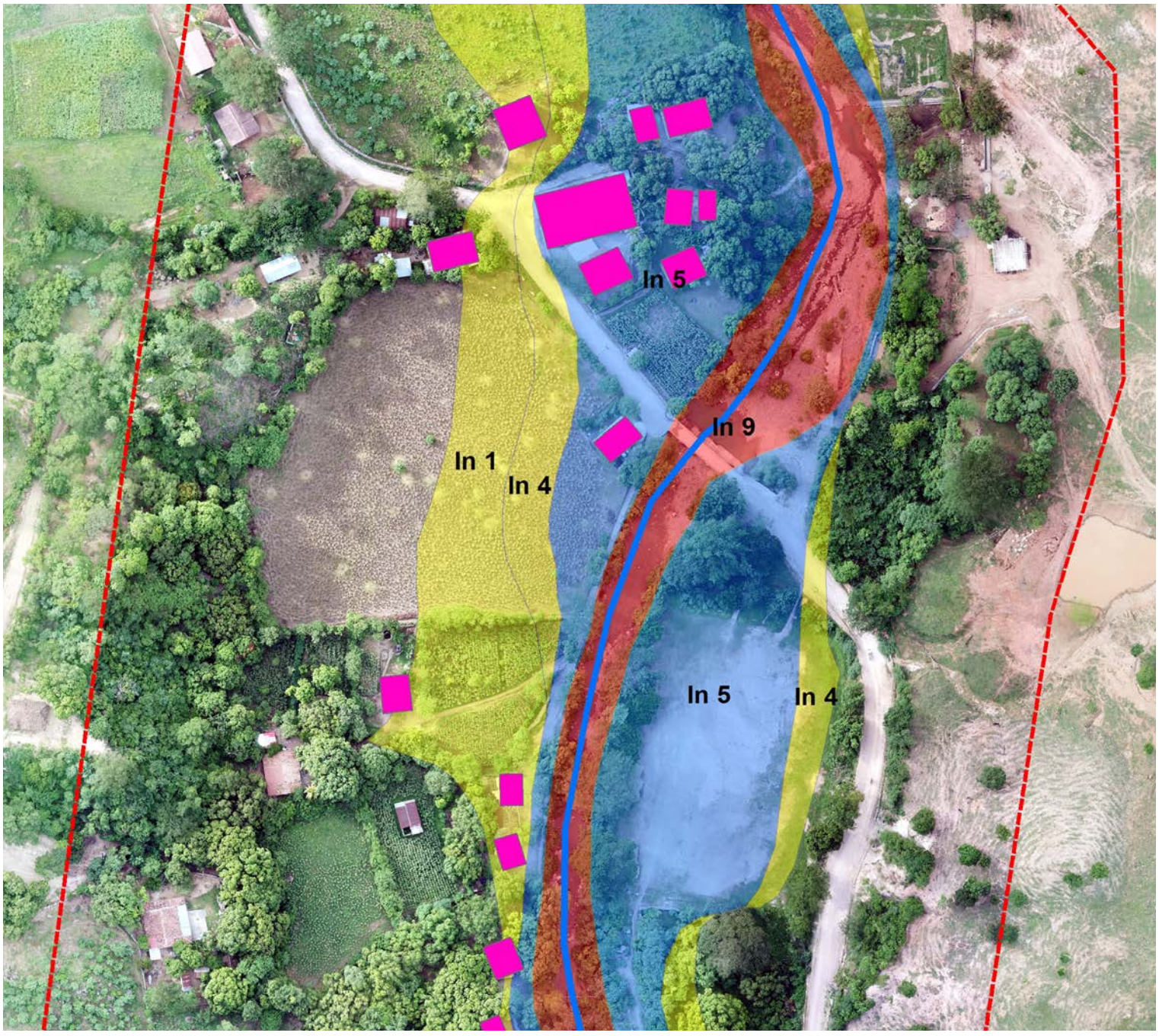
SRC International Cooperation

Documentation of Hazard Analysis Results



Landslide processes, debris flows and floods

Swiss Red Cross

Compilation of hazard maps

For each of the processes examined, the hazard maps represent the final product of a hazard analysis, together with the corresponding technical report. They show the spatial extent of the hazard with its frequency of occurrence and intensity. They represent the necessary basis for planning of mitigation measures (risk analysis and cost-benefit analysis of measures), for evacuation routes and for territorial planning.

