

Examining urbanization and its impacts in the Balkans using GIS and Remote Sensing

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The Balkan area is experiencing rapid urbanization in some areas. Many of the Balkan countries share the same characteristics in regard to urban related policies including: limited or no controls on urban growth; poor compliance with E.U. environmental protection regulations, inadequate planning for the expanding demand on local and regional infrastructure (transportation, water, sewer, telecommunications etc.) and insufficient housing policies. GIS and Remote Sensing offer excellent tools to examine the impacts of urbanization on the economy, environment, transportation, agriculture, forestry and other issues in the Balkans which can assist in making better decision-making and policies. The use of GIS and Remote Sensing to examine urbanization is in its infancy in the Balkans. This overall umbrella topic could be impetus for several projects such as: creation of a GIS and Remote Sensing urban and regional databases for distribution over the Internet for researchers; the development of an urban spatial analysis group, standardization efforts for urban and regional GIS databases; integration of urban GIS by nation and region: development of a GIS education program to train professionals who are skilled in urban GIS databases: and identification of urban environmental problems by different scales.

Introduction

This paper discusses the possibilities of the use of geographic information to analyze urbanization in the Balkans. This area is complex with a unique set of urban problems. However, there are some common themes such as infrastructure improvement, environmental protection and adequate housing needs. The use of spatial or Geographic Information technologies (e.g., GIS, Remote Sensing, GPS, spatial modeling etc.) can provide decision-makers the ability to organize and study spatial related problems and solutions.

For the purpose of this paper, the Balkan countries are considered as 1) the former Yugoslavian Republic (Slovenia, Croatia, Bosnia and Herzegovina, Serbia, Montenegro, and Macedonia), Albania, Romania, Bulgaria and Greece. This could be further expanded to be termed Southeast Europe, which includes Türkiye. Türkiye will be discussed in its proximity, integration/cooperation and common problems with the Balkan or other Southeast European countries. Some countries are either soon to enter the E.U. (Bulgaria and Romania) or are candidates for membership (i.e., Croatia and Turkey). Others are E.U. members, such as Greece and Slovenia. Other countries such as Albania and Serbia are seeking E.U. memberships, but are not up for candidacy (E.U., 2006). There is a complex set of commonalities and differences, as will be discussed later in this paper.

The use of Spatial Technologies (ST) which includes GIS, Remote Sensing and Global Positioning (GPS) can aid in decision-making related to the myriad number of urban issues in the Balkans such as the provision of adequate infrastructure (transportation, telecommunications, water and sewer etc.), establishing housing for all income levels, environmental pollution, land use planning and many others. Regardless of the ability and potential of ST to aid urban analysis and decision making in the Balkans, some prerequisites should be met. These would involve, but not limited to: adequate funding for the implementation of ST in appropriate sectors and levels of government; the integration and transparency of spatial data; training of persons equipped with ST skills and increased cooperation on a regional and international basis.

Critical impact areas of urbanization in the Balkans

Urbanization is one of the key issues in the Balkan Europe countries and has been shaped by numerous forces. One of the over riding themes in this area is the transition from former communist states and centrally controlled economies to

democracies and capitalism. This affects almost every aspect of present urban development. Recovery from civil war in the former Yugoslavian republics is another thread. Overall, all the economies in this region could be considered developing ones, with the exception of Greece and Slovenia (World Bank, 2006). The next section will briefly outline some of the urban themes (environment, housing, transportation, urban planning) and then address the role of spatial technologies.

There are numerous environmental problems in the Balkan in terms of water, air and noise pollution. Urban areas significantly contribute in the overall environmental status of the region. The exact nature and severity of the problems vary according to each nation. A current inventory of the environmental problems in the region has been well summarized by the Regional Environmental Center for Central and Eastern Europe (R.E.C, 2006). For example, water pollution, solid waste disposal, waste water management are major issues in many of the former Yugoslavian states. In Albania, many of the streams are being polluted by untreated sewage. In Bosnia and Herzegovina, many tons of solid waste has not been disposed due to the conflicts in the area. In all countries, greater private vehicle ownership in urban areas is causing increasing vehicle related emissions. There are significant efforts in all countries to address environmental problems (Fiedler, J. and Artim, 2005). In the case of the Government of Bulgaria, the Ministry of Environment and Water (2006) is presently undergoing major efforts to comply with E.U. regulations. The challenge in some of these countries is: obtaining and efficient management of financial resources; setting priorities; and establishing legislation and enforcing existing regulations to meet EU standards as a candidate countries (i.e., Croatia) or as a country desiring to enter negotiations as a candidate country (i.e., Albania, Bosnia and Herzegovina) (REC, 2005)

Adequate housing is a concern for all countries in the region. The former communist countries of Romania and Bulgaria are dealing with inadequate or poor housing stock. In Bulgaria, there were loans during communist times for housing, but since the introduction of a market economy there are not enough resources to provide for adequate housing. Organizations like Habitat for Humanity are attempting to fill the gap (Habitat for Humanity, 2006). Many of the former Yugoslavian republics have to reestablish an adequate housing supply for many who lost their homes during the ethnic conflicts in the area (Wegelin, 2005). There are also problems with illegal housing development, as the private sector is unable to meet the existing housing needs, particularly in some of the former Yugoslavian republics. In many cases,

efforts to improve these situations are being hampered by the economic status of many of these countries.

