GIS ROLE IN EMERGENCY MANAGEMENT IN ALBANIA

Pal Nikolli[a]
Adelajda Halili[b]
Jostina Dhimitri[c]

[a] Tirana University, Faculty of History and Philology, Department of Geography, Tirana, Albania, palnikolli@yahoo.com
[b]Tirana University, Tirana, Albania, adel_vl@yahoo.com
[c] University of Gjirokastër, Gjirokastër, Albania, jostinak@yahoo.com

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ABSTRACT

Albania is vulnerable to a range of disasters, and like several countries in the region, the greatest single disaster threat is that of severe earthquake. In addition, records indicate there is a typical risk across Albania of small-scale disasters related to floods, landslides, forest fires and snowstorms. Poor infrastructure and public services, an insufficiently regulated building boom, poor watershed management and a range of other environmental factors compound the vulnerability of the population to disasters.

In Albania, a national emergency Management Strategy has been elaborated which settles the measures to be taken within this domain. This strategy aims at mitigating the impact of emergency events on the population and property, through adequate planning and policy in accordance with the standards and expectations of the human community and protecting the environment.

This paper discusses the Emergency Management Strategy in Albania and how Geographic Information System (GIS) technology and spatial information has contributed to this emergency operations management system.

Visualization of spatial information in the form of maps is a critical task to facilitate decision making in emergency management. Therefore this paper shows some maps that are building with GIS. These cartographic products can be highly technical and require the skills of highly trained and educated individuals when production and interpretation is required.

Key words: Geographic information systems, GIS, crisis management, emergency management, firefighters, flood warning service, flash floods, Albania, natural hazards

INTRODUCTION

Albania is exposed to a considerable number of natural and man-made disasters. The biggest risk of natural disasters comes from earthquakes, but in recent times, floods, landslides and winter emergency, even though at lower impact, were more evident. Factors such as the economic situation, damaged infrastructure and communication means, mass migration, building boom and other factors related to misuse of forests, natural sources of water and environmental pollution, increases vulnerability of the population and the economy in general.

Civil Protection and Emergency Management in Albania is handled within the Strategy for National Security. It covers a complex organisation of arrangements, means and operational forces and involves many planning and implementation actions. These actions are conducted in accordance with the Government's policy and programme, as well as in cooperation with international partners. Recently, a legal framework was adopted creating the conditions for the development and consolidation of Civil Protection and Emergency Management. Albania's new perspective on Emergency management includes reforms which aim to bring Albanian legislation in line with European Union and NATO standards. Progress has been achieved with regard to the democratic control of civil protection structures. Progress has also been achieved in planning, implementation of standards and international cooperation, particularly the activities carried out in the framework of the Peace Partnership Program with NATO. The Albanian Civil Emergency Service is an important member of events organised by Civil-Military Emergency Planning (CMEP), the South eastern Europe Initiative (SEEI), the South eastern Europe Simulation Network (SEESIM), the Disaster Preparedness and Prevention Initiative in South eastern Europe (DPPI/SEE), Black Sea Initiative, etc. Albania cooperates closely with counterparts in neighbouring countries and beyond. The Albanian Civil Emergency Service has followed standard procedures for setting up its structures. Coordinated activity in handling an emergency situation is based on the National Plan for Civil Emergency, approved by the Council of Ministers. International agencies operating in country have their own alert plans to act in cases of civil emergency in Albania. Permanent and temporary structures are in the lead at central and local level for planning and facing civil emergency and natural disasters in Albania as defined by law.

CONCEPTUAL BACKGROUND

1.1. Emergency Management Systems

Management is not easy, especially when managers work in the uncontrollable area with untrusted/unconfirmed data. Managers normally work under risk. Whoever gives better decision under risk, she can be called a successful decision maker. At this point, managers need computer tools providing them with valuable information form raw data in order to reduce the probable future risks as much as possible. From the above explanation, it is obvious that much more work must be done about the emergency management in advance, so that the important part of the risk can be reduced. By this way, not only the lives can be saved, but also the economic lost can be reduced considerably in case of emergency.

After realizing that there is no way to stop the disasters, such as earthquake, flood, etc., it became necessary to be prepared in advance as much as possible in order to reduce the damage. Every country has its own disaster problem; for example United States mainly has a hurricane problem, and Japan and Turkey mainly have earthquake problems. To reduce the damage of these kinds of disasters, every country tries to establish some emergency management plans.

In order to be ready for emergency conditions, special disaster reduction centers and disaster education centers have been built especially in Japan and the US. In the education centers, every kind of educations has been offering to the trainees. These include how to get to the safe place, how to help others, etc. during the earthquake or any other disaster. This kind of information and training are very valuable for the individual readiness. However, global preparation is more important than individual preparation, since managing the emergency means coordinating the readiness. Deploying the rescue team into the right direction, finding and sending the professional equipment into the places where urgently needed, are the some of the most important activities during the emergency management. In order to do it better, managers need detailed information about the current situation, inventory of the human resources and technical equipments for the whole province.

1.2. Integrated emergency management

Emergency management (or disaster management) is the discipline of dealing with and avoiding risks. It is a discipline that involves preparing for disaster before it occurs, disaster response (e.g. emergency evacuation, quarantine, mass decontamination, etc.), as well as supporting, and rebuilding society after natural or human-made disasters have occurred. In general, any Emergency management is the continuous process by which all individuals, groups, and communities manage hazards in an effort to avoid or ameliorate the impact of disasters resulting from the hazards. Actions taken depend in part on perceptions of risk of those exposed. Effective emergency management relies on thorough integration of emergency plans at all levels of government and non-government involvement. Activities at each level (individual, group, community) affect the other levels. It is common to place the responsibility for governmental emergency management with the institutions for civil defence or within the conventional structure of the emergency services. In the private sector, emergency management is sometimes referred to as business continuity planning.

