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Faculty of Environmental Sciences



DIPLOMA THESIS

CZECH UNIVERSITY OF LIFE SCIENCES, PRAGUE

Faculty of Environmental Sciences

Master academic studies

Department of Landscape and Urban Planning



DIPLOMA THESIS'S ASSIGNMENT

**Defining the character of the landscape as a basis for restoration
and management of the Botič River in Prague**

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CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Environmental Sciences

DIPLOMA THESIS ASSIGNMENT

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Landscape Engineering
Landscape Planning

Thesis title

Defining the character of the landscape as a basis for restoration and management of the Botič River in Prague

Objectives of thesis

This thesis aims to define the landscape character of the Botič River watershed in Prague and then to propose specific recommendations for restoration of key landscape components. Specifically, the main goal of this thesis is to define clear planning and design guidelines for landscape restoration (morphological – ecological and landscape – design rules) with the help of a comprehensive approach that integrates the physical aspect of the landscape, ie the structure of the landscape, and the non-physical aspect related to cultural constituents. Connecting the physical and non-physical elements of the landscape can serve as a starting point for further management and preservation of the value of the landscape, ie strengthening its character.

Methodology

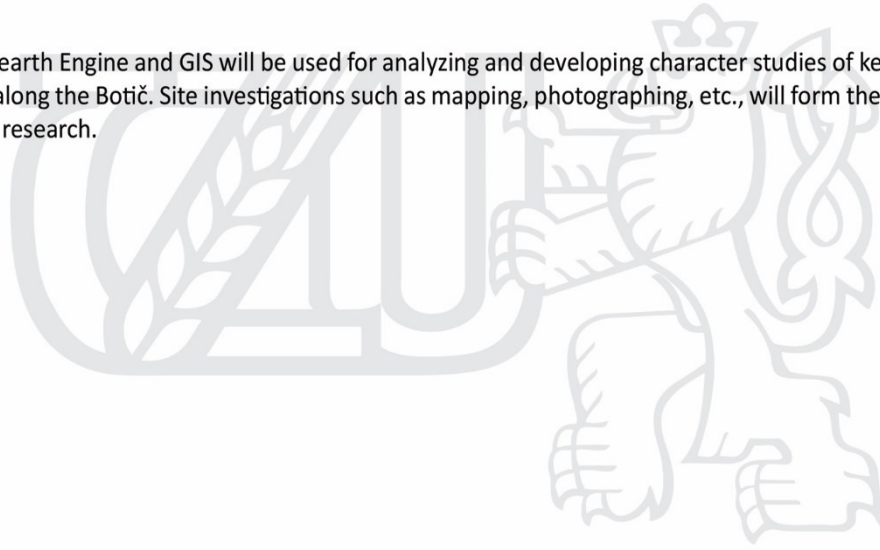
The initial hypothesis is based on the fact that spatial planning, which is regulated by the Law on Planning and Construction, is an area of social activity and responsibility in which it is possible to achieve the general goal of preserving and improving the character of the landscape as a carrier of spatial identity.

Based on the assessment of the sensitivity of the landscape, which arises from its established character and the present services of the space ecosystem, it would be possible to form rules of arrangement and construction.

In order to obtain only accurate information related to the historical and spatial development of the study area – the Botič River watershed – literal, graphic and other available data will be analyzed. In order to know a space, it is necessary to understand what it carries within itself, what is its "signature" that depicts its so-called spirit of the place. Exploring everything that happened in one space, and the way it evolved, is a step towards understanding the identity of the landscape. Therefore, monitoring and understanding the course of landscape development is necessary for this work.

The assumption is that the strengthening and preservation of the valuable character of the landscape of the researched area of the cultural landscape of the Botič river watershed, future restoration proposals can be achieved through holistic planning of the cultural landscape that integrates cultural services.

Google earth Engine and GIS will be used for analyzing and developing character studies of key urban park spaces along the Botič. Site investigations such as mapping, photographing, etc., will form the basis for the original research.



The proposed extent of the thesis

70 pages

Keywords

Watershed restoration, landscape character assessment, watershed preservation

Recommended information sources

- Ahern J. (1999): Spatial Concepts, Planning Strategies, and Future Scenarios: A Framework Method for Integrating Landscape Ecology and Landscape Planning, Springer
- Hiss, Tony. 1990. "The Experience of Place: A completely new way of looking at and dealing with our radically changing cities and countryside." Knopf: New York.
- Liu J., Opdam P. (2014): Valuing ecosystem services in community-based landscape planning: introducing a wellbeing-based approach, Landscape Ecol
- Plieninger T. et al. (2012): Assessing, mapping, and quantifying cultural ecosystem services at community level, Land Use Policy

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Author's declaration

I hereby declare that I have independently elaborated the diploma/final thesis with the topic of: **“Defining the character of the landscape as a basis for restoration and management of the Botič River in Prague”** and that I have cited all of the information sources that I used in the thesis as listed at the end of the thesis in the list of used information sources.

With my own signature, I also declare that the electronic version is identical to the printed version.

In Prague, on _____

Signature

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I would like to express my appreciation and give my warmest thanks to my supervisor, Professor Peter Kumble, Ph.D., Czech University of Natural Sciences in Prague, without whose help and support, completion of this study would have been impossible. I would like to express my deepest gratitude for the time, trust and help, suggestions, advice, and guidelines that he placed in drafting this master's thesis.

I am deeply grateful to my family, parents Dragan and Suzana, who gave me great support and love, who always had understanding and patience during my schooling, and my most wonderful sister Anastasija for her immense support and motivation.

I dedicate this thesis, as the crown of my schooling, to my grandmothers and grandfathers, Stojko and Ljeposava Elčić, Strahinja and Mira Dražić, who I know are very proud of me today.

Thank you!

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Abstract

This thesis, through a modern approach to landscape planning, explores and examines all the characteristics and values of the Botič stream in Prague, which flows along its south-western side and flows into the Vltava River. The desire to preserve a landscape that is under strong pressure from urbanization and globalization raises the question of understanding the multidisciplinary of landscapes in order to develop guidelines for its preservation and rules of management.

Through the established holistic approach in the assessment of the landscape, all the values of the researched area have been identified, its character and the structure as its integral part, later have resulted in defining the rules of its preservation and improvement. Thus, the method of characterization recognizes all those parts of the research area that differ from each other in the unique patterns of landscape/physical structure, that allows the separation of different landscape character types. Within the researched urban area three types of landscape character were singled out as a clear result of landscape transformation due to urbanization, while only one, the type of discontinuous urban tissue, where the Botič stream suffers the most, was selected for further steps of the thesis which represent the creation of its ID card. The ID card of the chosen landscape type, defined its structure, meaning, and changes observed through a retrospective method. The dynamics of development assumed further direction of development type, while the overall result, together with the results of the estimated vulnerability of the landscape, obtained by calculating the values of ecosystem services in the study area and its visual assessment, determined the rules divided into two big groups; morphological-ecological and landscape-design rules.

This way of research creates a comprehensive, integrated approach that seeks to preserve, improve and regenerate the landscape. While at the same time confirms the fact that landscapes, which are attractive, diverse, and of great public and social value, must be planned side by side with environmental, social, and economic aspects. Each step in the thesis forms a solid basis for further discussion, consideration, and interpretation of different variations that exist in the type or can be taken into account when applying the characterization method.

Key words: Urban Landscape, Landscape Character Assessment, Landscape Sensitivity Assessment, Ecosystem Services, Landscape Planning and Design Rules, Watershed restoration, Watershed preservation

Abstrakt

Tato diplomová práce zkoumá a prověřuje, prostřednictvím moderního přístupu ke krajinnému plánování, všechny charakteristiky a hodnoty potoka Botiče v Praze, který protéká po její jihozápadní straně a vlévá se do Vltavy. Touha zachovat krajinu, která je pod silným tlakem urbanizace a globalizace, vyvolává otázku porozumění multidisciplinarity krajin za účelem vytvoření pokynů pro její ochranu a pravidel managementu.

Skrze stanovený holistický přístup hodnocení krajiny byly identifikovány všechny hodnoty zkoumaného území, definováním charakteru a struktury krajiny jako její nedílné součásti, což vyústilo v definování pravidel její ochrany a zlepšování. Metoda charakterizace tedy rozpoznává všechny ty části zkoumaného území, které se od sebe liší specifickými vzory krajinné/fyzické struktury, což má za následek rozlišení typů krajinného rázu. V rámci zkoumaného intravilánu byly vyčleněny tři typy krajinného rázu jako jasný výsledek transformace krajiny v důsledku urbanizace, přičemž pouze jeden, typ nesouvislé městské zástavby, kde potok Botič trpí nejvíce, byl vybrán pro další kroky práce, které představují vytvoření jeho identifikační karty. Identifikační karta zvoleného typu definuje jeho strukturu, význam a změny sledované retrospektivní metodou. Dynamika rozvoje předpokládá další směřování typu zástavby, přičemž celkový výsledek spolu s výsledky odhadované zranitelnosti krajiny, získanými výpočtem hodnot ekosystémových služeb zkoumaného území a jeho vizuálním posouzením, určil pravidla rozdělená do dvou velkých skupin; morfologicko-ekologických a krajinnotvorných pravidel.

Tento způsob výzkumu vytváří komplexní, integrovaný přístup, který se snaží o zachování, zlepšení a regeneraci krajiny. Zároveň potvrzuje skutečnost, že krajiny, které jsou atraktivní, rozmanité a mají velkou veřejnou a společenskou hodnotu, musí být plánovány ruku v ruce s environmentálními, sociálními a ekonomickými aspekty. Každý krok této práce tvoří pevný základ pro další diskusi, úvahy a interpretace různých variací, které v daném typu existují nebo je lze vzít v úvahu při aplikaci metody charakterizace.

Klíčová slova: Městská krajina, Hodnocení krajinného charakteru, Hodnocení citlivosti krajiny, Ekosystémové služby, Pravidla plánování a navrhování krajiny, Obnova povodí, Ochrana povodí

Summary

The city is rightly marked as the cradle of civilization. Cities as well as people have their own destiny and their own biography. In some historical epochs, they flourished, while in others they decayed and disappeared. Regardless of the complex ecological conditions in which there is a modern city, its attractiveness does not diminish. Today, overcrowding and environmental pollution in large cities have reached critical proportions.

The research will consider the modern conceptualization of landscapes, all those characteristics of current approaches to defining and understanding the values of landscapes. Basic assessments of the character of the landscape help to understand the rough physical structure of the landscape, and play a significant role in informing and deciding on its management. The importance of the developed landscape identity of the landscape, which is based on respect and affirmation of natural and cultural values, as well as the role of the landscape in ensuring the quality of human life, will be emphasized. Defining the character of the landscape will result in the formation of rules of arrangement whose focus will be on emphasizing the values that the researched area carries, and thus restoring the "neglected" area of the city.

The very word renewal means that something that was once lost, forgotten, or replaced, is now found, rearranged, and renewed. But it also means taking control. On the one hand, optimism and hope are associated with the re-emergence of "cultural treasure", with a view to a new, stimulating perspective. On the other hand, renewal implies a dose of sentimentality (nostalgia) and power (possession), which are inextricably linked to the landscape. According to the famous professor John Barrel, this represents the "*dark sides*" of the landscape.

In order to strengthen the stability of the landscape, with the aim of achieving measurable sustainable spatial development, it is necessary to establish a relationship between the interaction of natural and human factors that act in that area. This is achieved through the study and identification of landscape character, by considering the horizontal and vertical structure of the landscape. The characterization recognizes the identity of the landscape in accordance with local conditions, spatial, ambient, and form characteristics that provide a basis for impact assessment, and a basis for determining spatial development strategies. The result is the protection of the structure of the landscape and the smooth functioning of natural processes, with the protection of biodiversity, as well as the preservation of inherited values and the establishment of new rules of arrangement (management).

1. Introduction

As each landscape has its "history" of the way it was used and the natural processes that took place in it, it is seen as relatively constant or susceptible to sudden changes. It is generally known that landscapes are constantly active spaces that undergo various changes over time. Therefore, the changes that are happening in every region are not a new phenomenon, but the intensity with which they are increasing today leads to the unpredictability of the outcome of these processes. Today, due to the consequences of intensive urbanization and globalization, there are increasing changes in the structure of the landscape, which threatens the creation of a homogeneous structure and permanent erasure of the identity of the place.

Antrop (2004a) defines urbanization as *“a complex process that transforms the rural or natural landscapes into urban and industrial ones forming star-shaped spatial patterns controlled by the physical conditions of the site and its accessibility by transportation routes”*.

The sense of connection, belonging and emotional security that landscapes bring with them is the starting point for all activities of the individual and the society to which he belongs. Actions that result from people's desire to adapt landscapes to their living needs change its unique characteristics, which later lead to the creation of a lower quality living space with which a person could not achieve multiple interactions that contribute to his well-being. As a result, extremely valuable landscapes that have developed over the centuries are gradually disappearing or being transformed. Due to the above, it is necessary to emphasize all the values that the character of the landscape brings with it in order to avoid its neglect and destruction.

The practice of planning today must focus on all the values that the landscape carries within itself and create a holistic approach that will create a balance between the two sides. Because different ethno-cultural groups place different value structures upon the landscape, one of the ways to achieve this goal is to study the concept of urban landscapes. If the existence of a valuable urban landscape with a strong character is recognized in a certain area, the services it provides to people will be more pronounced, and the user's interaction with such a space will be greater, not only in terms of use but also in the context of its improvement and preservation.

By analyzing the landscape elements of the vertical and horizontal structure of the landscape, and integrating ecosystem services into modern planning processes concerning the characterization of the landscape, a new concept of understanding the landscape is formed. This analysis justifies the understanding of the re-creation of a stable landscape through the newly formed rules of arrangement. The value of the landscape is also seen from the aspect of cultural heritage. Understanding landscape planning and management ensure a more harmonious connection between man and nature, for the benefit of both. Observing urban landscapes through the lens of cultural services of ecosystems is one of the approaches that put in the first place the benefits that man has from his environment. As we ourselves are witnessing a growing population, the anthropocentric approach has been accepted in advance as the easiest way to bring people closer to the values of urban landscapes in order to protect them.

Characterization of landscapes as a method also means integration. This way of landscape research provides an integrated approach in preserving, improving, and regenerating landscapes that are attractive, diverse, and of great public, social value,

which also shows that the environmental, social, and economic aspects of planning must be harmonized. Characterization defines parts of the landscape with rare or unique patterns of landscape and physical structure. It results in ensuring the protection of the landscape structure and the smooth functioning of natural processes, with the protection of biodiversity, as well as the preservation of landscape values and the establishment of new rules of regulation.

The focus of this work is the basin of the Botič watershed in Prague. The stream flows on the east side of the capital and ends in the Vltava River. The course of the river itself can be seen as one of the axes of the direction of development of the city, which greatly increases the importance of this landscape element located in the heart of Europe. Driven by the desire to emphasize the importance, character, and all the values that one of the longest streams in Prague carries, the focus of the work will be on defining the character of the landscape that will result in creating an orderly, functional, and pleasant landscape, with abundant recognizable landscape and urban structures.

1.1. Subject of thesis

The subject of the master's thesis is the arrangement of the Botič stream basin zone in Prague. The problem of the devastation of certain parts (neglect of green areas, present equipment, and contents), led to the loss of attractiveness and significantly reduced the level of user safety.

Starting from the fact that this space offers great potential and should be included in the system of green areas of the city, in this thesis, rules of landscape management will be defined, in a way that would provide enough space for recreation and "scenic areas" available to all visitors. Stage areas are those spaces that represent *the stage*, which means that they are in a good place, and have good views, which reflects their quality.

The thesis will explore the character of the urban landscape of the researched area, whose values are observed through the aspect of services it provides. The interpretation of ecosystem services and the assessment of the sensitivity of the character of the landscape will define clear planning and design guidelines for landscape restoration (morphological-ecological and landscape-design rules).

In the context of the research of the basic subject, the thesis will consider the broader context of the location, which has a direct impact on the "restoration of identity" space.

The task of the work arose from the need to improve the functionality of the space and the necessity of planning and exploiting the potential of the "landscape image" that this location carries.

1.2. Aims of thesis

The aim of the thesis is to integrate the researched area of the Botič streamflow with its form and contents, both in the immediate surroundings and the city as a whole. By defining clear guidelines and rules for landscape management, with the help of a comprehensive approach that integrates the physical aspect of the landscape, i.e. the structure of the landscape, and the non-physical aspect related to cultural constituents.

Connecting the physical and non-physical elements of the landscape can serve as a starting point for further management and preservation of the value of the landscape, i.e. strengthening its character.

Achieving this goal creates a basis for the results of work to be used in the future design of space on different scales, as well as to bring existing values closer to the local population.

1.3. Starting hypotheses

Starting from the fact that stable and quality landscapes are the basis, but also an indicator of sustainable spatial development, this thesis will attest hypothesis that, based on the established character of the landscape, it is possible to form land use regulatory guidance, which realization would allow ample use of the total potential of the landscape. This is based on the fact that spatial planning, which is regulated by the Law on Planning and Construction, is an area of social activity and responsibility in which it is possible to achieve the general goal of preserving and improving the character of the landscape as a carrier of spatial identity.

The assumption is also that by strengthening and preserving the valuable character of the landscape of the researched area, holistic planning of the urban landscape that integrates cultural services can be achieved.

2. Literature Review

2.1. Review of previous research - General considerations

At the beginning, within the framework of theoretical foundations, it is necessary to define the modern meaning of the concept of landscape architecture, and its broad definitions, applications, and approaches, and to clarify its place within other spatial disciplines. The activity of the profession has changed and expanded throughout history, following social and economic changes and, in connection with that, changes in the state of the environment.

The European Landscape Convention (Council of Europe, 2000) defines the concept of landscape as *"Part of the land, as perceived by local people or visitors, which evolves through time as a result of being acted upon by natural forces and human beings"*, where the landscape becomes a key element the quality of individual and social well-being, and its protection and planning, the rights, and responsibilities of all.

The landscape reflects the relationship between people and places and has a big role in shaping our daily lives. It is a product of the interaction of natural and cultural components of our environment, and how it is understood and felt by users. Respect for and understanding the term *"landscape"* has grown over time. Recently, there have been changes in planning methods related to the social and natural sciences, often driven by the need and desire to influence and manage change. With the changes that took place in the urban revolution in Europe in the 19th century, the activity of landscape architecture is expanding. There is now, a need for the reconstruction of

cities through the spatial organization. **Landscape planning** is an important area of activity for landscape architects.

Vasiljević (2018) defines the concept of landscape planning as a tool that expresses the mental creation of space as well as an intention to change the landscape from existing to desired. We inherit the great experience of landscape architects who have developed this area over the centuries in relation to the needs of society.

We find the beginnings of landscape planning in the time of the first planning protection movements, and this concept was later understood by society as the domain of environmental philosophy.¹ A wide range of spatial dimensions, as well as the application of various knowledge and skills, represents the conceptual framework of the scientific field of landscape architecture, which integrates landscape planning.

Within the theoretical foundations, the meanings of terms, used in this thesis are defined for; urban landscape, landscape character, landscape structure, ecosystem services, and landscape rules. Research of world practice, as part of the theoretical basis, provided an insight into the way of understanding and interpreting the landscape and its values.

2.1.1. Urban landscape

It is generally well known that urbanization and globalization are the two main phenomena that significantly affect social, economic, and cultural life, as well as the physical environment. Despite the broad context of issues related to these two processes, it would not be incorrect to say that the main global concern stemming from urbanization and globalization is environmental sustainability. On the other hand, current studies on the sustainability of urban areas mainly focus on factors such as water, air, energy, and transport, while on urban identity is rarely paid attention.

Camillo Sitte in his book *"City Planning According to Artistic Principles"*, (1945) describes the notion of the city as one major presentation of art. From this perspective, observation of the city is an objective view and the main emphasis is on the ornament and some qualities such as multiplicity and diversity, proportion, naturalism, and organic system in the form and combination of colors (Keshtkaran et al., 2017). In fact, a city is a physical object and the consideration of experts is only on the visual aspects of the city. As for this view, Frederick Gibberd (1970), as one of the followers of the artistic view, introduces texture, color, mass, and lines as the most important elements of the urban landscape. From another perspective, Le Corbusier defines four important areas for the city including residential, industrial, commercial, and transport infrastructure. So, Corbusier is looking at the city from a functional point of view. Contrary to the artistic vision, he believed that simplicity in architecture was the most famous aesthetic response to human needs.

¹ It was the time when they were creating; Patrick Geddes, Scottish biologist and geographer, Fredrick Law Olmsted, the first landscape architect and his sons, John Charles and Fredrick Law Olmsted Jr., Charles Eliot and John Nolen, Lewis Mumford, American historian, philosopher and scientist. Ian McHarg brought a "renaissance" to landscape architecture, which included solving the whole spectrum of environmental problems.

Some scholars, such as Kevin Lynch (1960), considered the notion of the city more than individuals and social objects. According to their interpretations, the city is more of a state of consciousness, i.e. they claim that they represent the coherence of organized habits, traditions, and attitudes. The city is not just a physical mechanism, but it is involved in all those social processes of the people who formed it.

A new group of theorists considers the city a product of nature, which is considered and valued as part of the ecosystem with the presence of man (Council of Europe, 2000; Ian McHarg, 1969).

Depending on the different definitions and interpretations of the two controversial concepts of "*city*" and "*landscape*", and whether an individual's view is objective or subjective, the definitions of urban landscape are different and sometimes contradictory. According to Raskin (1974), the urban landscape encompasses many issues such as urban design, planning, but also recognizing the goals and responsibilities of individuals (Keshtkaran, 2017). Gordon Cullen (1961), by emphasizing the combination of adjacent buildings and the concept of "serial vision", describes the urban landscape as the art of proportion. Lingfeng and Xilong (2009) describe the urban landscape as a kind of environment created by man in the natural environment, and as such, it has its own physical and spiritual aspects. Zhang with his associates (2019) expresses the urban landscape as an urban image of the socio-cultural environment. A physical space consisting of materials and shapes leads to the creation of an integrated artistic space. In this space, the urban landscape as an all-encompassing art is inherently connected with other forms of art. Thus, different art forms play an important role in the formation of the urban landscape. It can be said that the modern urban landscape includes dynamic and flexible relations; the stratification, congestion, and interpenetration of landscapes constitute an unlimited and undefined spatial-temporal urban continuity that is difficult to distinguish (de Wit, 2016). In fact, the urban landscape encompasses all areas and functions such as; residential, institutional, commercial, industrial, cultural land use (Kalaiarasan, 2016).

2.1.2. Landscape structure

Rapid urbanization has dramatically changed the structure of the urban landscape, modifying the urban ecological environment on all scales (Grimm et al., 2008; Xu et al., 2020). The structure of the urban landscape is the spatial arrangement and combination of components and elements of the urban landscape (Vu et al., 2004). As a process of transformation of natural landscapes into artificial impermeable surfaces, changes in land use types have a profound impact on urban structure (Luck et Wu., 2002; Li et al., 2013). Over the past few decades, significant research efforts have been developed to study the structure of urban landscapes, such as types of urban expansion (including filling expansion, edge widening, and expansion) (Jiao et al., 2019; He et al., 2019; Xu et al., 2020; Liu et al., 2021), land use dynamics (Sun et Chen, 2017; Jiao et al., 2019) and urban form (Dong et al., 2019; Gong et al., 2017). Urban researchers have proposed a number of models and methods to abstractly describe the landscape structure of cities, including the traditional monocentric city model, polycentric city model, sector model, concentric zone theory (Van Eetvelde et Antrop, 2004; Tian et al., 2019; Jiang et al., 2016).

Landscapes vary significantly within the framework of structure (pattern) and function (process) that arise as a result of its natural and anthropogenic factors (McGarigal, 2006). The result in the formation and effect of the pattern and process of a landscape varies greatly from the influence of people on it. Regardless of the many definitions of the term landscape, its "essence" always remains the same. Each landscape has its own structure or pattern that is defined by the users of space that affect its further function or the processes that take place in it. Thus, the structure of the landscape, defined as a separate spatial pattern, is read through two key elements; composition and configuration. The composition of the landscape basically represents all those spatial elements that stand out in it and as such, further define its function. The elements that are read through the composition are proportion, uniformity, or dominance, as well as the diversity of landscape elements (Vasiljević, 2018). On the other hand, the configuration of the landscape is defined by the spatial character, layout, and context of all the elements present. Configuration deals with geometry, that is, the study of properties and relationships between landscape elements. In other words, the composition basically represents the non-spatial aspect of the landscape, while the spatial aspect is read as a configuration.

The structure of the landscape, therefore, composed of composition and configuration, conditions a heterogeneous landscape. The degree of heterogeneity of a landscape is and will be conditioned and described through the complexity of composition and configuration. Together, as such, they influence and continue to "dictate" the behavior of users of a certain area (Fry et al., 2009).

2.1.3. Landscape character

The approach to the research of landscape character fully corresponds to the concept of a new paradigm that integrates landscape-ecological and aesthetic principles of landscape as a system in the identification of which its users interactively participate (Vasiljević, 2018). The definition of the landscape character is best defined as: "*A consistent and clear scheme of landscape elements that makes the landscape recognizable, different from other landscapes*" (CA/SNH, 2002²; Cvejić et al., 2008).

As Swanwick, (2002) states: "*Particular combinations of geology, landform, soils, vegetation, land use, field patterns, and human settlement create character*". The character that will create each part of the landscape distinct, but will give him its particular sense of place (Swanwick, 2002).

The key issues related to the landscape that is of mater interest to decision-makers are:

1. What kind of landscape development is acceptable and where?
2. What intensity of change can a certain landscape endure?
3. When the character of the landscape is irretrievably lost?

Numerous changes in traditional landscapes and the emergence of new ones that occur due to urbanization, road infrastructure development and needs for recreation and

² CA/SNH, 2002 – Countryside Agency and Scottish Natural Heritage: *Landscape Character Assessment: Guidance for England and Scotland* (Authors: Swanwick C., and Land Use Consultants), Cheltenham: Countryside Agency Edinburgh: Scottish Natural Heritage

tourism, or the general need of man to completely modify the landscape and adapt to their needs, have expanded the concept of landscape character to all types of landscapes. is also proposed by the European Landscape Convention. The European Landscape Convention further emphasized and confirmed the importance of the character of the landscape, which resulted in great interest of states that ratified this document, in the process of assessing the character of the landscape. Encouraged by this Convention, the character of landscaping emerges as a new concept. Landscape character is what makes an area unique (Swanwick, 2002), it is an expression of the holistic nature of the landscape (Jessel, 2006).

Studying, understanding, and perceiving the character of the landscape requires extensive research, which includes a number of landscape constructs, which act on a certain area to a greater or lesser extent. The research of landscape character includes analyzes of the geological structure, relief, soil types, climatic conditions, hydrographic characteristics and vegetation cover that developed on it, historical and cultural influences that leave a physical trace in a certain area.

When we talk about the character of the landscape, we can freely say that it stems from the uninterrupted, invisible, but always present connection of the local population with its surroundings. The character of the landscape is therefore the bearer of tradition, history, as well as the entire heritage of one area.

2.1.4. Ecosystem services (Nature's Services)

Ecosystem services represent the various benefits that the natural environment and healthy ecosystems provide to humans. Although many scientists and ecologists have debated this topic for decades, The Millennium Ecosystem Assessment (MEA) popularized this concept in the early 2000s, as a result of continuous landscape degradation. The main idea of this study (Ecosystems and Human Well-being: Synthesis, 2005) was to search for and identify all those connections between man and the landscape, in order to establish appropriate instruments for quantifying their value. According to their words: *"A well-defined ecosystem has strong interactions among its components and weak interactions across its boundaries"* (MEA, 2005).

MEA 2000, classify ecosystem services into four broad categories: providing services (such as food, water, oil, wood ...), regulatory services (including climate control, water, soil, disease spread ...), support services (circulation of nutrients, oxygen ...) and cultural services of ecosystems (spiritual and recreational benefits). Evaluating ecosystem services makes an equivalent comparison with infrastructure and services that have emerged from social projection. Due to its very important role, the implementation of ecosystem services in planning processes should be an indispensable step.

Germany, together with the European Commission in 2010, is launching a global study on the economics of ecosystem loss, led by Indian environmental economist Pavan Sukhdev. The Economics of Ecosystems and Biodiversity (TEEB) study highlights the benefits of ecosystems, where support services are defined as **ecosystem functions** that integrate the remaining three pillars of services formed in the 2000 Millennium Assessment. In the preparation of this thesis, all ecosystem services will be identified and evaluated, which will later result in establishing of landscaping rules.

A special focus, on the group of cultural services of ecosystems, will appear in this thesis, due to the great importance and potential that the wider research area has. MEA 2000 in the study, defines cultural services of ecosystems through; cultural diversity, spiritual and religious values, meaning systems (traditional and formal), educational values, inspiration, aesthetic values, social relations, sense of place, cultural heritage values, and recreation and ecotourism. For the purposes of creating a master's thesis, cultural services of ecosystems are considered within the functions and processes that they play in the phases of landscape planning.

2.1.5. Landscape assessment

2.1.5.1. Landscape character assessment

Landscape diversity stems from the unique arrangement of landscape elements that define it. Therefore, it is necessary to have a holistic view of its components, geological structure, soil types, topographic, hydrographic, and climatic characteristics, as well as vegetation cover, while taking into account the historical and cultural development of the place that defined the structure and land use (Figure 1). The combination of landscape elements in a certain relationship defines landscape patterns, i.e. what a landscape is, as an area, perceived by local people, whose character is the result of actions and interactions of natural and cultural factors (Council of Europe, 2000). The landscape pattern defines each landscape individually and based on it, its unique character is determined. Landscape character is defined as a clear and recognizable scheme of elements that consistently appears in a certain landscape (Swanwick, 2002), and the diversity of landscapes is reflected in their different characters.

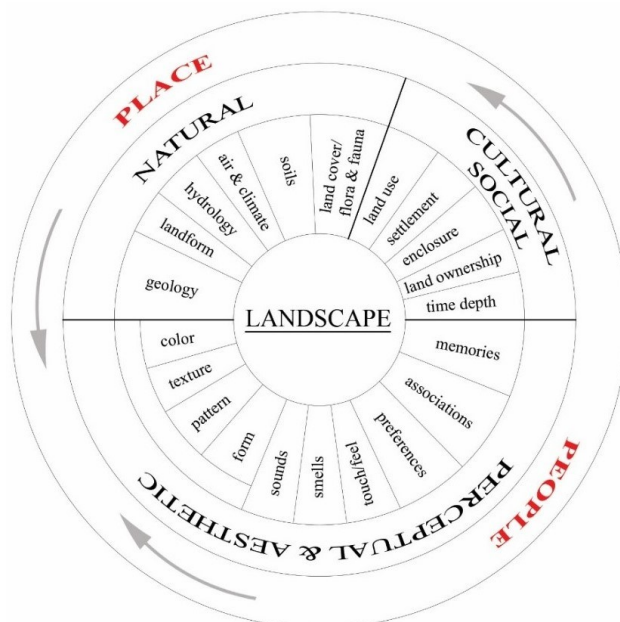


Figure 1. What is the landscape?
(Image made according to the study “An Approach to Landscape Character Assessment”; Tudor, 2014).

The process of assessing the character of a landscape takes place through two key steps: characterization and assessment (Figure 2). The first step - the characterization

of the landscape, implies its classification and description, with the aim of distinguishing all types of areas, which will differ from each other according to their character. The second step - the assessment of the landscape corresponds to the purpose and goals in relation to which it is formed (Vasiljević, 2012). The Landscape Character Assessment Guide was developed as a result of many years of experience in landscape character assessment in the United Kingdom, and in other countries around the world, it served as the basis for similar studies.³

The four steps of the Landscape Character Assessment process (Tudor, 2014):

1. Define purpose and scope and preparation of the Brief

In order to clearly assess the character of a landscape, the boundaries within which it operates must be clearly defined at the outset. The purpose of the assessment must be clearly defined, which will further determine the scope of the assessment, the level of its detail, the necessary data, and the like.

2. Desk Study

This phase is an analysis of all collected data on the basis of which the character of the landscape is identified. In this step, preliminary types of landscape character are determined and mapped, as well as their varieties selected on the basis of natural and socio-cultural factors.

