

# Detecting Differences Between Romanian and American Cities Using Remote Sensing and GIS Techniques

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Urbanization is a continuous phenomenon analyzed from different perspectives. Cultural and legal differences put a serious fingerprint on the urban planning, and urban models vary around the world. There are also different definitions for concepts commonly used in urban planning. Geographical Information Systems, referred thereafter as GIS, were extensively used for various urban planning approaches. Urban sprawl follows a distinct pattern in America. This pattern affects the shape of the cities and the location of different facilities and services. This study uses GIS to identify some of the characteristic features of American and Romanian urbanism using Bucharest, Romania and Columbia and Spartanburg, SC as an example. This example indicated that GIS tools might be used to assess possible environmental impacts and resolve current urban problems.

## 1. Introduction

Urbanization will continue in all the geographical regions based on population growth and on the rural areas depression. Urban population will represent at least 60% in 2030, out of which 40% will come from rural areas [1]. This is a general phenomenon, even though urbanization differs among continents. Even the definition of what is an "urban area" is different. An urban community must have in the US a population of 2,500 or more [2]. The shape of cities varies across the world. Most cities with a sense of identity are strongly related to topographical forms and affected by subsurface features [3]. American cities are different. "When you get there, there's no there, there", said Gertrude Stein [3].

More recent phenomena affected American cities. Parallel to the explosion of the peripheral neighborhoods [4], American cities assisted to the death of the downtown areas [5]. This is confirmed by the relocation of the main services and coincides with the development of the mall that ended producing "multi-nucleated cities" [5]. These changes ended by having different impacts over the environment [6] and on human health [4]. The development of the outskirts determines changes in the energy flow and food chains, and determines the fragmentation of natural habitats, contributing to the overall loss of biodiversity [6]. Poorer health is expected in various parts of the city [4].

Geographical Information Systems (GIS) represent a decision support system involving the integration of spatially referenced data in a problem-solving environment [1]. Some of its applications include the field of land records, or multi-purpose cadastre. GIS techniques find an increasing number of urban applications in the United States and Romania as well.

A bird-eye view of American and European cities may sometimes reveal significant differences attributable to cultural differences, but hardly classifiable. Usually European cities tend to be concentrated around some central area, an equivalent of the American downtown, and, likewise the downtown, this center has a historical value and also hosts the local government [8]. Even so, European cities differ substantially across various European countries. The expansion of every city is dictated by the legislation of the country where it is situated.

## 2. Methods

The South Carolina Department of Natural Resources GIS Data Clearinghouse Home Page (<http://www.dnr.state.sc.us/gisdata/>) has a broad collection of topographic maps for 85 percents of the state available for the public. The original image was downloaded in an image-specific format (TIFF). Several layers of information were produced using on-screen digitization available in ArcView GIS. Three layers of information

available for Spartanburg, SC were used in this paper: the limits of Spartanburg City, as available on the topographic map, the location of all churches and schools present on the map, and the street network for the whole area.

The map of Columbia, SC was produced based on the information available on the website of the Department of Geography at the University of South Carolina (<http://www.cla.sc.edu/gis/dataindex.html>).

The information about Bucharest, Romania was provided by the National Institute for Research and Planning URBANPROIECT, in Bucharest, Romania and consists of ArcView GIS plans of the city and of the proposed development plan.

ArcView GIS was used to produce the images displayed in this paper.

### 3. Results

A first difference that can be easily noticed is the shape of the city. Bucharest (Figures 1-2) has a more regular shape, whereas Columbia (Figure 3) presents some shrunk areas that suddenly expand and Spartanburg (Figure 4) appears composed of islands of areas lying within the city limits. This pattern maybe similar to the one observed in Rome, Italy, called “the archipelago city”.

