Basic Territory Risk Units as a Mean to Approach the Territory Risk Scenarios

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THE BASIC TERRITORY RISK UNITS

The territory at risk is heterogeneous. When we focus at the national level, we can see one big prone disaster area. But if we do a close up, there are affected areas separated by non-affected areas.

At spatial scale, the territory at risk seems a net of small territories, called TR_Units (figure 1). The size of the TR_Units depends on the scale defined by: the perception of the risk, the purpose of the study, the availability of the data, the Subject at risk, etc. It seems that the level of *resulting risk* of the territory can be represented by the average of risk of its TR_Units. In temporal scale, risk variability can be considered as the change of behavior of its TR_Units along the time; the risk changes because its TR_Units change.

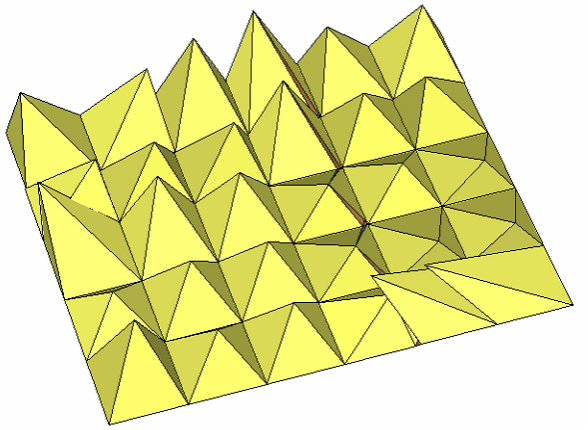

Figure1: A territory of risk divided in TR_Units.

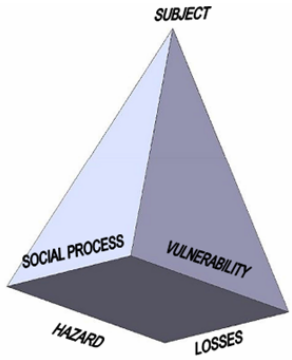

Figure 2: Basic TR_Unit Components.

Although each TR_Units is different, scale invariance is a characteristic of the TR_Unit, because its structure does not change, independently of the observer's standpoint (Murphy, 1996). ***Subject (S)***: The subject depends upon the objective of the study: population, buildings, etc (Fernández, 2008). The Subject determines the other four components nature and its relationships. ***Hazard (H)***: Subject extrinsic factor. It can be dangerous not because of its nature but because of the Subject exposure (Smith, 1992). ***Specific Vulnerabilities (v_s)***: Subject intrinsic factor. It is the lack of resistance to damaging/destructive forces (Kron, 2005). ***Social Process Vulnerabilities (V_{sp})*:** primary causes that affects all the subjects of the territory of risk (Blaikie, 1995). ***Losses (L)***: the values at risk that are lost after disaster (Kron, 2005).

The level of risk, called ***Resulting Risk (R_s)*** − because we are dealing with events already occurred − is better understood if three dimensions of the ***Vulnerability (V)*** are considered (UNDRO, 1979; Blackie, 1995; Kron, 2005, Daphné, 2004; Lavel, 2003).

$$R_s = f(H, V_{sp,} v_{s,,}L_s) \quad (1)$$

The *Resulting Risk* for an specific Subject in a determined TR_Unit, is calculated by

$$\|Rs\| = \sqrt{H^2 + Vsp^2 + vs^2 + Ls^2} \quad (2)$$

APPLICATION OF TR__UNIT CONCEPT TO THE VEZ RIVER FLOODING AREA, PORTUGAL

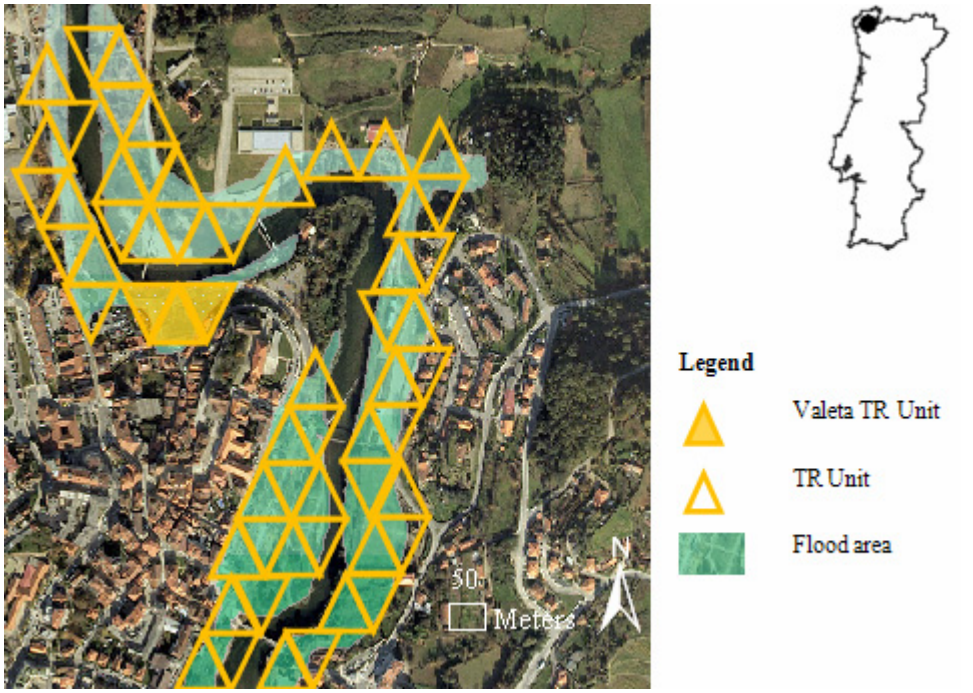

Figure 3: TR_Units in the flooded area since 1900.

