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## INTRODUCTION

The volume is very diverse, bringing together research ranging from the finest nuances of sacred sculpture to the perception of the urban silhouette in the landscape. One of the studies looks at the aesthetic values of the landscape, related to the biophysical and ecological characteristics of the landscape, as well as touching on biodiversity. On the other hand, the next study examines the assessment of cultural ecosystem services and decision making in documents, seeking a methodological framework. The research also shows that there is no common understanding of environmental psychology, people's attitudes and perceptions of the environment. The themes collected form a rich volume of reflections. Perhaps a study of landscape sketching, in which aspects of environmental psychology can be read more clearly, can help with the above problem.

One answer can be found in a study by Ukrainian scientists on the role of distant lines of sight in the perception of the urban landscape, which contribute to the development of a sense of place. For example, the perceptual qualities of the historic image of Kyiv were identified through the study of visual landscapes. Not only the lines of sight, but also the location of the sculptural works in the urban environment play an important role. This is attributable for the perception of the compositional expression of the sculpture in the lines of sight in the context of the scale of the specific urban space and the architectural character of the surrounding buildings. As population density increases, so does the pressure of urbanisation on the natural environment. This was particularly evident during the Covid pandemic, both in forested areas and on marsh boardwalks. People's attitudes towards the environment were assessed by studying the recycling of materials, with the study emphasizing the use of tire pellets. Returning to the historical aspects, the German-Baltic heritage in Latvian cultural history is not only linked to important events of the 19th century, but also to the history of the region. The cultural and historical development of the manors provided a good understanding of the skills of profitable agriculture management, which were later inherited and developed by the farmers during the free state of Latvia. Digitisation, which is becoming increasingly important in the identification of historical evidence, makes a very significant contribution to art and provides an opportunity to obtain accurate documentary evidence for the study of Latvian art. The collection of material on the interiors of Latvian Baroque churches is very interesting. The "moving sculptures" used in the altar section ensured the presence of God and angels in the church. The sounds of the organ, the singing of the congregation and the theatrical form of the sculptures were able to bring the spiritual message closer to the congregation psychologically. The transfer of knowledge from the mechanical to the visual arts created moments of mystery and wonder in worship.

## PRIEKŠVĀRDS

Izdevums ir ļoti daudzšķautnains, jo apkopo pētījumus no vissmalkākās nianses sakrālajā tēlniecībā līdz pilsētas silueta uztveres punktiem ainavtelpā.

Viens no pētījumiem aplūko ainavas estētiskās vērtības, kas saistītas ar biofizikālajām un ainavas ekoloģiskām īpašībām, kā arī pieskaroties bioloģiskai daudzveidībai. Savukārt, nākošais pētījums aplūko kultūras ekosistēmu pakalpojumu novērtēšanu un lēmumu pieņemšanu dokumentos, meklējot metodisko ietvaru. Izpētes materiāli liecina arī par to, ka nav vienotas izpratnes par vides psiholoģiju, par cilvēku attieksmi un vides uztveri. Apkopotie jautājumi veido bagātīgu pārdomu apjomu.

Iespējams, ka iepriekš minētajā problemātikā var līdzēt pētījums par ainavtelpas skiču zīmējumu veidošanu, kuros vides psiholoģijas aspekti ir nolasāmi skaidrāk.

Viena no atbildēm ir rodama Ukrainas zinātnieku pētījumā par tālo skatu līniju nozīmi pilsētas ainavas uztverē, kas veicina vietas sajūtas veidošanos. Piemēram ir izmantota Kijivas vēsturiskā tēla uztveres īpašību noteikšana, balstoties uz vizuālo ainavu izpēti. Nevien skatu līnijas, bet arī tēlniecības darbu novietojums pilsētvidē spēlē nozīmīgu lomu. Tas ir attiecināms uz skulptūras kompozicionālās izteiksmes uztveri skatu līnijās kontekstā ar konkrētās pilsēttelpas mērogu un apkārtējās apbūves arhitektonisko raksturu.

Augot apdzīvotības blīvumam, pieaug urbanizācijas slodze uz dabas pamatni. Īpaši spilgti tas bija nolasāms Covid pandēmijas laikā gan mežu teritorijās, gan apmeklējot purvu laipas. Cilvēku attieksme pret vidi ir novērtēta, pētot materiālu otrreizējo apriti, pētījumā liekot uzsvaru uz riepu granulu izmantošanu.

Atgriežoties pie vēsturiskajiem aspektiem, vācbaltiskais mantojums Latvijas kultūrvēsturē ir veidojis saikni nevien ar nozīmīgām 19.gs. personībām. Kultūrvēsturiskais ritējums muižās deva labu izpratni par rentablas saimniekošanas prasmi, ko vēlāk pārmantoja un attīstīja tautsaimnieki Latvijas brīvvalsts laikā. Pētījums ietver kādas fotogrāfijas pirmpublicējumu.

Vēsturisko liecību apzināšanā aizvien lielāku nozīmi mūsdienās veido digitalizācija, dodot ļoti spēcīgu pienesumu mākslā, un rodot iespēju iegūt precīzu dokumentalitāti Latvijas mākslas pētniecībā.

Ļoti interesants materiālu apkopojums ir par Latvijas baroka dievnamu interjeriem. Altāra daļā izmantotās "kustīgās skulptūras" nodrošināja Dieva un eņģeļu klātesamību dievnamā. Ērģeļu skaņas, draudzes dziedājums un teatrālais skulptūru veidols spēja psiholoģiski tuvināt garīgo vēstījumu draudzei. Zināšanu pārnese no mehāniski lietišķā uz tēlotājmākslu radīja noslēpumainības un brīnuma mirkļus dievkalpojumos.

**Aija Ziemeļniece**
Editor of Chief

CONTENT

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# MEETING NATIONAL LAND USE RELATED OBJECTIVES WHILE SAFEGUARDING TYPICAL LANDSCAPES

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**Abstract. Landscapes play a significant role in the regional development by providing ecosystem services to the local communities. Significant changes in land management due to the political decisions may significantly change the typical landscape in rural areas. Therefore, the aim of this study is to explore how to use the landscape differences to facilitate achievement of national socio-economic and environmental objectives, while avoiding significant changes and safeguarding typical landscapes. Cluster analysis was used to identify relatively homogeneous groups with four socio-economic and environmental indicators, namely, profit, employment, net GHG emissions, habitat quality. Results show that clusters with the highest socio-economic return are located closest to the capital city and carbon sequestration measures may be concentrated in the landscapes that are geographically farthest from the capital city, but then the abandonment of rural areas and the disappearance of typical landscapes may occur. The political decisions related to land use change should be adapted to the specific landscape, so that not only socio-economic and environmental objectives are achieved together with the fulfilment of international obligations, but also the typical landscape of the specific landscape region is preserved.**

**Keywords: land management, multifunctionality, agriculture, forest, biodiversity, land functions**

## Introduction

Landscape describes the changes that have taken place over thousands of years, facilitated by natural processes and human activities. Landscapes takes important role in formation of local culture and well-being of citizens. The aesthetic values of the landscape are related to both the biophysical and ecological characteristics of the landscape, as well as the biological diversity, however, one of the most important factor determining the aesthetic value is the perception of people, which can be different for each individual [1]. Any changes in the landscape and multiple societal demand for various ecosystem services affect the functionality of the landscape. For instance, the growing demand for bio-products has increased the production and promoted the development of bioeconomy. At the same time has also created challenges how to simultaneously achieve socio-economic and environmental targets. Climate change mitigation is one of the challenges, as the European Union is committed to make the EU the first climate-neutral economy and society by 2050, which consequently means that each member state has an obligation to reduce GHG emissions also from agricultural and land use, land use change and forestry sectors. Another societal challenge is how to tackle with biodiversity loss, therefore the EU has set the targets to expand the protected areas and to restore degraded ecosystems. All of these land-related societal demands require changes in land use and are going to affect multifunctionality of landscape in various ways.

The multifunctionality of the landscape is considered as the capacity of the ecosystem to provide the society with multitude of benefits, which are formed as a result of complex interaction amongst various land units and stakeholders. Heterogeneous agro-forestry landscapes may provide higher levels of multifunctionality, while heterogenous landscapes with the domination of built-up show less multifunctionality [2]. In homogeneous agricultural landscapes even abandoned land is important in providing environmental [3]. Such unmanaged or abandoned habitats, large trees, rock piles or any other natural elements in the landscape may be beneficial for species persistence. Agricultural expansion reduces forest areas and natural habitats, for instance, in a [4] study, agriculture expansion in Lishui, China has led to a 6.08% loss of habitat quality between 2000 and 2020, extensive forest loss and land fragmentation. In addition, the expansion of agriculture, the construction of infrastructure, regional and urban planning, as well as globally caused economic and environmental challenges also changes the usual and historically formed landscape. Therefore, the research question of this study is how to fulfil all of the land use related national objectives while preserve typical landscapes?

So far, the studies have been conducted to evaluate the supply and demand for soil-based ecosystem services of foodscape, namely primary productivity, water purification, nutrient cycling, carbon regulation, habitat for biodiversity [5], [6], [7] using Functional Land Management framework [8], [9]. For instance, the case study in eastern Amazonia showed that the demand for agricultural production can stimulate the expansion of agriculture in areas with fertile soils which in turn could compromise environmental objectives and change the typical landscape [5]. And the study in Philippines showed although there is a high demand for concentration of agricultural production in lowlands from policy makers, but due to low production potential, farmers have concentrated production on erosion-prone terrains [6]. Another study in Latvia, on the other hand, has selected spatial locations for specific land use changes in order to achieve bioeconomy and environmental objectives [7]. All of these studies have investigated the spatial distributions for supply and demand of soil functions and incentives how to achieve the balance between demand and supply, but most often, to achieve this, a land use change is required, which may significantly change the typical landscape. Therefore, the aim of this study is to explore how to use the landscape differences to facilitate achievement of national socio-economic and environmental objectives, while avoiding significant changes and safeguarding typical landscapes.

## Materials and Methods

### *Generic Research Approach*

In this study, the Functional Land Management framework is used to determine the societal benefits derived from agricultural and forest land use. Four categories of land use related societal benefits are evaluated: social, economic, climate regulation, and biodiversity protection.

The first step involves creating two spatial datasets: one for agricultural land and another for forest land (Figure 1). This is done to generate a single-layer detailed spatial datasets with attributes for agricultural and forest land fields. For agricultural land dataset several sources of information are used: Rural Support Service data (with attributes of crops, soil type, land quality, type of support, and owner's id for each land field of), Agricultural Data Center data (location of animal holdings, number of animals), Soil maps (soil type, land quality) and spatial locations of landscape regions. For forest land dataset, primarily information from the State Forest Service is used (incl. dominant specie, dominant specie age, forest type, forest age group, standing volume, height of trees, number of trees, stand density, standing volume, restrictions, year of last activity and type of the last activity).

The second step involves preparing algorithms to calculate the societal benefits related to land use, using the information from the datasets as input. Societal benefits are calculated for each land field and then, in the third step, summarised for landscape regions.

R along with the "tidyverse" and "sf" packages are used for data processing.

### *Economic function*

The indicator used to determine economic impact is profit, which is calculated per each agricultural and forestry land use field. Profit in agriculture is calculated as the difference between revenue and production costs and estimated in euro per ha. Revenue depends on crop type, its price, yield (which itself depends on land quality and size of farms), and support payments. Production costs include labour costs, depreciation of fixed assets, intermediate consumption, and taxes. Both, revenue and production costs, are adjusted with production scale coefficients depending on the farm size.

To determine the yearly profit in forest lands the following methodology is used. Initially profit for the whole rotation cycle is calculated as the difference between all incomes and expenditures within the rotation circle. Incomes within a rotation cycle include incomes from the main felling and stock maintenance felling. Expenditures within a rotation cycle include costs for soil preparation, planting material, planting, agro-technical maintenance, composition maintenance felling and main felling. The difference between incomes and expenditures divided by number of years in rotation cycle is considered as yearly profit in forest lands. Length of rotation circle depends on dominant species in each forest parcel. All calculations are made in current prices. Yearly profit is calculated for each individual forest parcel. Information on the type and volume of logging is obtained from the annual reports of the State Forest Service, which is then spatially linked to the database of the State Forest Register.

### *Social function*

The indicator used to determine the social impact is employment. Employments in agriculture and forestry are calculated as labour input per each land field and depends on crop type, farm size, and forest type. The Latvian farm accountancy data network (FADN) data from 2021, Latvian Rural Advisory and Training Centre standard income-costs calculations per crop from 2021 and unpublished spatial administrative data about each agricultural field from Rural Support Service agency are used to determine both profit and labour input indicators per each agricultural and forest land field.

### *Climate regulation function*

In order to determine the climate regulation function, the net GHG emissions from agriculture sector and land use, land use change and forestry sector (LULUCF) per each agricultural and forestry land field were calculated. Using IPCC guidelines [10] and national emission factors from the Latvia`s national inventory report [11], for each emission source (animals, manure management, mineral fertilizer management, crop residues, organic soil management, soil liming, carbon changes in living biomass, dead wood, litter, soil, wood products) emission coefficients for different land use types were calculated. Later for each specific land use type the relevant emission coefficient is multiplied by the area of the field to get the yearly net GHG emissions from each agricultural and forest land field. GHG emissions are recalculated in CO2 equivalent corresponding to global warming potential of AR4 [12].

### *Biodiversity protection function*

The habitat quality for birds is chosen as an indicator for biodiversity. In this study, the evaluation of habitat quality requires reference to both land use and a specific territorial unit, so the analysed criteria and data were performed at the hexagon level (size of each hexagon is 100 ha), covering

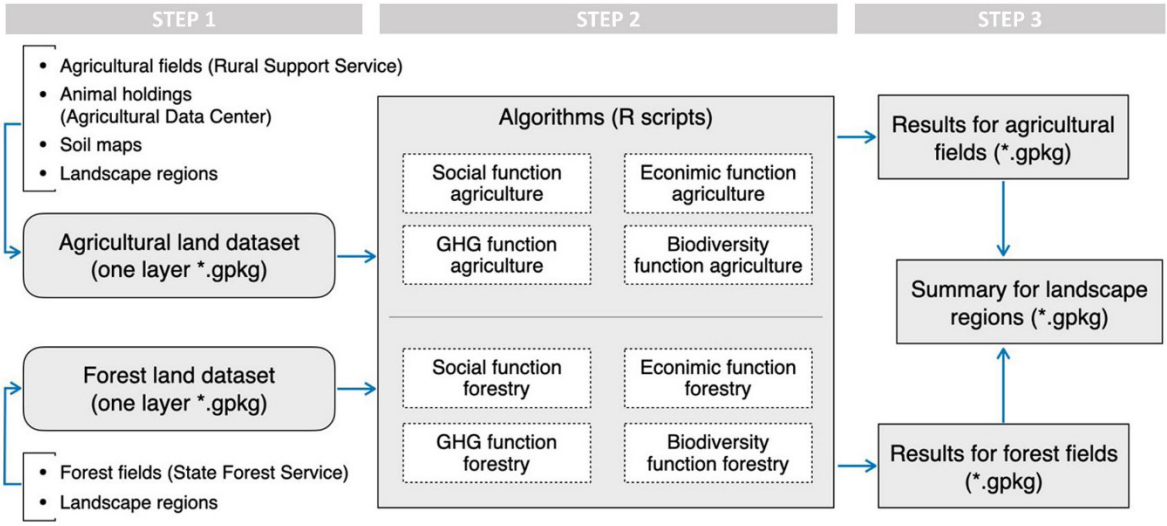


Fig. 1. Methodological steps for land function evaluation [created by authors]

Table 1. The characteristics on landscape regions [18]

| Landscape region | Characteristics |
|---|---|
| Piejura | The relief is formed by the plains, dune ridges and ramparts formed by the Baltic Ice Lake and the Litorina Sea. Forests occupy 60% of the territory with the pine as a dominant tree species. Agricultural land is located in polder systems. Rich in peatlands and shallow lagoon type lakes. The climate is moderately warm and humid with the average precipitation of 700 to 750 mm per year. Current ecological problems are related to eutrophication and rapid overgrowth of shallow lakes, extinction of biotopes, especially biologically valuable grasslands. The biggest challenge is ensuring the ecological quality of forest landscapes. |
| Ventaszeme | The relief and sediments are created by islands of moraine sediments, and the land cover is dominated by agricultural land. In places where sandy soils dominate, the forests spatially form one of the largest continuous forest massifs. The main tree species are pine and spruce. Climate is moderately warm and moderately humid with the average yearly precipitation of 650-750 mm. |
| Rietumkursa | Hilly terrain with wavy and flat plains. Agricultural land dominated, forests occypy 39% and are located in the moderately drained wide relief depressions. A dense network of small rivers. Large drained fields dominate, little meadows and pastures, and unused agricultural land. Average yearly rainfall exceeds 800 mm. As a results of agricultural land intensification, many small landscape elements (individual trees, groups of trees) have disappeared, which reduces biological diversity. Landscape region has a potential for development of wind farms. |
| Austrumkursa | Diverse terrain and the sediments. Arable land dominates, little pastures and meadows. Very few unused and abandoned agricultural land. Forest occupies 45% of the territory and the main tree species are pine, spruce and birch. The climate is moderately warm, the average amount of precipitation is 600-700 mm per year. The current ecological problems are related to the intensive use of agricultural land. The landscape is characterized by the homogenization of crop rotation. |
| Rietumzemgale | The terrain is flat and slightly wavy. Forests occupy 14%. The dominant species in the forest stands is pine. Soils are fertile. 85% of agricultural lands have been drained. Landscape is homogeneous dominated by agricultural land mixed with small groups of trees. Climate is moderately warm and relatively dry with average yearly precipitation 589 mm. The thickest river network, distinct river valleys, little lakes. Poor or very poor ecological quality of water bodies. |
| Austrumzemgale | Slightly wavy terrain with ridges, ramparts and hills. The 62% of the total area is occupied by forests. The main tree species are pine, birch and black alder. Agricultural lands have been preserved in the form of massifs of drained lands of various sizes in the vicinity of rivers and near major roads. Climate is moderately warm and moderately humid with precipitation of 700-750 mm per year. The most important ecological problem is forest fragmentation. |
| Dienvidvidzeme | A very homogeneous relief forms, the largest part of the territory is occupied by elongated ramparts. Forests occupy 55%. Pine, birch and spruce dominate in forests. Lakes of different origins. Typical karst processes. A lot of peatlands. Overgrowth of natural grasslands in river valleys. Homogenization is observed, fragmentation is increasing in the forest landscape. |
| Daugavzeme | The surface of the terraces is broken by ravines, ancient ravines and depressions created by the runoff of glacial waters. Agricultural land dominates in the landscape. Rapid overgrowth of unused agricultural land with pines and bushes. Floodplains are clearly visible in the valleys. The landscape is dominated by a reservoir. Forests occupy 26%. The climate is very different, more features of the marine climate. Precipitation is 655 mm per year. The main ecological problems concern construction of fishways and increase of biological diversity. |
| Augszeme | The marginal landforms of the glacier dominate - ridges and ramparts of moraines, massifs of half-ridges. Massifs of agricultural land dominate, fragmented by small groups of trees and homesteads. Forests occupy 48%. The dominant tree species in the forest stands are birch and pine. Moderate continental climate. The amount of precipitation is 590-700 mm per year. Many lakes and small rivers. Landscapes are becoming more homogenous and biodiversity conservation becomes crucial. |
| Latgales augstiene | The topography consists mainly of hilly terrain of various shapes and sizes, often in complex combinations with distinct depressions occupied by lakes and low peatlands. Agricultural land dominates. Due to the complex terrain, the mosaic-like spatial structure of the landscapes is dominated by forest lands, while the agricultural lands are dominated by grasslands, which form separate patches. The forests are dominated by birch, aspen and black alder. The overgrowth of grasslands creates serious difficulties in maintaining the quality of landscapes. A lot of abandoned farmland. Forests occupy 36%. Continental climate. The average annual rainfall is 650 mm. The region with the most lakes. The most significant problems are the abandonment of agricultural lands and homesteads. Loss of biodiversity. |
| Aiviekstes zeme | Great variety of landscapes. The depressions between the ramparts are swamped. Rapid overgrowth of agricultural land. Birches and pines are common in the forests. In some places, clumps of oak trees have been preserved. Pronounced agricultural land and forest land mosaic. Deciduous young growth forests dominate. Forests occupy 53% of the area. There are many large peatlands. The climate is moderately warm and humid. Precipitation 550-700 mm per year. Many lakes. The main ecological problem concern conservation of floodplain meadows. |
| Austrumlatgale | The relief is wavy. Agricultural land forms large reclaimed massifs that are used as grasslands. The dominant tree species in the forests are pine, spruce, birch and aspen. Forest massifs are fragmented. Peatlands occupy 30%. Forests occupy 47 %. The climate is distinctly continental. Precipitation 600-700 mm per year. There are not many lakes. Agricultural lands are overgrown or afforested. Rapid decline of natural grasslands. Abandonment and collapse of single-family homes. |
| Vidzemes augstiene | The terrain consists of hill bands of different sizes. Forests, meadows and pastures cover larger areas, and wet and permanently wet meadows and pastures are preserved. Forests occupy 52%. The dominant species in the forest stands is spruce. There are very large areas of abandoned agricultural land, which are naturally afforested. Average annual precipitation exceeds 750 mm. Many lakes. The most significant ecological problems are related to the non-management of the agricultural land and the disappearance of natural meadows, as well as the risks of erosion. |
| Gaujaszeme | The relief is formed by a river valley. The landscape is dominated by forests. Peatlands are located in the lower parts of the terrain. Forest stands is dominated by pine. Forests occupy 62%. Climatic conditions in the landscape are very different. Precipitation 650 – 850 mm per year. The ecological problems are related to the operation of small hydroelectric power plants on rivers. The hydrological regime of the river has changed, the river ecosystem and landscape have been affected. |
| Austrumvidzeme | The relief consists of separate massifs and depressions. Lakes and peatlands are found in the depressions. The landscape is distinctly mosaic, consisting of agricultural land and forest clumps. Agricultural land is dominated by grasslands, overgrowth of pastures and meadows can also be observed. There are many peatlands. Average yearly rainfall is 758 mm. The shortest vegetation period in Latvia. Many lakes. The most significant ecological problems are related to the non-management of natural meadows and the disappearance of natural meadows, as a result of which the nature of the mosaic landscape changes, which affects biological diversity and the aesthetic quality of the landscape. |
| Ziemelvidzeme | Moderately wavy relief. A lot of peatlands. Large forest massifs dominate. The main tree species in forests are birch, spruce, pine and black alders. A lot of young growth forests with deciduous trees. The climate is influenced by the Gulf of Riga. The amount of precipitation is 700-850 mm per year. The landscape is rich in lakes. Fragmentation is increasing in the forests, homogenization is observed in the rural landscape, abandoned settlements and abandoned agricultural land occurs. |

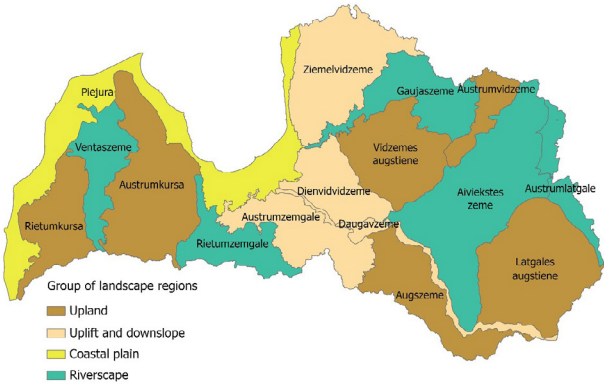


Fig. 2. Landscape regions in Latvia [created by authors]

the entire territory. The habitat quality has been evaluated within ecosystems using an integrated two-stage evaluation system, which considers interaction of several elements: land use, land use intensity, length of ecotone, and presence of the EU protected habitats.

In the first step, the weighted average value of the hexagon`s ecosystem quality is evaluated according to the ecosystem composition, with the rationale that the highest biodiversity of species is in undisturbed ecosystems, and it decreases depending on the land use intensity and other anthropogenic factors in the specific location [13], [14], [15]. The ecosystem quality value is determined in points ranged from 1 to 10. The 10 points indicates an undisturbed natural area, where one point represents a completely transformed natural ecosystem without the wildlife species specific to a particular ecosystem. The ecosystem quality is determined for these ecosystems and subsystems: meadow and pasture, grassland, perennial plantations, arable land (organic and integrated), forest land (with restrictions, without restrictions), water bodies (lakes and river), bogs (natural and managed).

In the second step, the elements important for higher habitat quality are evaluated in the hexagon: the presence of the EU protected habitats in the hexagon and the relative length of the ecotone in the hexagon. Habitat quality assessment is calculated as the sum of the average weighted values of habitat quality of a specific area and the values of elements important for higher habitat quality. This approach allows for a conceptual assessment of habitat quality potential at the ecosystem level in the country and in different regions.

*Landscape regions*

Landscape region is the highest division of landscapes in Latvia. The formation of these landscape complexes is based on the differences in the forms of the land surface and its constituent sediments [16]. In Latvia, 16 landscape regions have been distinguished, and the main criteria in their classification are relief forms and large river basins (Figure 2). Landscape regions are grouped in four groups: upland, which represents the most elevated watershed areas; uplift and downslope, which is transition between highlands and lowlands; coastal plain, the characteristics of which determine the final stages of the transfer processes caused by runoff with an accumulation of sediments; riverscape territories have been formed by various historical valley development processes and economic activities, for instance, land cultivation, construction of infrastructure, urban development.

Within the framework of the project of Latvian State Research Programme "Sustainable Land Resource and Landscape Management: Challenges, Development Scenarios and Proposals" (LandLat4Pol), the boundaries of landscape regions have been reviewed and digitized [17]. The characteristics on landscape regions are described in Table 1.

Cluster analysis. K-Means cluster analysis was used to identify relatively homogeneous groups with four land functions using IBM SPSS Statistics Version 22. Characteristics used for clustering are profit (EUR per ha), employment (EUR per ha), net GHG emissions (CO2 price per ha), habitat quality (points per ha). The values of land functions were standardised before cluster analysis to create equal weights to all indicators. The overview map with cluster`s groups and average indicators of land functions for each cluster was created in ArcGIS Pro 3.1.2.

## Results

***Land functions in landscape regions.*** The highest profit is concentrated in the Rietumzemgale and the Austumkursa, where the most fertile soils are located, as well as in some areas of the Ziemelvidzeme and Aiviekstes zeme (Figure 3). In Vidzemes augstiene, Latgales augstiene and Augszeme are also territories without profit from agriculture which means that agricultural activities are subsidized with lower wage. Profits are most often made on market-oriented farms and losses on smaller farms, which means that labour on smaller farms receives less or no pay and invests additional funds and work. Profit in forestry is not obtained every year, but on average two to three times during one stand rotation cycle (30 to 100 year cycle on average, depending on the dominant species and quality of stand). In the forestry sector, both accumulated profits and, in some cases, small losses are formed - in places where forest restoration is more active – Aiviekstes zeme, Austrumzemgale, Augszeme.

Differences in employment between landscape regions are relatively small. The lowest number of people employed in agriculture and forestry is in Piejura, Austrumzemgale and Austrumvidzeme (Figure 4).

GHG emissions are emitted in the regions with the largest proportion of agricultural land, but in the large forested areas carbon stocks are formed (Figure 5). The areas with the higher emissions are located in the landscape regions Rietumkursa, Austrumvidzeme, un Rietumzemgale where intensive crop production occurs. Another source of emissions is located in the Latgales augstiene, where small and medium livestock farms are concentrated. The lowest GHG emissions are observed in the territories with the lowest agricultural intensity – in Piejura, Aiviekstes zeme and Austrumzemgale.

Territories with high habitat quality are concentrated in the coastal area, nature protected areas, on the banks of rivers and lakes, and the forests around the capital (Figure 6). While the lowest habitat quality is located in areas where agricultural production is concentrated: the landscape regions of Rietumzemgale, Austrumkursa, and Rietumkursa. Also in the landscape region of Vidzemes augstiene the habitat quality is low, which could be explained by the unfavourable terrain for crop production.

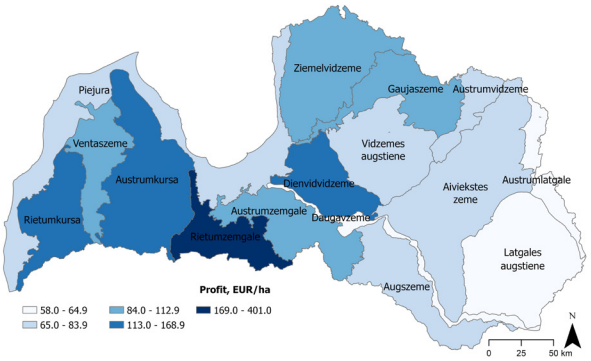


Fig. 3. Profit from agriculture and forestry per 100 ha of total land area in Latvia in 2021. Black lines indicate the boarders of landscape regions [created by authors]

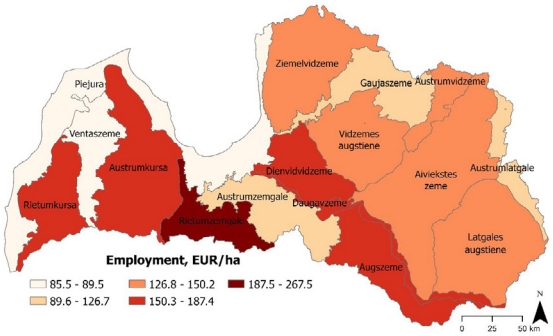


Fig. 4. Geographical distribution of people employed in agriculture and forestry per 100 ha of total land area in Latvia in 2021. Black lines indicate the boarders of landscape regions [created by authors]

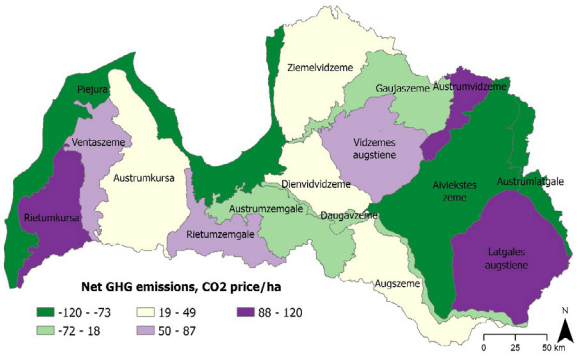


Fig. 5. GHG emissions and carbon stocks in agriculture and forestry per 100 ha of total land area in Latvia in 2021. Black lines indicate the boarders of landscape regionsboarders of landscape regions [created by authors]

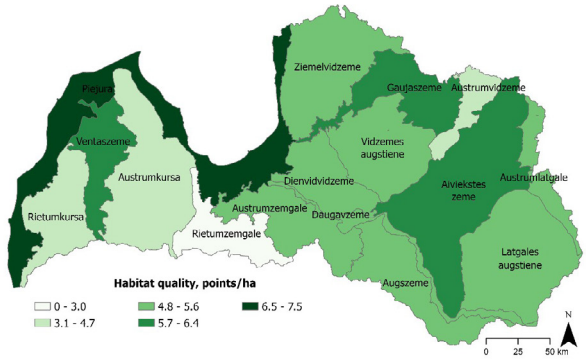


Fig. 6. Habitat quality points per 100 ha of total land area in Latvia in 2021. Black lines indicate the boarders of landscape regions [created by authors]

Table 2. Overview of the clusters

| Cluster | Profit, EUR/ha | Employment, EUR/ha | Net GHG emissions, CO2 price/ha | Habitat quality, points/ha |
|---|---|---|---|---|
| 1 | 401.0 | 304.9 | 77.1 | 61.7 |
| 2 | 130.8 | 181.5 | 43.0 | 100.5 |
| 3 | 80.2 | 161.1 | 62.2 | 110.8 |
| 4 | 72.9 | 137.3 | -93.1 | 126.0 |

### *Cluster analysis of landscape regions*

Cluster analysis shows that landscape specialization has already occurred due to differences in topography and historical anthropogenic impacts (Table 2).