An important step in examining the role of GIS in emergency management is selecting a conceptual framework to help organize existing research and development activities. One such framework that appears widely in the emergency management literature is *integrated emergency management (IEM)*). This relies on the temporal dimension of disasters to organize the emergency management process into a cycle of five, often overlapping, phases: mitigation, preparedness, prevention, response, and recovery, as shown in Figure 1.

Mitigation involves actions that are taken to eliminate or reduce the degree of long-term risk to human life and property from hazards. Preparedness is concerned with actions that are taken in advance of an emergency to develop operational capabilities and facilitate an effective response to an emergency. The prevention is the process of risk study and elimination and mitigation in emergency. The response phase involves actions that are taken immediately before, during, or directly after an emergency occurs, to save lives, minimize damage to property, and enhance the effectiveness of recovery. The recovery phase is characterized by activity to return life to normal or improved levels.

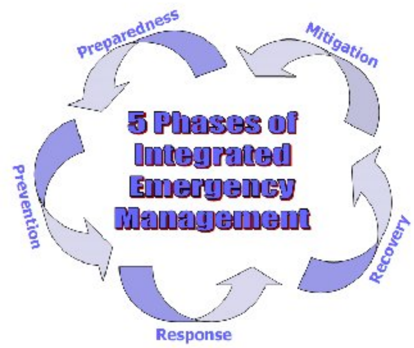

Fig. 1. Phases identified in a typical emergency management process

In examining the GIS literature, perhaps it is more appropriate to reduce the five phases of comprehensive emergency management into four or three phases: mitigation, preparedness and response, and recovery. This is simply because many GIS developed in the preparedness phase are utilized in the response phase. In other words, systems designed to help emergency managers respond to an actual disaster are frequently utilized to train emergency personnel and develop preparedness plans. From a GIS perspective, this serves to blur the preparedness and response phases into a single phase. However, GIS applications in the phases of mitigation (e.g. risk mapping) and recovery (e.g. damage assessment) are clearly distinct from the proposed merged preparedness and response phases.

1.3. Hazard, vulnerability, and risk

Another relevant area to address is *environmental hazards*. A few fundamental concepts that appear in this area are: natural hazard, technological hazard, vulnerability, risk, and disaster. As these terms often escape precise definition, there is a host of definitions and conceptual models that relate these terms (Alexander 1993; Burton et al 1993; Cutter 1996; Godschalk 1991; Palm 1990; Smith 1992).

Godschalk (1991) provides a succinct set of working definitions for these concepts where a *hazard* is some threat, natural, technological, or civil to people, property, and the environment. *Risk* is viewed as the probability that a hazard will occur during a particular time period. *Vulnerability* is susceptibility to injury or damage from hazards. A *disaster* is a hazard occurrence resulting in significant injury or damage. As an example, a flood is a natural hazard; flood risk is defined in terms of the hundred-year flood; the people and buildings located within the hundred-year flood zone are vulnerable, and a flood disaster is a flood that injures a number of people, or causes significant damage.

Alexander (1993) has taken a relatively formal approach to this process by using conceptual equations, a system that lends itself well to the perspective of a GIS research community who often strive to formalise. In Alexander's framework, a hazard is a pre-disaster situation where some risk of disaster exists, principally because the human population has made itself vulnerable in some way. In this framework, risk is viewed as a combination of hazard and vulnerability. This is appealing from a GIS perspective as the elements at risk can be viewed as spatial information layers (e.g. population, properties, and infrastructure) and these layers can be combined through spatial modelling procedures to arrive at an effective estimate of hazard, vulnerability, and risk. This topic is taken up further in the subsequent section on risk mapping.

2. GIS ROLES IN EMERGENCY MANAGEMENT

All phases of emergency management depend on data from a variety of sources. The appropriate data has to be gathered, organized, and displayed logically to determine the size and scope of emergency management program(s). During an actual emergency it is critical to have the right data at the right time displayed logically to respond and take appropriate action. Emergency can impact all or a number of government departments. By utilizing a GIS, all departments can share information through databases on computer-generated maps in one location. Without this capability, emergency workers must gain access to a number of department managers, their unique maps, and their unique data. Most emergency do not allow time to gather these resources. This results in emergency responders having to guess, estimate, or make decisions without adequate information. This costs time, money, and, in some cases, lives. GIS provides a mechanism to centralize and visually display critical information during an emergency.

Most of the data requirements for emergency management are of a spatial nature and can be located on a map. The remainder of this section will focus on how data is acquired, displayed, and utilized in all aspects of public safety programs. This paper will illustrate how GIS can accomplish data requirement needs for planning and emergency operations and how GIS can become the backbone of emergency management.

Emergency management activities are focused on three primary objectives. These objectives are protecting life, property, and the environment. In order to accomplish these objectives, the following basic processes are necessary.

Emergency management programs begin with locating and identifying potential emergency problems. Using a GIS, officials can pinpoint hazards and begin to evaluate the consequences of potential emergency or disasters. When hazards (earthquake faults, fire hazard areas, flood zones, shoreline exposure, etc.) are viewed with other map data (streets, pipelines, buildings, residential areas, power lines, storage facilities, etc.), emergency management officials can begin to formulate mitigation, preparedness, response, and possible recovery needs. Lives, property, and environmental values at high risk from a potential emergency or disaster become apparent. Public Safety personnel can focus on where mitigation efforts will be necessary, where preparedness efforts must be focused, where response efforts must be strengthened, and the type of recovery efforts that may be necessary. Before an effective emergency management program can be implemented, thorough analysis and planning must be done. GIS facilitates this process by allowing planners to view the appropriate combinations of spatial data through computer-generated maps.