3. Field Study

Field research involves checking the preliminary types of characters and their isolated varieties, due to the aesthetic and perceptual qualities of the landscape that are difficult to notice during the study. At this stage, it is also possible to include a survey in order to identify all the problems that the local population recognizes.

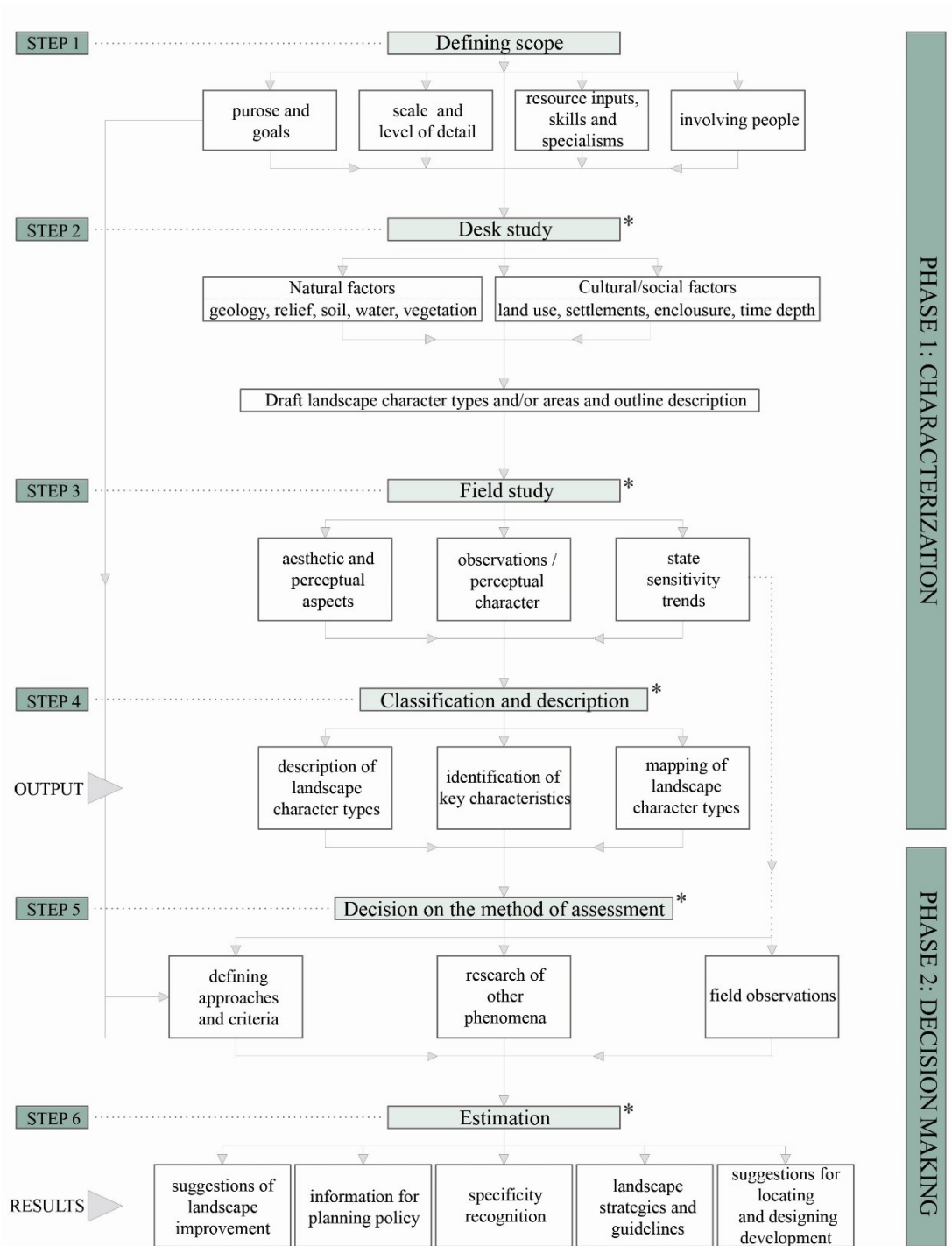
4. Classification and Description of Landscape Character Types and Areas

All the obtained results of the characterization process are further improved and finalized by classifying, defining, and mapping clear boundaries of landscape character types, which completes the characterization process itself.

Five Key Principles for Landscape Assessment, taken from the Landscape Character Assessment Approach (Tudor, 2014):

1. Landscape is everywhere and all landscape and seascape has character;
2. Landscape occurs at all scales and the process of Landscape Character Assessment can be undertaken at any scale;
3. The process of Landscape Character Assessment should involve an understanding of how the landscape is perceived and experienced by people;
4. A Landscape Character Assessment can provide a landscape evidence base to inform a range of decisions and applications;
5. A Landscape Character Assessment can provide an integrating spatial framework – a multitude of variables come together to give us our distinctive landscapes.

³ *Typology of Belgrade landscapes for the purposes of applying the European Landscape Convention*; Cvejić J., Vasiljević N, Tutundić A., 2008; Secretariat for Environmental Protection of the City of Belgrade University of Belgrade - Faculty of Forestry, Serbia



* Possible stakeholder engagement

Figure 2. Diagram of the methodology for landscape character assessment. (Image made according to the study “An Approach to Landscape Character Assessment”; Tudor, 2014, and Typology of Belgrade landscapes for the purposes of applying the European Landscape Convention; Cvejić, 2008).

Landscape Character Assessment is a complex process of recognizing and describing landscape structure. It enables an understanding of the existing structure of the landscape, its past, and possible changes in the future. Landscape characterization provides a framework for the identification, assessment, protection, management, and planning of landscapes encourages the preservation and improvement of landscapes and their unique characteristics while adapting them to the needs of people. Vasiljević

(2016) states that the characterization of the process of classification and description of landscapes in order to identify types of landscapes and their characteristics that differ in character *"and that the assessment of landscape character is based on the principles of quality (stability and sensitivity), value and the status of the landscape with the aim of making decisions about the future development of the landscape"* (Vasiljević, 2016).

Landscape Character Assessment is concluded after landscape characterization; making maps and accompanying descriptions, a landscape assessment process based on the principles of quality and landscape strategies; value and status of the landscape. The presentation of results and evaluation directly depends on the purpose of the evaluation.

2.1.5.2. Cultural ecosystem services in the function of landscape assessment

The Millennium Ecosystem Assessment (MEA, 2005) deals with the study of only those cultural services that can be quantified to some extent, i.e. the assessment of spiritual and religious values, aesthetic values and recreation (e.g. measuring aesthetic values as part of the experience of touring certain locations). Also, the problem arises at the core of the idea of ecosystem service, which is turned to natural scientific paradigms. This makes it even more difficult to measure cultural services that have been put under the pressure of economic valuation from the very beginning, which directly creates an imbalance between these services and other ecosystem services defined by MA (2005). Due to this, there is a growing need to create a new interdisciplinary, or transdisciplinary approach that will overcome the problems faced by cultural services.

According to Schaich (2010) and his associates, ecosystem services should be viewed through the concept of cultural landscape research, which includes cultural services of ecosystems (Schaich et al., 2010). The idea is to overcome the inequality of assessment of ecosystem services in this way, and in favor of cultural benefits, by including anthropogeography, landscape ecology, and spatial planning, as areas with a long tradition of researching these specific intangible ecosystems services (Schaich et al., 2010).

Because this thesis, deals with the urban landscape structure, and its characteristics, the focus will be mostly on ecosystem services, that are placed in the corpus of human perception, i.e. his needs, and benefits that he recognizes in the landscape.

2.1.5.3. Cultural ecosystem services in the process of landscape planning

Despite the constantly growing trend of emphasizing the importance of cultural ecosystem services in considering and defining sustainable landscaping, there is no adequate coin in the landscape planning literature to express the value of this service (Schaich et al., 2010; MEA, 2005). The very existence of this trend speaks to the importance of cultural ecosystem services among people and how important these services are for improving the sustainability of the local population (Milcu et al., 2013; Plieninger et al., 2015; Vasiljević et Gavrilović, 2019).

Increasing degradation, and often complete "erasure" of urban landscapes, which are witnesses of human existence and development, diversity of landscapes and the entire population, leads to the loss of human identity, which is why there is a growing need to find an integrated, holistic approach and take into account the issue of landscape multi-functionality. The European Landscape Convention also promotes a holistic approach to planning through the integration of landscapes into cultural, environmental, social, and economic policies, through a participatory approach (Jones et Stenseke, 2011; Vasiljević et Gavrilović, 2019).

Cultural services of ecosystems are closely correlated with the way of life of the local population, their customs, traditions, and all historical events that, as such, have shaped and defined a certain landscape. Therefore, the adoption of cultural ecosystem services in the planning process cannot take place without the involvement of its local population. Evaluation methods are reflected in various surveys, questionnaires, discussions, and interviews, in order to better understand the user's view of the landscape. Consequently, cultural ecosystem services can be mapped, quantified, and further evaluated so that, as an end result, they can be implemented in landscape planning processes. Different approaches to urban landscape research, in different assessments of intangible values of landscapes and cultural services of ecosystems, have proven to be very valuable. Aesthetic values and cultural heritage, as the most valuable cultural services, provide valuable results and methods for a comprehensive assessment of ecosystem services (Schaich et al., 2010).

2.1.6. Examples of world practice

This chapter summarizes the review of previous research related to relevant concepts and methods used in the thesis, it considers different approaches in land use planning in the world.

2.1.6.1. Landscape approach in land use planning - world practice

George Perkins Marsh's book *"Man and Nature"* (1801-1882) appeared in England in 1864. In that book, Marsh included scientific knowledge about the impact of human activities on the natural environment. This book conditioned the development of planning through the topic of "uncertainty" of the results of increasing use of the natural environment, as a consequence of the accelerated development of industrial society.

A significant trace in the history of planning was set by Sir Patrick Geddes (1854-1932), who was called the "father of city planning". His activities were aimed at resolving conflicts in environmental protection, the plans had many similarities with the planning of landscapes in which he proposed a system of parks and a system of open spaces.

One of the first "ecosystem" approaches in the planning of modern metropolitan regions was developed by Benton MacKaye (1879-1975). His plan was based on a careful analysis of the whole landscape. MacKaye has identified several categories of land that are particularly valuable or sensitive and that should therefore remain undeveloped. As MacKaye has proven, reefs, steep slopes, canyons, alluvial plains of

rivers, swamps, lakes and sea shores are at the same time a natural "dam" that controls the "metropolitan invasion". His proposal, published in 1928, entitled "The New Exploration", was the first attempt to deal with the decentralization of urban expansion. He believed that what he described as the "almond system", such as the system of natural wetlands, could control the metropolitan "invasion".

The father of American landscape architecture, Frederick Law Olmsted (1822-1903), in his writing on the problems of urban development called for not only the protection of a healthy environment but also the protection of open undeveloped areas. His proposal for the "Riverside" community near Chicago from 1869 is a typical example of respecting the goals of environmental and nature protection. The main idea was to provide enough space for recreation and to provide scenic areas available to all residents. To achieve this, they protected the floodplain, the river banks and two open areas on the hills.

An important landscape architect in America was Charles Eliot (1859-1897), who also protected sensitive and important natural resources, such as areas along rivers and beaches. He demanded that the catchment areas remain undeveloped, in order to be preserved for supplying urban areas with water. He also demanded that the catchment areas remain as natural as possible and that they be mostly covered with forests and artificial lakes.

Probably the most famous landscape planner who advocated a landscape-ecological approach in land use planning is Ian L. McHarg (1920-2001). He argued that landscape features - attributes should be the basis for land use planning. Today we call these attributes the character of the landscape. McHarg concludes that mountains provide maximum recreational potential, limestone is a resource for agriculture, and shale is the best location for urbanization. The latter is important, as it ensures that urbanization does not occur at water sources. Resources and their distribution are very convenient; forested mountains, fertile valleys and shales, which stretch along the river, are suitable for urbanization, which achieves a significant aesthetic quality (McHarg, 1969).

However, although it is clear that landscape planning as a concept has a relatively long existence, the search for issues such as: *what is the domain and subject of research on landscape planning*, as well as *who deals with it*, confirms the fact that basic doubts are still unresolved (Vasiljević, 2018). It is clear that the quality of people's lives depends to a large extent on the landscape, which therefore deserves more systematic, comprehensive and comprehensive approaches than the simple sectoral protection of space. Today, many theories view the landscape through a holistic approach in which all those natural and cultural processes of one place are united. All of this can direct economic, environmental, and social goals toward creating a landscape that is resilient (Antrop et Van Eetvelde 2000, Antrop 2005a, 2005b; Ahern, 2011; Selman, 2006, 2010; Steinitz, 2005).

2.2. Defining basic terms

The main terms that form the backbone of this thesis will be defined in the forthcoming chapters, giving it a basis for further elaboration. The key terms are singled out and defined; urban landscape, cultural services of ecosystems, sensitivity assessment, and landscape planning and design rules.

2.2.1. Urban landscape

An urban landscape is a completely grounded natural or rural landscape through human interventions, which is established and functions adapted to urban needs; it is characterized by predominantly urban land use, higher population density, urban settlements and periurban areas.

As mentioned earlier, the urban landscape has always existed as a city-related fact, but it has not been transferred to the level of a scientific discipline or academic concept. Therefore, the evolution of the concept of the urban landscape is an issue that can be understood by researching and studying urbanism, urban design, architecture, and landscape. The term urban landscape as a concept has existed for many years, since the emergence and development of the first cities, but also as a specialized term in the late nineteenth century, which appears in the work of Frederick Law Olmsted (1863).

Today's cities are significantly multicultural and heterogeneous. The influence of neoliberalism and globalization is very pronounced on the development of urban areas, which consequently affects their identity. Therefore, the management and preservation of local heritage and values have become an important aspect of urban design and planning.

Cities are not only physical constructs but also include social structures. People are the basic element of every city, which makes it alive and functional, so there is a mutual relationship between the physical characteristics of the city and its citizens.

2.2.2. Landscape character

Different social influences, over a longer period of time, change and adjust spatial structures, from which it is clearly concluded that the term urban landscape is closely correlated with its character. The unstoppable interaction between the natural and cultural elements of a landscape creates its unique character. If the landscape itself has specific natural and cultural-historical characteristics, i.e. specific, inherent character, which shapes the identity of the landscape, it is the basis for the evaluation of landscapes, which help create a sense of place (*genius loci*), contributes to the quality of space use and is a resource for creating new values, development of circular economy, creative tourism, recreation, and education. expressing the identity of that territory. and preserving the original culture of the people who inhabit or visit the landscape.

2.2.3. Landscape character assessment

Landscape character assessment is the method of determination of unique landscape character, his mapping, classification and description (Vasiljević, 2018). Consist of four main purposes: to establish the context of the landscape, to develop development guidelines and to help identify and label landscape resources, to identify opportunities at the local level, and to lay the groundwork for sharing experiences. Landscape character assessment is a framework through which it is possible to see the richness of landscape diversity, define its uniqueness and enable its integration into landscape decision-making and management programs.

2.2.4. Cultural ecosystem services (CES)

According to The Millennium Ecosystem Assessment (2005), cultural ecosystem services are closely correlated with human values and behavior, as well as with the way of social, economic, and political organization. As they are all those intangible benefits of one space, it is difficult to quantify them, as a result of which subjectivity is present to a high degree. However, the great benefit of cultural services of ecosystems is that the users of space can feel and understand them without previously acquired knowledge.

Ecosystem cultural services are all intangible benefits that people receive from nature or ecosystems. They can be seen as "DNA" of the space. They are carriers of information about the local population, all traditions, the way of functioning, perception, and understanding of the landscape.

2.2.5. Landscape planning and design rules

In the thesis, just before the step of establishing the rules of landscaping, the focus will be on the current way and speed of development of the city, as well as all those future ideas that will dictate the dynamics of development of Prague.

The current zoning plan for the city of Prague, approved in 1999, defines the development of the city. This plan identifies development of public importance, dictates the development of traffic and technical infrastructure, but mostly determines how land plots can be used.

The first draft of a new zoning plan for the city of Prague called, the Metropolitan Plan - is currently being prepared by the Prague Institute of Planning and Development and presents the future of Prague. It has been developed since 2012, and it will be discussed for about four more years. The document sets out clear rules on the development of Prague for the next 15 to 20 years. As today's development of the city, under uncontrolled urbanization, is considered harmful to the environment and economically defective, the main priority and goal of this plan is to stop the uncontrolled expansion of the city against green areas around the city, through steps of clearly defined borders between village and town. On the other hand, the idea of the Metropolitan Plan is to promote the identity and locality of the landscape. Increasingly smaller spatial units, which can be viewed as separate entities of space, have a certain character and reflect specific cultural and economic conditions. Therefore, the plan has the idea to support and further improve the existing urban character in different parts of the city and that, therefore, different regulations should be applied, in accordance with respect for their urban context. At the same time respecting the urban context of the city, the sites themselves and their identities, the plan lays the groundwork for maintaining the city's character by regulating building height limits (allowing higher buildings where space is considered appropriate).

Rules of arrangement (construction), according to the Spatial Planning and Building Regulations Act (Building Act)- *Zákon o územním plánování a stavebním řádu (stavební zákon)* and according to the Spatial Plan of the settlement unit of the capital city of Prague- *Územní plan sídelního útvaru hlavního města Prahy*, emphasizes following:

1. Creating conditions for sustainable development of the area, which is in a balanced relationship of conditions for favorable environment, economic development, and cohesion of the community of the population of the area, while meeting the needs of present and future generations, without endangering the environment;
2. Conditions and measures for the protection of natural resources and immovable cultural property, as well as the protection of natural and cultural heritage, the environment and human life and health;
4. Ensuring the availability of public spaces within the settlement, their easy accessibility, and interconnection;
3. Within the undeveloped area, it is possible, in accordance with its character, to locate facilities in accordance with nature and landscape protection, to reduce the risk of ecological and natural disasters and eliminate their consequences, while they will improve the conditions of its use for recreation and tourism, for example, bike paths, toilets, environmental and information centers;
6. Urban and other conditions for arrangement and construction of areas and facilities of public purpose and networks of traffic and other infrastructure, as well as conditions for their connection;
7. The concept of arranging characteristic construction zones or characteristic units determined by the plan according to morphological, planning, historical-ambient, shape, and other characteristics;
8. Degree of communal equipment of construction land by units or zones from the planning document, which is required for issuing location and construction permits;
5. Ensure quality through integrated and comprehensive solutions

From the above enumerations, that the Spatial Plan and Building Regulations emphasize as crucial, the rules for the land use regulatory, can be further divided into two groups; morphological-ecological and landscape-design rules for landscape restoration.

2.2.6. Landscape sensitivity assessment

Landscapes are dynamic systems of the earth's surface (Phillips, 1998) that contain not only objects but also stores of energy and matter, maintained by processes of growth, decay, flow, and transformation. Any component of the landscape, or more, can, and often does, cause instability elsewhere in the system. The concept of predicate sensitivity, therefore, implies conditional instability of the system, with the possibility of rapid and irreversible change, due to disturbances in controlled environmental processes (Thomas, 2001).

The sensitivity of the landscape must be sought in their resistance and response to the forces of change. When the landscape is in a state of stability in relation to the control environment and its minor disturbances, the changes in it will take place at such a speed that will enable the mutual adaptation of all components of the landscape. However, when a landscape enters a state of instability, the level of stress exerted on its components increases, and then a period of the adjustment occurs, as different sub-systems react in an attempt to establish a new balance (Thomas, 2001).

The sensitivity of the landscape must be sought in their resistance and response to the forces of change. When the landscape is in a state of stability in relation to the control environment and its minor disturbances, changes in it will take place at such a speed that will allow all components of the landscape to adapt to each other. However, when the landscape becomes unstable, there is an increase in the level of stress that manifests itself on the components of the landscape, and then there is a period of adaptation, as different sub-systems react trying to establish a new balance (Thomas, 2001).

Landscape sensitivity is determined on the basis of the character of the landscape and its quality, i.e. ecological stability and visual value. The overall sensitivity of the landscape character is the inherent sensitivity of the landscape as a whole and does not depend on potential changes (Vasiljević, 2018).

The assessment of the sensitivity of the researched character of the landscape in the thesis will be performed through three phases. The first phase presents the visual sensitivity of the landscape, the second phase presents the assessment of the sensitivity of the character of the landscape based on defined landscape services, while the third step is the assessment of the sensitivity of the landscape read through ecosystem services. The summary assessment of these three phases will give the overall sensitivity of the researched area of work, which will further, in the thesis, significantly condition and help in the formation of future rules of arrangement of the researched area.

3. Methodology

Theoretical and practical experience confirms that the interpretation of the unique character of the landscape, as a public good and public interest, can be achieved by applying the method of Landscape Character Assessment (LCA), which is at the top of the development ladder of different approaches to landscape interpretation. The method of determining the sensitivity of landscapes used in this master's thesis is largely based on techniques and criteria for determining the capacity and sensitivity of landscapes that are part of the Guide to Landscape Character Assessment of England and Scotland from 2002 (CA/SNH)⁴. The choice of this method stemmed from the fact that it has long been used in the practice of landscape impact assessment as an integral part of the EU Directive on Environmental Impact Assessment (Council Directive 85/337/EEC, Council Directive 97/11/EC) and EU Directive on Strategic Impact Assessment (Council Directive 2001/43/EC).

The methodological procedure in the preparation of the master's thesis consists of several successive, interrelated steps (Appendix 1).

As stated in previous chapters, landscapes are constantly dynamic spaces, which bring with them the history of a place and its people. One space cannot function without people, and vice versa, the mutual connection of each landscape determines its structure, character, and function. The practice of good planning emphasizes the importance of "going back in time" when it comes to landscape analysis, and for that reason, the retrospective method and dynamics of development are included in the thesis, to define the changes that have occurred in the landscape. The dynamic development itself can help in understanding the further direction of the city's development and predict the changes that will take place in the future. Guided by Kevin Lynch, who announces that the inevitable step in understanding the landscape is the involvement of the public and the recording of their observations, which help them to create a certain image of the place, survey, was included in this thesis. The critical moment of the work will be provided by the ecosystem services, which speak about the stability of one landscape. A special focus will be given to the cultural services of ecosystems that are related to the way the space functions and the behavior of the users themselves in it, and greatly influence the formation of a sustainable area, which strives for uncontrolled urbanization of the city.

At the very beginning, in order to get acquainted with the research area itself, after the established boundaries of the work, basic data were collected that speak more about the character of the landscape (desk phase of the thesis). This phase, called vertical and horizontal analysis, through basic thematic maps, confirmed the structure of the landscape as an urban landscape and helped to understand the basic characteristics of space, from its inception until today, including all those natural and cultural factors.

The next step of the thesis was to go to the field in order to get a clear picture of the research area and determine the information collected during the desk phase. This was followed by the definition of different types of landscape characters, which are recognizable in space.

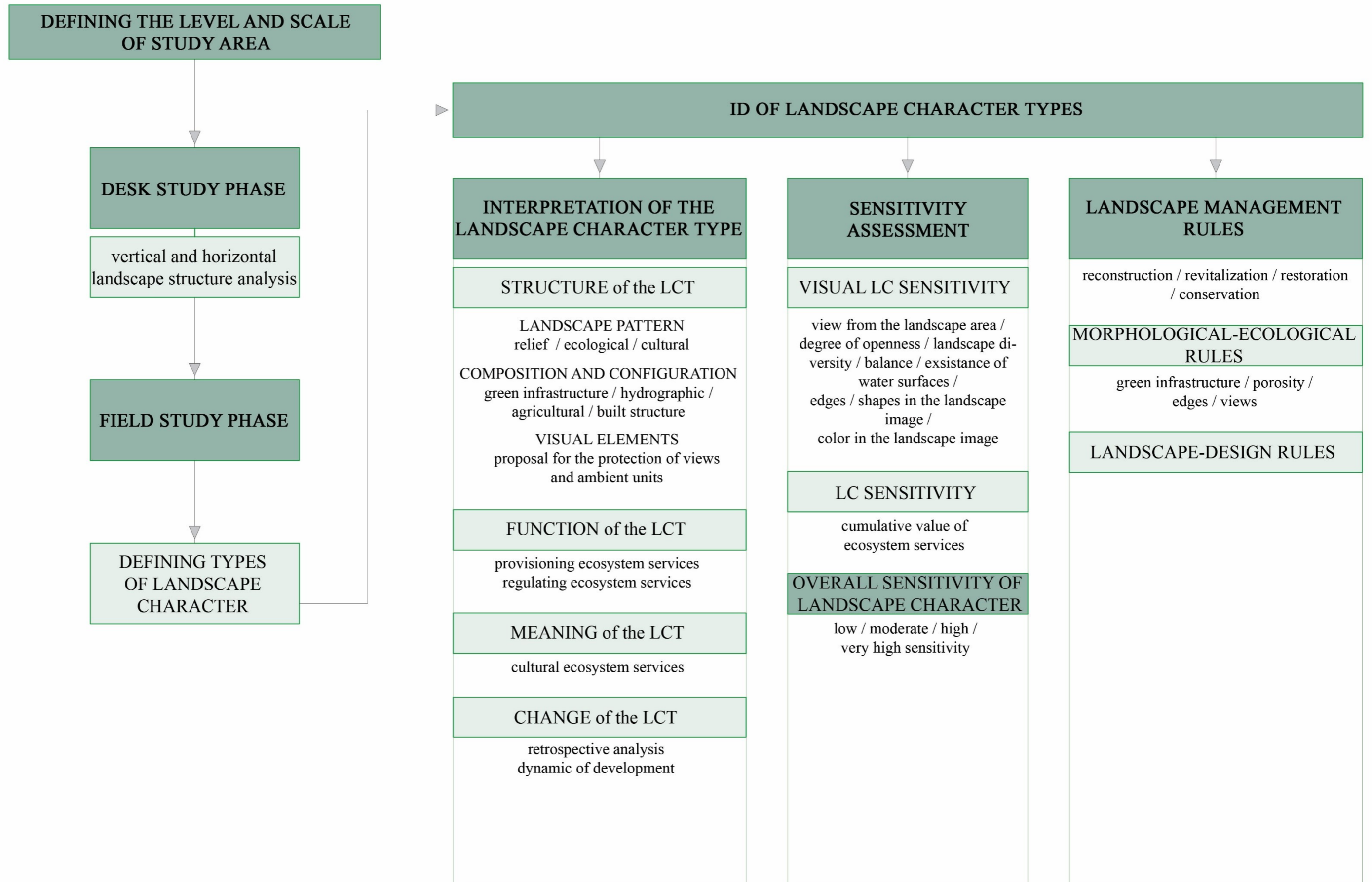
⁴ *Landscape Character Assessment* - Guidance for England and Scotland, the Countryside Agency and Scottish Natural Heritage, Department of Landscape University of Sheffield and Land Use Consultants, 2002.

The main data and results of the work arise in the process of forming the so-called ID card of the chosen type of landscape character. In order to reach the main output of the work (rules of spatial planning), this phase is defined through three levels;

The first level represents the interpretation of the character of the landscape of the researched area, where the main goal is to get acquainted in more detail with the chosen type of landscape character through the descent to smaller scales. This phase defined the structure, function, meaning and changes that took place in the region. The landscape structure of the investigated type was determined through; landscape pattern, composition and configuration and visual elements of the character of the space. The landscape pattern, composed of relief, ecological and cultural pattern, more clearly defines the types and subtypes that are perceived in the area. The composition and configuration, as a way of interpreting the structure of the landscape was read through the green infrastructure, hydrographic, agricultural and built structure. Based on this, a type diagnosis was made, in order to set the optimal landscape planning strategy. Visual elements of the character of the landscape, again included field research, and collecting photo material, which will be evaluated in the next steps of the thesis through a survey.

The second phase is the assessment of the sensitivity of the landscape character type. Guided by the fact that the involvement of ecosystem services helps to form a sustainable and stable landscape, ecosystem services are the main element for assessing sensitivity. Consistent with the fact that only the selected area of this thesis is an urban landscape, it is clear that providing and regulatory services will not have high values, so special emphasis is placed on cultural services of ecosystems. Another element in the evaluation of landscape sensitivity is the visual sensitivity determined through the survey.

The main motive for researching the sensitivity of the character of the landscape, stems from the belief that the results obtained, will significantly direct future proposals for spatial planning rules, which is the third and final phase in the preparation of this master thesis. The rules of arrangement are divided into two large groups, morphological-ecological and landscape-design rules. The strategy created in relation to the situation and trends in the landscape gave general rules of landscaping (morphological-ecological) aimed at conservation and activation of the landscape structure, or its character. While, the obtained landscape-design guidelines integrate the needs of the local population and the capacity of the landscape, in order to preserve and improve its character.



Appendix 1. Schematic representation of the Methodological Approach

4. Results (Case study)

4.1. Results of the analysis of the current situation

4.1.1. Spatial coverage - position and boundaries of the research area

The main goal of this thesis is to propose future, potential guidelines for landscaping along which the Botič stream flows (Figure 3). The research area itself is located in the southeastern part of Prague, Czech Republic.

The Botič stream is considered as one of the longest waterbodies that flows through the capital from south-east to west side, where it flows into the Vltava River. The Botič flows through 5 districts of Prague (Districts 2,4,5,10,11 and 15). Because of its location, stream itself was modified in terms that in some part goes underground.

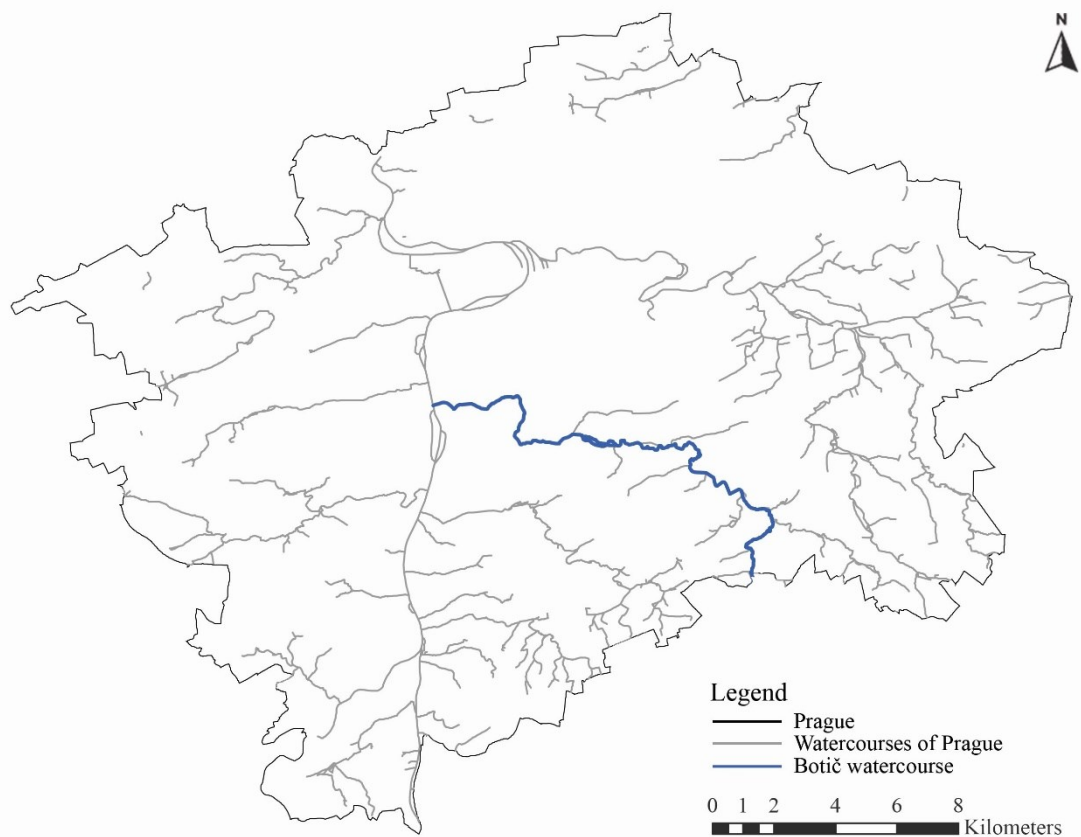


Figure 3. Position of the Botič and other watercourses of Prague

In order to define the landscape, its character and structure, study the functions and processes that took place and continue to take place in it, for the final phase of its arrangement, for the boundaries of the investigated area, a much larger space around the stream is taken (Figure 4).

