THE APPLICATION OF GEOGRAFIC INFORMATION SYSTEM FOR ENVIRONMENT PROTECTION IN SERBIA

Čekerevac Zoran[1], Radović Dragan[2], Čekerevac Petar[3]

ABSTRACT

The paper presents results of application of GIS in Serbia through the pilot project program EXCHANGE. The role of Serbian government and its Decree on the content and managing of the information system of environmental protection, methodology, structure, common grounds, categories and levels of data collection, as well as the content of information that are regularly and compulsory published is analyzed. Practical problems and results of implementation of GIS in environmental protection are analyzed on the example of Kovin municipality.
Recommendations for application of GIS in other areas are given in the conclusion.

Keywords: *GIS, environment, waste management, crisis*

INTRODUCTION

A good information system and effective communication is of key importance for timely decision-making and for effective response in crisis situations. Even in cases of mass disaster communications largely rely on use of the existing systems, equipment and routine practice. Plans for the crisis situations should enable integration of all existing communication capabilities into one system. The main communication means are: radio, fixed telephony, mobile telephony, pagers, faxes, Internet, data banks, television and radio stations, telecommunication companies and geographic information system (GIS). These systems are also available in other situations and can be used as resources to prevent crisis situations, primarily to protect the environment.

Information System of environmental protection has interconnected electronic databases and data sources of the state, pressures on the environment and spatial characteristics, as well as other data and information that are important for monitoring the

1 Dr Zoran Čekerevac, Ass. Professor, University "Union" Belgrade, Faculty of Industrial Management, E-mail: zcekerevac@fimmanager.edu.rs, www.fimmanager.edu.rs
2 Dr Dragan Radović, Ass. Professor, University "Union" Belgrade, Faculty of Industrial Management, E-mail: drarad@nadlanu.com, www.fimmanager.edu.rs
3 Petar Čekerevac, dipl. polit., Belgrade University, Faculty of Political Sciences, stormaydk@gmail.com

environment at the national level. This information system is decentralized but integrated. It is organized through the concept of GIS, and it is available through a single Internet portal.

1. THE ROLE OF STATE AUTHORITIES

Because of the importance of environmental protection the Government of the Republic of Serbia on 29 December 2009 adopted the Decree on the content and managing of the information system of environmental protection, methodology, structure, common grounds, categories and levels of data collection, as well as the content of information that are regularly and compulsory advises to public. This Decree specifies content and manner of managing of the information system, methodology, structure, common ground, categories and levels of data collection, as well as the content of the information which will be compulsory and regularly published.
According to the Decree information system links data and information obtained by Internet, remote sensing and satellite technologies in a manner that ensures timely and transparent reporting to the public, in accordance with the Program of management of the information system which is brought by decision of the minister in charge of environmental protection.

Program for management of the information system includes:

1. the organization, the manner of managing and maintenance of information systems;
2. list of reporting entities including the reference center, the manner and deadlines for submission of data by thematic areas;
3. way to manage data and information;
4. computer, software and communication equipment, and financial resources;
5. necessary measures and activities for thematic areas.

According to the same decree, the information system ensures the implementation of appropriate methodological procedures for:

1. information processing in accordance with the primary data source;
2. data and / or information collecting, with availability of such data and / or information to the other entities and users for their own purposes, as well as their promotion and implementation into the existing system of collecting data and information;
3. ability to access data and information in order to take environmental protection measures, to assess the results of such measures and to ensure adequate public information about the state of the environment;
4. technical and scientific support;
5. application of unique informatics tools, standards and procedures of transferring data and information;
6. interoperability on a technical (norms and standards to connect computer systems and services), semantic (meaning of data) and procedural level (definition of objectives, process modeling and co-operation between reporting entities, reference centers, and users) by using national and international technical standards. Data and information about the environment are formed into the electronic relational databases in thematic areas and are delivered in electronic form or in another appropriate manner, in accordance with the law.