2.1. Mitigation

Mitigation efforts attempt to prevent hazards from developing into disasters altogether, or to reduce the effects of disasters when they occur. The mitigation phase differs from the other phases because it focuses on long-term measures for reducing or eliminating risk (Haddow Butterworth-Heinemann. Amsterdam. ISBN 0-7506-7689-2). The implementation of mitigation strategies can be considered a part of the recovery process if applied after a disaster occurs (Haddow Butterworth-Heinemann. Amsterdam. ISBN 0-7506-7689-2). Mitigation is the most cost-efficient method for reducing the impact of hazards, however it is not always suitable. Mitigation does include providing regulations regarding evacuation, sanctions against those who refuse to obey the regulations (such as mandatory evacuations), and communication of potential risks to the public (Lindell, M., Prater, C., and Perry, R. (2006). Fundamentals of Emergency Management. Retrieved January 9, 2009 at: http://training.fema.gov/EMIWeb/edu/fem.asp). Some structural mitigation measures may have adverse effects on the ecosystem.

A precursor activity to the mitigation is the identification of risks. Physical risk assessment refers to the process of identifying and evaluating hazards (Haddow Butterworth-Heinemann. Amsterdam. ISBN 0-7506-7689-2). The hazard-specific risk combines both the probability and the level of impact of a specific hazard.

In the emergency management phase well before a disaster, or more appropriately 'between disasters', the overarching goal is mitigation. Perhaps the most active role of GIS in this area relates to analytical modelling. This is a phase characterised by the opportunity to conduct long-term assessment, planning, forecasting, and management. One of the key avenues of inquiry in this phase is revealing the inherent spatial variation in hazard, vulnerability, and ultimately risk. The hazard and vulnerability elements exist as spatial layers and the concepts of hazard, vulnerability, and risk are couched in a spatial modelling process.

The task of developing spatial models for a wide array of hazards and their associated vulnerability is a significant GIS research focus in this phase.

In natural hazard mapping, the primary focus is on the physical environment and its associated processes, although humans may intervene through resource management strategies like fire suppression, levy construction, or land use. In general, the human vulnerability component in this class of study is implicit. Wadge et al (1993) note that for natural hazards, the hazard model is generally either an inductive combination of the hazard layers (spatial coincidence) or a deterministic model of a physical process. In contrast to natural hazard studies, GIS vulnerability studies generally focus on the human environment, where the hazard is either implicit or primitively modelled. In its most reduced form, vulnerability is simply population density, but there are much richer conceptualisations of vulnerability available. An interesting micro/macro division in vulnerability analysis is developing, whereby some studies focus on the vulnerability of individual structures (McLaren 1992), while others focus on the vulnerability of aggregate populations (Emani et al 1993). Conducting vulnerability studies using GIS is a relatively new research area, but the potential for GIS.

2.2 Preparedness and response

In the preparedness and response phase, GIS is primarily utilised to help formulate and execute emergency response plans. Emergency managers take centre stage in this phase, which is frequently characterised by urgent, mission-critical decisionmaking. The tremendous demand for timely, accurate answers to geographical queries makes this GIS application area unique. The primary benefits of GIS in this phase lie in spatial information integration and dissemination. Emergency management personnel need to know where an event is occurring in order to minimise further loss and effectively deploy relief. GIS development activity in this phase currently focuses on designing comprehensive disaster management systems to serve the information needs of emergency management personnel under various disaster scenarios. GIS may be used for training (preparedness) or in responding to actual emergency. Innovations in real-time GIS, remote sensing, interoperable GIS, and the Internet are having a significant and beneficial impact on research and development in this phase. Effective communication is paramount in this phase and for some hazard types, like hurricanes and floods, GIS is being utilised in a real-time monitoring and warning context.

One of the hallmark applications in the preparedness and response phase is automated mapping. Automated mapping played an essential role in addressing many of these tasks, as maps provided crews with the necessary information to deal with many of these problems. One challenge was simply navigation, as landmarks had been erased by the hurricane. The transportation network layer quickly became the most valuable information source. Corbley notes that the GIS must survive the disaster to assist in this phase, thus distributing a spatial database across sites or via the Internet is an important security measure. Increasing dependence on GIS during future disasters may lead to the notion of a *spatial information lifeline*. As circular as it may sound, a GIS lifeline analysis regarding the risk incurred due to the loss of a critical GIS during a disaster may be a likely study in the future.

Another GIS role in the preparedness and response phases relates to hazard modelling, which differs slightly from the hazard modelling in risk assessment. In this context the disaster *is* occurring, and it is possible to gather many of the environmental parameters to aid in short-term prediction. Sea, lake, and overland surge from hurricane (SLOSH) model (Griffith 1986) is a simulation model that uses current wind speed, direction, precipitation predictions, and topography to predict land areas most likely to be submerged during a storm, to aid in evacuation planning. The model output can be integrated into a GIS as another spatial layer to support further inquiry. CAMEO (Cartwright 1990) is another well known hazard model in use by HAZMAT teams in the USA that supports response efforts during chemical spills. CAMEO has three modules that allow a user to identify hazardous chemicals and their risks, display spatial information about an area, and model atmospheric plume dispersal respectively. It is designed to be carried on emergency vehicles, an anticipated trend in GIS development for this phase.

Another preparedness and response strategy that has received attention in GIS and emergency management is evacuation planning. Dunn (1992) has examined the potential role of GIS in generating alternative evacuation routes, Silva et al (1993) have developed and integrated an evacuation simulation model into a GIS to support the development of evacuation contingency plans around nuclear facilities, and Cova and Church (1997) describe a GIS-based method for revealing potential evacuation difficulties in advance of a disaster.

2.3 Recovery

In the recovery phase after the initial relief has been provided and the goal is returning life to normal or improved circumstances, a GIS can serve as a spatial inventory system for coordinating recovery activities. Difani and Dolton (1992) note that during the recovery phase an initial priority is performing a cursory damage assessment to minimise the time necessary to apply for government relief. GIS can help in managing the tremendous spatial detail associated with a structure by structure damage assessment. An increase in adoption of GIS technology following disasters is a general trend. Another significant issue in the recovery phase is educating the public. A GIS was developed to help people who live in the contaminated areas lower the radiation in their diet. Farmers are shown how much and what type of radiation is absorbed from the soil by various crop planting strategies. They can then plant to maximise (cleanse) or minimise (harvest) the amount of radiation absorbed by a particular crop. The key value of GIS relates to the inherent spatial variation in radiation absorption levels across a landscape.