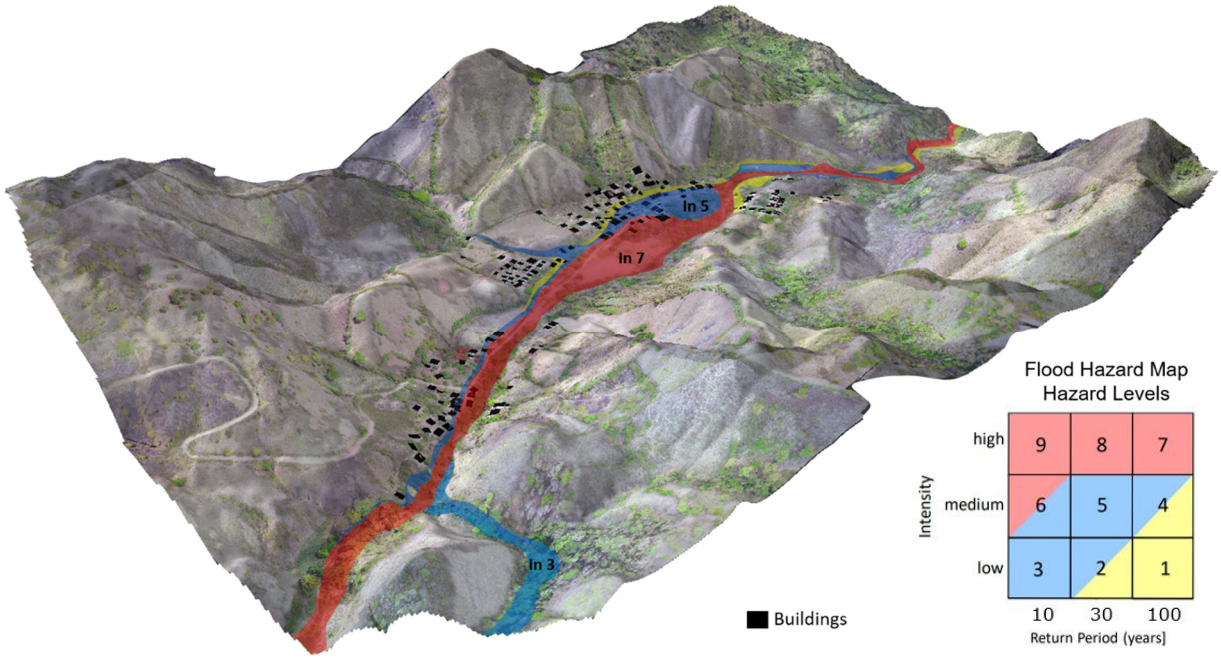


Illustration 1: 3D view of the flood hazard map of La Avispa in the department of Olancho, Honduras. Source: SRC.

Each hazard area is assigned a hazard level on the map, as shown in the 9-field diagram in Illustration 2, depending on the frequency of occurrence and intensity.

A distinction is made here between high hazard (red areas), medium hazard (blue areas) and low hazard (yellow areas). By assigning an index, it is possible to specify the hazard in more detail (numbers from 1 to 9).

