Journal of Environmental Protection, Safety, Education and Management
2013, Number 1, Volume 1
ISSN 1339-5270

UTILIZATION OF SPATIAL DATA FOR CRISIS MANAGEMENT

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ABSTRACT
Crisis management is one of the areas that cannot do without information support. Current time is marked by the large amount of information and information systems, which are also spatially oriented too. The advantages of the use of spatial information is better clarity and clearness situation for rescue forces as well as a better understanding of the different contexts and other risks. Slovakia still lacks sources of information that would be directly useful in decision-making in crisis management.

Key words
crises management, spatial data, GIS

Introduction
Within crises management, emergency management applies geo-information technologies in the crisis management process and Geographical Information Systems (GIS) have been used for over 20 years. Examples for GIS utilization in natural and man-made disasters are to support flood mapping, hurricane prediction, and environmental clean-ups after industrial accidents.

Crisis Management and data support
Crisis management is a very important part of public safety. Crisis management is a continuous process in which all phases of the plan are being reviewed and revised. Each phase in the crisis management cycle (mitigation and prevention, preparedness, response, recovery) requires specific collection and processing of geographic information [1].

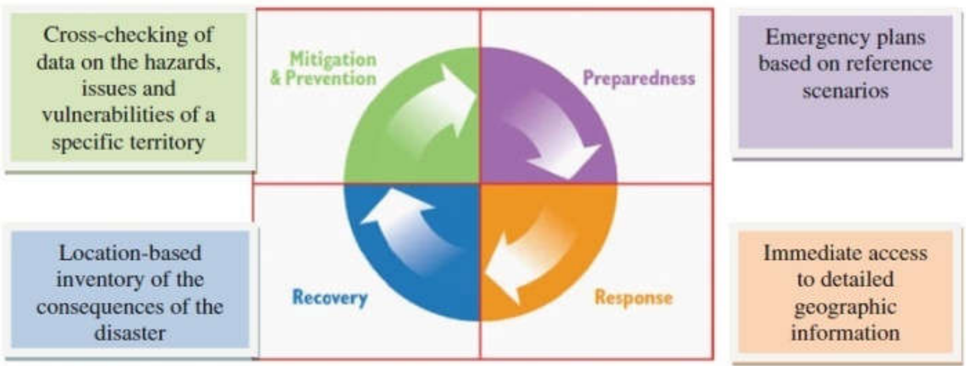

Fig.1. Risk and need management in terms of geographic information [3].

Whereas most of the phases are part of medium-and long-term approaches, it is important to separately-dedicate preparation of data (fig. 1). The Mitigation and Prevention phase consists in the global identification and prioritization of the risks in a specific area, in order to define the proper measures for risk reduction (technical responses, land-use planning, information specifically dedicated to the population). Prevention implies the cross checking of all the data related to hazards, issues and vulnerabilities at various scales. It requires negotiations between the different actors to reach some compromise between protection and development. The preparedness phase is based on the development of different municipal, departmental and national operational plans. Such negotiations are based on maps, and all the actions cover the short, medium and long term. In the risk management cycle, the response phase is the only one requiring immediate access to information and resources to determine and organize a rapid response. The *reconstruction phase*, management cycle, requires a location-based inventory of all material, social, economic and environmental consequences of the disaster. Reconstruction is usually a very slow process, given the scale of the damage; it includes establishing liability, re-evaluating safety standards, redefining technological choices and the organization and functioning of territories [2,3,4].

Spatial data in crises management
Spatial data has a significantly different structure and function. It includes structured data about objects in the spatial universe - their identity, location, shape and orientation, and other things we may know about them. Geospatial data can

come from many sources. Geospatial data has been digitized by a wide variety of agencies and commercial enterprises at an increasing pace over the past ten years. The first digitization often involved tediously tracing existing paper maps with a digitizing device (similar to a mouse) to record, point-by-point, the shape of roads, rivers, contours, buildings, etc. More recently, techniques have been developed to ease the in-field gathering of positional and other data. Utilities have field devices with a global positioning system (GPS) to gather positional information about assets (transformer vaults, utility poles, hydrants, valves, etc.) as well as allowing the entry of other data about the asset. The spatial data should be linked to non-spatial data (attributes) and field based data so that they can be visualized in the form of maps, which can further be used in map based modelling to provide inputs for risk mapping.