2.4. Benefits of a GIS

Risk analysis occurs in emergency management from two perspectives including ex ante (prior to the event) and ex post facto (after the event). Newkirk (1993) sees that a geographic information system provides critical views of potential disasters and their impact both prior to an event and in the post event analysis. His concern is that the commercial GIS encourage the user to assume that the data is exact. The system should be used to allow for a broader examination of the risks and their potential or actual (as calculated) impact. There is a need for the broad based emergency management community to have a risk assessment tool that allows for close examination of events and their outcomes.

Benefits center on providing information to enhance decision making associated with emergency planning, response, recovery, and mitigation efforts. A GIS can provide regular maps of the local community and of areas of special interest to
emergencency management. A GIS can conduct spatial queries and display the results.

3. NATURAL HAZARDS IN ALBANIA

3.1. Geographic position of Albania

Republic of Albania is situated on the west of Balkan peninsula on the eastern littoral coasts of Adriatic and Jonnian seas (fig. 2).

Fig. 2. Albania on the west of Balkan peninsula

It is situated in the north geographical latitude 42^0 39' (Vermosh), south geographical latitude 39^0 38' (Konispol) and eastern geographical longitude 21^0 40' (Vernik), west geographical longitude 19^0 16' (Sazan). Republic of Albania borders the Montenegro and Kosovo to the north and northeast, the Former Yugoslav Republic of Macedonia to the east, and Greece to the south. Its western coast faces the Adriatic and Ionian Seas. Albania has a total area of 28,748 square kilometers. Its coastline is 362 kilometers long and extends along the Adriatic and Ionian Seas. The lowlands of the west face the Adriatic Sea. The 70% of the country that is mountainous is rugged and often inaccessible from the outside. The length of the border is 1094 km where 657 km are land, 48 km river, 73 km lake and 316 km littoral border The north - south extension is 340 km, east - west 148 km and over the sea level 2751 m (mountain of Korab).

The relief mainly hilly - mountainous is significant for the various forms, big contrasts. Until 200 m over the sea level lays 23.4 % of the country. The altitudes 200 - 1000 m include 48.1 % and over 1000 m include 28.5 % of the Albanian territory.

Plain field areas suitable for the intensive agricultural development and without erosion problems are few and situated on the west. The rest hilly part which lifts up gradually toward east offers possibility for the development of the fruit bearing, stock breeding, tourism etc.

The climate is Mediterranean on the west. Inside the country are appeared the influences of the continental phenomenons in the climate while in height the alpine ones. Summer, in general, is hot and dry , while the winter is wet. The period with equal or higher temperature than 10^0 C changes from 260 to 300 days in a year. In general there precipitate average 1480 mm in a year. But the average annual quantity of the precipitation changes from 600 mm to 2100 mm. There are met 2000 - 2700 hours with sun radiation. The extraordinary meteorological situations which are accompanied with economical damages happen rather often.

Albania is rich with water richness. It is traversed by a hydrographical network with general length over 49 000 km and mean density 1.7 km/km^2. The annual volume of the water quantity of the rivers arrives 41.2 km^3. Main rivers are Buna and Drin with average discharge 680 m/sek, Vjosa 195 m^3/sec, Mati 103 m^3/sec, Seman 95 m^3/ sec. It has parts of the big tectonic lakes (Shkodra, Ohri and Prespa), glacial lakes (about 30), karstic ones (80), littoral (10) and artificial (700). It is rich with underground water and big karstic springs, mineral springs and thermomineral ones. Some of the rivers, parts of the littoral and some lakes are polluted by the industrial , agricultural and urban wastes.

Vegetation world is various. There are 3250 kinds of natural plants, which constitute 29 % of the total number grown in Europe and 47 % of the Balkan plants. In Albania are met plants of different regions such as: Mediterranean, northBalkanic, alpine - carpatian, central of europe, euroaziatics. etc. 1 % of the Albanian vegetation is endemic and 5 % is subendemic. There are four vegetation belts (Mediterranean shrubs, oaks, beeches and conifers, alpine in pastures).

About 35 % of the territory is occupied by the forests , from which to every person belongs 0.3 ha. The high forests occupy about 47 % of the forest area, low forest 29 % and shrubs 24 %. About 10 000 ha forest are proclaimed national parks. The wild world is rich with many kinds of animals, even rare ones (grey dark bear, wild cat and goat, pelican , etc). As we see the country is significant for the biodiversity but are damaged a lot by the man's activity.

3.2. Natural hazards in Albania

Albania is vulnerable to flood, earthquake, landslide, drought, extreme temperature, windstorm and high snowfall (including avalanche and epidemic). The country is highly vulnerable to earthquake, flood and landslide. EM-DAT shows that, during 1974-2006, floods accounted for the major share of disaster events (32 per cent), followed by earthquakes (18 per cent). There were two technological hazards reported during this period; one transport accident and one industrial accident, in 1991 and 2004 respectively. Incidence of hazard events in the country (1974-2006) shows that there has been a steady increase in the number of events. There could be two compound reasons for this: (i) the data recording mechanisms became more organized during recent years, and events are being more systemically recorded; and/ or (ii) there has been an (apparent) increase in the number of various natural and technological hazards in the country. The detailed hazard analysis is dealt with in detail below. Only two technological hazards have been reported during this period, hence the data is insufficient to interpret the trend over the period.

Occurrence of different hazards over the period 1974-2006 in the country shows that 62 per cent are hydrometeorological hazards: flood- and drought-related events. The September 2002 flood alone affected 16,971 families, inundated 30,000 hectares of agricultural land, damaged 494 houses (126 were heavily damaged) and affected areas of Lezha, Shkodra (northern), the district of Berat, Skrapar, Permet, Tepelena, Gjirokastra, Saranda and Korga (southern), with reported damages of USD 17.5 million. In terms of victims, the 1989-1991 drought affected almost the entire nation (http://drace-project.org/index.php/map/albania): as per EM-DAT, 3.2 million people were affected. Hydrometeorological disasters affected 3.32 million people and incurred an economic loss of USD 24.67 million.

