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Integration of Instruments for the Protection of Natural Protected Areas in Urban and Biodiversity Strategies and in Urban Planning Regulations

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Abstract

Approximately 75% of the urban settlements in Romania are superimposed or are tangent to at least one natural protected area, these not being integrated from the point of view of their regulation in the urban strategies and in the urban planning regulations. From a spatial point of view, this type of relationship often represents a contrast between the urban fabric and the quasi-natural fabric. However, in the regulatory or strategy instruments for the development of urban settlements, where such contrasts exist, they are only integrated at the border level. The ecotone is, in most cases, the only element mentioned in urban planning instruments and is approached as a land that can only function in isolation and that in no way can support urban development. This reluctance and fear of approaching natural protected areas, also negatively influences the conception of the community, investors and the administration. Urban actors are not informed and therefore not motivated, but neither do they have the opportunity to get involved in the conservation and protection process. The purpose of this article is to research urban and biodiversity strategies at E.U level, to identify gaps in the formulation of urban planning tools, what are the reasons behind generating these gaps and how they can be eliminated, or at least mitigated. The analysis will focus on some models of urban strategies which address natural protected areas, but will also consider related elements, directly related to their conservation, urban ecology and the involvement in the process of urban actors.

Keywords: *Natural protected areas; urban planning tools; spatial relationship; ecotone; urban fabric.*

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1. Introduction

The subject of urban nature is becoming more and more debated with the continuous growth of cities. The threat of nature in cities is a topical issue, but it is certainly not a problem that has been identified in recent times. In Berlin, the presence of native plants in the city has been considered an important resource and carefully analyzed by botanists since 1970 (Tertilt, 2010). *It is generally assumed that cities and biodiversity are incompatible, but the fact is that many cities have great species richness* (Secretariat of the Convention on Biological Diversity according to Smith et al., 2018). Today, when about 80% of Europeans live in urban areas (Sundseth & Raeymaekers, 2006), the *first hand experience with wilderness has been replaced by experiences with urban nature* (Miller, 2005), so the current approach to the natural elements present in cities will influence or even shape the approach of future generations.

I. L. Caragiale, one of the most famous Romanian writers, noted in one of his works - *Maybe our children may have their reason to cry – we've laughed enough* (2008). Although this was probably not the intention, his words capture the risk to which our descendants are exposed if we fail to adopt and respect, together, a strategy for the protection of nature, in all its forms. There is currently no such universally valid strategy. *Currently, cities are also allowed some freedom in choosing which indicators to apply and how* (Davis et al., 2015). These indicators may vary from case to case, depending on data availability and the specifics of each area, but an important issue that has been addressed in most tools aimed at protecting nature in urban areas and beyond, is informing and involving the public - the most important actor in this process (Nilon et al., 2017). *With the community, the environmental education work will allow the information exchange similar to the observed between the public and private sectors. (...) the public power will publicize the project as well as indicate to the population that its participation is fundamental for success* (Smith et al., 2018) and *crucial for achieving the sustainable development of the area* (Petrișor et al., 2016). Public participation can also work in the opposite direction, by identifying the effects which its approach has on urban ecology – *there is an urgent need to identify important variables (environmental, social) and their respective effect sizes, which shape biodiversity within urban areas* (Brunzel et al. according to Sattler, 2009).

The phrase "urban biodiversity" is sometimes approached as an oxymoron, the two terms being considered to be totally opposed or incompatible, but *cities are connected to larger ecosystems and don't exist in isolation. Beneath the steel and concrete of cities are the soil and waterways that are connected to the areas outside city boundaries* (ICLEI, 2010). On the first impression/analysis of the nature's presence in European cities, the existence of urban biodiversity

cannot be denied - *there are 11,000 Natura 2000 sites within, or partly within cities, representing 15% of the total area of the Natura 2000 network* (European Commission, 2020). The larger the cities, the more difficult the relationship with the natural environment can be to understand or manage it, but this relationship exists. *The human settlements, which developed as size and complexity in time, are not just important forms of human coexistence, but also important forms of the relations between man and the environment* (Onete & Ion, 2008).