The cluster 1 represents landscape region with high socioeconomic return, high emissions and low habitat quality, and can be considered to be specialized in bioeconomy production. The cluster 2 combines landscape regions with average indicators of land functions, compared to the other clusters, so it can be considered that this cluster represents the average

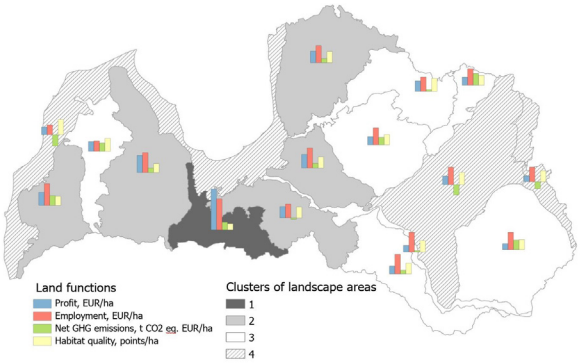


Fig. 7. Suite of land function for clusters of landscape regions [ created by authors]

situation in Latvia and has no pronounced specialization. The cluster 3 shows both high emissions and high potential of habitat quality, but low profit, so this cluster is important from a habitat quality potential perspective. The cluster 4 represents landscape regions with the lowest profit and employment indicators comparing to other clusters, but these landscape regions are specialized in carbon sequestration, and also show the highest average indicator for habitat quality.

## Discussion

Already decades ago, a debate was started in forestry, that land use specialization is needed to concentrate timber production in the most relevant areas, and ensure recreational and biodiversity functions of [19]. Simulations of different scenarios representing the demands for carbon storage and biodiversity protection show greater intensification and less expansion of agricultural land [20] which in turn raises concerns about ecological state of agricultural land. This study shows that intensification of agricultural land is occurred in cluster 1, and further consideration is needed to limit the extra intensification and protect the typical landscape of rural areas (Figure 8). To deliver higher local ecosystem services to society, [21] recommends a holistic approach to landscape planning, where the landscape consists of some protected areas, a mosaic of optimised smallholder agricultural systems, and a bufferzone in between.

Significant changes in land management due to the political decisions may significantly change the typical landscape in rural areas, but these changes do not mean that it is the most efficient way to reach socio-economic and environmental objectives at national level. Most often the changes in typical landscape is related to economic and social considerations. For instance, family decides to move to the city because of the lack of necessary infrastructure in rural areas and as a result the land abandonment may occur [3].

Clusters with the highest socio-economic return are located closest to the capital city, which on the one hand is explained by the fact that it is easier to reach the market, as 30% of the population in Latvia lives in the Riga region, but on the other hand it has also been affected by natural processes, because the large part of the fertile agricultural land is located close to the Riga region. Which means that we may concentrate carbon sequestration measures more in the landscapes that are geographically farthest from the capital city, but then we would further encourage the abandonment of rural areas and the disappearance of typical landscapes. Therefore, the political decisions related to land use change should be adapted to the specific landscape, so that not only socio-economic and environmental objectives are achieved together with the fulfilment of international obligations, but also the typical landscape of the specific landscape region is preserved. Table 1 already shows that the land use changes and land abandonment are found in several landscape re-

gions, as a result of which biologically valuable grasslands have overgrown. Typical landscapes are not only an aesthetic pleasure for local residents and tourists, but these landscapes have also created specific conditions for the development of biodiversity and economic activities for decades.

## Conclusions

Due to ambitious land use related political objectives, many policy makers are primarily focused on achieving objectives such as financially sustainable and profitable production of bioresources (agricultural and forest products), increasing job opportunities in rural areas, reducing net GHG emissions, and giving more attention to biodiversity. However, given the ambitious nature of these objectives and the lack of the solutions on how to simultaneously address these conflicting objectives, there is limited discussion on how these efforts might reshape the typical landscape.

The importance of the typical landscape is not only from aesthetical point of view, but understanding of typical landscapes may help to reach the political objectives. The reason why the landscapes are as they are today are based not only in geography, but also economics behind the current land use. In this research we concluded, that there are differences in the societal benefits what different landscapes provide and this should be used in policy making process developing smart specialization. National and regional goals are directly related to the ability of the given landscape to achieve these targets, so they should be linked to the specifics of the given landscape. Nevertheless considering the differences of landscape regions, it may be reasonable to establish differentiation of ambitious targets to the clusters of landscape regions which are best suited for particular objective.

*Acknowledgements*

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## Kopsavilkums

Ainavām ir nozīmīga loma reģionālajā attīstībā, nodrošinot ekosistēmu pakalpojumus vietējām kopienām, tāpēc šī pētījuma mērķis ir izpētīt, kā izmantot ainavu atšķirības, lai veicinātu valsts sociālekonomisko un vides mērķu sasniegšanu, vienlaikus būtiski neizmainot tipisko ainavu. Pētījumā ir izmantota klāsteru analīze, lai identificētu ainavzemju grupas ar līdzīgu sociālekonomisko ietekmi un vides rādītājiem, piemēram, peļņu, nodarbinātību, neto SEG emisijas un biotopu kvalitāti. Rezultāti parāda, ka, pielāgojot politiskos lēmumus, kas saistīti ar zemes lietojuma veidu maiņu, konkrētajai ainavai, ne tikai palīdzēs sasniegt sociālekonomiskos un vides mērķus, bet arī saglabāt konkrētajam reģionam raksturīgo ainavu.

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# METHODOLOGICAL FRAMEWORK OF CULTURAL ECOSYSTEM SERVICE ASSESSMENT

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**Abstract. In recent decades, cultural ecosystem services have been increasingly studied in the field of ecosystem services. Even more diverse studies have been conducted since the Covid-19 pandemic and today's political situation brings cultural ecosystem services, more specifically identity, symbolic, religious and cultural-historical values even more to the fore. Although the services of cultural ecosystems in general are more and more extensively researched, mostly focusing on tourism issues, the cultural-historical, symbolic, religious and entertainment value as base not only for tourism, but also for strengthening local communities, is still rarely studied in research in the world and in Latvia due to the lack of data and the intangible nature of research. Therefore, a methodological framework for conducting such a research, selecting data from publicly available sources, as well as obtaining missing data in field studies. Also, tools for integrating results from assessment of cultural ecosystem services related to identity, religious and symbolic values into political and decision-making documents are missing.**
**Thus, as a continuation of the study on the assessment of cultural ecosystem services and integration into political and decision-making documents, the aim of the particular article is presentation of a methodological framework developed for the assessment of cultural-historical, symbolic, religious and entertainment values in the landscape. The methodological framework includes seven steps, which are described in this article.**
**The methodological framework created will be tested and validated in future studies, where improvements may be made depending on the situation during the process.**

**Keywords: cultural ecosystem services, methodological framework, assessment**

## Introduction

Nowadays when the sense of place, identity and historic, cultural values for many countries in the world has been threatened, these values are becoming increasingly important and more often studied to increase belonging to a particular place or landscape, thereby providing a range of cultural ecosystem services (CES). In the Millennium Ecosystem Assessment CES has been explained as nonmaterial benefits that people obtain from ecosystems through recreation, aesthetics of surroundings or spiritual or religious enrichment [31]. The number of studies on CES has increased in recent years, but there is still a lack of comprehensive studies due to various reasons, such as difficulties in measuring individual indicators, evaluations tend to be subjective, lack of extensive data, etc. [4; 37; 47; 49]. CES are used and directly experienced in society, but due to the complexity of assessment CES is difficult to integrate into decision-making and management [16; 50]. In the research process it is necessary to know for which landscape management level specific data can be useful, for this reason the methodology framework is needed where several scenarios are incorporated, for which specific CES assessment can be useful.

This research is a continuation of two previous research articles developed by authors [45; 46] where literature review of methods for landscape quality assessment using ecosystem services approach was researched. During previous research [45;46], the knowledge gap for CES assessment methods and specifically research gaps related to symbolic, religious, entertainment and cultural-historical values of CES were determined and thereby is the main research objects (see figure 1). In the studies conducted in Latvia [27; 28; 29; 30; 43], the lack of assessment of the aforementioned ecosystem services stands out even more, the assessment is based only on expert assessments and data availability is not sufficient for detailed assessment. Previous studies of ecosystem services in Latvia focused more on services related to local ecology [27;28;29;30] and tourism [29;30,43]. Cultural services as a basis for strengthening local identity and creating a sense of place have so far been little studied. In Latvia, cultural services in the context of recreation, aesthetics of landscape, cultural heritage and education have been examined in the studies of Grassland Ecosystem Services [28;29], MAREA Project [30], LIFE Ecosystem Service Project [27] and Zemgale region landscape and green infrastructure plan [43], but lack of connection with the strengthening of local identity and the creation of a sense of place evaluation is still missing. To reduce this gap in research on cultural-historical, symbolic, religious and entertainment ecosystem services in the landscape, a methodology framework is developed and described in this article. The aim of this research is to develop a methodology for CES assessment, specifically for cultural-historical, symbolic, religious and entertainment values of ecosystems and describe tools for integrating the results of this study into political, spatial planning and decision - making documents. The developed methodological framework was viewed in the context of Latvia, analyzing the available data accordingly. Methodology described in this paper consists of seven stag-

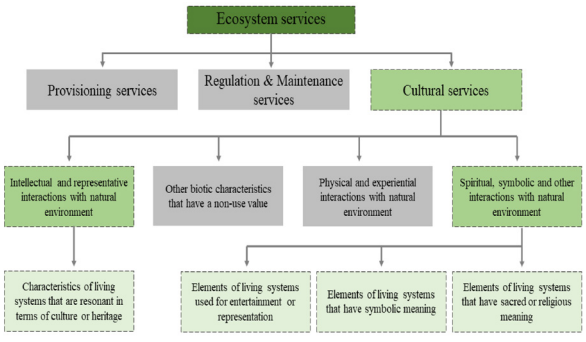


Fig. 1. Scheme with the researched cultural ecosystem services in the overall context of ecosystem services, where at the bottom of the scheme are the ecosystem services assessed by this methodology [created by authors]

es, which has been described step by step in the next section. This paper reflects the methodology which will be applied and tested during the continuous research.

## Methodological framework and Discussion

Methodological framework for CES assessment has been created and will be tested and carried out in ongoing research. This section introduces every stage, the theory and describes the steps more detailed. In order to navigate the structure of the research, a scheme was created (figure 2), where all stages of the research are represented.

### *Research of the study field, experience, knowledge gap*

As mentioned before two previous research articles were made in order to research the ecosystem service assessment methods, study field and discover knowledge gaps. Additionally, research was done in Latvia's previous projects and researches of ecosystem service assessment and methods used in these studies. Several researches have been done in Latvia to evaluate CES [27; 28; 29; 30; 43], only a few of these researches have been assessing the symbolic, religious, entertainment or cultural-historical value. The expert evaluation method is the most popular among these studies, but pointing to the lack of accurate and complete data and possible shortcomings of the method due to data limitations [27]. Cultural-historical value in Latvia has been associated mainly with cultural-historical heritage data, which has specific state protection status. The National Cultural Heritage Administration has been pointing out that the heritage database and data collection needs to be more comprehensive and involve a broad part of society [8], but until now such methodology is not widely used and the database is not extensively updated. Several researches point out that in cultural-historical evaluation relying only on heritage data or element protection status can lead to biases in the research [13; 43]. Due to changes in the political situation in the territory of Latvia in the 20th century, inaccuracies and gaps are possible in the process of creating the heritage list [9]. In order to obtain a comprehensive list of cultural-historical objects, it is necessary to supplement the list of cultural heritage used so far with symbolic elements of the landscape, as perceived by local residents, cultural workers, etc. the cognitive aspect of landscape [13]. Several authors point out that a combination of methods can give comprehensive research with more precise data, while with one method assessment can be biased [4; 19; 51].

### *Definition of CES supply objects*

To define the objects, territories, symbolic features, events and other elements of cultural significance it is necessary to use multiple methodologies. One of the stages of the research is the identification of the necessary data and evaluation criteria for the research and assessment of the proposed CES. In general, when analyzing the research of other authors, it can be seen that the most frequently used criteria in landscape studies, which would be related to landscape CES, are the history of the place, architectural heritage, visual aesthetic factors, sense of place and identity (see figure 3).

Several elements can be defined and mapped using publicly available databases but some must be obtained through field research and interviews with local residents and experts. Publicly available data can be used for initial research without surveying the territories in nature. The analysis of the available data in the context of Latvian landscape research was carried out within the framework of the State Research Program project "Sustainable management of land resources and landscapes: assessment of challenges, methodological solutions and proposals" (hereinafter referred to as LandLat-4Pol) [39]. In the LandLat4Pol project, landscape characterization took place on the scale of landscape areas in Latvia. Considering the availability of public data analyzed in the LandLat4Pol project, it is possible to determine data related to cultural services - historically significant and symbolic effects of landscape elements and structures on society, which can be used in this study according to the set goals. In order to ensure effective data processing, it is recommended to use the geographic information systems (GIS) approach, which provides both spatial transparency of all available data, simultaneously viewing and analyzing the overlap of information from different spatial layers, and ensuring data processing offered by various GIS software. In some cases, data can be obtained from old photographs and maps. The determined, publicly available data for the assessment of CES are included in the table 1.

Considering that all the necessary data cannot be obtained only from available databases, field research and interviews are also necessary, within the framework of which it is possible to obtain data by surveying specific territories and interviewing local residents. It is also important to make sure that the previously collected data correspond to the situation in nature.

The symbolic meaning and cognitive dimension of the landscape or landscape elements is an essential aspect in the landscape evaluation process when the understanding of the values and meaning of the landscape is needed, respecting intangible values as well. The cognitive study of the landscape is related to the physical state of the landscape to the socio-cognitive one - here a close connection is formed between the spatial structure of the environment and the cogni-

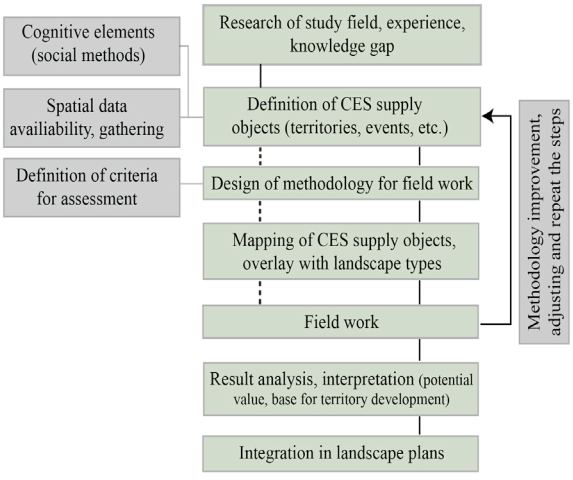


Fig. 2. Schematic representation of the methodological framework [created by authors]

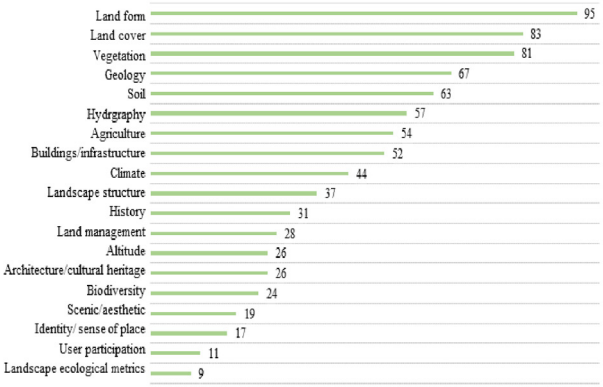


Fig. 3 Simensen et al. [44] analysis of the most frequently used criteria in landscape assessment (a total of 54 studies) [created by authors]

Table 1. Publicly available data for the characterization and evaluation of proposed CES

| # | Place identtity, symbolic value | Religious value | Cultural-historical value | Entertainment value | Data |
|---|---|---|---|---|---|
| Natural values (natural elements – relief, rock outcrops, dunes, individual trees, etc.; structures – forest massifs, water bodies and streams, etc., landscapes) | x | x | | x | Natural data management system Ozols [34] |
| Land use types and land cover | x | | x | | Rural support service database [42]; Corine Land Cover Database |
| Toponyms | x | | | | Latvian Geospatial Information Agency [21] |
| Cultural and historical heritage | x | x | x | | Cultural Heritage Database [8]; Project of the National Library of Latvia Zudusī Latvija [40] |
| Historical roads | x | | x | | Cultural Heritage Database |
| Tourism objects | | | | x | Latvian State Forest Database [14] |
| Objects and territories important to society | x | x | x | x | The most significant landscapes in the Landscape Treasures project were selected by public vote [38] |
| Areas of scenic value important to the municipality | x | x | x | | Municipal databases |
| Landscape values determined within the landscape surveys of the LandLat4Pol project | x | x | x | x | Digital atlas of landscapes [39] |

tive content of the place. Researchers Jurģis Šķilters and Ģirts Burgmanis [33] distinguish several groups of environmental perception factors in this interaction. The first group describes the fact that we remember places through roads (how we get to the landscape) and places (through names, size, spatiality, characteristic features) - all together a cognitive spatial structure. There are also perception approaches, or analysis, which divides all landscape objects into two groups - the object/ objects we are looking for, or the objects that help us search for a goal, or remember/orientate in landscape. On the other hand, the second group of environmental perception factors is related to the individual's personal experience and knowledge – here, cognitively simulated situations that form non-existent mental connections and automatically assigned roles, meanings or symbols to landscape objects. Such a process of cognitive perception is completely based on our ability to abstractly perceive a place and give it an emotional-psychological character (6; 11; 15; 20; 25; 26]. Human perception is subjective and landscape characterization based only on these results is easily interpreted in different forms and has questionable reliability in scientific terms. Therefore, it is essential to combine the studies of the cognitive perception of the landscape with other methods, creating a comprehensive image, where the cognitive meaning of the landscape has its own role, because the landscape is able to accumulate in itself the knowledge, experience, traditions and peculiarities of perception - seeing and feeling more than in the physical manifestation of the landscape - in the most literal sense of the word - 'invisible landscape'.

The importance of community surveys is appreciated by many landscape researchers who incorporate landscape associative perception into their research. Here, a concept as Psychology of Place appears, which in Canter's theory [5] is characterized by physical elements, people's understanding and perception, and people's activities [2].

Recognition of cognitive, symbolic and emotional characteristics, values and aspects of landscape perception is possible with the help of surveys of residents and experts. Citizens' and experts' involvement take place in different ways:

- Remote surveys - it is positive that data can be obtained quickly and widely, but not all groups of respondents can be reached - it is the senior citizens who have accumulated the most experience about the landscape that remain less surveyed. One should be aware that obtaining qualitative data, where the respondents have to express themselves, write or speak, is a more difficult result to achieve [42];
- Interviews - one-on-one - a very effective method for obtaining qualitative data, but time-consuming. Respondents are not always ready to meet with researchers and share their personal experience of the landscape. Here, the best methods are to communicate with respondents through non-governmental organizations, involving them in the research process - it is easier for respondents to trust and share [17];
- Open discussion interviews - discussions where larger groups of respondents are involved at once - they can be organized in parallel with some territorial planning processes, as part of research - involving residents and experts both in discussions and in working groups with a specific task, where one of the goals is also to obtain landscapes symbolic values. This method is effective and can be used in the spatial planning process of the territory;
- Creative tasks - the involvement of young people and children through creative tasks - drawings, models, creative events - where the whole family gets involved through the children, participating in the event - part of the task is highlighting the values of the landscape. This method is valuable with the possibility of involving younger respondents as well, but difficult to interpret, because the creative expressions have a broad focus and it is difficult to maintain a narrow concentration only on the mental values of the landscape;
- Ethnography – immersion of the researcher in the daily environment of the entire social community in order to observe and experience the daily life and culture of a local community, to observe their perception of the landscape and their importance in daily life and also their role in culture. The results of ethnographic research are very reliable, but time-consuming [23; 24; 49].

These methods are the most suitable for determining the cognitive values of the landscape, as they are able to provide data that characterize the 'invisible values' of the local landscape.

*Design of methodology of field work*

The method of this research aims to evaluate landscape potential to supply symbolic, entertainment, religious and cultural-historical values using ecosystem service approach. The size of the data collection cells used in this research is 1x1km, in order to use the collected data and research results for wider data analysis with other researches and Central Statistical Office data.

Table 2. CES assessment indicators and criteria for field evaluation

| Indicator | Criteria | Notes |
|---|---|---|
| Access to object or territory | 0 - no public access<br>1 - the object can only be reached by private transport, there is no possibility of public transport, or it runs very rarely<br>2 - the object can be reached by public and private transport, there is parking infrastructure + a walk of more than 15 minutes<br>3 - the object can be reached in less than 15 minutes from a parking place or a public transport stop | Accessibility of objects is an important criterion for providing a range of CES. For example, if an object is not accessible there is much less visit to a specific object. 15-minute walking distance has been proven to be the maximum distance for object visitation by several researches [32; 52]. Public transportation data needs to be analyzed beforehand |
| Infrastructure | 1 - no special infrastructure or amenities have been created<br>2 - infrastructure or amenities are incomplete or outdated<br>3 - a complete infrastructure has been created, in good condition | Basic infrastructure and amenities are an important criterion for public places, to encourage use of specific objects. |
| Visual accessibility | 0 - the object is not visible in nature and from access points<br>1 - the object is visible only in the immediate vicinity (100 - 500 m)<br>2 - the object is visible from access roads, parking lot<br>3 - the object is dominant from the surrounding areas, adjacent roads | Visual accessibility assessed in the field work, is the object a dominant and creates symbolic scenic landscapes or is it difficult to find specific object even when being directly next to it |
| Accessibility of the environment for people with mobility impairments | 0 - not provided<br>1 - is provided incompletely<br>2 - is fully provided | Object accessibility for everyone, also for people with mobility impairments. Object can be easily accessible without any manmade objects, then rating is the highest |
| Function | 0 - not applicable (ancient graveyards, etc.)<br>1 - does not fulfil either the original or any other function, visually unattractive<br>2 - preserved or restored architecture or original appearance, without additional functions<br>3 - performs several functions, multifunctional | Function assesses the use of a specific object, its multifunctionality or perhaps no use due to neglected state. Some objects, for example, graveyards do not correspond to other functions, for this reason this criterion is not applicable. |

For field research, a questionnaire is drawn up using GIS Survey 123 tool, including the necessary evaluation criteria in the questionnaire. During the field work, the survey is filled out, while marking the location of the elements and adding photos. For the field study, in accordance with the previously analyzed studies on the evaluation of CES, the criteria were put forward (table 2), which is included in the site survey to be filled out when surveying the studied territories. Indicators and criteria in table 2 definition uses term 'object', with meaning that it could be territory, process or any other significant element for local society.

*Mapping of CES supply objects*

Table 1 summarizes the publicly available data sets that overlap with each other using GIS software. After mapping all the cultural-historical, natural and other landscape elements with CES potential, elements that result from social assessment methods need to be mapped in the same matter. Some of the criteria defined for field work can be assessed already in mapping process, for example for accessibility criteria public transportation data needs to be assessed before field work.

*Field work*

In order to collect precise data and verify initial research results from publicly available data, it is necessary to do field work. As several authors emphasize, field research can confirm the initial research results, supplement them, or completely overturn the previously proposed theory due to the inaccuracy or lack of the data [3; 19]. Based on the developed aforementioned criterion and initial assessment with publicly available data field work is done. For data collection ArcGIS tool Survey123 will be used, to systematically collect data and have a geographical location for each surveyed point. After the first field work stage it is possible that adjustments of the methodology will be needed. If necessary, revision and improvement of methodology is done and assessment repeated.

In a field study, it is also important to identify those natural and human-made elements that have not previously been marked as values in publicly available data, but which are visually expressive in the landscape and which can potentially have historical or cognitive significance in the specific place and region [36]. In order to obtain data on the significance of these natural and man-made elements determined in the field research, as well as the landscape values previously identified in public databases, in the local cultural space (municipality, region), surveys of the local community and interviews of experts are an important stage. Thus, it is possible to evaluate which of the landscape values identified in the feasibility study and field study have a symbolic, religious, cultural-historical, informative or entertaining significance from the point of view of the local society. Such assessment is important in the grouping and inclusion of these valuables in the implementation of certain future development scenarios.

*Result analysis, interpretation (potential value, base for territory development)*

In the context of territory development planning and management, it is important to determine the development possibilities and scenarios of territories with identified CES, evaluating the CES provided by the specific territory against possible development scenarios.

The assessment of the CES provided by the landscape is a process in which the individual CES of the landscape are evaluated in the context of a possible development scenario. Such an assessment allows territory planners and decision-makers to determine in which direction it would be desirable to develop the specific territory in order to more effectively use the CES provided by the landscape. The results obtained can help:

- developing territory planning documents;
- preparing thematic plans in spatial planning;
- in landscape management plans;
- for individual proposals.

After all stages of CES assessment, separate stage of the methodological framework is to evaluate the assessed CES in the context of possible development scenarios. Therefore, one of the tasks that was set in the research is the determination of the possible development scenarios of the studied territories in connection with the theme of CES provided by the landscape. Sustainable development strategies of local governments, as well as development planning documents in the international and Latvian context [35], were used to determine development scenarios, which note the importance of the landscape and its elements in creating a cultural space, which is determined by the complex of several CES provided by the landscape. The following documents are the main documents for identifying development scenarios:

- Convention Concerning the Protection of the World Cultural and Natural Heritage [48], which determines the identification, protection, preservation, presentation and

transmission of the existing cultural and natural heritage to future generations. Heritage is a resource to strengthen identity and build a sense of belonging.

- Convention for the Protection of the Architectural Heritage of Europe [7], the main purpose of which is to strengthen and promote the European heritage conservation and development policy. It was emphasized that the architectural heritage is an irreplaceable form of expression of the richness and diversity of the European cultural heritage, it contains invaluable evidence of our past and is the common heritage of all Europeans.
- Framework convention of the council of Europe on the value of cultural heritage for society [12], which emphasizes the characteristics of cultural heritage and the importance of their use also in landscape diversity policy. The Convention emphasizes the importance of linking with other documents, such as the European Cultural Convention (1954), the European Convention for the Protection of the Architectural Heritage (1985), the European Convention for the Protection of the Archaeological Heritage (1992, amended) and the European Landscape Convention (2000).
- The Burra Charter [1] was adopted in Australia in 1979 with the aim of helping to assess the cultural significance of the heritage values found in a place. This concept made it possible to preserve landscapes with cultural significance.
- European Landscape Conventions (2000) [10], the purpose of which is to promote the protection, management and planning of landscapes, as well as to organize cooperation on landscape issues in Europe.
- Lausanne Declaration (2020) [22] aimed at integrating landscapes into national regional and urban planning policies and into cultural, environmental, agricultural, social and economic policies, as well as any other policy with a possible direct or indirect impact on the landscape.
- Consequently, the following possible development scenarios arise, according to which the CES provided by each territory are evaluated, determining which of the scenarios is more appropriate for each of the territories:
- Different scenarios according to a specific theme (e.g., protected landscape area, sacred landscape area, etc.)
- International, national importance/value according to the importance of the provided CES on an international or national scale
- Local municipality importance/value according to the importance of the provided CES on the scale of the local community, municipality
- Tourism development (including thematic tourism – tourism of manors and castles, etc.)
- Local communities' development initiatives – importance for strengthening local community/ society traditions, sense of belonging.

## Conclusion

Such a comprehensive assessment methodology of landscape CES can produce true and accurate assessment results that can be used in landscape development plans and guide the development of specific areas based on various scenarios. Until now, in the studies carried out in Latvia, the CES discussed in this article have not been widely studied, in some cases they have been studied with the expert method and give an insight into the potential of CES. Assessment and knowledge of CES values can lead to specific tools for development of endangered landscape elements or historic processes in the landscape.

Publicly available data, which should be used in the research, occupy an important place in the methodological framework of landscape CES. However, currently in Latvia they are not enough to evaluate CES related to place identity, symbolism, religion and entertainment. Therefore, collecting these missing data in field studies and surveys and individual interviews is an essential step. In the context of CES, it is necessary to collect data both on landscape values that are visible in the landscape, analyzing their meaning in the context of various aspects, as well as on those values that have remained in people's memories.

During the evaluation stage of CES, it is important to identify the possible scenarios for the development of the territory, within the framework of which the lost CES would be used most effectively and sustainably. Both international strategic documents and local sustainable development strategies can be used to identify scenarios, from which the main ideas and needs of the specific municipality can be gathered.

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## Kopsavilkums

Kultūras ekosistēmu pakalpojumu novērtējumi pēdējo gadu laikā ir kļuvuši aizvien populārāki, taču lielākoties tie ir vērsti uz ekoloģisko vai tūrisma virzienu un ainavu simboliskā, kultūrvēsturiskā, izklaidējošā vai reliģiskā vērtība tiek vērtēta reti. Šajā rakstā aprakstīts metodoloģiskais ietvars iepriekšminēto kultūras ekosistēmu pakalpojumu novērtējumam.

