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Developing GIS databases to work with Disaster Management

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Abstract
Geoinformation databases are used worldwide for monitoring disaster and emergency events. We overview some existing inter-sectoral geoinformation databases, such as the Multi-Agency Situational Awareness System (MASAS) in Canada and HAZUS developed by Federal Emergency Management Agency (FEMA), USA to show how geoinformation technology aids in the assessment of potential financial losses from emergency events.. We also present our current efforts to develop a geoinformation database at the Nazarbayev University.

Keywords: Central Asia (CA), geo-portal, geoinformation database, emergency, flood, MASAS, HAZUS.

Introduction

According to the United Nations (UN) experts, every dollar spent on precautionary preparation for emergency events reduces risks and decreases economic losses from natural disasters by USD5 to USD10 [4]. Prompt disaster event information, constant analysis and emergency forecasts require preparation and regular updates of the databases, indicating the exact location of a dangerous region, a distribution forecast, and the movement of danger sources. For the proper forecasting of an emergency event, the spatial aspect of information is important: it is necessary to assess the nature, size of a threat, and location of an emergency. Geoinformation databases are used for such purposes. Two significant examples are the Canadian inter-sectoral geoinformation database and emergency notification system MASAS [2], and HAZUS developed by the Federal Emergency Management Agency, FEMA, the geoinformation technology with the possibility to assess potential financial loss from emergencies [3]. The current work on the creation of a geoinformation database at the Nazarbayev University is described last.

An example of a cross-sectoral geoinformation database and emergency alert system MASAS in Canada

MASAS is an aggregated system based on a GIS platform that facilitates the exchange of information on emergencies [2]. Canadian public security organizations have access to MASAS, which has several levels of access, including shared access for rapid response specialists to reduce the time spent on calls and improve the safety of citizens. MASAS is also used to prepare and reduce future complications and conflicts during any mass public events,

such as marathons and festivals. Also MASAS is used for visualization of cross-border events between Canada and the USA. MASAS monitors and analyzes information about emergencies from various open source data, including public warning systems of Canada and the United States. MASAS users can connect to the database in various ways. Commercial and community emergency services, such as fire services, can publish data on dispatching, routing, geographic and other data. The common MASAS web application (Figure 1) ensures that all public safety organizations can use MASAS using desktop and mobile Internet browsers. As well, data can be downloaded through Feature REST ArcGIS, and GIS data layers of MASAS in their ArcGIS can be used.