Transportation is a key factor in the economic and political integration of all the Balkan countries. Urbanized areas, as key locations of economic activity, could benefit greatly from a better inter-urban and inter-regional transportation network. Due to the past fragmentation and the isolation from the rest of the European countries (see figure), the Balkan countries have inadequate links to the rest of Europe and to other surrounding countries (i.e., Ukraine, Russia, Türkiye) (Papadaskalopoulou, 2005). Presently, divided access-controlled highway. To improve mobility for personal and commercial activities, there needs to be an integrated inter-regional highway network linking up with other major European cities. There is a great need to improve the connectivity of the region's railroads and integration with the network of high speed railroads developing in the rest of Europe. The problems in the area are well documented in the European Commission's report: Regional Balkans Infrastructure Report-Transportation. (2003). In urban areas, transportation infrastructure needs to be upgraded. In many cases, improvement of transportation facilities and construction of new facilities are without preliminary studies (SWPG, 2004).

Many of the urban areas in the region are struggling to transition to a developed economy. They are transitioning from Post-Industrial and centralized economies to market driven and the information/service sector oriented urban economy. Some of the countries in former communist countries have seen industrial development decline as firms compete in the global market. In many cities, one can see the abandoned factories, which is symptomatic of the changing economies. However, these economies share many of the same traits as other developing economies around the world (Dimirovski et al., 2006). In addition, they are in the process of improving the infrastructure to meet EU standards. Predictably, one of the goals of this region is sustainable urban development, but it must be geared toward the specific needs of the region (Slaev, 2004). To make this transition, there needs to be adequate urban and regional planning. However, the urban planning strategies should be tailored to the specific urban environments of particular countries and not taken from traditional planning methods from more developed countries.

Türkiye's urban context and relationship to other southeast European countries

Türkiye, although not a Balkan country, can be considered part of Southeast Europe and has many economic, political and cultural connections to the Balkan countries. With the collapse of the Soviet Block, economic interaction between Türkiye and the Balkan region has dramatically increased and expected to increase further. It shares many of the same urban problems as many of its neighbors such as air pollution due to increasing vehicle ownership, watershed protection, housing problems, and a transitional economy. As a candidate country for the E.U., it is implementing new legislation and making related major infrastructure improvements such as a railroad tunnel under the Bosphorus which will greatly improve movement in Istanbul and inter-regional/international movement of good and services. Urbanization is somewhat different in that there is a well developed system of hierarchy of cities within a national context. Istanbul and urban areas in Trakya (Thrace) have the greatest amount of economic contact with the region. One of the greatest needs of Istanbul and Türkiye is a well developed transportation network in Southeast Europe. In other regards, Türkiye has more resources than some of the Balkan states and have stronger institutions and financial resources to aid urban areas. However, these financial resources are being strained by a growing population and greater economic expectations. There is already a significant amount of interaction on mutual concerns between Türkiye and the rest of South Eastern Europe. However, there is a need for increased communication concerning mutual needs related to urbanism.

Contributions of ST to enable decision-making in the Balkans

Spatial technologies can be used to study these pressing urban issues. From a preliminary review of the use of GIS in the Balkans, there has not been widespread use of ST to study urban problems.

The following could be examples how ST could be used to solve the region's urban problems:

1. Housing

One of the basic functions of urban ST, particularly GIS, is to inventory housing as to ownership, quality and value. These inventories can be used for housing studies and for forecasting future growth. The inventory of housing stock by GIS is of particular importance when locating areas of cities where there is substandard housing. In the case of some of the countries, illegal housing development is a problem. High resolution satellite images can be used to document where these settlements are located.

2. Transportation

Transportation systems in the Balkans can be viewed at various scales. There is an inherent relationship of internal transportation and external transportation needs. There is a specialized group of GIS programs that are directed toward transportation often referred to as GIS-T. GIS-T can be used for facility inventory and classification, traffic monitoring, travel demand modeling, traffic engineering, public transportation scheduling and monitoring and many other tasks. The connectivity and inter-urban and inter-regional travel movements and demands including freight for all modes of transportation can be analyzed through GIS-T programs with travel demand modeling extensions. Likewise, GIS-T can be used to forecast future movement demands for particular urban areas. In the Balkans, GIS-T could be used in many studies to analyze future travel demand for regions, countries or urban areas. In addition, future alternatives can be developed and tested as to their impact on traffic reduction, air pollution and energy efficiency.

