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Supporting the Process of Designing and Planning Heritage and Landscape by Spatializing Data on a Single Support Platform. Case Study: Romania

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Abstract: Data handling is a general objective of education, regardless of the educational level (middle school, high school, university or postgraduate) and branch. Being at the intersection between the humanities and the exact sciences, the field of design requires a continuous summation and overlapping of information from specialists. Obtaining data is essential for perceiving the current situation, but also for adapting the solution proposed in the planning process to the given situation, to the particularities and main characteristics of the context. How difficult it is to obtain information, but especially their overlap and correlation to obtain indicators specific to target areas, depends in most cases on the experience of the specialist in the field, but for a recent graduate, the training received during the years of university training is perhaps his most important support. However, there may be data that are predominantly available during university training and data that can be obtained predominantly outside the academic environment (financial data, communication with public institutions). The paper describes a proposal for a support platform to assist the process of architectural design, urban planning and landscaping in Romania, but which can also support adjacent studies and analyzes. The purpose of the platform is to support the design and planning process of heritage and landscape, architecture and urban planning, by simplifying the data acquisition process and also directing the design/planning process to a long-term perspective, which is based on resilient solutions for natural and built heritage and for the conservation of the local cultural landscape.

Keywords: *data handling; support platform; natural heritage; built heritage; cultural landscape.*

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1. Introduction

Big Data technology is used in various fields, and urban planning is one of them, and for this reason, urban, territorial and landscape planners need an understanding of it and how it can be used (Ivanov & Gnevanov, 2018). The continuous development of the field of technology, the new capabilities of computers and the improvements made in telecommunications facilitate the exchange of large amounts of data (Coll et al., 2012). These data are not only growing at an exponential rate, but are becoming more specific and diverse, being also available to the general public, which gives them the name of "big data" (Royds, 2018). The processes of capitalization of these data have had a special impact on urbanism, an area that is based on data collected from the field and on their use and interpretation, so as to eliminate or reduce existing conflicts. In China, for example, in 2014 there was an expansion of the implementation of big data in urban studies and projects (Hao et al., 2015). With the integration of various tools - smartphones, GIS, drones, various types of sensors, large volumes of data have begun to be generated in the urban environment, and urban research is currently looking for ways in which these data can give a smart image of specific dynamics of the urban environment (Tekouabou et al., 2021), including the need for careful analysis of possible disadvantages and possible dangers of control and manipulation. Thus, it is noted the special importance of citizen participation in urban management (Hasegawa et al., 2019), through the data provided by them, voluntarily or involuntarily, but it is necessary to question the ethics of the process of approach and involvement. For example, the satisfaction of visitors to natural protected areas is, in itself, a benefit to society (Oliveira et al., 2020), an ecosystem service that, once quantified by data, can help increase the adequacy of the planning process (Acasandre & Crăciun, 2015). Emotional data, such as galvanic skin response (GSR) as an emotional response to a space, can also be spatialized (Fathullah & Willis, 2018).

In the urban landscape, such tools can be used to monitor and conserve urban biodiversity, by tracking the distribution of species, for example. Because in the urban environment there are variations and environmental transitions over very short distances, making a sudden transition from green spaces to residential building complexes (some densely built, with a high occupancy rate on the ground), distribution monitoring data species need to be even more accurate (Planillo et al., 2021). At the same time, the planning of existing natural systems at the urban level could

be based on such precise data. One such example is the green-blue systems found in urban environments. Currently, an important obstacle in the proper planning and monitoring of green-blue infrastructure (green spaces and surfaces permanently under water) and/ or yellow (productive land) is the lack of data necessary for proper management of these areas (Sorensen et al., 2021), which can contribute to a study and a proposal for integrated and resilient strategic management (Crăciun & Gârjoabă, 2020).

Design and planning schemes can be strongly influenced and even optimized by large data visualization technologies, and they are increasingly used in the urban planning industry (Cao et al., 2020). Urban analytical tools are likely to continue to evolve and thus new ways in which urban theories can be understood and modeled can be discovered (Yap et al., 2022). However, managers and urban planners need support to handle data efficiently and to be able to acquire the skills needed to navigate these new data sources, software or platforms (Chackraborty et al., 2015). There is an increasing need to develop innovative solutions based on sophisticated data and approaches, in order to counter conflicts in the urban environment (Bibri, 2019). Currently, geographic information systems (GIS) allow the precise labeling of information specific to certain areas, and urban planning is one of the main applications of GIS (Bachour, 2002). GIS-type systems offer valuable opportunities in data processing and in identifying the main positive or negative factors that affect the urban environment and implicitly the landscape as a resource that restores the quality of life of the inhabitants, the community and the health of the urban metabolism (Crăciun, 2008).