So, the borders will not be the basin of the Botič stream, but they will form an administrative unit. The space whose structure is observed is determined so that it meets three conditions;

1. Parallel lines are the boundaries of the stream, on both sides a distance of 1 kilometer;

2. Different spatial and landscape elements are included within the research area; and
3. That border lines follow the streets

Recognizing the great influence of urbanization that leads to significant degradation of the landscape, certain boundaries of the investigated territory, far larger than the catchment area, will contribute to creating a broader picture of space. It will enable the perception of all those influences, which are interconnected with the stream itself. It will take into account the further direction of landscape development and help us understand the uncertainty of when and to what extent a certain spatial element will "put pressure" on others and how this will affect the overall landscape structure. The constant focus in the work is the Botič stream, which is a pillar of development for the researched area.

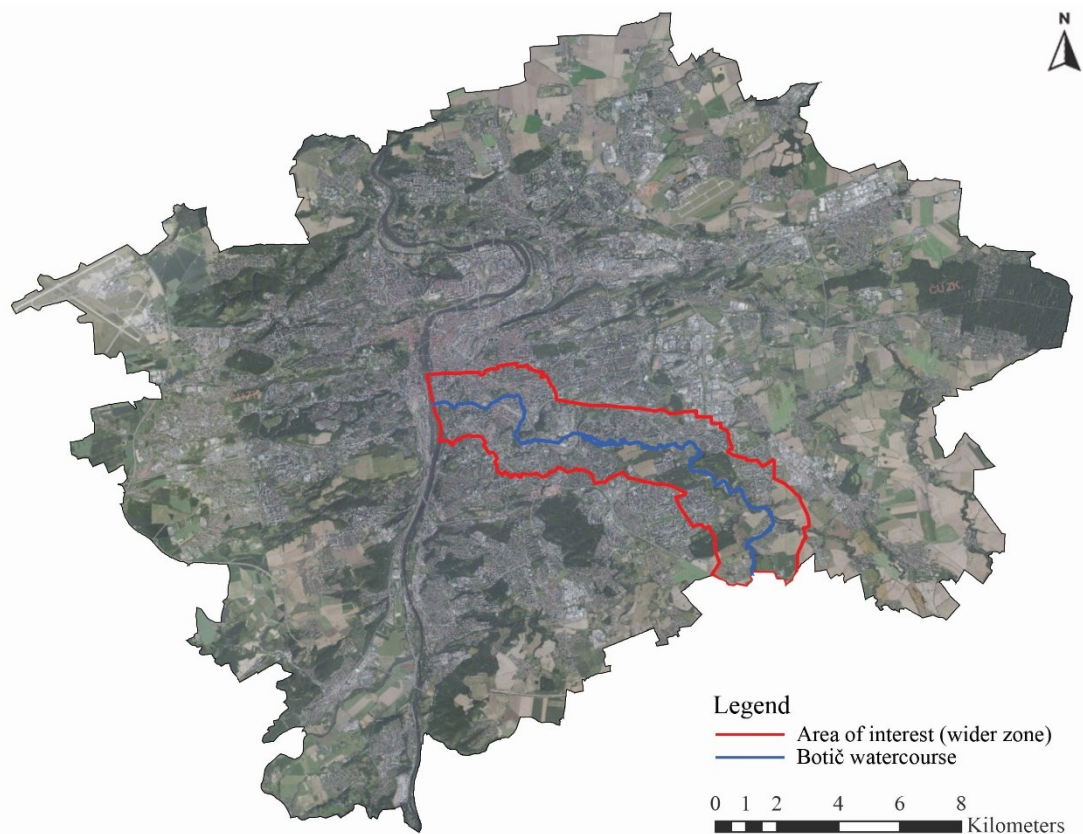


Figure 4. Boundaries of the area of interest (Wider zone), Location in relation to Prague

The researched area of the thesis is defined within those limits that enable the perception and appreciation of the peculiarities, specifics, and typical characteristics of the physical structure of the environment in which the stream flows. Borders of the wider zone include built structures (discontinuous urban fabrics), that are mostly situated on the western part, as well as agricultural fields, placed on the southern part of the area.

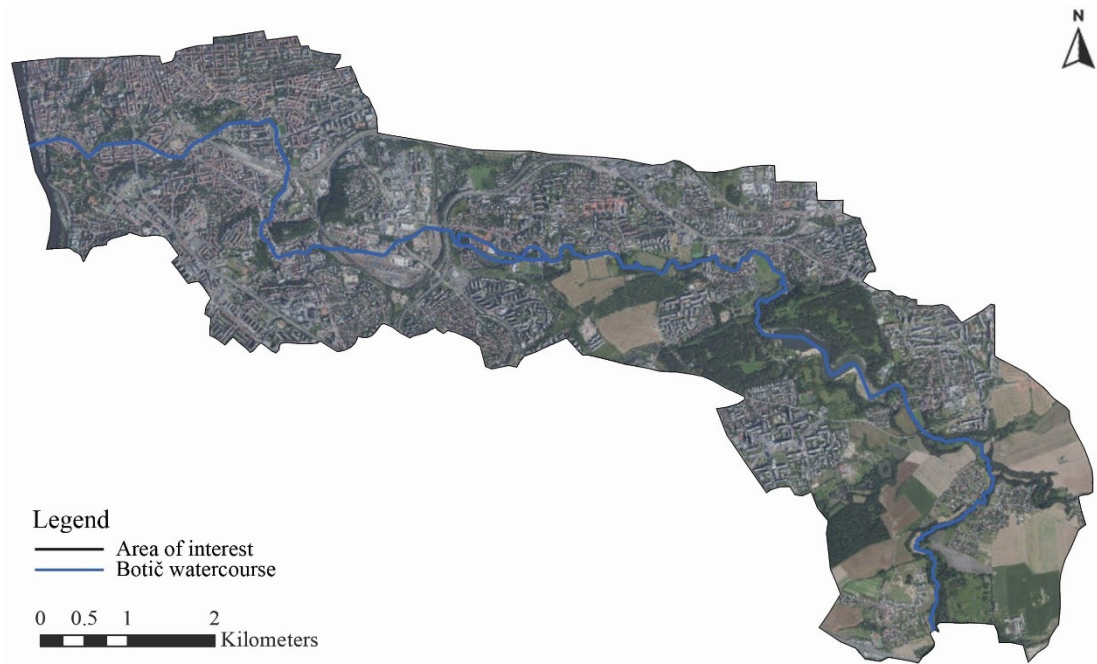


Figure 5. Ortho-photo map of the wider territory of researched area

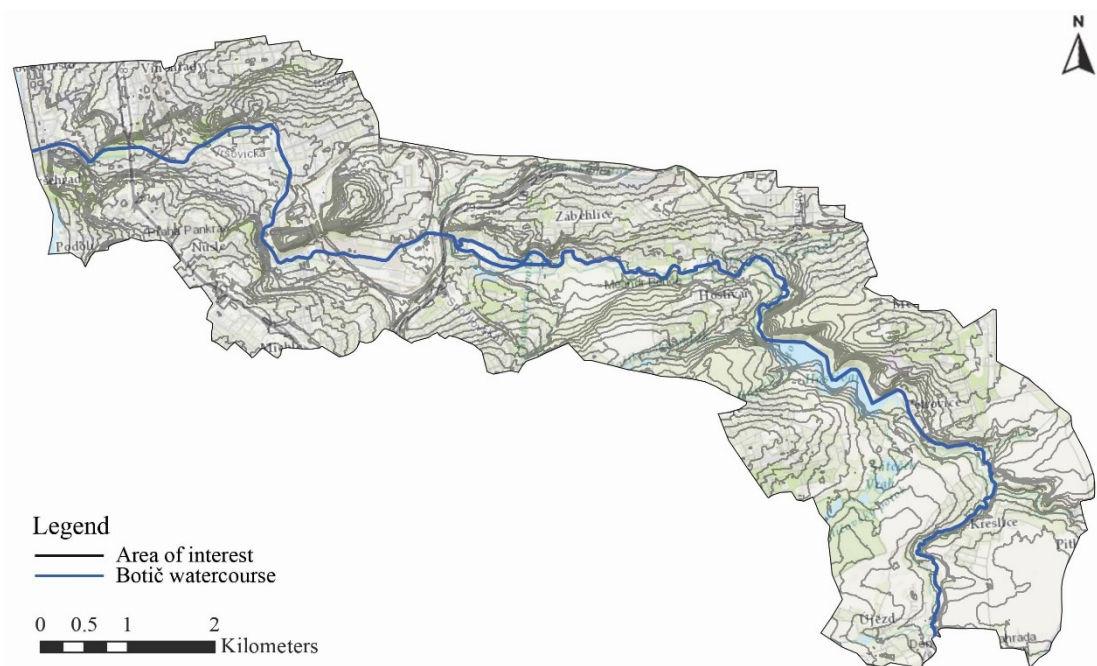


Figure 6. Topographic map of the wider territory of researched area

4.1.2. Desk study

The research phase of this thesis, includes the vertical and horizontal structure of the landscape that will be explained in later chapters of manuscript (Chapter 6).

4.1.2.1. Vertical and horizontal analysis of the landscape structure

The role of vertical and horizontal analysis is in finding the key characteristics and features of the landscape. The combination of characteristics arising from physical and socio-economic influences makes one landscape different from another.

This chapter presents the mutual relations and processes that are manifested within the wider zone of the investigated area, and because of that basic characteristics, as geology, soil types, Potential-Natural vegetation and land use will be considered. Scale of obtained maps is 1:30.000 (Appendixes from 2 to 5).

4.1.2.1.1. Geology

Geological material with all its physical and chemical characteristics affects other natural elements such as topography, types of soil present, vegetation, and thus indirectly determines the character and intensity of land use (Mücher et al., 2010). Substrate type information therefore represents a common database for complex typology (Romportl et Chuman, 2012, Antrop et Van Eevelde, 2009).

The territory of the Czech Republic is formed by two regional geological units; the Bohemian Massif and the Western Carpathians. Bohemian Massif is a part of the European Variscan system, that was built up by the basement of Proterozoic crystalline, Prevariscan Paleozoic rocks and the platform cover, forming in that way, the majority of the country territory. The Western Carpathians, with rocks of Alpine development, occurs in its eastern part of the country. From the information gathered from Czech Geology Survey, it established that almost the entire area belongs to the Mesozoic Bohemian Massif developed in different eras (Table 1).






Color	Era	Region
	Paleozoic	Paleozoic Bohemian Massif
	Paleozoic	Paleozoic Bohemian Massif
	Paleozoic	Paleozoic Bohemian Massif
	Paleozoic	Paleozoic Bohemian Massif (mostly marine)
	Neoproterozoic	Paleozoic Bohemian Massif

Table 1. Geological Eras and Regions, in the Wider zone of researched area

According to the Geological map (Appendix 2), five geological units are present in the Wider zone of researched area:

1. Shales, Siltstones, Sandstones, intercalated with Basalt;
2. Shales, Siltstones, Sandstones, Quartzites, Cherts, Basalts, Tuffs;
3. Graptolitic Shales, Basalt intercalations, Limestones of the Bohemium;
4. Terrestrial fresh water to marine Claystones, Siltstones, Sandstones, Conglomerates; and
5. Shales, Greywackes, minor Conglomerates (rhythmic alternation, flysch facies), indurated/slightly metamorphosed

The biggest part of the researched area belongs to the firsts geological unit. The extreme south part of the area was made of again slates together with conglomerates and metamorphic rocks and represents the second big geology structure in the

researched area. The smallest part (middle of the area) is built up from slate, sandstone, quartzite, basal, and tuff rocks. Sporadically in the area, the combination of previously mentioned materials with clays, limestone, and graptolite shales can be found.

On the southern part of the area, small surface, belongs to Neoproterozoic Era (the unit of geologic time from 1 billion to 541 million years ago). Neoproterozoic Era is followed by the Paleozoic Era which follows the fact that the rest of the research area belongs to the Paleozoic (or Palaeozoic) Era. This era is the earliest of three geologic eras of the Phanerozoic Eon. It is the longest of the Phanerozoic eras, lasting from 541 to 251.902 million years ago.

4.1.2.1.2. Soil types

According to the information gathered from soil types of the Czech Republic (Research Institute for Soil and Water Conservation), it is concluded that various types are present in the wider zone of the researched area (Appendix 3). Most of them are soils that are characterized as very fertile.

Land on which Vltava River and Botič stream are flowing, is characterized as Fluvisol. Fluvisol, as a soil type occur in river floodplains that are or have regularly flooded. As Botič stream, which has been constantly flooded in the past, has created a country very suitable for agriculture on its shores, since sediments were deposited during the floods. Since 1964, when the Hostivar dam (Vodní nádrž Hostivař) was filled, the water regime has changed and the stream has stopped being flooded.

The whole area of research is located on Kambizem (Groves), type of soil that belongs to Cambisol (the most widespread soil type in the Czech Republic). This type of soil is characterized as very developed soil, which is very similar to black-colored soil that contains a high percentage of humus, called chernozem. Kambizem is occurring in areas that have characteristics of temperate climate, in areas where there is more precipitation than in the chernozem zone. They have about 5% of humus, so they belong to very fertile soils, which justifies the fact that this region is suitable for agricultural production, which has happened in the not-so-distant past.

South-eastern part of the area records Brown earth soil type. Characterized with over 20cm in depth, rich in humus and mineral matter, these soils are great for agricultural activities. Sporadically in the area, Chernozem, Luvisol, Gleysol and Regosol are located.

4.1.2.1.3. Vegetation

Data on the present vegetation in the field are a crucial source of information on the quality of the biotope, possibly on its degradation rate and actual or potential biodiversity. Naturally potential vegetation should therefore be the inevitable basis for defining the type of natural landscape, if the typology is used as a basis for future restoration and reclamation plans (Rompörtl et Chuman, 2012).

Three types of forests can be found in the researched area (Appendix 4):

1. Oak-hornbeam forest;
2. Acidophilus oak and pine forest; and

3. Floodplain forest

The most dominant type of forest in the wider zone, is the first one (Oak-hornbeam forest), that is considered as an original vegetation (deciduous) that occur on Cambisol.

Characteristic communities of floodplain forest are occupying low-lying areas adjacent to streams and rivers, and are subject to periodic over-the-bank flooding and cycles of erosion and deposition. This type of forest is recorded near Vltava River. Acidophilus oak and pine forest are observed in the southern area.

Today, due to the consequence of intensive city growth, only some small remnants of mentioned forests are present in forms of vegetation that occur along the Botič stream, vegetation that forms Natural Parks, or vegetation that is left on the hills in the area.

4.1.2.1.4. Land use

Land use data is the last unavoidable source of information about one area. The way of land use indicates the specific distribution of human activities in space and thus determines the rate of anthropogenic impact.

The way we use land shapes our environment in a positive and negative way. Data on changes within the study area in the period from 2008 to 2018 show that the development of populated areas leads to a continuous loss of agricultural and forest land.

As it can be seen in the map of Land Use (Appendix 5), discontinuous urban fabrics, occupy the largest percentage of the researched territory. In the past, these areas were under agriculture, where production met the needs of the inhabitants, but with urbanization, only few of natural elements can be seen. Leftovers of Broad-leaved forest, small areas with Transitional woodland-shrub composition, along with Non-irrigated arable land occur in the southern part of the area.

In the central part of wider zone, Green urban areas and several sport and leisure facilities are present, which can be understood as a transit zone of urban-developed city from its leftover agricultural fields.

4.1.3. Types of landscape character

The characterization identified and clarified the unique combination of elements and structures that make the investigated landscape recognizable (Mücher et al., 2003). The specific geographical composition of the earth's surface with all its attributes, together with the "results of the past and present", human activities, to a large extent, have a significant impact on current and future land use. Therefore, the main parameters for determining the type of landscape character are depicted in the **geological and map of land use** (Appendix 2 and Appendix 5).

On the geological map, as previously mentioned, there are three large geological units that are different in terms of rock from which these units are composed. The biggest unit occupies the western and central part of the wider zone, the smaller central-southern part is another geological unit, while the third one appears in the extreme south-eastern zone.

A similar situation is with the land use map as well. Even if there are many different land covers in the area, easily can be seen that three different surfaces leaning on each other, are dominant in the landscape. As the area is considered as an urban landscape, the biggest part of the area (western and central part) is an artificial surface where discontinuous urban fabrics are present. In the central-southern part, the biggest area belongs to artificial, non-agricultural vegetated areas, where green urban surfaces are. Almost, same on the surface, the extreme south-eastern zone of the area is estimated as an agricultural area, that is non-irrigated arable land.

According to this, three different types of landscape character can be distinguished in the observed area (Figure 7, Figure 8 and Appendix 6);

1. Discontinuous urban tissue on shale, siltstone and sandstone sedimentary rocks;
2. Artificial, non-agricultural vegetated area on shale, siltstone, sandstone, quartzite, chert, basalt and tuff rocks;
3. Arable land on shale, greywacke and conglomerate rocks.

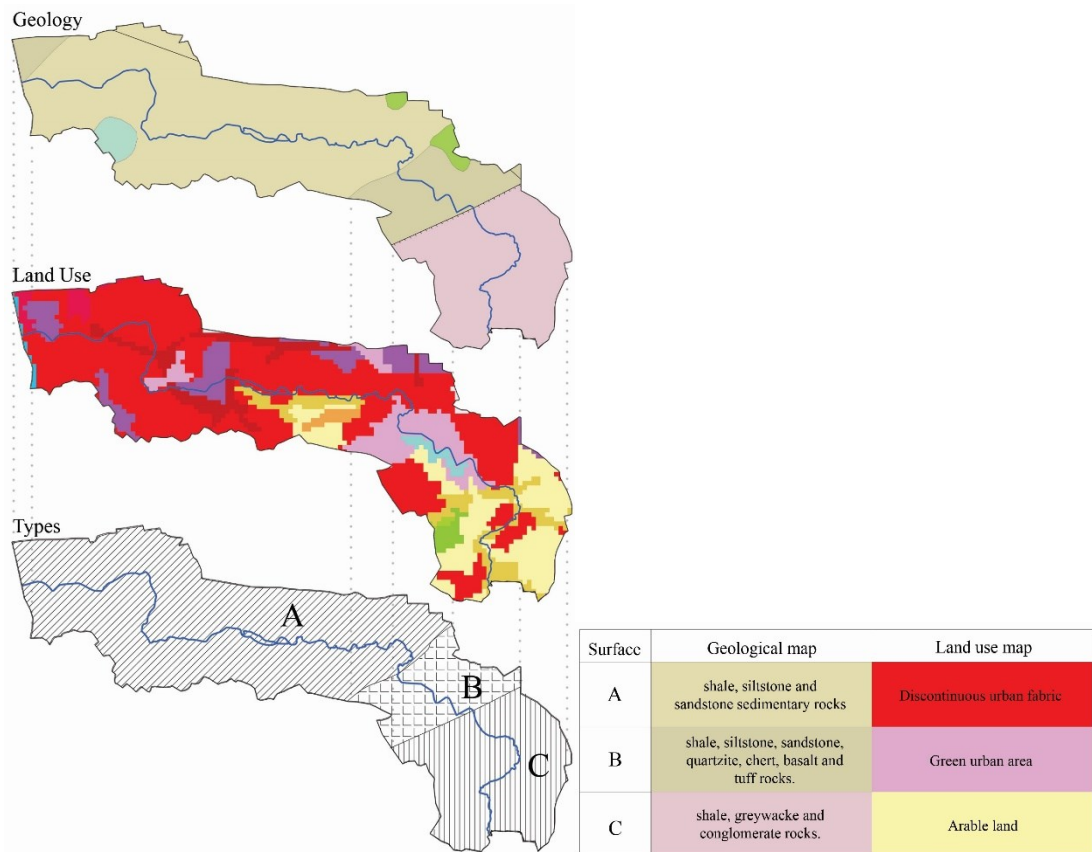


Figure 7, and Table 2. Schematic diagram and Tabular presentation of three distinguished geological types present in the observed area

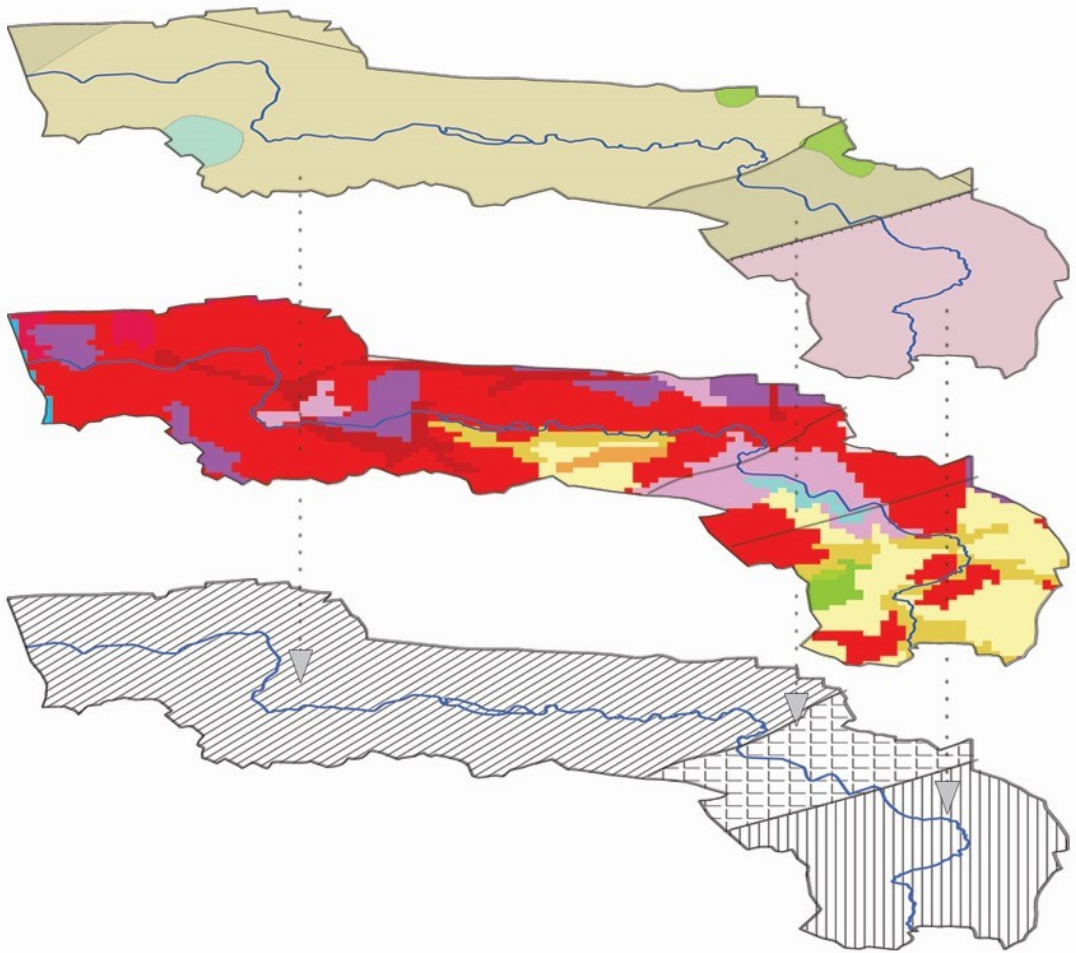
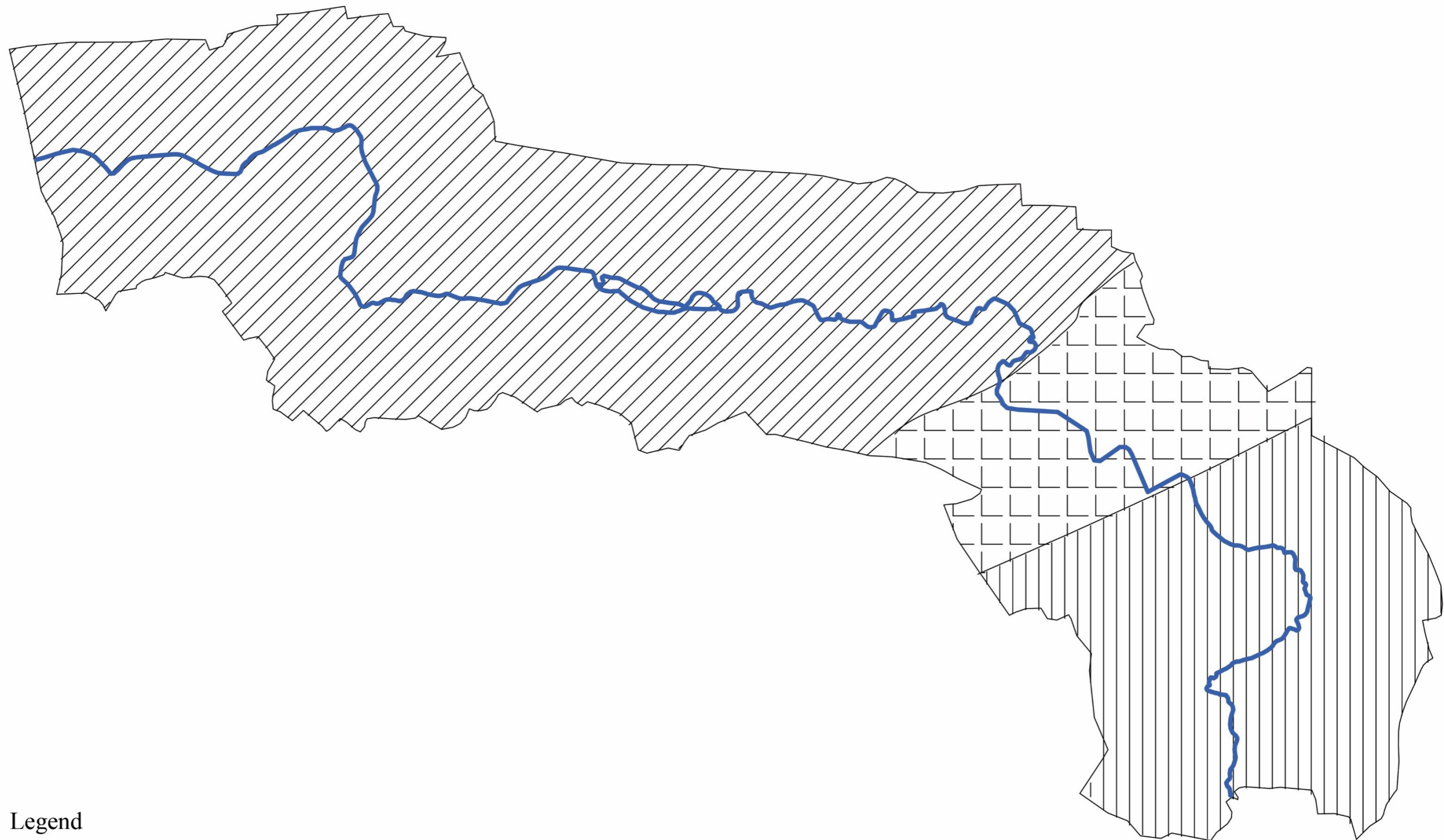
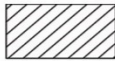
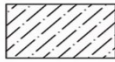
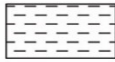
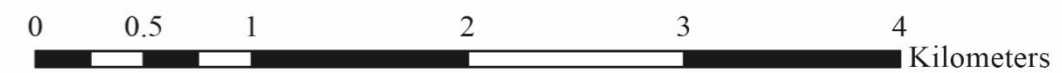


Figure 8. Demonstration of how different types were distinguished in the area of research



Legend

-  First type of landscape character
-  Second type of landscape character
-  Third type of landscape character
-  Botič watercourse



Appendix 6. Selected types of landscape character based on geological and land use map for a wider area of the researched landscape

The chosen area, for further detail analysis, is the first type of landscape character (A); **Discontinuous urban tissue on shale, siltstone, and sandstone sedimentary rocks** (Figure 9 and Figure 10). Only this type, which now represents a narrow zone of the thesis, in the following chapters will be further elaborated.

The reason for the chosen area stems from the fact that the space, under the influence of urbanization, will most likely continue to develop further. Therefore, it is important to consider its current state, character, and structure from which it will be possible to conclude the rules of regulation, protection, and further improvement of this area.

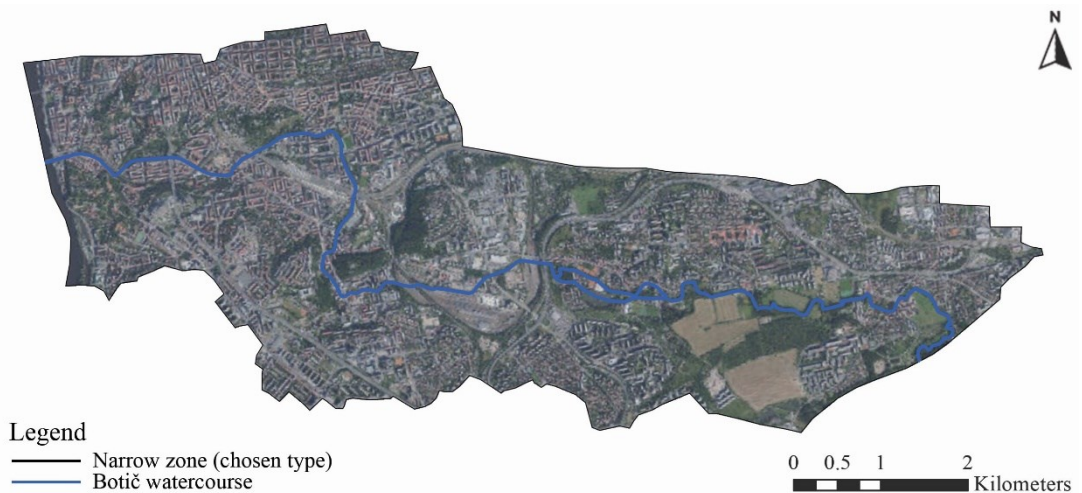


Figure 9. Ortho-photo map of the chosen type of landscape character (Narrow zone)

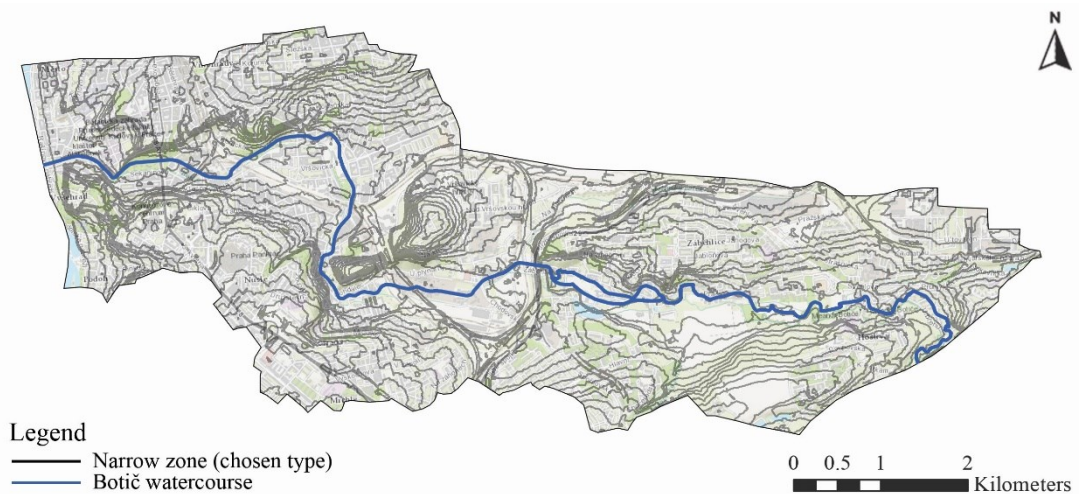


Figure 10. Topographic map of the chosen type of landscape character (Narrow zone)

4.1.3.1. Interpretation of the landscape character

Interpretation of the chosen type of landscape character Discontinuous urban tissue on shale, siltstone and sandstone sedimentary rocks, is shown through: structural and functional aspect of landscape, as well as through aspect of landscape meaning and changes. Each of these aspects will be in detailed explained in further chapters of thesis.