Although there is a large number of natural protected sites in urban areas, their status is uncertain in urban planning, and the relationship between the two types of tissues is neglected - *Urban protected areas are thus often referred to as "protected islands" which are isolated* (Iojă & Breuste, 2020). Therefore, although the protection of these areas is regulated by law, in reality it is necessary to integrate them into green infrastructure networks and ecological networks at macro-territorial level, and the creation of such systems, especially in the case of urban settlements, is possible through urban planning.

Natural protected areas, together with green spaces, the landscape of the anthropized natural environment of cities and the built urban-architectural framework, participate in maintaining a healthy urban metabolism and a metabolic effect (Crăciun, 2008, p. 80) with a therapeutic effect, bringing an increase in quality of life and eliminating some of pollution problems and extreme weather effects which contemporary cities are currently facing. The urban metabolic phenomenon represents *the external manifestation of the urban metabolic reality, of the essence of the metabolic process, accessible and perceptible; it is at the same time a process of the natural and/or anthropic framework, of man/communities/society, event and real fact, in correlation with the essence of the city, showing the interior/exterior aspect in which the essence of things/components and processes is manifested, perceived directly by the sensory organs; it can also be a set of characteristics of the urban organism that can change within certain specific limits, without the city changing or any other urban aspect in motion, temporal, perceptible through the senses* (Crăciun, 2008).

2. Materials methods

The study began with the identification of the cities in Europe for which biodiversity conservation strategies have been developed. Only the capital cities were selected for analysis, due to their characteristic dynamism and, therefore, the difficulty involved in trying to protect the quasi-natural heritage. In order to be able to analyze how the components of the quasi-natural system are treated in cities for which no such strategies have been

developed, other capital cities have been added, for which any other planning tools have been detailed with reference to green spaces, natural protected areas or to ecological networks within cities. In the process of selecting the case studies, the spatial relationships between the urban fabric and natural protected areas were taken into account, so that they differ from one case to another.

In order to avoid possible inconsistencies in the classification of natural protected areas and to be able to find to a common factor, this analysis considers only cities spatially related to natural protected areas in the Natura 2000 Network. For choosing the case studies, the following criteria were analysed: the spatial relationship between the urban fabric of the city and the natural protected area (so as to be as diverse as possible), the type of planning tool that refers to natural heritage elements and the approach and formulation of the respective instrument.

3. Case studies

Starting from the planning tools listed above, after comparing them according to the analysis criteria, three case studies were selected, whose approach and way of relating and reporting to natural protected areas differ: Lisbon, Berlin and Amsterdam. For Lisbon and Berlin there were developed strategies dedicated to biodiversity conservation. For Amsterdam, the strategy for the city's green infrastructure was taken into account, being the main instrument for regulating quasi-natural areas. The three cities fall into three types of spatial relationship with the Natura 2000 network: Lisbon is in the vicinity of a Natura 2000 site, Amsterdam is tangent to such a site, and Berlin is surrounded by Natura 2000 sites, which are located in the vicinity, at the tangency or inside the administrative area of the city.

Lisbon is the only European capital located on the Atlantic coast. Its administrative area is tangent to the Tagus River, in the area where it flows into the ocean. As the presence of major natural elements suggests in its vicinity, Lisbon is located in a privileged area in terms of natural heritage and, therefore, also an area rich in natural protected areas. In its vicinity there are five Natura 2000 Sites (Figure 1), of which 3 are Sites of Community Importance (SCI) and two are Special Protection Areas for Birds (SPA). The closest to Lisbon are the SCI Site PTCON0009 "Estuario do Tejo" ("Tagus River Estuary") and the SPA Site PTZPE0010 of the same name. These two natural protected areas are tangent to the administrative area of Lisbon, in its northeastern part (Figure 2).