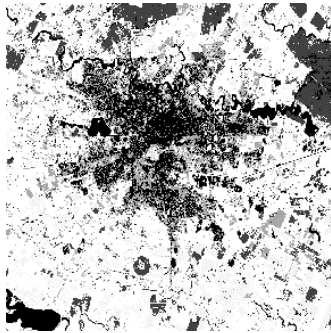


Figure 1. SPOT Image of Bucharest, Romania



Figure 2. Map of Bucharest, Romania

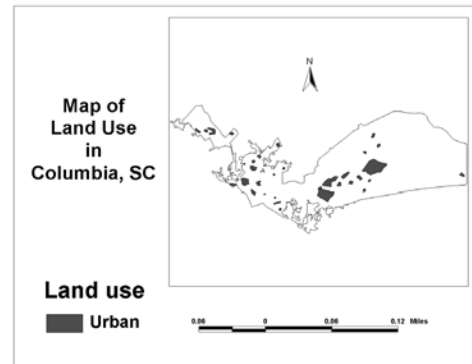


Figure 3. Map of Columbia, SC

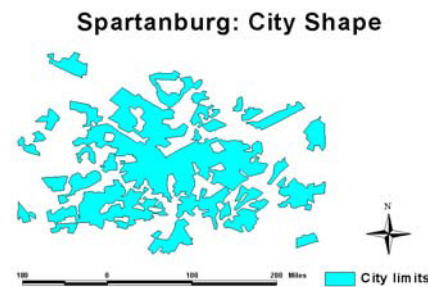


Figure 4. Spartanburg, SC: City Limits and General City Shape

Figure 5 displays a proposed development plan for the city. The growth of Bucharest may produce substantial impacts on the environment. The impacts are buffered through the creation of a green belt around Bucharest. The belt is designed to protect the natural ecosystems and also the agricultural areas surrounding Bucharest. However, the belt is threatened by the uncontrolled expansion of the surrounding settlements. In addition, more green spaces will be created within the city limits.

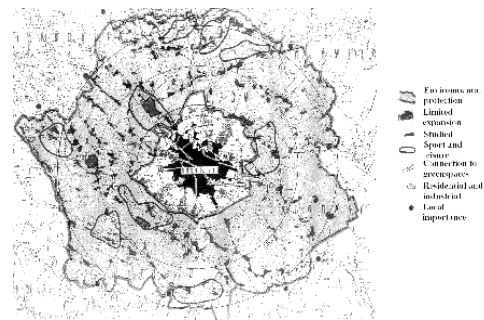


Figure 5. Proposed Development Plan of Bucharest, Romania

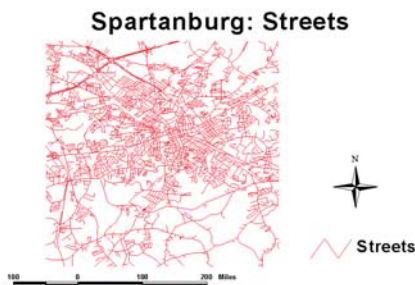
It is also necessary to underline several aspects related to some demographic and historical data to understand the differences. Europe and America differ in what may be called “culture of living”, and the easiest to notice difference is the American need for privacy; as a result, European cities tend to present higher population densities

(Table 1). The culture of living could be defined, for the purposes of the current study, as a system of mentalities, customs, techniques, behaviors, and systems of values characterized by a mixture of traditional and outside elements, sometimes insufficiently assimilated or transformed.

The street network of Spartanburg is also typical for an American city. Whereas most of the European cities have a radial symmetry of the street network, i.e. streets originate in the historical center of the city and spread outside, towards the outskirts, American cities have a rectangular pattern. Most of the streets are aligned from North toward South, and East toward West. However, the alignment pattern is broken in some regions, but even these areas respect the rectangular symmetry, as indicated in Figure 6.

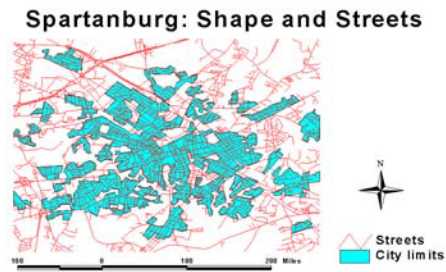
**Table 1. Geographic Data for Bucharest, Columbia, and Spartanburg**

	Bucharest	Greater Columbia	Spartanburg
<b>First historical mention</b>	1459	1786	1831
<b>Population (1998)</b>	2,021,000	509,935	43,318
<b>Area (sq. mi.)</b>	88.1	117.1	19.25
<b>Density (per sq.mi.)</b>	22,940	4,355	2,250



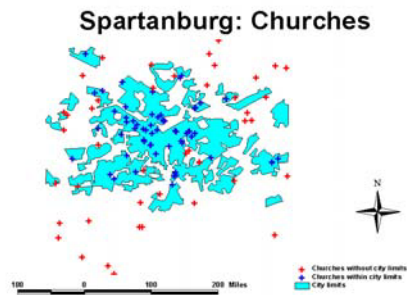
**Figure 6. Street Pattern in Spartanburg, SC**

Figure 7 overlays the two themes indicating the position of the streets related to the city limits. Supporting the statement regarding the definition of an American city, it is easy to find in this image areas where the street network is well developed, therefore the urbanization is high, but they do not fall within the city limits. Overall, as expected, the street network is relatively dense within the city limits.