4.1.3.1.1. Structural aspect of the landscape

The structural aspect of landscape represents the structure of the chosen landscape character type. In thesis landscape structure is characterized based on the following features: landscape pattern, composition and configuration, and visual elements that are bearers of the landscape character.

4.1.3.1.1.1. Landscape pattern

Landscape pattern is formed on the basis of relief, ecological and cultural pattern (model). As previously stated in the thesis landscape pattern defines each landscape individually and based on it, its unique character is determined. Landscape character is defined as a clear and recognizable scheme of elements that consistently appears in a certain landscape (Swanwick, 2002), and the diversity of landscapes is reflected in their different characters.

For the purposes of this thesis, specific data was collected and furthermore, helped in the determination of types and subtypes that are present in terms of different observed patterns. For relief patterns, types were determined according to the present soil types in the type, while slope determined subtypes in the area. Types of the ecological pattern were different types of forest that are present (according to the Potential-Natural vegetation), and subtypes were determined according to the protection classes of the soil. The cultural pattern was defined according to the Corina Land Cover types, while different subtypes present in the research area, are classes defined by Corina. Scale of obtained maps is 1:25.000 (Appendixes from 7 to 9).

4.1.3.1.1.1.1. Relief pattern

Map of the relief pattern (model) was obtained by overlapping two maps; the geological map of Czech Republic (Scale: 1:500.000) and by calculating of Slope from the researched area (by Digital elevation model - DEM), (Appendix 7).

As it can be seen from the map (Map/Appendix X), four types of soil are present. According to them, types of relief pattern for the researched area are distinguished, while subtypes are represented with a slope that is occurring. The biggest surface has very flat terrain (0-1%) surrounded with something higher slopes (1-2 %), where roads and objects of the area are placed. Something higher elevation (2-8%) is mostly occurring in places where green urban areas, parks, and abandoned vegetated areas are present. Very high slopes of the area (> 11%), sporadically appear in the area.

4.1.3.1.1.1.2. Ecological pattern

Map of the ecological model (pattern) was obtained by overlapping two maps: Potential-Natural vegetation map of Czech Republic (Scale: 1:1.000.000) and soil protection classes (obtained from the Research Institute for Soil and Water Conservation, VÚMOP), (Appendix 8).

There are five protection classes of the agricultural land fund (Table 3), determined by Decree of the Ministry of the Environment 48/2011 Coll. of 22 February 2011, as amended by Decree No. 150/2013 Coll.

Class	Description
I	The most valuable soils, mainly on flat or slightly sloping land
II	Agricultural land that has above-average production capacity
III	Mainly soils with an average production capacity, which can be used in spatial planning for construction and other non-agricultural uses.
IV	Mainly lands with below-average production capacity, only with limited protection, usable for construction and other non-agricultural purposes.
V	Soils with very low production capacity

Table 3. Description of protection classes,

according to the Ministry of the Environment

Area where the Botič stream is flowing, as in the past was often flooded, resulted with the soils that area categorized as a I protection class. In almost the same percentage share, III and IV protection class are present in the study area. Sporadically, mostly in the western part of the area, land belongs to V protection class, where there is very low capacity for agricultural production.

Because this study site is located in the very urban part of the city, the III and IV classes can be understood as good soils, even though the majority of the area is not currently being use for agriculture but for urban development, mostly. Even if they are characterized with an average and below-average production capacity, that is only in terms of agricultural activities. These soils are still in some percentage rich in nutrients and organic matter. For this reason, they can be still considered as suitable, and with their improvement, they can be used as other surfaces, besides construction (how it is described), where only, further degradation is happening.

4.1.3.1.1.1.3. Cultural pattern

The procedure of defining the cultural model is analogous to the method of separating the landscape elements of CORINE Land Cover, (Appendix 9).

It is clearly seen, that almost the entire narrow area of the research landscape character type belongs to the Artificial surface. As the western part of the area borders with Vltava River, a smaller part belongs to Water bodies, while the south-eastern area is occupied with Agricultural surfaces. These three main divisions present three types of cultural patterns of human influenced land use.

Subtypes are later divided according to the present categories (classes) according to Copernicus land monitoring service. Most of the artificial surface belongs to Discontinuous urban fabrics, and sporadically in type, bigger in surface, Industrial or Commercial units are also occurring. Other subtypes of artificial units belong to roads, green areas, and sports facilities. In agricultural areas, three subtypes appear; Non-irrigated arable land, fruit plantations, and a small area that is characterized as land that is occupied by agriculture, with a significant amount of natural vegetation.

4.1.3.1.1.2. Composition and configuration of the landscape

Landscape composition refers to the number, concentration and size of different types of elements in a landscape, where the composition of the landscape interprets characteristics such as proportion, uniformity, dominance and diversity of landscape elements. Landscape configuration, on the other hand, represents the spatial arrangement of landscape elements and deals with the shape and compactness of landscape elements, their distances, contrast of edges, which interprets the spatial geometry of the landscape pattern (Vasiljević, 2018).

Composition and configuration of the landscape in the thesis are interpreted as a structural aspect of the landscape system that came out as a result of economic, social, cultural, and natural factors that were participated in the process of landscape pattern formation. For that reason, the composition and configuration of the landscape were divided into four aspects of listed factors; green infrastructure, hydrographic, agricultural, and built structure. These four aspects will define landscape matrix of researched area.

The heterogeneous matrix of the landscape character type consists of a discontinuous urban fabric, which has no clear form. In addition to the dominant landscape element of the constructed tissue, the investigated type contains elements of river forests and agricultural areas of irregular geometric shape along with the fluvial relief (Botič stream).

The edges are fragmented, as a result of which there is a spatially dynamic change of landscape elements, which gives the whole landscape an insufficiently legible character.

4.1.3.1.1.2.1. Green infrastructure

Observing the western part of the study area the category with the largest elements of green infrastructure (pervious surface areas) are those containing vegetation and green spaces that are situated between buildings; gardens, lawns, squares and playgrounds (small public park as Zítkovy sady, Charls square (Karlovo náměstí) and Náměstí Míru square, Botanical Garden of Charles University, Catherine's Garden (Psychiatrická zahrada), Park Ztracenka, Park Folimanka, Havlíčkovy sady, Bezručovy sady, Sady Svatopluka, Heroldovy sady, Baarův park, Dětské Hřiště U Štíky and others). However, because this type is defined as discontinuous urban tissue, an important role of green infrastructure, also has residential greenery (mostly located in the middle of block on plots), flower beds, shrubs, and tree lines along the streets.

Tyršův Hill is located in the very central part of the area. Until the 19th century, this area was covered with orchards; there were also some small mineral quarries. Afforestation took place at the very beginning of the 20th century. Tyršův Hill is surrounded by the Botič stream channel, and today presents a very important green element of the area, with a huge potential for recreation, that is not used today. In the western and central part of the area, several sports facilities, surrounded by a significant amount of greenery are located.

Now we are approaching the eastern zone of the study area where, the most dominant green infrastructure is categorized as agricultural land (Appendix 9). This riparian vegetation situated, along Botič stream, that belongs to the Natural Park Meandry

Botiče. On April 29, 1968, Meandry Botič's natural monument was declared a protected natural creation due to the designation of protection for some endangered bird species and aquatic animal communities. In the eastern part of the study area, several abandoned meadows are also located (Appendix 9).

On the extreme south-eastern zone, a small part of the Nature Park Hostivař-Záběhlice belongs in this type of landscape character. With its whole surface, this park is a pillar of the second distinguished type of landscape character in the thesis, and it is connected, with one of the oldest Natural Park in Prague, Botič-Milíčov.

From the above, it can be concluded, that the elements of green infrastructure present in research type, can be distinguished into two parts. First would belong to the western part of the area, where elements of greenery are mostly present as urban green areas, as small size parks, playgrounds, squares, sports facilities, and residential vegetation (Figure 11). Second part (moving more to the eastern part), counts remnants of forests, meadows, small surfaces of vegetation along the streets (Figure 12). This does not mean that in the second part, there are no present elements of urban greenery. Since this is also very developed and area, sports complexes and residential vegetation is present. The only differences are that in the second part, there is almost no urban parks and squares, while Natural Parks, and more landscapes close elements are present, which is the opposite situation in the western part of the type. All of this is consistent with the existing land use characterization.

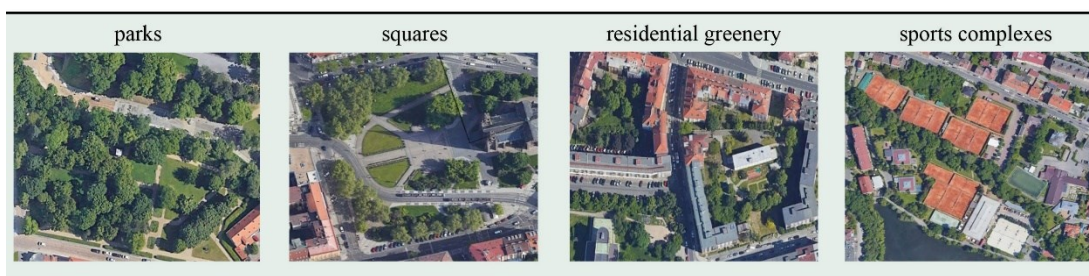


Figure 11. Elements of Green infrastructure (Source: <https://earth.google.com/web/>)

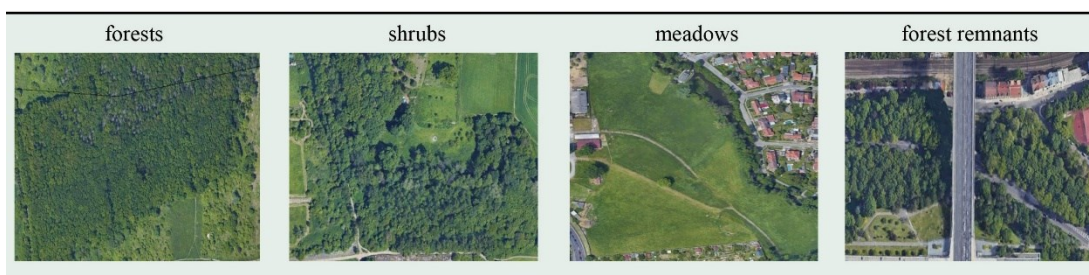


Figure 12. Green infrastructure (Source: <https://earth.google.com/web/>)

Since this type is a relatively considered as a small area, the percentage of greenery is favorable. Observing the whole type and moving in the west-east direction, several different elements can be singled out; the main element of the green infrastructure consists of smaller green areas together with residential vegetation, where linear forms of medium and high vegetation appear along the roads in the western and central part of the type. Moving to the east, the porosity gradually increases, where remnants of forests are present. As there are no continuous tree lines along all streets, and as the mentioned elements themselves are not interconnected, the marginal effect of green infrastructure in this area is not clearly expressed.

4.1.3.1.1.2.2. Hydrographic structure

The presence of surface waters is a crucial geographical, ecological and aesthetic factor. Rivers and streams are important corridors for both biota and humans. At the same time, flood phenomena, erosive and sedimentation processes, phenomena of biological invasions, etc., are an integral part of these landscape elements (Wascher, 2005). Despite the undeniable influence on the character of the landscape, hydrographic data are marginalized in the data of the typology of the landscape mainly due to its linear character (Romportl et Chuman, 2012). Surface water surface segments are reflected in land use assessment, and water flows are occasionally assessed by the water flow density network (Wascher, 2005).

The Prague stream Botič is the main landscape element of the hydrographic structure in the investigated type. Its specific form of meandering, characterizes the identity and the configuration of the landscape structure. Almost 13 kilometers (12.89 km precisely) long, passes through the five Prague Districts (2, 4, 5, 10 and 15) in the chosen type of the landscape character. Following the flow of the stream from the Vltava River, to the east of the type, during field phase, by visual perception, it was concluded that there is a weak presence and diversity of vegetation, high levees and low level of water present in the riverbed, make the stream almost completely invisible in space. The transferred pressure of urbanization resulted in the undergrounding of the stream in its very inflow into the Vltava. The constructed facilities, too close to it, disturb the balance of the stream with the environment, while at the same time, the traffic infrastructure interrupts its surface flow in many places (Figure 13). The flow of a stream that passes through or next to green areas (parks Park Folimanka, Havlíčkovy sady and Natural park Meandry Botiče) mitigates the effect of urbanization and allows access to the stream. As another consequence of the expansion of the city, the stream in the researched area is impossible to follow in its entirety. Many settlements and its built facilities make the promenade along the Botič stream impossible. In the central-eastern part of the type, there is a lake, fishpond Hamerský, which is a side pond on the Botič drive in Záběhlice. Originally, was built as a source of water and water energy for copper mills arounded 1770., and since 2007 is under Department of Environmental Protection of the City of Prague, that manages most ponds and reservoirs in Prague). The pond is rich in plants and animals, a large number of birds, amphibians, butterfly species, and woody plants enrich this lake, while at the same time emphasizing the need for its protection, regular maintenance, and preservation. Today, the lake with its surface area of 3.8 ha, has a main purpose for fish farming, landscaping and fire protection.

A great contrast when following the flow of the stream, occurs in the eastern part of the type where the pond is located. His presence and his approach to it is almost unstressed. However, the image of the landscape has changed from an urban and built structure, to a completely natural landscape. The ideal space for rest, walks and recreation of residents and visitors of Prague, to a very small extent exploits this potential of space. The crossing from the lake to the Meandry Botiče Nature Park, following the stream, does not exist, there is an exit to the bypass road and a tour of the stream, for access to the forest, disrupts the flow of visitors and destroys the image of the natural landscape. Around the Natural park Meandry Botiče, there are agricultural areas, which can only be seen in the background, without the specific existence of edges in the landscape image. The immediate vicinity of the built structure next to the Natural Park, disturbs both the image of the landscape and the overall feeling of man being in nature free from the stress and noise of the city.

Over time, the edges of the rivers are due to the consequences of urbanization, modified and adapted to construction, where in some places they provide access to the stream, which today significantly affects the level of recreation and quality of life. The edge effect is presented in the form of a watercourse that stretches along this type, fragmented in many parts of it. From all the above, it is clear that the balance between this landscape element and its environment has been lost. The Botič stream, as a very valuable element of the city structure, completely loses its aesthetic quality and almost never meets the needs of city users. It can be said that due to the development of the city, the pressure on the Botič stream itself leaves the impression that it almost does not exist in the area.

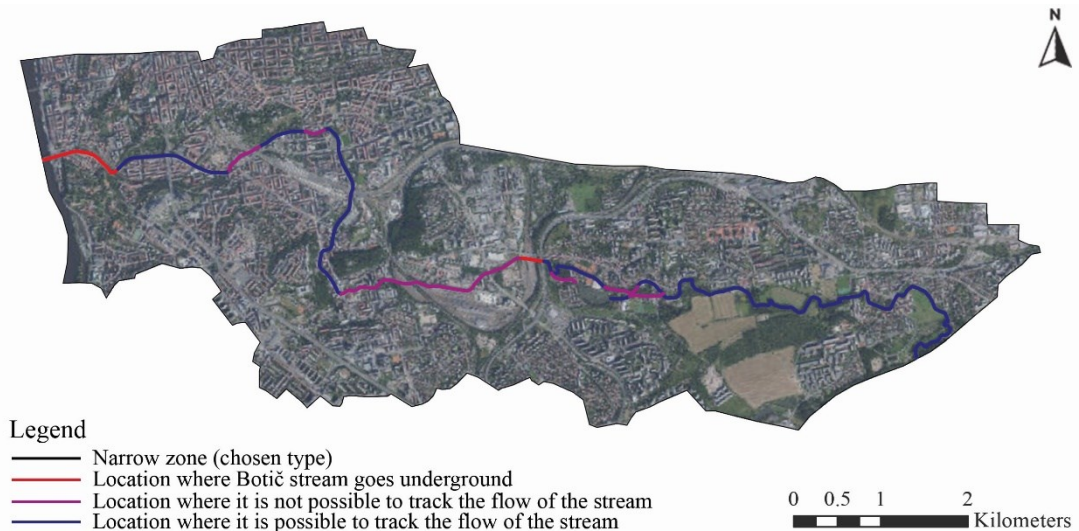


Figure 13. Demonstration of monitoring the flow of the Botič stream in the chosen type

4.1.3.1.1.2.3. Agricultural structure

Frequent floods have occurred in the past on the investigated type of landscape character, in the center of which flows the Botič stream. As a result, in the surroundings, lands suitable for agricultural activities have been formed, which is confirmed by the results of land characteristics (Chapter 4.1.2.1.). Many of these, agricultural areas in the south-eastern part of Prague, can be found at present, but due to increasing urbanization, these areas are now become only sporadically found along the watershed. Different in their shape and size, and also encroached upon by roads and small settlements of residential housing, they represent a rapidly vanishing remnants of the past, yet contain significant elements of green infrastructure (Figure 14).

The agricultural structure appears in the form of remnants of arable land, different in size, which are located along the roads in the south-eastern portion of the study area. Three different categories of agricultural land are present; Non-irrigated arable land (2.1.1.), Fruit trees and berry plantations (2.2.2.) and Land principally occupied by agriculture, with significant areas of natural vegetation (2.4.3.).

Vegetation that surrounds arable land belongs to the Natural Park Meandry Botiče, where the Botič stream is flowing. This vegetation represents riparian vegetation with the occurrence of protected and endangered bird species and aquatic animal communities.

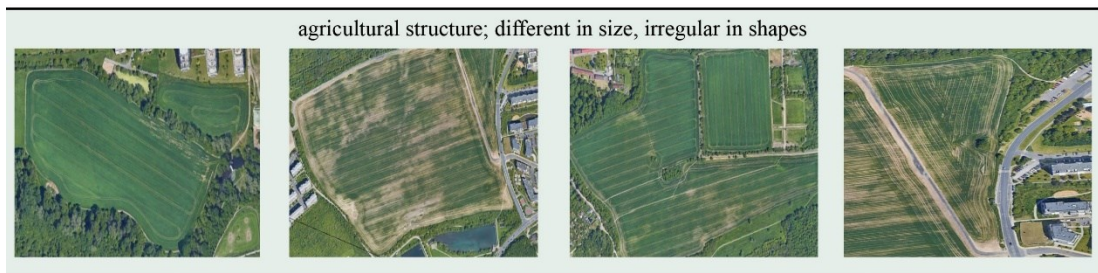


Figure 14. Agricultural structure (Source: <https://earth.google.com/web/>)

The edges of the agricultural structure are geometrized, and they are framed by clearly defined roads and fragmented hedges.

Now, due to uncontrolled and increased urbanization, it is obvious that this landscape element is under great pressure from all sides. Discontinuous urban fabric as a consequence of city development, has a high chance, to replace agricultural remnants in this area.

4.1.3.1.1.2.4. Built structure

Chosen type of the researched urban landscape is mostly occupied by built structure. From areal picture, it is very easy to establish two surfaces, with different characteristics (Figure 15).



Figure 15. Two different areas of built structure, present in the Narrow zone

In the western part of the study area can be found Surface A consisting of small and large blocks of flats, and, where the existing vegetation and green spaces are occurring between buildings, mostly on private land. In the southern and western parts (near Vltava River) of Surface A, commercial units are present (< 25 ha). In the northern part of this zone, all of the mentioned types of land use mentioned above are present in a denser pattern, where residential vegetation occupies less than 20% of plots in this area. When it comes to streets pattern, the whole Surface A can be defined as an irregular grid (irregular pattern), where plots have different shapes and sizes, but objects follow the regulation line of streets. The smaller (northern) part of this area has an orthogonal scheme of the streets.

Surface B is characterized as occurring primarily in the center and eastern portion of the study area and cannot be characterized as containing either with irregular or

orthogonal streets patterns. The built structure here is mostly composed of single-family homes along the streets. Sporadically in this zone, multi-story buildings, predominantly intended for housing are occurring. Industrial and commercial units are located in the western and northern part of Surface B.

According to this, Surface A can be characterized as the area that follows the central part of Prague development, while, the transition is occurring in the central part of the study area, where industrial zone and Railway is located. Plots that are following the orthogonal and irregular pattern of the streets instead of blocks have single-family houses that are unevenly distributed, thus creating a chaotic structure. Approaching more to the western part, orthogonal and irregular pattern is completely lost, forming a very “messy” structure that is a result of unplanned construction supported by unrestrained urbanization (Figure 16).

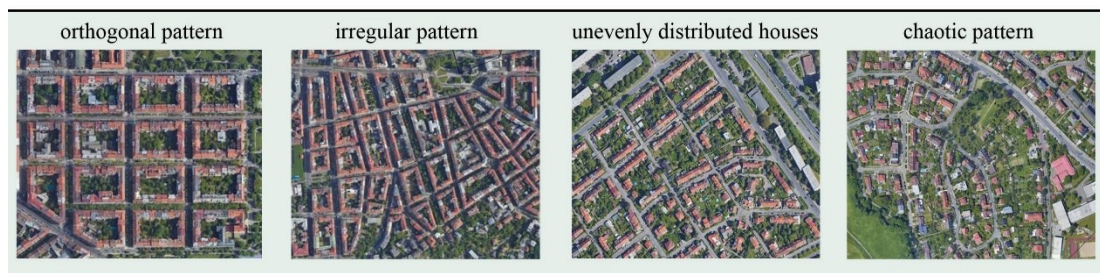


Figure 16. Built structure (Source: <https://earth.google.com/web/>)

Since the buildings are located along the regulation line, the edges in the space are clearly emphasized and legible. The streets follow the configuration of the terrain.

The matrix category of the entire study area is obviously heterogeneous, formed by a variety of landscape components, resulting in unplanned or perhaps poorly planning and uncontrolled land development. Accordingly, the edges in the landscape are not clearly legible and represent a combination of organic and geometric. Edges on agricultural land appear in places in the form of hedges that enclose them, which also results in illegible landscapes.

As a result of the composition and configuration, several Landscape Character Elements can be distinguished for the researched type of the landscape character;

1. Botič stream
2. Single-family houses of eastern part
3. Residential apartment blocks
4. Non-uniform agricultural areas in the southeastern part of the type
5. Natural Park Meandry Botiče (natural monument)
6. Nature Park Hostivař-Záběhlce
7. European route E65
8. Railway Stock Depot (part of the Czech Railway system) in the central part

4.1.3.1.1.3. Visual elements of the landscape character

Based on the field research and visual assessment, which has a role in understanding the structure of the landscape through visual perception and can serve as a basis for designing attractive landscapes, the following conclusions were made;

1. Within the researched type of the landscape character, there is a contrast between the elements created naturally and anthropogenically, which significantly affects the stability of the landscape.
2. The change in the shape and form of landscape elements is pronounced and sudden, and the edges are periodically lost.
3. An irregularity of the plots was noticed. Housing zones in the western part of the type (around the center of Prague) are characterized by high population density while moving from the Vltava River (eastern part of the type), these zones are fragmented, interconnected, and do not follow the plots

The experience of space comes down to recognizing the various elements in the landscape that are considered significant. It is clear that everyone has their own perception and knowledge of space, and therefore visual assessment of the researched area should have a key role in forming landscaping rules because landscape management in some way affects or controls user behavior or mentality.

The American urban theorist and planner Kevin Lynch, who worked on the image of the city, concludes that human perception is a complex process that analyzes and immediately interactively connects the results of observations with our knowledge and experiences from the past (Lynch, 1960). The way how each observer is understanding or processing information of the built area and how they are using these visual clues to create mental maps is significant in how we understand the importance of place. This way of thinking can be understood as a basis for future development of the study area because person's individual way of seeing and understanding the landscape should help to determine its structure, function, and dominant elements, that are valuable for the individual. According to Lynch's conclusion, people are forming mental maps of their surroundings consisting of five basic elements; paths, edges, districts, nodes, and landmarks. Whereas Lynch may have been one of the first to clearly understand this and clarify it using the aforementioned terminology, humans have likely been doing this since early times.

Since the topic of the master's thesis is the arrangement of the Botič stream, the visual analysis is reduced only to the level of its flow. Following the flow of the Botič stream, the points from where each of the pictures were taken was determined during site analysis and field study phase of this thesis research. The points are placed in all bridges of the stream, as well as in the streets that cross it. Places where a change in the structure in the landscape character was documented (for example: the moment when the river goes underground; the moment when a wider picture of the landscape opens; or a space that is more desirable compared to others, etc.), were also taken and considered for evaluation, as a dots from which pictures were taken. From every reference point, pictures were taken in all four directions of view. The most representative image (out of four) for each point, was chosen for further evaluation.

In the field, therefore, more than 200 images were collected, and only 56 images were evaluated. The evaluation was performed on the basis of eight established parameters,

where each parameter was evaluated with a descriptive adjective from 1 to 3 (Table 4).

No.	Valuation parameter	Parameter description	Evaluation description
1	View from the landscape area	how visible the area is (depth of view)	3-spacious; 2-framed; or 1-limited
2	Degree of openness	how visible the area is (width of view)	3-open; 2-semi-open; or 1-closed
3	Diversity of the landscape character	number of different elements in the landscape	3-variety; 2-moderate; or 1-simple
4	Balance	balance of landscape elements (position, direction, size, density, color); symmetry / asymmetry	3-balanced; 2-moderate; or 1-simple
5	Presence of water surfaces	number and size of water surfaces present in the area	3-high; 2-medium; or 1-low
6	Edges	presence and shape (readability) of edges in the landscape	3-high, cross-linked (compact); 2-low, cross-linked; or 1-fragmented
7	Dominant shapes in the landscape image	legibility of the shape in the landscape image	3-expressed; 2-weakly expressed; or 1-not expressed
8	Dominant color in the landscape image	legibility of the color in the landscape image	3-harmonious (polychromatic or monochromatic); 2-moderately-harmonious (polychromatic or monochromatic); or 1-inconsistent (polychromatic or monochromatic)

Table 4. Presentation of the parameters used in the thesis, their description and evaluation method

The parameters are established in a way that evaluates some of the basic elements of the landscape. Those elements that people perceive (consciously and unconsciously) in space, from which they themselves then create an image of the whole image of the landscape. Therefore, this phase of the thesis was done through a survey. Overall 24 people were randomly interviewed. Survey responders were given representative images of each of the previously described points and tables by which to evaluate each parameter. The overall result will be presented in the following chapters, from which the overall visual assessment of the landscape will be reported later (Chapter 4.1.3.2.1.). Although in all assessed images, part of the flow of the stream is included, parameter number 5 (Present of water surfaces), had the highest rating. The reason for taking this parameter into account is because it is considered that the presence of water significantly affects the picture of the landscape in humans. In this way, the visual assessment of the landscape in the middle of the built structure of the city is raised.

4.1.3.1.2. Functional aspect of the landscape

Functional aspect was carried through two groups of ecosystem services: **provisioning** (read through biodiversity and food) and **regulating** ecosystem services (read through quality of water, air (climate) and land).

For the purposes of presenting functional aspect and aspect of landscape meaning (Chapter 4.1.3.1.3.), the chosen type of landscape character, is presented in a shape of a square (dimensions 500x500 meters, where area of one square is 0.25 km²), where each square contains a variety of site data (Figure 17 and Figure 18). Since the grid of squares, set up with the help of ArcGIS software (Fishnet function), each square that covered less than 50% of the investigated type boundaries was excluded from the evaluation, in order to obtain relevant and accurate results.

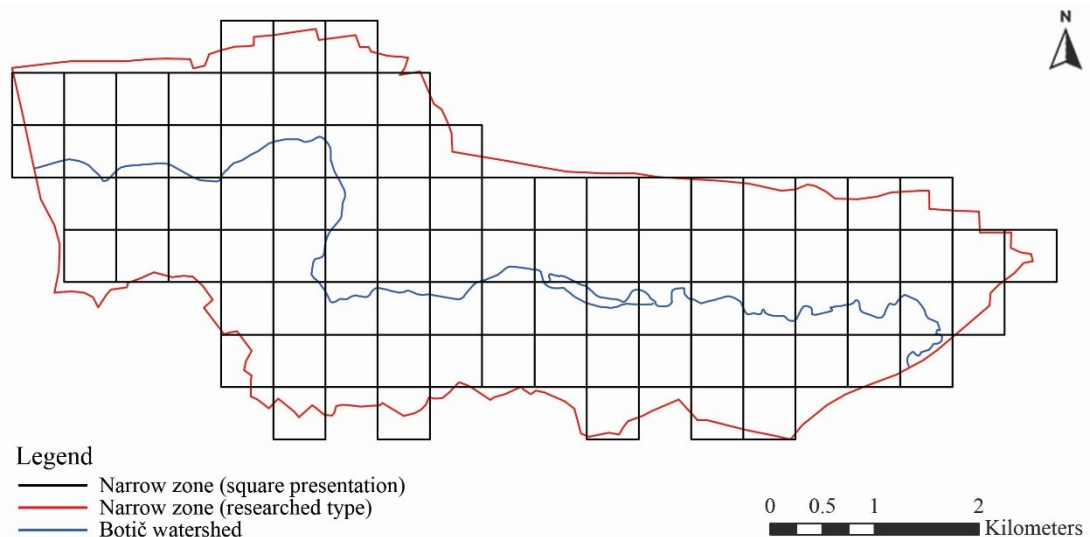


Figure 17. Chosen type of the landscape character, boundary represented at the square level

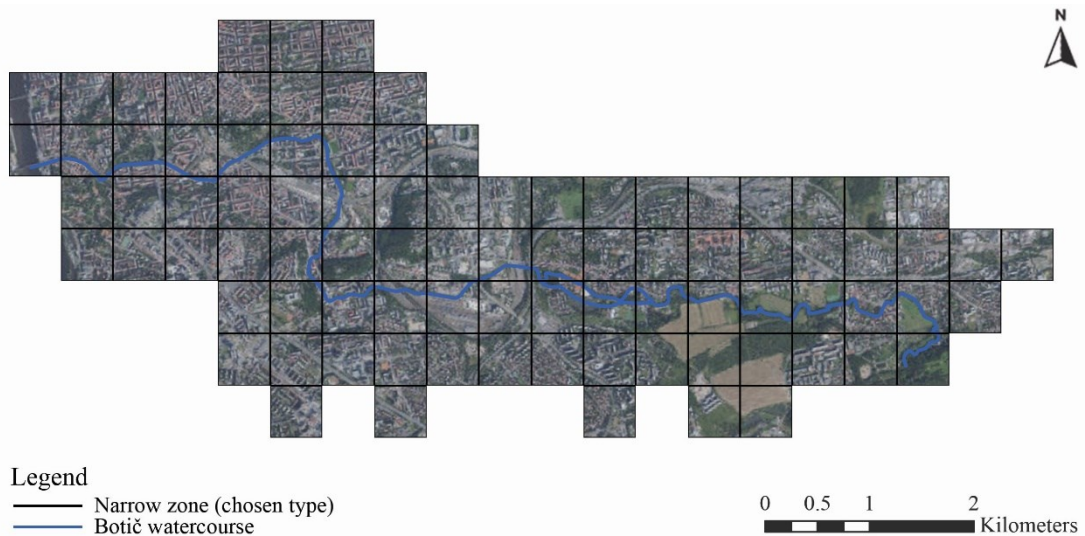


Figure 18. Ortho-photo image of the chosen type, boundary represented at the square level

All ecosystem services were evaluated on a four-point scale, ranging from low, through moderate, and high, to a very high levels of values that researched area carries (Figure 19).

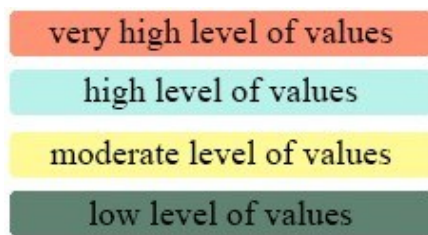


Figure 19. Scale for rating Ecosystem Services

4.1.3.1.2.1. Provisioning ecosystem services

As the researched area is defined as an urban landscape, where discontinuous urban tissue dominates, calculation of providing ecosystem services, will not give any significant results. But, as it was concluded from previous chapters (Chapter 4.1.3.1.1.2.), there is a significant amount of green infrastructure together with agriculture, whereby these spaces in the type, provide a favorable amount of green spaces, where biological diversity happens. Therefore, in this thesis, provisioning ecosystem services will be evaluated through biodiversity.