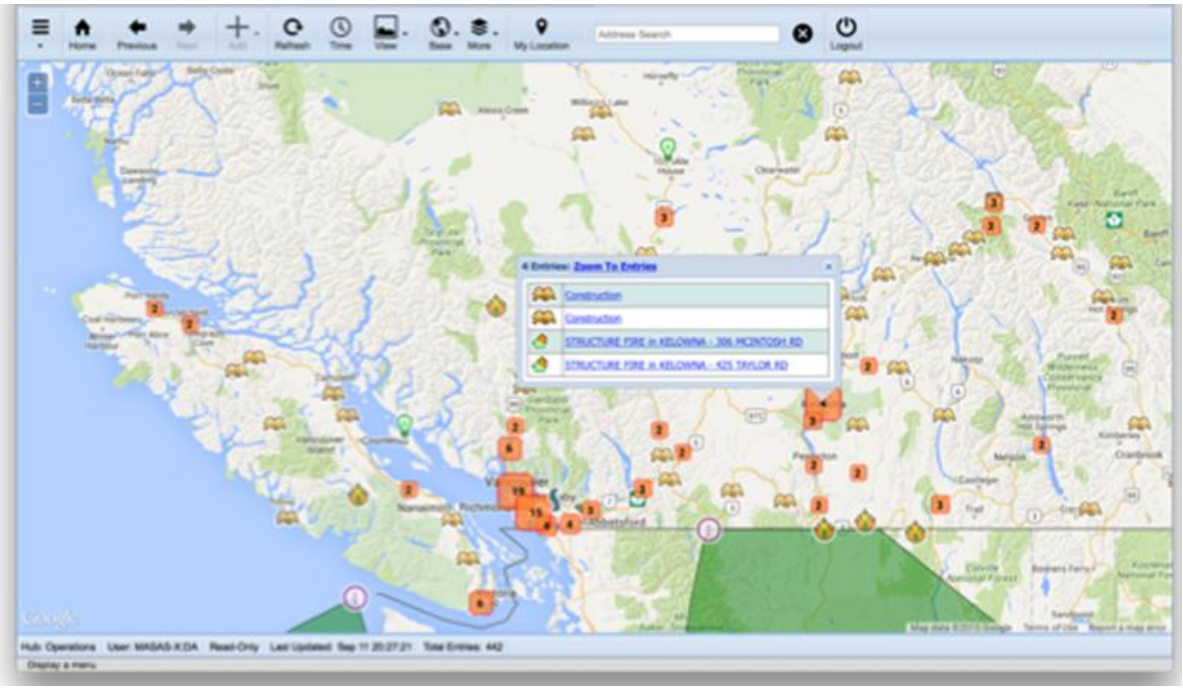

Figure 1. MASAS [2]

A HAZUS geoinformation database and assessment of potential financial losses from emergency events by the FEMA

The result of a damage assessment from an emergency allows us to classify an emergency situation, analyze the effectiveness of measures aimed at reducing the consequences of emergencies, protecting the population and territories from the impact of damaging factors, and determining the amount of compensation for harm from an emergency situation. Damage should be determined based on the consequences of an emergency. The common feature of damage assessment methods is the definition of a zone of spread of the damaging factors and their strength, considering the features of the location of different objects and the magnitude of the damage. In turn, based on this damage data, financial losses are estimated. For these purposes, it is necessary to create a geoinformation database with the value of the objects. The US Federal Emergency Management Agency FEMA uses the HAZUS program for analytical

work with the created geo-databases, according to preliminary estimates and future financial losses from emergency events [3]. HAZUS is the national standardized methodology of the United States, which contains models for assessing potential losses from earthquakes, floods, fires and hurricanes. Canada also uses the program and adapts its data from geodatabases for these purposes [4]. HAZUS uses GIS technology to assess the physical, economic and social impact of emergencies. The visualization system clearly illustrates the boundaries of certain high-risk sites due to earthquake, flood, fire and/or hurricane. HAZUS is a convenient system for visual analysis of the ES assessment, to estimate the spatial relationships between population and other more stationary geographic features. Thus, resources to reduce losses from an emergency can be allocated in the planning of pre-disaster preparation activities. HAZUS is used to provide and prepare for emergencies, and early response, and to reduce losses from emergencies and facilitate recovery with minimal losses. Canadian and US specialists in emergency situations, experts in planning cities and settlements, GIS specialists, and various levels of emergency managers use HAZUS to assess future financial losses and to make the most optimal solution to minimize losses from emergencies.

The potential risks of losses analyzed in HAZUS include:

- Physical damage to residential and commercial buildings, schools, critical facilities and infrastructure;
- Economic losses, including job losses, breaks in work, repairs and reconstruction costs;
- Social impacts, including estimates of housing needs, displaced households and populations, flood prone scenarios, earthquakes and fires.

Creation of a geoinformation database at the Nazarbayev University (NU)

NU is working on an adaptation of MASAS and HAZUS methods for Central Asia. At present, the open access geodatabase is being prepared. By using an integrated platform and methodology for collecting, storing, processing and presenting information, geoinformation projects are easily integrated. Using a common foundation map, various data sets (geodetic, topographic, biological, geological, microbiological, geophysical, etc.) can be distributed using web resources for downloading to various GIS platforms. The developed Web technology for visualization of geospatial data is friendly and accessible to any user. In Web GIS, many functions which are available in the desktop GIS can be implemented: map navigation, paper-based printing, geodatabase editing, geospatial analysis, geocoding, and many more (Figure 2). To work in the Web GIS environment, no specialized software or GIS specialist qualification is required. It is enough to have a web browser to connect to these data resources. The created geo-information database will be used for Kazakhstan Multi-Agency Situational Awareness System (KMASAS) and for Multi-Hazards Loss Estimation (KHAZUS). The three years project “ Creating a geoinformation system for risk management

of environmental, technological, epidemiological, and professional on prevention of adverse effects to human health" is under development.