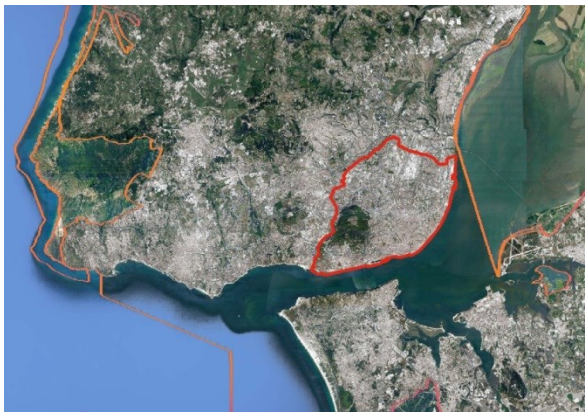

Figure 1. The city of Lisbon and the nearby Natura 2000 sites. Original image source: Google Earth. **Source of information:** https://natura2000.eea.europa.eu/. **Processing:** authors.

Figure 2. Spatial layout of Natura 2000 sites in relation to the urban fabric of Lisbon. **Source:** authors.

The main planning tool for quasi-natural spaces in Amsterdam is the Green Infrastructure Plan. Although Amsterdam is located in the vicinity of seven Natura 2000 Sites (Figure 3), to one of them being even tangent in the east (SPA Site NL9803029 - "Markermeer & Ijmeer", Figure 4), within the Green Infrastructure Strategy the Natura 2000 Sites are not taken into consideration.

Similarly to Lisbon, the city of Amsterdam is located in the vicinity of a major natural element - the North Sea, which could justify the presence of such a large number and such a large area of natural protected areas.

Figure 3. The city of Amsterdam and the Natura 2000 sites nearby or partially overlapping with the urban area. Original image source: Google Earth. **Source of information:** https://natura2000.eea.europa.eu/. **Processing:** authors.

Figure 4. Spatial layout of Natura 2000 sites in relation to the urban fabric of Amsterdam. **Source:** authors.

Similar to the Lisbon Biodiversity Strategy, Berlin's Biodiversity Strategy was developed simultaneously and related to the "UN Decade of Biodiversity". The administrative area of Berlin overlaps (totally or partially) with 20 Natura 2000 sites, being to some extent surrounded by them (Figure 5, Figure 6).

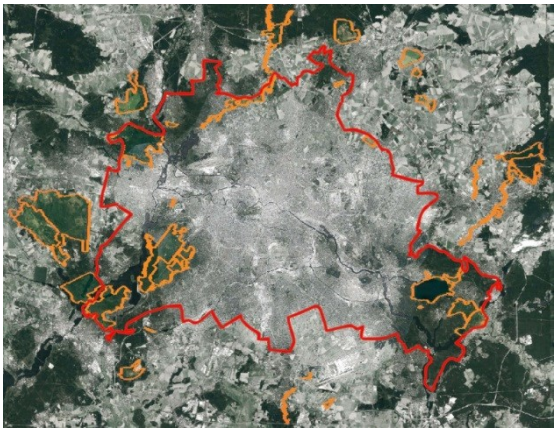

Figure 5. The city of Berlin and Natura 2000 sites nearby or partially overlapping the urban area. Original image source: Google Earth. **Source of information:** https://natura2000.eea.europa.eu/. **Processing:** authors.

Figure 6. Spatial layout of Natura 2000 sites in relation to the urban fabric of Berlin. **Source:** authors.

4. Results and discussions. Comparison of selected strategies

4.1. "Biodiversity in the city of Lisbon - a strategy for 2020"

The Lisbon Biodiversity Strategy was chosen as a case study for the results it generated, although the time horizon for its implementation ended with the "UN Decade on Biodiversity", in 2020. The Lisbon Biodiversity Strategy was developed in connection with the United Nations goal for the "UN Decade on Biodiversity". The final year of the strategy's implementation period was a successful year in terms of methods approaching environmental protection for Lisbon. The city of Lisbon won the European Green Capital Award in 2020.

The urban planning of Lisbon is regulated by the General Municipal Plan, which establishes the functional areas, building density and non-building areas. On 5 September 2020, the updated form of this plan was adopted, which has undergone significant changes in the approach to environmental protection. Article 82, paragraph 1 refers to the types of actions that can be financially supported from the municipal urbanization fund. Among these actions, the amendment of the Plan also added the increasing of ecosystem sustainability and importance of ecosystem services supply.

Lisbon City Hall is directly involved in promoting the conservation of urban biodiversity through environmental educational activities, by carrying out control actions (related to invasive insects, pigeons or rats), registering the number of dogs and cats and even by setting up a recovery center for wild animals.