4.1.3.1.2.1.1. Biodiversity

An indicator for the evaluation of biodiversity in the researched type of landscape character is the presence and density of vegetation, and water bodies. For the purposes of calculating, a four-point scale of the percentage share, of present vegetation was created (Figure 20).

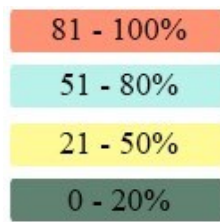


Figure 20. Scale of rating percentage share of permeable (porous) surfaces

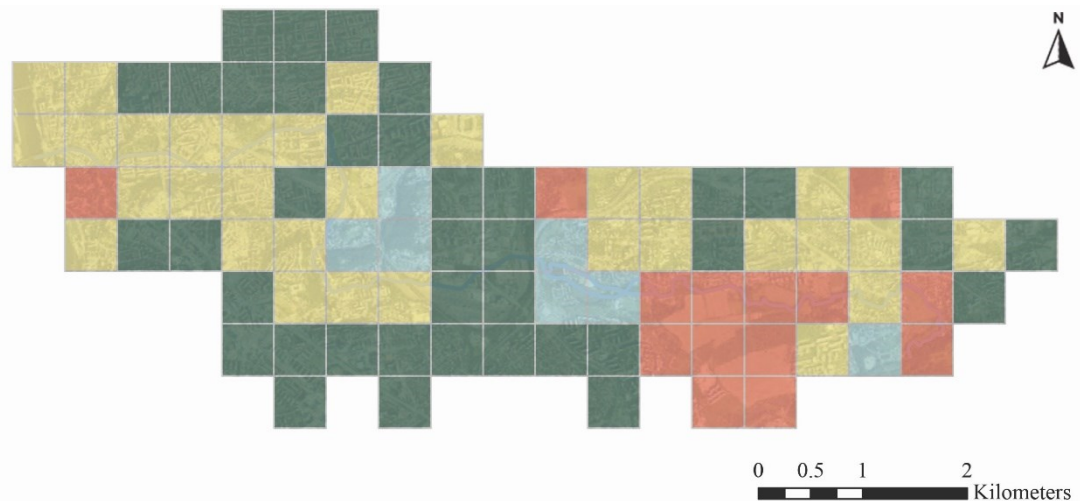


Figure 21. Presence of biodiversity values in the study area

BIODIVERSITY	very high level of present values	high level of present values	moderate level of present values	low level of present values
Researched area	16%	8%	34%	42%

Table 5. Percentage of biodiversity values present in the study area

From the above, it is clear that high levels of biodiversity are present in a very small percentage (in total 24%), while very low levels of present indicator, dominates through the whole type, with 42%.

Extremely high levels of biodiversity (16%), in the area, are noticed on its very, south-east part, where arable land and remnants of forests are present. These values are also recorded in the western part of the area (greenery around a historic fort and castle Vyšehrad), while in the northern part, remnants of forest, and meadows were the result of very high values. High levels of values (8%) occur, partially in type. In its central part, park Bohdalec Les (Tyršův hill), and Sports Complex HAMR-Záběhllice, around Hamerský fishpond (where Botič stream is passing), are present, while in the south-eastern part, these values are obtained because Nature Park Hostivař-Záběhllice occurs on a smaller surface.

A moderate level of observed values sporadically occurs in the researched area (34%). Those are mostly the places where open green urban spaces in the built part of the city are located (western part of the type), in the form of residential greenery, with tree lines along the streets, small surfaces of squares, playgrounds, or parks. In the central part, these values were recorded because of the presence of green open areas (meadows and remnants of the forest). These values are also recorded in the south-eastern part, as a result of Nature Park. Extremely low values of biodiversity (42%), due to the presence of built-up tissue of the city, can be found in all parts of the type, where present vegetation has less than 20% of share.

4.1.3.1.2.2. Regulating ecosystem services

4.1.3.1.2.2.1. Land regulation

To calculate the quality of the land, two indicators were used, soil erosion by water and the percentage share of vegetation (percentage share of permeable (porous) surfaces) in the field (since this is the area where discontinuous urban tissue forms its structure, all available types of vegetation were evaluated). The values of the possibility of water erosion are divided into a scale that determines low and high levels, while a four-level scale was used for the presence of vegetation (Figure 20).

The algorithm used is set up so that;

- high values of soil erosion by water in areas where the presence of green areas, natural and naturally-close elements is higher than 81% and above, give high values of soil quality.
- high values of soil erosion by water in areas where the presence of green areas, natural and naturally-close elements ranges from 51-80%, give high values of soil quality.
- high values of soil erosion by water in areas where the presence of green areas, natural and naturally-close elements ranges from 21-50%, give moderate values of soil quality.
- high values of soil erosion by water in areas where the presence of green areas, natural and naturally-close elements ranges from 0-20%, give low values of soil quality.
- areas where low values of soil erosion by water occur, are observed in relation to the percentage share of vegetation.

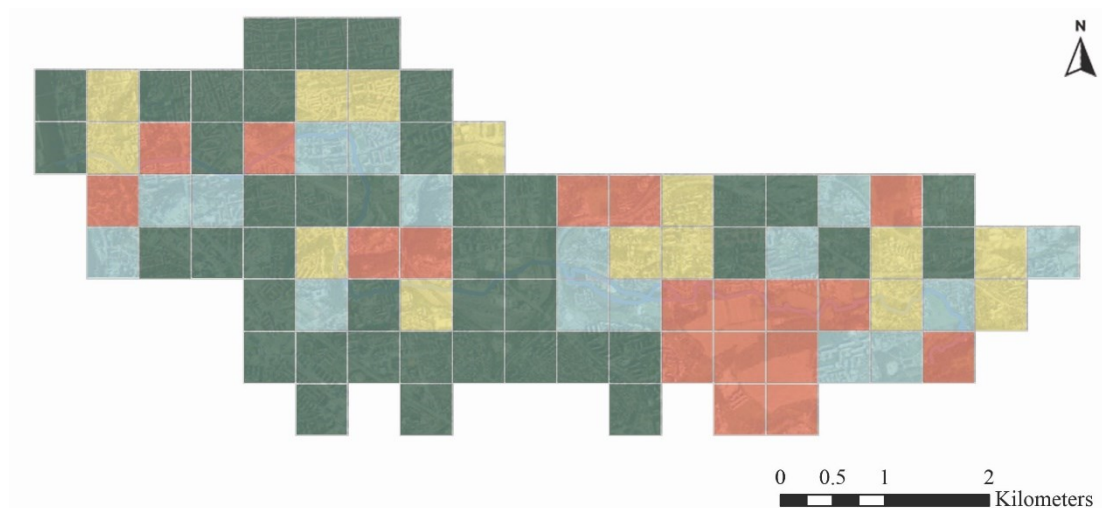


Figure 22. Presence of land quality values in the study area

LAND REGULATION	very high level of present values	high level of present values	moderate level of present values	low level of present values
Researched area	20%	18%	16%	46%

Table 6. Percentage of land quality values present in the study area

Very high values (20%) are recorded in the area where high water erosion can occur, but the significant amount of present vegetation has a tendency to prevent it to happen.

In the south-eastern part of the area, these values are obtained because of the arable land that is present here, along with the vegetation that is a part of Nature Park Hostivař-Záběhlce. These values that are recorded on the western and northern part of the research type, were a result of a significant amount of vegetation that is present in the urban area.

Low levels are the most dominant values in the type (40%). They are the result of landscape structure, which is defined with discontinuous urban fabrics, where there is not enough greenery, and where erosion by water can cause significant damage.

High and moderate values occur in an approximate percentage and are sporadically distributed by type.

4.1.3.1.2.2.2. Air quality regulation

For the assessment of air quality, the indicators used are the presence of green areas (their percentage share), together with the existing roads, and their direction of delivery in relation to the wind rose of the city of Prague.

Areas of intensive traffic and industrial facilities with a low share of vegetation, give low values of air quality, while their higher share, gives a higher level of quality.

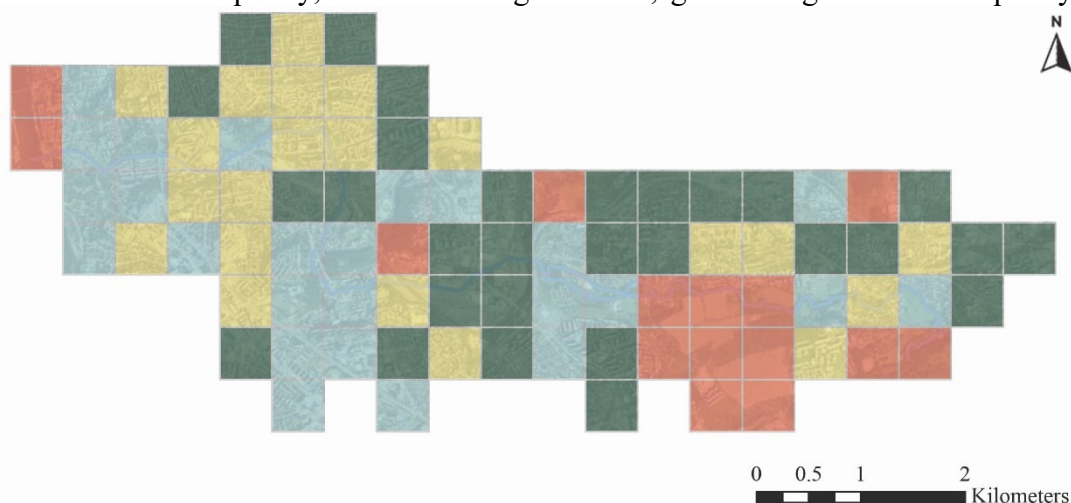


Figure 23. Presence of air quality values in the study area

AIR REGULATION	very high level of present values	high level of present values	moderate level of present values	low level of present values
Researched area	17%	28%	23%	32%

Table 7. Percentage of air quality values present in the study area

A very high level of present values (17%) was recorded in those areas, where bigger open space occurs, and where wind blow has a significant share in increasing the air quality. These areas are in the extreme western part of the type, where Vltava River is located, then on the south-eastern part, where arable land is, and sporadically among the type (its central part, where Tyršův hill is, and in its northern part, where remnants of forests are present).

An interesting observation is happening in the western part of the area, where air quality is moving around very high, high, and moderate values. Even if this area is a part of the urban tissue, a great number of greenery, and the position of the streets in the south-western direction (as wind blow), will significantly increase the air quality. In the central and eastern part, these values are recorded mostly because of higher vegetation that is present.

A low level of observed values is the most dominant value in the type (32%). They are recorded in all parts of the research area, mostly in those places where higher traffic intensity is, and small percentage share of present greenery, that might help in reducing the air pollution by noise and gases

4.1.3.1.2.2.3. Water regulation

For the calculation of water quality, two indicators were used, R-factor (Rainfall Erosivity factor) and the percentage share of vegetation in the field. The values of the R-factor are divided into a scale that determines low and high levels, while a four-level scale was used for the percentage share of pervious surfaces (Figure 20).

The algorithm used is set up so that;

- high values of rainfall erosivity in those areas where the presence of green areas, natural and naturally-close elements is higher than 81% and above, give high values of soil quality.
- high values of rainfall erosivity in areas where the presence of green areas, natural and naturally-close elements ranges from 51-80%, give high values of soil quality.
- high values of rainfall erosivity in areas where the presence of green areas, natural and naturally-close elements ranges from 21-50%, give moderate values of soil quality.
- high values of rainfall erosivity in areas where the presence of green areas, natural and naturally-close elements ranges from 0-20%, give low values of soil quality.
- areas where low values of rainfall erosivity occur, are observed in relation to the percentage share of vegetation.

Also, for an indicator of water quality, present water bodies were calculated.

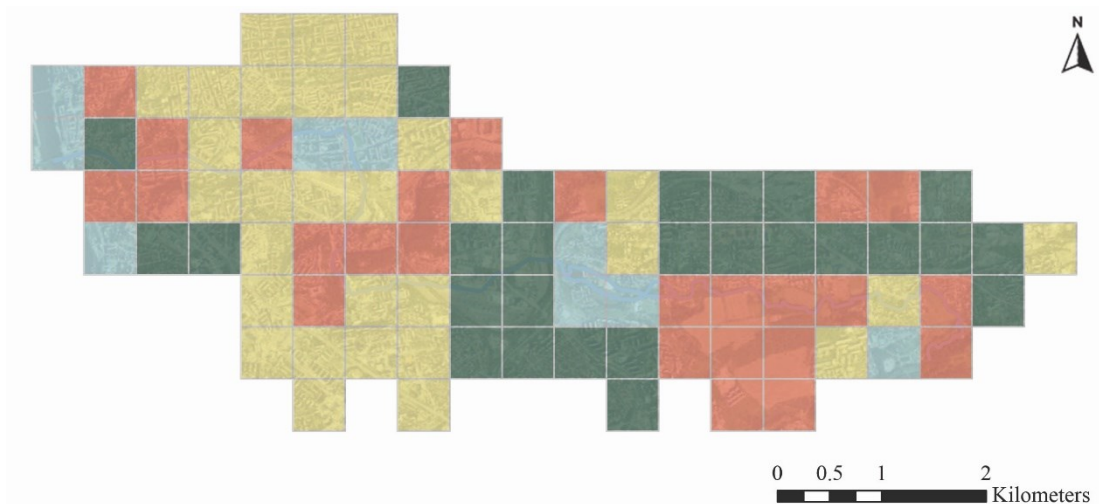


Figure 24. Presence of water quality values in the study area

WATER REGULATION	very high level of present values	high level of present values	moderate level of present values	low level of present values
Researched area	28%	10%	33%	29%

Table 8. Percentage of water quality values present in the study area

Percentage shares of very high and very low values are almost equal in the area when it comes to water quality. Very high levels, again, are recorded in those places, where a significant amount of green infrastructure together with arable land in the south-eastern part is located. Low levels are those places, where a higher R factor can occur, and a small share of vegetation, will not help to prevent the erosion.

Moderate levels are the most dominant (33%), they are recorded mostly in the western and central part of the area, where a significant percentage share of green urban infrastructure is present. High levels are sporadically occurring in a very small share according to the whole type (10%), Mostly in those areas, where water elements are present together with the greenery, while the R factor is not high.

4.1.3.1.3. Aspect of landscape meaning

The aspect of landscape meaning and social relations in the thesis were interpreted through the **cultural** services of the ecosystem.

4.1.3.1.3.1. Catalog of indicators for the analysis of cultural ecosystem services

Catalog of indicators for the analysis of cultural ecosystem services is taken from the study *Assessment and illustration of the cultural ecosystem services at the local scale - A retrospective trend analysis* (Szűc et al., 2015), with adjusting parameters and indicators to the research area.

Referring to the mentioned study, the following groups of indicators were used (Table 9):

1. Visual character	Shape diversity Number of view axis View-leading elements Diversity of landscape Presence of spectacular, unique or iconic elements and landmarks
2. Infrastructure	Number of roads Length of roads Density of roads Accessibility of the area
3. Utilization	Recreation activities
4. Natural elements	Number of special element attractions (streams, waterbodies, deadwood) Existence of old habitat trees
5. Special objects / anthropogenic monuments	Objects as recreation attractions Existence and visibility of cultural landscape elements Memorial stones Number and visibility of disturbing elements and objects Anthropogenic marks and footprints of human influence

Table 9. Display of indicators used for each cultural ecosystem sub-service. (Table made according to the study Assessment and illustration of the cultural ecosystem services at the local scale - A retrospective trend analysis; Szücs et al., 2015)

According to table above (Table 9), a catalog of indicators was done (Table 10). The main aim of this table is to determine and present, which indicators of services are relevant, not relevant or might be relevant for each cultural ecosystem sub-services.

ECOSYSTEM SERVICES		CULTURAL ECOSYSTEM SERVICES (subservices)					
		Cultural heritage	Cultural diversity	Aesthetic values	Recreation and tourism	Inspiration	Social relations
INDICATORS	Shape diversity	-	-	+	-	-	-
	Number of view axis	+	-	+	+	+	-
	View-leading elements	+	-	+	(+)	(+)	(+)
	Diversity of landscape	+	+	+	+	+	(+)
	Presence of spectacular, unique or iconic elements and landmarks	+	+	+	+	+	+
	Number of roads	-	-	+	+	-	+
	Length of roads	-	-	-	+	-	+
	Density of roads	-	-	+	+	-	+
	Accessibility of the area	-	-	-	+	-	+
	Recreation activities	-	+	(+)	+	-	+
	Number of special element attractions (streams, waterbodies, deadwood)	+	-	+	+	+	-
	Existence of old habitat trees	+	-	+	(+)	+	-
	Objects as recreation attractions	+	+	+	+	+	+
	Existence and visibility of cultural landscape elements	+	+	+	+	+	(+)
	Memorial stones	+	+	(+)	(+)	-	+
	Number and visibility of disturbing elements and objects	-	-	+	(+)	-	-
Anthropogenic marks and footprints of human influence	+	(+)	+	-	-	+	

+ relevant; (+) can be relevant; - not relevant for the subservice

Table 10. Catalog of indicators for the analysis of cultural services of ecosystem used in the thesis. (Table made according to the study Assessment and illustration of the cultural ecosystem services at the local scale - A retrospective trend analysis; Szücs et al., 2015)

4.1.3.1.3.2. Cultural ecosystem services

According to the predefined list of services determined in the Millennium Ecosystem Assessment Study: *Ecosystems and Human Well-being: Synthesis*, (2005), seven

ecosystem services were singled out, namely; cultural heritage, cultural diversity, visual and aesthetic values, recreation and tourism, inspiration, social relations, and the spirit of the place- *genius loci*.

Inspiration, social relations, and spirit of the place are not taken into account for the further steps of the thesis. First two, of mentioned parameters were taken into account for the catalog of indicators (Table 10) because the process of changing the social structure is considered to be extremely influential in changing the structure of the landscape, and inspiration because of the fact that different elements of the landscape, their shape, and position in the space, are provoking different emotions and behavior. They are helping in the process of creating our own mental picture of the visited area.

Since the researched field of the thesis is defined as an urban landscape, special attention is given to the cultural services for ecosystems. Through the consideration of various indicators, cultural sub-services are grouped into three main groups (cultural heritage and diversity, visual and aesthetic values and recreation and tourism). For every group, along with the other evaluated indicators, the percentage share of present green urban areas is taken into consideration (Figure 20), but the places, where none of the indicators were recorded, even with the significant amount of vegetation, these areas were considered as areas with a low level of observed values.

4.1.3.1.3.2.1. Cultural heritage and diversity

For obtaining the results that will present these sub-services; cultural goods, buildings of public importance, cultural facilities, memorial trees, and significant landscape elements were the main indicators.

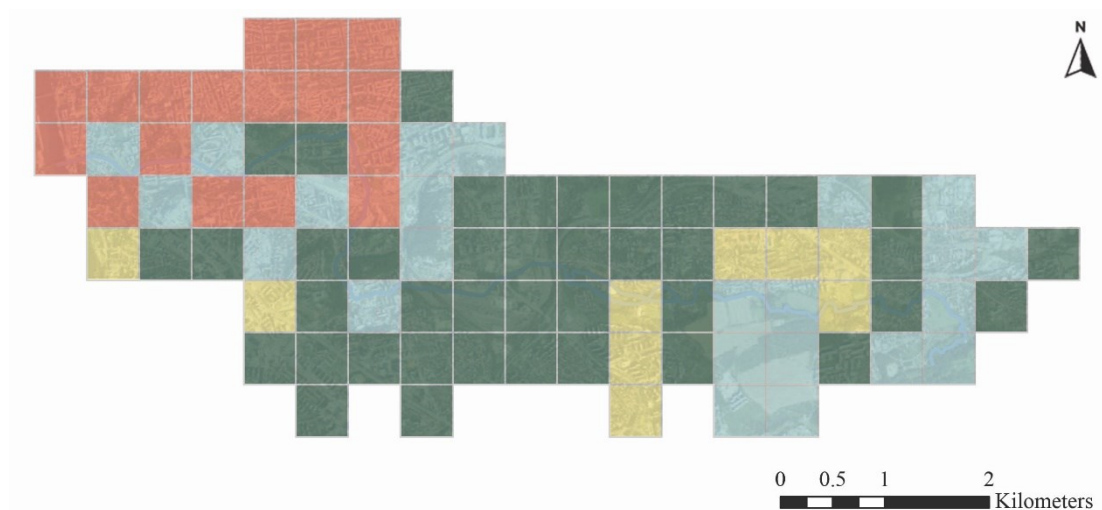


Figure 25. Values of cultural heritage and diversity in the study area

CULTURAL HERITAGE AND DIVERSITY	very high level of present values	high level of present values	moderate level of present values	low level of present values
Researched area	19%	26%	10%	45%

Table 11. Percentage of cultural heritage and diversity values in the study area

Extremely high values were obtained in the extreme western and south-western parts of the study area, yet only represent 19% to the composite total. A high number of

cultural facilities, cultural goods, and building of public importance, with a higher percentage share in type, gave these values. As this part of the area is very close to one of the most significant landmarks of the city (National Museum and Astronomical clock in Prague), it is obvious, that this zone will carry higher observed indicators.

Sporadically in type, high and moderate levels of values (only 26%), are recorded in those places, where green areas (parks, Nature park) are occurring. As it can be seen from the above figures, the low level of observed indicators is the most dominant in the chosen type (45%). From the central until eastern part, mentioned evaluated indicators, are not present at all.

4.1.3.1.3.2.2. Visual and aesthetic values

Results for visual and aesthetic values were obtained according to the data that gave information about present significant vantage points of view, cultural goods, cultural facilities, significant landscape elements, memorial trees and nature parks.

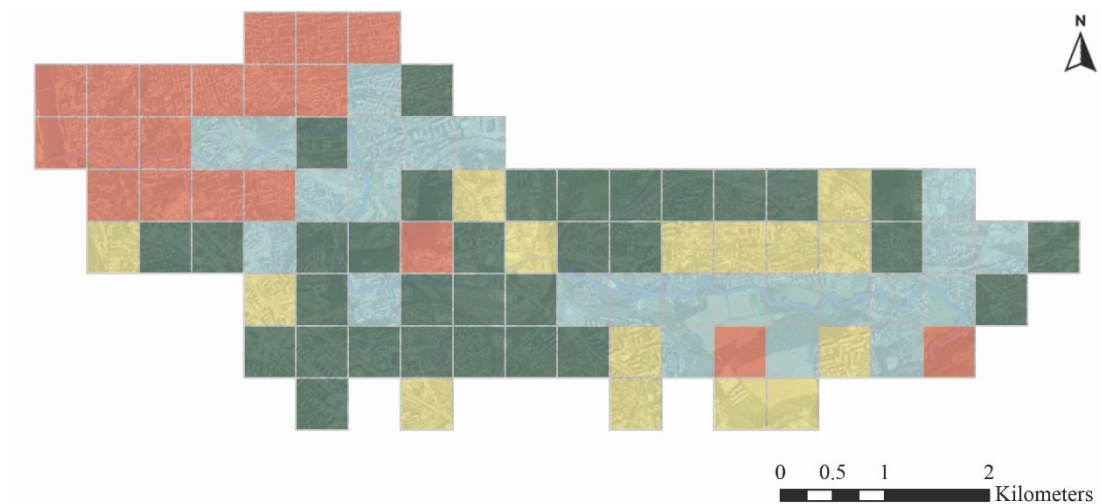


Figure 26. Visual and aesthetic values in the study area

VISUAL AND AESTHETIC VALUES	very high level of present values	high level of present values	moderate level of present values	low level of present values
Researched area	21%	27%	17%	35%

Table 12. Percentage of visual and aesthetic values in the study area

High levels of visual and aesthetic values, as can be seen from the appendances above, are present in a small percentage (in total 21%), while low levels of these values, once again dominate.

Very high levels are present in the parts of the area, that are near Vltava River, located in Prague 2 and Prague 5 districts. These areas are very rich in the number of cultural goods, while the unique architectural style characteristic for the city of Prague is contributing to these values. On the south-eastern part of the type, these values are recorded as high, obtained because of the Nature Park. A high level of values is recorded in those places, where a higher number of evaluated indicators are present (western part of the type), as well as significant percentage share of them is present with the parts of Nature park (south-eastern part of the type).

Moderate values are sporadically occurring (17%), they are a result of low percentage share of indicators. Low values are the most dominant (35%) mostly in the central part, where indicators were not recorded, even if elements of greenery present.

4.1.3.1.3.2.3. Recreation and tourism

Recreation and tourism as sub-services of the cultural ecosystem were evaluated on the basis of open green areas (parks and sports centers), along with the significant vantage points of view, cultural goods, buildings of public importance, cultural facilities, significant landscape elements, memorial trees, Nature parks and parts of Territorial system of ecological stability (TSES).

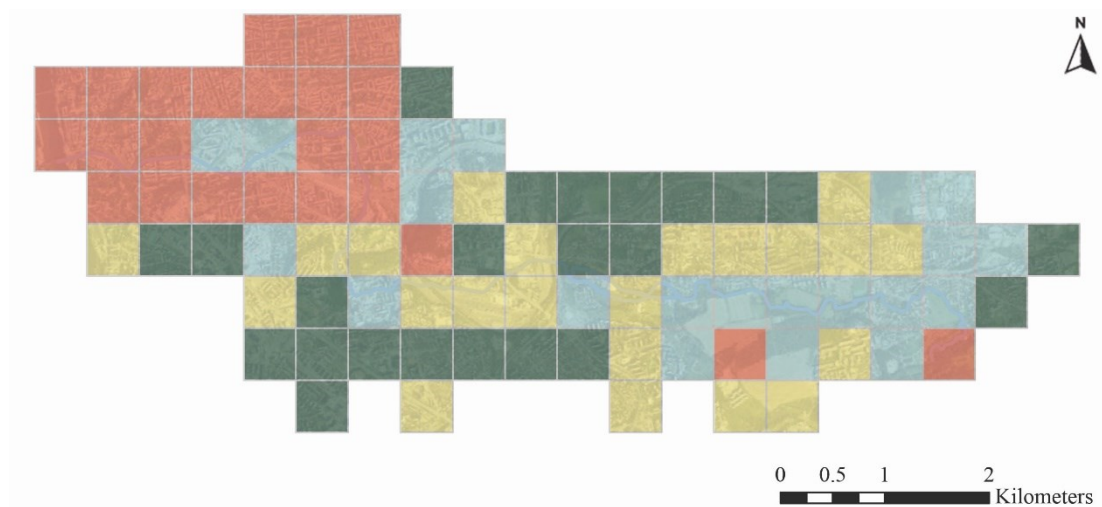


Figure 27. Recreation and tourism potential values in the study area

RECREATION AND TOURISM	very high level of present values	high level of present values	moderate level of present values	low level of present values
Researched area	27%	23%	24%	26%

Table 13. Percentage of values for recreation and tourism in the study area

For this sub-services of cultural services, we can conclude, that almost all four values, occur in same percentage, where extremely high level of values, for the first time dominate in the type (27%). They are, once again, recorded in the western and north-western part of the area, while in the south-eastern part, these values were result of present Nature Park. High, moderate and low levels (73%) are sporadically present in the whole researched area.

4.1.3.1.4. Cumulative presentation of existing ecosystem services of researched landscape

The summation of all indicators for every ecosystem service (provisioning, regulating, and cultural services) are resulting in cumulative ecosystem services that will be used in the further steps of the thesis. The cumulative presentation of every ecosystem

service represents *the functional aspect of the landscape*. Scale for rating cumulative ecosystem services is the same four-point scale, used for valuation of indicators of ecosystem services (Figure 19).

4.1.3.1.4.1. Provisioning ecosystem services

Provisioning services were read through biodiversity (Chapter 4.1.3.1.2.1.).

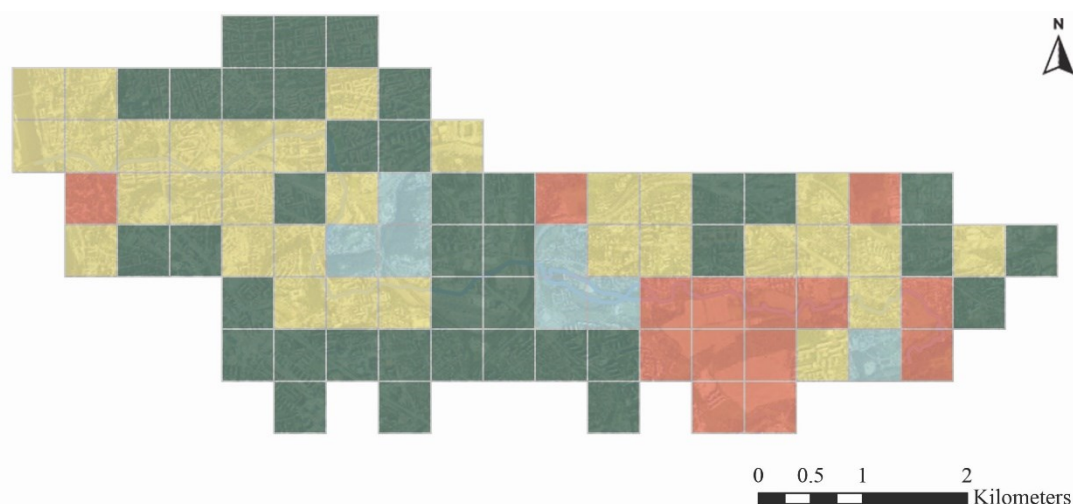


Figure 28. Review of provisioning ecosystem services in the study area

PROVISIONING ES	very high level of present values	high level of present values	moderate level of present values	low level of present values
Researched area	16%	8%	34%	42%

Table 14. Percentage of provisioning ecosystem services in the study area

As the type itself is a predominantly built-up area, providing ecosystem services are with extremely low values (42%), while high values are not recorded in much smaller percentage (24%), mostly in the areas where significant part of green infrastructure occur (Tyršův hill, Bohdalec Les park, Nature park). Moderate values of providing services (34%) are recorded in the western and eastern part of the area.

4.1.3.1.4.2. Regulating ecosystem services

Regulating ecosystem services of the researched type of the landscape character are read through the quality of water, air and soil (Chapter 4.1.3.1.2.2.).

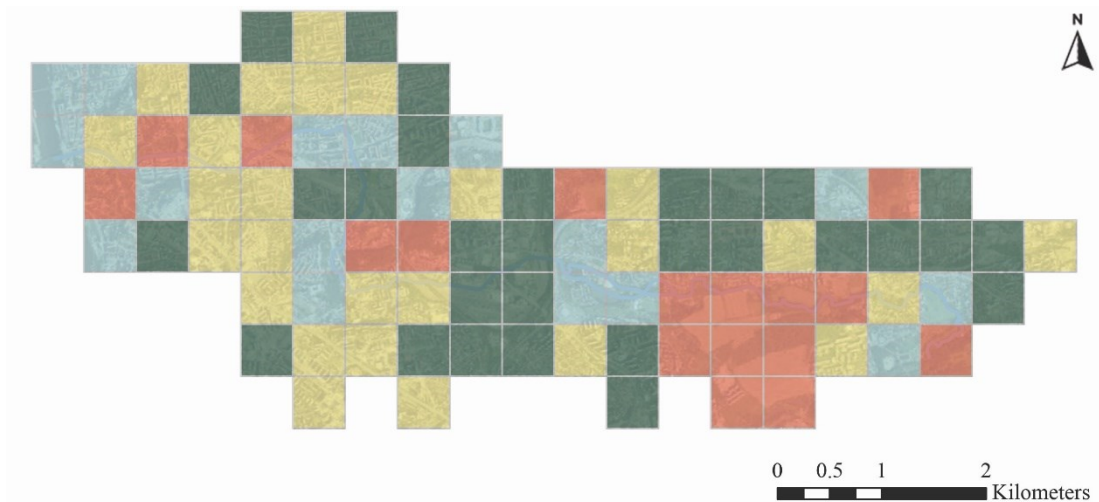


Figure 29. Review of regulating ecosystem services in the study area

REGULATING ES	very high level of present values	high level of present values	moderate level of present values	low level of present values
Researched area	19%	19%	29%	33%

Table 15. Percentage of regulating ecosystem services in the study area

Extremely high and high levels of values sporadically occur on the entire surface of the type, with the same percentage share (38%) and these are mostly built locations, where significant number of evaluated indicators occur. Predominantly, almost the entire area of the investigated type of landscape character is characterized by moderate and high values of services (62%).