In figure 3, the three TR_Units highlighted correspond to the Valeta, the old business center of the Arcos de Valdevez town with approximately 5ha and 100 residents. Follows the analysis of the Valeta, for the four most significant flooding years since 1900 (Gonçalves, 2009).

Selected Subject: constructed area with 40 old and new buildings (residential, administrative, commercial, industry), roads (main road, streets) and utilities (electricity, telephone, sewage system).

Hazard: The level of hazard for each event corresponds to the height of the water over street level. The flood in the Valeta is produced by the Vez river. When intense precipitations occur, an ebb impedes the Vez river to flow. *The worst scenario considers 3 mt over street level, as shown in figure 4.*

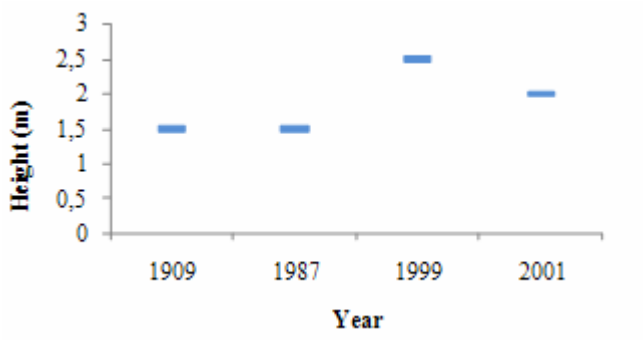

Figure 4: The magnitude of the flooding is represented by the altitude of the water over street level (Source: Gonçalves, 2009).

Social Processes Vulnerabilities: since 1900, constructions have been regulated by decreasing/increasing population because of epidemic diseases, colonial war and poverty. Due to European economical incentives for local development, since year 2000 a revitalization process is taking place. *The best/worst scenarios refer to the presence/absence of policies for rural development, for each year considered.*

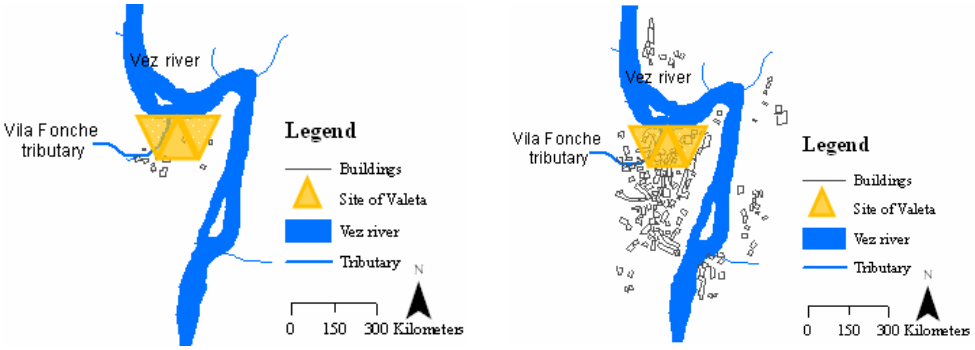

Figure 5: Expansion of buildings from 1900 to 1996. Source: Drawing of Arcos Salvador Vila, Local Government, 1900; IGeoE cartography, 1945, 1996.

Specific Vulnerabilities: at the beginning of the century, the Valeta was the business center of the town. Currently this is mainly a commercial and residential area (figure 5). Its importance decreased because of periodical flooding producing abandonment. The main road, being the most important communication route, became a barrier contributing to flooding. Since the end of 1990 decade, buildings renovation is happening. *The best/worst scenarios consider level of proximity to the river, building density and physical barriers indicators*.

Losses: *worst scenario considers one week interruption of communication and utilities, and floor damage referenced to the maximum number of existing floors for each yea*.

Comparative Analysis

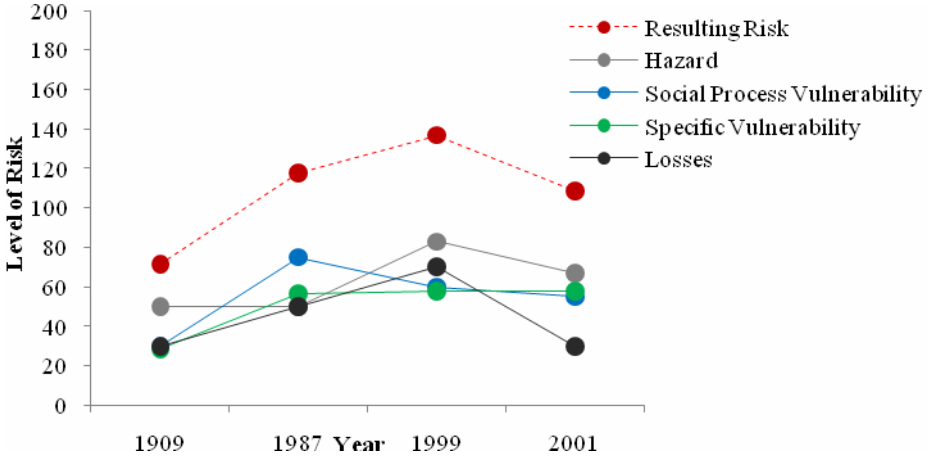

Figure 6: Resulting Risk in the Valeta for four flooding scenarios.

CONCLUSION

The TR_Unit shows to be a useful tool to join and compare different dimensions of risk at the territory, along the time. It is possible to differentiate the contribution of each component for the Resulting Risk. The larger size of the Risk Unit, the complexity of systematization increases, and assumptions based on generalizations has to be taken. In the other hand, smaller units being more homogeneous facilitate interpretation, but increase difficulties to get detailed data for larger areas.

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