During the last 33 years, EM-DAT reports four earthquakes killing 36 people and affecting 2,790 people. There are other major earthquake events recorded in Albania in the past. The 15 April 1979 Skodra (Montenegro) earthquake alone killed 35 people, injured 383 and rendered 100,000 homeless. Landslides often occur as associated hazards of floods or earthquakes. During the period 2003-2006, there are 45 reported cases of massive landslides (http://drace-project.org/index.php/map/albania).

Extreme temperature and technological hazards have severe impacts in the country, which is indicated by a large number of deaths compared to number of events. Landslides and earthquakes are the next most severe hazardous events in the country. Based on the EM-DAT data, the country is more vulnerable to disasters due to hydrometeorological hazards.

Analysing vulnerability across time (1974-2006) shows that number of deaths reported has reduced drastically, while economic losses, due to both natural and technological hazards, have been increasing. The period 1999-2003 has reported the highest economic losses incurred in last 33 years of hazards recorded in Albania. The vulnerability indicators across time - number of events, deaths, victims (affected and deaths) and economic loss - are presented in the figure 4 (a, b and c).

The incidence of flood-related hazard is high in Albania (one event in every six years). Economic loss due to flood, drought and earthquake during the last 33 years is USD 2.3 billion. Converting this amount into an annual average, it comes to 68.67 million (2.49 per cent of GDP). About 10 per cent of the population is exposed to flood and earthquake.

According to the World Health Organization, Albania is facing increasing pollution levels caused by poisonous gases released from industries and transport. The current levels are 10 times above the set tolerance limits.

According to a scenario analysis carried out in 2003 (http://drace-project.org/index.php/map/albania) estimating human casualties due to earthquake, the mortality rate is highest in Durres, followed by Vlora, Elbasan, Pogradec, Diber, Berat, Tepelena, Shkoder, Kukesh, Saranda, Himara, Lezhe, Tirana, Petrovac, and then the Leskovic Quark (Quark is a local word for region), for an earthquake scenario of a 475-year return period.2 From a structural point of view, it is estimated that the maximum percentage of building collapses will occur in Quark Diber, followed by Durres, Fier, Gjirokastra, Berat, Korga, Elbasan, Tirana, Shkoder, Kukes, Vlora and Lezha, for a scenario earthquake of 475 years. From the expected maximum flood potential for a 100-year return period, Gjirokastra, Tirana, Elbasan and Shkoder Quarks are in extreme flood risk zones. More than 30 per cent of the country is vulnerable to natural unstable slopes along road and rail networks. Road and rail network slopes of most parts of Tirana, Elbasan and Berat Quark are unstable for a scenario earthquake excitation of a 200-year return period. The Quarks Shkoder, Kukesh and Diber are particularly vulnerable to snow avalanche. From a forest-fire risk point of view, the Quarks that are under very high risk are Kukes, Tirana, Korga, Fier, Gjirokastra and Vlora. The Global Fire Monitoring Center reports that, between 1981 and 2000 in Albania, there were 667 fire events, affecting 21,456 hectares of land (http://drace-project.org/index.php/map/albania).

Natural hazards such as earthquakes, landslides, floods, drought, and other man made hazards have caused major loss of human lives and livelihoods. They have also disrupted and destroyed social and economic infrastructure, and have created damage to the environment in Albania Unfortunately, the frequency, magnitude and impact of disasters continue to increase.

Although there is very little or even a lack of evidence concerning mudvolcanoes in Albania, traces can be found in places crossed by the most important seismogenic belts. For this purpose the calibration of past seismic activity with recent activity has to be calibrated. For a continuous seismic activity, the calibration of past seismic activity with recent activity can be performed through the third extreme value distribution, while for sporadic seismic activity the "quiescence" zones are more important for such a calibration. Besides the geological and tectonic settings, some additional evidence such as fault rupturing on the free surface, induced ground failure phenomena, archaeological ruins in some ancient historical cities, etc. can be used to assess the size of the missing strong events.

Forest fires in Albania are a rare occurrence. The last were reported 60 years ago. However, during the Summer of 2007, widespread fires devatsed large expanses of Albania's territory. A total of 1036 different fires damaged 4150 Ha of forests and pasture land. Fortunately, thanks to the efficiency of the structures involved in managing the situation, there were no casualties. High temperatures (sometimes up to 43°C) and the prolonged dry weather had created the conditions for the spread of wild fires in forests and fields. In many cases, fires were started by shepherds cleaning pasture land, according to old farming traditions. In some cases fires were caused accidentally or sometimes intentionally as criminal acts.

4. EMERGENCY MANAGEMENT WITH GIS

4.1. Observations

Forty percent of Albania's geographical area is under agriculture, contributing 23 per cent of the nation's GDE As the country is more susceptible to hydrometeorological hazards, the impact of such hazards on agriculture will have an adverse impact on the nation's GDE. Higher incidence of flood- and drought-related hazards, and the historic earthquake events, all need to be given due emphasis while planning disaster preparedness and mitigation. The vulnerability of the nation is aggravated by factors like poor infrastructure and public services, uncontrolled land use, an insufficiently regulated building construction boom, poor watershed management, and a range of other environmental factors. This development paradigm needs to be examined and the development model shifted to support hazard risk management of the region. In 2003, GIS-based risk zone maps for earthquake (fig. 3), flood (fig. 4), landslide (fig. 5), forest fire (fig. 6), snowfall (fig. 7), avalanche and diarrhea were prepared for the country (http://drace-project.org/index.php/map/albania).