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# CONFLICTING PERCEPTIONS OF THE WELL-ORGANISED ENVIRONMENT

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**Abstract. The paper presents a cross-disciplinary investigation into the intricate state of human-environment interaction. Drawing from the field of environmental psychology, it is an inquiry of the attitudes and perceptions of the human's surrounding private and public environment, and presumably conflicting understanding, perception and individual interpretation of what well-organised and orderly environment means. It is very common to see the concept of a well-ordered environment in widespread public discourse. Depending on the context, a term encompasses various factors, such as physical, social, educational, and mental domains and can be applied not only to spatial environments but also to business and entrepreneurial, school and workplace environments, and more. Beyond creating an up-to-date understanding of the concept and understanding of orderly environment in the Latvian context, the paper aims to clarify whether there are limitations posed by conflicting understandings of the notion and set objectives, organisation of the environment, quality of life and personal and community growth. The research approach is based on the investigation through society involvement. The online questionnaire was employed to gather original and qualitative data to analyse the set topic. Additionally, the study of relevant scientific publications, bibliography and visual observations was used.**
**The obtained results shows that conflicting opinions and perceptions exist, and they pose challenges to spatial development and quality of life. The paper contributes to the current understanding of the collectively formed environment among Latvia's population. It can be applied to explain limitations and social colissions in spatial developments, as well as during discussions of environmental maintenance, architecture and urban quality, and overall condition of surroundings among various stakeholders.**

**Keywords: built environment, well-organised, urban design, conflict, environmental psychology**

## Introduction

The 21st century marks the goal and aspiration of a living city, safe, sustainable and healthy city requiring quality urban living [5]. The actuality of the research is related to generally accepted sustainability approaches on the way to making an organised, functional and beautiful surrounding environment promoted through the New European Bauhaus, creative and transdisciplinary European-wide initiative linking the European Green Deal to the living spaces and experiences [9]. Sustainability model as an answer to global challenges related to climate change, demographic, globalisation, resource depletion, urbanisation is also basis of the national strategy [14] highligting spatial development perspective, improved living quality for humans through creating attractive urban enviroment. The Sustainable Development Strategy [12] for capital Riga promotes a comfortable, safe and pleasant urban environment for citizens and Riga Development Programme 2022–2027 [11] accordingly pointing out such priority as an urban environment that promotes quality of life. Apart from strategic visions, well organised enviroment can mitigate social tensions and improve overall atmosphere in the city neighborhoods. For instance, the broken windows theory suggest that signs of untidiness and disorganisation in the neighborhood couses disorder to spread [6] and leaves negative consequences to the community. Moreover, as humans daily meet with numerous environmental stressors [13], an orderly environment as opposed to poor housing and outdoor quality, disorderly surroundings, noise and similar disturbances.

Cooperation and understanding between the different stakeholders and between citizens is an essential component in achieving improvements in the quality of the shared and private environment. It is very common to see the concept of a well-ordered environment in widespread public discourse, media, popular articles and communications materials of governing bodies such as municipalities, agencies, announcements from NGOs, and legal and private entities. This notion finds its manifestation in the government-level strategy documents, the Cabinet of Ministry orders, binding regulations of the county councils, competition briefs, as well as national-level publications. It is also apparent that this term can encompass a multitude of disparate meanings and interpretations which is also discussed in this investigation. Moreover, depending on the context, the term well-organised environment encompasses various factors, such as physical, social, educational, and mental domains and can be applied not only to spatial environments but also to business and entrepreneurial, school and workplace environments, and more. The research draws from the field of environmental psychology as "the discipline that studies the interplay between individuals and the built and natural environment" [13]. The paper is a cross-disciplinary inquiry into the attitudes and perceptions of the human's surrounding public and private environment, and presumably conflicting understanding and individual interpretations on what well-organised and orderly environment means, covering both, private and public domains. The main research relevant the topic comes from the fields of architecture and urban planning, landscape architecture, territorial and spatial planning, physical geography, environmental psychology and other social sciences. The livable and humane city concept and criteria has been very popularly theorised by Danish architect Jan Gehl. Human behavior and environment has been much researched by one of the notable environmental psychology field researchers and writers professor Linda Steg. The visual esthetic quality of the public space in Latvia has been thoroughly analysed by such researchers as Una Īle, Aija Ziemeļniece, Agnese Kusmane, Daiga Zigmunde, Sandra Treija and Uģis Bratuškins. Topic-related surveys have been conducted by the Central Statistics Office in Latvia, such as Quality of life in cities survey 2022

on places with high or low satisfaction with quality of life aspects in national cities other than Riga [1]. Additionally, there are surveys and studies carried out by the municipalities, for instance, Riga City Council Department of Urban Development, e.g. surveys of residents about life in the neighbourhoods, Development of a methodology for identifying degraded sites and areas and Community-led neighbourhood development in Riga [10]. However, the research level in Latvia respective to the exact intended topic is not sufficient, especially if analysing interplay of human-environment actions and development possibilities influenced by social context, relationships and attitudes to surrounding environment.

The environmental psychology "intends to understand and interpret the socio-environmental situation, and from it to generate new forms of action and intervention" [8]. According to Steg, environmental psychology has always worked closely with the discipline of architecture, spatial planning and urbanism to ensure a correct representation of the physical-spatial components of human-environment relationships and studies these interactions at various scales from domestic surroundings, neighbourhoods up until the scale of the planet [13]. The interdisciplinary nature of this paper should be underscored as it encompasses not only the field of environmental psychology but also establishes strong connections with disciplines such as architecture, design, urban studies, spatial planning and social sciences. This holistic approach may embrace diverse perspectives, fostering a comprehensive understanding of the complex interrelationships between the built environment, society and human behaviour, social dynamics embedded within spatial contexts and personal experiences. Besides it allows for further studies within various disciplines exploring other research directions and engaging other experts.

Table 1. The questionnaire "Survey "Study on "well-organised environment" in Latvia", 2023 [developed by the author]

| No. | Question | Type |
|---|---|---|
| 1. | Q1 General information: gender, age, place of living, education level, professional field of occupation, nationality. | Respondents' statistics. |
| 2. | Q2 What is an "orderly environment" for you? How do you understand the term "well-organised environment"? | Open-ended question. |
| 3. | Q3 Where is the "well-organised environment" most important to you? | Open-ended question. |
| 4. | Q4 Have you ever had disagreements about an "orderly environment"? | Open-ended question. |
| 5. | Q5 In public communication, media, etc., when you hear the combination of the words "well-organised environment", do you understand what it is about? | Multiple choice single answer question:<br>1. Yes, I think I understand it,<br>2. Mostly clear,<br>3. Mostly not clear, too vague,<br>4. I don't care, there are more important things to think about,<br>5. Other. |
| 6. | Q6 Do you believe that the individual, collective and society should strive for an "ordered environment"? | Multiple choice single answer question:<br>1. Yes, it is very important to me,<br>2. Yes, it might be important,<br>3. It is not important to me,<br>4. I don't understand what it means,<br>5. Other. |
| 7. | Q7 If you had such an opportunity, what would you like to do in your (private or public) environment? | Open-ended question. |
| 8. | Q8 What are your most important criteria for an "orderly environment"? | Multiple-answer multiple choice question. Respondents were given a list of 30 parameters. |
| 9. | Q9 Who do you think is responsible for creating an "orderly environment"? | Multiple-answer multiple choice question. |
| 10. | Q10 What could you do to organise the surrounding environment? Write down one thing or activity that is most realistic for you. | Open-ended question. |

Following the common interpretations of the term environment, the research paper explores the perception of the environment as firstly "the circumstances, objects, or conditions by which one is surrounded" and secondly as "the aggregate of social and cultural conditions that influence the life of an individual or community" [4]. According to Mirilia Bonnes, Professor of Environmental Psychology and Founder of Centro Interuniversitario di Ricerca in Psicologia Ambientale at the Sapienza University of Rome, "the environment is the physical environment – in spatial (and temporal)/physical terms – of everyday-life individual experience, ranging from the more built-up – in architectural and engineering sense (as setting or place) – to the more 'natural' ones – in a geographical or bio-ecological sense (as place or eco-system) – and differentiated along its spatial scale: small (house or tree), medium (neighborhood or wood) or large-scale (city or park)" [8]. She underlines [8]: "It is often also defined as a social-physical environment, since the daily life physical environment is always also a social environment." Although the term environment can be characterised quite broadly and in the daily discourse it is used in various meanings, the initial purpose of the paper was to focus the attention towards the physical environment. During the investigation and by analysing the results from the survey, it became apparent that other kinds of "environments" (e.g. natural environment, social setting, learning, work, digital and informational environment) must be also considered – as suggested by Bonnes, environment is not just physical, it is social at the same time. The paper is based on the investigation through society involvement – the online questionnaire that gathers original and qualitative data to analyse the set topic. The research aims to inquire on the following:

- explore the concept of a well-organised/ordered environment,
- explore whether people share a common understanding on what a well-organised environment is,
- conclude on what aspects they highlight when referring to it,
- conclude on whether there are differences, conflicting understandings or uniform perceptions on what neatly organised and pleasant surroundings are,
- conclude on the essential changes and improvements that people consider important and moreover, what they would be able to undertake themselves.

Beyond formulating the meaning and creating the understanding of an orderly environment, the paper aims to clarify whether there are limitations posed by conflicting understandings of the notion and set objectives, organisation of the environment, quality of life and personal and community growth. The concerns of the study are factors that determine and influence a person's physical, mental or moral well-being and his/hers capacity to act in society in order to develop, improve and maintain the environment according to generalised norms or individual preconceptions.

The research is based on the qualitative online survey, additionally performing the summary and analysis of relevant scientific publications, bibliography and electronic sources. The survey-questionnaire "Aptauja "Pētījums par "sakārtotu vidi" Latvijā" (Survey "Study on "well-organised environment" in Latvia") consisting of 10 standardised questions (TABLE 1) was designed and executed in Latvian, digitally and remotely in written form using online survey tool visidati.lv.

In the field of environmental psychology, the quality of life, satisfaction with living surroundings and well-being are factors much explored and studied through methodologies of Environmental Quality assessment – often "quality of life is

sought through improved design of residential spaces, housing or urban settings" [8]. Urban environmental quality can be assessed from either an expert or lay-person viewpoint relying on soft psychological responses – perceptions, appraisals, preferences, and evaluations [13]. The development of this paper is based exactly on the non-expert subjective evaluation. Questionnaire studies is one of the main research methods used in environmental psychology. Conducted in the independent settings they have high external validity. They are cost-effective for reaching large populations and give direct insight into describing societies and their practices. In developing the questionnaire, the approaches of different urban environmental quality evaluation methods were examined (e.g. PREQI, Perceived Residential Environmental Quality Indicators; PSCOQ, Public Space Characteristics Observation Questionnaire).

The purpose of the survey was to collect distinctive perspectives and opinions from society members, a group of respondents at a single point in time, that give a cross-sectional description and comparison of their environmental perceptions, and investigate the correlations between their comprehension, opinions, associations, necessary and intended actions related to environment organisation. The individual survey mixed both – open-end and multiple or single answer multiple choice options. The target audience for performing the questionnaire was people living in Latvia. In preparation of the paper/research, a number of 75 persons were surveyed and took part in the questionnaire. The average age of respondents was 42.4 years old with youngest – 23 and oldest – 70 years old. Majority of participants were 80% women, 18.7% – men. 63% of respondents hold Master's level education or Doctoral degree; the rest – Bachelor's level education or lower. Majority of respondents (77%) live in Riga, the rest – Pierīga, other towns in Latvia or the countryside. 74 of 75 respondents were Latvians.

**Perceptions of "well-organised environment"**

The ultimate goal of individuals and society as a whole is development of surroundings, transformation of the society towards sustainable, inclusive and aesthetic environment. In general, it can be assumed that improved design and environment is the basis for satisfaction and well-being, but do we as a society have a common consensus of what a well-organised, pleasant and enjoyable environment is? Contemporary society holds greater expectations and is much more sensitive towards "environmental aspects, such as facilities, urban services, green spaces, atmosphere, neighborhood and home" [8]. The living environment constitutes a residential, urban and architectural reality, experienced subjectively and psychologically [8] and this needs to be considered – we are also subjective and psycho emotionally different and sensitive as far as the living environment and spatial qualities are concerned. The important part of Latvian cultural tradition is people's attachment to their birthplace. As Latvian Latvian literary scholar, linguist and Professor at the Faculty of Humanities, University of Latvia, Janīna Kursīte writes that it was formed on the basis of a sense of local belonging and is often associated with the hard physical labour for maintenance and upkeep [7]. However, the sense of belonging to a place is subjective – one person may perceive the same place as beautiful, another – as ugly and unkempt. Here Kursīte refers to renowned Latvian born geographer Edmunds V. Bunkše's story about visiting Danish colleagues who, when they saw the rickety old wooden barns so dear to Latvians, judged them as primitive and unkempt [7]. In the recent years, the clean-up movement (talkas – in Latvian) has been helping to improve and tidy the environment. It helps to recognise that people's engagement, actions of individuals, businesses and governments affect the spaces we live in. However, for the purpose of this study, well-organised environment must be understood in the wider scope (not limited to litter-free streets) – the study aims to clarify what people understand with notion "well-organised environment" and what is the extent of their interpretation of it.

Urban and non-urban (rural and suburban) conditions are very much an inhomogeneous system – a complex structure consisting of a set of elements. These elements of uneven quality are both – purposefully planned and maintained, but much of it is a coincidence and vernacular randomness, decay, historical consequence and heritage of varying value and significance. Contrary to that, the initial stages of the research and survey attempt to see a "well-organised environment" as an ultimate goal and ideal world order, as if this would ensure quality of life and satisfaction with living conditions. Without any prior clarification or guidance before answering, the survey indicates that 31.3% of participants think they comprehend the concept of a well-organised environment in public communication fully, and 38.8% answer they mostly understand it. On the other hand, 18.8% find it too abstract. Only one respondent did not express any interest in the matter.

Further analysis of the inquiry reveals substantial variations in interpretation and signifying criteria attributed to a well-organised environment by respondents. Additionally, it indicates that the concept can be linked to both tangible and intangible environments, as well as relationships, ambiance, or social context. The responses also suggest that the term is highly contextual, needs further clarification and can be understood differently by different individuals. In general, it is described by respondents as a rather vague and ambiguous term, used in a primitive way. Moreover, when the word environment is not specified, it tends to be associated with urban environments rather than indoor or other environments. The most mentioned factor when asked about what is an orderly environment (Q2, TABLE 1) was cleanliness. Other commonly mentioned criteria can be distinguished between those related to physical space and those – to social domain.

Comparatively to the open-end question, another question (Q8) asked from 30 given criteria to mark a maximum of five resulting in the five most preferable criteria of a well-organised environment (Fig. 1):

1) functional, ergonomic, easy to use and accessible,
2) safe to be in and to move around,
3) comprehensible, intuitive and clearly organised, easy to navigate,
4) green and well-maintained,
5) natural, ecological and energy efficient.

Other parameters also had a high prevalence of responses (more than 20 markings), such as:

- organised waste sorting, bins available, no littering,
- a clutter-free living environment, housing and utility rooms,
- fresh air, free from odours, dust, air pollution,
- a pleasant and friendly atmosphere.

While many responses confirm that a tidy environment is important everywhere, half of the respondents say that a tidy environment is most important at home, as it is the area most immediate to each individual. It was also emphasised that the home is a potentially manageable place for each individual – it is a personal place that can be maintained. Notably, criteria of ordered public spaces and road infrastructure were pointed out, and at least a third of respondents stressed the importance of an ordered workplace and environment in the office or educational institution. It can be also concluded that

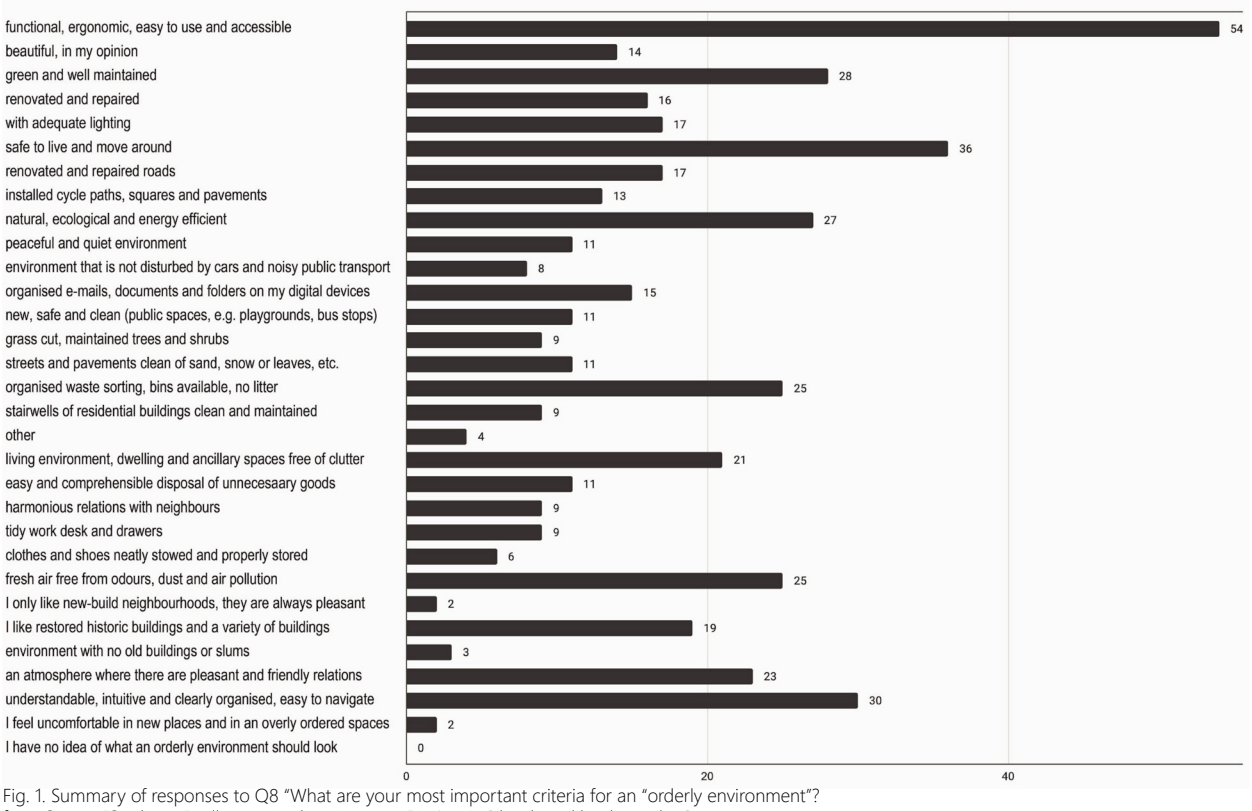


Fig. 1. Summary of responses to Q8 "What are your most important criteria for an "orderly environment"? from Survey "Study on "well-organised environment" in Latvia [developed by the author]

people connect well-organised environments with orderly processes and clear responsibilities in the workplace, clear and organised, transparent processes in public and governing institutions, banks, doctors, services, organised computer systems, software and paperwork. Additionally, it was observed that a well-ordered environment is important in the environments where people spend most time – at home, at work, and on the way to the workplace.

## Conflicting situations over a "well-organised environment"

The majority of respondents, nearly 70% (52 out of 75), agree that the individual, the collective, and society as a whole should endeavour towards an orderly environment (Q6); 21% view it as likely important. However, in the absence of a shared comprehension of the ultimate aim due to a state or condition characterised by a lack of agreement or harmony [3], challenges may arise. Usually, conflict denotes the action of opposing forces, but in static applications, it suggests an irreconcilability between duties or desires [3]. Thus referring back to the main hypothesis of the paper, respondents were asked (Q4) to indicate whether they had ever disagreed about the orderly environment and whether they felt that their views about it did not coincide with those of other people (e.g. family members, neighbours, colleagues or acquaintances, random encounters).

Minor part, 15% of respondents answered that they have not had any conflicting situations or differences in opinions about ordered and maintained environment and surroundings. The rest, 85% of respondents confirm they have had conflicting situations and inconsistencies in perceptions of what a well-organised environment is and briefly described the situations (Fig. 2). Such situations are typical at home among family members, with neighbours you have shared ownership of an estate, jointly manage the house and common facilities, at work about chaotic workplace or job-related processes and decisions, on a level of urban development – survey shows that citizens and users often disagree on how processes in the city are held. Disagreements also happen in the professional setting when discussing issues related to urban environment and development among officials or within workgroups.

Answers indicate that the conflicting opinions arise from different backgrounds, education and previous sociocultural experiences – such differences create the gap in evaluating surroundings and their orderly or disorderly appearance. Summarising results from the question, five social/physical contexts can be identified to describe the discrepancies and conflicting views: 1) home and family, 2) neighbours at the residence place, 3) workplace and work colleagues, 4) urban environment, public space and surroundings, 5) general answers without specifying the social and environmental context. From those confirming the conflicting situations, a third (31%) of respondents confirmed that there are conflicting situations typical with family members, parents or children – there are disagreements over standards of cleanliness, storage and storage of belongings, differences in taste or different perceptions of the proper care of the natural environment, garden, lawn. Generally, the answers highlight that people may have different perspectives on cleanliness, tidiness and atmospheric factors that influence their views on what constitutes an orderly and aesthetically pleasing environment. Different tastes and values contribute to different perceptions.

The second largest group mentioned in 23% of answers is about conflicting ordering and design intentions in the urban environment and public space. For those living in the urban centres, there are disagreements about the orderliness of the public environment and one of the factors can be noise from local cafes/bars/restaurants that is disturbing through the night. People also have the opinion that some places and sites do not need an orderly environment and on the other hand, there are situations in the city where next to a well organised site maintained by the municipality there is

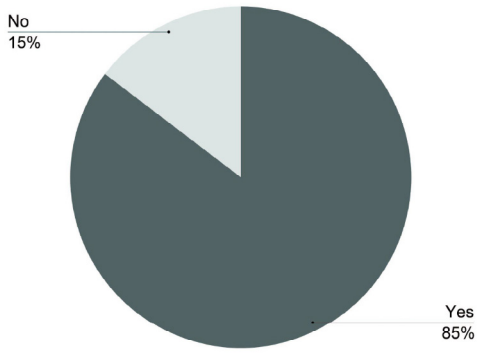


Fig. 2. Responses to question (Q4) "Have you ever had disagreements on the orderly environment"? Data from the survey "Study on "well-organised environment" in Latvia", 2023 [conducted by author]

a private, negligent territory and there can not be anything done about it. Certain criticism is directed at new buildings and development projects that prioritise cleanliness but lack aesthetic appeal, particularly in public spaces such as schools, clinics and hospitals. In addition, people identify challenges in improving environments, citing constraints in funding and human resources. There may be a lack of awareness at the management level, as they don't experience the day-to-day problems and may not prioritise the necessary improvements.

Several respondents pointed out exaggerated and useless space organisation and overly magnified maintenance that is not sustainable and even not aesthetically pleasant, for instance "(..) I often disagree with aesthetic decisions about landscaping and environmental facilities. I also try to pay attention not to what is tidy/not tidy, but to how long what is tidy stays tidy. I am interested in sustainability, in universal timeless solutions in design and materials. Cheap, last, new, cheap, last, new doesn't really appeal to me. There also seems to be a lot of pointless tidying up." The answers also suggest that excessive efforts to tidy up can lead to a loss of naturalness, for instance, natural meadows, lawns, thus indicating that the urge for maintenance of an order is exaggerated. Contrary to that, there are people to whom the absence of proper arrangements can create a sense of stress and disorder.

## Maintenance of the environment and the contributions from individuals

People's lives, with their multiple activities (school, work, play, shopping, leisure and travel), take place in a particular environment and particular set of circumstances. How the environment is planned, designed and maintained affects every member of society, every individual and society as whole. One of the aims of the survey was to find out people's views on who should be in charge of creating a well-organised environment. Three main answers were highlighted in the responses (Fig. 3); firstly, the households and people themselves as the users of the environment, secondly, it is state or local government administration, thirdly, real estate owners and managers. Besides choosing from given answers, respondents highlighted that all the mentioned parties are responsible – society as a whole is responsible.

Following these results, it can be concluded that the citizens themselves are responsible for cleaning up the environment, accordingly, it is relevant to find out what it is that they consider necessary and what they would like to do to clean up the environment (Q10). It is noteworthy that the majority of respondents indicate a preference for being more socially active when asked about realistic actions or initiatives to improve and preserve the environment. The survey participants stated their desire to engage in more public activities related to environmental improvement, including participating in clean-up events and taking part in municipal competitions and public debates. They expressed a need to be more active and involved. Clearly, the survey demonstrated that individuals in society take responsibility and actively participate in communal discussions. They comprehend the correlation between taxation and infrastructure improvements, and express interest in setting positive examples by participating in education efforts. Conversely, they also assert that their personal residence, or shared living areas nearby, are the most realistic locations to maintain and upkeep. In addition, many of the answers emphasise the desire to take care of waste management, sorting, and responsible disposal of waste. The lack of facilities, and containers is mentioned as an obstacle to realise that.

In the context of this discussion, people were asked for their opinion (Q7) on what should be improved in the surrounding environment. Answering this question, people gave more precise and concrete answers on what needs to be organised, improved and maintained. The answers to questions Q7 and Q10 do not correspond – responses to Q7 exclusively highlight improvements in the public space, especially numerous responses point out the necessity to improve transportation, pedestrian and car road infrastructure, public transport system and infrastructure, quality, security of the roads and convenient transit. Comparing the answers to Q7 and Q10, it can be seen that there is a difference between people's preferences, perceived needs and possibilities when asked about what they themselves could undertake to improve the environment. If the public administration and services could be entrusted with the improvement of the environment, people point to the shortcomings of the public space, with a strong emphasis on the crucial needs of improvement of the road infrastructure. On the other hand, if people think about what they could take on themselves (Q10), they point to jobs and tasks that concern the private space, their house or common property, and the social activism and involvement of themselves as individuals.

## Conclusions

There can be extracted several important discussions, main conclusions of the study and recommendations for further work. The findings from the survey proves that the well-organised environment for people is often evoked as an aspirational ideal for the desired and expected state of surroundings. Although overly organised and neat attitudes are in some cases criticised, individuals and society as a whole should strive for a well-organised environment. Despite the answers from the survey indicating similarities, the existence of a consensus and complete understanding among individuals regarding the domains, specific criteria and defining characteristics that delineate an optimal, orderly, and structured environment remains ambiguous. Investigation shows that the term well-organised environment has rather broad meaning and interpretation from respondents. The survey proves that people MOSTLY understand what a well-organised environment means and their answers prove that this term can refer not only to urban environments but also to other domains.

Speaking about criteria for a well-organised and orderly environment one of the dominating criteria is cleanliness (tīra – in Latvian), allowing to conclude that well-organised environment is associated with surroundings free from litter, garbage

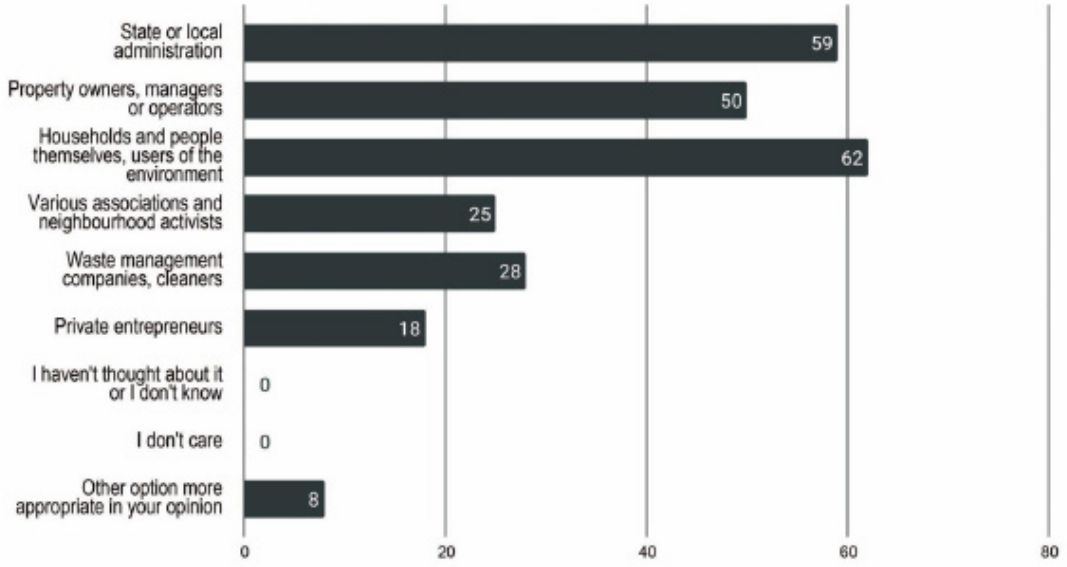


Fig. 3. Chart showing answers to the question "Who do you think is responsible for creating an "orderly environment"?". Data from the survey "Study on "well-organised environment" in Latvia", 2023 [conducted by author]

and similar pollution. However, if looking at the five most preferable criteria of a well-organised environment, they do not indicate any notion to cleanliness and tidiness. The criteria are as follows: 1) functional, ergonomic, easy to use and accessible, 2) safe to be in and to move around, 3) comprehensible, intuitive and clearly organised, easy to navigate, 4) green and well maintained, 5) natural, ecological and energy efficient.

As the study aimed to clarify whether there are limitations and conflicts caused by different understandings of the concept well-organised environment, it is concluded that the majority of respondents clearly express that there are dissenting opinions, situations and inconsistencies in the perception and maintenance of the well-organised environment. Conflicting situations are likely to hinder processes related to spatial development, quality of life, and personal and communal growth, as well as causing communication problems and negativity among stakeholders. Furthermore, variations in people's preferences, perceived needs, and opportunities become evident when they are asked about actions they could take to improve the environment. If the public administration and services were responsible for improving the environment, people would highlight the deficiencies of the public realm, specifically the need for enhanced road infrastructure. Conversely, if individuals considered their own responsibilities, they would focus on domestic or communal tasks pertaining to their private space or shared property. One of the most interesting findings is that individuals express a desire to be more socially engaged and participate in public processes relating to environmental development and upkeep.

Overall, the paper contributes to the current understanding of the collectively formed environment among Latvia's population. The research can have practical applications during discussions of environmental maintenance and spatial developments helping to comprehend differing opinions. The survey needs be continued by widening the diversity of the respondents, different age groups, occupations and living settings (urban centres, towns vs countryside), by adding more targeted questions or using such methods as in-person interviews. The research would benefit from involvement of psychology or other social science expert. Moreover, in the next stages the study can be continued by forming and working with a particular focus group. The current paper represents an initial stage in a broader research trajectory aimed at comprehensively understanding the dynamics and complexities of well-organised environments. The findings presented herein provide a foundations upon which subsequent studies can build, refine, and expand.

