A GIS LANDSLIDE DATABASE OF NORTHERN PORTUGAL SUPPORTED BY DOCUMENTAL SOURCES

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KEY WORDS: Landslides; Northern Portugal; Disaster Databases.

INTRODUCTION

In recent years a huge effort to collect, record and analyze information about disasters occurrence and impacts has been made worldwide.

The development of natural disasters databases is crucial for risk management purposes, because it allows improving systems of indicators on disaster risk and vulnerability at national and sub-national scales. In addition, the analysis of social, economic and environmental impact of disasters needs to be transferred to decision-makers and integrated in land use management and civil protection policies in order to prevent and mitigate disaster losses.

Landslides databases are essential to assess landslide hazard and risk. However, landslide databases may have different spatial resolution associated with different goals, scale and data capture methods. Limitations related with spatial resolution and data capture procedures of landslide databases need to be considered when data is transferred and applied by end-users.

STUDY AREA AND OBJECTIVES

During the last century, Portugal was affected by several destructing natural disasters, namely of hydrologic (floods) and geomorphologic (landslides) origin. The basic information on past damaging landslides occurred in Portugal from 1900 to 2008 can be found in the academic work performed at national scale by Quaresma (2008).

At the regional scale, a landslide database was made for the North Region of Portugal including the complete landslides occurrences identified exploring documental sources for the period lasting from 1900 to 2008 (Pereira, 2010).

In this work we present the Northern Portugal Landslide Database (NPLD) which was updated to 2011. In particular we want to answer the following questions: (1) What is the degree of completeness and the temporal and spatial accuracy of landslide distribution? (2) What are the advantages and limitations of landslides databases supported by documental sources?

METHODOLOGY

The NPLD is a geodatabase that includes the following information for each landslide occurrence: ID, date and hour of occurrence, location, x and y coordinates, landslide type, data source, and damages (fatalities, injuries, homeless people, disruptions in rail and road circulation and destructed buildings).

Data collection was exclusively based on documental sources: regional newspapers (daily and weekly), academic works and reports of the civil protection authorities. Most of landslide occurrences (68.6%) were identified in newspapers while landslides reported by the civil protection and academic works are only 26.1% and 5.3% of total, respectively.

Documental sources were carefully analyzed in order to identify and georeference landslides. Road maps, rail road maps and the Google Earth were used as additional tools to support the location of slope movements. Landslides were mapped in topographic maps (1:25 000 scale) with a point in the centroid of the rupture zone.

When descriptions about landslide location were not enough precise landslides were mapped in the parish centroid.

Spatial and temporal distribution of landslides belonging to NPLD was compared with a national database (Quaresma, 2008) of landslide damaging events occurred in Portugal, which generated fatalities, injuries, missing people, homeless and evacuated people. This database was originally for the period 1900-2008 and was further updated until 2010.

RESULTS

The NPLD has 640 occurrences, 79% of them georeferenced in the centroid of the landslide rupture zone (Fig. 1, Table 1). The National

database has only 63 landslides, which is explained by the criteria used for landslide inventory (Table 1). Nevertheless, the spatial distribution of landslides of both databases is quite similar. Landslides are located mainly along the Douro valley and in the Oporto metropolitan area.

Falls and debris flows are the most frequent landslides within the NPLD. More than half of these landslides caused disruptions in railroad and road circulation (37.5% correspond to line closed and 13.3% to road block).

More than 70% of landslides of the NPLD occurred in winter rainy months, especially in December (31%) and January (24.5%). The National database has the same monthly landslide distribution.

