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Data Preparation for Logistic Modeling of Flood Crisis Management

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Abstract

The aim of contribution isthe importance of preparing and verification of input data for logistic modeling of flood crisis management in GIS systems. Appropriate data is essential for crisis management operations. GIS systems offer a wide range of possibilities for further data analysis, the results of which can be used for decision-making process. The purpose of these systems offer wide range of possibilities, starting from complex base of digital data available online whenever anytime in the field, through ordinary and also specific spatial analyses, to the composing of specific outputs required by particular units of the Integrated Rescue System [1,2].

Keywords: GIS system; input data; maps; civil security; flood; modelling

1. Introduction

Floods are among the most frequent and costly natural disasters in terms of human and economic loss. Problems related to flooding have greatly increased, and there is a need for an effective modeling to understand the problem and mitigate its disastrous effects. The flood rescue activities are considered to be technical and organizational measures done during the floods in imminent endangered or already flooded areas in order to save human lives and property, particularly to protect and evacuate humans from these areas, to take care of the casualties for the

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necessary period, to save and move property to non-affected areas. A properly constructed database of interest area, maps of flooded area and modeling of floods is necessary for effective conservation planning. Geographic information systems (GIS) are usually used in the evaluation of the geo-environmental hazards but offersas welltools for logistic modeling and solving of floods [2,3,4].

2. GIS system in crises management

Crisis management is a very important part of public safety.Each phase in the crisis management cycle (mitigation and prevention, preparedness, response, recovery) requires specific collection and processing of geographic information [5].

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[6,7,8].

Fig.1. Risk and need management in terms of geographic information[6].

GIS systems have very important place in processing and analyses of dates. ArcGIS from ESRI is considered efficient tools for editing, analysis and modeling together with generous opportunities of visualization and opportunities of data management. GIS software uses two basic types of data: *Spatial data* - containing the coordinates and identifying information describing the map itself and *Attribute data* - containing information that can be linked to the spatial data. Specific type of spatial data is Geo-Spatial data represents real world objects (roads, land use, elevation) with digital data. Geo-Spatial data can be obtained from Satellite images, field data i.e. survey data and Global Positioning System (GPS) data. GIS. GIS integrates all kinds of data and contains the tools to manage and analyze data [2,3,9].

3. Logistic support by crisis management

Logistical supporth as an important place in crisis management and of course in civil protection. Logistics may be defined as the process of planning, implementing and controlling the efficient, effective flow and related information from point of origin to point of consumption (including inbound, outbound, internal and external movement) for the purpose of conforming to the customer´s requirements. Logistical support is neededin all parts ofcrisis management, namely [7]:

- system of measurements for transport, technical provision, services, health and material provision,
- quality provision of activities of forces and resources in crises situation solving by material and technical equipment,
- continuous process of planning, preparation, distribution and using of provision elements and services for implementing optimal variant of provision.

For logistics support in civil protection is most important to create concrete system (fig. 2).

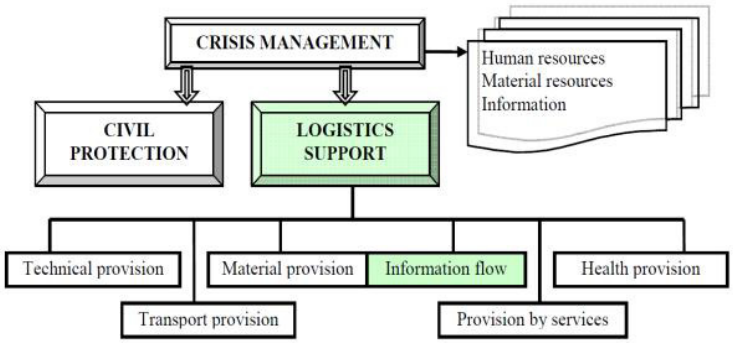

Fig. 2. Logistics support in civil protection [7].

View of the importance of logistical support is needed to logistics experts were also by the design of databases and data collection. There are many user groups that deal with activities related to flood management (Government, legal entities, Integrated Rescue System, River district Authorities, Public), therefore must be database the very comprehensively created [5,7].

4. Input data for logistic modeling- catchment area of river Bodva

The area of interest is the basin of the Bodva river. It is a 116 km long river in Slovakia and is situated in SW part and near of Hosťovce village leaves the Slovak territory continuing into Hungary. The river flows through seven villages, through populated parts, where each year it causes damage on property by floods. Each of the villages is equipped with all underground network services such as water supply, drainage, gas, electricity and telecommunications. In summary 19 750 habitants is threated by the Bodva River.

It is necessary for logistic support to collect and properly categorize input data from different sources. This data is collected from government institutions, networks distributors and the management of the catchment area and by direct collection in the catchment area, etc.

Obtained data can be split into 2 following groups:

- Data on populated geographical area endangered by the flood,
- Data on defense and salvage capacities.

In order to handle this high priority issue, the key set of geo-data was defined as one of the main outputs of the FLOODLOG project. This set, besides another important data, also contains the data about material-technical resources available to Crisis Headquarters during the handling an emergency flood situation. Particular categories of material-technical equipment as well as an expertise and professional support are divided into the following units (table 1)

Tab. 1.Thematic input data for the LOGISTIC model.

Data on populated geographical area endangered by the flood	**Type**	**Specification** (Geographical location (X,Y +)
buildings	residential buildings	address, number, age, sex of inhabitants
	high priority objects, other relevant objects	address, name, relevancy
infrastructure	water, electricity, gas and telecommunication networks	id number, categories, types
industrial areas		classification (i.e. vulnerability)
Data on defence and salvage capacities	**Type**	**Specification** (Geographical location (X,Y +)
buildings (+ other stationary objects)	hospitals, potential shelters, storages,catering	type, name, capacity, structures
material depots and resources	sand mines, stone mines, etc.	type, name, capacity
meeting points of defence forces		type
Consumables (i.e. etc)	bags, cleaning supplies, other materials,	type, name, capacity
human resources	police & fire stations, disaster &water management authority	number of persons, type
mobile tools and equipment	vehicles , special machines	type, name, capacity

5. Conclusion

Effective crisis management systems require precise planning in order to minimize the response time. The main prerequisite for efficient operations of Crisis Headquarters is the availability of comprehensive and high quality data. GIS systems offer a wide range of possibilities for further data analysis, the results of which can be used for decision-making process. The purpose of these systems offer wide range of possibilities, starting from complex base of digital data available online whenever anytime in the field, through ordinary and also specific spatial analyses, to the composing of specific outputs required by particular units of the Integrated Rescue System. Managers have to allocate the available resource to places or people in order of priority, considering disaster supply chain management and they need to much information at the right time.

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