3. Environment

ST is widely used in analyzing the environment. In the Balkans, GIS and Remote Sensing could be used to analyze and monitor the spatial distribution of water quality, air pollution, loss of farmland and forests due to urbanization, erosion, flooding, ground water pollution etc. ST can also be very useful in monitoring of compliance with E.U. regulations.

4. Urban and Regional Planning

ST has long been used in developed countries for urban and regional planning. Remote Sensing images have proven to be very useful in monitoring urbanization. There are many tasks that in urban planning that ST can assist such as planning of future water lines, regulation compliance (housing codes, zoning etc.), protection of historic areas, areas, flood mitigation, traffic impact of new industries, economic development, environmental protection and travel demand.

Realizing a more active role for GIS in the decision-making in the urban development process in the Balkans

There is growing ST community in the Balkans, from a preliminary examination. However, regardless of the robustness of ST and the ability of these technologies to assist in decision-making, it can not be a viable tool in urban decision making before certain conditions are met. Some of the conditions that are needed are:

1. Standardization and transparency of geographic data.

One of the problems in the GIS community is the multiple data forms in terms of specialized files that can only be used by some GIS programs and not by others or the use of numerous datum and projections. In addition, there is the limited access for researchers to spatial data. The ability to access to data and the level of quality is commonly referred as transparency. Much urban GIS data in the Balkans is not readily available for use in research and other analysis. By the creation of Internet portals, many parties could have access to urban spatial data. Presently, these efforts are being undertaken in the European Union by INSPIRE (2006). Any particular effort in this area in the Balkans appears to be limited.

2. Development of Urban GIS databases

This would involve using existing databases and the creation of new ones. This is a prerequisite for any GIS analysis. These databases should be configured so that they can be used for multiple purposes and exclusively strictly project oriented. At this time, it would appear that only a few cities in the Balkans have a fully developed GIS. There are some agencies and universities that have GIS databases, but the interchange of data between different levels of government appears to be fragmented or non-existent.

3. GIS education in higher education institutions.

Before GIS can be an integral part of urban analysis, there has to a sufficient number of professionals that are qualified to be able to develop and maintain GIS systems. At present, very few university that offer GIS programs in the Balkans. There needs to be more universities and other institutions providing training for both professionals and technicians who are experts in ST.

4. Regional and national ST coordinating associations and institutes

There are many organizations that could coordinate GIS activities in the region. There are organizations in the Europe that are presently dealing with the use of spatial technologies such as the European Umbrella Organization for Geographic Information (EUROGI, 2006). It should be noted that none of the countries in Southeast Europe are included in this organization. There are others such as the Network of Associations of Local Authorities from South-East Europe (NALAS, 2006) which is dealing with common problems such as waste water management and other urban issues.

5. Adequate funding for hardware, software, infrastructure and GIS projects.

There are also numerous organizations that are funding projects to aid urban areas. One of the most prominent is the European Bank for Reconstruction and Development (2006) who gives assistance in public infrastructure and

other capital needs of cities. The European Union also is contributing substantial financial support for projects such as waste water management, environmental monitoring and for the promotion and compliance with E.U. regulations. It is not apparent if funds are being allocated for the infrastructure, data collection, software, training and technical assistance for the use of ST in these projects.

Conclusion

The countries in the Balkans are coping with common urban concerns such as traffic congestion, pollution, sustainability, economic development and housing. In addition, many of the Balkans are harmonizing their regulations and infrastructure with those the E.U. This has direct impact on urbanized areas. Spatial technologies are essential in analyzing these complex issues and assisting decision making. There are multiple funding agencies including the World Bank, and the European Union that are involved in the previously mentioned urban issues. However, in a preliminary review of some of the funded projects, there was an absence of the mention of the utilization of ST. These are the most appropriate institutions for assisting the integration of GIS in appropriate projects and programs. Most essential is constant funding for qualified ST professionals, hardware and software and the related infrastructure.

Some example start-up urban GIS projects for the Balkans would be:

1. a prototype urban GIS that could be reproduced for all urban areas in the region;
2. an integrated travel demand model all modes for regions and urbanized areas;
3. a model project for air pollution modeling; and
4. a watershed inventory and regional modeling effort in a test area.

In urban areas, ST is not a luxury or a frill but an essential element in urban analysis and management. For the Balkans to be able to deal with urban problems, the use of GIS must go beyond a project-oriented tool to one which is integrated with the urban decision making process. This will not happen over night as there has to serious efforts by regional, national and regional institutions to ensure that ST plays an intergral part of every project and program.

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Cities and Major Roads in Southeastern Europe