Another regulatory instrument through which biodiversity protection measures are adopted is the Spatial Planning Tool for the Lisbon metropolitan area. It establishes a hierarchical ecological structure through which the national network of natural protected areas (Figure 7) connects with the metropolitan area of Lisbon through green corridors and with the municipal ecological network (Figure 8).

Lisbon's biodiversity conservation strategy emphasizes the importance of ecosystem services from the outset, noting that the well-being of the urban population is directly and indirectly influenced by the state of biodiversity within and around the city. The strategy mentions the types of identified ecosystem services, from food to seed dispersal, climate regulation and water purification.

The strategy approach starts with the spatial mapping of Lisbon areas, taking into account the following criteria: areas with a certain protection status, types of green spaces, density/ presence of trees, the

permeable area of the city and the naturalness of ecosystems. The EUNIS (European Nature Information System) classification was taken into account in the action sorting the ecotopes, but new ecotopes were defined, specific to local characteristics (Figure 9).

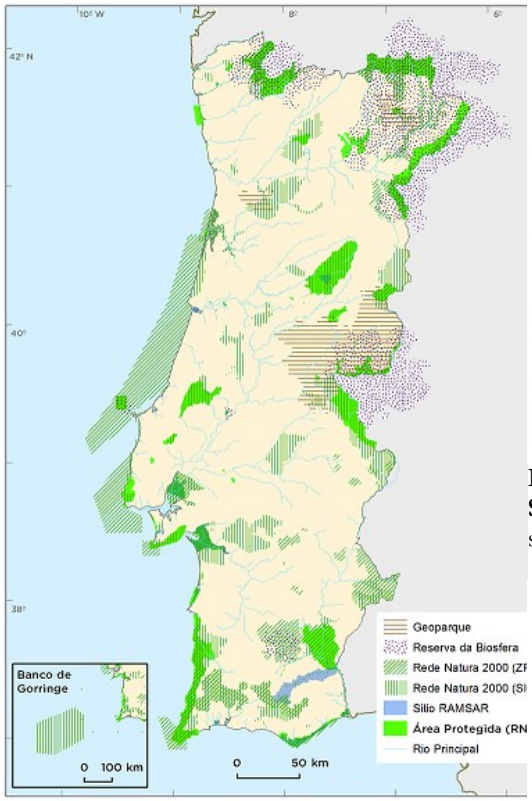

Figure 7. The national system of natural protected areas in Portugal. **Available at:** https://rea.apambiente.pt/content/sistema-nacional-de-%C3%A1reas-classificadas. Accessed on 25.04.2021.

Figure 8. Municipal ecological network. **Source:** Biodiversity in Lisbon - a strategy for 2020, p. 32

Figure 9. Types of ecotopes identified in Lisbon. **Source:** Biodiversity in Lisbon - a strategy for 2020, p. 48

Being the spaces closest to the characteristics of a natural area (although they are entirely artificial), the strategy provides a detailed picture of green. At the same time and in connection with this analysis, a detailed analysis of the soil was prepared. Green spaces were divided into two

categories: natural (this category also included spontaneous green spaces in abandoned areas) and semi-natural (small green spaces) - Figure 10. The analyses presented throughout the strategy are complex and touch on topics such as: location of areas lacking green spaces (Figure 11), identification and location of allogeneic and invasive plant species (Figure 12), location of public green spaces, population density, location of trees and shrubs and location of permeable spaces.

Figure 10. Classification of natural or semi-natural areas in Lisbon.

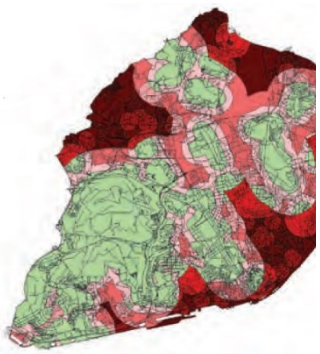

Figure 11. Areas lacking green spaces.