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## Kopsavilkums

Starpdisciplinārs pētījums par cilvēka un vides mijiedarbību, kas balstoties uz vides psiholoģijas jomu, pēta cilvēka attieksmi un apkārtējās vides uztveri, kā arī, iespējams, pretrunīgo izpratni un atšķirīgo individuālo interpretāciju par to, ko nozīmē labi organizēta un sakārtota vide. Sakārtotas vides jēdziens ir plaši sastopams publiskajā diskursā, taču atkarībā no konteksta jēdziens ietver dažādus faktorus, piemēram, fizisko, sociālo, izglītības un garīgo jomu, un to var attiecināt ne tikai uz telpisko un būvēto vidi, bet arī uz uzņēmējdarbības, skolas un darba vidi. Pētījuma mērķis ir noskaidrot Latvijā dzīvojošo izpratni par sakārtotu vidi, kā arī izpētīt, vai pastāv ierobežojumi, ko rada pretrunīga izpratne par jēdzienu un vai konfliktējoši ir šķērslis izvirzītajiem mērķiem saistībā ar vides organizāciju, dzīves kvalitāti, personīgo un sabiedrības kopumā izaugsmi. Darbā izmantota sabiedrības viedokļa noskaidrošana caur tiešsaistes aptauju, kurā apkopoti oriģināli un kvalitatīvi dati, lai analizētu izvirzīto tēmu.

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# AN INCLUSIVE APPROACH OF URBAN OPEN SPACE ANALYSIS VIA FIELD SKETCHING

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**Abstract. This research explores how field sketch drawing can help in understanding, and analysing urban open spaces, and their potential roles for their experiential dimension.**
**The research begins with a theoretical interpretation of the term "Place" and an examination of the components that make up an urban open space. This is followed by an analytical study of field sketch drawing techniques, which are selected and applied to develop an inclusive approach for analysing urban open spaces via field sketching.**
**The final product of this research includes a theoretical study of urban space components and field sketching, serving as a comprehensive guide for analysing urban spaces through field sketching.**
**The research findings highlight the potential of field sketch drawing as a valuable method for understanding and analysing urban open spaces, and its ability to enhance the experiential dimension of these spaces. The proposed inclusive field sketching approach provides a practical tool for designers and planners to conduct on-site analysis and generate preliminary design proposals for urban open spaces. The results of this research contribute to the field landscape architecture and design by providing insights and recommendations for incorporating field sketching as a valuable approach in the analysis and design of urban open spaces.**

**Keywords: Field sketch drawing, landscape architecture, place theory, experiential dimension, on-site analysis**

## Introduction

Landscape architects and designers could modify and change our environment. They create gathering places, buildings, landscapes, and roads... The designs that they create are the elements that make up a place [1]. However, in making a new design, the old one is modified. Usually, landscape architects will undertake a paradigm process at the initial steps of design. The evaluation of a site in most cases involves cataloguing the ecological and anthropogenic uses into inventory maps. The landscape architect can use these studies to create a suitability map, which indicates the appropriate solutions and areas to modify.

This overlay process is essential in listing the quantifiable issues of a site. Unfortunately, it cannot give information about other aspects of a place such as character, feeling, or about its identity. Overlooking these elements in the design may result in the deterioration of the place after the modifications. Knowing and identifying all the components that contribute to the place is vital in the first design stages. Understanding the essence of a place can be made through experiencing the place [16]. That raises the problem of how a designer can experience a place to identify its qualities.

Usually, in design practice field sketch drawing is used as a tool of communication and an excellent way for rapid concept development, elemental compositions, and visual exploration. This takes form in plans, sections, and renderings. In most cases, field sketch drawing activity is ignored to gather information and is not considered a standard tool for site investigation [15]

Three successively progressive research questions (RQ) are guiding the work to achieve the aims, targeting a specific set of objectives for their attainment:

RQ.1 Which components and elements of place should be analysed to gain an understanding of its character?

RQ.2 What is field sketch drawing and how it can inform a designer about the place?

RQ.3 Which different sketch drawing techniques can most effectively be used during the analysis of urban open spaces?

Seeking to respond to the problems identified, this article is driven by four aims:

- Identify all the constituent elements of urban open space.
- Investigate the role that field sketch drawings can play in understanding the character of urban open spaces.
- To introduce 16 sketch drawings techniques that landscape architects can use during the site exploration phase and at the beginning of the design process.
- Propose an inclusive series of field sketching steps that landscape architects can follow systematically in order to discover the site and its characteristics, and also to allow the possibility of creating preliminary design proposals onsite.

## Materials and Methods

The research at hand encompasses two distinct topics, namely place theory and field sketch drawing. To address the first research question, the author will conduct a literature review that delves into three prominent theories of place: Edward Relph's Place theory, Christian Norberg-Schulz's place theory, and Yi-Fu Tuan's place theory. This literature review will continue to serve as a theoretical foundation for the subsequent analysis of field sketch drawing, which is aimed at answering the second research question. To answer the third research, question the authors used Drawings inspiration by Janet Swails' "Field Sketching and the Experience of Landscape Architecture," Crowe's "Visual Notes," and Elpényi Anna-Christian and Oláh Brigitta's "The Language of Landscape Sketching" books, to select a curated collection of 16 techniques that will be employed to explore urban open space as part of the developed field sketching approach. Subsequently, the research will proceed with the conceptualization of an inclusive guide for urban open space analysis through field sketch drawing, which constitutes the primary objective of this research. The developed guide will be presented in detail, outlining its key components and the proper sketch drawing techniques for each of them.

### Synthesizing place components from a comprehensive literature review

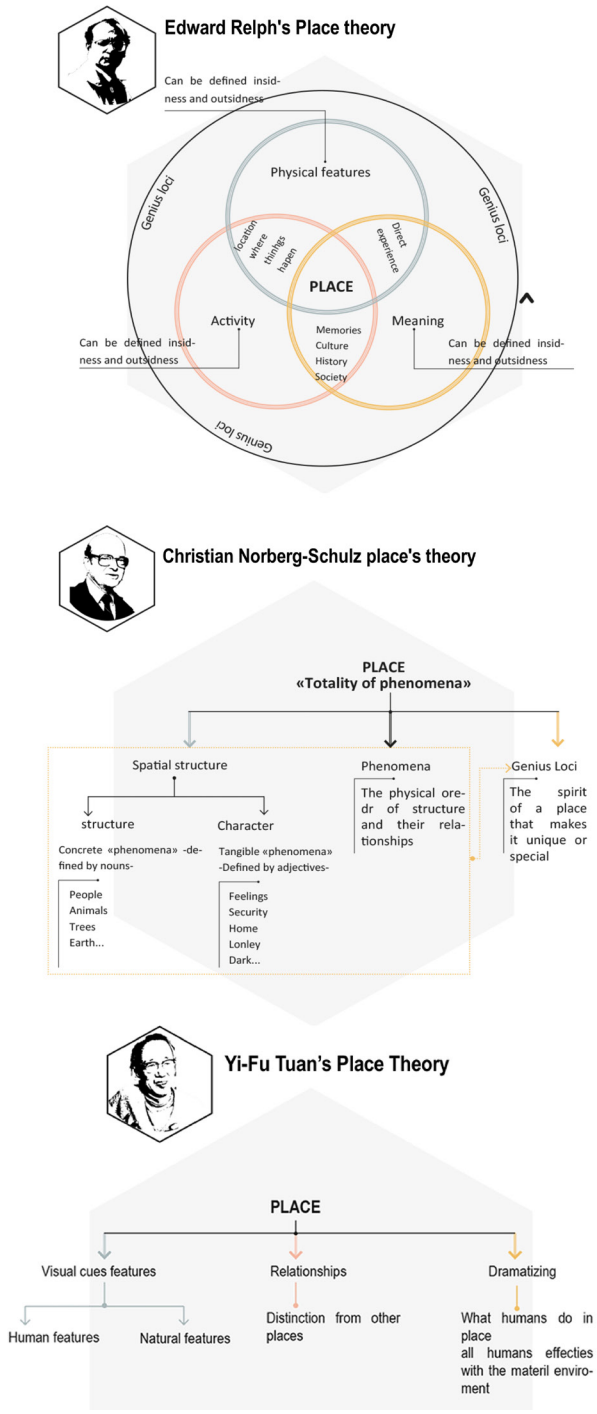



Fig. 1. Pace components schemes according to the three chosen theorists (Edward Ralph's place theory, Christian Norberg-Schulz's place theory, and Yi-Fu Tuan 's place theory) for the place theory [created by Seloua Benkaid Kasbah]

To grasp the significance of field sketch drawing as a tool for understanding the character and identity of a place, it is crucial to critically analyse the theoretical concepts that underpin our understanding of place. Drawing from a comprehensive review of relevant literature, this research focuses on examining the unique characteristics and local identity of a place, which can be effectively documented and analysed through field sketch drawing in the early stages of the design process. The theoretical works of renowned geographers Relph and Tuan, as well as architectural historian and architect Norberg Schulz, are employed to inform the concept of place and its components, with additional insights from notable writers such as Kevin Lynch and Canter serving as foundational ideas for this research.

In his book "Place and Placelessness," Canadian geographer Relph explores the phenomenology of place, describing it as the organization of experience. He argues that understanding the nature and meaning of place is crucial for restoring, maintaining, and creating new places. Relph differentiates between place and space, stating that while space provides context for places, the place derives its meaning from experiences. He identifies physical and ecological features, activity, meaning, and the genius loci or spirit of place as the components that make up the framework of place. Relph also emphasizes that place is not just about physical features or function, but also about the values and identity that humans attribute to it. Understanding the insideless and outsideness of place, or the perspective of insiders and outsiders, can reveal the different components that contribute to the essence of a place. This understanding is essential for avoiding the destruction of a place's character during the design process [6].

Norberg-Schulz classifies place as a combination of phenomena, Genius Loci or spirit, that renders a place unique. This can be further categorized by nouns, related by prepositions, and defined by adjectives, as well as the structure of the physical elements that shape a place, such as its texture, materials, and form. The combination of these elements gives a place its distinctive character. Christian Norberg-Schulz, the founder of the "Genius Loci" theory in architecture, argues that our experience of the world is formed by an endless number of phenomena, which encompass both concrete things and perceived feelings. These phenomena create the environment or essence of a place, which Norberg-Schulz describes as a "total" qualitative phenomenon made up of concrete things with material substance, shape, texture, and colour. He suggests using phenomenology, a philosophical inquiry into first-person experiences, as a method to obtain knowledge of the place. Norberg-Schulz breaks down place into distinguishable components, including landscape character and space, which can be analysed through languages, such as nouns, prepositions, and adjectives (Norberg-Schulz, 1984). However, he acknowledges that a character of a place is complex and cannot be fully captured by a single adjective [5].

Yi-Fu Tuan, a notable geographer, defines place as a stable scene that captures our attention and can be found anywhere, we stop to examine it. He describes place as being explicit through various means such as conflict, art, ceremonials, architecture, and visual prominence, and emphasizes that human places become more real through the dramatization of functional and emotional aspects. Tuan proposes three components for identifying place: visual features, dramatizing human needs and attachment to the environment, and unique relationships that make a place special. He uses the term "topophilia" to describe the emotional bond between humans and their environment, which can be aesthetic, emotional, or tactile [10].

The literature review has identified four key components of place: physical and ecological features, personal experience, the relationship between physical features and experience, and the local essence or character of a place known as Genius Loci. These components are common among various theories of place. Physical and ecological features shape the explicit forms of a place in the landscape. Personal experience and the time spent in a place influence its meaning for individuals. The relationship between physical features and experience can be seen as an activity that creates a connection between people and the place. Sketch drawing is proposed

to identify and understand these components. This research aims to investigate these components through sketch drawing to better understand the essence of place and protect valuable places from identity destruction.

**Urban open-space elements:**

Based on the reviewed Place theories, this research identifies Urban Open Space through four components: The physical and ecological features, Activity, Relationships, and Genius Loci. The following section will include what makes up these four components, and explanations for each (Fig. 2), to answer what we need to record and analyse with field sketch drawing.

*Physical & ecological features*

The identification of the physical and ecological features of urban open space is based on Catherine Dee's book "Form and Fabric in Landscape Architecture" and other authors' works on field sketch drawing. Chip Sullivan, in "Garden and Climate," highlighted the elements of earth, air, water, and fire to discover features of a garden through drawing [7] Paul Laseau, in "Graphic Thinking for Architects and Designers," emphasized the investigation of physical, organic, and cultural analogies in urban open space [4]. In this research, we adopted Dee's approach and identify five elements of the landscape fabric that constitute the physical and ecological features of urban open space: spaces, paths, edges, foci, and thresholds. These elements are derived from forms in the landscape that are used and experienced by people in distinct ways and for specific purposes [2]. This five-part order provides a conceptual structure for understanding the first component of urban open space - the physical and ecological features.

*Spaces:*

According to Dee (2001), investigating spaces is fundamental for experiencing, understanding, organizing, and using urban open space. This inclusive guide for exploring urban open space through sketch drawing will investigate spaces through elements such as topography, space walls, vegetation, and water elements, and it is essential to note the absence of any of these elements when exploring urban open space. Topography represents the physical appearance and third dimension of urban open space, and it is crucial to explore it during site investigation to understand how it influences other urban open space components. Space walls enclose urban open spaces and impact the human experience, microclimate, and character of the environment. Vegetation is a fundamental pillar of landscape architecture, providing structural and aesthetic qualities, ecological and environmental roles, and influencing human comfort and their experiences. Water elements play a significant role in landscape architecture, enhancing the aesthetic appeal of a space, providing habitats for wildlife, and impacting the character and experience of the space. Exploring these elements is crucial for gaining a comprehensive understanding of the urban open space being studied [2].

*Pathways*

Paths in urban open spaces serve as links between spaces and create networks for circulation. They can also function as landmarks and perform other physical and ecological roles. Different types of paths are needed for different uses, and when exploring paths through field sketch drawing, it is important to consider built or designed paths, spontaneous paths, natural paths, spaces, and pathway hierarchies [2].

*Foci (landmarks)*

Foci in urban open spaces are significant places that hold spiritual, social, or cultural importance. They can be built or natural forms and serve as landmarks, destinations, or gathering places. When exploring foci through sketch drawing, it is important to consider their qualities, types, scale, form, and how they function as physical and ecological features [2].

*Furniture*

Urban furniture, such as lighting, wayfinding systems, bollards, and seating, plays a crucial role in landscape architecture. It can either enhance or detract from the character and identity of urban open spaces. The design, qualities, and placement of furniture influence the users' experience and the functional, aesthetic, and social aspects it brings to the

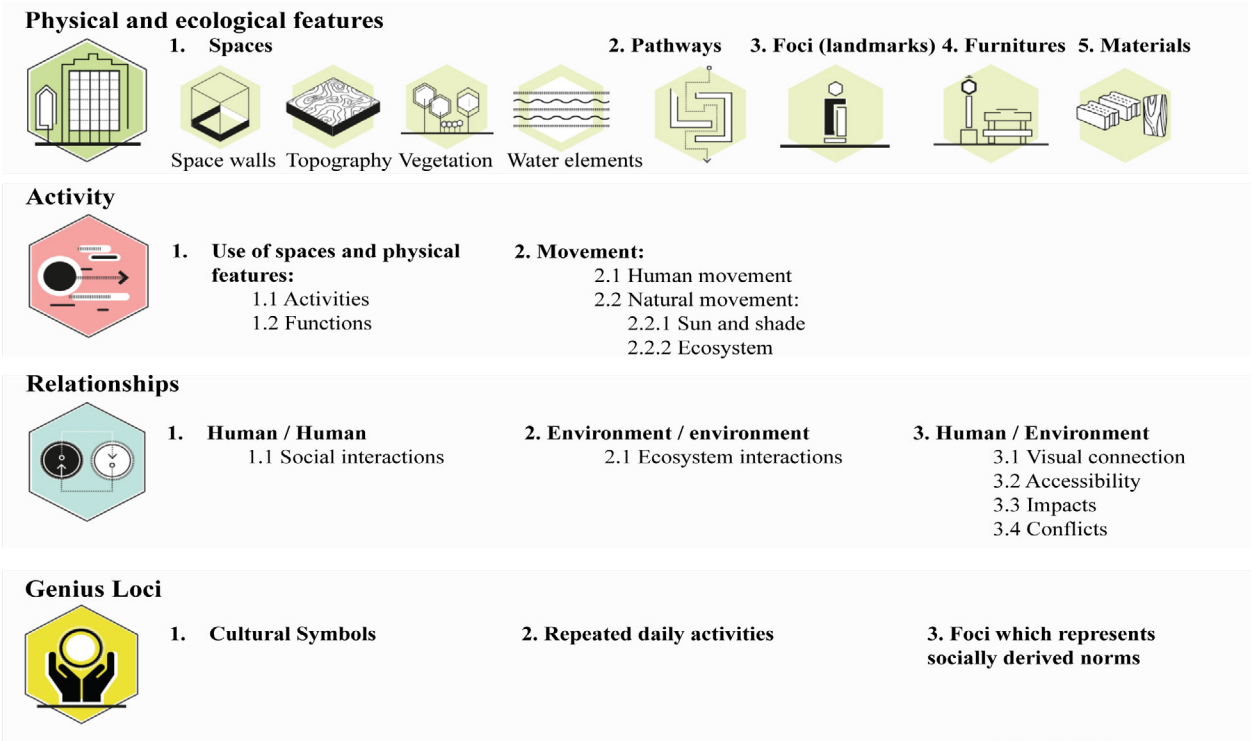



Fig. 2. Urban open space elements of each place component [created by Seloua Benkaid Kasbah]

site. Careful observation of the site's patterns of use is necessary for effective furniture selection, considering factors such as form, appearance, siting, layout, function, safety, durability, and materials [2].

*Materials*

The details of materials and their patterns, couleurs, and textures are not essential only in giving complexity, and richness to animate landscape experience, but also in offering coherence and simplicity in the unifying experience [2].

*Activity*

After conducting a thorough exploration and observation of the physical and ecological features through field sketch drawing, the next step is to investigate the activities that take place within these spaces. According to Relph (1976), activities are a crucial component in identifying a place. Field sketch drawing techniques can be used to document patterns of activities and functions, as well as movement within the urban open space. This includes human movement, which encompasses built elements and human behaviour, as well as natural movements such as sun and shade patterns and ecosystem dynamics. Recording these activities and movements helps in gaining a comprehensive understanding of the place.

*Relationships*

After conducting field sketch drawings of the physical and ecological features, as well as associated activities, the next step is to investigate the relationships among these components. In the first step, individual elements of the physical and ecological environment are examined, exploring how they relate to each other. Another important criterion of this component is the interaction between physical and ecological features with activities, which involves finding evidence of the effects of activity, as explained by Norberg-Schulz in Chapter Two as "phenomena". The understanding of relationships provides insight into a place and makes it unique and diverse from others [10]. The recording of relationships requires profound observation of human-to-human interactions (social interactions), human-to-environment connections (accessibility, impacts, and conflicts), and environment-to-environment relationships (ecosystem interactions and visual connections). This phase involves exploring how all field sketch drawings relate to each other up to this point.

*Genius Loci*

The final step in the comprehensive guide for the discovery of urban open space through sketch drawing is the exploration of Genius Loci. Previously, Genius Loci is defined as the unique "spirit" of the urban open space, with a focus on its sociocultural identity. Drawing on the literature of Christian Norberg-Schulz and Ian Thompson, it has been determined that this component of urban open space can be distinguished by exploring and recording the local character, everyday features, and cultural symbols that make the studied area distinct from others. The exploration of Genius Loci involves observing cultural symbols, significant repeated activities, and foci that represent socially driven norms, many of which have already been associated with the social and cultural functioning of urban open space. While some of these aspects may have been explored in earlier steps of the guide, such as foci/landmarks and repeated daily activities, identifying cultural symbols that represent the ethical values of the urban open space community may require critical thinking and keen observation. Understanding the character of urban open space entails identifying the unique properties that contribute to its Genius Loci, and this step completes the comprehensive method outlined in this research for analysing urban open space through field sketch drawing, providing designers with a framework to consider the four components and conditions that make up each facet.

**Literature review on field sketch drawing:**

A field sketch is a place-observed, and hand-produced drawing made on-site. Precise observational drawing on location is one of the main concerns of this research. However, field sketching as practice in landscape architecture is not limited just to drawing activity; it extends beyond the drawing to our experience of the analysed site. Also, it drives our attention to how movement, temporal conditions, and other factors influence our perceptions. It is a practical technique that aids in capturing analytical field observations, through the medium of art practice; also, it helps in encouraging the visual and other sensory perceptions engaging with the curious mind and visual sensibilities we all share.

*What landscapes architects think about sketchbooks and field sketching*

According to articles in the ASLA journal (2009) and the UK Landscape Institute journal (2007), many landscape architects no longer view on-field sketch drawing and keeping a sketchbook as essential skills. However, landscape architects like Marc Treib, Laurie Olin, Kim Wilkie, and Thomas Oslund believe that sketching and keeping sketchbooks have an important role in the design process. Olin states that sketchbooks provide a durable and portable locus for experimentation, recording, and note-taking [12], while Treib believes that drawing demands immersion in a situation, tests observations, and nudges designers to take more care [9]. Oslund views sketchbooks and sketches as essential means of exploring space and examining ideas before designing. Wilkie finds field sketching to be an immediate and portable companion that provides a personal space for exploration and observations [11]. In the author's opinion, keeping a sketchbook and establishing field sketch drawings during the analysis phase is an invaluable discipline for landscape architects and designers, as they provide a reference for later studies and serve as memory joggers about what was found and experienced on-site. Sketchbooks are considered insights into the path of our thoughts that will lead us to particular design solutions.

*Field sketch drawing and the experience of urban open spaces -Regain a role for field sketching in contemporary landscape practice-*

Despite its importance as a framework for landscape architects, field sketch drawing has been reduced and manipulated through digital photography and modelling. Although field sketching is an old-fashioned low-tech technique, this research argues for its continued relevance in contemporary practice. Field sketching provides unique benefits for our perception of landscapes and offers a visual language for communicating and sharing landscape experiences. Even in the digital age where remote examination and analysis of field data has become the norm, field sketching still plays a crucial role due to the benefits that it brings to the designers:

Movement and participation play a crucial role in the experiential approach to landscape architecture practice. Field sketch drawing can provide benefits in how we perceive and evaluate landscapes. The link between our actions and bodies is essential when walking and producing hand-generated sketch drawings and notations. Sequential experience and movement are now part of landscape architectural practice and teaching, as landscapes are places of movement. Field sketching and the act of walking and sketching offer more advantages and potentials than passive approaches, such as

using photography or interpreting remote data.
Additionally, the way we experience places affects our perception. If we disconnect ourselves from places or limit our sensory experience, our perception is also limited. The use of all our senses is known as multi-sensory perception, which provides a more participatory and inclusive approach to understanding the environment. Fieldwork offers a richer sensory experience compared to purely visual observations from a desk. Engaging all our senses can lead to deeper feelings and thoughts, which research in landscape architecture supports. People value different sensations in the environment beyond just aesthetics.
The other benefits that this research highlights is Movement and gesture are important in activating our perception of the environment. The movement of walking and hand gestures in sketching activate our perception in a multi-sensory way that goes beyond the visual. According to Tim Ingold, sketching is a powerful means of description and observation that allows us to participate in active perception. The direct link between gesture and observation is interrupted when writing is automated via keyboard or using a camera instead of sketching by hand.

## Field Sketch drawing techniques for the developed inclusive guide

To comprehensively explore urban open space, various field sketching techniques must be used together to discover crucial information about the space's identity and character. The inclusive approach distinguishes between what will be drawn and how it will be drawn. Before delving into how to draw, what will be drawn and what to investigate were identified in this research. The research assumes basic knowledge of drawing in landscape architecture and design.
Drawing inspiration from Janet Swails' "Field Sketching and the Experience of Landscape Architecture," Crowe's "Visual Notes," and Elpényi Anna-Christian and Oláh Brigitta's "The Language of Landscape Sketching" books, this section presents a curated collection of 16 techniques that will be employed to explore urban open space as part of the developed field sketching approach.
The author will explain various field sketching techniques and provide two examples for each one. The examples will include works by another landscape architect and the author's sketches from various Budapest locations (Fig.3, 4). The purpose is to demonstrate the usefulness of each technique in enhancing the perception and understanding of the site, and how they relate to each component of urban open space in the inclusive guide.

*1. Linear plot*
The line is the fundamental element in drawing that can define an object's structure, perspective, and shape. When applied in landscape architecture practice, it offers many benefits, such as saving time on-site while effectively communicating information, integrating the composition of space layout and arrangement, and accurately transferring measures and proportions from observation onto the page. These advantages were observed during the author's application of the technique at a particular site.

*2. Value & Tonal sketch drawing*
Tonal sketch drawing emphasizes a place's depth, form, and atmosphere using various degrees of shade and shadow. While different mediums can be used for tonal drawing, a line-based technique can save time and minimize the necessary tools required on-site. Tonal drawing is helpful for understanding the position and direction of elements in a space and is a useful technique for recording time on-site in landscape architecture practice.

*3. Analytical sketch drawing*
Analytical drawings allow us to extract information by being analytical rather than representational [1]. They are purposefully abstract. They include the recording of patterns, shapes, geometry, form, rhythms, contrast, and proportion. his technique is beneficial in landscape architecture practice as it allows for maximum information extraction and can provide a more comprehensive picture of a place when several sketches are joined together. It is objective, rational, and problem-oriented, and is suited to fixed qualities and subjects such as land use patterns, topography, and built elements.

*4. Texturing*
The texture is a key element in landscape architecture, referring to the quality of a surface that affects how light interacts with it. This technique involves observing and recording the various textures, including their rhythm, density, and direction, using a set of homogeneous marks and patterns. Practitioners can develop specific techniques to represent different landscape materials, but over-detailing can result in confusing drawings. The benefits of texture sketching in landscape architecture include recording surface materials, communicating land cover and land use patterns, capturing visual qualities, and representing character and atmosphere. This technique is particularly suited to detailed aspects such as foliage effects.

*5. Gesture sketch drawing*
Gesture sketch drawing is a technique used in landscape architecture to quickly capture the essential gesture and movement of an object, rather than focusing on its appearance. This method is ideal for recording changing and dynamic subjects, such as human activities, weather changes, and movement. It is also useful for capturing the mood and energy of places and recording details such as textural effects or foliage. This technique is best suited for situations where rapidity is desired, and a fast impression is all that can be attempted.

*6. Mapping*
The mapping technique is a two-dimensional representation of space that provides an impression of the spatial organization layout of the investigated site. It describes physical features' length and width dimensions such as routes, views, dimensions, orientation, and relationships. This technique is useful in gaining an understanding of the site, obtaining an overview of the spatial layout, and revealing the hierarchy and arrangements of the spatial structure of urban open space. The process of mapping in this context of sketch drawing is not aimed as a technical survey but to comprehend the space from above.

*7. Annotation*
The Annotated Field sketching technique is used to record observations and ideas about an observed urban open space on-site. This is achieved using sentences alongside a sketch drawing, providing a reference for refreshing memory later. Benefits of this technique in landscape architecture practice include the ability to refresh memory with short, spontaneous sentences or one-word recordings, the versatility of annotation with any other field sketching technique, and the ability to record relationships between urban open space elements. It also helps to exchange, gather, and clarify information, collect non-visual information, and bring the analytical level to descriptive field sketch drawing.

*8. Behavioural mapping*
The behavioural mapping sketch drawing technique is useful

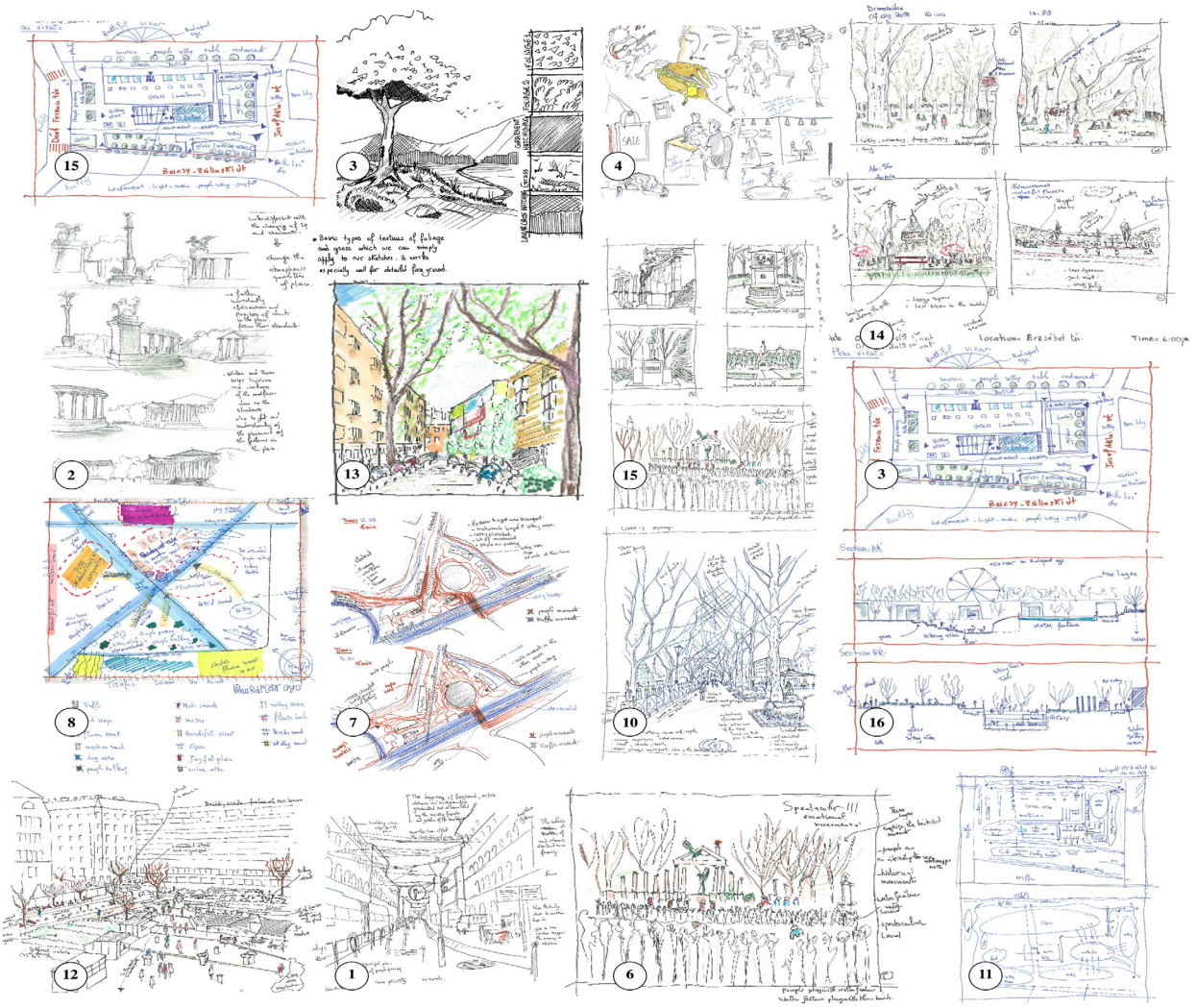

1. Linear Plot
2. Value & Tonal sketch drawing
3. Texturing
4. Gesture sketch drawing
5. Mapping
6. Annotation
7. Behavioural mapping
8. Sensory and perceptual qualities
9. Analytical sketch drawing
10. Depth
11. Spatial diagrams
12. Ariel view sketch drawing -isometric-
13. Colors
14. Sequential sketch drawing
15. Focused views
16. Architectural sketch drawings: plan, elevation, and sections

Fig. 3. Sketch drawing exemples from other landscape architects and artists [collage created by Seloua Bnekaid Kabah]

for recording and representing how users interact with urban open spaces by capturing their behaviours and movements. This can be done by using overlapped lines and code notation to show the direction and type of movement. The benefits of this technique in landscape architecture practice include recording movement directions, addressing potential differences in behaviour settings, and collecting and recording variations in activity intensity between different types of settings.