The data to be entered into the information system are collected on the different levels as:

1. economic entities whose activities have an impact on the environment;
2. users of natural resources;
3. authorized organizations;
4. units of local self-government;
5. authorities of the autonomous province;
6. government bodies and organizations.

Each municipality in Serbia has its own environmental strategy that includes:

- citizens education and promotional and educational activities;
- effective monitoring, and inspection;
- application of for the environment secure technologies;
- implementation of projects which contribute to environmental protection;
- promotion of the rational consumption of energy and water.

Depending on the size of the municipality, financial situation and previous situation, the introduction of GIS tasks are assigned to different administrative bodies. Larger and richer municipalities, such as the municipality of Stara Pazova implement this task through the Department of Information Technology and Communications. This department in addition to planning and organizing takes care and provides a functional and technological unity of the information system of the municipality.

The Department develops and implements training plans and training of employees in the municipal administration, communicates with the citizens, takes care of the development of public and internal publications and the web site, and is responsible for the implementation of the Law of information system of the Republic of Serbia. It also performs other duties in accordance with the law, the Statute and decisions of the municipality. In some municipalities the care about the GIS information system is awarded by the Office of Construction. Such a case is, for example in Kovin municipality, which has a total area of 725 km^2 and is one of the largest in Vojvodina and the whole Serbia.

2. IMPLEMENTATION OF GIS IN SERBIA

The initiative for the introduction of GIS has been launched by the municipality of Kovin in the year 2005, for the purpose of modernization of services for construction jobs. Like in many other municipalities in Serbia, GIS was introduced through the proposed project EAR (European Agency for Reconstruction), which was financed by the EU, through the SCTM (Standing Conference of Towns and Municipalities) and program EXCHANGE.

In the municipal building a peer-to-peer LAN was created and the customized Manifold GIS software was installed. In the year 2007 a wireless connection was built for communication with local offices and local communities. Thus, by wireless network, all local offices and local communities were involved into the (LAN), enabling data flow between the Municipality Building and its organizational units in the villages. The whole network was connected to the Internet via wireless connection. So, all workstations were connected to the Internet. This way the citizens/civilians got Internet access to GIS. The

project was completed on 22 May 2007 when the application GIS started. The budget of the project was € 77,990, of which the share of Kovin municipality was € 13,000, and the rest was donated by the EAR.

In December 2005 the "Memorandum of Understanding" was signed to support municipalities in Serbia in order to improve the management of communal land.. Establishment of "Municipal GIS" is the result of the cooperation between the municipal administration, public enterprises, the Republic Geodetic Authority and other holders of information on land. The pilot program participant cities were: Valjevo, Sombor, Subotica, Nis and Kragujevac. The experiences of these cities are very favorable.

Initial investments were high. So the city of Kragujevac in the first year invested € 141,600. Part of the funds was donated by the EAR and the UN. After a large initial costs caused by supply hardware and software supply, as well as by staff training, and filling the database, the costs were stabilized at a lower level in the following three years of implementation. Projected profit of the implementation of GIS systems in Kragujevac was supposed to be at a level of € 240,000 a year, but has not yet been realized because of the global economic crisis and slow economic development in Serbia and the low interest of citizens. However, the experiences in all the pilot local governments have been positive.

3. POSSIBILITIES OF APPLICATION OF GIS FOR ENVIRONMENTAL PROTECTION

The goal of GIS is to establish environmental monitoring in the municipality, and the recognition and assessment of environmental priorities for action of local authorities and NGOs to manage and implement environmental programs. Such defined priorities have a greater ability to obtain financial assistance from national and international institutions and donors. The main components of the project are classified as:

- GIS as an integrated computer system for collecting, processing, management, analysis, viewing, and maintaining a space-oriented information;
- Integral cadastre of polluters that represents the public record, which registers all types of pollutants with the relevant data necessary for monitoring, planning, design, and measures for environmental protection and protection of natural resources in the municipality;
- Detailed analysis of the environment presents synthesis program of the Intervention rehabilitation plan of the primary environmental rehabilitation and long-term program of rehabilitation, revitalization and environmental protection of Kovin municipality. On the basis of representative samples a critical evaluation of environmental impacts will be make. This analysis will consider harmful impacts in the form of threats to human health, quality of life and ecosystems.
- Continuous measurement and monitoring of key environmental and meteorological parameters with the help of the installed measuring sensors and probes to specific locations in the municipality and the integration and updating of GIS.

