SRC International Cooperation

Flood Hazard Analysis

Description of working steps for flood hazard analysis

Minimal standard

Swiss Red Cross

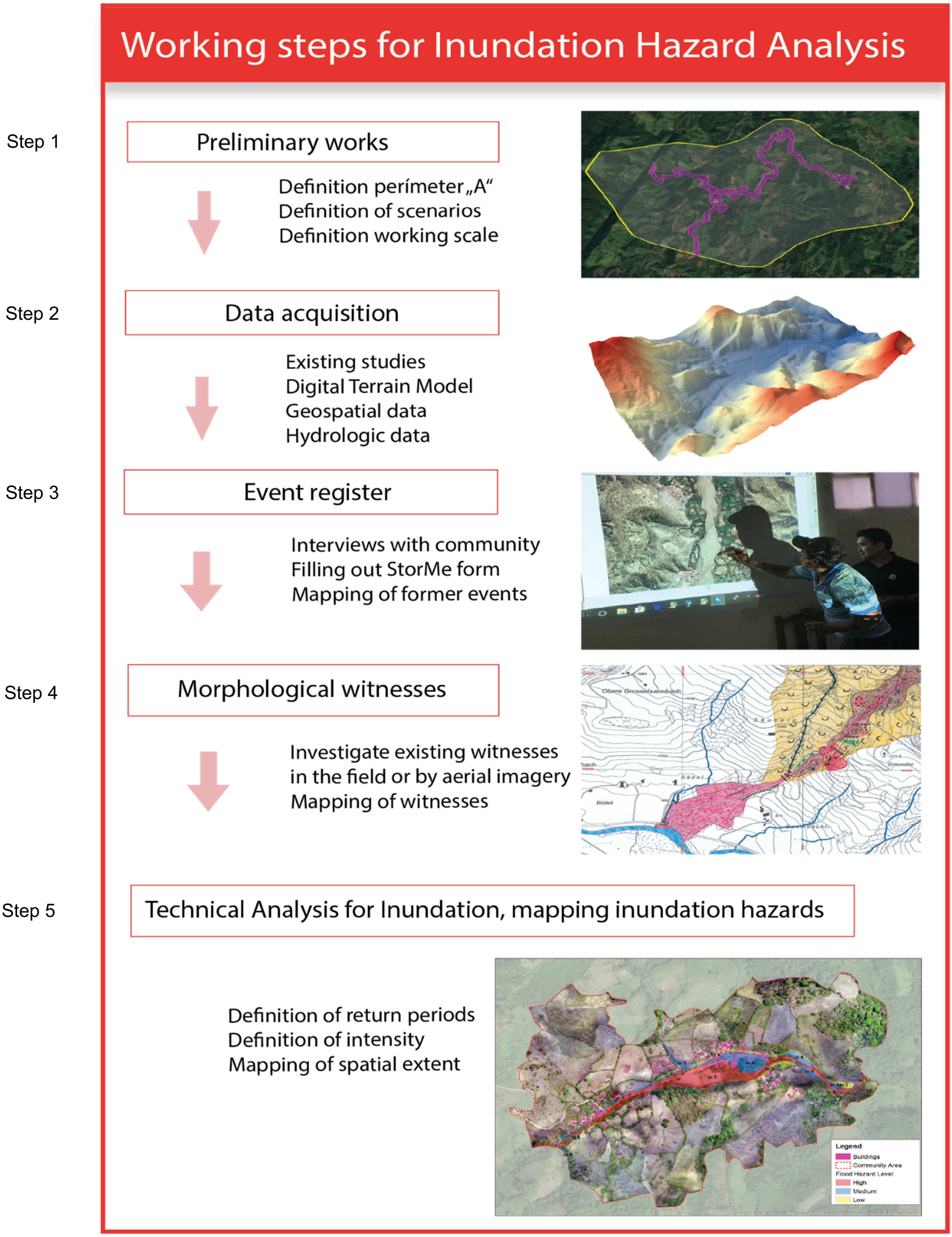

Illustration 1: Working steps for the analysis of flood hazards. Source: SRC.

Step 1 – Preparatory work

Definition of the perimeter and detail level of the analysis

Before starting a hazard analysis, the study area should be spatially defined and captured on a map. As a general rule, the perimeter of a hazard map is smaller than the project area and includes areas for settlements, infrastructure facilities and important livelihoods. Therefore, the perimeter of the hazard mapping must be limited to these existing or designated areas (perimeter "A"). By limiting the perimeter to relevant areas, it is possible to save time and costs. Areas outside this borderline should also be explored if they affect this perimeter. Illustration 2 shows the project area (in yellow) and perimeter "A" of a hazard mapping (in purple). Perimeter "A" is defined jointly by the communities and competent authorities. In tenders for hazard mapping, perimeter "A" must be defined in the terms of reference. The detail level of the analysis must also be determined. Scale accuracy between 1:5,000 and 1:10,000 is appropriate for land use and mitigation measure planning at the municipal level.