*9. Sensory and Perceptual Qualities Mapping*

This technique simplifies the understanding of multisensory perception in the built environment and aims to record and overlap sensory spatial experience and perceptual memories on site. It involves observation and attention and results in a map that represents the sensory phenomena experienced on one brief visit. The benefits of this technique in landscape architecture practice include reminding of the experienced phenomena, synthesizing sensory effects across the whole



1. Linear Plot
2. Value & Tonal sketch drawing
3. Texturing
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5. Mapping
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9. Analytical sketch drawing
10. Depth
11. Spatial diagrams
12. Ariel view sketch drawing -isometric-
13. Colors
14. Sequential sketch drawing
15. Focused views
16. Architectural sketch drawings: plan, elevation, and sections

Fig. 4. Examples of sketch drawing techniques created by the author at different sites in Budapest to test the drawing techniques [created by Seloua Benkaid Kasbah]

site, acquiring sensory knowledge, evaluating environmental quality, and identifying opportunities and issues for improvement.

*10. Depth*

The perspective drawing technique is used to create an illusion of depth on a two-dimensional surface, by decreasing the size of objects and making them appear more distant using vanishing points. This technique is advantageous in landscape architecture practice to accurately represent physical features in a space and help develop design approaches. It also allows for the use of techniques that reinforce the illusion of depth, such as fading colours and details as elements recede into the distance.

*11. Spatial diagrams*

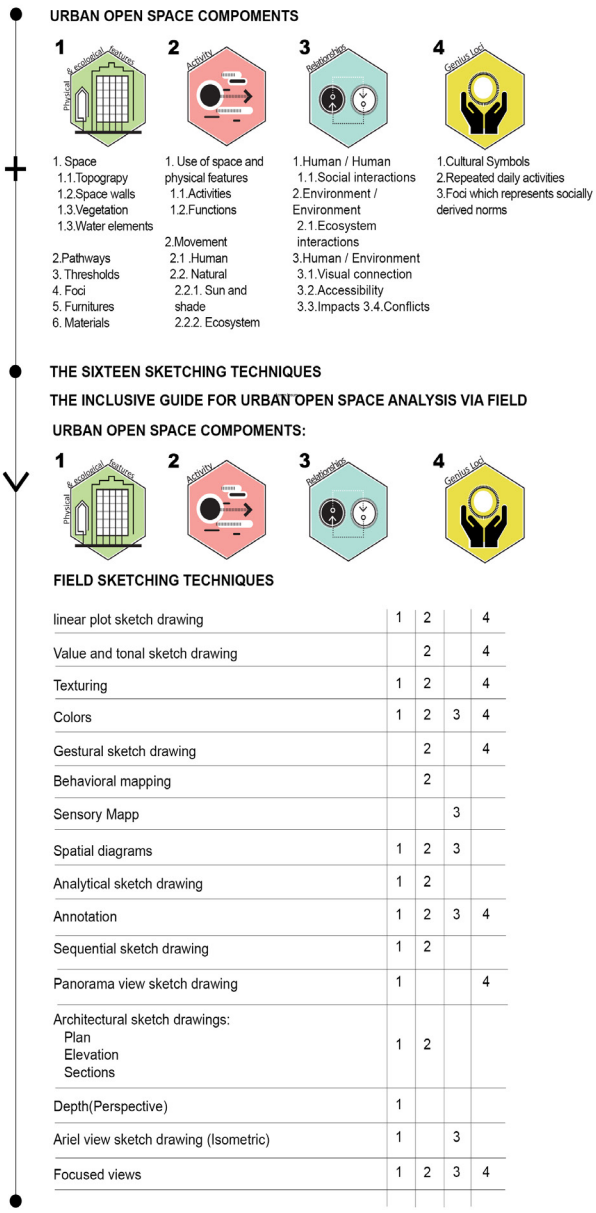
The diagram technique is a simple and rapid way of recording the relationships and underlying structure in a physical space, using bubbles and lines to represent subjects and interactions respectively. It allows for an understanding of the abstract spatial structure, identifies patterns, and provides a notation technique for studying views. In landscape architecture, this technique communicates physical spatial elements, identifies areas for improvement or change, and helps prioritize the highest priority areas.

*12. Ariel view sketch drawing -isometric-*

The isometric sketch drawing technique is a three-dimensional representation of an object with parallel lines and no perspective or vanishing point. It has a lower viewing angle and provides a more balanced emphasis on the top and side views of the represented place. The benefit of this technique in landscape architecture is that it is useful when dealing with complex information about the three grounds of space (sky, ground, and wall) and other physical and ecological features of a place.

*13. Colours*

Colour has three attributes: intensity, value, and hue, and can be rendered through different media such as coloured pen-




| | | | | |
|---|---|---|---|---|
| linear plot sketch drawing | 1 | 2 | | 4 |
| Value and tonal sketch drawing | | 2 | | 4 |
| Texturing | 1 | 2 | | 4 |
| Colors | 1 | 2 | 3 | 4 |
| Gestural sketch drawing | | 2 | | 4 |
| Behavioral mapping | | 2 | | |
| Sensory Mapp | | | 3 | |
| Spatial diagrams | 1 | 2 | 3 | |
| Analytical sketch drawing | 1 | 2 | | |
| Annotation | 1 | 2 | 3 | 4 |
| Sequential sketch drawing | 1 | 2 | | |
| Panorama view sketch drawing | 1 | | | 4 |
| Architectural sketch drawings:<br>Plan<br>Elevation<br>Sections | 1 | 2 | | |
| Depth(Perspective) | 1 | | | |
| Ariel view sketch drawing (Isometric) | 1 | | 3 | |
| Focused views | 1 | 2 | 3 | 4 |

Fig. 5. The developed inclusive guide for urban space analysis via field sketch drawing [created by Seloua Benkaid Kasbah]

cils, crayons, pastels, watercolour, and gouache. Using different media with colour can provide unique interpretations of texture and tone. In landscape architecture, colour techniques can be used to investigate and record atmospheric effects, record colour composition and its effect on the character of a place and portray the effects of temporal qualities such as light and seasonality on the site.

### *14. Sequential sketch drawing*

Using sequential sketch drawing allows for a better understanding of a place by experiencing its changing geometries and sensory changes [3]. This technique captures experiences from different points of the explored site and allows the landscape architect to be more involved in the sensory world of the site. Benefits in landscape architecture include the ability to record the essence of the explored urban space and its changing geometries, as well as capturing sensory perception in a series of views.

### *15.Focused views*

The technique involves focusing on a landmark or feature in the observed composition, which becomes the organizing principle. The focal points can be drawn in either wider or framed views, and they highlight and pinpoint important features in the environment. This technique is particularly helpful for investigating and recording existing landmarks in the explored site.

### *16. Architectural sketch drawings: plan, elevation, and sections*

Architectural drawings, such as plans, sections, and elevations, are commonly used in landscape architecture and only have two dimensions. They depict perpendicular views (sections and elevations) or parallel views (plans) of the ground. These drawings are beneficial for landscape architects as they represent the layout, dimensions, and spatial relationships of buildings and their surroundings, allowing for a quick and accurate way to describe the order and character of the site's physical and ecological arrangement, as well as the scale and relationships between its parts.

### The inclusive guide for urban open space analysis via urban sketching outlines:

To better understand the complete and comprehensive method explained above, the author in this study presents an outline of the inclusive guide for urban open space analysis via field sketch drawing, which a Landscape architect, designer, and student can follow to remind them of the four components of the explored urban open space and the conditions that make up each one of these facets (Fig. 5).

## Conclusion

Field sketch drawing connects the eye, mind, and hand to provide an experience of the observed phenomena. It allows the landscape architect to experience the significance of the explored site to design them sensitively. This research set out to build up a set of systematic steps for analysing urban open space through field sketch drawing. It examined the theoretical notions of place and field sketching to generate an inclusive guide for exploring urban open space via field sketching. The inclusive guide provided a means for experiencing urban open space.

Due to the necessity of cataloguing the quantitative elements for any landscape development, the possibility of complementing the developed inclusive guide with a standard inventory opens new scope for future research. Could the inclusive guide for analysing urban open spaces via field sketch drawing developed in this research combined with typical site inventories provide the landscape architect with a more comprehensive and complete analysis of the site? The investigation could include the standard overlay process, with the incorporation of the field sketch drawing method into its primary framework. Continuing research about combining the two would help develop a complete guide for site inventories. Also, including other media with field sketch drawings might be beneficial. Technology like time-lapse video or animation could develop to be a supplementary exploration tool, especially because field sketching does not consider time. It may impair the experimental qualities of understanding a site if it starts to put backfield sketch drawings. Hence, field sketch drawing must be used as a primary exploration tool. If a real understanding of urban open space is gained, it should be projected in the later complete design. Hence a research application that includes a full and detailed design would be based on this research. The inclusive developed guide could also be applied in a classroom setting. Then a comparison could be made between students designing an urban open space utilizing this guide for the analysis phase, with others employing only standard inventory methods. Another comparative research application could be done with students utilizing photography to investigate urban open spaces rath-

er than field sketch drawings.

The final limitation of this research is the time issue. The developed guide is aimed to be carried out for a long duration. The more time we spend on-site, the more understanding and experience we gain. However, in the landscape architecture profession where time is a valuable resource the idea of spending days or even weeks exploring and recording with field sketch drawing may not sound practical. For this reason, research into the economic integration of this guide into the standard inventory procedures will help in including field sketch drawing as a means to explore urban open space in the landscape architecture profession. If this is realized, the future design will be done sensitively to the characteristics that make the site unique and might not destroy its identity and charter.

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## Kopsavilkums

Pētījumā izvērtēts kā skiču zīmēšana ainavā var palīdzēt izprast un analizēt pilsētas atklātās telpas un to iespējamo lomu noteiktā dimensijā. Pētījums sākas ar jēdziena "vieta" teorētisko interpretāciju un to komponentu izpēti, kas veido pilsētas atklāto ainavtelpu. Tam seko lauka skiču zīmēšanas metožu analītisks pētījums, kas tiek izvēlēts, lai izstrādātu iekļaujošu pieeju pilsētas atklāto telpu analīzei. Konkrētā pētījuma galaprodukts ietver pilsēttelpas komponentu teorētisko izpēti un skicēšanu, kas kalpo kā visaptverošs ceļvedis pilsēttelpas analīzei. Pētījuma rezultāti sniedz ieguldījumu ainavu arhitektūrā un dizainā, sniedzot ieskatu un ieteikumus skicēšanai kā vērtīgas pieejas iekļaušanai pilsētas atklāto telpu izpētē.

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# CIRCULAR MATERIAL USE IN LANDSCAPE DESIGN

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**Astract. The aim of the article is to highlight trends in landscape and environmental improvement by including new environmental and landscape elements made from recycled materials. To achieve this objective, a number of objectives have been defined: to present a recycled tyre pellet material for use in outdoor landscaping, to look at the tyre recycling process and how this material is obtained, to look at and analyse market trends and products for this material, how this material fits into the circular economy, to propose new ways of using this material in environmental and landscape landscaping. The methods used in the research are literature analysis, research of examples of good practice in Europe, constructive criticism and analysis, public surveys and grapho-analytical compilation of the obtained data. An essential part of the research is the conducted experiment, as the result of that recycled tire granules were used in outdoor furniture collection. The selected research topic is actual because it is necessary to think about the wider use of recycled tire materials, to increase the use of recycled material in various outdoor environmental products, to create demand in this sector; as well as introduce more people to this material - in a different way than usual.**

**Keywords: tires, recycling, recycled tire granules, circular design, circular economy, product design, and landscape**

## Introduction

Tires as we know them today were introduced about 70 years ago. The external characteristics of the tires have not changed significantly since their introduction, but the structure of the tires has improved considerably. Many components are added to improve tire performance, longevity, wear resistance, and more. These properties are useful both during tire operation on the road and also contribute to the efficiency and further use of recycled tire materials in various products [1]. Car tires contain several valuable materials such as rubber (75%), steel (15%), textile fibers (10%). Tires that are no longer usable and need to be recycled are called end-of-life tires (ELT). In Europe, approximately 50% of all used tires are recycled to recover their valuable materials. The pure rubber in the tires is processed into granules, which can further be used in various industries, such as sports, construction, product design, etc. [2]. The purpose of this article is to highlight landscaping and environmental improvement trends, offer recycled tire granule materials for use in outdoor landscaping, review the tire recycling process and how this material is obtained, review and analyse market trends and products for this material, and how this material fits in circulation economy, to offer new ways to use this material in environmental improvement and landscape. Nowadays, outdoor furniture of various designs and materials can be observed in the outdoor environment. Next to the classic outdoor furniture, more common are non-standard design solutions, and more sustainable choice of materials [3]. The use of recyclable materials in products is not only a trend, it is important to do so in order to reduce as much as possible unnecessary waste into nature. It is relevant to come up with new uses for worn-out materials, giving them a new life. Since many materials that end up in waste have properties beneficial to the outdoor environment, various recycled materials are often used in outdoor landscaping (Fig. 1). It is more and more common to think about how to make modern cities greener and more pleasant for people [4]. It is relevant to use various greenery pots, to integrate them into city streets and squares [5]. Outdoor furniture is also supplemented with places for such decorative greenery, thus ensuring that this piece of furniture fulfils several functions at once (Fig. 2, 3). In order to provide the furniture with the widest possible use, simple, well-integrated shapes are thought of. Unusual furniture design is often used, but there is always a consideration of how well this product will fit into the environment given how many different styles are found in the outdoor environment. When studying recycled tire granule material and products already made from them, it was concluded that this material has many positive properties - longevity, it is suitable for outdoor conditions, withstands frost, rain, abrasive weather

Fig. 1. Paving of recycled tire granules in front of a public building [*]

Fig. 2. Decorative plants integrated into the urban environment [*]

Fig. 3. Outdoor furniture with an integrated place for decorative greenery [*]

Fig. 4. Recycled tire granules in outdoor furniture collection with user [*]

Fig. 5. Visualization of products in an urban environment [*]

Fig. 6. Offer of colour variations of the collection [*]

conditions, is difficult to damage mechanically and it can be recycled repeatedly, as well as using binders, it is possible to make elements of different shapes from it. In the experimental part, with her work, the author wants to show a wider use of recycled tire granules, increase the use of recycled material in various outdoor environmental products, create demand in this industry; as well as to introduce more people to this material - in a different way, as in tires (Fig. 4). The style of the developed furniture is designed in such a way that it is as easy as possible to integrate it into urban environments of different styles, but if necessary, the developed collection can be expanded - the rubber granules can be offered in other colours, as well as the wooden seat can be painted and offered in additional shades (Fig. 5., 6.). It is also possible to expand the composition of the collection. Keeping the existing style of the collection, it is possible to offer a coffee table made from recycled tire rubber granules, variations in the size of greenery boxes, variations in the length of the benches, offering benches with a backrest. All this furniture should be designed in such a way that it can be used both separately and can be combined with each other and complement each other so that it can be more easily integrated into the outdoor environment and the overall landscape.

## Methodology

In the literature analysis section, articles and statistics from the publications and data sheets of The European Tire & Rubber Manufacturers Association (ETRMA) were reviewed, data and information from the European Environment Agency were used, scientific articles from the books of scientific collections "Tire waste and recycling" (2021) and "Waste" (2019). A number of companies in Europe engaged in tire recycling, production of recycled tire granules, as well as companies producing various products from this material have been reviewed and analysed. The observations examine the products of these companies, because of which recommendations are given in the field of design and recommendations for further research. In the conducted experiment, a solution for a circular design object from recycled tire granules is proposed. The descriptive method is used for structuring the work and creating content.

## I Tire recycling (relevance of the topic)

The European Union (EU) adopted three directives during the millennium to ensure that the largest amount of tires are diverted from landfills and recycled in a sustainable way [6].
The Landfill Directive (1999) was the first to be adopted, banning the landfilling of whole car and truck tires from 2003 and tire by-products from 2006. Thanks to this directive, end-of-life tires were defined as 'waste'. The overall aim of the directive was to divert the majority of tires away from landfills, thereby using the material for recycling or energy recovery [7].
Shortly after, the End-of-Life Vehicles Directive (2000) was adopted, which required end-of-life vehicles to be disposed of with the tires already removed to ensure that end-of-life tires do not end up in landfills [8].
Third, the Waste Incineration Directive (2000) was adopted. The aim of the directive is to reduce dioxin emissions by 90% by 2005. This directive controlled the use of tires for energy recovery and inadvertently directed tires towards this type of recycling [9].
Thanks to these directives, the possibilities of tire recycling and the reuse of their materials in new products were thought of. A waste tire management system is needed so that waste tires can be collected and sent for recycling. In general, three end-of-life tire management models have been developed

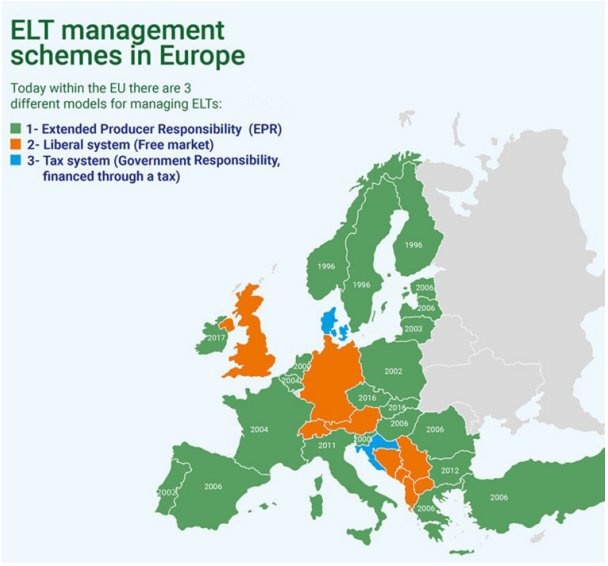


Fig. 7. Waste tire management models in Europe [10]

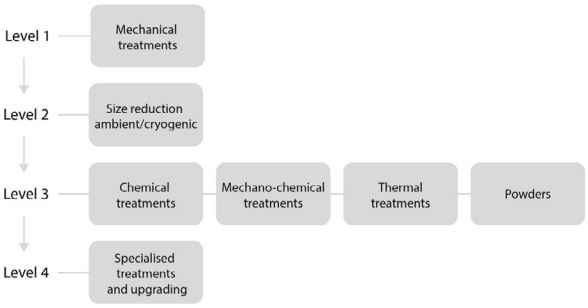


Fig. 8. Tire recycling levels [*]

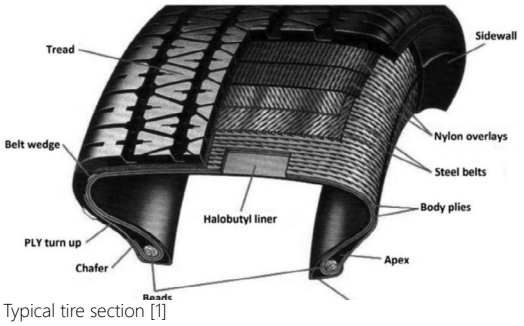


Fig. 9. Typical tire section [1]

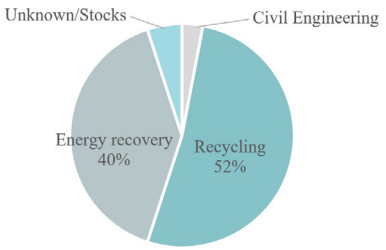


Fig. 10. Processing of used tires in 2019

in Europe:

1) Extended Producer Responsibility (EPR) - EPR is the producer's full or partial operational and/or financial responsibility for the product, which is extended to the stage of the product's life cycle after consumption. In other words, under this system, the original manufacturer has a duty of care to ensure that waste from its products is disposed of in a responsible and environmentally sound manner. This led to the creation of non-profit companies funded by tire manufacturers, which aim to manage the collection and recovery of ELTs using the most economical solutions.

2) Free market system - according to this system, legal acts determine the goals to be achieved, but do not specify the responsible parties. In this way, all operators of the recovery chain enter into contracts under free market conditions and act in accordance with the law. This can be supported by voluntary cooperation between companies to promote best practice.

3) Tax system - according to the tax system, each country is responsible for ELT management. It is financed by a tax collected from tire manufacturers and then passed on to consumers.

In Europe, the Extended Producer Responsibility (EPR) system is the most widely used (Fig. 7) [10].

Before being sent for processing, the tires are sorted into categories – car tires, truck tires, etc., and then they are sorted again by size. Partially worn tires that are still fit for road use or export are diverted from recycling and integrated back into the market. Retreadable tires are directed to tire retreating facilities. Tires that cannot be further used or renewed are sent for recycling, before which they are further sorted.

Before processing, the tires are cleaned of debris such as glass, stones or various objects. Tires obtained from stock or other long-term storage must be washed before handling.

In total, there are four levels of tire recycling, which become progressively more complex (Fig. 8). Recycled tire granules are obtained as a result of the first and second levels, this material also accounts for 75% of the demand for materials obtained as a result of processing, so these two levels are examined more closely.

*Level 1*

Wire Stripping - A mechanical procedure that removes the rubber-coated steel coil wires by cutting or tearing the rubber parts that secure the wires to the tire casing (Fig. 9).

Tire sidewall removal - a mechanical cutting procedure that releases the tread strips from the carcass (Fig. 9).

Shredding and chipping - used for whole car or truck tires. Shredding is a process that uses different technologies to break up the tire. The process results in shredded tire material ranging in size from 50 to 300 mm and irregularly shaped. Shredding is usually a secondary crushing process that results in irregularly shaped material in the range of 10 to 50 mm.

*Level 2*

Ambient grinding – this process uses whole or pre-treated car or truck tires in the form of shredded, chips, sidewalls or treads. This process is a multi-stage technology that results in the sequential separation of rubber, metals and textile fiber.

At the beginning of the process, previously unremoved metals are magnetically separated from the rubber. The rubber material is then passed through one or more successive granulators. In order to sift out the last remnants of impurity and divide the granules into size fractions, the material passes through several sieves and screening equipment. In the last phase, textile fiber residues are removed with air separators.

Cryogenic processing - this process usually uses pre-treated tires as raw material, most often wood chips or granules obtained from ambient grinding. Cryogenic processing takes place at very low temperatures so that the rubber remains brittle. At the beginning of the process, the material is placed in a freezing chamber, with the help of liquid nitrogen it is cooled to a temperature where the rubber loses its elasticity. As a result, the rubber remains brittle and can be broken to obtain smooth and regularly shaped granules of the required size. Due to the fragility of the material, textile fibers and met-

al are easily separated in the mill. To remove the last traces of impurities, the material is passed through magnetic and sieving equipment [11].

Both of the mentioned methods can be used repeatedly to obtain finer fractions of better quality granules. Often both of these technologies are combined to take advantage of each technology and reduce the cost of the overall granulation process [12].

In Europe in 2019, 95% of all used tires were collected and recycled. Data analysis shows that approximately 1.95 million tons or 52% of used tires were processed using material recovery (Fig. 10). This figure includes 1.36 million tonnes of tires sent to the granulation process; 476,000 tons of used tires were incorporated into cement; 112,954 or 3% tons were used in civil engineering. 1.43 million tons or 40% of tire diverted energy for recovery. The amount of used tires in storage or unknown and awaiting recycling was almost half less than the previous year, reaching 165,000 tons or 5% [13].

## II Circular design

A circular economy is an economic system that opposes a linear open-ended system (produce, consume, dispose). It aims to achieve sustainable development while creating environmental quality, economic prosperity and social equity for the benefit of current and future generations [14]. The system aims to return to nature what comes from nature through the life cycle of the product (Fig. 11).

The European Community (EU) aims to double the use of recycled materials as a share of the total amount of material used in the economy between 2020 and 2030, as set out in the Circular Economy Action Plan. Increasing the use of secondary materials would reduce the extraction of primary raw materials and the associated environmental impact. In 2021, recycled materials accounted for 11.7% of material used, an increase of less than 1% since 2010. These data show slow progress to double the rate of recycling materials by 2030. For the progress to be faster, there must be a greater demand for circular materials in the market [15].

Due to the lack of demand and market for waste tire granules in Europe, some of the waste tires are incinerated for energy recovery, which is a wasteful use of resources (Fig. 12). Statistically, in Europe on average, one tire is mechanically recycled for every tire burned [2].

Tires are not an easy product to renew, their recyclability is affected by the possibilities of current technologies, as well as market demand in this direction. At the moment, tires belong to the category of products for which complete circulation is not possible, but they are suitable for an "open loop" life scenario, as a result of which it is possible to produce other, no less important products. The four "R" scheme is used for tire recycling, which includes reuse, retreating, recycling, recovery [16].

The Reuse process involves the sale of partially worn tires for continued use, as well as export to countries with fewer restrictions on the use of tires on the road.

Recovery process turns tire waste into fuel. Tires, like coal,

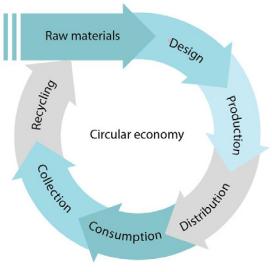


Fig. 11. Circular economy scheme [*]

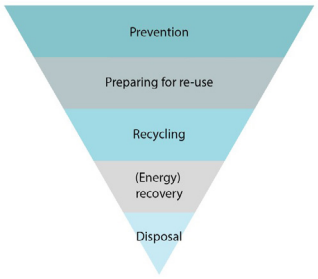


Fig. 12. Waste hierarchy [*]

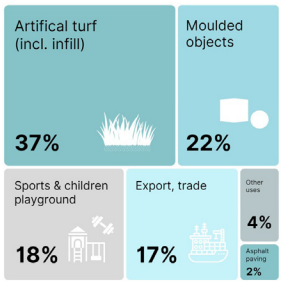


Fig. 13. Segmentation diagram of the recycled tire granule market [*]

have a high calorific value, making them useful as fuel. For example, the use of tire-derived fuel in cement kilns helps reduce harmful emissions, and wire embedded in rubber can help improve the quality of cement.

As a result of recycling, tire waste is turned into raw material that will be reintegrated into the economic flow. The recycling of used tires into rubber granules is a common and productive way of recycling tires, it is widely used in various sports field surfaces, children's playground surfaces, in the production of road curbs, in road construction, as well as in the production of various everyday products [2] (Fig. 13). Using pyrolysis, it is possible to obtain gases, oils, carbon coal and steel from tires, which can be used as new resources that are re-entered into commerce [17].

Retreating remanufactures the tire casing to reduce production energy and resources needed to produce new tires.

Some of the examples of good practice in Europe were investigated - companies producing recycled tire granules from waste tires, as well as companies producing products from recycled tire granule material.

Companies engaged in the production of products from recycled tire granules:

- ***Rubrig*** (Latvia) – the company offers various types of outdoor rubber tiles, coverings with 2D graphics, rubber 3D shapes [18];
- ***Kraiburg*** (Germany) – the company uses recycled tire granule material as sound and vibration absorption material in specific products, offers various types of rubber covering tiles, rubber 3D forms, delimiting rubber borders [19];
- ***Eco paving*** (United Kingdom) – the company offers various types of laid rubber coverings for outdoor environments [20];
- ***Ecoprodev*** (Portugal) – the company offers rubber covering tiles, curbs, rubber carpets, greenery boxes of various sizes [21].

Companies that produce recycled tire granules from used tires:

- ***Tire recycling solutions*** (Switzerland) – rubber powder is produced from used tires, which can be used in the production of new products (tires, asphalt production, production of molded rubber products) [22].
- ***Ecopneus*** (Italy) – the company deals with the collection and processing of used tires into granules, this product

is further sold as raw material for the production of new products [23].

- ***Genan*** (Denmark) – Genan is one of the world's largest tire recycling companies. Because of tire recycling, the company offers rubber granules of various fractions and colours, rubber powders, as well as recycled steel and textile fibers [24].
- ***Eco Green Equipment*** (UK) – The company provides tire recycling solutions including tire shredders and granulators to transform tires into valuable materials [25].
- ***Granuband*** (Netherlands) – the company deals with tire recycling and produces rubber granules for various applications, including filling artificial sports fields and various industrial applications [26].

Benefits of tire recycling:

- The tire recycling process reduces waste - tire recycling reduces the number of old tires in landfills and illegal dumping sites, including helping to prevent the release of dangerous chemicals;
- Conservation of resources - saves natural resources and energy for the production of new rubber products;
- Reduction of carbon footprint – the lifetime of rubber products increases, which reduces the production of new rubber products, which contributes to the mitigation of climate change.
- Noise reduction in the urban environment – the use of recycled tire granules in highway and railway barriers is common, they reduce noise pollution in urban areas, which benefits the urban environment and society;
- Water management - these same recycled granules are used in storm water management systems, helping to filter runoff that helps prevent flooding or soil erosion;
- Safer environment - contributes to the general well-being of society, for example, using this material for the surfaces of playgrounds, as well as sports fields to absorb shocks, reducing the risk of injuries;
- Resource efficiency - tire recycling reduces the generation of new waste;
- Improving the urban environment – by including rubber mulch in landscaping and green areas in the urban environment, which helps retain moisture in vegetation, prevent weeds from growing, and create breathable and water-permeable coverings;
- Sustainable construction – recycled tire granules can be used as filler for various building materials;
- Marine ecosystems – creating artificial reefs from this material, which help to create habitats, helping to solve biological diversity and ecological balance;
- Cost savings – using recycled tire granule material in new products will reduce their overall costs, as this material will be cheaper than new rubber material;
- Promotion of the circular economy - including this material in the production of new products.

## III Experiment and its results

Nowadays products made from recycled materials are becoming more and more relevant (Fig. 14). Both buyers and producers pay more attention to how environmentally friendly the product is, what resources were used in its production, whether it will be possible to recycle it.