Spatial data requirements for risk mapping and disaster management are described according to the following broad categories [5]:

- *Baseline data layers*
- *Utility and Infrastructure data layers*
- *Disaster specific data layers*
- *Thematic data on terrain and natural resources*
- *Near-real time satellite data and thematic maps*

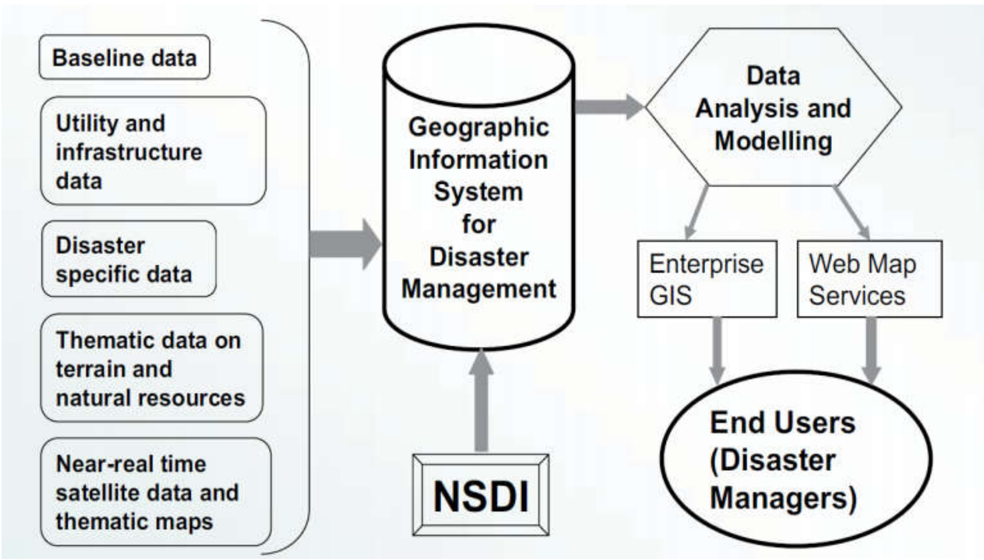

Fig. 2. Conceptual framework - The Spatial Information for Disaster Management [5].

Baseline data serve as the reference data related to the permanent features of the landscape such as administrative boundaries, human settlements, rivers, drainage, roads and basic infrastructure etc. Theme specific data layers are normally referenced to the baseline data layers. In the pre-disaster stage, baseline data should provide inputs to assess risks, including the identification of hazard prone areas/ locations and vulnerabilities, and the preparation of plans for risk management, early warning, and preparedness. During the response phase, baseline data should help to locate the areas affected by the hazard.

Utility and infrastructure data provide inputs to better understand specific risks and also to prepare specific disaster management plans. Most of the infrastructure data is in network form.

Data related to disaster risk reduction include hazard maps. Their preparation calls for the collection of risk related data, including data on major accident hazards, such as chemical, biological, and nuclear hazards, as well as transport accidents, climate related hazards. Normally such data needs to be collected by the local government.