4.1.3.1.4.3. Cultural ecosystem services

Cultural ecosystem services of the researched area are determinate through several chosen sub-services; cultural heritage and diversity, visual and aesthetic values, and through recreation and truism (Chapter 4.1.3.1.3.2.).

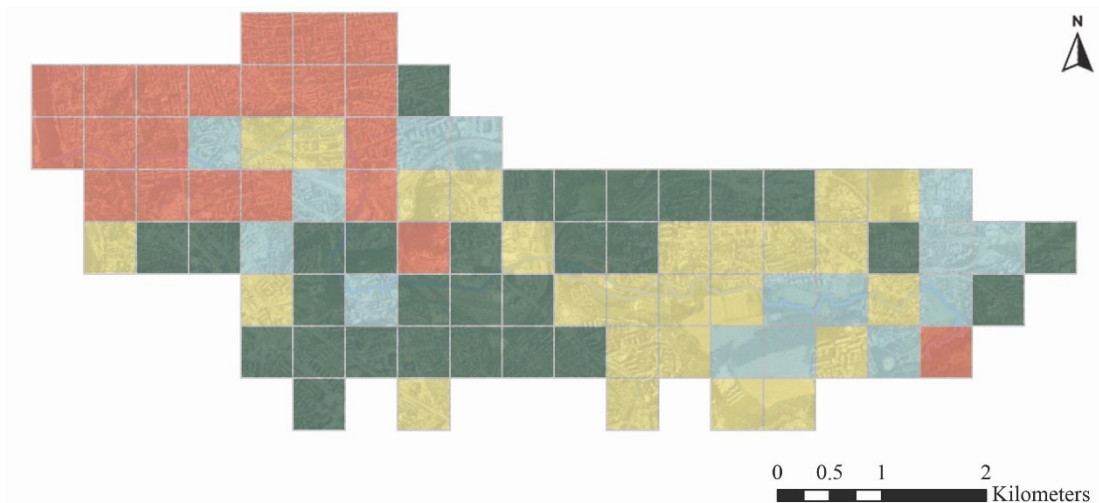


Figure 30. Review of cultural ecosystem services in the study area

CULTURAL ES	very high level of present values	high level of present values	moderate level of present values	low level of present values
Researched area	23%	17%	28%	32%

Table 16. Percentage of cultural ecosystem services in the study area

A very high level of values of cultural ecosystem services (23%) is mostly present in the area near Vltava River, in the core area of the city of Prague (western part), as well as in the area where the Natural Park is located (south-east). The high values are leaning on the mentioned areas, characterized by smaller participation of observed indicators (17%).

Moderate values (28%) are occurring in the areas where the presence of green areas that are providing recreational potential, as well as cultural goods are recorded (mostly south-eastern parts of the area). Low values are observed mostly in the central and partially in the eastern part of the area (32%). These values were obtained as a result of a very low percentage share of observed indicators.

From the cumulative services of the ecosystem, it can be clearly concluded, that unevenly distributed indicators in type, were the result of the unplanned growth of the city. As the chosen landscape character type is an urban landscape, where the larger area is very developed, provisioning and regulating ecosystem services, do not have high values. Partially, in the study area, green (open urban) areas, agricultural fields, and parks are occurring, and they should be considered as very important features of the landscape structure. As urbanization has accelerated uncontrollably in the last few decades, preserving and improving these elements should be the focus, so that their disappearance can be prevented.

4.1.3.1.5. Aspect of changes

The aspect of changes in the study area were analyzed through retrospective method and dynamics of landscape development. The retrospective method is focused on all the changes that took place in the landscape and how they affected its structure and character today, while the dynamics of development will follow the speed of development that took place in different periods, encouraged by different influences. All possible directions of development in the near future will also be considered in this chapter through the research of various existing and future plans.

4.1.3.1.5.1. Retrospective analysis

The history of the city of Prague is more than a thousand years old, and during that time it grew from Vyšehrad Castle to the capital of the modern European state, the Czech Republic. The thesis will indicate the crucial moments that dictated and defined the development of the capital, with the help of which a retrospective analysis of the type of explored character of the landscape will be more clearly defined.

The main axis of the development of the type of landscape is characterized by the banks of the Vltava River, where the Vyšehrad Castle (probably built in the 10th

century) began the further expansion of the city. According to local legend, Vyšehrad is the location of the first settlement that later became Prague. The need to connect inner Prague with the settlements behind Vyšehrad took place in the years between 1902-1905. to build an elevated embankment and tunnel through the Vyšehrad Rock. Due to that, small houses at the foot of Vyšehrad disappeared. In their place, in the period from 1911-1913, new cubist houses of architect Josef Chochol were built, and later, mostly residential houses.

The great prosperity of Prague is depicted during the 14th century, under the reign of Charles IV, whose reign is considered as the "golden age of Prague". In 1348, he founded the New Town (Nové Město), next to the Old Town (Staré Město). During his reign, he rebuilt Vyšehrad.

The great fire that occurred in 1689 destroyed Prague, but at the same time encouraged its reconstruction and renewal, followed by economic success during the next century. Under the rule of Joseph II (1780-1790), four independent urban areas (municipalities) of Prague; Staré Město, Malá Strana, Hradčany, and Nové Město were united in 1784 and thus proclaimed as one city. From this moment, Prague continued to expand further, when the Hebrew district Jozefov was constructed in 1850. and annexation of Vyšehrad in 1883.

The Industrial Revolution (1760-1840), which is closely related to rapid social development, led to a sharp increase in the city's population of 100,000 in 1837. As a negative consequence of the modernization that results from this era, a large part of the Old Town and almost the entire New Town were destroyed (part of the area covered by the investigated type boundaries).

The transformation of Prague continues to proceed faster and faster. The Law of Greater Prague of 1920 expanded the city, and at the beginning of 1922, another 37 municipalities were annexed to Prague, bringing the city to 676,000 inhabitants. In 1938, the city had a million inhabitants. After this period, expanding the borders of Prague can be seen in the appendix below (Figure 31).

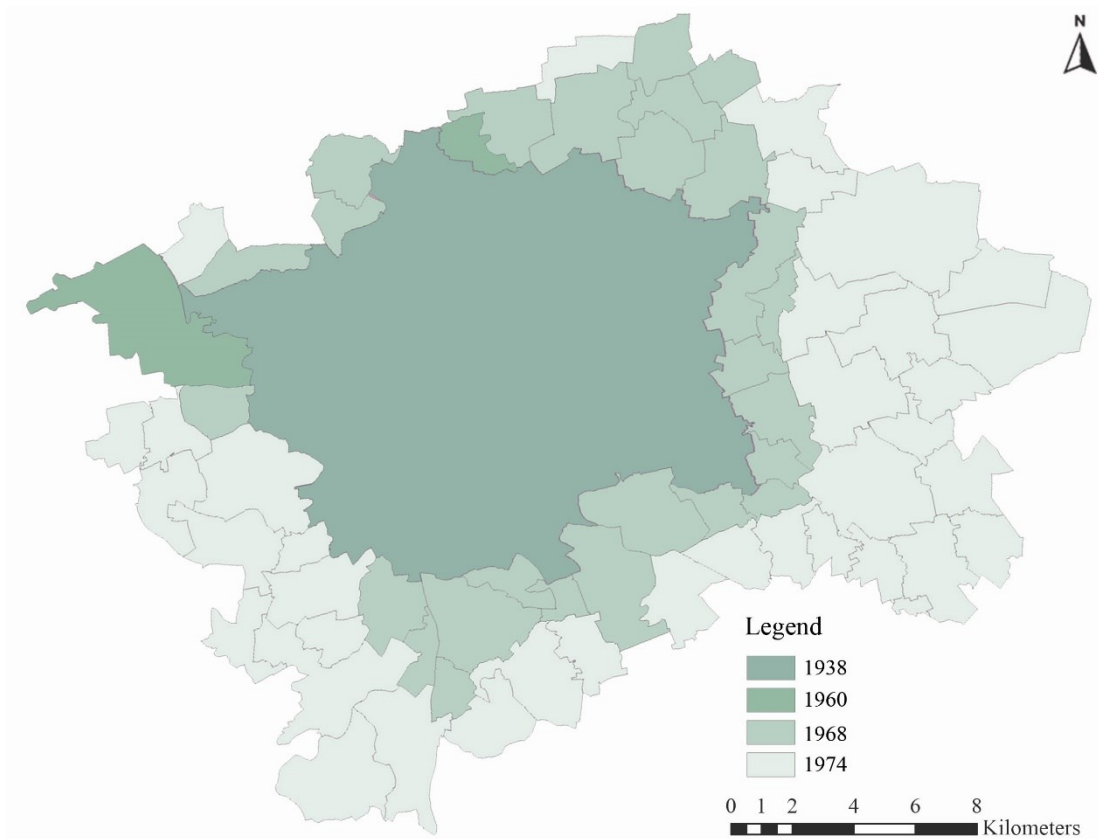


Figure 31. Borders of Prague through years (Image made according to the open data, provided by Prague Institute of Planning and Development, Source: <https://app.iprpraha.cz/apl/app/ortofoto-archiv/>)

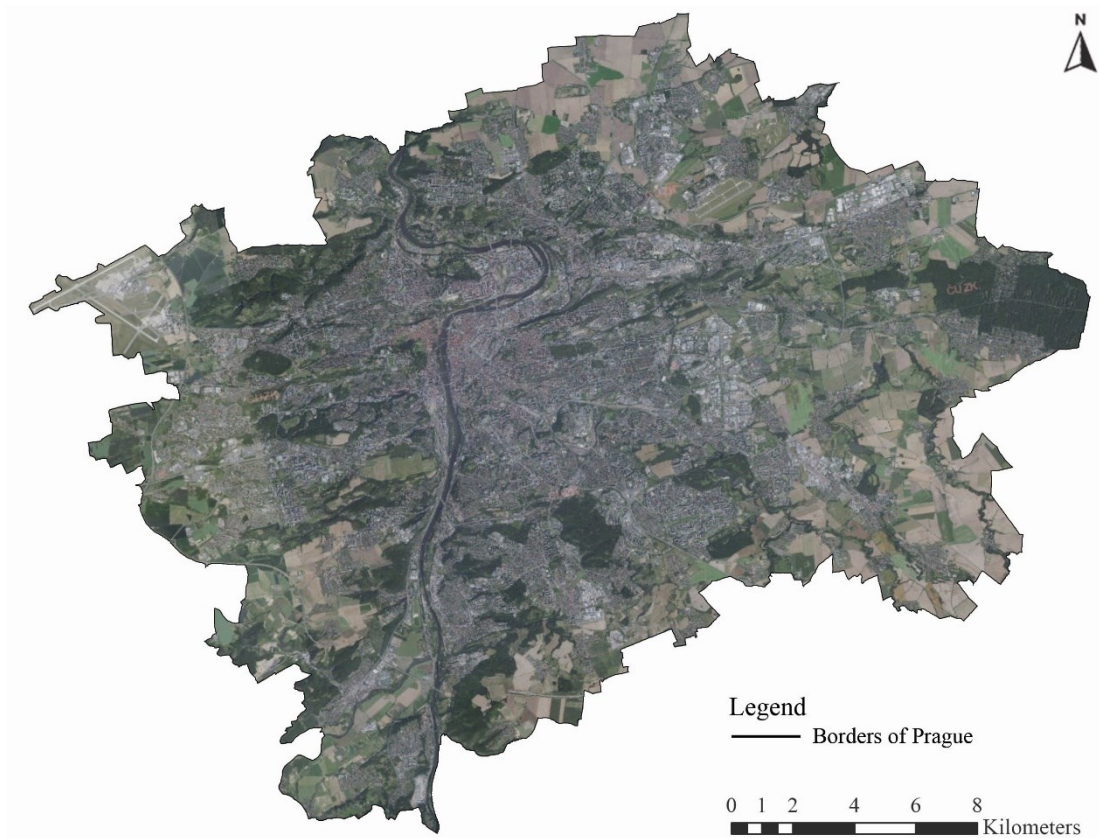


Figure 32. Ortho-photo map of Prague, current situation (Source: <https://earth.google.com/web/>)

It is clearly seen that the current borders of Prague city, were defined in the period of 1974 (Figure 31 and Figure 32). The perimeter of the city itself is mostly made up of arable land and forests, between which there are rings of built-up areas.

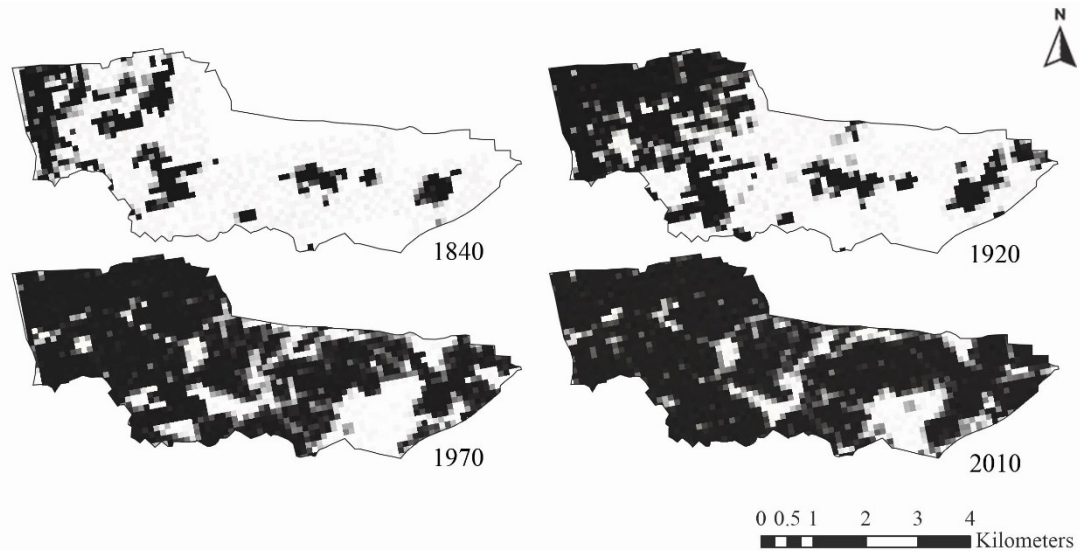


Figure 33. Built-up development of the study area through years (Image made according to the open data, provided by Prague Institute of Planning and Development, Source: https://iprpraha.cz/uploads/assets/dokumenty/obecne/do_you_know_prague.pdf)

As previously said, the western part of the research type, which includes parts of the New Town leaning on the Old Town, and Vyšehrad on the banks of the Vltava River, where the first settlements around which Prague, continued to develop. Vyšehrad was formed during the 10th century, and the New Town was established in 1348 by Charles IV.

During the Industrial Revolution until 1840, with increased population, researched area of the landscape character in the thesis, began spreading towards the east, where family houses around agricultural lands, resulted in an increase of suburban development in the study area. After this significant period which represents a noteworthy historical milestone, annexed municipalities that surrounded Prague were affecting its further growth, and with that, as the number of inhabitants in 1920 reached nearly 729,820, and therefore impacted the percentage of open space was notably decreasing. From 1920 to 1970, most of the central and eastern parts of the type were built. As depicted in Picture X, the current borders of Prague were established in 1974, and therefore, there are no significant changes from 1970 until today, however it is obvious that already established built parcels occupy the remaining open space in the study area.

In the space of half a century (period from 1920 to 1970), urbanization drastically changed the structure of the researched study area; the situation at that time is very similar to today's condition. The last review (conducted in 2010) only confirms the development of the city and spreading urbanization or suburbanization, which has significantly reduced the percentage of arable land and forests.

An interesting observation is in the first two years. The interval of 80 years, in the context of the type of constructed development, does not drastically reduce the porosity of the study area, while the next transitional period (until 1970), which is only 50 years, the porosity of the study area, almost does not exist. This was followed by the fact that in January 1922, an additional 37 outlying towns and suburban

municipalities were attached to Prague (for the New Town and Vyšehrad research areas). The then added administrative units resulted in a new name for the city, better known as Greater Prague. This was an important step in terms of urban planning because architects could now plan the city as a whole, striving to create a unified appearance and interconnected infrastructure.

4.1.3.1.5.2. Dynamic of development

Changes in the political regime in both the economy and society have resulted in changes that are observed in the spatial context. Economic restorations of once-private houses and agricultural areas in urban and suburban parts of the city were important preconditions for the new urban development of Prague. All this directly impacted and influenced the creation of a new functional purpose of the land and a clearly visible transition from residential to commercial use of buildings.

Intensive migration from the city center to the suburbs, in Prague, has been very active since 1995. The researched type of landscape character is mostly characterized by new construction located on empty plots within the existing settlements (infill development). A characteristic aspect of suburban development in the study area is the realization of small projects of 20-50 family houses or the fairly widespread realization of individually built houses. Under the influence of increasingly intensive suburbanization and the development of the suburbs, it is clear that there are numerous threats in the context of the degradation of natural and nature-close elements, where the expansion of the city is to the detriment of open, free spaces.

From the previous chapters (Chapter 4.1.3.1.1.2.4.), a different structure of built area was determined, which changes as we move from the river banks to the far east of the study area. The traditional form of urban expansion, which was characteristic of the development of the city in the 19th century, is observed until the central part of the study area, after which suburbanization takes off and without clearly established rules changes the character of the landscape itself.

The eastern part of the study area of the Botič represents the oldest part of the city in which the further development of the capital is depicted from the banks of the Vltava River. This part of the city center reflects the historical growth and development of the city from its urban nucleus- Vyšehrad Castle and the bank of the Vltava River. In this part of the study area, cultural objects of high national importance are being developed. As concluded from the previous chapters (Chapter 4.1.3.1.1.2.1.), the amount of green infrastructure in this part of the type is significant and large in relation to the degree of porosity. However, green areas are not spatially and functionally connected into a single system, in order to improve and preserve the character of the Prague region and improve the multifunctional roles of green infrastructure with adequate spatial layout and typology. Therefore, it is necessary to provide users with access to all green spaces.

The central part of the study area, intersecting the European Road E65, which defined the direction of further development of the city, is surrounded by commercial and industrial facilities. In this part, Railway is also located, which conditioned a different development. Multi-story buildings, on irregular plots, rise in this part, which creates a chaotic scheme of streets. Therefore, it is necessary to establish protective green

belts, with the role of providing visual barriers, in order to protect residents, settlements, and agricultural areas within the immediate vicinity. When erecting new protective green belts, the choice of tree or shrub species should be in accordance with the conditions of the habitat, use endemic species, and the method of planting should be adjusted to the primary function.

The eastern part of the type is characterized by a chaotic structure of discontinuous tissue that, by unregulated construction and development of the city, puts great pressure on existing arable land, forest remnants, coastal vegetation along the Botič stream, as well as the Nature Park Hostivař-Záběhlce. Inevitably, with the current dynamics of the city's development, the remains of natural and nature-related elements will be degraded to such an extent that their existence will not provide certain values to residents and visitors or will lead to complete "erasure" of these units. Therefore, it is necessary to protect, improve and further promote the protection and development of these areas in the type. High potential in terms of aesthetics, recreation, tourism, education, in addition to basic natural influences, needs to be emphasized and preserved. The connection of these areas with the central and eastern part of the river should be provided to such an extent that it draws users into the area, while at the same time creating a bio-ecological network in the form of a green or blue-green corridor.

Looking at the spatial planning documents of Prague, one can see a common foundation and ideology based on the use of its neglected potential of the city. Ideas to use all the benefits of brownfields and neglected urban spaces instead of penetrating deeper into the open space on the outskirts of the city. This idea is supported by the fact that in this way of planning, it would be possible to limit the urban expansion of the city, while at the same time promoting a significantly larger number of parks, buildings and places for free activities of city residents.

Since the 1930s, ideas have been promoted about how the city itself should be divided into four basic zones that provide different functions; zone of work, housing and recreation, while the fourth zone, the zone of transport would be the connection between the main functions. Looking at the current zoning plan of Prague (The current zoning plan for the City of Prague, approved in 1999), it is clear that these, the original four zones, are divided into smaller areas, which today number more than 90 zones. In addition to this, the inevitable observation is the instability of the zonal plan, which only in the observed period from 2000 to 2012 considers over 2060 changes. Thus creating instability of the plan itself, subject to changes, which means that the city loses its identity, structure and character.

As mentioned before (Chapter 2.2.5.), the main plan under development, the Metropolitan Plan, has as its main idea to return the city of Prague to its traditional planning roots, where it will further determine and strengthen its structure. The main subject matters that this plan promotes are;

1. The end of the city's growth into the surrounding landscape
2. The setting of height regulations
3. Quality public spaces
4. Protection of the character of localities
5. New city parks
6. Exploiting the potential of the river
7. Creation of new municipal districts (According to Prague Institute of Planning and Development; <https://iprpraha.cz/>)

In the main output of the thesis, proposing rules for future landscape management rules, the researched type of landscape character, the ideas will mostly rely on the goals that the Metropolitan Plan wants to satisfy. Considering that thinking about the future landscaping, in order to plan well, should be supported by spatial and zonal plans.

4.1.3.2. Landscape character sensitivity assessment

Sensitivity of the chosen type of the landscape character was determined on the basis of a visual landscape assessment, obtained on the basis of the overall survey results, and on the basis of the estimated landscape character assessment, derived from the present levels of ecosystem services value.

4.1.3.2.1. Visual assessment of the landscape character

For obtaining a visual assessment of the chosen landscape character type, a total of 24 people were examined. All representative images with eight given parameters, through an online survey, were rated with grades from 1 to 3 (Chapter 4.1.3.1.1.3.). The results of the examination are presented in the continuation of the chapter and summarized on a four-point scale (Figure 34).

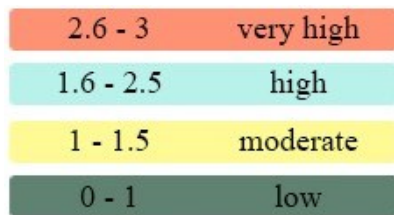


Figure 34. Scale of rating visual assessment

It is important to note that this type of evaluation varies greatly from the time of observation, the season, the current state of the observed landscape, as well as the personal attitude of the observer, which is why the assessed visual assessment of the landscape can be characterized as quite subjective.

All 56 pictures were evaluated by 24 respondents. By calculating their average, the final value for each parameter was obtained (Figure 35). The attached table (Table 17) shows the total score for each image, obtained as the average score of all respondents per image. Based on that, the total rating of all evaluated images was calculated. This number also represents the total visual value of the observed landscape.

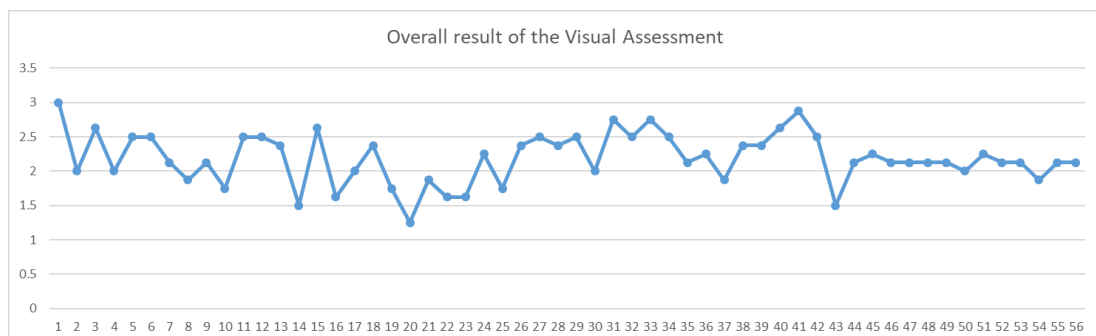


Figure 35. Graphic representation of the total result of visual assessment obtained from the survey

Pictures	Total score of all respondents	Visual assessment
1	3	
2	2	
3	2.625	
4	2	
5	2.5	
6	2.5	
7	2.125	
8	1.875	
9	2.125	
10	1.75	
11	2.5	
12	2.5	
13	2.375	
14	1.5	
15	2.625	
16	1.625	
17	2	
18	2.375	
19	1.75	
20	1.25	
21	1.875	
22	1.625	
23	1.625	
24	2.25	
25	1.75	
26	2.375	
27	2.5	
28	2.375	
29	2.5	
30	2	
31	2.75	
32	2.5	
33	2.75	
34	2.5	
35	2.125	
36	2.25	
37	1.875	
38	2.375	
39	2.375	
40	2.625	
41	2.875	
42	2.5	
43	1.5	
44	2.125	
45	2.25	
46	2.125	
47	2.125	

48	2.125	
49	2.125	
50	2	
51	2.25	
52	2.125	
53	2.125	
54	1.875	
55	2.125	
56	2.125	
Total:	2.185267857	<i>high visual assessment</i>

Table 17. Tabular presentation of the total result of the visual assessment obtained from the survey



Figure 36. Examples of images that were rated with high descriptive adjectives, which gave a high visual rating

Based on the attached table, it is clear that the overall visual assessment of the investigated area is determined as high, according to the established four-point scale rating of this assessment (Figure 19).

The presence of various landscape elements (agricultural areas, green areas - forest remnants and greenery of residential buildings, main roads - European route E65) is an important characteristic of the type, although it dominates the urban fabric, which is also its matrix. The balance between these landscape elements is mostly moderate. The edges in the landscape painting are not clearly legible and represent a combination

of organic and geometric, which is the result of spontaneous construction. The visual character is clearly seen in the change of the built and the unbuilt. The colors that dominate within the type are moderately harmonious - polychromatic (gray, cream, green, white, brown, black, red).

4.1.3.2.2. Landscape character assessment

For the purposes of this assessment, ecosystem services of the landscape established for the researched area were taken into account. This assessment was evaluated on same four-point scale, ranging from low, through moderate and high, to very high (Figure 19).

Depending on the dominance of the values that providing, regulating and cultural services of ecosystems (Chapter 4.1.3.1.4.) have in the type of the investigated landscape, its total landscape character assessment was determined.

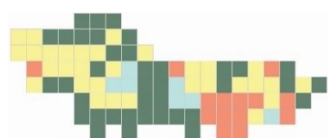


Figure 37. Provisioning ES



Figure 38. Regulating ES

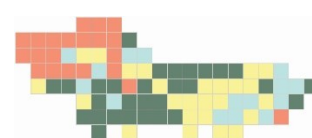


Figure 39. Cultural ES

ECOSYSTEM SERVICES	Provisioning	Regulating	Cultural
score			
overall score	<i>extremely low assessment</i>		

Table 18. Sensitivity assessment of researched type of landscape character

Landscape character assessment done for the study area according to the values that different sub-services of the ecosystem have is evaluated as very low. This is a logical conclusion, because of the fact that the area of interest is an urban landscape that has been and still is changing under the pressure of urbanization.

People typically are adjusting their surroundings to meet their desires and needs, and therefore, it is a usual that urban landscapes will not be able to provide crucial services and benefits to the environment. However, humans create their own sense of place for themselves, even if this sense of place is being constantly modified and changed. These features are still the critical habitats for many species, and places that provide some forms of food, energy, energy flow, and so on. This is the main reason why we need to focus on the preservation of these landscapes, and why we need to encourage the functions of the environment so that they can occur independently of the speed of changes that are resulting from people.

4.1.3.2.3. Overall sensitivity of the landscape character

As previously mentioned, landscape sensitivity is determined on the basis of the character of the landscape and its quality, i.e. ecological stability and visual value. The overall sensitivity of the landscape character is the inherent sensitivity of the landscape as a whole and does not depend on potential changes (Vasiljević, 2018).

Overall sensitivity assessment of the chosen type in thesis is obtained as the average of overall result from visual and landscape character assessment. Overall sensitivity was evaluated on a four-point scale, ranging from extremely low, through moderate and high, to very high sensitivity that researched area carries (Figure 39).

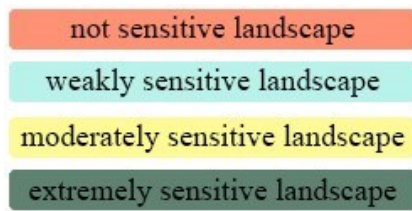


Figure 40. Scale for rating sensitivity assessment

As the visual assessment proved that the landscape is characterized by high values, and the presence of the examined values of ecosystems as extremely low, the overall assessment of the sensitivity of the landscape is defined as moderate. According to this result, future proposals for landscape management will be set (Table 19).

OVERALL SENSITIVITY	Visual sensitivity	Landscape character sensitivity
score		
overall score	<i>moderately sensitive landscape</i>	

Table 19. Overall sensitivity assessment of study area and its landscape character

5. Proposed landscape strategy

5.1. Landscape planning and design rules

As a result of the Landscape Character Assessment, the key phase leading to the final outcome of the thesis is proposing guidelines for the preservation and improvement of landscape elements (Botič stream), which is considered to be the bearer of the type identity, and which is under the "blow" of development sector projects (urbanization and infrastructure).

As the presence of ecosystem values is extremely low, and the visual assessment is high, the estimated sensitivity of the landscape is defined as moderate. Based on this, the proposed measures for future landscaping and preservation have been determined. The main idea is to preserve and improve the researched landscape, where the presence of a stream bed increases the quality of the landscape image. Landscape planning and design rules in this thesis will be divided as morphological-ecological and landscape-design rules which determine the concept of landscape design of characteristic landscape structures (Figure 40).

Preventing further urbanization, and the pressure of construction that is getting closer to the stream, thus burying it, must be achieved through morphological and ecological rules, while landscape design will be mainly focused on meeting all the shortcomings identified during the visual assessment, which will increase landscape quality and establish a system where the stream will reach its maximum potential with visitors. Morphological-ecological rules will be read through the green infrastructure, hydrological, agricultural, and built structure, that is, in the same way as the composition and configuration (Chapter 4.1.3.1.1.2.) were read, which were aimed at finding all those "weaknesses" present in the researched area. The obtained results

from this chapter, conditioned the formulation of morphological-ecological rules which are focused on solving the problems of urbanization that affect the Botič stream, because the stream, as an integral part of the entire landscape, cannot be read and observed separately from its surroundings. Landscape-design rules, on the other hand, will not be formed on the basis of these four structures. These rules will be focused exclusively on the stream itself and its restoration because these rules, enable descending to lower scale, which is the most aim in satisfying the thesis topic.

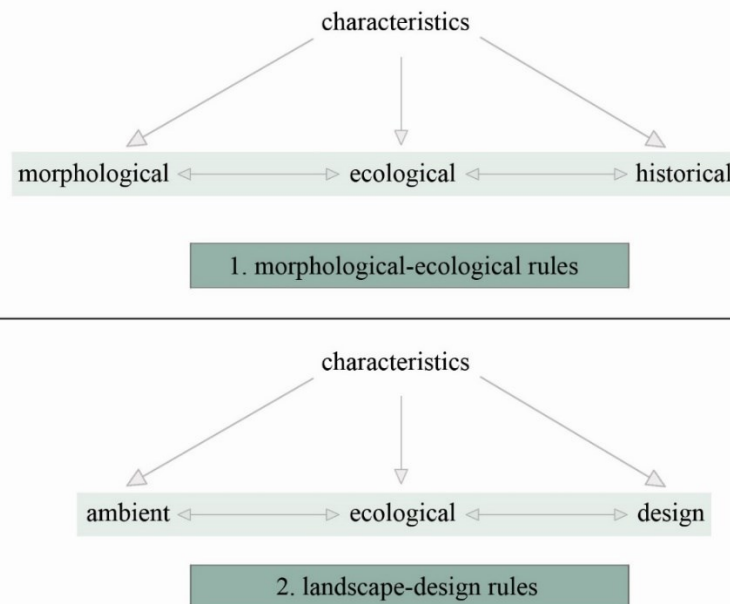


Figure 41. Schematic representation of Landscape planning and design rules

5.1.1. Morphological-ecological rules

Morphological-ecological rules define the guidelines for the rules of arrangement of development within the investigated zone. As previously mentioned, the rules of regulation in the work will apply only to the flow of the Botič stream and its immediate surroundings. This does not exclude the fact that looking at the bigger picture is crucial if you want to achieve serious and specific results.

