

CROSS-BORDER MAPPING FOR DISASTER MANAGEMENT

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Abstract

In the last twenty years Europe was frequently and highly affected by natural and man-made disasters. Although European Early Warning System and Disaster Management organizations are in progress decision making and cross-border cooperation between two or a group of neighboring countries in crisis situations are rendered difficult because of lack of harmonized data and special detailed and accurate maps of cross-border regions. This paper examines some problems that arise in cross-border mapping due to the various type, structure and classification of the data provided by different organizations as well as the language peculiarities. The main aspects of harmonizing data of various sources and the ways for presenting geographical names are indicated. The paper makes a suggestion for geographical and thematic elements of the contents of the cross-border maps for disaster management that aims to support decision making in crisis situation.

Keywords: cartography, cross-border mapping, disaster management.

1. INTRODUCTION

Disaster management is a complex and responsible process. The Bulgarian laws for disaster and crisis management are often being modified in order the process of decision-making in case of natural or man-made disaster to become more efficient. Despite the boundaries often disasters occur in cross border regions. In case of disasters in such regions it is necessary cooperation between two or more neighboring countries to be established. In order urgent measures of protection to be taken adequately disaster management should be supported by detailed and accurate maps of these cross-border areas. Cross-border mapping takes into account the peculiarities of the neighboring countries, the national acts and the type and classification of the information provided.

2. CARTOGRAPHY AND DISASTER MANAGEMENT

In Bulgaria a Disaster Management act last modified on 24 November 2009 is in force. According to this act disaster management should be planned at municipal, district and national levels. The Municipal Disaster Management plan includes two main sections: "**Geographic characteristics of the municipality**" (physiographic, climatic, demographic, economic, hydrological characteristics) and "**Measures for disaster prevention or mitigation of the effects of disasters**" (rehabilitation and reconstruction of facilities; risk assessment; risk monitoring; early warning system, planning of rescue operations; evacuation routes; evacuation centres; etc. (Disaster Management Act, 2009). One of the main components of both sections of the municipal plan is the graphic part that depicts the characteristics and peculiarities of each municipality, critical infrastructure, etc. (Bandrova, Marinova, Milanova, 2009)

To reduce the number of human loss and property damages and to improve the whole process of disaster management the maps of the Disaster Management plans at municipal, district and national levels should be produced by the means of modern approaches and techniques.

Often disasters occur in two or more neighbouring countries. Therefore the graphical part of the Disaster Management plans of border municipalities should include cross-border maps to support the cooperative activities of the authorities of the neighbouring countries in crisis situation. Cross-border maps should be in conformity with the aims of the

project, the national peculiarities, the type, classification and accuracy of the information provided by different organizations.

According to the Bulgarian Disaster Management act cross-border maps are not required to be included in the municipal plans. Although some organizations are awake to the importance of availability of special data of cross-border areas so some cross-border projects for reducing risk and disaster protection are in progress. The PHARE project entitled “Green and Safety Forests – Business Responsibility” (BG 2004/016-785.01.01-13) between Bulgaria and Serbia started in 2007. Its main goal is producing maps and Geographic Information System (GIS) for prevention and planning the activities in case of forest fire. This project aims to establish a public-private committee for monitoring the forests of the cross-border region with head offices in Zajecar (Serbia) and Vidin (Bulgaria). As the maps are produced for fire fighting operations they represent the main infrastructure objects of the region, land cover, rivers, reservoirs and other water sources.

Disaster management is being realized by a series of activities such as:

- **preventive activities**, including analysis, assessment and prediction of disaster risks; scenarios; categorizing the territory of the country depending on the risks; planning the protection from disasters; planning the emergency aid; implementation of preventive measures to avoid or mitigate the effects of disasters;
- **activities for protection**, including early warning, organizing rescue plans and rescue operations, evacuation, etc;
- **coordination** of the operations of the **Integrated Rescue System**, defined by the Disaster Management act;
- **recovery**, including human help, economic support, rehabilitation, reconstruction, strategic development;
- other activities (Kotter, 2004), (Disaster Management Act, 2009).