In the conducted experiment (as part of the bachelor's thesis), recycled tire rubber material was chosen to be used in the outdoor furniture collection (Fig. 15). The offered collection products can be used both in public places - parks, near various buildings, bus stops, city squares, and also in private places - house yards, gardens, terraces. The main task of benches and decorative greenery boxes is to show that

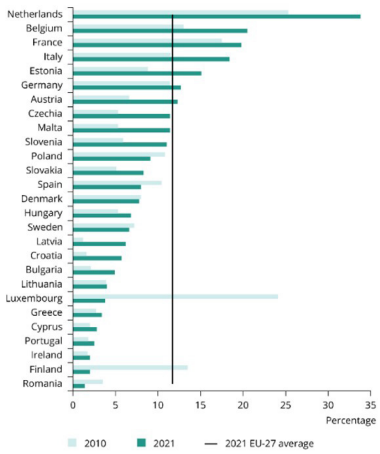


Fig. 14. Use of recycled materials in Europe in 2010 and 2021 [12]

Fig. 15. Recycled tire granules in outdoor furniture collection [*]

the material of recycled tire granules can be used not only industrially or as a covering material, but it can also be used to create various outdoor furniture, thus functionally and aesthetically complementing the surrounding environment and landscape.

As part of the work, a survey was conducted in which 76 respondents took part, the purpose of which was to find out the public's views on the necessity of tire recycling and the use of recycled materials in various products. To the survey question, "Do you think it is important to think about tire recycling and reuse of this product?" 76% said that it is definitely important to think about it (Fig. 16).

There are many potential places to place such furniture, according to the survey data, it can be concluded that people would like to see this type of product placed in public places (Fig. 17). This product could definitely conquer the landscaping market, where the main buyers would be city governments and public building owners.

The base of the bench and the greenery box are made from pressed recycled tire rubber granules, which are treated with a polyurethane binder. The products use granules in the size of 0.8-2.5 mm fractions.

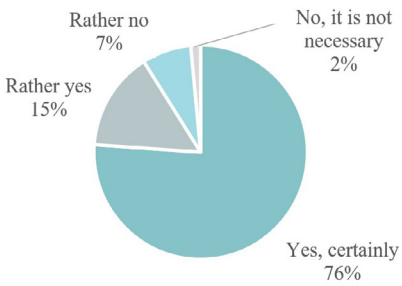


Fig. 16. Respondents' answers to the question "Do you think it is important to

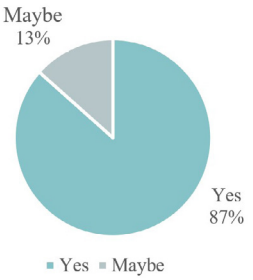


Fig. 17. Respondents' answers to the question "Would you like to see this type of product in parks, squares, near public buildings?" [*]

Fig. 18. Heat resistance testing process [*]
Fig. 19. Cold resistance testing process [*]
Fig. 20. Moisture resistance testing process [*]

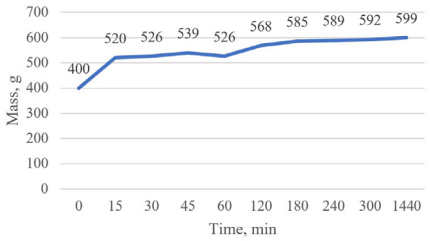


Fig. 21. Weight of pellets immersed in water versus time [*]

Rubber shapes are made by pressing recycled tire granule and polyurethane binder mass in aluminium moulds at a temperature of 125°C. Such compressed rubber forms are suitable for outdoor environments - they are resistant to moisture and adverse weather conditions. They are suitable for use in both cold and hot weather conditions, and also have high resistance to mechanical damage and are long-lasting. Such compressed granules can last for an average of 10-15 years, after their service life they can be re-ground, recycled and used as a repeated raw material.

During the materials research stage, tests were carried out with a sample of pressed recycled tire granule material. The resistance of pressed rubber granules to heat, cold and moisture was tested. To verify the heat resistance of the granules, the sample was heated and its surface temperature was measured after heating with a light cloth pressed to the surface to ensure that no stains were formed from the hot granules (Fig. 18).

The test confirmed that when the surface of the sample was heated to 41.3°C and a light cloth was pressed against it, no stains were formed, which means that this type of material is safe for use in the hot season when the material could heat up in the sun.

In order to verify the cold resistance of compressed recycled tire rubber granules, a compressed granule sample was left in the snow at -6°C for 12h. After testing, the granules could be observed to be frozen and covered with snow, but no damage was found (Fig. 19).

To observe the moisture resistance of the pressed recycled tire rubber sample, water was poured onto the sample (Fig. 20). Initially, the water remained on the surface of the rubber, but after a short time it could be observed that it slowly seeped through the rubber shape. After the test, it was concluded that the rubber granules conduct water well and act like a sponge. The absorbed water slowly flowed through the sample, as moisture could be observed underneath for a long time after the test.

The ability of pressed granules to absorb moisture was examined. A compressed rubber granule sample was weighed and placed in water, its weight was recorded at various time intervals.

After the test, it could be concluded that the weight of the rubber granule shape increased by 200g within 24 hours (Fig. 21). This factor could be influenced by the density of the compressed granules, but it can be concluded that the granules can absorb and retain water.

After the tests, it can be concluded that this type of pressed granules are well suited for various outdoor conditions, they are flexible - they do not deform when freezing and thawing.

Each product of the collection is not only aesthetically attractive, but also functional. When creating a collection of outdoor furniture, it is important to pay attention to the basic functions of each product, as well as to make them easy to read for the user. The bench fulfils its main function as a seat, its shape is a simple horizontal rectangular shape, which will ensure that this bench will be easily placed and included in any type of environment, and its height corresponds to the basic principles of seating ergonomics. The rectangular shape is designed in a suitable length so that two to three people can sit on it freely.

The greenery box is designed so that it is convenient to plant and care for decorative plants, as well as to be stable and serve well in an outdoor environment. Its shape, like that of the bench, is rectangular, but to ensure easier planting and care of plants, this shape is placed in a vertical direction, which is 24 cm higher than the seat of the bench (Fig. 22).

The shapes of the elements of the collection are consistent with each other, their sizes are designed in such a way that it is possible to place the products of the collection both together as one element and separately.

After the conducted experiment, it can be concluded that by properly using recycled tire granule material and potentially combining it with other materials already known to the public, it is possible to obtain functional, designer outdoor furniture that gives an aesthetic design to the green-blue landscape. Aesthetic design is one of the three main functions to ensure a unified spatial system in the urban environment [4]. It is also important to use new technologies in landscaping, thus developing the urban environment and offering new solutions for its improvement. The use of recycled tire granule material in outdoor landscaping facilities can serve as a new technological solution, while at the same time introducing people to this material more widely and promoting demand in the production industry of this material [3].

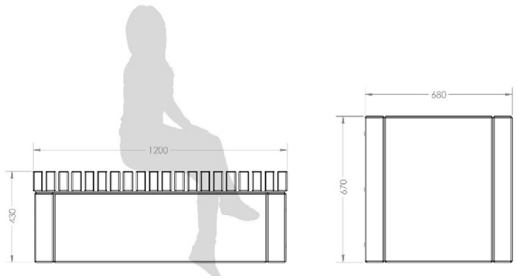


Fig. 22. Product main dimensions with user [*]

This experiment demonstrates that there is potential for wider use of this material, which would potentially create greater demand for the material by encouraging tire recycling processes to recover valuable materials, thus diverting them from recycling to energy recovery, a more inefficient use of this resource.

## Conclusions and recommendations

- The study of urban environments and landscape realities emphasizes the relevance of utilizing recycled materials in modern environmental and landscape beautification projects;
- Historically, pneumatic rubber tires have been produced since 1888, however, the recycling of rubber tires was not addressed as an issue until 1999, when the first "Landfill Directive" was adopted. During this period of time, environmental pollution from used tires is assessed and used tires are considered "waste" for the first time.
- In accordance with the first three directives, recommendations are given on how to combat waste rubber tire pollution in Europe. Thanks to the Landfill Directive (1999), tire recycling possibilities and their involvement in the circular economy were thought about.
- Tires can be included in the circular economy using the Four R scheme (Reuse, Retreating, Recycling, Recovery), which is also used for the management of used tires in Europe.
- In Europe, most of the tires produced are recycled, but only ~50% of them are recycled to recover valuable materials. In order to promote the recycling of materials, the market needs more demand for this material;
- In order to promote the demand for the material, an extended market analysis should be carried out on the use of the specific material, as well as on the products in which this material could potentially be used most successfully. The article discusses new ways of using the material.
- In percentage terms, the majority of the market segment where recycled tire granule material is used is made up of artificial grass infill, pressed objects of various shapes and coverings of sports and playgrounds.
- While the European product offering from this material is currently uniform and narrow, there is potential for wider applications.
- Exploring new ways to use the material, potentially combining it with other known materials, can result in functional and aesthetically pleasing outdoor furniture that enhances green-blue landscapes.
- The use of recycled tire granule material in outdoor environmental improvement facilities can serve as a new technological solution, while at the same time making people more familiar with this material and promoting demand in the production sector of this material.
- In the education of an architect and a landscape architect, it is important to think about competencies such as circular economy and circular design, to ensure that the future urban environment is greener and more pleasant for people, as well as that the use of sustainable materials is thought about in this sphere.

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# URBAN PRESSURE AROUND AREAS OF NATURAL HERITAGE. CENAS TĪRELIS

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**Abstract. The study looks at the perimeter or ring encroachment of anthropogenic pressures around areas of natural substrate or marshland. The anthropogenic load, the intensity of which began with the invasion of the Soviet-era economic policy and the wave of migrants bringing large numbers of migrant workers to Latvia in the 1960s-80s, brought with it an alien understanding of living space, exaggerations of the scale of development, a distorted understanding of spatial harmony and equilibrium. Rapid settlement construction, the establishment of drainage networks, the pace of collectivisation and agro-technology, and logging began. These are things that today are being increasingly controlled in the spatial plans of municipalities. To maintain the sustainable development of the natural base, it is necessary to look for ways of bringing residential areas closer to it, without reducing the ecological status. The settlements of the 3 districts of the Tīrelis of Cena are examined in more detail, where the 19th–21st centuries are described. transformation processes.**

**Keywords: natural base, anthropogenic load, spatial structure, multi-storey residential development**

## Introduction

The study covers issues that are becoming increasingly topical as the pressures of urbanisation draw closer to both the natural substrate and the historic cultural space. This is most evident in the impact of metropolitan agglomeration, with the emergence of a number of settlements or so-called satellites with their own infrastructure and public space character, and which have an undeniably strong prospective development prognosis. The study therefore draws attention to the search for a balance in the development plans of municipalities, so as not to undermine the identity of the area and its sustainability [2]. A striking example is the Cenas Tīrelis and the Black Lake marsh, which are in close proximity to the Riga agglomeration and whose eastern edge is being increasingly encroached upon by the 20th/21st-century development of the Cenas Tīrelis and the Black Lake marsh. The area is also the site of a number of new and growing anthropogenic developments, such as residential areas, and industrial and warehousing zones, including peat extraction in the marsh. Undeniably, the area of Tīrelis can successfully serve as a recreational area (bog footbridges, berry picking, mushroom picking, flora identification, etc.), creating the so-called urban or urban forest character [4].

During the Duchy of Courland in the 17th/18th centuries. In the 17th century and 17th century of Courland, land roads with several churches, small manor houses and roadside inns developed around the Tīrelis marsh of Cena. The spires of the historic churches were still visible as vertical dominants in long sight lines in the 1950s/1960s. In the post-war years of the 1970s/1980s, as the intensity of development increased, new buildings encroached more closely on the cultural space, obscuring the dominance of the historic buildings.

The study aims to reflect on the 20th/21st century. The development of the urban load alongside the natural base area.

Research objectives:

- suppression of the visual expression of cultural and historical values along the outer edge of Tīrelis (old roadside trees, churches with cemeteries and parsonages, taverns, memorials of the fallen in the Freedom Struggle);
- studying the increase in density and intensity of high-rise buildings;
- the retreat as an educational space (marsh boardwalks, recreation, educational places), with the emergence of urban (city) forests "entering" the urban space;
- the search for cultural and historical space and the context of the uniqueness of Tīrelis – as emotionally powerful criteria (swamp wells, sand dunes, pine forest, woodland, church silhouettes);
- transformation processes and visual-aesthetic quality.

The study uses a comparative method, based on research of archives and historical documentation. It also uses a photographic method and takes into account the main sight lines and points in the existing situation. The graphic method provides additional information for a more in-depth presentation of the issues.

The relevance of the topic covered in the study is related to the intense rate of new low-rise housing developments, which are approaching the Tīrelis areas or Natura 2000 uniqueness. As the quality of life and comfort of the population increase, there is a growing desire to live closer to nature [3]. The proximity of the sea, the marsh boardwalks, berry picking, mushroom picking, moving away from the emotional everyday rush of the big city.

The research work is related to the search for harmony and synthesis and includes the characteristics of the natural substrate, the development opportunities of urban forests and the contextualisation of

settlement infrastructure. The above is addressed by selecting the Cenas Tīrelis area, which is located 2km from the low-rise buildings of Jaunmārupe, Babīte and Olaine and 3km from Riga Airport.

"The urban forest is a natural or man-made ecosystem in all its stages of development, and whose current potential tree canopy projection is at least 20% of the area covered by the stand. Forest serves as public open space within and outside the urban administrative boundaries of cities in an urban environment where the primary social and environmental functions require regular maintenance and restoration, preserving or enhancing the social, aesthetic, cultural, historical and economic value of the area' [4].

These include Natura 2000 sites, managed by the state or municipality, and are popular recreational areas, blue-green structures, and specially designed infrastructure. This also includes the Cenas Tirelis and the adjacent Black Lake Marsh.

The assessment of landscape change processes under mod-

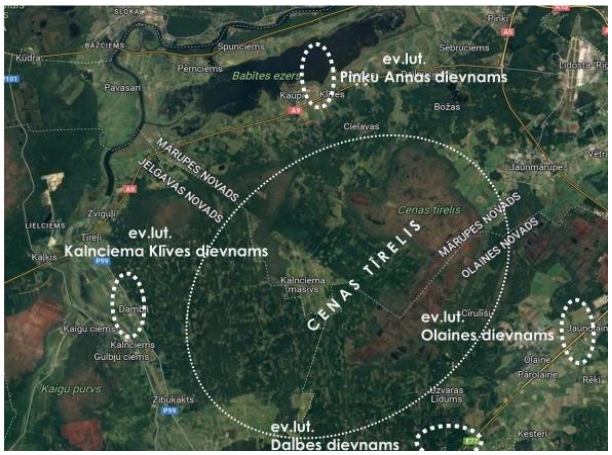


Fig. 1. Cenas Tīrelis with perimetral sacred landscape [authors' scheme]

ern anthropogenic pressures is related to several functions: social, environmental education, nature conservation, aesthetic, economic, and emotional well-being criteria definition [4].

## Materials and Methods

The transformation processes in the landscape, as mentioned above, around Cenas Tīreli in the 17th century. The land roads along the Lielupe River to the sea and to Riga, bypassing the marshland along its western and northern sides, began to form in the 17th century.

Nowadays, after the administrative-territorial reform, Tīrelis is located in 3 municipalities – Olaine, Mārupe and Jelgava. This imposes a serious task on these municipalities to maintain the load of balance brought by the 21st century. Urbanisation processes. The eastern part of the Tīrelis territory is located in close proximity to the Riga agglomeration, which creates a rapid rhythm of economic pulsation. Tīrelis is located between 3 national motorways – N-S direction Jelgava – Kalnciems, D-DA direction Jelgava–Rīga road, R-A direction Liepāja – Rīga road.

In the early 20th century, the location of places of worship was important for rural people. Christianity as the most important thing in a person's life The distance to the church meant the distance to be travelled every Sunday to worship. Especially in winter, on a sledge path across a frozen bog. Our daily life and our relationship with sacred values have changed over the centuries.

In the northern part of the Tirelis of Cena - St. Anne's Church of Pinki (second half of the 19th century, architect J.D.Felsko) (15). With the construction of the new Liepāja highway, the historical sight lines have been lost, as they are covered by dune vegetation. A modern office building has been built just a few dozen metres from the altar. The picturesque avenue of historic trees in the northern part of the dune is not visible. A fragment of the old Liepāja road with its large trees along the rectory and the part of the park with the Dzilnupīte River has been preserved. The farmsteads have been replaced by dense detached housing.

On the eastern edge of the Cena Tīrelis – St. Elizabetes Ev.lutė Church (18th century, architect J.H.Giterboks). After the war, the church lost the elegance of its bell tower spire. A dense housing estate has developed around the church and the old trees. The site of the historic dirt road is preserved by some 200–250-year-old oaks, lindens and larches.

On the southern edge of Tīrelis – Dalbe church (mid-19th century; arch.N.Gusevičs) – preserves the historically spatial character of a rural church with a cemetery.

On the western edge – Kalnciema Klieve Evangelical Lutheran Church (19th century; arch.E.J.Strauss) with the burial place of

Fig. 2. The old dirt road to Riga along the Olaine church
Fig. 3. The silhouette of the Olaine church at the beginning of the 20th century

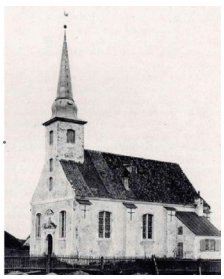

Fig. 4. Kalnciema-Klīve Lutheran Church with cemetery field for German soldiers
Fig. 5. Olaine church 19th/20th century [Rundāle Palace Museum]

Fig. 6. St.Anne's Ev.lut. Pinki Church [15]
Fig. 7. Ev.lut.Dalbe Church [https://www.visit.jelgava.lv/lv/apskates- objects/churches-and-monasteries/item/158-dalbes-luther-an-church]

Fig. 8. Victory Pike. Establishment of a ditch system for clearing fields in the 1930s 20th century
Fig. 9. Victory Pike. Ditching through the forest in the 20th century 1930s


Fig. 10. Victory Pike. "Silenieki" houses, 1930 [https://www.lsm.lv/uz-varas-lidums#rec665404277]

Fig. 11. Victory Pike. "Līdumnieki" houses, 2023 [https://www.lsm.lv/uz-varas-lidums#rec665404277

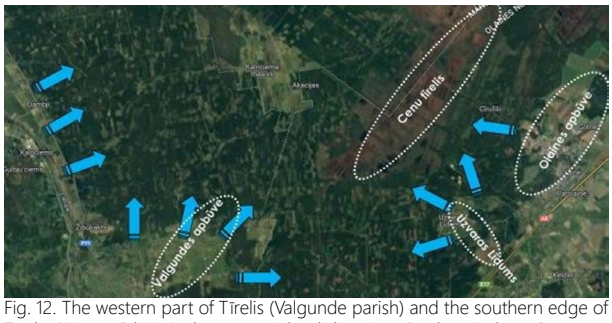

Fig. 12. The western part of Tīrelis (Valgunde parish) and the southern edge of Tīrelis (Victory Pike). Anthropogenic load directions [authors' scheme]

German soldiers killed in World War I.

The urban load in the area of Tīrelis bog dates back to 1936, when the "excavation" of the southern edge of the bog began. The First Free State of Latvia, after the Freedom Struggle, was distributing land to new farmers. Many Latvians wanted land and there was not enough of it, so part of the marshland was cleared. One of them is the above-mentioned Tīreļa bog. The recovered land was called Victory Pike, which was intended for a typical rural settlement of 250 hectares. "The land was deforested for 16 medium-sized model farms and one forester's house. First, trees and shrubs were cut down, stumps were broken, and then 160 workers cut down the firewood trees and left them for the next owners. After that, 70 men dug a drain by hand, which led the swamp water to the Misa River. The main channel was a grandiose 3.5 metres deep and 11 metres wide, in an overgrown marshy area. A considerable amount of money was spent on deforestation and drainage system. It was estimated that the vast Riga-Jelgava marsh area, covering about 300 km2, could yield about 260 million tonnes of dry peat. This bulk could provide Riga with 100 years of fuel material. There is a lot of unusable land that can be turned into fertile and flowering wastelands or forests. Cultivation of unsuitable land will provide work and bread for many new farms, and this will be a blessing for the whole Latvian nation" [5]. Today, in order to ensure quality management of the Tīrelis forest, the so-called Church stiga has been created alongside the forest area on the western edge of the Victory Pike, which forms an emotionally powerful link between two cultural and historical spaces – the Dalbe church and the historic village area. The south-eastern edge of the Tīrelis is spatially closed by the road and the railway Jelgava–Rīga. The historical dirt road to Riga existed until the 19th century. It was located away from the southern edge of Tīrelis. This is evidenced by the old roadside trees as the road passes closely by the Evangelical Lutheran church of Olaine (St. Evangelical Lutheran Olei - German). The church was built on a sand dune and could be seen from a distance. In 1830–1857, the new Riga-Yelgau dirt road was built through Olaine with a horse post station. In 1868, during the Russian Governorate, the Riga-Jelgava railway line was built, which served the Germans particularly well during World War I, while the adjacent Cenas Tirelis guarded the Latvian Riflemen's defence line during the Battle of Freedom. Two important trade arteries, the highway and the railway, which united with Western Europe, brought new stigas, alleys, rows of trees, bridges and view lines to the churches. On the western edge of the Tirelis, the Evangelical Lutheran Kalnciema-Klīve Church has preserved its historic sacred landscape.

## Results and Discussion

When studying the territory of Tīrelis in more detail, the part of Tīrelis belonging to each municipality differs both in its geomorphological structure and in the intensity of the anthropogenic pressure, which was most pronounced in the 1960s-1980s under the influence of the state economic policy. Several areas of anthropogenic pressure can therefore be mentioned around the perimeter of Tirelis: In the west, the village of Valgunde, which developed as a collective farm centre with agricultural tendencies; In the south, the Victory Pike, with the development of agroindustry and forestry; To the east – Olaine urban area with high-rise residential buildings and a strong industrial area; to the north – several detached housing areas belonging to Mārupe and Babīte parishes, as well as the construction of the new Liepāja-Riga motorway, which created several sand quarry sites in the immediate vicinity, digging up sand dunes. Each of these areas has a different origin, intensity and spatial composition in the 1960s–1980s. However, they all share a perimeter around Tīrelis and its characteristic natural features of the substrate – early frosts in autumn, late frosts in spring, high humidity, freezing air in summer, soil with high acidity, low fertility in the sand dune zone, differences in relief.

### Western edge of Tyre

The western edge of the Tīrelis is covered by the Langer Wald forest belt, which runs parallel to the Lielupe riverbed and connects the Zālīte forest massif with the Ķemeri Tīrelis forest (Langer Wald - German). Part of the territory belongs to Jelgava County, which is occupied by Valgunde Parish with about 1.6 thousand inhabitants. The municipality has 6.6 inhabitants. It is a lowland of the Seaside and lies 3–4 m above sea level. The parish is dominated by sandy plains, but there are also some dunes and dune ridges. The highest point in the municipality is Ložmetējkalns – 33 metres above sea level. In general, the parish has a rather large variety of landforms. The southern part is very flat, there are no large hills or elevations – a typical Zemgale landscape. The northern part is rich in dunes, dune ridges, hills and elevations. The municipality has peat reserves, some of which are exploited industrially. The forest areas are of great value. The forests are mainly pine – 70 %, birch – 25 %, spruce – a little. Valgunde village as a settlement was formed by the establishment of a kohoz in the 1950s with wide streets and ditches, and fragmentary tree plantations. There are also drainage ditches connected to the Tīrelis forests. The village of Valgunde is linked to the nearby former Tirelli Forest. The village of Valgunde is close to the nearby Valgunde Manor (Volllgut;Wolgunt – German) on the banks of the Lielupe River. The spatial composition of the village is based on an axis which is linked to the site of the former manor house on the banks of the Lielupe, thus forming a distinct perpendicular to the shoreline. It is the central street of the village, which forms a distinctive blue/green spine of the development, connecting the Lielupe River with the Tīrelis woodland [13].

### South-eastern area of Tyre

The south-eastern edge of the Tīrelis is the strongest anthropogenic pressure because in the 20th century, the Tīrelis was under the influence of the sea. In the 1960s–1970s, the construction of Olaine began, creating a Soviet-era exaggerated scale of typical reinforced concrete buildings and the intensity of industrial areas. Olaine has its origins as a small settlement of peat diggers with few buildings. This can be attributed to the adjacent 19th century 1960s–1980s: a railway and an earth road, enabling the onward transport of peat briquettes. The Tīrelis area contains rich peat layers and in 1939 the peat industry began to develop in earnest, with workers employed on the bog and in the peat briquette factory [8]. In 1940, the first apartment house was built on an empty site for the Tīrelis peat diggers during the first Latvian Free State, to serve the needs of the peat factory. The two-storey stone house with stove heating and comfortable rooms. It is the only building that has survived to the present day, renovated and has in-



Fig. 13. Olaine peat factory workers' village barracks, 1951 [OVMM archive]
Fig. 14. Village street near barracks and some trees, 1951 [OVMM archive]

Fig. 15. The western edge of Tīrel with the Lielupe floodplain and the long axis of Valgunde Manor [authors' scheme]



Fig. 16. Multi-storey residential buildings in Stacijas Street, 1971 [OVMM archive]
Fig. 17. Typical school building in T. Zeiferta Street, 1970s [OVMM archive]


Fig. 18. Gastronomy shop Zemgale street 1970s [OVMM archive]
Fig. 19. Cinema building 1970s [OVMM archive]



Fig. 20. Meadow between Tīrelis forest and railway, 1970 [OVMM archive]
Fig. 21. High-rise residential development in the former meadow area, 2022 [photo by authors]



Fig. 22. Construction of a treatment plant at Tīrelis Forest, 1970s [OVMM archive]
Fig. 23.High-rise residential development, 1990s [OVMM archive]

dustrial heritage value. The name of the street, Kūdras Street, and several old buildings exist today as historical evidence. Between July 1940 and June 1941, several barrack-type buildings were built for the workers in the peat bog. In the post-war years from the 1950s onwards, the transformation of the Olaine landscape began a rapid urbanisation process, which was continued by a large-scale industrialisation process. In 1949, after the deportation of the population and the wave of migration of the eastern peoples, an alien understanding of living space flowed in. The construction of sleeping barracks developed. The small buildings housed at least 40 people with a shared kitchen, dry toilet and narrow beds. Even larger numbers of Soviet citizens were brought in to build the city and later to work in the factories. According to the 2021 census, out of a total population of 10 324, 4 312 (41.8 %) Russians, 4 126 (40) Latvians and 1 886 (18.2 %) other nationalities lived in the city.

From 1956 to 1960, 2-storey apartment houses were built in Olaine along Kūdras Street and Zemgales Street. The intensity of the industrial load a l s o contributed to the pace and quantity, rather than the quality, of residential development. Peat briquettes as fuel material for war-torn Latvian towns were a very important contribution and support to Latvia's industrial development. Today, it is an industrial heritage story for the city. In the 1950s, Olaine was home to the glue and gelatine factories, a prison with prisoner employment, and the chemical and pharmaceutical industries. The level of ecological balance of the natural substrate, the Cena Tīrelis, was a secondary concern in the post-war years. The historic 2-storey buildings of Zemgales Street are still legible today, as they preserve the character of the old workers' village: the simplified form of the buildings with shuttered windows, the symmetrical position of the external doors, the giant chimneys, the inner courtyard, the parallelism of the buildings. The street structure does not show avenues or rows of trees (lindens, oaks), which was an important criterion in urban planning. Only individual birch trees are visible. This is a good description of the Soviet-era tendencies in urban planning and the introduction of a foreign mentality in Latvia after the deportations of the population in the 1950s.

Scale and intensity of population Olaine is characterised by modified natural landscapes: a typical urban landscape of high-rise residential and industrial areas, a road scape, a forest and marsh landscape, peat quarry sites, some of which have been adapted for small gardens, a marsh ditch adapted for an urban canal with a green belt. The above clearly demonstrates the development of anthropogenic pressures. However, it is also possible to obtain feedback by bringing the 'blue' veining of the Tyrel (small marsh streams and ditches) into the urban space and giving it an aesthetically high-quality appearance. Olaine's infrastructure forms part of the Riga outer urban agglomeration area. By encouraging the urban development to have the character of a forest park, such a blue/green urban character can create a very strong upward trend in demand for residential space in the vicinity of Riga.

In the 1960s–1970s, the city's buildings included typical 5-storey, 9-storey residential buildings, kindergartens and schools, a cinema, a department store, a hospital. The proximity to Riga encouraged the development of industrial areas, with buildings encroaching into the approximately 1km of the Tīrelis forest. The proximity of the new Riga airport and the metropolitan infrastructure in the 1960s-1980s contributed to the expansion of the areas towards the conservation area [1]. Growing chemical plants increased the demand for workers, resulting in a population increase of 2000 between 1965 and 1967, and 11 apartment blocks were built in the new town within two years [6]. The further development of the town was closely linked to the development of the factories. It was natural that the construction of the town continued on the higher ground - the narrow strip of land along the Riga–Jelgava railway line. It was not possible to build towards the factories because it was necessary to leave a 'green belt' between the factories and the residential area [11; 12]. In the 1960s-1980s, as residential housing developed, the areas of small gardens grew, providing food for the city's industrial workers. The existing bed of the Olaine River became a nuisance for the rapid multi-storey residential development, so its underground bed was fragmented. The river was giv-

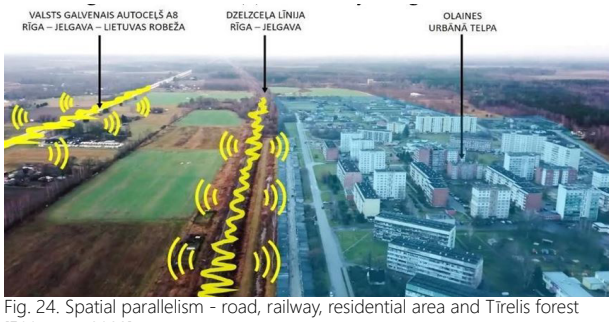


Fig. 24. Spatial parallelism - road, railway, residential area and Tīrelis forest [E.Vanaga, 2022]

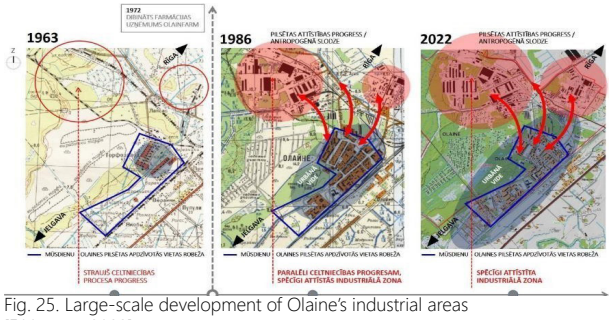


Fig. 25. Large-scale development of Olaine's industrial areas [E.Vanaga, 2022]


Fig. 26. Transformation processes of the Olaine river - an urban canal [E.Vanaga, 2022]

Fig. 27. Olaine river - an urban canal, 1970s [OVMM archive]

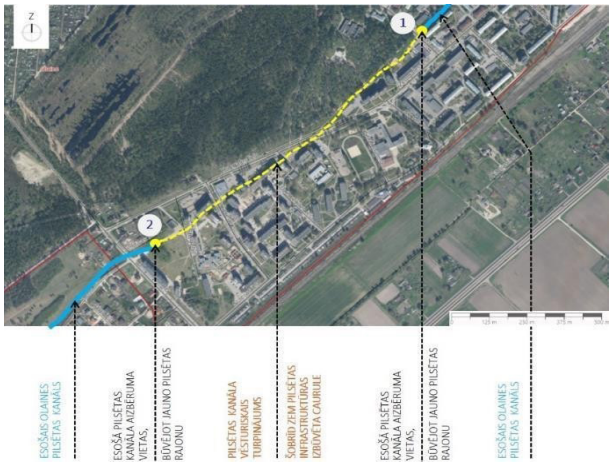


Fig. 28. Transformation of the Olaine river - city canal [E.Vanaga, 2022]


Fig. 29. Olaine river - city canal in nowadays [E.Vanaga, 2022]

Fig. 31. Tīrelis wetlands [https://www.rigasmezi.lv/lv/mezi/par_meziem/facts_/

en a concrete bank, visually resembling an urban canal [7], crossed by bridges.