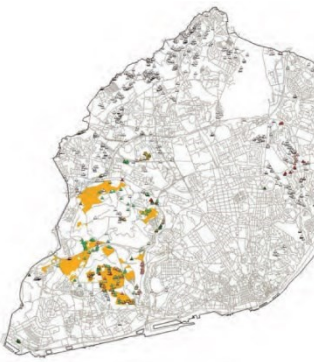

Figure 12. Mapping and locating allogeneic and invasive plant species.

Source: Biodiversity in Lisbon - a strategy for 2020, pp. 39, 59, 42.

Although the strategy includes a multitude of analyses and proposals, there are currently not enough data on the city's flora, fauna or biotope. The analyzes were prepared on the basis of studies or partial official information. The reason why a biodiversity strategy cannot be drawn up with very clear measures is the lack of a comprehensive biodiversity monitoring program (the only area of the city monitored since 2013 is the seafront area).

4.2. "Amsterdam's Green Infrastructure. Valuing Nature's Contributions to People"

The time horizon of the Green Infrastructure Strategy is 2040 and is based on the following objectives: increasing the attractiveness and quality of public spaces, increasing the value of the benefits offered by natural capital and reducing Amsterdam's contribution to climate change. To achieve these objectives, five scenarios/strategies were defined: the Bussiness-As-Usual scenario (/ if not scenario) only took into account population growth and the expansion of residential areas (unlike the other scenarios, the time horizon is 2025); the "Green Neighborhoods" scenario (Figure 13) focuses on growing green spaces in areas where there is little green space; the

"Green Network" scenario (Figure 14) supports completing the green corridors that make the connection between the green spaces of the city and also the consolidation of the ecological structure; the "Urban Parks" scenario (Figure 15) involves the expansion of existing urban parks and the creation of new parks; the "Metropolitan Landscape" scenario (Figure 16) involves "bringing" areas close to the city, valuable in terms of natural heritage, closer to the people of Amsterdam, by expanding pedestrian spaces and bike paths.

Although the last scenario, the "Metropolitan Landscape" considers a larger study area, which partially overlaps with the Natura 2000 SPA site NL9803029 - "Markermeer & Ijmeer", it does not address in any way the natural protected area. The boundary of the Natura 2000 site is missing from the scenario plan? (Figure 18), and in the written part of the Green Infrastructure Strategy, the presence of the area in the immediate vicinity of the city is not mentioned.

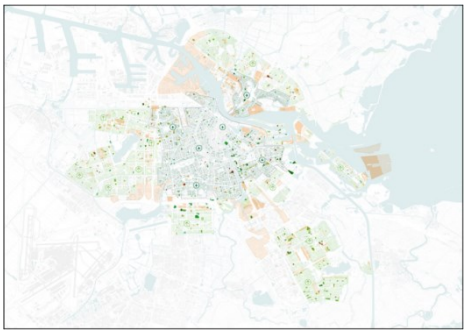

Figure 13. "Green Neighbourhoods" scenario.

Figure 14."Green Network" scenario.

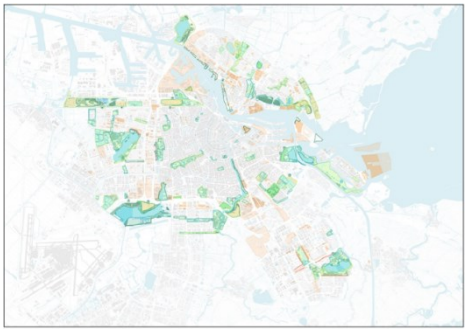

Figure 15. "Urban Parks" scenario.

Figure 16. "Metropolitan Landscape" scenario.

Source: Amsterdam's Green Infrastructure. Valuing Nature's Contributions to People, p. 18, 20.

For the analysis of the potential effects generated by the five scenarios, a series of indicators were taken into account, such as: physical

activity, real estate value, water storage or the effect of heat islands. The plans of these analyses, related to the application of a series of formulas and data tables, have the potential to be incorporated in maps showing ecosystem services and thus can highlight the causes that reduce the quality or quantity of ecosystem services in a particular area of the city.