Morphological-ecological rules arise as a result of research that included the description, analysis, and interpretation of the shape and variation of landscape elements within the type of the studied character of the landscape. The rules concerning morphology result in the application of a planning strategy that achieves the improvement of form and content through engineering solutions, spatial-formative principles, which results in the improvement of the aesthetic experience. Morphological rules in this case are mutually related to ecological ones because they directly affect the regulation of the microclimate. From an environmental point of view, these rules include the selection of measures to improve, or the procedure for solving a particular biological-environmental problem within the forest, agricultural, water, and agricultural land, with a focus on improving biodiversity. Biodiversity is the only possible response to the constant variability of environmental conditions, which is why it is part of the rules of regulation of Botič stream, focused on increasing biodiversity as a form of diversity.

In order to improve biodiversity, as well as to preserve the bearer of the character of the landscape of the study area (Botič stream), morphological-ecological oriented rules were formulated through four main landscape structures that lean on and act on the stream itself.

5.1.1.1. Green infrastructure

Regardless of the fact that the restoration of natural vegetation is difficult and slow, by applying the elementary rule of afforestation and improving biodiversity, which includes planting more indigenous species belonging to different life forms, certain risks in afforestation (and other types of natural vegetation renewal) would be avoided. In that way, the floristic diversity of the planted dendroflora would be achieved (a larger number of tree species, shrubs, and ground vegetation).

When it comes to green infrastructure within the riparian zone of Botič, the following rules are proposed;

- Preservation of existing forests and their translation into high cultivation forms
- Networking of green and open spaces (within existing and planned plots) by introducing linear elements of green infrastructure (tree lines, green corridors, hedges)
- Formation of a protective forest belt on the stretch from Tyršův hill along with the Train Depot South parcel, with industrial and commercial facilities
- Afforestation of the Natural Park Meandry Botiče, in order to mitigate the impact of the city and its built structure

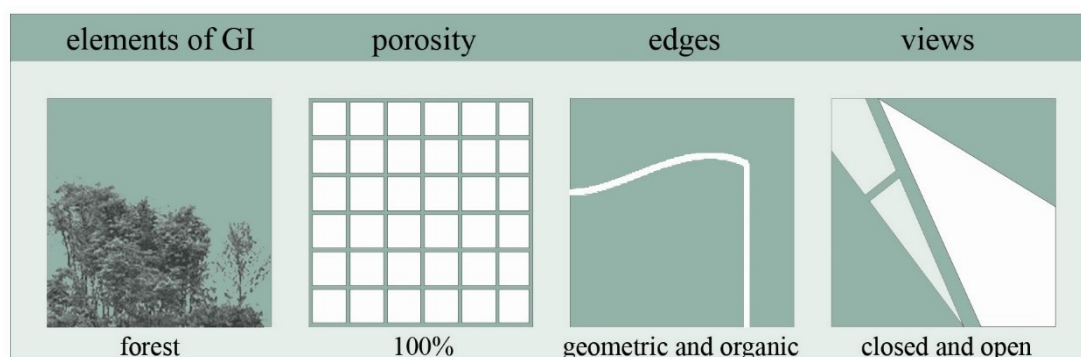


Figure 42. Pictogram presentation of green infrastructure solutions

5.1.1.2. Hydrographic structure

Banks of the Botič stream are not steep, and its profile is similar to natural ones, therefore the restoration of the living world and the increase of biodiversity should proceed relatively quickly. The rule of managing the river-bank (riparian zone) implies that belts of autochthonous vegetation are envisaged next to the pedestrian pathway, and aquatic vegetation is renewed. Such an environment is not only rich in ichthyofauna (fish) but also in the fauna of wetland birds and amphibians, indicating in the best way that River flows can be important for the preservation of biological diversity. According to this, the following rules are proposed;

- Preservation of riparian vegetation and erection of new plantations in areas where possible
- Preserve the embankment that bears the identity of the endemic landscape type and provide access to the stream
- It is a generally accepted ecological fact that aquatic ecosystems, if various negative impacts are eliminated, recover spontaneously faster. The current vegetation along the stream is uniform, where old and rotten trees can be found in some places. Therefore, it is necessary to set up artificial nesting places, which will help birds in almost all forest ecosystems in a simple and cheap way. As much as many thought it was unproductive, on the contrary, it gives fast and visible effects in terms of increasing biodiversity on the one hand and preserving the biological balance of ecosystems on the other.
- Conservation of ponds and aquatic ecosystems (protected and endangered aquatic animal communities) and their sensitive use
- Preserve and form a multifunctional blue-green corridor of the small city watercourse, the Botič
- Revitalization (phytoremediation) and preservation of Lake Hamersky

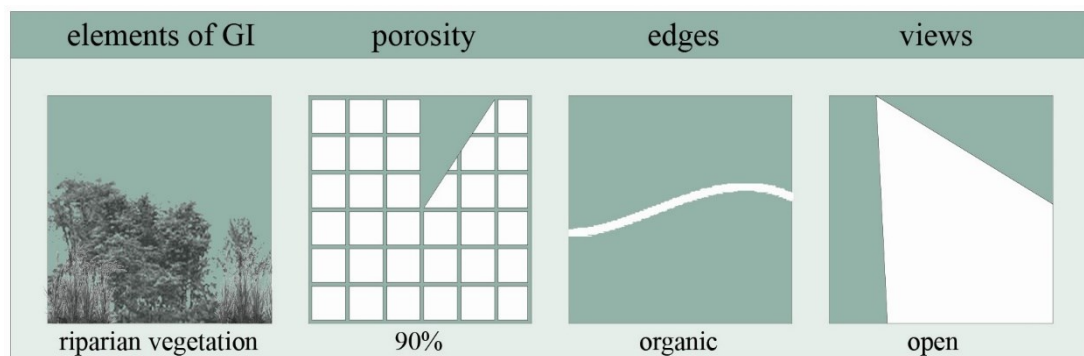


Figure 43. Pictogram presentation of hydrographic structure solutions

5.1.1.3. Agricultural structure

Existing agricultural areas in the immediate vicinity of the Botič stream should be improved by introducing field buffer zones comprised of, groups of trees and hedges. Field protection belts and hedges (buffer areas) are not only the most effective protection against wind and soil erosion, but they are also habitats for many predatory species that feed on pests of agricultural crops, especially rodents and insects. By creating diverse biotopes in which, in addition to agricultural areas, forest and shrubby habitats of hedges rich in autochthonous species will be mosaically distributed, the biological diversity of the landscape structure will be preserved, as well as its ecological and biological stability. The main goal in the agricultural structure is to;

- Preserve the inherited pattern of agricultural land, as an element of the traditional cultural landscape of the city's peripheral zone, where possible, and to emphasize the form by raising new hedges
- Prohibit the construction of high-story buildings whose dimensions can endanger the views over the fields of agricultural land

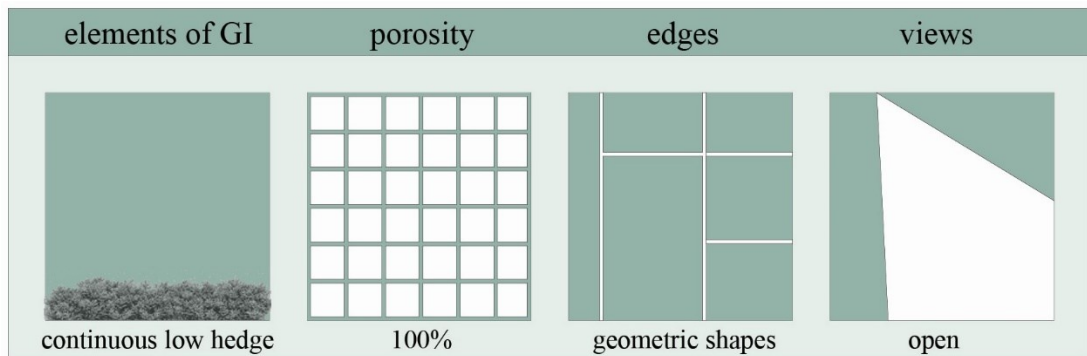


Figure 44. Pictogram presentation of agricultural structure solutions

5.1.1.4. Built structure

The constructed construction, as one of the main results of urbanization, is an unavoidable part of the diploma thesis, due to the great influence on the flow. When the built structure is not in correlation with all its landscape elements, they are deleted, which is the result of the fact that in certain parts it goes underground. Therefore, it is necessary to pay special attention to the rules of arrangement of these spaces;

- Preserve the matrix of open and built spaces at the level of the entire type, and direct its further transformation in the direction of building residential blocks of single-family and multi-family housing of limited stories (maximum four floors)
- Provide a minimum of 40-60% of open space on the plot and a high degree of coverage of tall trees
- Use of porous curtains that will alleviate the degree of sealing and reduce surface runoff
- Forming a system of smaller public spaces with elements of green infrastructure as bearers of identity and cohesion;
- Infrastructural equipment, better accessibility compared to other parts of the city, as well as internal connectivity
- Development of recreational activities close to nature (establishment of educational and recreational trails along the stream)
- Increasing the degree of porosity at the level of the type of landscape character and prevent further occupation of agricultural and forest land by new construction
- Defining landscape rules for the arrangement of the E65 road belt in order to create a better picture of the landscape
- Limit the site coverage to 40%

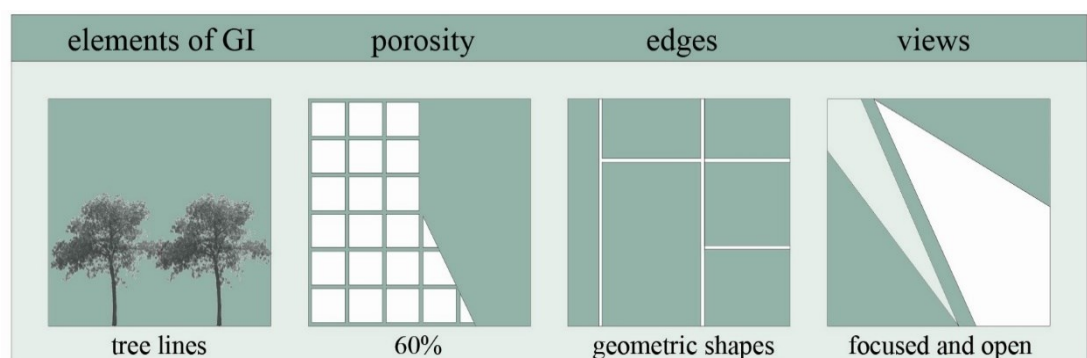


Figure 45. Pictogram presentation of built structure solutions

5.1.2. Landscape-design guidelines

After the set morphological-ecological guidelines, the design guidelines for landscaping within the selected type of landscape character were developed. These guidelines are defined in the context of the strategy of protection and improvement of the recognized and established character of the landscape. The rules were formed in order to establish the disturbed balance between Botič stream and the city of Prague, and in order to rediscover the forgotten and suppressed present and very important landscape element for the residents and visitors of the city.

Applying the rules of arrangement would make a positive contribution to the existing character of the landscape, which would further serve in understanding the importance of preserving its structure.

The main idea in the landscape-design rules is to reduce the existing pressure of urbanization on the stream as well as to prevent its further spreading. What is almost imperceptible in space today, through these rules, the goal is to *rediscover the forgotten* and revive the present landscape element for all its visitors and users.

Increasing greenery is one of the main goals to be met. As the course of the stream, cannot be changed in such a constructed urban city, it can stand out in space with the elements of green infrastructure. Therefore, the main idea is to create a blue-green corridor in the form of planted diverse vegetation along the slopes of the stream, which will not obscure its surface, but will significantly increase biodiversity and provide new habitats for many animals. Low to medium-high species (Table 20 and Table 21) will aesthetically increase the quality of the Botič stream and thus regulate the microclimate, while at the same time reduce water pollution from traffic. This requires the exclusive use of aquatic, indigenous species, which will follow the organic, natural winding line of the stream, which will return the lost, today fragmented edges along the water. Low vegetation in those parts next the promenade will not block the view, while it is possible to plant higher trees on those slopes along the canal that are located right next to the street. In that way, noise pollution is prevented, wind protection belts are created, and the view is blocked from the immediate presence of the built structure.

The promenades that exist today by the stream also need to be highlighted in space. By adding a pattern in the paving, along the edges along the stream itself, it would significantly emphasize its existence, and increase the safety of passers-by. In those parts where there is no vegetation, and where the approach to the slope of the stream is not present or emphasized in the space, it is necessary to set up small, low fences. In those parts where there are free, undeveloped areas, along the stream, it is possible to plant tree lines, with species whose color during the year (Table 22) will attract users, and, at the same time emphasize the presence of water, while creating a dynamic environment.

plant species
<i>Ilex aquifolium</i> L.
<i>Pterocarya fraxinifolia</i> (Lam.) Spach.
<i>Alnus glutinosa</i> (L.) Gaertn.
<i>Hydrangea macrophylla</i> (Thunb.) Ser.
<i>Malus floribunda</i> Siebold ex Van Houtte.
<i>Malus sylvestris</i> (Line) Miller.
<i>Koelreuteria paniculata</i> Laxm.
<i>Phellodendron amurense</i> Rupr.
<i>Prunus laurocerasus</i> L.
<i>Camellia japonica</i> L.
<i>Cupressus arizonica</i> Greene.
<i>Calocedrus decurrens</i> (Torr.) Florin.

Table 20. Examples of Hydrophytes Shrub species, suitable for the vegetation along the slopes of the stream

plant species	ecological group
<i>Agropyrum repens</i> (L.) Beauv.	-
<i>Agrostis alba</i> L.	swamp
<i>Alisma plantago-aquatica</i> L.	water
<i>Bolboschoenus maritimus</i> (L.) Palla.	-
<i>Carex pseudocyperus</i> L.	swamp
<i>Epilobium palustre</i> L.	swamp
<i>Heleocharis palustris</i> (L.) R. Br.	swamp
<i>Lemna gibba</i> L.	water
<i>Lemna trisulca</i> L.	water
<i>Lysimachia vulgaris</i> L.	swamp
<i>Lythrum salicaria</i> L.	swamp
<i>Lythrum virgatum</i> L.	-
<i>Mentha aquatica</i> L.	swamp
<i>Myriophyllum spicatum</i> L.	water
<i>Najas minor</i> All.	water
<i>Oenanthe aquatica</i> (L.) Poir.	water
<i>Phragmites communis</i> Trin.	water
<i>Potamogeton crispus</i> L.	water
<i>Potamogeton fluitans</i> Roth.	water
<i>Potamogeton lucens</i> L.	water
<i>Potamogeton pectinatus</i> L.	water
<i>Rorippa amphibia</i> (L.) Bess.	swamp
<i>Schoenoplectus lacustris</i> (L.) Palla	water
<i>Scutellaria galericulata</i> L.	swamp
<i>Sium latifolium</i> L.	swamp
<i>Sparganium ramosum</i> Huds.	water
<i>Stachys palustris</i> L.	swamp
<i>Typha latifolia</i> L.	water

Table 21. Examples of Hydrophytes (aquatic plants), suitable for the vegetation along the slopes of the stream

plant species
<i>Taxodium distichum</i> (L.) Rich.
<i>Parrotia persica</i> (DC.) C.A.Mey.
<i>Maclura pomifera</i> (Raf.) Schneid.
<i>Betula pendula</i> Roth.
<i>Alnus incana</i> (L.) Moench.
<i>Corylus colurna</i> L.
<i>Populus tremula</i> L.
<i>Salix caprea</i> L.
<i>Erica verticillata</i> L.
<i>Tilia tomentosa</i> Moench.
<i>Physocarpus opulifolius</i> (L.) Maxim.
<i>Prunus serotina</i> Ehrh.
<i>Sorbus torminalis</i> (L.) Crantz.
<i>Pyrus pyraeaster</i> L.
<i>Ribes aureum</i> Pursh.
<i>Styphnolobium japonicum</i> (L.) Schott.
<i>Rhus typhina</i> /R. <i>hirta</i> L.
<i>Koeleruteria paniculata</i> Laxm.
<i>Acer negundo</i> L.
<i>Cornus alba</i> / <i>Thelycrania alba</i> L.
<i>Fraxinus excelsior</i> L.
<i>Fraxinus ornus</i> L.

Table 22. Examples of trees with seasonal changes of different colors during the year, suitable for the vegetation along the promenade

By removing all illegally constructed buildings (houses) in order to increase the degree of porosity, along the stream is one of the main goals that would manifest the maximum potential of the stream and at the same time allow free access to the water. Also, all present parking lots that prevent the continuous flow of the promenade along the stream, should be removed, in order to form smaller ambient green areas, which will keep passers-by while increasing the presence of greenery (as parts of the blue-green corridor), and attract users to continue their walk along the Botič.

When it comes to the present bridges along the stream, different types of fences and their color have a positive effect on the image of the landscape. The views that stretch from them in the direction of the stream attract users to continue walking along it. Therefore, they need to be maintained regularly. Planting creeper species on the fences of bridges, such as *Parthenocissus quinquefolia* or *P. tricuspidata* that have different colors of leaves during the seasons, would also improve the aesthetic appearance. On the other hand, roads that cross the stream have caused the complete loss of vegetation and land. In these parts, where the creek bed is completely concreted, it is possible to beautify the image and create an attractive, dynamic space for passers-by by applying different graphic designs on these surfaces.

The idea is also to keep people close to the stream, so setting up benches along the promenade facing the water, in those places where it is possible, is also recommended.

In those places where it is not possible to follow the entire flow of the stream, because it intersects the roads, it is possible to set low vegetation such as shrubs or grass cover, which will continue the formed corridor in space and lead people to meet water again.

The installation of lighting along the promenade or the edges of the stream is also desirable in order to emphasize the space and increase the level of safety during the evening hours, with special care that the lighting does not interfere with nearby traffic and residential buildings.

The initial step, when it comes to arranging the pond (Hamerský rybník) and the space around it, the goal should be to emphasize its presence. Information displays and clear signposts should invite users to this space. The paths around the pond itself should

maintain their natural appearance, without asphaltting, which requires their regular maintenance and preservation. The installation of benches, trash cans and furniture on smaller extensions along the promenade is necessary, in order to provide users with maximum comfort in the space. Today, it is impossible to cross from the area where the pond is located, to the Natural Park Meandry Botiče, by following the flow of Botič stream. A large number of areas within the sports complex (Sports Complex HAMR-Záběhlíce) intersect this road, so it is necessary to mark a clear and easily passable road between these two units, or remove neglected areas, in order to free the passage for users.

Applying the rules of arrangement would make a positive contribution to the existing character of the landscape, which would further serve in understanding the importance of preserving its structure.

6. Discussion

As a fundamental basis of this thesis, the Literature Review chapter starts from the interpretation of the concept of landscape and its planning, thus setting the framework of the thesis. A review of previous research on world practice, explicates different ways of interpretation, understanding, and evaluation of landscapes, while at the same time asking the question what is the subject of research on landscape planning: *protection or development?*

Studies in the field of landscape planning throughout history have been mostly guided by the research framework of presenting different methods (Vasiljević, 2018). Starting from the traditional, sectoral-protective, through interdisciplinary, to a modern holistic approach, different planning processes have been formed through time (Vasiljević, 2018; von Haaren, 2002; Hackett, 1971; Ogrin, 1994; Ndubisi, 1997, 2002a; Marušić, 2004; Swaffield, 2005; Selman, 2006, 2010, Selman et Knight, 2006; Selman and Swanwick, 2010). As Ndubisi (2002b) points out, the concept of landscape planning depends on how we understand, value, and interpret landscapes. Since the Renaissance, landscapes have been approached in different ways, and each approach has its own perspective, terminology, concept, and method of research (Turner, 1982; Naveh et Lieberman, 1994; Zonneveld, 1995; Muir, 1999, 2003; Farina, 2006; Olwig, 2002; Claval et Entrikin, 2004; Ogrin, 1994, 1999;). A common rule in the application of different planning methods is based on respect for landscape complexity, and enjoyment in considering all those aspects of an ecosystem, environment, history, and development conditions that influence diversity (Romportl, 2012).

Applying the principles of different sciences, such as landscape ecology (Dramstad et.al., 1996; Botequilha et Ahern 2002; Ahern, 2005; Steiner, 1999), forestry (Fry et al., 2009), and aesthetics (Litton, 1974; Meyer, 1997, 2002; Daniel, 2001), planners through history, tried to answer the question of how landscapes should be planned (Steinitz, 2008). From the first moment of defining the concept of landscape and development of the profession of landscape architects and planners, as an unwritten rule, the core of these professions was set, whose main goal is the protection and preservation of landscapes and the environment. Regardless of the many definitions and different interpretations of landscape planning and the domain of the profession, through examples of world practice in the thesis, it is clearly concluded that planning does not take place in an isolated space.

Nowadays, the era of urbanization and globalization, which have taken their place in space, is developing very quickly, leaving behind a structure of a homogeneous landscape. Therefore, through many chapters of the thesis, like an invisible thread, the terms urbanization and globalization are explained as the main threat that every individual, including the landscapes, is facing. The development of each city can be read through an indelible trace full of ups and downs, and it is clear that its landscape, as well as society, is an integral part of that space. People without their environment cannot meet all their needs, just as the landscape itself does not manifest its maximum potential and functions without users. The mutual relationship between these two sides can be viewed, in this context, through different perspectives. All those negative and positive aspects that are the result of the mutual action of people and space, will define the different characters of the landscape, where the urban landscape, as the greatest result of human activity is the subject of this thesis.

Guided by the desire to emphasize the value and importance of the existing stream that is rich with high-quality values and many untapped potentials in the core of the European city, the thesis considers modern ways of landscape planning, which retain traditional postulates and result in future proposals for management rules. The chosen method does not dictate the levels of planning (Vasiljević, 2018). Therefore, the definition of the level and scale of the study area in the thesis is determined in relation to solving existing problems. The larger scale, in the thesis, affected the way of working, but it did not change the logic of the activity and the very core of the method that was used.

Theoretical and practical experience confirms that the interpretation of the unique character of the landscape, as a common good, can be achieved by applying the method of Landscape Character Assessment. This method is at the top of the historical and evolutionary ladder, which integrates different approaches of landscapes understanding and interpretation, and its application at different spatial levels is possible. The indispensable two steps are the separation of types (method of characterization) and determining the value of the landscape (method of evaluation).

Many authors point out that the landscape plan is preceded by analyzes of the benefits of different uses, landscape stability and space capacity (McHarg, 1969; Werthmann, 2007), analysis of “vulnerability” of the landscape (Golobič et al., 2006), and visual landscape estimates (Purcell 1992; Kaplan R. et Kaplan S., 1989; Lynch et Gimblett, 1992; Sheppard 2001; Ode et al., 2008), which is why this thesis establishes a holistic principle of landscape planning that will lead to an established goal. This way of planning dictates the direction of gathering the necessary information.

As all elements of the defined urban character of the researched landscape, have their dimension in space, the original analyzes of space were presented through the vertical and horizontal analysis. This analysis laid the foundation for the first step of the Landscape Character Assessment; a method of characterization, which singled out and defined the types of mutually different landscape characters.

The aim is then to focus on defining an identity card (ID card) of the landscape of the chosen type, with a specific character, with the basic step being the interpretation of the landscape, through research and description of the type, formed by nature and man. This interpretation, as an initial step towards setting the rules of landscape management, integrates the definition of its structural, functional aspect, together with the aspect of landscape meaning and change. According to Vasiljević (2018), landscape ecologists try to understand the processes that form the existing pattern of landscapes, while planners create new ones in order to change the existing way of land use. Therefore, the landscape pattern was considered an indispensable analysis, where the subtypes of the investigated landscape are identified by overlapping different maps. This step opens a discussion in order to consider the separate units as subunits of the type, which in the planning processes can be considered as unique types for further arrangements if the descent to a smaller scale is required.

As a result of urbanization, transformations of natural landscapes are changing land uses that have a significant impact on urban structure (Luck et Wu., 2002; Li et al., 2013). Therefore, the composition and configuration determined the clearer elements present in the type on the basis of which the landscape matrix was defined. Read through the four main present structures in space (green infrastructure, agricultural, hydrographic and built structure), this step in the thesis confirmed the present

heterogeneous landscape structure that was formed due to the intensive and uncontrolled process of city expansion.

In order to understand a landscape and try to arrange it in accordance with all economic, environmental, and social aspects, which is the goal of modern planning principles, it is necessary to understand the history of that landscape. Just like people, landscapes carry a trace of the past, evidence of history, and stories of their people. Therefore, if a parallel is drawn between man and the landscape, it is definite that they are helpless without each other, where a man can be seen as a cell, and the landscape, its DNA. Therefore, the aspect of change played an important milestone in the thesis. Composed of two main threads, retrospective analysis and dynamic of development, the chapter clearly explained how the unique character type of the landscape was formed. The retrospective method in the thesis starts from the first steps of development and the most significant features of the city of Prague, because, as previously mentioned, it would not make sense to talk about the history of the research area only, when it is a part of a larger entirety. What the chosen type of the landscape character, is today presents a picture and an opportunity of Prague and its people. The dynamic of development presupposes its further development in accordance with the acquired knowledge about the speed of creating the current structure, but also the interpretation of all existing laws and regulations of a country, as well as future plans that highlight all weaknesses of existing ones.

The key second step of the Landscape Character Assessment, the evaluation method, included two important elements that the modern principle of landscape planning advocates; ecosystem services and people involving. Ecosystem services, which are defined as *all those benefits that man receives from ecosystems* (MEA, 2005), represent the result and connection of the structure and function of a system, together with people and their expected needs (Comberti et al., 2015; La Notte et al., 2017). ES as a concept, in the last decade, is considered an indispensable segment that needs to be integrated into planning processes. Therefore, the analysis of the present values of these services was considered as an inevitable step for the evaluation analysis of the investigated landscape (Tengberg et al., 2012; Bastian et al., 2013). Their interpretation, at different levels, through different indicators, closely determinate the landscape itself and helps in further proposals and directions of its arrangement. Since the observed services are needed and provided within the urbanized space, they can also be defined as services of the urban ecosystem.

On the other hand, landscapes are not regulated only for the purpose of eliminating existing, perceived problems, nor for the purpose of regulating the economic and ecological system of the environment. Society, as previously mentioned, is an integral part of fulfilling its potentials and involving public opinion, through various aspects has long been the subject of research by many authors. Guided by Kevin Lynch, who in his book "*The Image of the City*", (1960) highlights the importance of the human eye in the landscape, and the way in which they, through the presence of certain elements in space, their spatial connections and arrangements, create a mental image of the city degree of landscape valuation method, survey included. The summarized data, together, presented the values that the study area carries within itself, and were presented through the sensitivity of that landscape, which further directed the rules of landscape management, defined through morphological-ecological and landscape-design rules.

7. Conclusion

The main goal of this thesis was to create a comprehensive approach to landscape planning. The holistic approach of perceiving spatial values enabled the assessment of landscapes by the method of characterization. This method, in the urban landscape of the researched area, defined three types of landscape character, which differ in their structure and character. By field verification of preliminary types and visual assessment of the landscape image, further interpretation of the structure of the chosen type, through the composition and configuration, pointed out in detail all the characteristics of the researched area, its values, and also the conflicts that are present in it. Ecosystem services, which are defined as values derived from the ecosystem and important for human well-being, are included in the work with the main goal of determining its function as an ecosystem (through provisioning and regulating services) and the meaning it creates with visitors through cultural services of the ecosystem). The changes that have taken place in the researched area throughout history and that have defined it today, have been viewed through a retrospective method, while the dynamic of development has more clearly determined the speed of changes that have occurred in place during the past and will probably happen in the near future.

Landscape vulnerability assessment (through ecosystem services and visual assessment of respondents), determined the degree of susceptibility of landscape to change under the influence of natural and human factors, that are an integral part of its existence. An indispensable part in the assessment of vulnerability were the respondents, with the help of which the visual vulnerability was assessed, through the perception of different ways of the human image of space.

Based on the characteristics of space that the Spatial Planning and Building Regulations Act (Building Act)- *Zákon o územním plánování a stavebním řádu (stavební zákon)* envisages as important, established rules of landscape management in work (morphological-ecological and landscape-design rules), pointed out are the importance of the developed identity of the character type, and its cultural values. These steps achieved the improvement, preservation of the image and structure of the urban landscape, which resulted in the creation of a positive identity of the city.

With the proposed rules of landscape planning, it is possible to reach compromises between the current ways of land use and the future functioning of the landscape, with an emphasis on the multifunctionality and aesthetics of the landscape. The way land is used is one of the main drivers of environmental change, with a significant impact on the quality of "life" and ecosystems, as well as on infrastructure management. They result in ensuring the protection of the landscape structure and the smooth functioning of natural processes, with the protection of biodiversity, as well as the preservation of inherited values. Morphological-ecological rules of improvement have as a starting point, the improvement of landscape biodiversity and mitigation of existing conflicts. These rules, defined in the thesis, not only contribute to basic ecosystem regulation services, such as microclimate regulation and water purification, but also support the local economy through tourism, creating attractive places that reflect the uniqueness of the landscape, its architectural heritage and the city's overall ecosystem wealth. good. Although economic arguments have a growing tendency and acceptance today, in the last few years the essential value and uniqueness of the structure of a landscape still remain the main reason for its continuous management and protection. Protection

provides a humane aspect of the construction and arrangement of settlements, which cannot be measured only by economic parameters. With the help of established principles of landscape design, the thesis presents the effect that designed landscape has in ensuring the quality of life of people. By opening the views towards the surroundings of Botič, the goal was achieved to emphasize the traditional value of the landscape.

Therefore, this master's thesis was focused not only on observing and examining the research area, but also on specifying the present problems, initiating discussions and encouraging the use of landscape characterization methods, as well as all those techniques and skills related to systematic landscape planning. The main aspiration was focused on the application of the method necessary for such research. The thesis recognizes the character of the landscape that was created in accordance with its local, spatial, ambient and shape characteristics. It is shown that based on the determined character of the landscape, it is possible to form rules of restoration and management, which would regulate the flow zone of Botič stream, with the potential of the entire landscape being adequately used. While it is clear from this that similar methods can be used on a larger scale, for the needs of managing larger administrative units. The application of the method of landscape characterization, as the main topic of many experts today, has enabled the monitoring of landscape development, which is considered a necessary step for this type of research. Planning without the history and evolution of the landscape has little chance of providing a rational, long-term solution. By using facts, which are integrated from the data on the evolution of the landscape, as a means of planning, the landscape is described more precisely, but it was also important to engage people in order to understand their experience of space.

The loss of biodiversity and identity of urban landscapes, which is becoming more and more intense today, calls for the urgent need to create a comprehensive approach to landscape planning that will integrate antropocentric and biocentric approaches, as well as control its functioning in a changing spatial context. Systematic spatial planning is a long-term process that requires the integration of several professions and can only be of good quality if the knowledge and skills of intellectuals are combined. The characterization of the landscape in the thesis was only one of the "tools" of landscape architecture that led to the formation of the proposed rules of arrangement. It can also be the subject of "deeper" and joint elaboration of urban planners, spatial planners, architects, historians, ethnographers, linguists, geographers, biologists because the identity of a place consists of interesting connections and mutual influences of nature and ethnic moments, together with all human activities. What would be interesting at the end, as a proposed step for the future implementation of the method of characterization of landscapes in order to form the rules of arrangement, would be to consider all three types, both individually and together. Make an ID card for each type, present in the researched area. It is clear that their different present land use, will require different considerations when it comes to rules of arrangement.