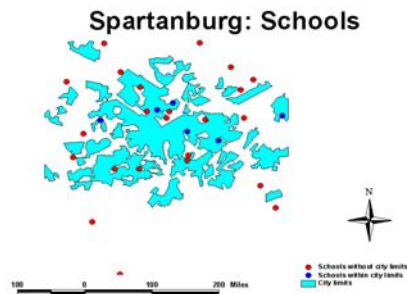
**Figure 7. Street Network and City Shape of Spartanburg, SC**

In the following, two particular themes will be analyzed, i.e. churches and schools. Figure 8 presents the churches in Spartanburg: out of the 101 churches found on the map, 43 (dark blue) fall within the city limits (43 percents), and 58 (red) fall outside the city limits (57 percents). The explanation may consist of the fact that as soon as the new residential areas emerge, churches are built within the area to satisfy the needs of population. However, not all the new residential areas are included in the city limits. Most of these churches lie close to the city limits, but do not fall within them.



**Figure 8. Churches Located in Spartanburg, SC**

The situation is different for the schools (Figure 9). In this case, 6 of the 29 schools, representing 21 percents (and marked dark blue) fall within the city limits, and 23 (79 percents, marked red) fall outside the city limits.



**Figure 9. Schools Located in Spartanburg, SC**

#### 4. Discussion

The shape of American cities may appear very interesting for European eyes. The areas within the city limits are not necessarily urbanized, and urbanized areas may lie outside the city limits. Sometimes, islands of “non-city” areas appear within what is marked as belonging to the city. This pattern may appear as unusual, but the explanation resides on how a city is defined. In most of the cases, the areas marked as parts of the city fit some tax categories, and not necessarily urbanization requirements. More exactly, what is within the city limits is subject to the city taxation regulations. It may be argued that Bucharest is developed concentrically, whereas Columbia and Spartanburg are developed in a tentaculate fashion. The difference may be explained by the different definitions of the city limits in Romania and the United States [8]. Nevertheless, the legislation does not vary substantially in terms of what is required, but varies in the minimum setback values, governing the position of a dwelling related to the neighboring one, and, therefore, the expansion of a neighborhood or even of a city, vary substantially, underlining the American need for space and privacy and explaining somewhat why European cities exhibit an apparently controlled expansion and higher densities, and American cities are diffuse and- excepting large centers as New York, NY or Los Angeles, CA- have lower densities. Nevertheless, the Romanian legislation- including the one governing urban planning- is in a continuous process of change in order to fit the European legislation. Moreover, the socio-economic base of urbanization is influenced by the particular aspects of the transition period crossed by Romania and sets a serious fingerprint on the spatial patterns detectable through remote sensing techniques. Changes become effective in short periods (usually several years). Most of the times, analyses of remote sensing data indicate a change of land use. Most likely, agricultural areas become urban areas, residential or related to transportation or industry.

Most of the schools tend to be situated outside the city limits. This observation sustains the statement indicating the death of downtown areas due to the relocation of the services in the peripheral regions [5]. A possible explanation is that most of the wealthy peripheral neighborhoods have highly-ranked schools, and most of the schools in the downtown disappeared as the number of students was insufficient. Furthermore, schools occupy large areas through their facilities- buildings, research centers and libraries, sport fields. Large pieces of land may not be available within the city limits, or these areas may be very expensive or subject to various legislative requirements. It is easier in many respects to extend over the city limits. Furthermore, American legislation allows extensions over the city limits more than the European legislation does.

The comparison between churches and schools may point toward the conclusion that as the city develops and

peripheral areas are preferred to the downtown, churches tend to remain concentrated within the city limits, whereas most of the schools will lie in the peripheral areas. There is not enough evidence to support this statement, even though there are some reasons. Old churches are situated in downtown areas, and even if people reside in the outskirts they will remain members of a certain church, more than they will have their children studying in a downtown school.

Unlike Spartanburg, Bucharest developed during its historical evolution in a concentric fashion. Due to the fact that legislation required that any new education facility should lie within 8-10 minutes walk distance from its corresponding residential area, schools are scattered uniformly within each "growth ring". Furthermore, given that 9 years of education are compulsory and the city occupies a large surface, the number of schools is large, i.e. 511 [9].

The situation of churches is different since practicing religion was discouraged during the communist period. Nevertheless, 346 buildings are used as churches or belong to various religious groups [10]. Churches appear along with the city, but their construction stopped in the communist period (1947-1989). This is the reason for churches having greater densities in the center of the city and lacking in the new neighborhoods. However, new churches were built after 1989 through the efforts of the parishioners.

Finally, the relocation of services toward peripheral areas is a phenomenon that started affecting Bucharest in the last years, but the effects are not yet manifest as in the American cities.

Particular aspects of the American built environment may be analyzed using GIS to detect their impact on the natural environment. Moreover, understanding different urban patterns and their underlying causes may provide future solutions to the problems with which American cities confront.

From an environmental viewpoint, multinucleated cities characteristic to the United States are desirable due to reduced impacts on the environment according to the documents of the 2000 meeting of the European Conference of Ministers responsible for Regional Planning in Hanover [11].

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