Cartography plays an important role in all stages of Disaster Management (figure 1)

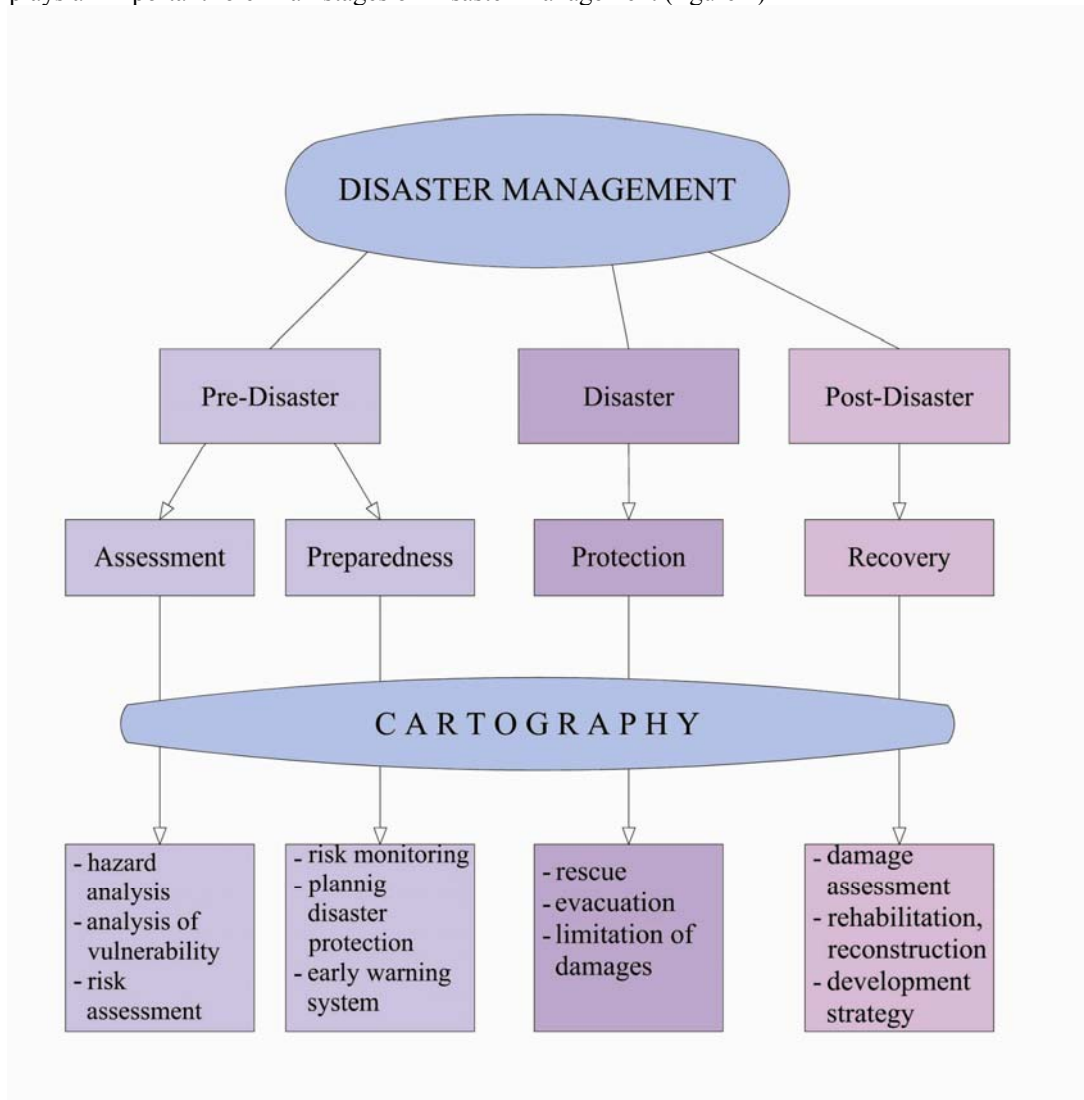


Figure 1. The role of cartography in disaster management

Risk analysis, risk assessment, prediction of disaster are based on maps. Coordination of the evacuation and rescue operations and other post-disaster activities are supported by maps as well. “The role of cartography in crisis management is therefore clear – simplify and well-arrange required spatial data. That makes the decision-making process quicker and better and leads to minimization of damage”. [Konecny, Bandrova, 2006]

3. MAP CONTENTS OF DISASTER MANAGEMENT PLANS

Determination of map content of disaster management plans follows some principles:

- Choosing elements that present the peculiarities of the region;
- Studying the features and phenomena subject to the maps, their structure and main characteristics;
- Classifying the features and phenomena;
- Determination of the level of detail.