2. Materials and methods

The QGIS platform was used for the current study. The reason why the use of a GIS software was chosen was the fact that through it very different data types can be superimposed and quantitative analyzes can be performed at the territorial level (Turkyilmaz et al., 2007).

The data entered in the proposed platform are official data, downloaded from the websites of the Romanian institutions. The administrative boundaries of the counties, cities and urban areas of the cities have been downloaded from the platform of the National Agency for Cadastre and Real Estate Advertising. The boundaries of natural protected areas have been downloaded from the websites of the National Agency for Environmental Protection and the National Agency for Natural Protected Areas. The study aimed to identify potential urban natural protected areas, by initially identifying partially natural protected areas overlapping with

urban areas of urban settlements, tangent to the urban boundary or arranged as enclaves within urban areas of cities. The aim of the paper is to create a basis for a support platform to help urban and landscape planning, to encourage the implementation of existing natural and built heritage conservation processes in or near cities.

3. Support platform

The publicly accessible F4 Demo Map database, available via QGIS software, was used as a base to support the data spatialization. First of all, the following limits were added: the limit of the national territory, the administrative limits of the county, the administrative limits of the urban localities and the limits of the urban areas of the localities (Figure 1).

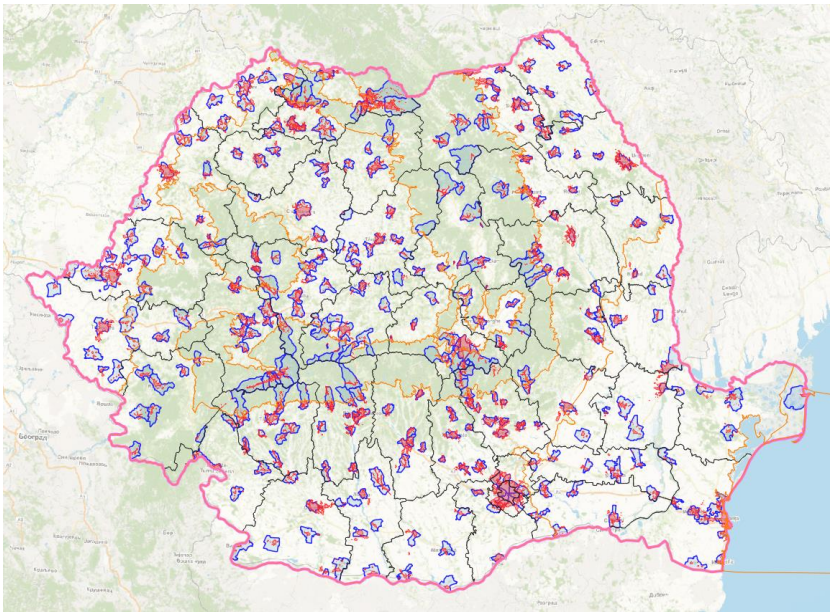

Figure 1: Administrative boundaries of the country, counties and cities and urban boundaries of cities. Source: authors.

Subsequently, the declared areas of natural protected areas were added, the boundaries of which were obtained from official data (Figure 2). Therefore, Natura 2000 sites, biosphere reserves, UNESCO sites, RAMSAR wetlands and natural protected areas corresponding to IUCN categories have been added at the national level.