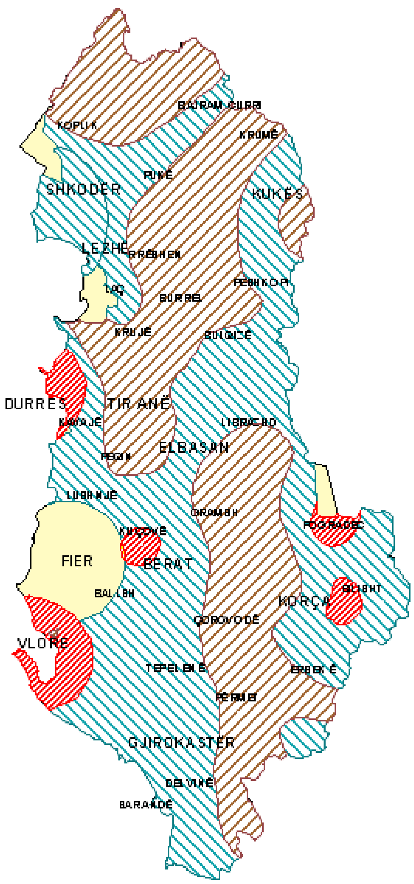

Fig.3. Map of seismic areas of Albania

Earthquake with VII Richter magnitude that affect 12 regions, with 1 million residents and about 150 thousand dwelling.

Earthquake with VIII Richter magnitude that affect 18 regions, with 1.2 million residents and about 200 thousand dwelling.

Earthquake with above VIII Richter magnitude that affect 6 regions, with 0.8 million residents and about 150 thousand dwelling.

This data, in its GIS format, can be utilized with other variables like population density and land use to develop location-specific vulnerability assessments for various hazards. Some of the challenges faced by Albania are: setting up an integrated communication, early warning and notification system; improvement of response capacities at the local level; establishing, strengthening and supporting structures for planning, monitoring and operations; enhancing capacities of staff at all levels; and community training systems.

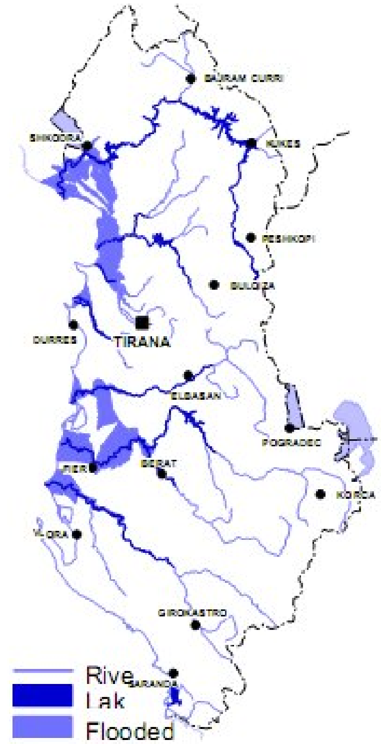

Fig. 4. West Plain 100 Years Return (Period Flood Risk)