Thematic data on natural resources and terrain Near real-time satellite data for disaster management Satellite data, combined with topographical maps, provide an excellent source for preparing thematic maps related to terrain parameters and natural resources. Some data layers, such as land use and forests, are dynamic in nature and need to be updated frequently, depending on the pace of development in the area. Data layers such as soils, geology, and hydro-geomorphology are static in nature and therefore remain valid for long periods of time. Thematic maps derived from satellite images are important scientific inputs for mapping a range of hazards including flood, erosion, landslide, fire,

storm, cyclones, drought. These data layers can be integrated with baseline data for predicting risks related to the natural and manmade disasters.
Near real-time coverage from satellite images helps to provide information on the area impacted by the disaster. These maps should be able to be integrated with the spatial data layers described above. The use of the maps derived from satellite images is well demonstrated in mapping the impact of floods, earthquakes, landslides, mudslides, cyclones and droughts.

Availability of spatial data in Slovakia

Spatial data include a wide group of such data. background data for creating topographic maps, environmental data, information about the rock environment, data infrastructure (eg. grids, pipelines routes) etc. Most of these data is collected within the state or corporate information systems. In Slovakia, the interoperability of data, preparation of government information systems and spatial data management are adjusted by several laws and the European INSPIRE Directive 2007/2 / EC of 14 March 2007 establishing an Infrastructure for Spatial Information in Europe (INSPIRE) [6]. Availability of digital data is not the same for each category of spatial data, despite current legislation. The available and relatively up to date are primarily environmental data on the other hand there are still not been processed some important location data as the register addresses. GIS operated in Slovakia can be divided according to the categories of data that offer to [7]:

1) GIS systems offering basic spatial data
- *a) Information System of Geodesy, Cartography and Cadastre*
- *b) The basic data for a geographic information system*
- *c) Military information system on the territory*

2) Information systems offering information about the environment
- *Environmental information system*
- *Information system on the territory*
- *Enviroportal*
- *Monitoring information system*
- *GIS of water management*
- *Geological Information System*
- *Enviroinfo*
- *Environmental Spatial Data Infrastructure*

3) Other information systems
- *Geographic information systems in the agricultural sector*
- *Information system on soil*
- *The information system forestry*
- *Geographic Information Systems in the transport*
- *Information model of the road network*
- *The information system infrastructure and the geographic information system of Slovak Railways*

Of these information systems are the most important spatial data contained in the base data for geographic information system GIS ZB. ZB GIS is a spatial database containing basic spatial data on the SR (fig. 3). It consists of three components, namely:
- *vector digital elevation model,*
- *digital topography,*
- *digital continuous orthophoto.*

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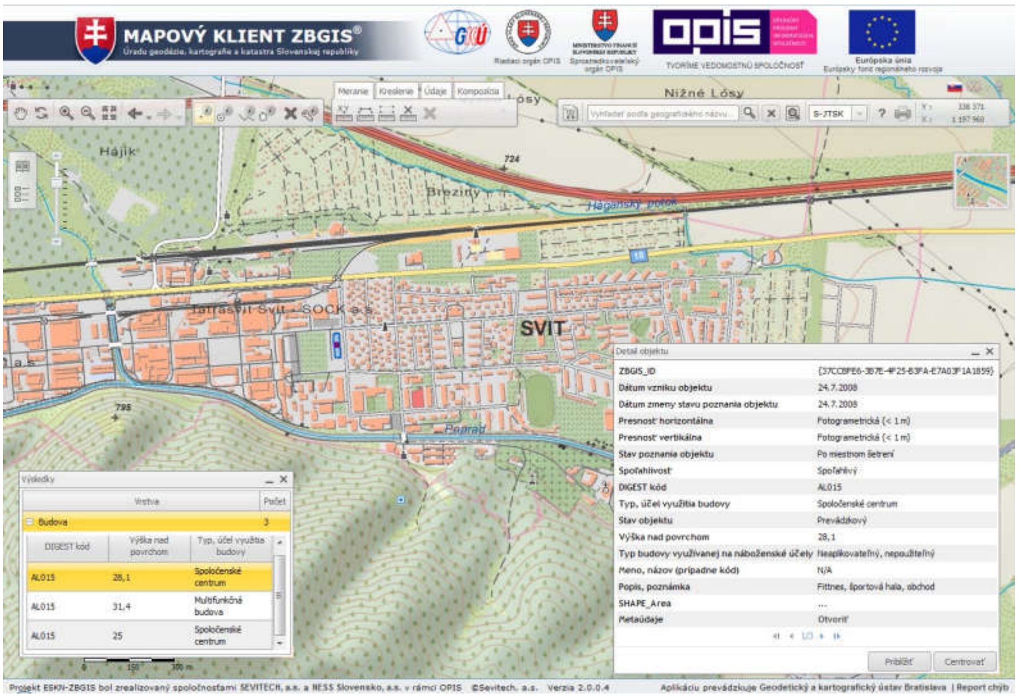