The methodology for developing a plan for disaster management at municipal level requires the maps created for the plan to support studying and assessing the:

- location, boundary and area of the municipality;
- relief and water resources;
- technical infrastructure, including transport system; hydrotechnical structures;

Therefore the maps of Disaster Management plans should contain the following elements:

- Hydrography – rivers, channels, reservoirs, lakes
- Relief – contour lines, hill shading, hypsometry
- Settlements, classified according to:
 - number of population
 - administrative status
 - type – city, village

The classification of the settlements as well as the presentation of the names of the cities and villages should be in conformity with an official document, for example the Unified Classification of Administrative-Territorial and Territorial Units in Bulgaria (UCATTU) created and maintained by the Bulgarian National Statistical Institute in cooperation with the Ministry of Regional Development and Public Works.

- Railway system – railway, railway stations
- Roads – national road system (motorways, Ist grade roads, IInd grade roads, IIIrd grade roads), municipal roads, paved roads
- Pan-european transport corridors
- Borders and administrative boundaries - national borders, district boundaries, municipality boundaries

The administrative boundaries not only define the area of the municipality but also show the neighbouring municipalities, districts and countries that should cooperate in activities for protection in case of disaster.

- Land cover – forests, arable land

The representation of the land cover aims to support the fire risk assessment and the determination of the areas potentially endangered by forest fires

- Important objects
 - Border crossing points
 - Airports
 - Ports
 - Electric stations
 - Factories using dangerous materials
 - International gas pipelines, oil pipelines, electric transmission lines
 - Services for population protection
 - Emergency Medical Service
 - Police
 - Fire service
 - Civil Protection General Directorate
 - Mountain Rescue Service
- Geographic grid

The cartographic visualization should ensure readability and possibility of adding some special information by text, drawings and charts. Suggestions for cross-border maps for disaster management are shown on figure 2 a, b.

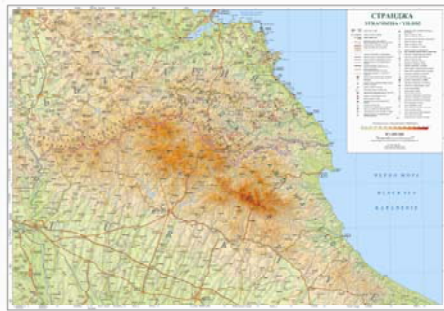


Figure 2a

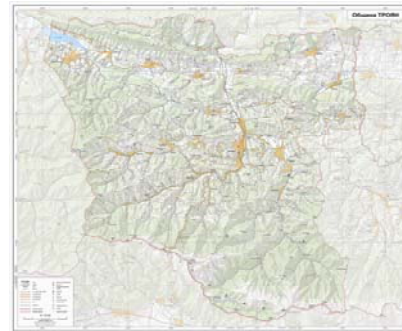


Figure 2b

Figure 2a, b. Maps for disaster management plans

The presentation of all these elements is based on integration and harmonization of various data provided by different organizations.

4. DATA HARMONIZATION

Cross-border maps usually combine international, national and regional data. Depending on the special features of the particular cross-border region heterogeneous basic, statistical and thematic data provided by various services, agencies and organizations should be combined. In addition Witschas (2009) says that “in some cases it is necessary to create own data sets by means of own data collection or derivation from existing data”. In order all this data to be integrated and presented on a map it should be harmonized.

One of the main goals of the Infrastructure for Spatial Information in Europe (INSPIRE) Directive is to ensure harmonization of spatial databases and services in Europe (Boes, 2009). The realization of the requirements of the Directive would support cross-border mapping significantly. The definition of data harmonization given by INSPIRE Drafting Team “Data specifications” (2008) is “providing access to special data through network services in a representation that allows for combining it with other harmonised data in a coherent way by using a common set of data product specifications”. Villa, Reitzb, Gomarasc (2008) explain that “harmonization refers to the standardization of data so that they can be matched with other data and information regardless of the format.”

The main aspects of data harmonization for cross-border mapping are:

- georeferencing the information into a geographical reference system;
- standardizing the attribute structure;
- standardizing the object classification;
- standardizing the level of detail of the information;
- unifying the cartographic visualization. (Gruber, Moser, Pitacco, Benvenuti, Cucek-Kumelj, Schabl, 2006)

5. GEONAMES AND MULTILINGUALITY

Some of the main aspects of cross-border mapping are presentation of geographical names and multilinguality.

