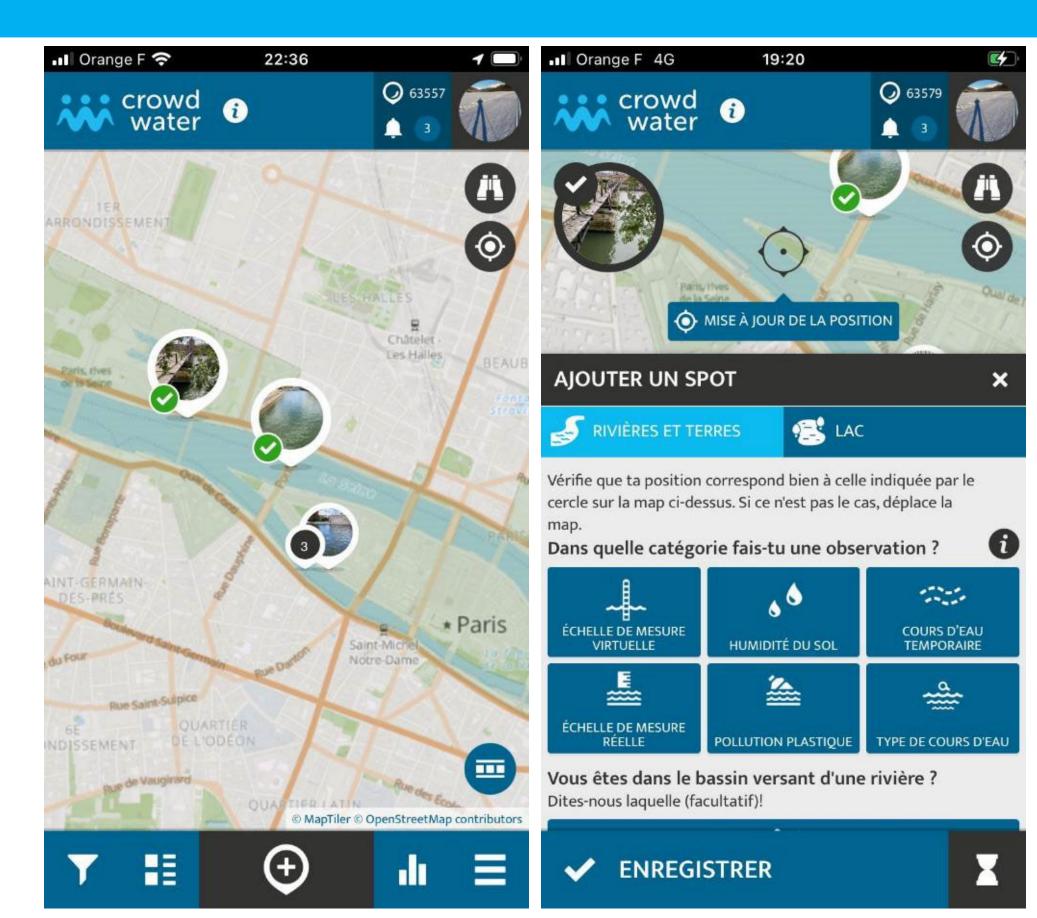
Ilja van Meerveld, Franziska Clerc-Schwarzenbach,
Mirjam Scheller, Sara Blanco, Barbara Strobl, Simon Meili, Linnaea Cahill, Rieke Goebel, Vanja Maksimovic, …

University of Zurich UZH

crowd water

What is CrowdWater?

- Citizen science project by the University of Zurich, Switzerland
- Collection of water data by engaged people via a smartphone app since 2017
- **Philosophy:**

  - "Geo-caching approach"

  - Data collection by anyone and at any location

  - No sensors required

Observations with the CrowdWater App

64 461 observations at 11 241 sites,

822 sites with 10+ observations,

461 users with 10+ observations

https://crowdwater.ch/de/dashboard-3/

We are the CrowdWater Team!

Jan
Seibert
PI

Ilja
van Meerveld
PI

Linnaea Cahill
PhD student

Vanja Maksimovic
Community
manager

Rieke Goebel
Community
manager

Franziska
Schwarzenbach
PhD student

… and our former PhD students:

Two pillars of CrowdWater

- **How can the public observe which water-related variables?**
- **How useful could these observations be?**
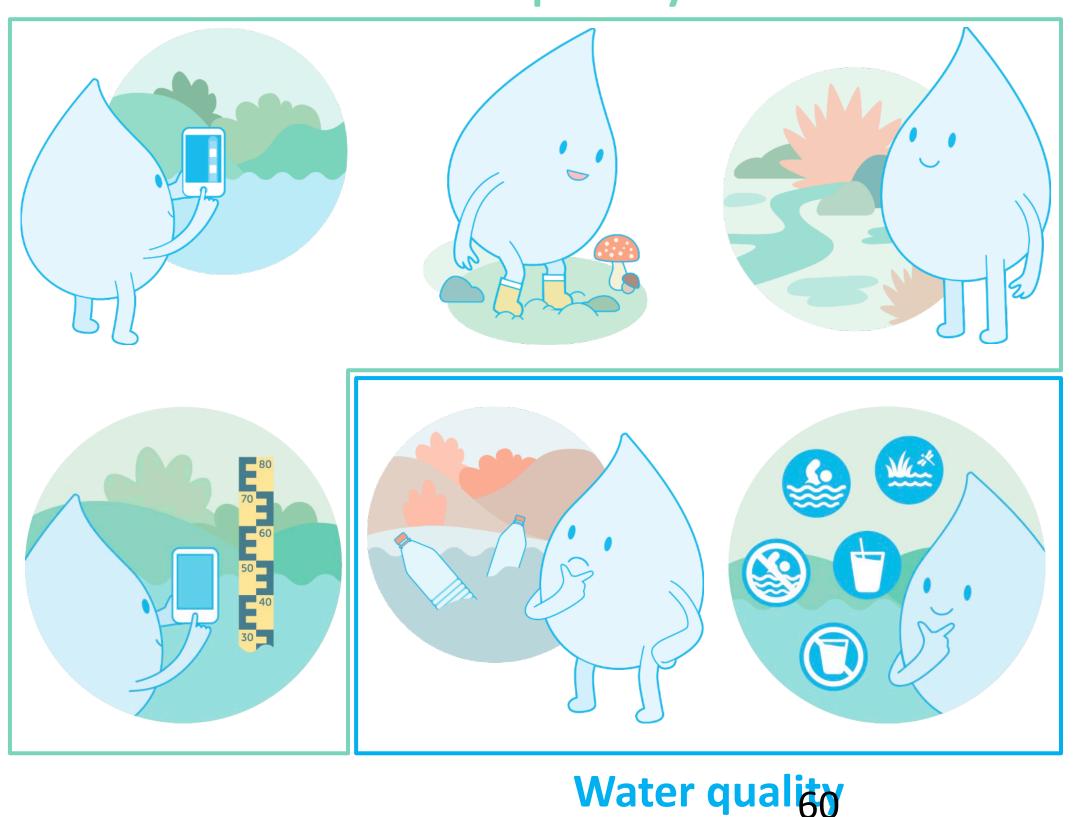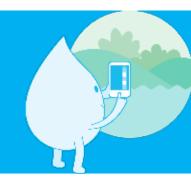
CrowdWater App

Water quantity

Water quality

Virtual staff gauge

- Observations of water levels
- Water level classes based on 'virtual' staff gauge ('sticker')

- No physical installation

- Participants can start own 'gauging stations' (spots)
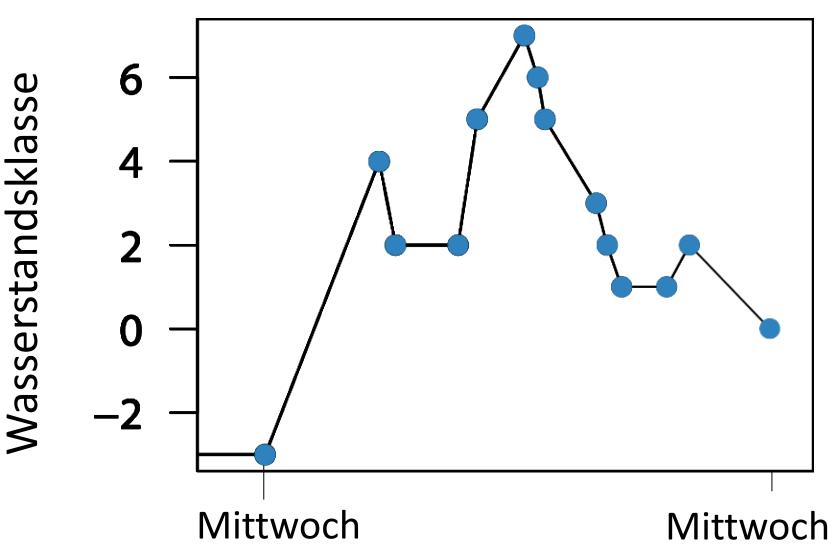
Foto: Simon Meili-Etter