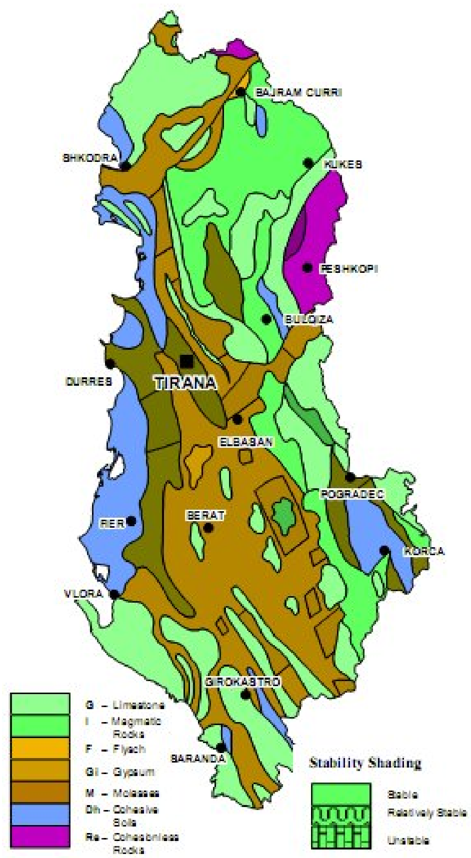

Fig. 5. Geotechnical Map of Albania

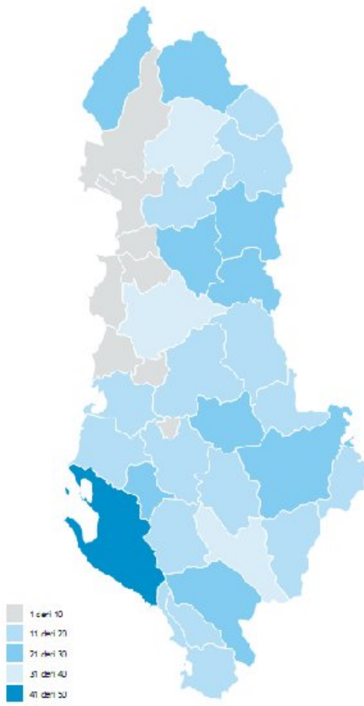

Fig. 6. Yearly events of fires in forests

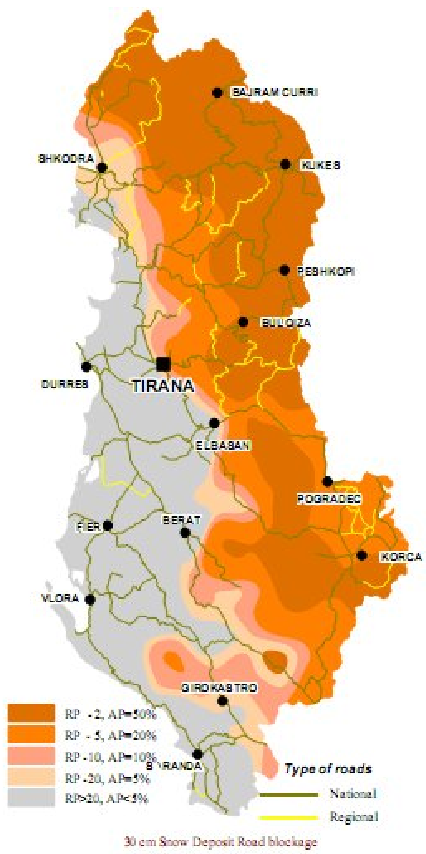

Fig. 7. 30 cm Snow Deposit Road blockage

The institutional structure for disaster management needs strengthening at the national level and regional level. In one of the surveys conducted as part of a UNDP study on local vulnerability and capacity assessment in Albania, two-thirds of the surveyed population showed a relatively clear understanding of the roles and mandates of local government, emergency services and civil society organizations in disaster management. However, a majority thought that these organizations were not active or were inexperienced (55.4 per cent). Seventy-one point five per cent said that they were "not pleased" with the performance of these services before, during and after disasters. Seventy-four point seven per cent were also dissatisfied with national-level organizations and services (UNDF 2004). The Seismological Institute of Albania had proposed to set up in 2003 a fully integrated digital seismograph system for the nation, with the ability to link to regional systems, and data-sharing facilities for stakeholders and regional organizations, as part of the earthquake monitoring in support of disaster preparedness in SEE region.

For the identification of the floods in Albania are used large images from NASA (fig. 8).

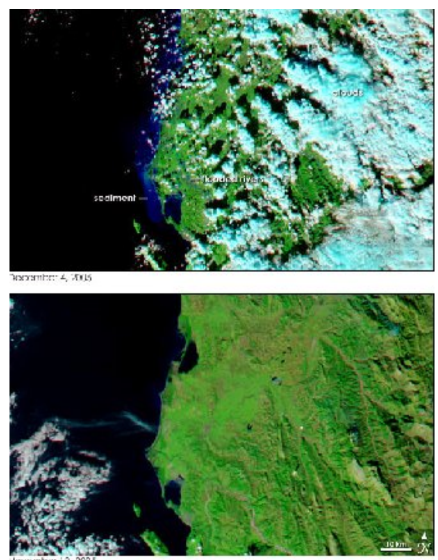

Fig. 8. Large Images Floods in Albania

The Moderate Resolution Imaging Spectroradiometer (MODIS) on NASA's Aqua satellite detected signs of flooding in Albania on December 4, 2005, top image. Muddy water, clouded with sediment from storm run-off, colors the coastal waters of the Adriatic Sea a brilliant blue. On land, swollen rivers form a faint web of pale blue where only green vegetation existed on November 13, 2005, lower image. According to news reports, the floods were caused by heavy rains on December 2. Clouds, blue and white in these false-color images, still covered much of the country on December 4. The large images provided above have a resolution of 250 meters per pixel, MODIS maximum resolution. The MODIS Rapid Response Team provides daily images of the region in a variety of resolutions. NASA images courtesy the MODIS Rapid Response Team at NASA GSFC.

4.2. Identifying Hazard and Risk

At local and national levels, effective preparation and protection requires familiarity with the specific hazards and the potential risk they pose. The *Disaster Risk Assessment in Albania* 2003 provides an expert analysis of the specific hazards and their risks, including potential losses of life and property in Albania. The Disaster Risk Assessment identifies specific hazards, the risks they pose to life and property, and the areas of Albania that they have historically affected and the areas that they are most likely to affect in the future. The following major hazards affecting Albania are explained and analysed in the narrative text of the Risk Assessment, supported by tables and risk-maps of the territory: Seismic Hazards and Risks Flood Hazards and Risks Dam-burst Hazards and Risks High Snowfall and Avalanche Risks Forest Fire Risks Technological Hazards and Epidemics.

At local and national levels, discussion in mitigation committees of the risks posed by the greatest specific hazard in an area, automatically leads to consideration of measures to prepare for such an event and how to protect people and property from its effects. This Preparation and Protection stage is however beyond prevention and mitigation, in that the existing vulnerability of population and property is assessed, and any immediate measures to prepare for, and protect against an event, are taken. Different hazards present very different risks, but some of the general preparedness and protection measures for one hazard may also be effective for another hazard.

5. ORGANIZATION OF THE NATIONAL SYSTEM OF EMERGENCY MANAGEMENT IN ALBANIA

The National System of Management of Emergency is comprised of permanent and provisional structures on a central, regional and local level. Through these structures, each concerned Ministry, Directorate or Institution currently shoulders specific roles and responsibilities essential through all the stages of the disaster management cycle (fig. 9). Such roles and responsibilities are often divided among two or more institutions, dealing, for instance, with such matters as water supply, canal digging, supporting walls, dams and dikes, as well as other issues. In certain cases, these roles and responsibilities have already been incorporated into existing specific plans developed by those institutions, to deal with civil emergency matters. When these institutions carry a response role, they will almost certainly have to play a corresponding role in the other phases of the disaster management cycle, including prevention and mitigation. The Council of Ministers leads and governs the national system of civil emergency management in Albania (National Civil Emergency Plan of Albania). It approves and endorses appropriate strategies, policies and programmes that aim to prevent, mitigate, prepare and respond to civil emergency situations. In compliance with the The National System of Management of Civil Emergency is comprised of permanent and provisional structures on a central, regional and local level. Through these structures, each concerned Ministry, Directorate or Institution currently shoulders specific roles and responsibilities essential through all the stages of the disaster management cycle. Such roles and responsibilities are often divided among two or more institutions, dealing, for instance, with such matters as water supply, canal digging, supporting walls, dams and dikes, as well as other issues.