The drafting of Integral cadastre of polluters and detailed analysis of the environment with placement of measuring devices can be realized in accordance with financial possibilities after activation of GIS.

4. INTEGRATED WASTE MANAGEMENT

Functional GIS makes it easier solution issue of solid waste and waste water, as the most drastic environmental problems that deserve priority. For example, in the municipality Kovin by using GIS it was determined that the existing landfill is inadequate, that it is a source of environmental incidents, and that it is necessary to make steps towards its improvement and start the preparatory activities for the construction of a modern center for the treatment of waste.

Activities would be conducted in two directions

- determination of the location and construction of sanitary landfills and
- creating the conditions (investigative, project, property - legal affairs) for the formation of a mixed enterprise or giving concessions for the processing of waste.

Problem of waste solving would include the rural areas, but benefit will in the first period get the villages exposed to the harmful effects of the surrounding factories.
The same analysis found that the current system for waste water does not work, and that it is urgently needed to access to its repair and re-activation.
It was determined, too, that the current system is designed exclusively for the fecal water, and it is necessary to bind all identified users of the system to perform high-quality pre-treatment of industrial waste water through separators installation (for oils, fats and detergents).

Rehabilitation and resolving the causes of harmful impacts on the environment

The use of GIS precisely defined sources of pollution, so it was possible to define a recovery program. Remediation and removal will take place on the basis of local environmental and rehabilitation programs contained in the detailed analysis of the environment. This primarily refers to the areas exposed to the harmful effects of the surrounding factories.

Figure 1 Sedimentary field of alcohol factory "Alpis"-

Protection and promotion of green spaces

Application of GIS has confirmed the subjective feeling of the citizens of Kovin about the lack of the green spaces and landscaped area for relaxing and for children to play. It enabled intensification of activities with goal to overcome these problems. This caused the municipality to determine funding for restoration and planting

Figure 2 Wild landfill next to the Danube

of new trees in the city, stimulating individual planting trees and setting park inventory. The design of space for the formation of the city's botanical garden has been approached.

Zoo Hygiene

On the basis of perceived problems and crisis situations and phenomena (rabies, trichinosis, Lyme disease ...) it was found necessary to access systematic destruction of mosquitoes, ticks, rodents and stray dogs. This prompted the drafting of the plan for spraying and municipal participation in deratization and destruction of stray dogs.

5. CONCLUSION

As it can be seen on the example of Kovin municipality, the application of GIS can greatly help the environment protection by documenting acute problems of pollution of the environment, with locating potential crisis areas and facilities, as well as through assess the adverse impact on the particular site. GIS application can be used as a tool for balanced and sustainable spatial planning. This approach has a positive impact on safety and health of citizens, on the rural development and agriculture, telecommunications, transport networks, trade and distribution, and the like. Balanced spatial development contributes to the development of these areas and the quality of life in general and in the long run.

LITERATURE

[1] Službeni glasnik Republike Srbije, br.112/2009
[2] http://www.starapazova.eu/sr/OU-odeljenja/
[3] www.arilje.wsupport.net/dokumenti/prezentacija_PRO_Arilje.ppt
[4] http://www.hitnanis.org/Arhiva/Plan zbrinjavanja u masovnim nesrecama 2007/Plan zbrinjavanja u masovnim nesrecama 2007.html
[5] www.logincee.org/file/15668/library

Článok recenzoval:
prof. Ing. Ladislav Šimák, PhD.