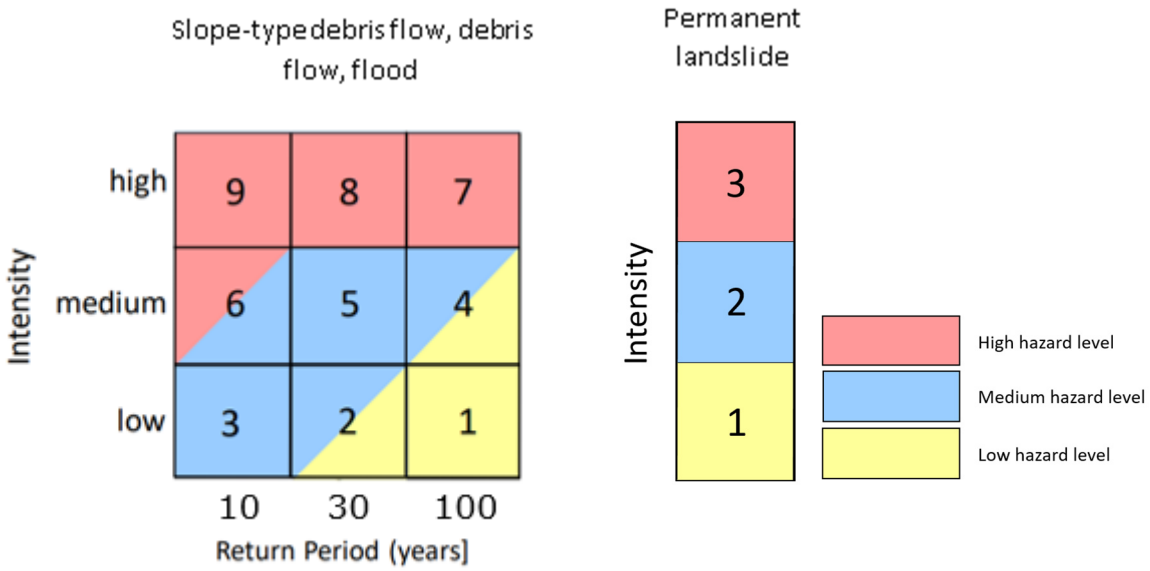


Illustration 2: Hazard level diagram. No return periods are defined for the "permanent landslide" process; only the intensity criterion defines the hazard level (diagram to the right). Source: PLANAT.

Fields 2, 4 and 6 in the matrix have two colors each. The higher hazard level is assigned for severe processes (slope-type mud flows and debris flows); the lowest hazard level is assigned for floods.

> **Example 1:** A flood hazard area with a 100-year return period and medium intensity (In 4) is classified as low hazard (yellow area).
>
> **Example 2:** A debris flow hazard area with a return period less than 10 years and medium intensity (Fd 6) is classified as high hazard (red area).

For permanent landslides, the matrix consists of only one column with three intensity levels because no return period can be assigned to this process due to the fact that it is continuous.

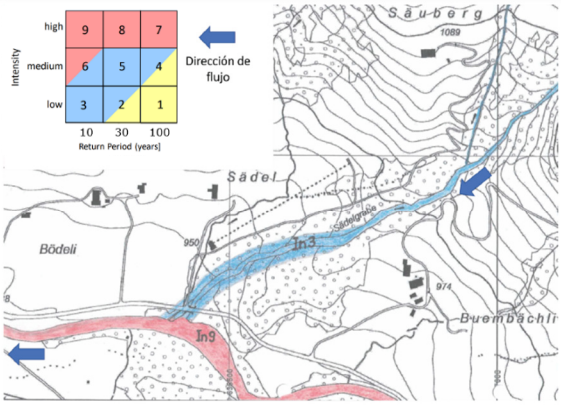
Hazard mapping for debris flows and floods

For water processes (debris flows and floods), it is recommended to separately map the potential areas of impact for each scenario (return period) and then merge the maps into a single hazard map. For example, for the "flood" process, 3 maps are obtained, each with their red, blue and yellow areas, depending on the intensity levels. Overlaying the three maps results in the final flood hazard map. The overlay can be done in Geographic Information Systems (GIS) or visually.

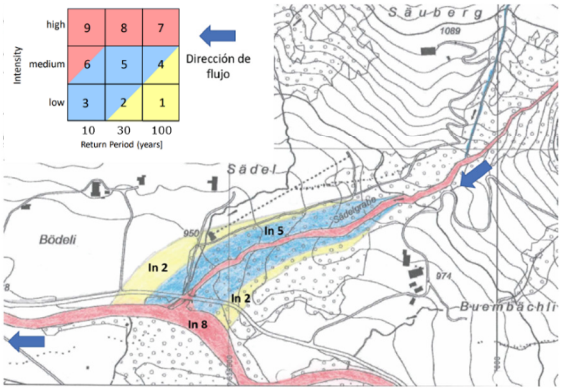
When overlaying, the following rule has to be observed: for areas affected by different scenarios and therefore with different color codes for hazards, prioritize red followed by blue and then yellow.

> **Example 1:** An area is affected in the 10-year scenario, in blue (index 3); in the 30-year scenario, also in blue (index 5); and in the 100-year scenario, in yellow (index 4). The crucial color for the final hazard map is blue (index 5).
>
> **Example 2:** Example 2: An area is affected in the 10-year scenario, in blue (index 6); in the 30-year scenario, also in blue (index 5); and in the 100-year scenario, in red (index 7). The crucial color for the final hazard map is red (index 7).