Information exchange between national and local structures for planning, monitoring and assessment and operational and supportive structures of civil emergency. Information is crucial for early warning, public information and advice, to inform national and local mitigation groups and committees as well as for planning prevention and mitigation measures at national and local level. Essential information includes: Seismological, hydrological, meteorological data. Technical information on the conditions of maintenance, repair and safety of: housing and transport infrastructure, and essential installations including dams, mines, public and private sector land and marine industrial installations, complexes and stores. Technical information regarding the state of environmental areas, such as drainage basins and watersheds, including forests, rivers, primary, secondary and tertiary channels, unstable slopes, wetlands and reclaimed areas. The level of pollution, hygiene and epidemiological data as well as level of civic order.

In certain cases, these roles and responsibilities have already been incorporated into existing specific plans developed by those institutions, to deal with civil emergency matters. When these institutions carry a response role, they will almost certainly have to play a corresponding role in the other phases of the disaster management cycle, including prevention and mitigation. The Department of Civil Emergency Planning and Response (DCEPR) is a permanent and specialized structure, participating in all the stages of the civil emergency management cycle. However it is also directly responsible for handling the initial stages of response to an actual civil emergency situation.

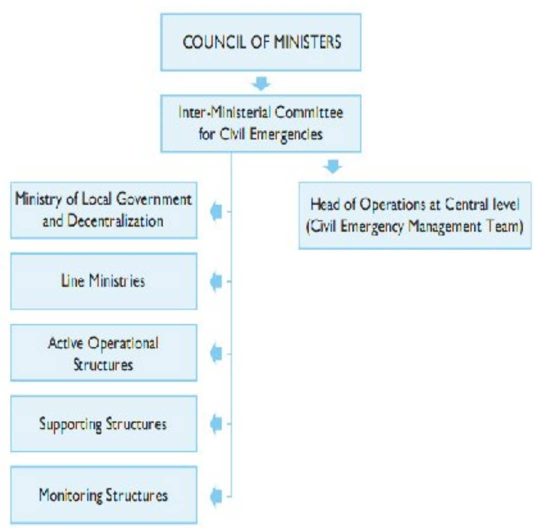

Fig.9. Organization of the National System of Emergency Management in Albania

In Tirana, Albania, is established a GIS based Emergency Information System (EIS) especially for crisis management (fig. 10). All kind of inventory about Tirana, vehicles, inventory, qualified and unqualified (mainly technical) personnel, type of factories and their details such as capacities, gas stations, food stocks, electricity lines and transformer, etc. All kind of related data were entered into the GIS and some software have been developed to utilize GIS based data in various ways. During the regular time, EIS helps to provide many socio-economic information to the user. During the emergency time, EIS provides immediate maps and facts about the requested area. Assisting rescue teams, ambulances, fires and polices are very important during the emergency time, and EIS also does that. Where to establish temporary accommodation (tents and prefabricates houses), where to build permanent houses, where are the assembly areas, who will be in charge, what is the evacuation systems, which doctor should go which temporary health unit, how to collect donations, where are the warehouses, etc.

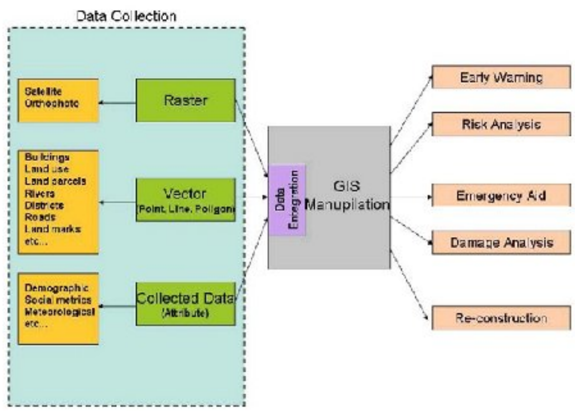

Fig. 10. Data Collection and Manipulation of GIS for Emergency Management System

With the aid of GIS, all of the necessary precautions are handled by the computerized GIS system, especially for planning and management purposes. MapInfo GIS software has been used to develop many applications. The Visual Basic programming language is used for devel oping the graphical user interface parts of the GIS. The application software was deployed on the Internet environment gradually, so that public can take advantage of maps and map-based applications. Later, the extranet connection with other government organizations had been established in order to share the common map-based information. Internet applications will be improved day by day. Not only vector and raster based maps, but also interactive GIS maps had been deployed into the web site, so that users can utilize some query applications.

Emergency management is an important and necessary process for every sensetive and responsible organization. Depends on the interested area, governments are focused on wide range of problems. On the other hand, private organizations may be interested in very specific case. As mentioned earlier, this article focuses on local government cases, and proposes an architecture how to deal with managerial issues during the disaster. To deal with disaster, any government needs specific plans and management system for any situation. Otherwise, experiences showed that the loss of death and economy are so big that there is no way to recover them.

For many years, governments are faced with disaster problems. For the last ten years, map-based computer technology developed variety of advanced strategies for governments while dealing with disasters. GIS technology allows users to create complex maps and sophisticated new maps are being developed that are based not only on street addresses, but also on coordinates.

6. CONCLUSSIONS

Emergency management programs are developed and implemented through the analysis of information. The majority of information is spatial and can be mapped. Once information is mapped and data is linked to the map, emergency management planning can begin. The use of GIS technology takes emergency management planning information "off the shelf" for utilization by response personnel for real-world operations. In short, the thoughtful application of a GIS can take much of the panic and surprise out of emergency.

Disaster events, such within this study, natural hazards in Albania and architecture for Emergency Management System by utilizing GIS techniques has been studied. The aim is to minimize the chaoses during and after the emergency cases. The detailed information and explanations are provided in order to be ready before an emergency situation. It is clear that GIS with digital map overlays can be best utilized as an Emergency Management System.

The significance of the research is in creating unique emergency management methodology and developing the software (based on the mentioned methodology) which can be applied in emergency management. Multidisciplinary approach is based on the new information technologies (GIS, Web services, ontology, semantic integration), expert's knowledge about structure and processes in the hazard management system, hazard emerging and possible effects on living environment, as also combine the knowledge of expert's working in different domains.

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