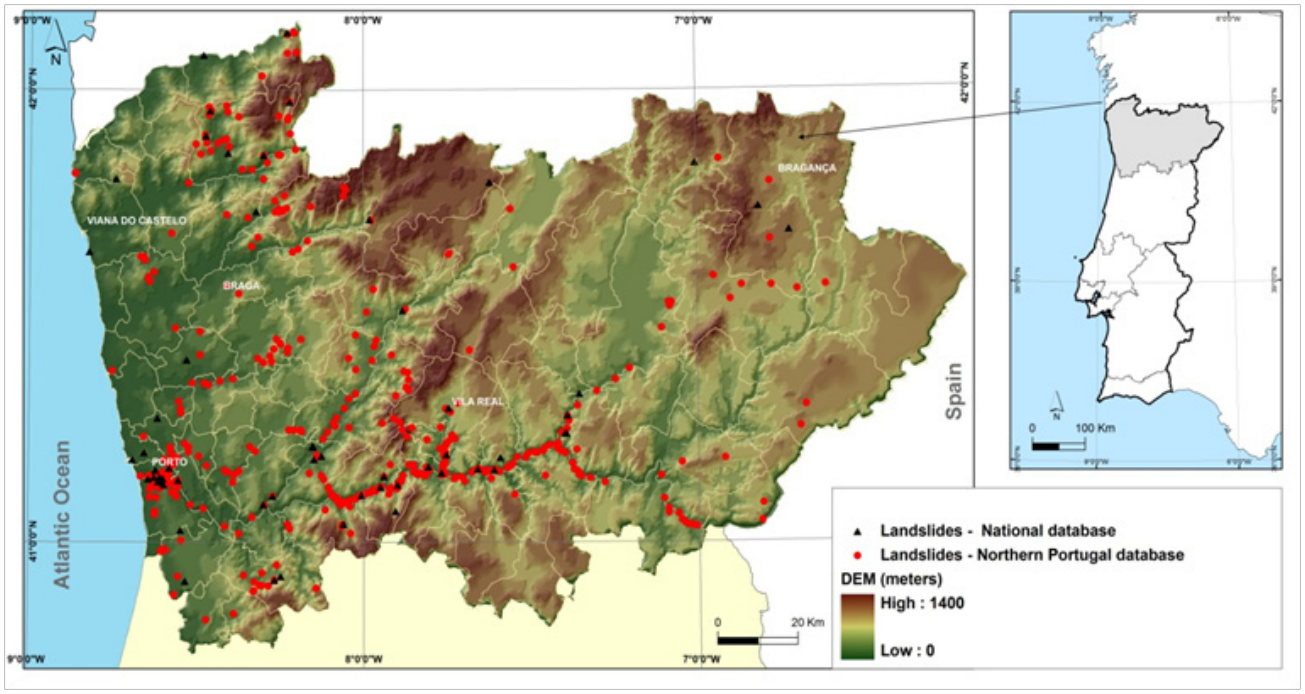

Figure 1 – Landslides distribution in the Northern Portugal according to the national and regional landslide databases.

For a similar reference period, the NPLD includes a higher number of deaths and homeless people in comparison with the national database. Therefore, we can conclude that information reported by newspapers at the national level (used to construct the national database) is not enough representative of landslide damages occurred at the regional scale. In addition, the regional newspapers also provide more accurate information regarding location of landslides.

	Northern Portugal Landslide Database	National Database
Period	1900-2011	1900-2010
Main Sources	Regional newspapers (daily and weekly)	National newspaper (daily)
Nr. landslides	640	63
Landslides/year	5.8	0.6
Nr georeferenced landslides	505	63
Georeferencing	Point (centroid of landslide)	Point (nearest toponymy)
Criteria for landslide inventory	All landslides	Landslides that caused fatalities, injuries, missing people, homeless and evacuated people
Nr. deaths	129	60
Nr. injuries	124	122
Nr. homeless	381	279

Table 1 – Landslide databases details.

CONCLUSIONS

Temporal distribution of landslides is strongly associated with wet months reflecting the rainfall triggering of slope movements. Although the NPLD theoretically includes all landslides, in practice the spatial distribution of landslides reflects the pattern of landslides that generated direct damages in population (e.g. fatalities, injuries, homeless), buildings and infra-structures (e.g. road, railroads). Therefore, landslide inventories based in documental sources can be easily transferred to emergency planning and societal risk assessment. Nevertheless, these landslide inventories are not enough complete to generate landslide susceptibility assessment which is crucial for land use planning.

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