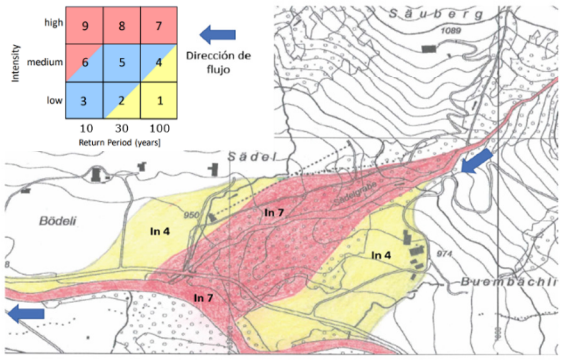
Elaboration of the Hazard Map



Map of the 10 yearly scenario



Map of the 30 yearly scenario



Map of the 100 yearly scenario

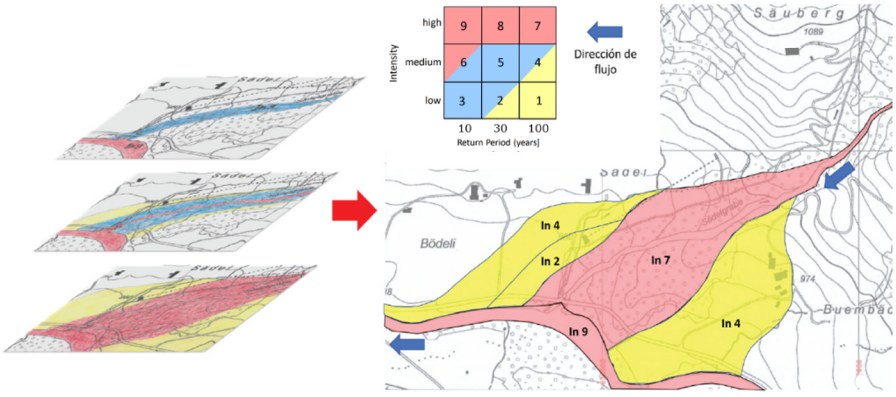


Illustration 3: Mapping of flood scenarios for different return periods and compilation of a flood hazard map (map below to the right). Blue arrow shows the flow direction of the torrent. Source: SRC.

Meaning of the hazard levels

Table 1: Definition of the hazard levels. Source: SRC.

Hazard level		Meaning
Red	High hazard	People are exposed to hazards both inside and outside of buildings. Destruction of buildings and infrastructure is to be expected.
Blue	Medium hazard	People are not exposed to hazards inside of buildings but outside of them. Significant damage to buildings and infrastructure is to be expected. The destruction of buildings cannot be excluded in simple constructions (wooden or adobe constructions).
Yellow	Low hazard	Buildings and infrastructure may suffer minor damage. People are not exposed to hazards inside or outside buildings.
White	Non-hazard area	

Alternatively, hazard maps (landslides and water processes) can be overlaid and combined to form a synoptic hazard map. If an area is endangered by several hazards, the highest hazard level is decisive.

It is recommended that the symbols of the morphological silent witnesses are not displayed on the hazard map.

Cartographic requirements

For cartographic documentation, the minimum requirements are listed below:

- Satellite photo as base map or topographic map
- Semitransparent presentation of hazard areas
- Information of the institution that prepared the hazard mapping
- Map title
- Scale specification
- Correct alignment of the North arrow
- Items legend shown on the map
- Coordinate grid specifying the coordinate system used
- Optional: date of mapping