As a first phase, the analyses were performed for the "Business-As-Usual" scenario. Based on these analyses, it was then possible to make a comparison between the effects of the "Business-As-Usual" scenario and the four scenarios for which changes are proposed for the green space infrastructure. In this way, major differences were identified, especially in the case of the "Green Network" and "Green Neighborhoods" scenarios. For example, for the analysis of physical activity by area, the indicator expressing the time spent on the bicycle to/from work was used. As might be expected, the most obvious changes were noted when applying the "Green Network" scenario (Figure 17, Figure 18). When applying the "Green Neighborhood" scenario, there were major increases in the value of health services due to urban ecology (Figure 19, Figure 20).

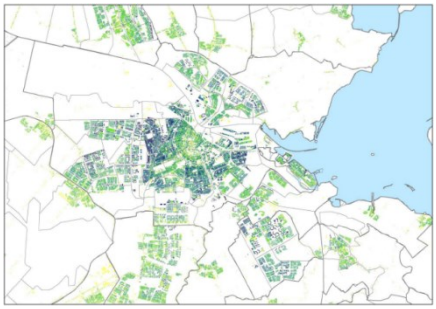

Figure 17. Physical activity (time spent cycling to/ from work) - Business-As-Usual Scenario (BAU)

Figure 18. Physical activity (time spent cycling to/ from work) - Green Network scenario

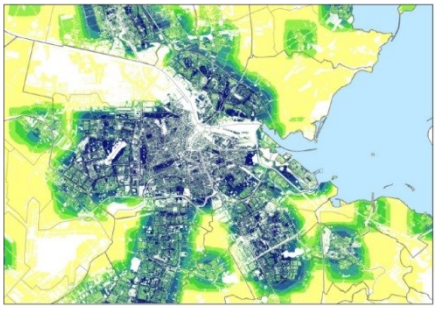

Figure 19. Health - value of health services due to urban ecology (euro / year) - Business-As-Usual Scenario (BAU)

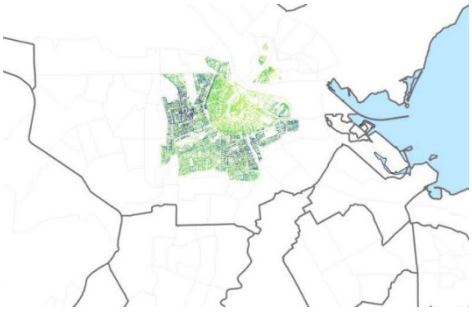

Figure 20. Health - value of health services due to urban ecology (euro/ year) - Green Neighborhoods Scenario

Source: Amsterdam's Green Infrastructure. Valuing Nature's Contributions to People, p. 33, 34, 39, 41.

However, although for the "Metropolitan Landscape" scenario, major increases in indicators measuring visits to recreation areas and cycling were identified, in the written part of the strategy, the benefits of applying this scenario were not located in space, as in the case of the other similar instruments. Being the only one of the five scenarios that partially overlaps with the Natura 2000 site, the mapping of the benefits brought by its implementation could have highlighted the value and potential of the natural capital of the area. Being a special protection area, the natural protected site and the areas in the immediate vicinity have the potential to attract many visitors, thus increasing the values of the indicators related to recreation and health.

As the main green space planning tool in the city of Amsterdam, its green infrastructure strategy has the potential to highlight the value of natural protected areas in the vicinity of the city and, in particular, the Natura 2000 SPA site NL9803029 - "Markermeer & Ijmeer", which is

tangent to the city. At the same time, given the characteristic valuable natural heritage of these areas, they can become true poles of attraction. Such an approach would have been possible in the case of the last scenario - "Metropolitan Landscape". However, the strategy did not mention the presence of natural protected areas and did not present the results of the analyses.

4.3. Berlin's biodiversity strategy

Taking into account the large administrative area of Berlin (approximately 890 square kilometers), managing the situation of urban biodiversity, conserving and even analyzing it, are all the more difficult. In this strategy, biodiversity is understood in a very complex way and is perceived under different ways, ranging from the diversity of genes and species, to the diversity of habitats and the diversity of the landscape, even reaching the subject of the urban cultural landscape. This justifies the division of the strategy into four major thematic areas: "species and habitats", "genetic diversity", "urban diversity" and "society". Each of these thematic areas includes different analysis levels. A total of 33 such levels are described, such as: "habitats", "protected biotopes", "research", "social commitment" etc. Although the strategy details so many and diverse categories, the information is not spatialized - the strategy includes only text and photos.