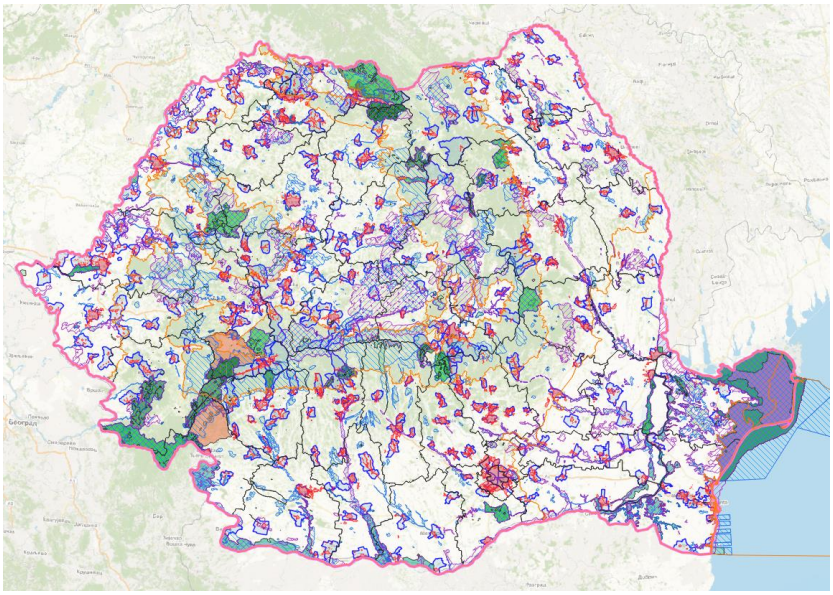

Figure 2: Administrative boundaries and areas declared as natural protected areas. Source: authors.

In the next step, natural protected areas partially overlapping or tangential to urban areas of cities were identified. The vector overlap function, the "intersection" tool, was used to obtain the areas overlapping the urban areas (Figure 3). The same function was applied individually for each layer corresponding to any different category of natural protected area.

The identification of these areas and their highlighting within the support platform has the role of drawing the attention of the urban and landscape planners on the importance of including the elements of natural heritage in the development process of the city (Romanian Parliament, 2018). At the same time, by spatializing the intersection areas between urban areas (more precisely, their built areas), it can be seen that such overlaps are very common cases at national level and that it is necessary to adopt a set of measures dedicated to natural protected areas located in the urban environment, which takes into account the constant pressures to which they are subjected.

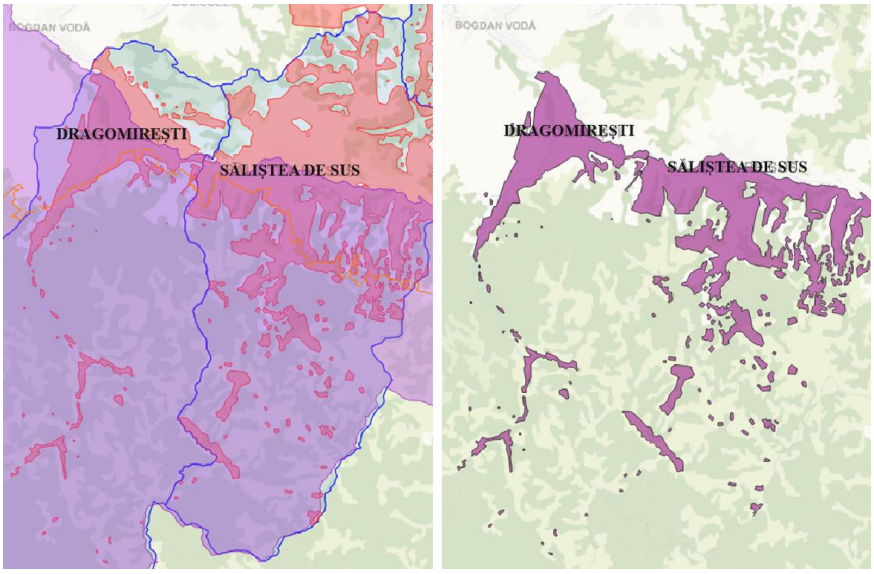

Figure 3: The spotting of overlapping areas between urban areas of urban localities and natural protected areas – One of the largest overlaps in the area of Dragomiresti and Salistea de sus in Maramures County. Source: authors.

Currently, in Romania there is no legislation to clarify how to protect and build on these overlapping areas of natural protected areas, in the built-up area of a locality, and often, these areas are not located on the periphery of human settlement, but they cross it along a river, which represents a structuring green-blue axis that was at the origin of the morpho-typological germ of genius loci, for the historical-evolutionary development of the locality (Crăciun, 2008).

All spatialized or even obtained information (by processing and relating "raw" data, similar to the previous example with overlapping areas between natural protected areas and built areas of cities) was made using GIS applications, made available to the public and superimposed with other spatialized projects. They have the potential to draw up support plans to help the processes of planning and landscaping and the development of strategies for landscaping, protection, conservation and development of the territory.

