E314

Understanding the risk in the downstream of the dam– A case study of Ngan Truoi Dam, Central Vietnam

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Introduction

Viet Nam has one of the largest networks of dams and hydraulic structures in the world, with over 7,000 dams of different sizes and types. Many dams have not been designed to withstand more than moderate floods and are in deteriorating condition. The Viet Nam-New Zealand Dam Safety Project (VNZDSP) was launched with the aim of providing Vietnam Government a methodology to deliver evidence-based decision making for dam safety management and improving community-based disaster risk management (CBDRM). This paper focuses on discussing the modeling of flood risk caused by the potential failure of Ngan Truoi dam, the pilot case study of the Project.

Approach and Methodology

As risk is the function of hazard and vulnerability, risk modeling for this case study used GIS analysis and RiskScape software following the steps: (i) Flood scenarios were defined and their inundation maps (hazard modules) were developed; (ii) The relevant exposure modules were created using data from field surveys, satellite images, etc; (iii) Individual asset exposure was defined based on the spatial extent and flood water depth and velocity of each scenario (exposure analysis) and (iv) A vulnerability module was then used to define the relationship between hazard intensity and the impact based on an asset's exposure (Step iii) and specific attributes (e.g. building age, use category, material type) (Step ii) (impact analysis).

Study area and available dataset

Ngan Truoi dam located in Ca river basin (Figure 1) is a 53.9m high earthfill structure with a reservoir storage of 752Mm^3. The dam is a multipurpose facility, primarily with an irrigation function (32,585ha) but also a small electricity generation function. This means its failure or mis-operation is likely to cause loss of life and significant economic loss, and environmental and infrastructure damage in areas downstream.

Sources of data available for asset module development are the population and housing collected from Statistics Books and field survey by RiACT app and other secondary sources.

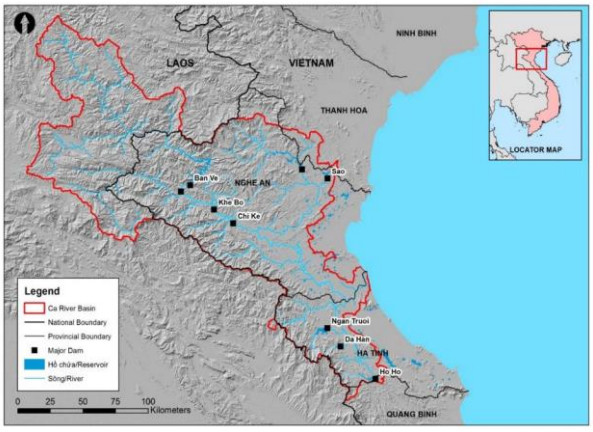

Figure 1. Ca River basin showing location of Ngan Truoi dam.

Result and discussion

The exposure and risk calculated were calculated for the 08 scenarios as listed in Table 1.

Table 1 Dam failure scenarios used in this study

#	Description
1	Spillway outflow-Design flood (P=0.5%, 1:200)
2	Spillway outflow-Check flood (P=0.1%, 1:1000)
3	Sunny Day dam failure
4	Rainy Day dam failure
5	Auxiliary Dam - Sunny Day dam failure
6	Auxiliary Dam - Rainy Day dam failure
7	03 cascade dams release design flood
8	03 cascade dams release check flood

As the example, Figures 2 & 3 show the flood extent and building impact for #3 (Sunny Day dam failure) Scenario. Note that the building dots show not only its location, but also the severity of impact.

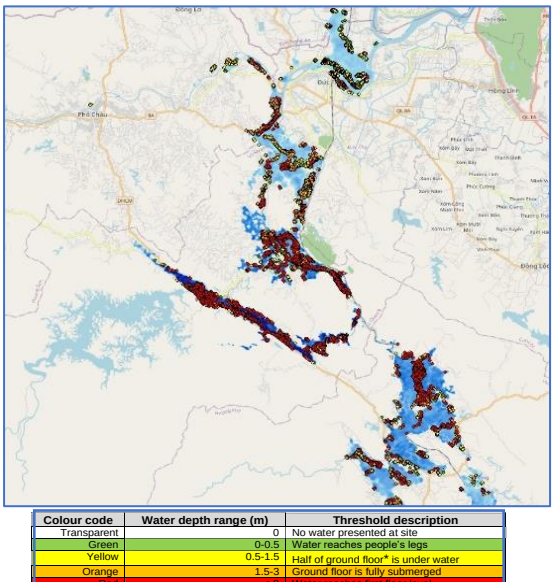

Figure 2. Buildings exposed to flood under #3 Scenario

Regarding to the risk, the key difference of dam failure compared to alluvial seasonal flooding is the critical emergency. In case of dam failure, an early warning system may not yet be activated timely. To further assess the influence of early warning systems we examine hourly flood extent under Scenario #3 (Sunny Day Dam Failure) to assess its impact on life risk (i.e. the total number of impacted people at that time step). In practice, people may be considering flooding during a heavy rain day and the purpose of this exercise was to demonstrate evacuation times when people are not expecting a flood to occur. As shown in Table 2, the number of people affected can significantly drop if a

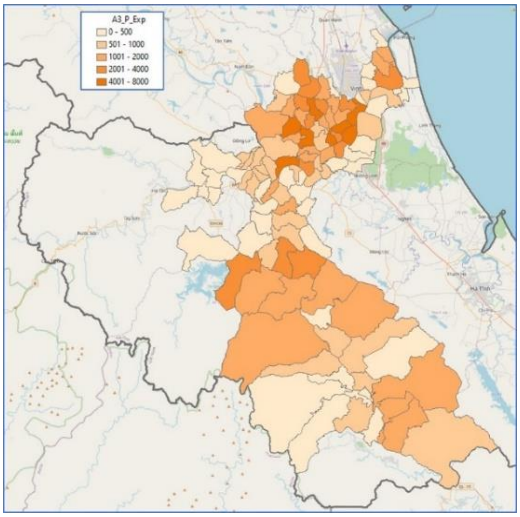

Figure 3. Total number of people exposed to #3 Scenario

warning can be issued within 2 hours (or even hour) after dam flood initiation. We note that at Vu Quang, the commune that is immediately downstream of Ngan Truoi dam, the water from dam failure (#3 Scenario) arrives within half an hour. Hence it is unlikely there is enough time for significant community evacuation.

Table 2: Estimated total number of deaths at various warning levels for #3 (sunny day dam failure) scenario

Little or No Warning	Adequate Warning
7,797	137

Conclusion In this study, flood risk was modeled for a range of scenarios in an attempt to bound possible future flood and dam break scenarios and used these to assess the possible range of Ngan Truoi downstream impacts. The dam failures could occur at any time of the year, not just during the annual flood season, and can therefore be both 'surprise' events and of a scale much larger than recently experienced.

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