Geomorphologically, the relief of Olaine is formed by the accumulation plains of the Baltic Ice Lake. The flat relief is interrupted in some places by dunes, which are reinforced with forests. As the ridges of the dunes obstruct the water runoff, marshes have developed on the plain. The 170 ha Bluķu bog is located close to the town. A separate feature of Olaine's blue-green structure is the city centre drain, which is further fed into a closed collector. In most parts of the area, runoff conditions are difficult and the ground is waterlogged, and raised bogs are widespread. In the northern part of the town there are swamp forests with their characteristic zones – reedbeds, swamp forests. Forests cover 31 % of the city territory The most biologically valuable forest is the forest stand directly adjacent to the industrial zone next to the factory A/S "Olainfarm". A small fragment of pine forest has preserved its natural structure and a plant species listed in the Latvian Red Data Book, the annual milfoil (Lycopodium annotinum), has been found there. The species is also listed in the Baltic Red Data Book. The Olaine municipality spatial development plan states that "Cenas Tīrelis and the adjacent Black Lake Marsh are two Natura2000 sites – as specially protected nature areas. The natural values of the nature reserve – although part of the bog is used for peat extraction, the area is of outstanding importance for the protection of raised bogs, transitional bogs and dystrophic lakes. It is one of the few bogs in Latvia that has characteristics of both eastern (Betula nana, Chamaedaphne calyculata) and western (Trichophorum caespitosum) bog types. The area is also important for bird conservation, with 10 bird species protected in Latvia and Europe. According to the nature conservation plan, the greatest natural value of the area is the low human impact raised bog with transitional bog fragments, which includes ecologically diverse elements of the spatial structure of the landscape – swamp forests, bog lamas and acacia, open bog or moorland. Small areas are covered by scrub, forest stiles and roads, and ditches of various sizes. Due to the established drainage network and contour ditches, the natural contact zones between marsh and forest, or marsh and meadow, are practically non-existent. The drainage ditches, which drain large quantities of water, alter the natural hydrological regime, which has a significant impact on wetland habitats and reduces their biological value. Such undesirable changes may threaten the sustainable existence of the wet-

land complex. The nature management plan also mentions human traffic as a factor affecting the site, as the site is relatively close to populated areas, including Olaine, and the site is well accessible, which poses a potential threat to the more sensitive habitats and species (by scattering, disturbing birds) that are located within the nature reserve. The anthropogenic pressure can be reduced with the installation of appropriate infrastructure and regular management, as the area is widely used as a place for recreation, berry picking and mushroom picking. The existence of a fire risk due to peat extraction in the vicinity is also mentioned as a hazard [11; 12].

## Conclusions

Nature conservation plans, site management measures, nature reserves, development of recreational infrastructure are important criteria for balancing natural areas with adjacent urbanisation processes. The study area – Cenas Tīrelis and its adjacent areas – is very intensively filled with information which is only partially known. The site is located near the Riga agglomeration. Olaine has historically existed as a rural settlement with a few farmsteads on the edge of the marshland. In the post-war years of the 1970s, rapidly losing its scale and identity, prefabricated concrete panel housing entered the vacant territory, the courtyards of which were designed with exaggerated asphalt concrete pavements – passable, draughty, without trees, shrubs and compositional elegance. The picturesque coniferous forest adjacent to the urban space of Olaine forms a strong expression of the green structure. The forest has a marshy character with small ditches and tussocks. This provides an opportunity to bring or continue the wedge-like character of the natural substrate into the urban space, with a compositional play of blue-green structure.

- The western edge of Tīrelis, where the compositional-spatial axis of the Valgunde village is located, connecting Tīrelis forest and the Lielupe river bed at the former site of the village of Tīrelis. The area between the Valgunde River and the Valgunde River, which connects the Valgunde River with the Valgunde River, the Valgunde River and the Valgunde River, provides an opportunity to improve the level of visual and aesthetic quality and to create a continuation of the natural base and urban space between the Lielupe River, the western edge of the Tirelis Forest and the adjacent Ķemeri Tirelis Forest.
- The south-eastern edge of the Tirelis, which is characterised by a high density of development for the town of Olaine, creates an opportunity to create an urban forest, respecting the Natura 2000 criteria. The marsh footpaths (4 km), observation towers and outdoor terraces for educational conferences raise the awareness of the population about the importance of green areas for the quality of life of the urban population.
- Prices for the Northern edge of the Tyrol in the 21st-century beginning of the 21st century. In the first half of the 21st century, detached housing areas have developed in the territories of Babīte and Mārupe municipalities, with a spatial structure of high aesthetic quality, incorporating flat areas, hills and pine overgrowth in dune areas. The compatibility of the architectural form of the streets and buildings of the villages, which are plastically solved, is to be assessed positively.
- As one of the strong elements of the natural base, Cenas Tīrelis encourages people to connect more closely with nature - walking footbridges, bird-watching towers, a reflection of the historical sites of the Battle of Freedom - trenches, blinds, drape fencing scissors; industrial-technological cognition - peat extraction, peat pans; observation of natural phenomena - frost, fog, snowfalls, spring floods, summer wetlands, peculiarities of tree species in forest forests, bird migration, etc.).
- Very careful consideration must be given to sight lines to ensure that the dominant features of the historic buildings are not lost. This is especially true for the sacred landscape with cemeteries and old roadside trees.

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# ORIENTATION OF MONUMENTAL DECORATIVE SCULPTURE IN URBAN SPACE

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**Abstract. This article examines and analyzes the main characteristic features of the relationship between sculpture and the external urban environment, the essence of which is the principle of its perception in certain locations, taking into account the orientation – the angles of perception of a specific sculptural composition that is projected in the urban space. The peculiarities of the orientation of monumental-decorative sculpture in architectural space are investigated. An analysis of the patterns was carried out (using real examples) and the probable directions of perception of the expressive silhouette of the sculpture were determined both in typical and in special spatial situations of the urban environment. Directions and points of view are identified, the totality of which constitutes the zones of perception of the sculptural composition depending on the specific spatial situation, which is based on a system of classifications of the external urban environment.**

**Based on the results obtained during the study, the types of perception of the expressive silhouette of monumental and decorative sculpture are systematized and formulated, taking into account the main and additional zones, points and directions: circular perception in closed space and open space, frontal perception in half-closed space and half-open space, frontal perception in corner space, and frontal-bilateral perception in transit space. As a result of the study, a method was developed for determining the types of perception of sculpture, taking into account its orientation and relationship with the layout of urban space. The advantage of this method is the ability to identify in advance (at the modeling and design stage) the directions of the main, additional zones and observation points of the expressive silhouette of monumental and decorative sculpture of any genre and type in urban space.**

**The proposed method for determining the types of perception of the most expressive silhouettes of sculptural compositions will help to more effectively model, design and install monumental and decorative sculptures, taking into account specific spatial situations and features of the urban environment.**

**Keywords: orientation of sculptural composition, types of perception of monumental and decorative sculpture**

## Introduction

For sculptural compositions, the architectural environment forms a variety of spatial features of perception, which depend on a certain type of space. Monumental and decorative sculpture in the urban environment always involves the correction and enhancement of the clarity of the silhouette, not only through its generalization, but also through its most active expression, which should always be taken into account in the main directions, in the main and additional zones of perception.

Based on the conditions of the relationship between monumental and decorative sculpture and the space of the architectural environment, special means of expressing sculptural compositions are established, taking into account certain directions, zones and points of perception of volumetric form, which depend on the specific conditions of its placement in the environment and the type of public urban space. Despite the fact that the term "round" sculpture implies the perception of a three-dimensional form evenly from all angles, in reality and in most cases, sculptural plastic of such a compositional type is not designed for equally uniform perception from all sides. This is one of the pressing problems (especially recently), which is often not taken into account by designers and sculptors working on "linking" a certain sculptural composition to a specific architectural environment with its own special conditions.

Today, theoretical studies highlight various aspects of the general relationship between monumental and decorative sculpture and architectural space, where practical and aesthetic problems, functional and psychological ways of integrating sculpture into urban space, the perception of the synthesis of sculptural art and the park environment, methods of forming architectural space with works of art are analyzed [5; 7; 8; 23; 24]. Researchers are studying ways to place monumental and decorative sculpture in urban space from the standpoint of the quality of public areas by introducing monumental and decorative sculpture into city space, where the spatial and social role of sculpture in the urban environment is analyzed [13; 14]. The experience of establishing new spatial configurations in changing urban conditions through the design of sculptural complexes is also studied, the processes of combining sculpture and architectural space are identified, based on the unique ability of plastic objects to transform the urban environment and organically live in it [15; 18; 25]. In the aspect of the general perception of three-dimensional objects in space, there are studies, the results of which demonstrate the desire to maximize the perception of an object in a space with several observation zones, where there is a preference for installing a sculptural object with a high degree of perception, in one of the best possible directions [3; 6; 11; 12; 19; 27]. Scientific works on the perception of the expressive silhouette of monumental and decorative sculpture in urban space examine the patterns of generalization of the silhouette of sculptural compositions in the aspect of the relationship of plastic objects with open public space [21; 22].

In the process of creating and constructing a sculptural composition in a real environment, the psychology of perception of a three-dimensional form is of great importance, the process of observing which is a holistic perception of the totality of the silhouettes of a given sculpture in combination with many angles of its observation [6]. One of the most interesting problems in the psychology of the perception of three-dimensional form is the relationship between the nature of the form and the choice of the most favorable points of view. It is the nature of the form of the sculptural composition that dictates the choice of the best points of view [1]. But an even more difficult problem is the design and creation of a sculptural composition in practice, taking into account the real

perspectives of perception that have developed and depend on the specific conditions of the spatial situation – the type of space according to spatial features.

Accordingly, we can state the scientific interest of this topic and its relevance. The studied material in the context of this topic shows that today there is no comprehensive study of the relationship between architectural space and monumental and decorative sculpture, taking into account its orientation in the urban environment, namely, the likely directions of perception of the expressive silhouette of a sculptural composition of various types and genres.

That is why it is important to study the issues of perception of sculpture in the context of urban space in order to obtain the necessary results that can be applied in the design of sculptural compositions in the urban environment.

**Aim of the research** is to develop an effective method for the orientation of sculpture and its relationship with the layout of urban space – to determine the main types of perception of the expressive silhouette of monumental and decorative sculpture in typical and special spatial situations of the urban environment.

## Materials and Methods

For an integrated approach to the study, in order to systematize and generalize it, as well as to determine the relationship between the orientation of monumental and decorative sculpture and the type of architectural space, a structural analysis of the existing modern theoretical and practical material was carried out: literary sources; visual sources (monumental and decorative sculpture in the urban environment, maps – plans, master plans) [9]. The following methods were used for this purpose: 1) the experimental method (plein air studies, photography); 2) analysis of practical material (determining the relationship between the directions and silhouettes of the sculpture); 3) the structural method (structuring, determining the main and additional zones of perception); 4) the method of systematization (summarizing practical material, defining and formulating the main types of perception).

At the initial stage, plein air studies were conducted using photographic recording to address the research objectives. Based on plein air studies, research, and photographic evidence concerning the characteristics of perceiving the silhouettes of realized sculptural compositions, confirmations were obtained. These confirmations are grounded in the factors of optimal visual (physiological) and psychological perception of the realized monumental sculptural composition from various points of observation (Figure 1).

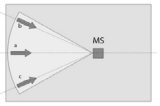
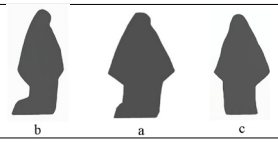
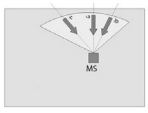
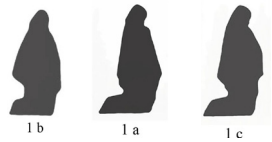
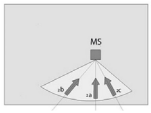
After conducting plein air experimental observations, studying and recording the main and additional directions, zones, and points of perception of the sculpture's silhouette, an analysis of practical material on silhouette perception was carried out based on the example of a realized monumental sculpture composition. A visual table was developed TABLE 1.

Analysis of practical material, taking into account this type of sculpture in a specific spatial situation, made it possible to identify and structure the main zones of perception:

1. The main zone of perception, which accommodates: the main point of the main direction – (a); additional point of additional direction – (b); additional point of additional direction – (c).
2. Additional perception zone (1), which accommodates: the main point of the main direction – (1a); additional point of additional direction – (1b); additional point of additional direction – (1c).
3. Additional perception zone (2), which accommodates: the main point of the main direction – (2a); additional point of additional direction – (2b); additional point of additional direction – (2c).

Fig. 1. "Monument to the employees of the Ministry of Internal Affairs of Ukraine", sculptor Chepelyk V.A., Ukraine, Kyiv, 1997 [author's photo]

Table 1. Comparative analysis of the perception of the expressive silhouette of monumental and decorative sculpture [created by authors]

| Perceptual zones | Directions and zones of perception (plan-scheme) | Perception silhouette |
|---|---|---|
| Main zone |  |  b a c |
| Additional zone 1 |  |  1 b 1 a 1 c |
| Additional zone 2 |  |  2 b 2 a 2 c |

Analyzing and comparing the schematic images of silhouettes created on the basis of natural shooting by a camera from each 9 points and directions indicated by letters determined the most favorable point of perception of the expressiveness of this image (grieving, kneeling) of the sculptural composition – the main point of the main direction main area of perception (a). The silhouettes of the main points of the main directions of the two additional zones of perception also remain expressive (1a, 2a). But, taking into account the genre (the human figure), the sculptural composition required a clear orientation in this space – the position of the woman's figure, which is oriented to the main axis of the square (perpendicular to Povitroflotsky Avenue in Kiev) and turned towards the larger part (ceremonial zone) of the square, which coincides with the most favorable main point of the main direction of the main perception zone – (a) (Figure 2).

Despite the fact that the sculptural composition has a full volume, stands freely in space and has the possibility of a circular view, it is not designed for perception from all sides. A slight displacement of the composition into the depth of space creates the impression of an "invitation" to the square, dividing it into two parts that are different in function and size. The analysis of the silhouettes of perception depicted in the table (TABLE 1) showed that the most expressive in all three zones are the silhouettes that are perceived in the main directions indicated by letters – (a, 1a, 2a). From all other directions of perception, the silhouettes of this sculptural com-

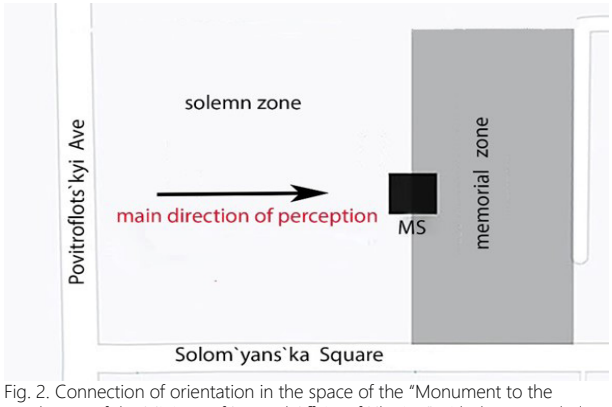



Fig. 2. Connection of orientation in the space of the "Monument to the employees of the Ministry of Internal Affairs of Ukraine" with the general plan of the city of Kyiv [10]

Fig. 3. "Monument to the founders of Kyiv", 1982. Sculptor V. Boroday, Kyiv, Ukraine [17]

Table 2. Comparative analysis of the perception of the expressive silhouette of monumental and decorative sculpture [created by authors]

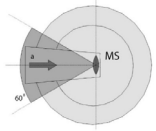
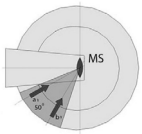
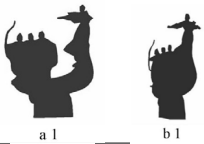
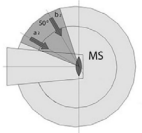
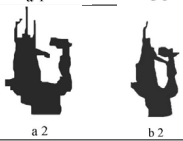
| Perceptual zones | Directions and zones of perception (plan-scheme) | Perception silhouette |
|---|---|---|
| Main zone (60˚) |  |  |
| Additional zone 1 (50˚) |  |  |
| Additional zone 2 (50˚) |  |  |

Table note 2: (MS) – monumental sculpture; (a), (a1, b1), (a2, b2) – directions of perception and their corresponding silhouettes.

position came to light as secondary and not expressive for the perception of the recognizable image of the monument. The author of the monument, studying and taking into account the specific conditions of space, for the most expressive perception in a real spatial situation, more actively calculated and worked on the silhouettes of the sculpture in the main directions of the identified perception zones (a, 1a, 2a), it was these contours of the model that were corrected at the stage of the draft design. Therefore, as a result of examining this monument, attention is fixed primarily on the main direction of the main zone of perception, gradually transferring attention to additional zones.

To consolidate the results of the experiment, plein air observations were carried out using photographic recording using the example of a multi-figure sculptural composition (Figure 3).

Based on the results of experimental observations and photographic recording, and identification of the main and additional zones and directions of sculpture perception, an analysis of this practical material was conducted using a multi-figure monumental sculptural composition installed in the city as an example. A visual table has been developed to indicate the main perception zones in degrees (Table 2).

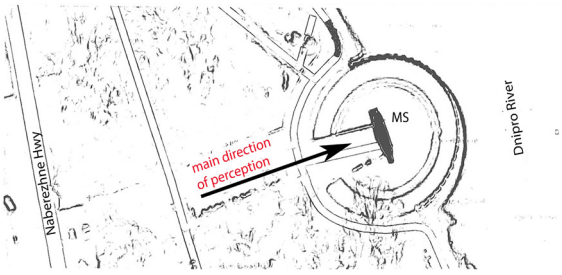



Fig. 4. The relationship of orientation in the space of the "Monument to the Founders of Kyiv" with the general plan of the city of Kyiv [10]

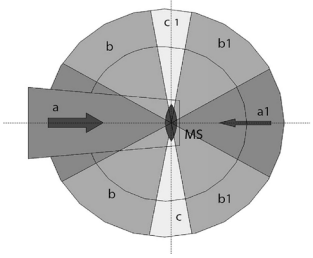



Fig. 5. Determination of the main (a, a1) directions of perception, additional (b, b1) and "blind" (c, c1) zones

In each of the 5 directions, indicated by letters, schematic images of silhouettes made on the basis of outdoor photography are analyzed and compared. As a result of the analysis of this practical material, taking into account the features of a multi-figure sculptural composition in a certain spatial situation, the main zones of perception are identified and structured with an approximate indication of degrees:

1. Main perception area (60˚), which contains: the main direction and the point of perception – (a).
2. Additional zone of perception 1 (50˚), which contains: the main direction and the point of perception – (a1); additional direction and point of perception – (b1).
3. Additional zone of perception 2 (50˚), which contains: the main direction and the point of perception – (a2); additional direction and point of perception – (b2).

The most favorable direction of perception of the expressiveness of the silhouette of a monumental sculpture is the main direction – (a), the main zone of perception, which is about 60˚. From this direction, monumental sculpture has the most recognizable image of a well-known composition. That is why the main direction of the main perception zone coincides with the planning basis of the city and the main direction of approach to the monument from the side of the Naberezhnye Highway (Figure 4).

Also, quite expressive is the silhouette from the main direction of the additional zone (1) the point of perception – (a1). Despite the fact that noticeable changes in the proportions of the composition can be traced from this direction, it still remains quite recognizable, although some details (figures) have already been combined into one whole mass, the main details of the composition are still quite recognizable – the contours of the boat, figures and waves. In the direction of the additional zone (1) the point of perception – (b1) there is a fundamental change in the proportions of the composition: the merging and unification into one mass of all the main details of the monument, which are no longer recognizable by silhouette, except for a separate female figure in the foreground. The hull of the boat in this perspective has

completely lost its expressiveness and a significant distance between the figures completely disappears. Observation of the silhouette of the composition in the direction of the additional zone (2) of the point of perception – (a2) and (b2) clearly demonstrates that the expressiveness of the silhouettes and the recognition of the image of the monument is completely lost, although from the point of the main direction of the additional zone (2) of perception – (a2) it is still enough the same basic details of the composition are recognized – the boat, human figures and waves. The analysis and comparison of the depicted silhouettes showed that the most expressive of the zones of perception defined in the table are mainly two silhouettes that are observed: from the main point of the main direction of the main zone and the main point of the main direction of the additional zone of perception, which are indicated by the letters – (a, a1). From all other points and directions of perception, the silhouettes of this sculptural composition are revealed as secondary and not so expressive for the perception of a clear recognizable image of the monument.

Despite the fact that the sculptural composition has a full volume, stands freely in space and has the possibility of a circular view, it is not designed for perception from all sides. This happens because in the additional zones of perception of the silhouette of the sculpture, its angles change and, as a result, deviating (approximately by 30˚) in both directions from the main axis of the direction of observation, the figures of the monument begin to gradually "merge" into one mass and overlap each other, thereby distorting the expressiveness of the artistic and plastic image. In general, as a result of the analysis, regarding this monumental and decorative composition in a specific spatial situation, we can conclude that the monument was installed with the calculation mainly for frontal perception from two opposite sides, which have certain viewing angles – 160˚ common areas (a, b, a1, b1), by 60˚ – main (a, a1) and by 50˚ – additional zones (b, b1). Therefore, bearing in mind the features of the compositional structure and the genre of sculpture (figurative), the second, but not the main direction of perception of the most expressive silhouette is the direction – (a1), opposite to the main frontal direction (a) of the main zone of perception of the silhouette. Also, as a result of the analysis of the expressiveness of the silhouettes of all available zones and directions of perception of this composition, the zones ("blind") of the least expressiveness of the silhouette were identified – (c, c1,) each by 20˚, respectively (Figure 5).

Thus, the influence of the main, additional zones and points of perception of known monumental and decorative compositions in specific spatial situations, on the development of their silhouette in certain directions, has been identified and analyzed.

Based on a comparative analysis of these examples of the introduction of monumental and decorative sculpture in certain types of urban environment, the main patterns of perception of the expressive silhouette of a sculptural composition were identified. It was found out how important it is to take into account the main directions of the main, additional and even "blind" zones of perception when designing and architectural "linking" of a sculpture in a certain spatial situation.

The key role for the maximum expressiveness of the silhouette of the sculptural composition and the recognition of its image is played by the definition of the main (most favorable) zone of perception, and hence the position (orientation) of the three-dimensional form in space relative to visual observation. The point of view on the object and its position (angle) relative to the visual perception of the observer are interrelated factors, which in our case are essentially identical concepts.

**Results and Discussion**

Based on the results obtained in the course of a comparative analysis, we can draw a general conclusion for the practical design of monumental and decorative sculpture in urban space: even if any sculptural composition is designed for perception in the center of space and is a voluminous "round" shape, its silhouette is not always from all points vision is actively expressed. Therefore, in order to perceive a more expressive and recognizable image, a conceived idea of a sculptural composition, especially for the perception of the first impression of a silhouette from long distances, one should pay attention to the main directions of perception, the main areas of perception with the main points of view. Firstly, it is necessary to choose the most favorable angle of the sculptural composition for this in relation to the observer, and secondly, to actively enhance the expressiveness of the silhouette, work it out even at the stage of designing and creating a sculptural composition, depending on the alleged main directions of observation of the sculpture, which determine the main areas of perception that have developed in a particular spatial situation.

As a result of experimental plein air studies measurements and photographic fixation, it was established that the main zones of perception sometimes differ significantly from the additional ones. This is what affects the level of expressiveness of the silhouette of a sculptural composition, which is perceived in a specific direction and zone of perception with its own points of view, which of course should be taken into account in the practical application of sculpture, which is designed in an urban environment.

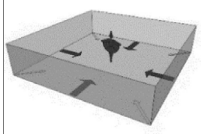
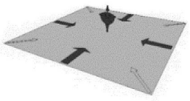
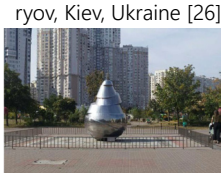
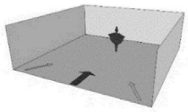
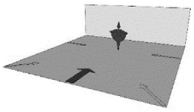
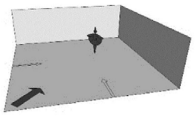
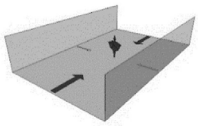
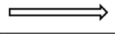
As a result of structuring the main zones of perception, based on known types of spaces according to spatial characteristics, the main types of perception of the expressive silhouette of a sculpture were identified, systematized and formulated depending on the directions and zones of perception that were formed under the conditions of a typical spatial situation – TABLE 3.

TABLE 3 presents the characteristics of the 6 main types of perception, which correspond to schematic images and real examples of typical spatial situations, along with the main and additional zones of perception (in degrees):

1. Circular perception in closed and open space – (№ 1, 2). It is characterized by the continuity of the main and possibly the existence of additional zones of perception. The name "circular" perception most accurately conveys the nature of the observation of the sculpture in space, meaning its central placement in space and the possibility of a circular view of the volume from almost all (4 main sides). The principles of perception in closed and open space, with the central (dominant) placement of the sculpture, have common features and are similar, therefore these two spatial situations opposite in character were united by one type of perception – "circular". Circular perception requires the development of maximum expressiveness of the silhouette of the sculpture, taking into account almost all directions, zones and points of observation (360˚).

2. Frontal perception in a half-closed space – (№ 3). It is characterized by a limited number of zones – one main, two additional zones of perception, taking into account the "blind" zone. This type of perception has one main (frontal) direction and two additional perception zones in a spatial situation limited on three sides by architectural structures. Frontal perception in a half-closed space requires the development of maximum expressiveness of the sculpture's silhouette, taking

Table 3. The main types of perception of monumental and decorative sculpture in the urban environment [created by authors]

| No | Schematic representation of types of perception | Examples of types of perception | Characteristics of types of perception | Main zone of perception | Additional zone of perception | "Blind" zone |
|---|---|---|---|---|---|---|
| 1 |  | St. Peter's Square, Rome, Italy [20]  | Circular perception in closed space | 360° | _ | _ |
| 2 |  | Sculpture "Pear", 2012. Sculptor A. Zolotaryov, Kiev, Ukraine [26]  | Circular perception in open space | 360° | _ | _ |
| 3 |  | Monument to A. Solovyanenko, 2001. Sculptor M. Rapay, Kyiv, Ukraine [author's  | Frontal perception in a half-closed space | 60°–140° | 70°–90° | 60°–140° |
| 4 |  | Monument to M. Grushevsky, 1998. Sculptor V. A. Chepelik, Kyiv, Ukraine [16]  | Frontal perception in half-open space | 90° | 45° | 180° |
| 5 |  | Sculpture "Themis", 2007. Sculptor A. P. Polubok, Kyiv, Ukraine [author's photo]  | Frontal perception in corner space | 90° | 10°–70° | 120°–270° |
| 6 |  | Obelisk "Hero City Kyiv", 1982. Architect V. Lashko and L. Semesyuk. Kyiv, Ukraine [2]  | Front-double-sided perception in transit space | 90° and less | 90° and more | – |
| Symbols | | | | | | |
| |  | | Direction of the main zone of perception | | | |
| |  | | Direction of the additional zone of perception | | | |
| |  | | Conditional image of the sculptural composition | | | |
| Note on table (3): a closed space with a diameter of more than 200 m with a height of enclosing elements of 10–15 m has signs of an open one [according to the sensations of visual perception]. | | | | | | |

into account the directions of only one main zone (60°–140°) and two additional (70°–90°) perception zones.

3. Frontal perception in half-open space – (№ 4). It is characterized by the presence of one main zone and two additional directions, zones and points of perception, including a "blind" zone. Sculpture observation is mostly limited to structures on one side. Frontal perception in a half-open space requires the development of maximum expressiveness of the silhouette of the sculpture, taking into account one main frontal direction of perception, one main (90°) and two additional (45°) perception zones.

4. Frontal perception in corner space – (№ 5). It is characterized by one main and two additional directions, zones and observation points, also taking into account the "blind" zone. The perception of sculpture is limited to architectural structures from two adjoining sides. Frontal perception in a half-open corner space requires the development of maximum expressiveness of the silhouette of the sculpture, taking into account one frontal direction, one main (90°) and two additional (10°–70°) perception zones.

5. Front-double sided perception in transit space – (№ 6). It is characterized by two main opposite directions, main and additional zones and points of perception, which are limited by architectural structures from two opposite sides. Front-double sided perception in the transit space requires the development of maximum expressiveness of the silhouette of the sculpture, taking into account observation from two opposite directions, the main (90˚ and less) and additional (90˚ and more) perception zones.

To understand the method of determining the type of perception, the most typical spatial situations are induced here and the very essence of the relationship between the type of perception of sculpture and the type of space is demonstrated. The essence of this method is to determine the types of perception of monumental and decorative sculpture, depending on the directions of observation and zones of perception, which were formed in the conditions of typical spatial situations. In practical work, when designing a sculpture in space, determining the type of perception will help you orient yourself in relation to the main directions, the main zones of perception for maximum expressiveness (activity) of the silhouette of any sculptural composition in the right angles, also taking into account additional and "blind" zones, depending on the specific spatial situations. In practice, more complex combinations of types of spaces are often encountered, therefore, it is always necessary to take into account a specific spatial situation with certain features: the complexity of the terrain, zoning of space, its geometric shape, type and specifics of the environment, and more.