The natural protected areas on the Romanian territory are concentrated especially in the vicinity of the Carpathian mountains and the

Danube river. An extensive program is currently underway to promote economic, social and territorial cohesion in the Danube region - the Danube Transnational Program, abbreviated DANUrB + (Interreg Danube Transnational Program, 2022), in which the "Landscape Planning Department", from the Faculty of Urbanism, "Ion Mincu "University of Architecture and Urbanism Bucharest is a partner [1].

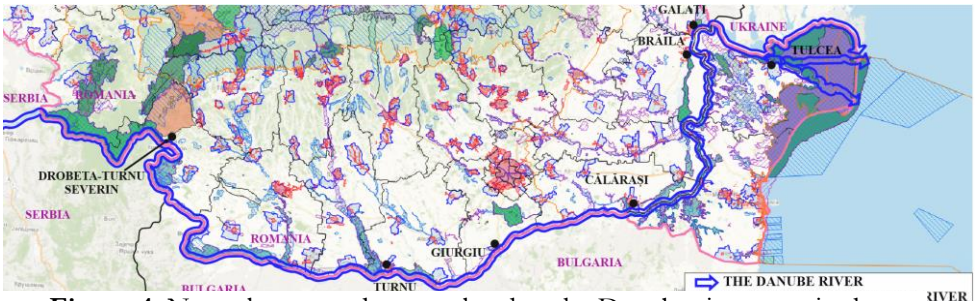

Figure 4: Natural protected areas related to the Danube river area, in the Romanian section between Bazias and the Danube Delta - Black Sea. Source: authors.

Spatialized data obtained through the DANUrB+ program, overlapping with natural protected areas in urban areas can highlight valuable areas from an economic, social or cultural point of view and can generate new strategic concepts and investment ideas.

For example, the overlapping of built heritage objectives (identified by the DANUrB + program), with urban natural protected areas, can highlight clusters of landscape objectives and natural and built heritage, which can generate proposals for protection, conservation and enhancement of the integrated landscape, including through common transnational strategies at macro-territorial scale or tourist routes at mezzo-territorial and local scale (Figure 4, Figure 5, Figure 6).

Thus, the Danube River can sustain its importance as a major morpho-typological structuring axis and the "blue-green highway" in Romania, but also in Europe, being an element of "sensitive" continuity not only from a historical-evolutionary point of view, but also and through its unique feature of the specific natural, anthropic and cultural heritage and

[1] Additional data related to the project "DANube Urban Brand + Building Regional and Local Resilience through the Valorization of Danube's Cultural Heritage" at the links: https://www.interreg-danube.eu/approved-projects/danurb_plus
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landscape, which should be preserved, enhanced and supported by sensitive urban-territorial operations as the only European metabolic footprint in the territory.

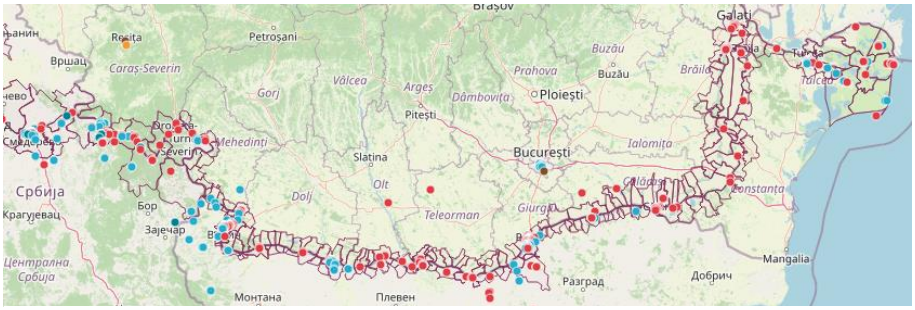

Figure 5: Heritage objectives and built landscape, in the area related to the Danube river
Source: https://www.danurb.eu/#/projects/heritage?page=18&sort=id,asc

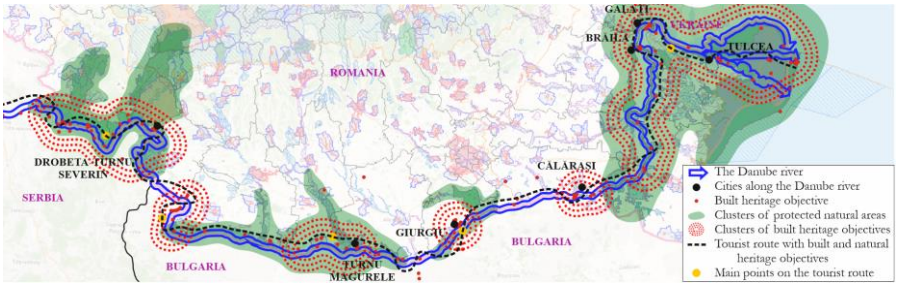

Figure 6: Clusters of heritage objectives and natural, built and cultural landscape along the Danube River. Source: Authors.