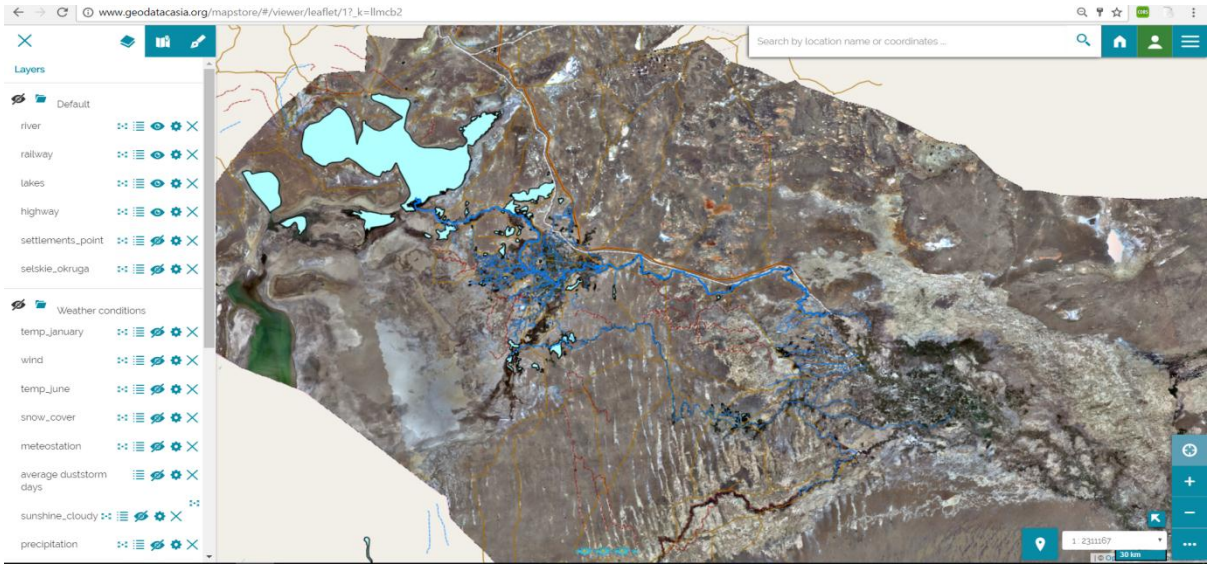

Figure 2. Geoportal at http://www.geodatacasia.org/

Conclusion, cooperation on geodata common use in Central Asia

Creating a geoinformation database is a painstaking and time-consuming task. In Central Asia, many organizations already have prepared GIS data. Cooperation and provision of open access to this general geoinformation will eliminate duplication of work, optimize time and financial costs, and allow for faster progress to the next stage in reducing losses from emergencies through the introduction of similar MASAS and HAZUS technology in Central Asia.

References

[1] Schwarz, E., 2006, A Needless Toll of Natural Disasters, UN Secretary General's Deputy Special Envoy, Op-Ed, *Boston Globe*.

[2] MASAS, 2017, Canada's Multi-Agency Awareness System (MASAS), http://www.canops.org/?page=AboutMASAS

[3] HAZUS, 2017, FEMA Multi-Hazards Loss Estimation (HAZUS), https://www.fema.gov/hazus-software

[4] HAZUSCANADA, 2017, HAZUS Canada Using natural disaster scenarios for better planning and response, http://hazuscanada.ca/