61

Referenzbild
17.08.18

22.02.20 | 23.02.20 | 24.02.20 | 25.02.20 | 27.02.20 | 28.02.20
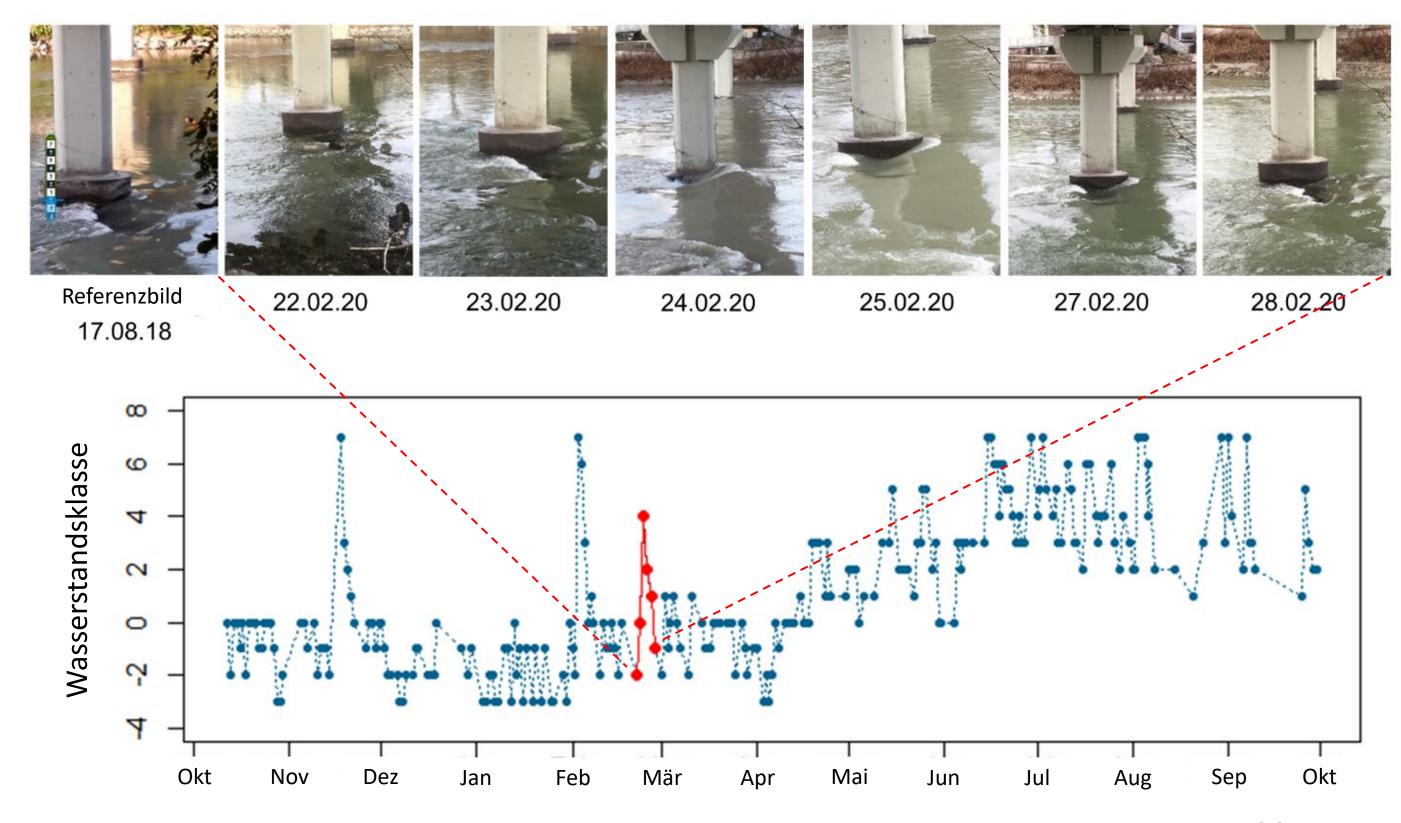
Qualitative soil moisture observations

SCIENTIFIC BRIEFING

HP TODAY

Sensing with boots and trousers — qualitative field observations of shallow soil moisture patterns
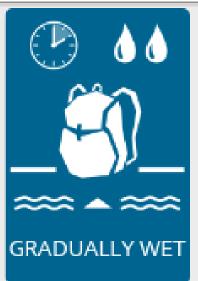
Michael Rinderer,[1*]
Andrea Kollegger,[1]
Benjamin M. C. Fischer,[1]
Manfred Stähli[2] and
Jan Seibert[1,3,4]