Still, on the Berlin's city website there is a section dedicated to spatialized information, in the form of an interactive map, created at the government's initiative with the aim of providing transparent data. Environmental information comes mainly from the specialized departments of the public administration of the environment, transport and climate protection. Among the information presented on the website, there is valuable data on environmental elements, some of which are presented from several perspectives. For example, information on green spaces includes: green spaces, height of vegetation (Figure 21), volume of green space per urban island (Figure 22), green roofs, types of vegetation. Separately, there is a plan with the types of biotopes (Figure 23), one with the biotopes protected by law (Figure 24), a plan with urban climate zones (depending on the specific temperatures of each area of the city) and a plan with the risks of groundwater pollution.

Figure 21. Height of buildings and vegetation.

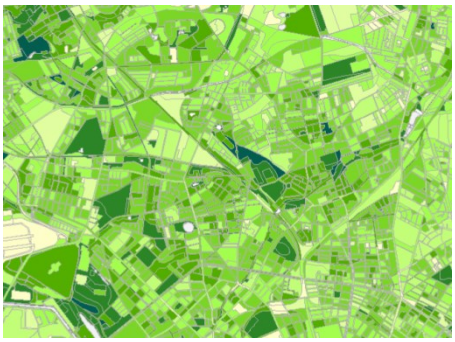

Figure 22. Volume of green space (calculated in m^3 / m^2)

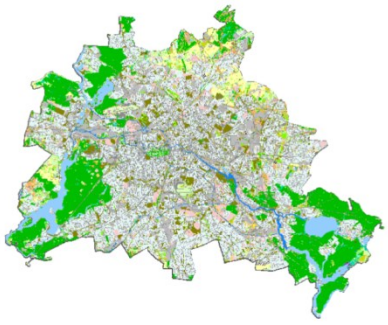

Figure 23. Types of biotopes.

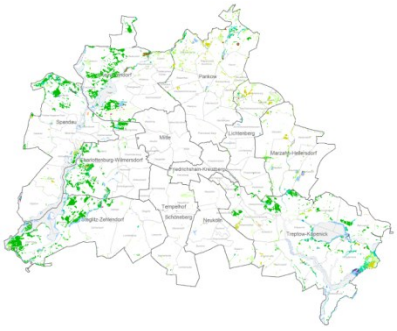

Figure 24. Biotopes protected by law.

Source: https://fbinter.stadt-berlin.de/fb/index.jsp?Szenario=fb_en

A map of Berlin's natural protected areas is also available on the website (Figure 25). In addition to the Natura 2000 sites taken into account for this study, seven other types of natural protected areas are marked on the same map: nature reserve, landscape conservation area, protected landscape area, natural monument, nature park, area with special regulation in the particular Conservation District Directive, provisional safeguarded area.

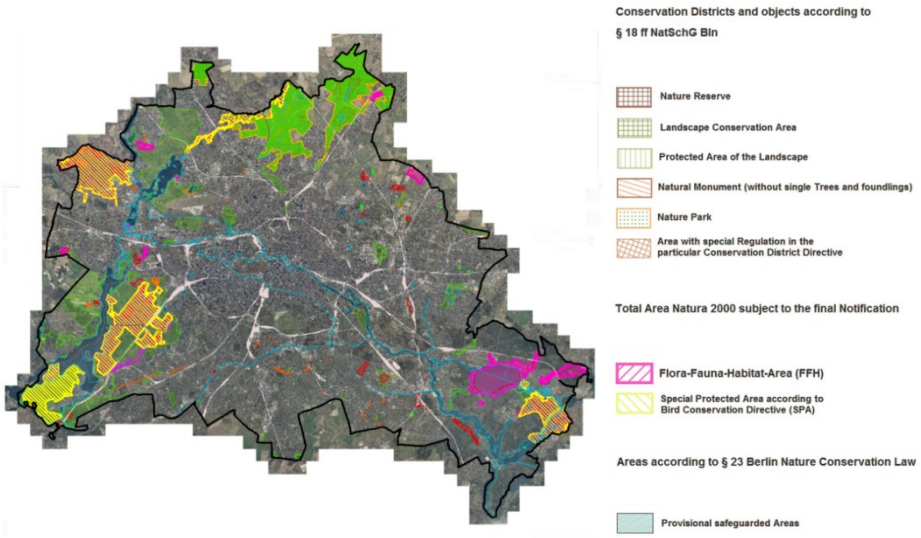

Figure 25. Urban Natural Protected Areas.
Source: https://fbinter.stadt-berlin.de/fb/index.jsp?Szenario=fb_en