4. Results and discussions

The identification of overlapping areas between natural protected areas and built areas of urban localities has resulted in a considerable number of overlapping cities with at least one natural protected area - 187 cities out of a total of 319 cities currently existing in Romania, which represents a percentage of about 59% (Figure 7). Among them, the most overlap with Natura 2000 SPA and/ or SCI sites - 124 cities overlap with SPA sites and 129 cities overlap with SCI sites.

In addition to the number of overlapping cities with each type of area, the total overlapping area between the two was identified. In total, approximately 253540505 sqm is located at the overlap between the built-up

area and a natural protected area, which represents approximately 5% of the surface of the built-up areas of the urban localities in Romania.

This represents an important area in the context of urban and landscape development, through the possibility of developing the necessary green spaces of 24-26 sqm/ capita and in the future 30 sqm/ capita, according to European Union legislation and 50 sqm/ capita, respectively minimum 9sqm/ capita, according to World Health Organisation norms (Romanian Parliament, 2018).

Table 1: Analysis of overlapping areas between built-up areas and natural protected areas

LAYER OVERLAY		**Number of overlapped cities with natural protected areas**	**Overlapped area (mp)**
Built area – Urban localities	Natura 2000 SPA site	124	119264529
	Natura 2000 SCI site	149	138563880
	Natural monument	Insufficient data	
	Global geopark	2	12967294
	National park	14	4558639
	Protected landscape	17	82223632
	Strict nature reserve	Insufficient data	
	UNESCO World Heritage Site	1	125450
	Wetlands of international importance	25	29619121
	Biosphere reserve	5	12448444
TOTAL		187*	253540505**

* Total overlapping cities with at least one natural protected area.

** The total area of the overlapping areas between the built-up area and the natural protected areas. In the case of areas where several natural protected areas are superimposed, the areas have been taken into account only once.

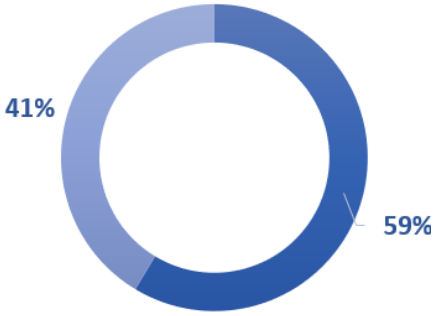

Figure 7: A percentage of 59% of the cities in Romania overlap with at least one natural protected area. Source: authors.

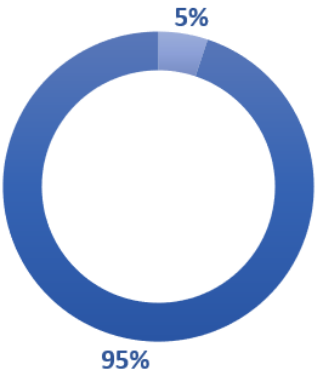

Figure 8: A percentage of approximately 5% of the built area of urban localities in Romania overlaps with at least one natural protected area. Source: authors.

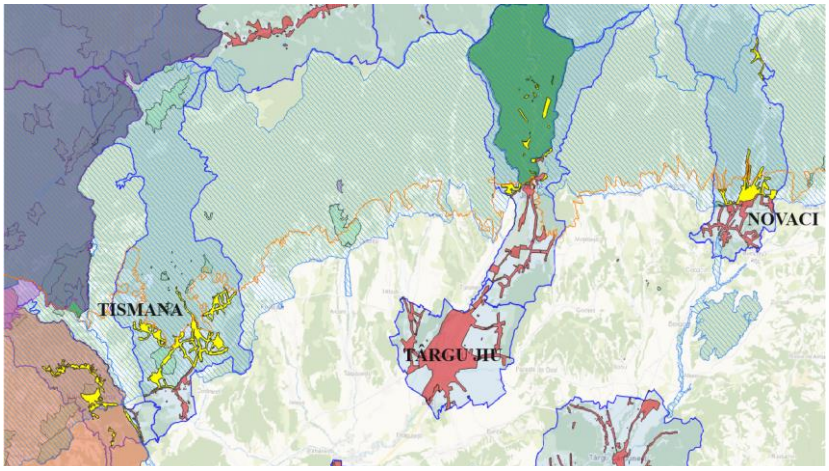

Figure 10: Areas located at the overlapped area between built areas and natural protected areas (regardless of category) - represented on the map in yellow. Source: authors.