Abstract

While soil moisture patterns can be interesting traits to ir
heterogeneity of catchments relevant for various physical pr
interaction and soil water redistribution, many of the exi
spatial patterns are time consuming, expensive or need site-s
study we present a quick and inexpensive supplementary fi
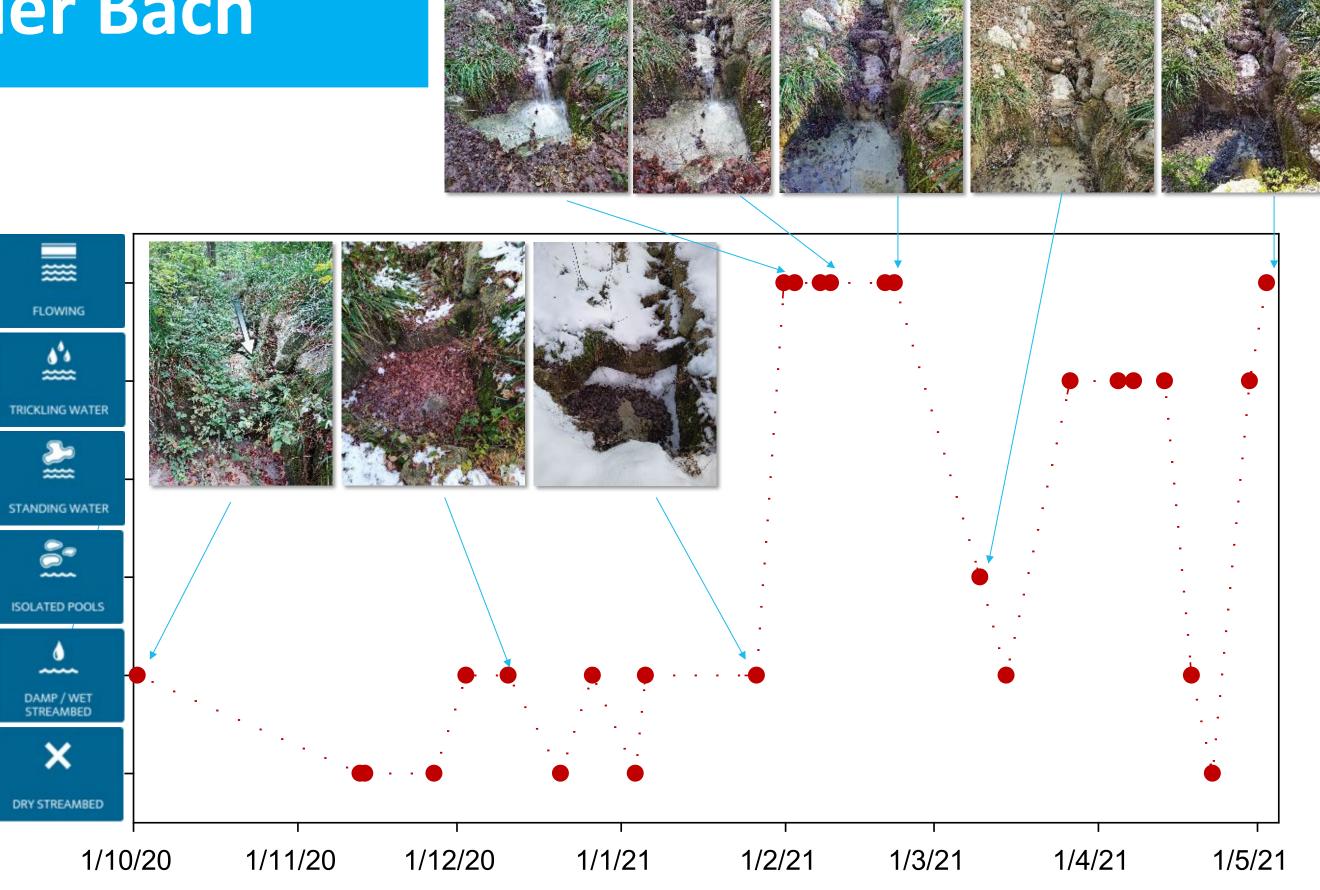
Rinderer et al., 2012, Hydrol. Proc.

Trockenfallender Bach

FLOWING

TRICKLING WATER

STANDING WATER

ISOLATED POOLS

DAMP / WET STREAMBED

DRY STREAMBED

1/10/20 1/11/20 1/12/20 1/1/21 1/2/21 1/3/21 1/4/21 1/5/21

Data:
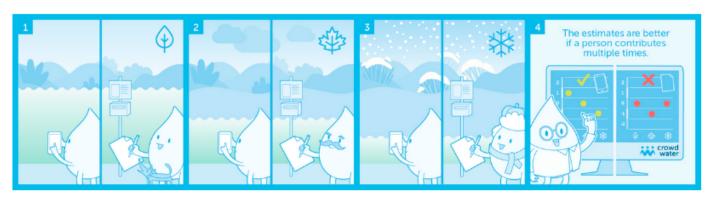
Papers about **CrowdWater** on our website:

www.**CrowdWater**.ch

Thank you !

www.crowdwater.ch

For more info: www.crowdwater.ch

CrowdWater App

Social media

 @crowd_water

 @crowdwater

 CrowdWater Channel

 crowdwater.bsky.social

THANK YOU.

THANK YOU.