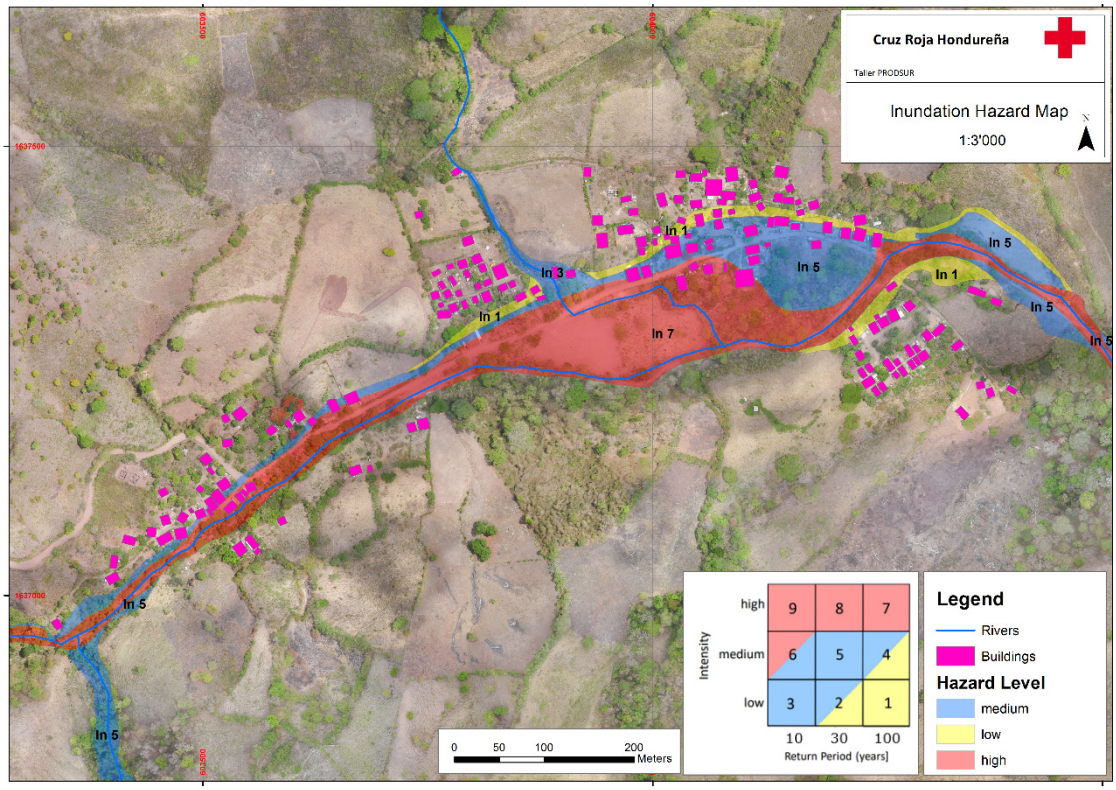


Illustration 4: Debris flow and flood hazard map of the community of La Avispa, Olancho departement, Honduras. Source: SRC.

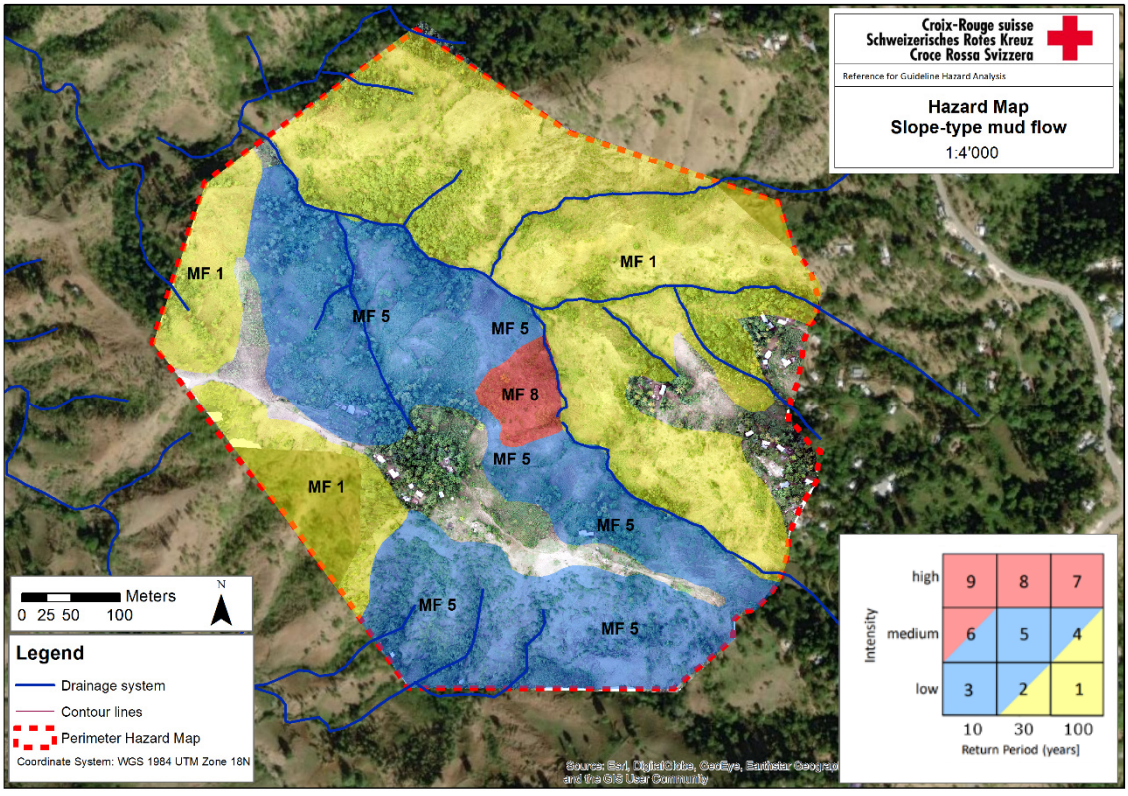


Illustration 5: Slope-type mud flow hazard map in Léogâne, Haiti. The indices are marked with the acronym "MF" for "MudFlows". Source: SRC.

Report requirements

A standard format for the technical report of the hazard map preparation is presented in Annex 6. It is important to provide a well-founded explanation of the study methodology and to clearly separate the methodological section from the results.