5. Conclusions

In the process of territorial, urban and landscape planning, urban data plays one of the most important roles, representing the basic elements for identifying the current situation on the ground, but also the support for strategies, regulations and smart decisions, as well as in the management of

natural protected areas (Gârjoabă et al., 2020). The accentuated and constant development of the technology has made the accumulation of diverse, specific and valuable data and, perhaps most importantly, their provision to the general public possible. In the process of education, and especially in the field of landscape planning, urbanism and landscaping, access to data can critically influence the possibility of a feasible project and, therefore, the degree of subsequent adaptability of the student in the field, after the completion of studies. It is important that with the understanding of the constant growth and change of cities, the means and methods of observation also change (Sanchez, 2021).

Through the support platform whose way of structuring was presented in the paper, the aim is to capitalize on the data available to the general public and manipulate them in a form of developing the good of the community and quality of life, so as to support the urban planning process in the direction of adopting environmentally friendly means and the conservation, revitalization and renaturation of the landscape heritage.

The main objective analyzed, the natural protected areas in the urban environment, is a sensitive subject at national level. There is currently no legislative basis to support the conservation of these areas, so they are subject to the same regulations as any other natural protected area or being exposed to the existing legislative void, which often falls exclusively under the general urban regulations of within the built-up areas of the localities.

Through the application, areas with a high potential for vulnerability to urban pressures were identified, specific landscapes that could even become an asset in the local strategy, as "message-attitude" and "product-engine" of local and territorial development (Crăciun, 2014). A more complex support platform could be achieved by adding as many layers as possible, which are currently not available to the general public. Other valuable layers for the planning process could include valuable objectives from the point of view of the built landscape heritage, areas characterized by natural risks (flooded areas, high risk areas for landslides), functional zoning of land, green infrastructure systems, green-blue or green-yellow-blue etc.

A support platform to help the planning process could considerably facilitate the actions of obtaining the respective data from public institutions and would offer the opportunity to have all these overlapping data available, so that a more accurate and exhaustive diagnosis of the analyzed area can be made. This could be an integrated and coherent smart way to structure and initiate the strategy and regulation of a territory, a landscape, a locality or a cluster of localities, integrating natural protected areas and valuable landscapes seen as a "vector" for the development and preservation of the

identity and particularity of a place and the memory of the place associated with it (genius loci).

This study aimed to highlight important issues at the national level to support the work of urban planners. Information is currently one of the most valuable resources, and planners' access to information directly influences the territory under regulation. However, information can be useless if it is not understood, and overlapping data and relating it can be a difficult process. Access to information during studies is important for the training of professionals, but the acquisition of knowledge to extract, understand and relate relevant data is crucial.

Considering the proposed solution represented by the support platform, this study can be useful for any country, being even recommended the realization of such a platform that would include as much data for as many levels of analysis as possible. An exhaustive urban planning process depends on the availability of data, and their overlap can provide a specific and integrated diagnosis of the targeted territory. It is also recommended to plan the landscape as a whole - at the level of the integrated landscape, by taking into account its characteristics in terms of natural landscape, built landscape, and last but not least the cultural landscape, which has the role to render the identity of the place. Therefore, it is recommended to summarize as much data as possible and make them available to the public in order to be able to understand as comprehensively as possible the existing situation and, implicitly, to be able to subsequently regulate the targeted area as adequately as possible. The publication of the data as soon as possible will facilitate the training process of the students and, implicitly, the level of training of the future specialists in urban planning.

6. Study challenges and limitations

One of the main challenges of the study was to obtain data for the simulation of the support platform. Although there is data available online, it is not spatialized and it is accessible through several web pages. Data overlapping also required a software with the help of which they can be spatialized, so to get an idea of the current situation on the ground, it is necessary to go through a time-consuming process that could be avoided by making the data available to the public through an interactive map.

Data availability was also the main limitation of the study. As can be seen from the analysis of the spatial ratio between natural protected areas and urban areas (Table 1), no exhaustive results could be obtained, as there are not enough data available for some types of natural protected areas.

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