Overall, there are about 205 such interactive maps that provide valuable information. The overlapping of these data, especially those related to green spaces and urban natural protected areas and their interpretation by the appropriate specialists, can be the basis of a complex urban planning strategy in accordance with the natural heritage of the city. Although at first glance, judging by the content of the biodiversity conservation strategy, the spatialization of the described measures seems difficult, in reality Berlin has a valuable and complex official information base, which together with planning tools have the potential to produce significant positive effects related to the three types of landscapes approached by the strategy - anthropic, quasi-natural and cultural.

5. Conclusions

The freedom to choose the tools for managing the conservation of urban biodiversity and for planning the quasi-natural system inside the city, whether it refers to natural protected areas or green spaces, has created the possibility to draw up plans adapted to the characteristics of the target area. Thus, as it appears from the analysis of the three case studies, different tools resulted, both in terms of their structure and approach, but also of the objectives they pursue.

Within the Natura 2000 network, from a spatial point of view, cities are located nearby (Lisbon), tangentially (Amsterdam) or in a mixed way

(Berlin) in relation to the urban fabric of the city. However, not all selected planning tools refer to Natura 2000 sites.

The Lisbon Biodiversity Strategy mentions the national network of natural protected areas, but the protected site in the immediate vicinity is not included in the analysis and proposals of the strategy. The reason could be the location of the site in another administrative area, but although the strategy is strictly addressed to the city of Lisbon, to create a network that would link quasi-natural spaces, it will be necessary to develop planning tools on a much larger scale than the city scale. The city of Lisbon could even be crossed by corridors linking natural protected areas, given that there are Natura 2000 sites in both the eastern and western parts of the city.

The city of Amsterdam, on the other hand, although tangent to a Natura 2000 site, does not have a biodiversity conservation strategy. The planning tool considered for the study is the green infrastructure strategy. As in the case of Lisbon, this instrument does not mention the presence of the Natura 2000 site tangent to the administrative border of the city. The strategy proposes five scenarios, one of them extending beyond the city limits, to the landscapes in its vicinity. In a possible corroboration of the benefits that each scenario could bring, the Natura 2000 site tangent to the city can become a real attraction within the green space system and a starting point for a strategy for conserving the city's biodiversity.

Compared to Lisbon and Amsterdam, Berlin has a much more spatially complex relationship with the Natura 2000 network. Although there is a biodiversity conservation strategy developed for the city of Berlin, the written proposals are not spatialized, but Berlin does not lack information from this point of view. The website where official information is available is a source of information that in the future can be the basis of a complex strategy, which can work in relation to the written text of the strategy. For example, one of the objectives of Berlin's biodiversity strategy emphasizes the importance of conserving its habitats, especially those in Natura 2000 sites. In addition to this objective, the protected habitats plan in Berlin can be accessed from the database available online.

Both positive and negative aspects and multiple and different approaches have been identified in the analyzed planning tools, but each of them neglects the importance of natural protected areas. In the first two examples, Natura 2000 sites are not mentioned, and in the case of Berlin, although they are mentioned, the text of the strategy does not correlate with the database in which the information is spatialized. These sites have obtained protection status precisely because of their value in terms of biodiversity and can be interpreted as "cores" of biodiversity in strategies related to natural or quasi-natural heritage.

In order for natural protected areas to be integrated into green infrastructure systems, but also to be able to function within the urban fabric, it is necessary to formulate tools dedicated to these areas or to change the current approach in existing instruments. Moreover, the landscape of protected areas has an important role even in generating the identity of a place, within an urban metabolic process (Enache & Crăciun, 2013).

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