“The past lives on in art and memory, but it is not static: it shifts and changes as the present throws its shadow backwards. The landscape also changes, but far more slowly; it is a living link between what we were and what we have become. This is one of the reasons why we feel such a profound and apparently disproportionate anguish when a loved landscape is altered out of recognition; we lose not only a place, but ourselves, a continuity between the shifting phases of our life”.

referenced by Margaret Drabble in *A Writer's Britain: Landscape in Literature*, (Thames & Hudson, 1987)

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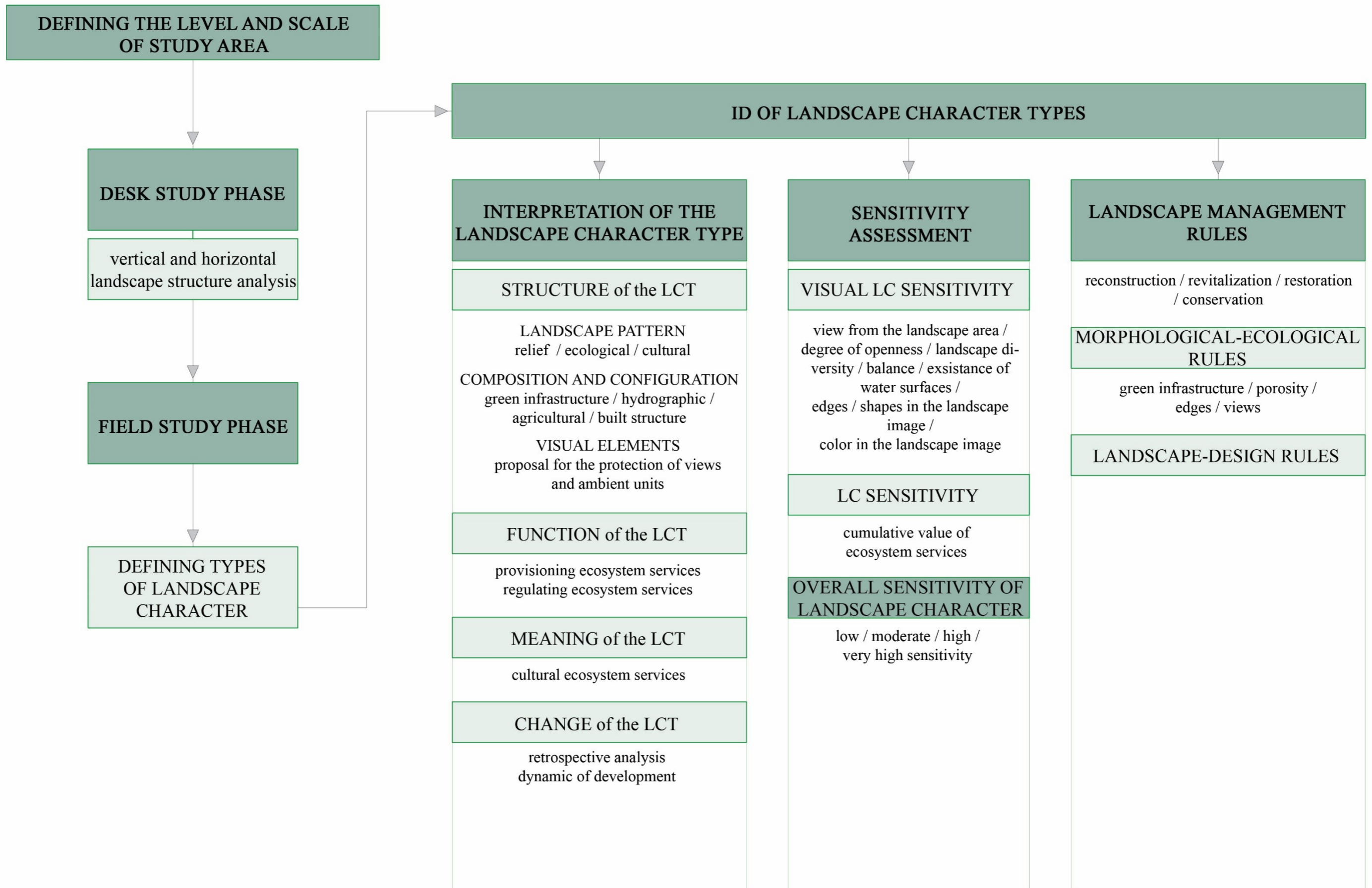
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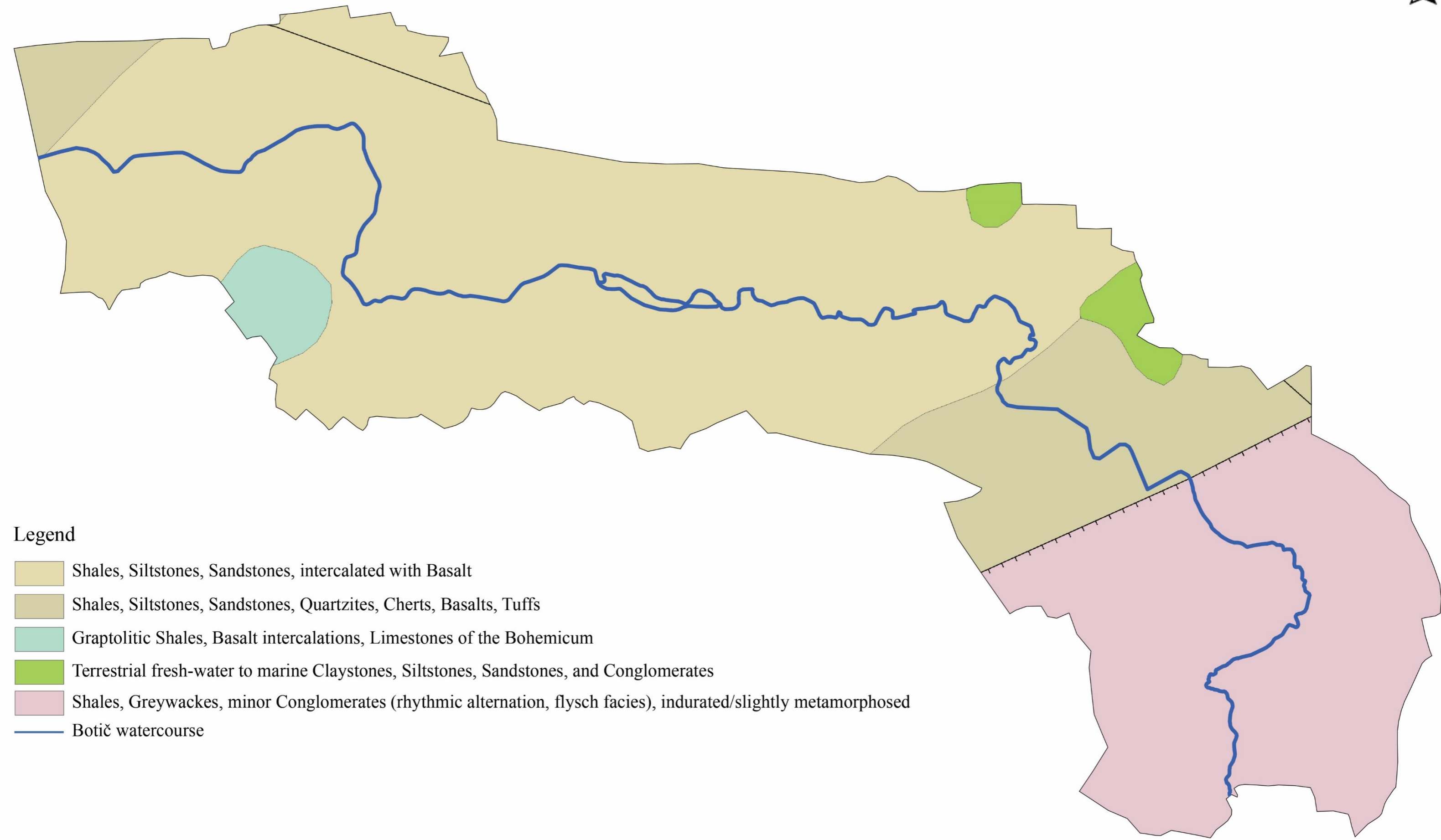
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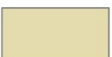



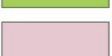

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Appendix 1. Schematic representation of the Methodological Approach



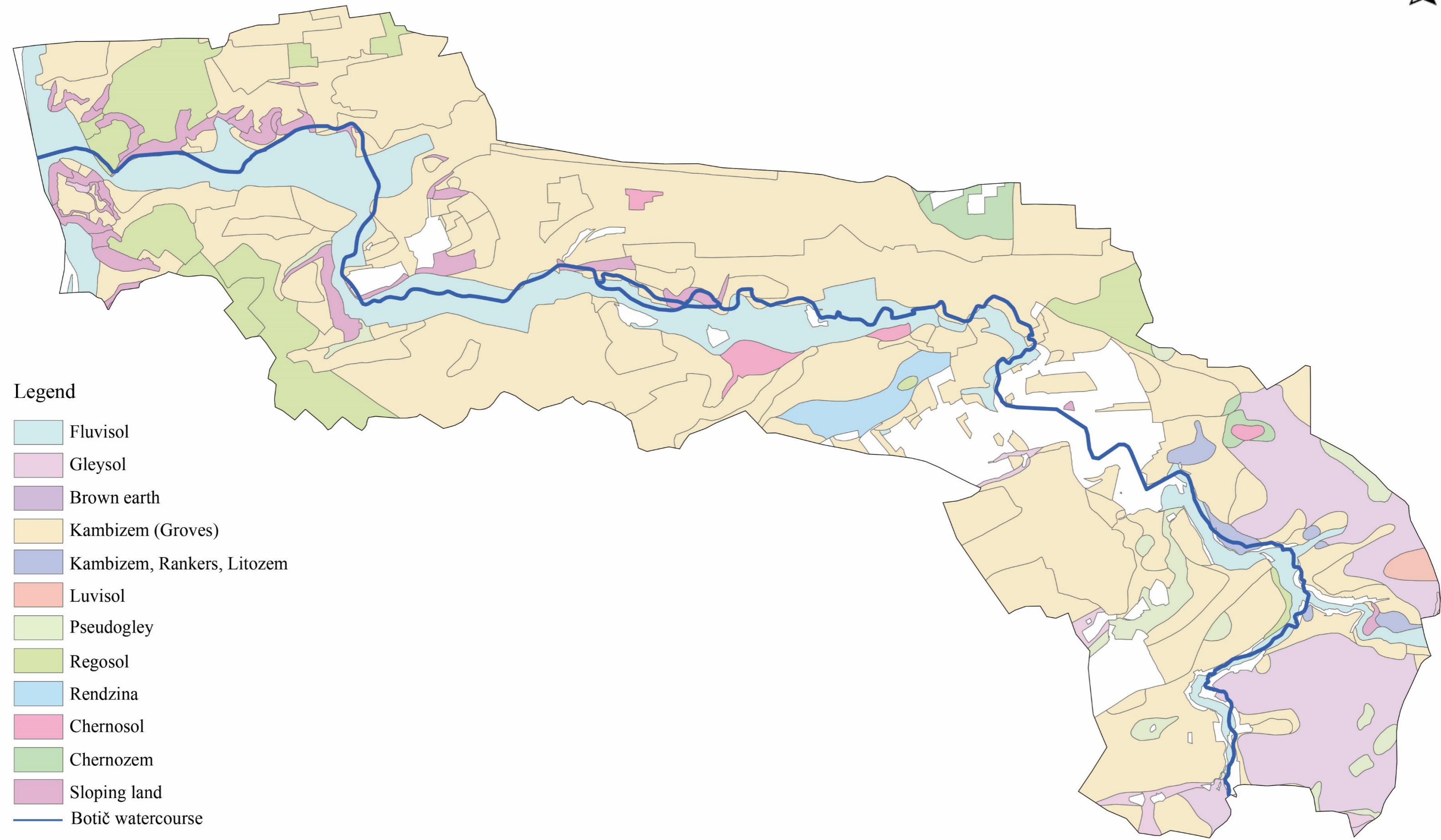


Legend






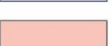



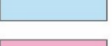



-  Shales, Siltstones, Sandstones, intercalated with Basalt
-  Shales, Siltstones, Sandstones, Quartzites, Cherts, Basalts, Tuffs
-  Graptolitic Shales, Basalt intercalations, Limestones of the Bohemicum
-  Terrestrial fresh-water to marine Claystones, Siltstones, Sandstones, and Conglomerates
-  Shales, Greywackes, minor Conglomerates (rhythmic alternation, flysch facies), indurated/slightly metamorphosed
-  Botič watercourse



Appendix 3. Soil types, Wider zone of researched area

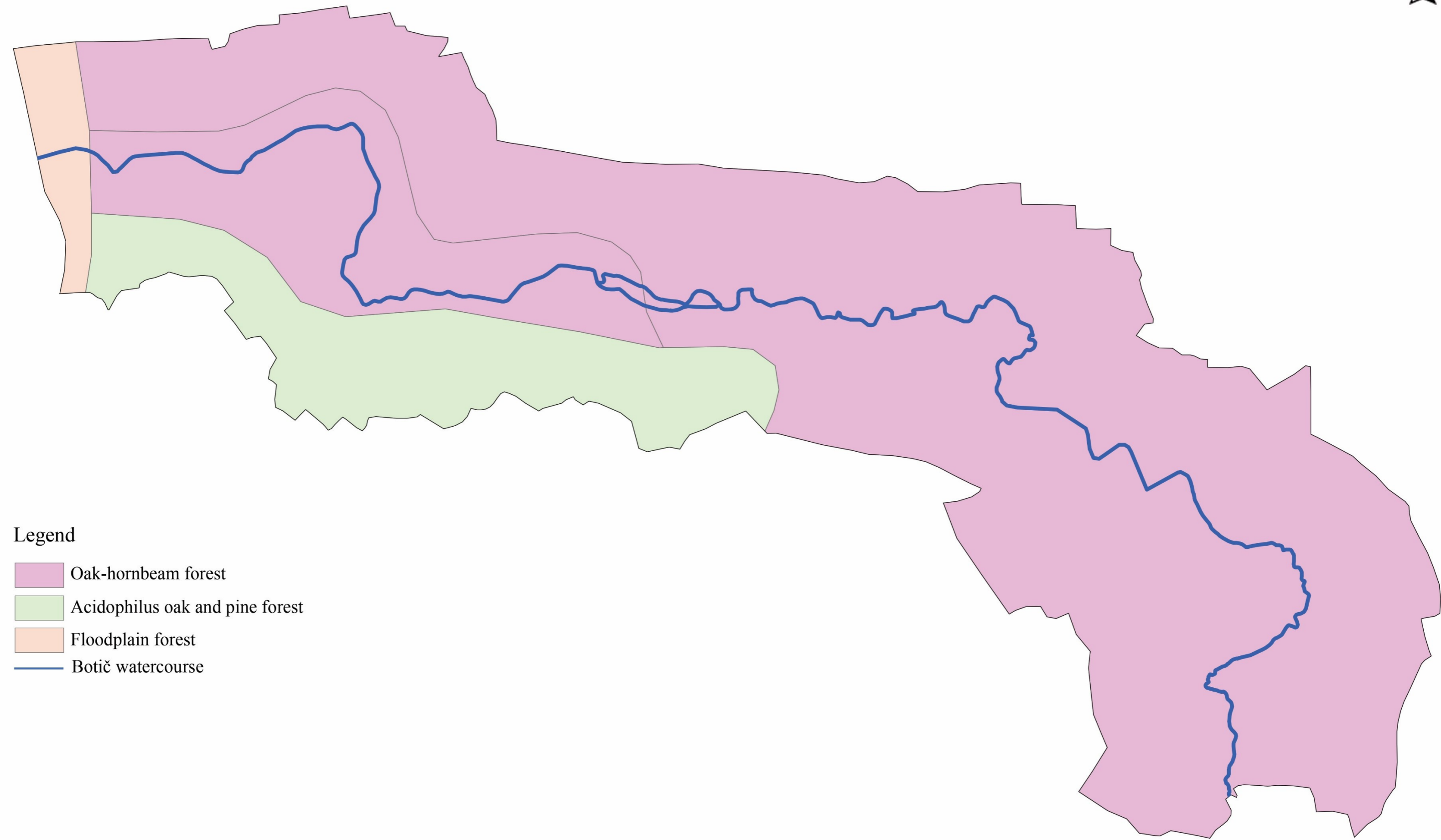






Legend

-  Fluvisol
-  Gleysol
-  Brown earth
-  Kambizem (Groves)
-  Kambizem, Rankers, Litozem
-  Luvisol
-  Pseudogley
-  Regosol
-  Rendzina
-  Chernosol
-  Chernozem
-  Sloping land
-  Botič watercourse

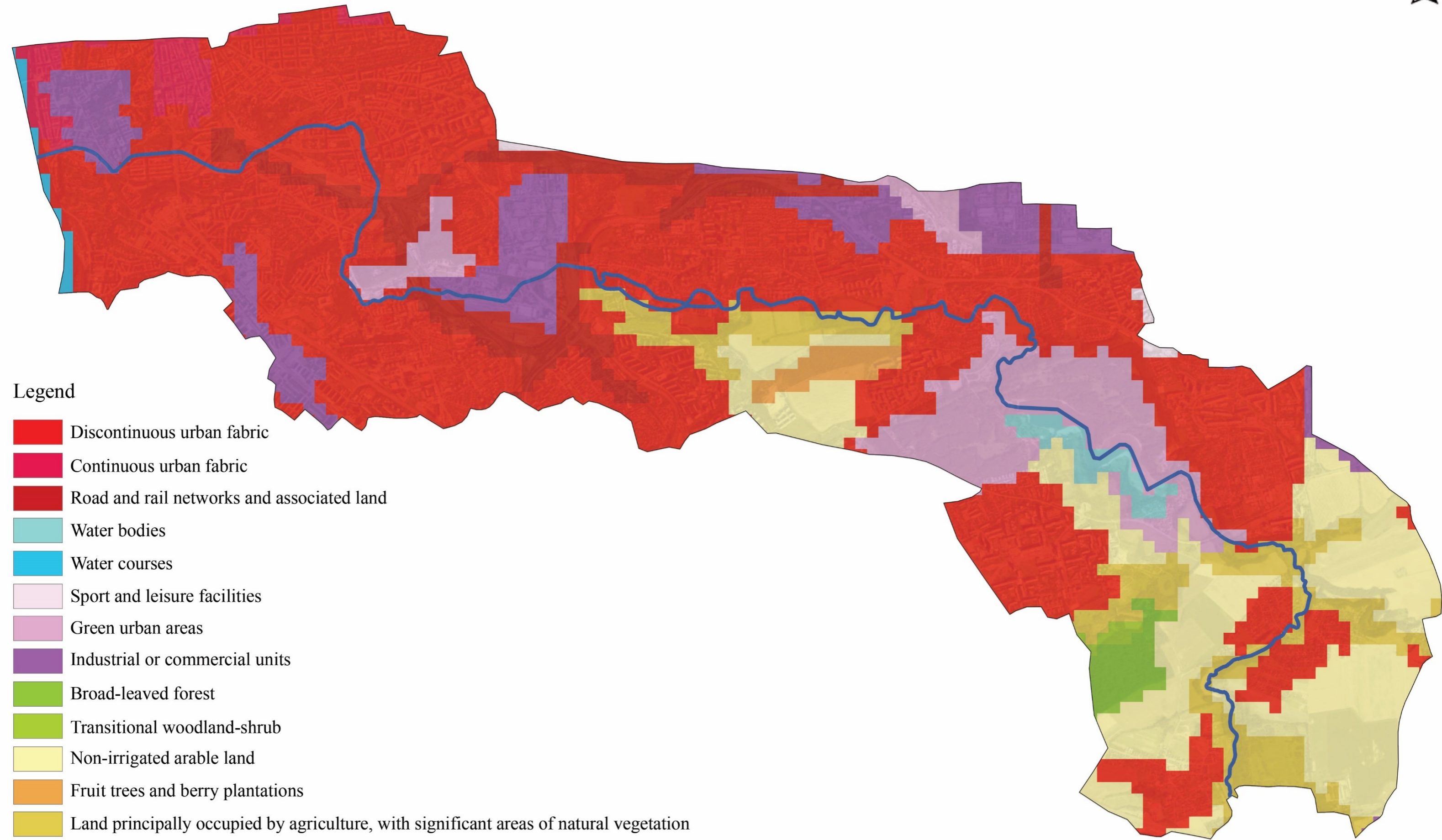


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- Legend
-  Oak-hornbeam forest
 -  Acidophilus oak and pine forest
 -  Floodplain forest
 -  Botič watercourse

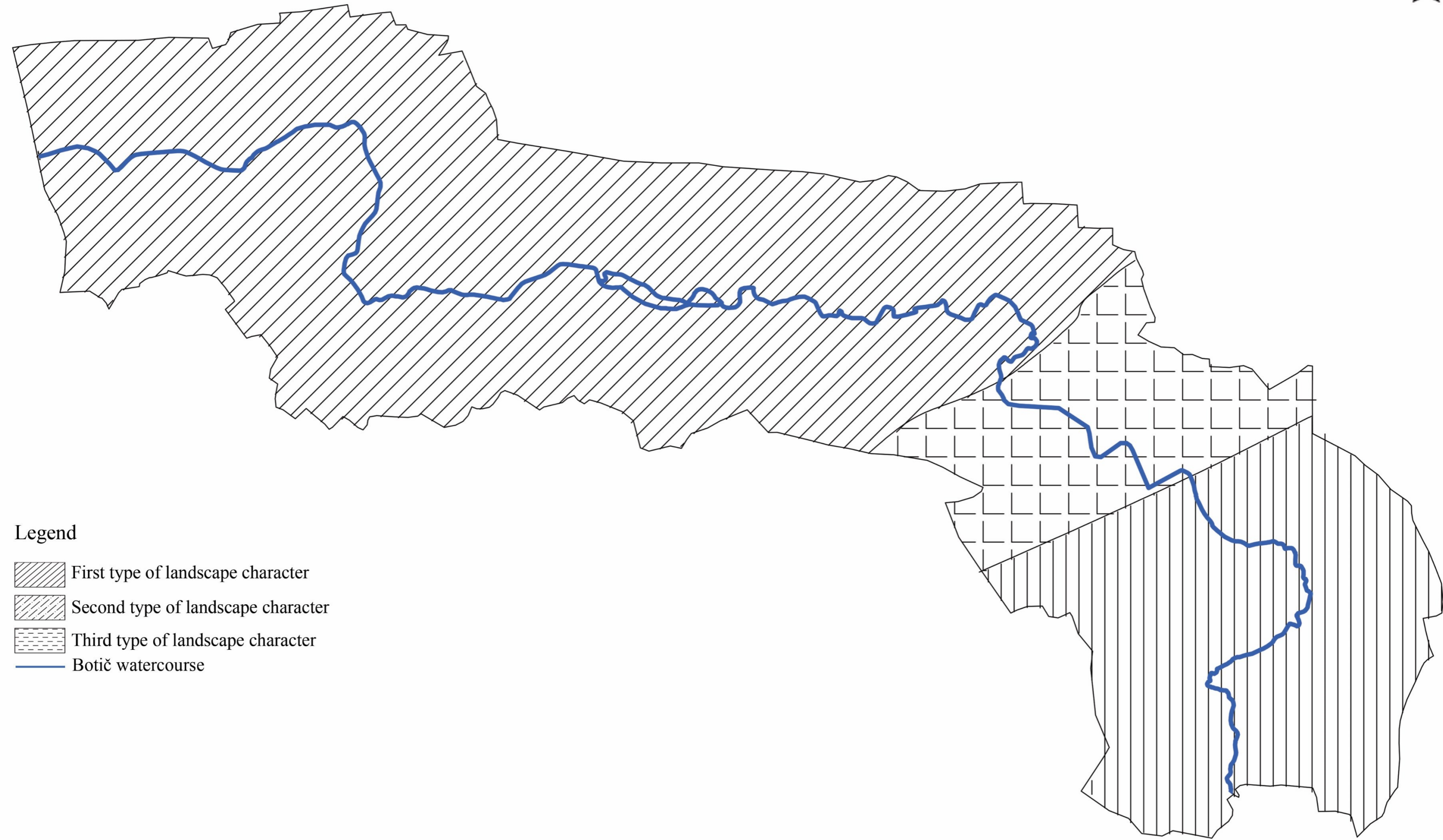





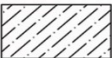


Legend

-  Discontinuous urban fabric
-  Continuous urban fabric
-  Road and rail networks and associated land
-  Water bodies
-  Water courses
-  Sport and leisure facilities
-  Green urban areas
-  Industrial or commercial units
-  Broad-leaved forest
-  Transitional woodland-shrub
-  Non-irrigated arable land
-  Fruit trees and berry plantations
-  Land principally occupied by agriculture, with significant areas of natural vegetation
-  Botič watercourse





Legend

-  First type of landscape character
-  Second type of landscape character
-  Third type of landscape character
-  Botič watercourse




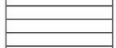










Legend

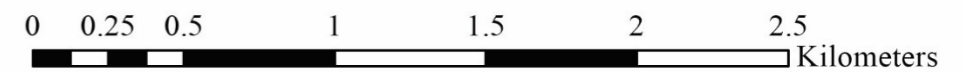
— Botič watercourse

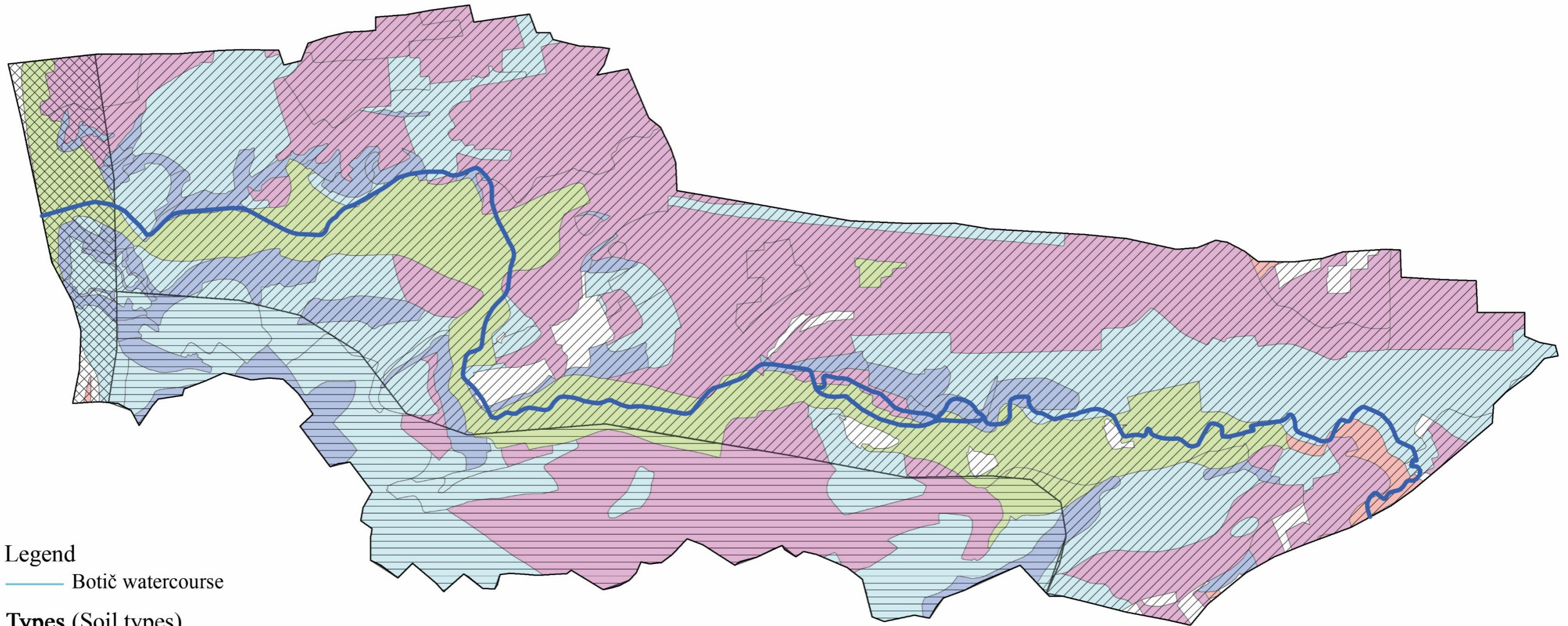
Types (Soil types)

-  Shales, Siltstones, Sandstones, intercalated with Basalt
-  Terrestrial fresh-water to marine Claystones, Siltstones, Sandstones, and Conglomerates
-  Graptolitic Shales, Basalt intercalations, Limestones of the Bohemicum
-  Shales, Siltstones, Sandstones, Quartzites, Cherts, Basalts, Tuffs

Subtypes Slope (° / %)

-  0 - 3° / 0 - 1%
-  3 - 8° / 1 - 2%
-  8 - 17° / 2 - 5%
-  17 - 27° / 5 - 8%
-  27 - 40° / 8 - 11%
-  > 40° / > 11%




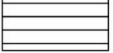


Legend

— Botič watercourse

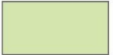
Types (Soil types)

 Oak-hornbeam forest

 Acidophilous oak and pine forest

 Floodplain forest

Subtypes Protection classes

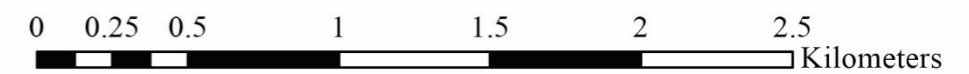
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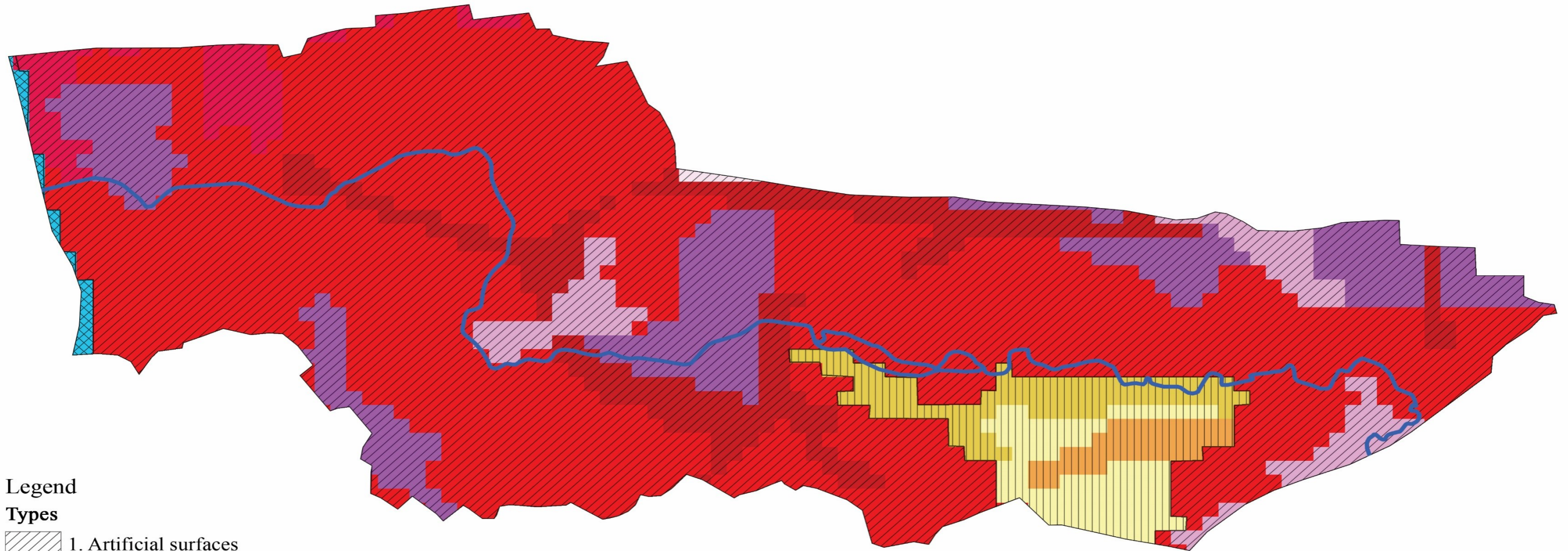
 II

 III

 IV




 V









Legend

Types



-  1. Artificial surfaces
-  2. Agricultural areas
-  5. Water bodies

Subtypes

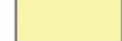
1.1. Urban fabric

-  1.1.1. Continuous urban fabric
-  1.1.2. Discontinuous urban fabric
- 1.2. Industrial, commercial and transport units
-  1.2.1. Industrial or commercial units
-  1.2.2. Road and rail networks and associated land

1.4. Artificial non-agricultural vegetated areas

-  1.4.1. Green urban areas
-  1.4.2. Sport and leisure facilities


2.1. Arable land

-  2.1.1. Non-irrigated arable land



2.2. Permanent crops

-  2.2.2. Fruit trees and berry plantations

2.4. Heterogeneous agricultural areas

-  2.4.3. Land principally occupied by agriculture, with significant areas of natural vegetation

5.1. Inland waters

-  5.1.1. Water courses
-  Botič watercourse

