Swiss NGO DRR Platform

Training concept for the learning journey hazard and risk assessment including the use of airborne data

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1. Background

The Swiss NGO DRR Platform intends to offer a training in hazard and risk assessment of natural hazards, including the use of airborne data (satellite data and drones), for staff involved in disaster risk management (DRM).

The present concept can be adjusted during the course of the learning journey, according to the needs of the Platform.

2. Thematic introduction

DRM according to the risk cycle comprises a variety of elements (e.g. early warning, emergency plans, functional committees, structural and organisational measures, etc.) to reduce climate and natural hazard risks and increase resilience. For these DRM elements to be effective, the hazard must first be known. This requires a hazard assessment, with the following questions:

- Where do natural hazards occur (spatial delimitation)?
- How often do these processes occur?
- How strong do they occur (energy)

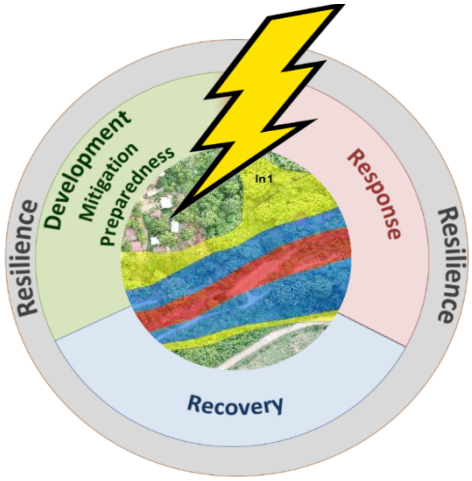

Figure 1: Risk cycle showing the hazard map in the centre as the basis for DRM activities.

The product of the hazard analysis is the hazard map. It shows on an aerial photograph or a map the areas that can be affected by a hazardous process. It distinguishes between three hazard levels, depending on the expected frequency and the expected intensity of the event. Often these three levels are shown in colour (e.g. red, blue and yellow hazard level).

All objects (buildings, infrastructure facilities, etc.) located in hazard zones are recorded on the hazard map. Objects that lie above a defined tolerance threshold of danger are called "critical sites". The definition of critical sites is the simplest form of risk analysis. DRR activities are subsequently directed towards these critical sites. Risks can also be determined mathematically if cost-benefit analyses of possible measures are to be carried out in the subsequent planning of quantitative protective measures.

3. Course objectives

General objective:

Enhance the capacity of practitioners on how to independently conduct a hazard and risk assessment, including how to retrieve airborne data, and determine the cost-benefit ratio of a DRR measure.

Specific objectives

1) Participants know all three methodological elements of the hazard analysis and can apply them based on practical examples in the field.
2) Participants know where they can obtain free satellite data. They can use these data for hazard analysis in a purposeful way. They also know the limitations in the use of satellite data.
3) Participants learn how to manoeuvre drones and know the possible applications and limitations of drone-based data.
4) Participants know a qualitative approach for the assessment of critical sites (risk assessment).
5) Participants know the quantitative risk approach, are able to independently calculate risks and conduct cost-benefit analyses of protective measures.

4. Target groups

The training course is aimed at staff working in the field of DRR in programme countries as well as in head offices (in Switzerland and elsewhere). It is primarily geared towards staff of member organisations of the Swiss NGO DRR Platform but open to interested persons from non-member organisations.

No special previous knowledge is required. There is an option to receive a certificate.

5. Methodology

5.1 Hazard assessment

The proposed methodology for hazard analysis is based on the SRC Guidelines for Hazard and Risk Assessment. It comprises the following three methodological elements:

- Historical profile: corresponds to community-based approach as part of a vulnerability and capacity assessment.
- Silent witnesses: fieldwork to identify and interpret evidence of past events, e.g. deposits from landslides or floods. These characteristics provide information about the event intensity and possibly the frequency of events.
- Technical assessment: supplementary simplified calculations of the hazard.

Figure 2: Methodological elements of a solid hazard assessment

5.2 Use of airborne data

The availability of baseline data for hazard assessment is often low in typical project areas of the member organisations of the Swiss NGO DRR Platform. Nowadays, there is the opportunity to use freely available, precise satellite data. By means of practical exercises, the course shows where and how to obtain satellite data and how to use them.

The use of drones can be valuable as a basis for mapping and project documentation. Drones can now be obtained inexpensively and their use is simple. During the course, different drone models are presented. Participants learn how to manoeuvre drones and how to use drone-generated data in project work.

5.3 Risk assessment

If the hazard is known, it is then important to know which objects in hazard areas should be protected, as it is usually not feasible to fully protect all objects. The need for protection depends on the one hand on the hazard level, and on the other hand on the vulnerability of the objects and the capacity of the persons and communities concerned. The risk analysis determines the clarification of the need for protection. This can be done in a simplified qualitative manner (recording of critical sites) or in more detail, using quantitative methods (risk calculation):

- Recording of critical sites: together with decision-makers, object types are defined (e.g. housing, educational institution, transport facility, agricultural area, health facility). For each object type and together with the stakeholders, the maximum acceptable hazard level is defined (low, medium, high hazard). Subsequently, the objects for which the threshold of acceptable risk is exceeded, are selected on the map.
- Risk calculation: Advanced users can calculate the risks. On basis of the existing Excel tool of the SRC guidelines, which can be adapted to the respective project context, the value of the expected damage is defined for all objects and compared with the value of the objects. The risk level is indicated as a monetary value.
- Cost-benefit analyses of the planned measures compare the expected risk reduction through a measure (expressed in monetary terms) with the costs of the measure. If

the risk reduction is greater than the costs of the measure, the cost-benefit ratio is positive and the measure is recommended for implementation.