5.1. Geonames

The usage of geonames of objects located in cross-border regions takes into consideration reliable sources such as topographic maps, geographical dictionaries, indexes of geographical names, gazetteers.

The United Nations Group of Experts on Geographical Names (UNGEGN) considers the problems of standardization of geographical names. It aims to “to emphasize the importance of the standardization of geographical names at the national and international levels and to demonstrate the benefits to be derived from such standardization” and “to study and propose principles, policies and methods suitable for resolving problems of national and international standardization”. [UNGEGN, 2009]

Some of the main functions of UNGEGN are:

- “To develop procedures and establish mechanisms for standardization in response to national requirements and particular requests
- To make mapping organizations aware of the importance of using standardized geographical names

- To work at the highest possible national, international and United Nations levels to interrelate toponymy and cartography
- To make standardization principles and standardized geographical names available as practical information for as wide as user community as possible, through all appropriate media.” [UNGEKN, 2009]

Geographical names can be presented either by their endonyms or by their exonyms. UNGEKN defines endonym as a “name of a geographical feature in an official or well-established language occurring in that area where the feature is located” and exonym as a “name used in a specific language for a geographical feature situated outside the area where that language is spoken, and differing in its form from the name used in an official or well-established language of that area where the geographical feature is located“. [UNGEKN, 2007]

Endonyms of geographical features situated in Strandzha mountain region both in Bulgaria and Turkey are presented in table 1.

Table 1. Endonyms of geographical features located in Strandzha mountain region

Bulgarian endonym (transliteration in Roman)	Turkish endonym
СТРАНДЖА (STRANDZHA)	YILDIZ
Марица (Maritsa)	Meric

All geonames in cross-border maps should be presented in a uniform way. In case of disaster in cross-border region the usage of endonyms aims to help the national authorities of the affected countries in the process of decision-making.

5.2. Multilinguality

In order the cross-border maps for disaster management to be used by decision-makers from different countries the names of the geographical features of cross-border regions should be presented both by the official language of each country in which they are located and by their transliteration into Roman. (figure 3)

МАЛКО ТЪРНОВО Черноморец *Велека*
MALKO TARNOVO Chernomorets *Veleka*

Figure 3. Geonames in Bulgarian and in Roman

From March 2009 a Transliteration act is in force in Bulgaria. The transliteration rules determined in this act should be applied by each juridical and natural person who uses transliteration of geographical names. The transliteration system of Bulgarian letters into Roman letters in accordance of the act is presented in table 2.

Table 2. Transliteration system - Bulgarian-Roman (Transliteration Act, 2009)

Bulgarian alphabet	Roman version
А, а	A, a
Б, б	B, b
В, в	V, v
Г, г	G, g
Д, д	D, d
Е, е	E, e
Ж, ж	Zh, zh
З, з	Z, z
И, и	I, i
Й, й	Y, y
К, к	K, k
Л, л	L, l

М, м	M, m
Н, н	N, n
О, о	O, o
П, п	P, p
Р, р	R, r
С, с	S, s
Т, т	T, t
У, у	U, u
Ф, ф	F, f
Х, х	H, h
Ц, ц	Ts, ts
Ч, ч	Ch, ch
Ш, ш	Sh, sh
Щ, щ	Sht, sht
Ъ, ъ	A, a
Ь, ь	Y, y
Ю, ю	Yu, yu
Я, я	Ya, ya

Multilinguality of cross-border maps aims to support the usage of these maps by regional, national and international authorities.

6. CONCLUSION

Cartography plays an important role in all main activities of disaster management. The cooperative protection activities of the authorities of two or more neighbouring countries in case of disaster in cross-border region can be supported by special cross-border maps. The elements of these maps should present the peculiarities of the region and give information about the structure, characteristics and classification of the features and phenomena. Cross-border maps combine heterogeneous data provided by various services, agencies and organizations. In order all this data to be integrated and presented on a map it should be harmonized. This paper indicates the main aspects of data harmonization. Geographical names can be presented by their endonyms or exonyms. The usage of the endonyms of the geographical features aims to support the national authorities of the affected countries in the process of decision-making.

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