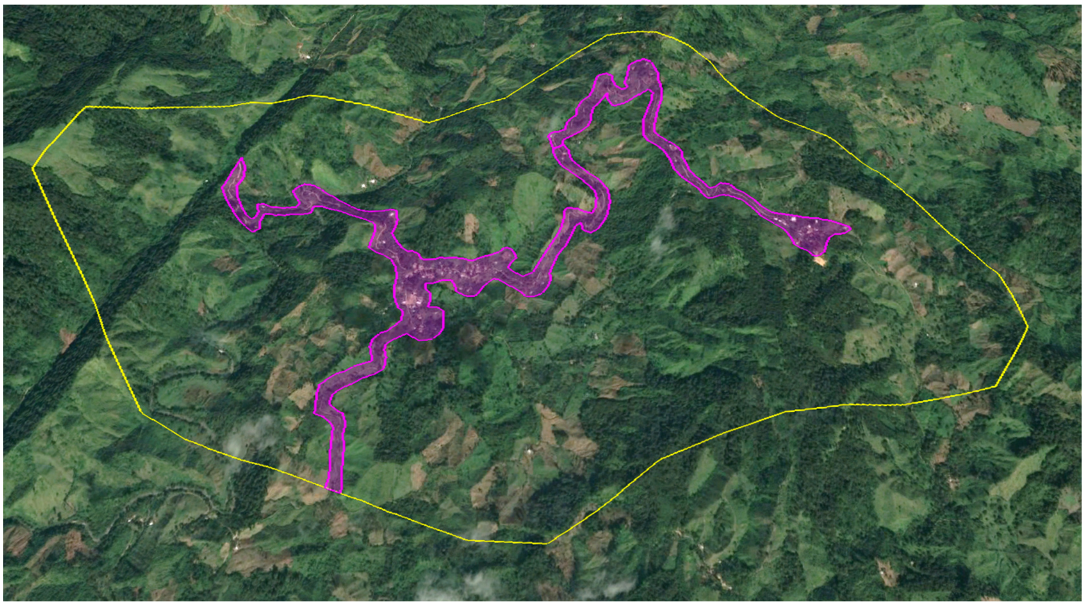

Illustration 2: Drawing of a project perimeter (yellow area) and perimeter "A" of a hazard map (purple area).

Definition of scenarios

The scenarios for the study (return periods to research) are usually specified by the authorities. If no specifications exist, it is recommended to consider three research scenarios, which are often applied with return periods of 10, 30 and 100 years, equivalent to a very frequent event, a generational event and an extreme event, respectively (see table 1). Typically, hazards from frequent and, sometimes, generational events can be reliably determined with the minimum standard. To determine an extreme event hazard, it is advisable to apply the advanced standard, as in a normal situation there is lack of information on events that have occurred within this scenario.

Table 1: Scenarios and their return periods. Source: SRC.

	Frequent event	**Generational event**	**Extreme event**
Name of scenario	„10-year“	„30-year“	„100-year“
Return period	≤ 10 years	10 – 30 years	30 – 100 years
Frequency of occurrence within 30 years	> 3 times	1 – 3 times	< 1 time

Step 2 – Baseline Data Collection

Background data provide valuable information on past events and their extent, return period and intensity. The quality of a hazard assessment relies primarily on the availability of baseline data, such as:

- Topographic map or satellite photos as cartographic base
- Local reports from previous events (VCAs, etc.)
- Photos of events and damage occurred
- Articles in newspapers
- Georeferenced aerial photos from different dates
- Digital Terrain Model (DTM)
- Digital drainage system
- Watercourse geometry (longitudinal and transversal profile measuring)
- Precipitation records
- Registers of discharge
- Previous hazard studies

Step 3 – Event Register

The analysis of past events is a core component of a hazard analysis. Particularly for very short return periods, the information obtained may be sufficient to describe a hazard in the relevant scenario. For scenarios with long return periods (extreme events), data serve to verify the results of technical analyses. The documentation process of these events allows for taking into account the local population's knowledge on natural hazards. It also serves to raise awareness and help the population to take ownership of the hazard map.