6. Course structure, timing and content

The training is organised as a learning journey in a modular way and conducted over a period of 2 years. The modules are grouped in the following packages:

1) GIS, Satellite Data, Drones
2) Hazard Assessment
3) Risk Assessment and Cost-Benefit Analysis

The first year focuses on hazard assessment, the second year on risk assessment and cost-benefit analysis. They both comprise a series of webinars of roughly 2 hours each, followed by a field day with emphasis on putting into practice what has been learned online. The package 1 (GIS, satellite data, drones) is divided between the two years.

Participants who complete all webinar modules of a series (i.e. hazard assessment, risk assessment) will receive a certificate.

The webinars for each year are conducted in monthly intervals, starting from January. The field days will most likely take place in June or July. Exact dates are yet to be defined.

Package 1 – GIS, Satellite Data, Drones

Webinar: Acquisition of satellite-based data, duration 2h (March 2023)

- Overview of basic data: vector data, grid data (RGB grid, elevation models, projections)
- Getting to know different acquisition platforms (Planet, UP42, Hexagon Content Program)
- Streaming services such as Google Maps/Google Earth
- Software for visualisation and analysis of such data (e.g. QGIS, ArcGIS, etc.)

Webinar: Use of drones, duration 2h (May 2023)

- Creation of basic data with drones
- Types of drones and their flight characteristics
- Equipment to fly drones
- Data processing
- Application examples

Webinar: Working with GIS, duration 2 x 1.5h (February/March 2024)

- Introducing GIS in relation to hazard assessment
- Setting up a project
- Adding data to the project

- Tools for editing the data layers (grid tools, vector tools)
- Tools for visualisation (colours, labels)
- Creating a printable version of the map (map scale, legend, orientation)

Package 2 – Hazard Assessment

Webinar: Introduction to hazard assessment, duration 2h (March 2023)

- Characterisation of gravitational hazard processes (flooding, debris flow, landslides, hillslope debris flows, rockfall)
- The added value of a technical hazard assessment
- Introduction to “Augur” as a concrete application example

Webinar: Hazard assessment flood, duration 2h (April 2023)

Practical use of the Augur satellite tool
Application of the SCS method
Quality control of flood estimation results
Introduction of channel hydraulics (assessment of discharge capacity)

Webinar: Hazard assessment landslide, duration 2h (May 2023)

- Process understanding (types of landslides)
- Historical profile
- Silent witnesses
- Satellite data and drones as supporting tools
- Hazard assessment
- Illustration of the hazard
- Creation of a printable version of the map (map scale, legend, orientation)

Field Day: Hazard Assessment Floods[1] (June/July 2023)

- Historical profile
- Calculation of flood discharges
- Determination of weak points along the watercourse
- Hazard mapping
- Use of drones for aerial photography, terrain modelling and project documentation (added value and limitations)
- Location: Bern-Emmental region

Package 3 - Risk Assessment and Cost-Benefit Analysis

Webinar: Introduction risk assessment, duration 2h (April 2024)

[1] If required, the topic of landslides or debris flows (mudslides) can also be addressed.

- Difference between hazard and risk
- Risk concept
- Theory of qualitative and quantitative risk assessment
- Exercise: qualitative risk assessment (identification of critical sites)

Webinar: Quantitative risk assessment, duration 2h (May 2024)

- Assessment of the damage potential
- Quantification of the risk based on the results of the terrain analysis and using the risk tool of the SRC website
- Determination of the benefits of a protective measure
- Joint calculation of the cost-effectiveness of a measure (cost-benefit analysis, CBA) using the risk tool of the website SRC

Field Day: Risk assessment and cost-benefit analysis (June/July 2024))

- Recording and classification of the affected objects
- Determination of the permissible hazard per object type
- Mapping of critical sites (qualitative risk analysis)
- Discussion of possible measures
- Mapping of hazards with consideration of protective measures
- Calculation of risks without and with measures (benefit analysis of measures)
- Calculation of the cost-effectiveness of protective measures (quantitative analysis)
- Location: Bern-Emmental region

7. Organisation

The learning journey is organised and facilitated by Andrea Blindenbacher and Georg Heim.

Andrea Blindenbacher has a MSc in Geographic Information Systems and Remote Sensing and has extensive experience in aerial data acquisition, processing and analysing. Andrea is responsible for package 1.

Georg Heim is a geomorphologist by background with a MSc in Geography. He has extensive experience in hazard and risk assessments, planning and realisation of mitigation measures. Georg is responsible for packages 2 and 3 and the overall organisation of the training course.

The Swiss Red Cross supports the facilitators and is in charge of logistics, administration and financial issues.

The training materials are available on SRC Guidelines for Hazard and Risk Assessment. Further information is available on the Platform website: a brief on acquisition of satellite-based meteorological data and on drone-supported hazard and risk analysis.