Fig. 3. ZB GIS - Example of data ZB GIS.

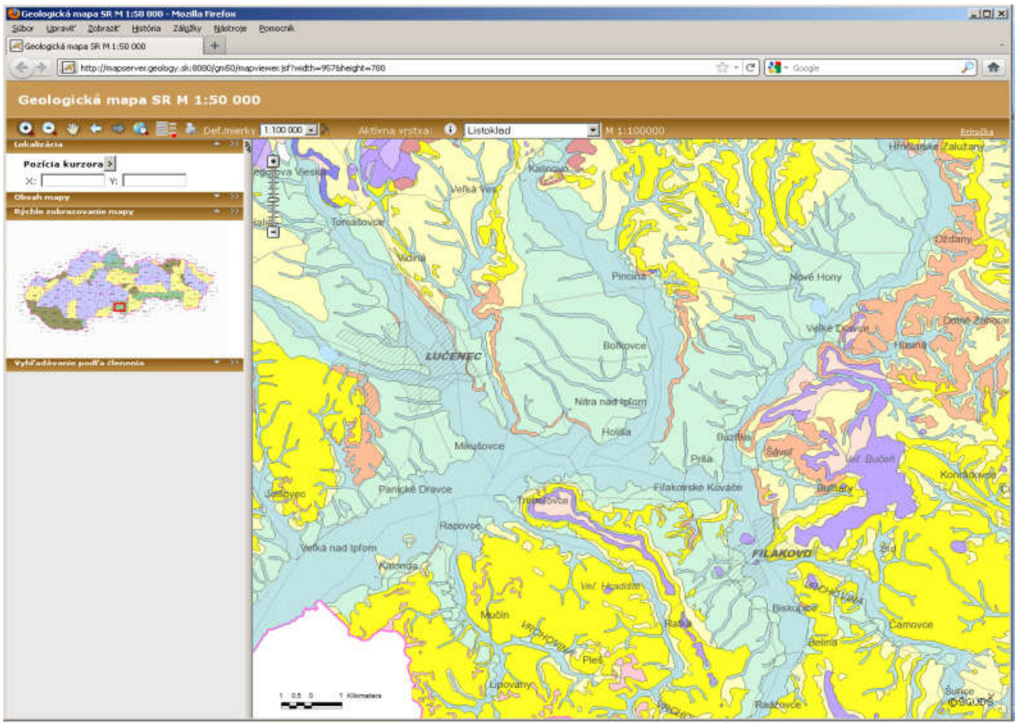

Fig. 4. Spatial data on the geological structure.

Environmental Information Systems (ISŽP) are an important class of data. This information system integrates information from environmental monitoring, assessment of environment and spatial information about the area. Furthermore, there also gather information for crisis management in particular data on the state of the environment, the water, soil, geological phenomena (fig. 4) etc..

Conclusion

The use of software tools in decision making is already standard. Their use depends mainly on the input data. Spatial information is a valuable source of data and in crisis management is the use of a number of advantages. GIS systems are used for the processing and analyzing spatial information. Possibilities of using GIS systems are wide analysis of the environment through modelling phenomena to prepare various scenarios to prepare for different situations. Extending of their use in Slovakia is conditional on the completion of state information systems.

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