The IFRC's VCA methodology describes methods and tools to collect information from past events in a participatory manner. Particularly interesting is the frequency and spatial extent of the debris flows occurred. In addition, the observed flow height of debris flows [m] should be mapped at as many locations as possible and recorded using the StorMe form (Annex). Two pragmatic approaches are presented below:

Aerial Photo-based Approach

- A facilitator projects an aerial photography of the perimeter of interest (GoogleEarth) on a white paper (Illustration 3).
- Through an exercise with the plenary, the facilitator ensures that all participants can orient themselves using aerial photography.
- In a participatory procedure, the spatial extent of previous events is marked on the white paper. Each event area is assigned with the date of the related event and the type of hazard process (event index). This is linked to the StorMe forms (Annex) attached to each documented event.
- In the plenary, known damage and event information are compiled into the StorMe form. For this, the facilitator appoints someone who has previously become familiar with the form so that he/she can be responsible of the protocol. The StorMe form is referenced with the event index on the photo displayed.

Illustration 3: Mapping carried out by the population on areas affected by previous events (Poco Poco, Bolivia). Source: SRC.

"Field Tour" Approach

After meeting with the community or when participants cannot orient themselves with aerial photos, they are invited to tour the area of events occurred. The information collected in the field is entered into the StorMe form. For the inundation process, points are placed where there is information about the depth and speed of the overflows occurred, and it is recorded on a map.

Illustration 4: A woman points out the water height after a flood event in Los Amates, Honduras. Source: SRC.

Step 4 – Collection of silent flood witnesses

By walking along the banks of the watercourse, we look for flood traces or silent witnesses, as shown in **Fehler! Verweisquelle konnte nicht gefunden werden.**. These are mostly traces of sediment or garbage hanging on branches near the river. Documenting and interpreting these witnesses in the field will lead to similar conclusions about future floods in terms of their possible spread, intensity and frequency of occurrence. Evidence collection is mainly carried out through on-site inspections but can also be complemented with information from aerial photographs.

Illustration 5: Traces of flood events on vegetation. Source: SRC.

Illustration 6: Traces of flood events on vegetation. Source: SRC.

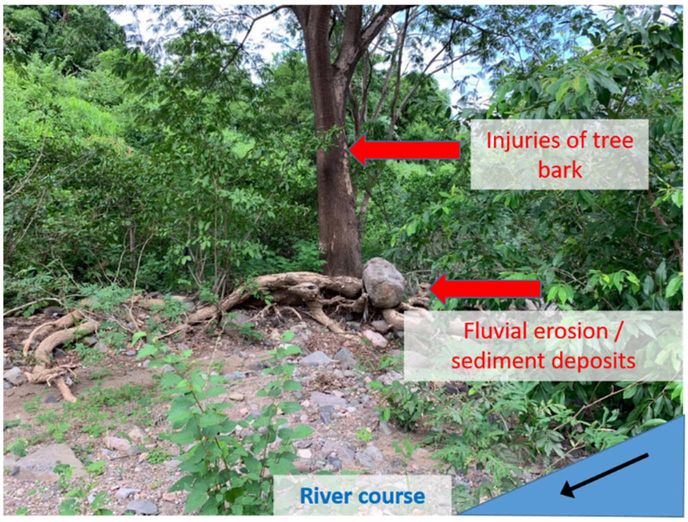

Illustration 7: Branches hanging from a bush near the river. Source: SRC.

Illustration 8: Aerial view of a watercourse. The lighter areas show traces of flows and sediment deposits from previous events.

Source: COSUDE Haiti.

Illustration 9: Aerial view of a watercourse. The lighter areas show traces of flow and sediment deposits from previous events.

Source: Helvetas Intercooperation Bolivia.

As with the morphological phenomena for landslide or debris flow processes, the traces of the "flood" process will be mapped on a topographic map or satellite photograph according to Annex.

Step 5 – Elaboration of a Hazard Map

Based on the information collected, a map is drawn up for each defined scenario (return period of 10, 30 and 100 years) showing the spatial extent and intensity of future floods with the relevant frequency of occurrence. As a result, three maps are obtained which differentiate flood intensities (low, medium and high), as shown in Table 2 and Illustration 2 in "Documentation of results". These three maps are merged in order to obtain a single flood hazard map. The "Documentation of results" describes the process of merging the maps.

Table 2: Differentiation of flood intensity.

	Intensity		
	Low	**Medium**	**High**
Flood height	< 0.5 m	0.5 – 2.0 m	> 2.0 m
Velocity	Low velocity	slower than a person sprints	As fast or faster than a person sprints
People affected	It is possible to cross the flood area without suffering any harm	Danger of drowning due to runoff velocity	Risk of drowning due to runoff velocity and/or height
Buildings affected	No structural damage	Potential structural damage to adobe or wooden houses	Structural destruction or damage to all types of buildings

Examples of flood intensities

Illustration 10: Low intensity flood. People can cross the flooded sector without risk of being swept away.

Illustration 11: Medium intensity flood. Vehicles and persons may be swept away due to flow velocity and flow height.

Illustration 12: High intensity flood. Buildings can be destroyed and washed away.