Properties of form such as lightness, color, texture are auxiliary; they only complement and correct the expressiveness of the main ones – scale, nature of the volume design, detailing. Therefore, the study focuses specifically on the geometric aspects of the visual perception of shape and silhouette, the basic properties of the form and the means of its expression. As for the distance from the observer to the monumental sculptural composition, the study takes into account the distance within the limits of visibility and the distinction between large and medium-sized details of its silhouette.

In the last few decades, the dissociation of sculptural plasticity from the architectural space, the loss of the relationship between them and the anti-aesthetic effect on others have affected, which often causes an uncomfortable stay in the urban environment and psychological fatigue. This often happens in the following way:

- - the theme and function of a particular urban environment is not taken into account, there is no relationship between the function of space and the theme of the sculptural composition;
- - the logic of a specific placement and installation (location, architectural "binding") of monumental and decorative sculpture is not thought out;
- - architects and sculptors often do not pay attention to the proportionality of space and monumental and decorative sculpture (scale);
- - certain means of expressing a sculptural composition are not taken into account, which must correspond to the specific dimensions of the space, sculpture and the distance of its observation (generalization of the silhouette, level of detail);
- - in specific spatial situations, the types of external spaces of the urban environment and the types of perception of expressive silhouettes of sculptural compositions are not taken into account. Often a sculptural work is installed in the architectural environment in such a way that it does not have the most expressive silhouette in the main direction of its observation for the perception of a recognizable image, and often it is installed in the most unfavorable angle in relation to the main zone and direction of perception, not to mention the "blind" areas in which the form is not perceived at all. This is due to a misunderstanding of the special tasks that are solved when introducing sculptural plasticity in the urban environment, and to some extent due to the lack of communication between the architect and the sculptor at all stages of design, especially at the initial stage of work. That is why today there is an urgent need to work on a more organic relationship between monumental and decorative sculpture and architectural space, the creation of a real synthesis of architecture, space and artistic form. The creation of harmony between sculptural plasticity and the architectural environment, more thorough methods of implementation, installation and architectural binding of monumental and decorative sculpture, taking into account all the above parameters of their relationship, becomes relevant.

In theoretical sources devoted to the principles of the relationship between monumental and decorative sculpture and the architectural environment, the relationship is mainly considered and analyzed, in which such aspects are highlighted: general relations of monumental-decorative sculpture and architectural space [5; 7; 8; 23; 24]; methods and techniques for placing monumental and decorative sculpture in urban space [8; 13-15; 18; 25] general perception of three-dimensional objects in space and aesthetic perception – sculptures in the urban environment [3; 6; 11; 12; 18; 19; 27].

In the article [15], on the example of the Olympic Sculpture Park for the Seattle Art Museum, the use of sculpture in the neglected areas of the city is considered, as interaction and integration with the urban context, to unite separate divided sections of the city in such a way that the architectural and plastic image reacts to its social, physical and economic aspect. In the context of urban planning and compositional-structural positions of the relationship between space and sculpture, an analysis is carried out (mostly of a descriptive nature) of the introduction of sculptural complexes and parks in urban environments that require new spatial configurations.

Among modern scientific and theoretical materials, articles [13; 14] about the role of visual art in the recognition of urban space and the methodology for localizing visual art in the public space of the city. The author has developed a typology of sculptural objects only on the specific basis of determining their role from the standpoint of the functional and spatial structure of the city of Poznan (Poland). But the article does not reveal in sufficient detail the specific methods of applying sculpture, which involve more universal methods for introducing sculptural compositions based on plastic means of expression, as part of the functional and spatial structure of the city, at the stage of designing the architectural environment.

The article [23] considers the introduction of elements of fine art in the urban space, in the context of the synthesis of art and architecture. These elements of art, the authors write, must be aesthetically consistent and comfortable for perception in the outer urban space, which will meet the requirements of visual aesthetics. Modern construction and urban environment create an urgent need for aesthetic perception and the creation of a visual aesthetics of the external public space. Caring for the psychological state of people occupies a special place in certain fields of science and art, the most relevant are the problems of visual ecology and aesthetics in various areas of human life in order to achieve a safe, fruitful

and productive life.

In an article [22] very close to the topic of this study, the main regularities of the relationship between sculpture and urban space are considered. Here, only the main factors that affect the perception of monumental and decorative sculpture in any city space are identified and analyzed: scale ratio, methods of placement, formation of the environment, generalization of the silhouette, detailing and perception of the expressiveness of the silhouette of the sculpture in specific spatial situations. But in [21], the importance of generalizing the silhouettes of the sculptural composition in the outer urban space of the architectural environment is already proved, as a way to improve the clarity of image perception, especially at long observation distances of monumental and decorative sculpture.

Among modern scientific and theoretical materials, special attention for the study of the topic of creating an aesthetic image of space, the emotional impact of the artificial environment on recipients (specialists and non-specialists) is caused by articles by some authors in the field of human perception and computational aesthetics, which combines science and art and becomes a new interdisciplinary field [4]. Computational aesthetics uses the computational methods of computer technology for aesthetic expression and the automatic creation of an aesthetic image. In this aspect, an important direction is being created in the future research – the creation of methods and tools for introducing sculptural plasticity into the urban environment using computer computing technologies.

Analyzing theoretical materials, it becomes obvious that today there are no sufficiently detailed studies on specific methods of applying sculpture, which involve more universal methods for introducing monumental and decorative sculpture based on determining the types of spaces in the urban environment as part of the functional and spatial structure of the city.

## Conclusions

The study showed the need to observe the orientation of monumental and decorative sculpture in the process of its design, taking into account the perception of the expressiveness of its silhouette and the relationship with the layout of urban space. According to the results of the study, a conclusion was drawn – how important it is, for greater expressiveness of a certain image of monumental and decorative sculpture, to take into account and apply an actively expressed silhouette, which is observed precisely from the main direction of the main zones of perception

As a result of the study, several types of perception of the expressive silhouette of monumental and decorative sculpture were obtained, taking into account the main and additional directions, points and zones of perception:

1. Circular perception in closed space.
2. Circular perception in open space.
3. Frontal perception in a half-closed space.
4. Frontal perception in half-open space.
5. Frontal perception in corner space.
6. Front-double-sided perception in transit space.

Based on systematization, a method has been developed for determining the types of perception of sculpture regarding its orientation and relationship with urban space. The purpose of this method is to ensure a more effective process of modeling, designing, and installing (architectural "linking") monumental and decorative sculpture, considering its orientation in specific spatial situations, the primary types of external urban spaces, and the types of perception of the most expressive silhouettes of sculptural compositions.

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## Kopsavilkums

Rakstā aplūkotas un analizētas tēlniecības un ārējās pilsētvides attiecību galvenās raksturīgās iezīmes, kuru būtība ir tās uztveres princips noteiktās vietās, ņemot vērā orientāciju – konkrētas tēlniecības kompozīcijas uztveres leņķus, tiek projicēts pilsēttelpā. Tiek pētītas monumentāli-dekoratīvās tēlniecības orientācijas īpatnības arhitektūras telpā. Pētījumā tika veikta modeļu analīze (izmantojot reālus piemērus) un noteikti iespējamie skulptūras izteiksmīgā silueta uztveres virzieni gan tipiskās, gan īpašās pilsētvides telpiskās situācijās. Tiek identificēti virzieni un viedokļi, kuru kopums veido skulpturālās kompozīcijas uztveres zonas atkarībā no konkrētās telpiskās situācijas. Pamatojoties uz pētījuma laikā iegūtajiem rezultātiem, tiek sistematizēti un formulēti monumentālās un dekoratīvās tēlniecības izteiksmīgā silueta uztveres veidi.

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# DIGITAL TECHNOLOGIES AS A TOOL FOR IDENTIFICATION THE AUTHORSHIP OF SACRED SCULPTURE

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**Abstract. Latvian sculptures created before the mid-19th century are located mainly in churches, not in museum collections. The most serious obstacle to research of Latvian art in the given period is lack of pertinent documentary material. As a result, Latvian art historians have mostly studied the sculptures for which written sources are available. This article will offer solutions for further research in cases when written sources are limited or altogether unavailable. How much and what can be discovered using digitisation solutions?**
**The study of the sculptures of the Biķernieki Church in Riga provides a paradigmatic case for further research with the help of digitisation. In 1967, when the congregation of the Biķernieki Church was forced to abandon the church, the sculptures were transferred to museums. Today they can be seen in the exhibition of the Rundāle Palace Museum. The scant extant documentary evidence does not allow us to establish the authorship of the sculptures or the time of their creation with certainty.**
**The study discussed in the article shows the importance of digitisation in art history research. The current research is based on 3D models of the sculptures of the Biķernieki Church obtained using 3D scanning technology. Supplementing them with high-resolution photographs and other digital solutions can confirm or, on the contrary, refute assumptions about their authorship and creation made by historians so far. The article outlines the methods used to identify stylistic influences on the sculptures of the Biķernieki Church, suggesting that they may have been modelled after similar sculptures in Gdańsk (Danzig) and Dresden and even after certain antique sculptures. The graphic methods used in the research have made it possible to precisely identify the style of execution of a single sculptor in several churches in Riga.**

**Keywords: digitisation, Jakob Ernst Mayer, St. James Cathedral, St. John's Church, Biķernieki Church**

## Introduction

In the context of Western European art history, the history of the sculptures created in Latvia until the middle of the 19th century is quite peculiar. Firstly, sculptures in Latvia then were created by immigrant artists, who brought with them craftsmanship and stylistic trends learned elsewhere. Secondly, most of the sculptures are found in the Lutheran churches. With the beginning of the Reformation in Livonia in 1525, the Duchy of Courland-Semigallia converted to Lutheranism and the construction of new churches began. By 1800, in addition to the existing 35 churches and 25 chapels, 63 new churches had been built [1]. The number of Catholic churches was considerably smaller. According to the statistics, 36 Catholic churches had been built by 1800. [2]. WWI, WWII and the Soviet occupation of Latvia did great damage to the church interiors. 20% of the Latvian Lutheran churches were damaged in WWI and 30%, in WWII. As a result of the atheistic campaign in the Soviet Union, many congregations were forced to leave their churches. Abandoned churches were demolished or converted to warehouses, workshops and gyms. During the Soviet period, 33% of the Latvian Lutheran churches were destroyed. Since the beginning of the 20th century, 60% of the Lutheran churches in Latvia had their interiors damaged or altogether destroyed [3]. Church archives and libraries were closed and destroyed thanks to the atheistic campaign [4]. As a result of all this damage and destruction, the number of artworks and historical documents that are still available for the study of Latvian art history was greatly diminished.
While art historians have identified some of the sculptors active in Latvia up to the middle of the 19th century, many sculptures created in that period remain authorless. They can be divided into two categories. The first category includes the sculptures about whose authors nothing is known, while the second category comprises those works about whose authorship art historians have made various assumptions. In order to further expand art historical research, which includes these two categories of sculptures, it is necessary to develop innovative research methods that will lead to new discoveries and interpretations.
The aim of this article is to evaluate the importance of the digitisation of church interiors for further research, new discoveries and more accurate interpretations of sculptures.

## Materials and Methods

The church of Biķernieki, the construction of which began in 1765, was chosen as the subject of the study. According to the research of the architect Paul Kampe, the altar, which was consecrated in 1766, was made by the carpenter Karl Gottlob Appelbaum. In 1932, the Biķernieki Church with all its furniture and furnishings was included in the list of monuments under state protection (Figure 1 on the left). After WWII, in 1967, the parish ceased to exist and the empty premises were demolished. On 23 July 1970, the authorities inspected the church as a protected monument and found that the interior of the church had been damaged, including the angel figures on the organ balcony and 4 vases on the barrier of the altar. All the artworks were removed from the church and handed over to the Rundāle Palace Museum (RPM) and the Sigulda Regional Research Branch of the Dole History Museum. The empty premises were used for storage, as well as for the stained-glass workshop "Māksla" (Figure 1 on the right). In 1989, the congregation regained the church and on 18 February held the first service after repossessing the church. Soon afterwards the renovation of the church began [5].
The preserved wooden sculptures have not been returned to the Biķernieki Church so far and are currently in the Rundāle Palace Museum's exhibition "From Gothic to Art Nouveau". As a result of the research by the museum historians, the sculptures have been identified as the work of Jakob Ernst Mayer. In written sources, the sculptor's name appears in

Fig. 1. Interior of the Biķernieki Church. On the left, the church interior in the 1960s-70s [photo from RPM collection]. On the right, the interior after the congregation was disbanded [photo from http://bikerudraudze.lv/bikeru-dievnams/]

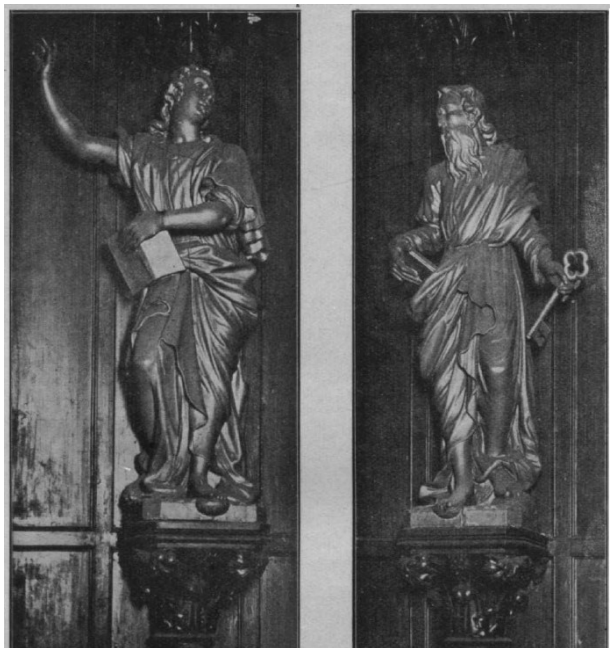


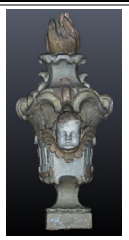
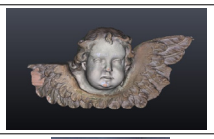
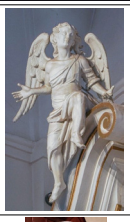
Fig. 2. Two sculptures from St Peter's Church [6]

connection with the altar of St John's Church in Riga, where he worked together with the aforementioned carpenter Karl Gottlob Appelbaum. The altar of St John's Church has survived to this day. According to Paul Kampe, the structure of the altar of St John's Church in Riga has similarities with the altar of the church in Biķernieki. Both altars have angels in the concluding volutes. Paul Kampe saw similarities in the design of the angels' wings and in the folding of their vestments. [6]. The name of the sculptor is not mentioned in any other written sources. It is mentioned neither in the RPM archive documents, nor in the transcripts available at the RPM from the Latvian State Historical Archives, nor in the archive documents of the National Heritage Board of Latvia. Assuming that the two masters collaborated on the interior of more than one church, it can be suggested that the sculptures of the church in Biķernieki may have been created by the sculptor Jakob Ernst Mayer.

In the 1760s, the sculptor Jakob Ernst Mayer created vases and other decorative elements for the Riga Town Hall and two figures of the apostles for St Peter's Church in Riga (Figure 2) [7]. These works have not survived.

In order to examine the relationship of the sculptor Jakob Ernst Mayer to the church in Biķernieki and St. John's Church in Riga, this research will refer to the following

Table 1. Digital materials used

| No | Description | Image |
|---|---|---|
| 1 | An angel from the organ balcony at the Biķernieki Church. |  |
| 2 | An angel from the altar in the Biķernieki Church. Personal archive of S. Bitko |  |
| 3 | A depiction of an angel's head on a decorative vase from the Biķernieki Church. Personal archive of S. Bitko |  |
| 4 | Angel's head with wings from the Biķernieki Church. Personal archive of S. Bitko |  |
| 5 | Angels from the altar in St John's Church in Riga. Personal archive of S. Bitko |  |
| 6 | A sculpture on the lectern of St John's Church. Personal archive of O. Spārītis |  |

digital materials:

- 3D models of the sculptures of the church in Biķernieki, created by the author of the article by means of 3D scanning. All 3D models are available at: https://arthistorylatvia.org/3d-modeling-bikernieki-church/
- Photographic images of St. John's Church in Riga

According to the digital visualizations, the sculptures can be divided into 4 stylistic groups:

- Type 1 – angel from the organ balcony in the Biķernieki

Church (Table 1. Row 1)
- Type 2 – angel from the altar in the Biķernieki Church (Table 1. Row 2)
- Type 3 – angels from the altar in St John's Church in Riga (Table 1. Row 5)
- Type 4 – angel's head on a decorative vase and angels' head with wings from the Biķernieki Church and St John's Church lectern (Table 1, Rows 3, 4, 6)

After the general stylistic comparison of the sculptures of angels, it can be noted that the similarity between the sculptures is only noticeable in the sculptures of type 4; therefore, additional research and analysis is required:

1. Sculpture studies in other churches in Riga, as the quality of the images of the no longer extant sculptures in St Peter's Church (Figure 2) is not high enough to enable definite conclusions about their authorship or relation to similar sculptures.
2. In order to analyse Mayer's carving style and to identify possible stylistic influences on it as precisely as possible, the sculptures provisionally attributed to him in other countries should be studied in depth. In the course of his research of pertinent archival material, Paul Kampe has pointed out that the sculptor came from Gdańsk. Kampe also suggests that Jakob Ernst Mayer may be identified with the sculptor Jakob Mayer, who in 1740, together with Paul Mayer, created the 6 figures of the Apostles for the Dresden Catholic Cathedral. The sculptures are made after models by the sculptor Mattielli [7].

## Results and Discussion

### *Type 1 - angel from the organ balcony in the Biķernieki Church*

Among Riga's churches, we should mention St James Cathedral, where the organ façade has been preserved to this day. It is now known that in 1760 a new organ was commissioned from the organ builder Heinrich Andreas Contius and consecrated in 1763 [8]. Information about the woodcarver of the organ is lacking. There are 4 angels in the organ façade of St. James Cathedral. Two of them are in the lower row, closer to the viewer, and two near the timpani in the upper row. A visual comparison shows that the angels in the top row (Table 2. Row 2) bear a clear resemblance to the angels of Type 1 (Table 2. Row 1) [5]. Their distinctive facial features, such as the dimpled cheeks and the small snub nose as well as their smiles and curly hair make them different from the other carved angels of the same period.

A review of the surviving sculptures in Gdańsk reveals possible stylistic similarities in the modelling of the facial features of the angels in the St James Cathedral in Riga and the sculptures of the organ façade of St John's Church (now St John's Centre) in Gdańsk (Table 2. Rows 3, 4). The detailed digitisation of the organ façade allows the sculptures to be studied in close-ups. The organ façade of St John's Church was created between 1760 and 1761 by Johann Heinrich Meissner, who was a leading sculptor in the Baltic Sea region. [14]. Both organ façades were made in the same period, and the task of future research is to identify the master under whose guidance J. H. Meissner had learned his skills. It is possible that the sculptor who made the Type 1 angels in Riga also studied with the same master, which explains the similarity in the modelling of the sculptures' facial features.

In determining stylistic influences, only sculptures of type 1 have been examined, without taking into account other ornaments and sculptures on the organ façade. At the moment, nothing is known about the visual appearance of the organ façade of the Biķernieki Church. The parish chronicles state only that a new organ was installed in 1875. According to the photographs of the 1960s, there were two sculptures of angels on the organ balcony, which had been moved there from the old façade, according to the practice of the time [13].

Table 2. Analysis of Type 1 sculptures

| No | Description | Image |
|---|---|---|
| 1 | An angel from the organ balcony of the Riga Biķernieki Church. Personal archive of S. Bitko |  |
| 2 | An angel from the organ façade of St James Cathedral in Riga. Personal archive of S. Bitko |  |
| 3 | An angel from the organ façade of St James Cathedral in Riga. Personal archive of S. Bitko |  |
| 4 | An angel from the organ façade of the St John's Centre in Gdańsk. Image from St. John's Centre, Gdańsk https://centrumswjana.pl/wirtualnyspacer/spacer.html |  |

### *Type 2 - angel from the altar in the Biķernieki Church*

Paul Kampe has found a correspondence between the Type 2 and Type 3 angel wings. Even though the two sets of wings are similar, the Type 2 angel wings are much closer to the real bird wings in appearance [Table 3. Row 3], while the Type 3 wings are more stylized [Table 1. Row 5]. Wings of angels in Latvian sacral sculpture are made in different styles. Mostly they are stylized and none of them exactly corresponds to the classical (bird) depiction of wings. For this reason, the two angels are divided into different types and discussed separately.

Attention should be paid not only to the wings of the Type 2 sculpture, but also to the profile of the angel's face, which is based on antique models. In the Latvian churches and in the sculpture created before the 19th century in general, this is the only sculpture based on an antique model. In order to explain the appearance of such a classical model in a Latvian church, it is necessary to use the materials obtained from research into the possible sites of the master's activity and influence in Gdańsk and Dresden. The most striking example of an angel's wings and profile can be seen in the sculptural relief of The Hill Gate (also known as The High Gate) in Gdańsk (Figure 3) by Willem van den Blocke [9].

From the 16th to the early 17th century, the largest sculpture workshop in Gdańsk was owned by the sculptor Willem van den Blocke, who worked with artists from the Netherlands. During this period, Gdańsk art was strongly influenced by Classical art, which came to Gdańsk from Italy through the work of Dutch artists. Later, German sculptors took over the workshop, but this did not mean a radical change in style. The workshop continued to operate in its usual manner, maintaining its links with antique art. [10] References to antique art can be traced not only in Gdańsk, but also in Dresden in the workshop of the Italian sculptor Mattielli Lorenzo. The most striking example from the workshop is the sculptural group of archangels at St Michael's Church in Vienna, dated 1724/25 (Figure 4)[11]. It shows archangels with both classical wings and antique face profile modelling.

Fig. 3. The Hill Gate in Gdańsk [9]

Fig. 4. The Archangel Group. St Michael's Church in Vienna [personal archive of S. Bitko]

Table 3. Analysis of Type 2 sculptures

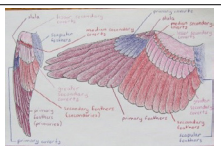
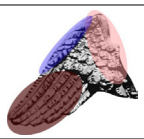
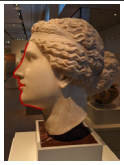
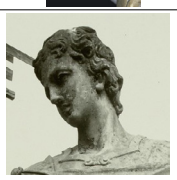
| No | Description | Image |
|---|---|---|
| 1 | Drawing of a bird's feathers. Image from https://rolling-harbour.com/2018/02/09/wing-feathers-draw-a-bird-day/ |  |
| 2 | A fragment of an angel's wing from the High Gate relief. Image complemented with colour markers. Image from source [9] |  |
| 3 | Fragment of a wing from the altar angel of the Biķernieki Church. Image complemented with colour markers. Personal archive of S. Bitko |  |
| 4 | Head of Singing or Talking Dionysus (Roman copy after an original from 270 –250 BC, Altes Museum, Berlin). Image complemented with a red contour line. Personal archive of S. Bitko |  |
| 5 | Profile image of the altar sculpture from the Biķernieki Church. Image complemented with a red contour line. Personal archive of S. Bitko |  |
| 6 | Fragment of a sculpture of St Venantius (1742). Image from source [12] |  |

Table 4. Analysis of Type 3 sculptures

| No | Description | Image |
|---|---|---|
| 1 | Fragment from the altar angel of St John's Church in Riga. Personal archive of S. Bitko |  |
| 2 | Head of St Rosalia of Palermo. Image from source [12] |  |
| 3 | Head of St Rosalia of Palermo. Image from source [12] |  |

Stylistic similarities with the Type 2 angel are also evident in the sculptures in the Dresden Cathedral, which were created between 1741 and 1747. At present, there is uncertainty about the attribution of some of these sculptures to Jacob and Paul Mayer. Detailed close-up photographs of each sculpture are available on the internet [12]. Among all the sculptures examined here, the use of the antique profile is most evident in the sculpture of St. Venantius (1742) (Table 3. Row 6), while the profiles of the other sculptures are in a different style.

For a detailed analysis of the wings and their correspondence to the classical wing model, a drawing of a bird wing structure has been examined (Table 3. Row 1). It shows the feather groups with primary feathers in dark red, secondary coverts in pink, primary coverts in blue and secondary feathers in the middle part of the wing. The same colour markers are used for the wing structure of the Type 2 angel (Table 3. Row 3) and the angel from the High Gate relief (Table 3. Row 2).

The graphic technique of contour line was used to precisely identify the similarities between the facial profiles of the angels and those of the antique sculptures. Initially, the contour line of the profile was drawn on a photograph of an antique sculpture (Table 3. Row 4). Without changing the proportions of the contour line, it was superimposed 1:1 on a photograph of a Type 2 angel (Table 3. Row 5). There are slight differences in the chin, which may depend on the individual style of each sculptor, while the profile of the forehead and nose match completely.

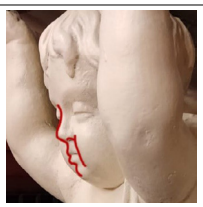
*Type 3 – angels from the altar in St John's Church in Riga*

When visually examining the facial features of the Type 3 sculptures (Table 4. Row 1), it can be notice that they are very different from the others. Stylistic similarities can be found in the sculptures of the Dresden Cathedral, especially that of St Rosalia of Palermo (1742). The nose of the sculpture is sharply outlined and the sculpture is depicted with half-closed eyes (Table 4. Row 2). The earlobes are much thicker than in the other sculptures of the same type (Table 4. Row 3). The author of this article has not yet identified sculptures with such facial modelling details in other Latvian churches.

*Type 4 – angel heads on a decorative vase and an angel head with wings from the Biķernieki Church and St John's Church lectern*

In order to reveal the similarities among the Type 4 sculptures more precisely, the graphic technique of contour lines has been used. The basic contour line is drawn on the profile of the sculpture on the lectern of St. John's Church in Riga (Table 5. Row 1). The contour line marks the most prominent facial features of the angel, such as the profile of the nose,

Table 5. Analysis of Type 4 sculptures

| No | Description | Image |
|---|---|---|
| 1 | Profile image of the sculpture on the lectern of St John's Church in Riga. Image from personal archive of O. Spārītis. Original image complemented with a red contour line. |  |
| 2 | Profile of the decorative vase from the Riga Biķernieki Church Original image complemented with a red contour line. Personal archive of S. Bitko |  |
| 3 | Profile of the winged head from the Riga Biķernieki Church Original image complemented with red contour line. Personal archive of S. Bitko |  |
| 4 | Decorative vases and winged heads from the Riga Biķernieki Church The image is supplemented with red control marks. Personal archive of S. Bitko |  |
| 5 | The coat of arms of Saxony and Poland Image from source [12] |  |

mouth and chin, with an additional line drawn for the cheeks. Without changing the proportions of the contour line, it is superimposed on the profile image of the winged head from the Biķernieki church (Table 5. Row 3), resulting in an exact match. On the other hand, no match was found when the contour line was used to examine the profile image of the face of the decorative vase sculpture (Table 5. Row 2), which may be explained by the size of the sculptures. The winged head depicted on the vase is many times smaller than the other two sculptures. For this reason, an additional examination was carried out by making control marks on the inner and outer corners of the eyes, the centre of the nose, the centre of the upper and lower lip (Table 5. Row 4). The control marks were made on the profile of the winged head from the Biķernieki Church and, without changing the proportions, they were moved to the profile of the sculptural face of the vase. In this case the proportions are completely consistent.

The stylistic influences of the type 4 sculptures can be seen in the Saxon and Polish coat of arms (Table 5. Row 5) by Mattielli Lorenzo above the main entrance to the Dresden Cathedral [12]. The resemblance is most apparent in the round cheeks and the folds around the mouth, which give the impression of a sad facial expression.

## Conclusions

The study reveals the potential of digital technologies in the study of art history. In the 20th century, the historian Paul Kampe could only make assumptions about artworks based on written sources or personal observations, which were impossible to verify without digital solutions because they were too far away from the viewer. The best examples are the sculptures of the Dresden Cathedral. They are situated on the roof of the building and each sculpture is about 3.5 metres high, so even if the viewer is on the roof of the Cathedral it is impossible to see the details. Similarly, the altar sculptures of St John's Church in Riga are far from the viewer. The stylistic analysis of the angels of types 2, 3 and 4 confirms the assumption made by Paul Kampe that the sculptor Jakob Ernst Mayer can be identified with Jakob Mayer who, together with Paul Mayer, created the 6 apostles for the Dresden Cathedral in 1740.

While it is possible to divide the sculptures chosen for the current research into 4 stylistic groups, it is not yet possible to determine the exact number of sculptors who worked on them. Even though Jakob Ernst Mayer has been placed in the centre of the current study, this does not mean that he worked alone on the commissioned works in Riga. The different styles of the sculptures and varying degrees of craftsmanship with which these were executed suggest that several sculptors worked on them in Riga, and that their styles may have been influenced by the sculptors and their works from Gdansk and Dresden. The analysis of the Type 1 sculptures reveals that it is possible to continue making new discoveries in art history despite the lack of written sources from the relevant period in Latvia. As the study shows, digital technologies have made it possible to discover the works of one sculptor in several churches, such as the Riga Biķernieki Church and St James Cathedral.

The graphical method of using contour lines or control marks that can be superimposed upon similar images can be used to show that:

- the existence in Latvia of sculpture based on antique art models, such as the altar angels of the Riga Biķernieki Church.
- one and the same author's style of execution can be identified in different sculptures in different churches in Riga, such as the decorative vases and the angel's winged head of the Biķernieki Church and the sculpture on the lectern of St John's Church.

Research in art history should use high-quality digital technologies and materials to achieve the most accurate results. 3D models are particularly useful for digital analysis, because by comparing the 3D model with photographs taken from a particular angle, the 3D model can be rotated to match the photograph 1:1.

The methods discussed in this study can be used to continue the study of Latvian sacral sculpture even in cases where extensive documentary sources have not survived.

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# "DEUS EX MACHINA" OR MOVING SCULPTURES IN THE INTERIOR OF LUTHERAN CHURCHES OF LATVIA

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**Abstract. The term "Deus ex machina" was used in ancient Greek and Roman theatre performances as stage machinery provided the appearance of a god or hero to unravel and resolve a hopeless situation. The present article characterizes the appearance, function, and use of moving sculptures - automatons - in Latvian Baroque church interiors. Renaissance science sparked developments in mathematics, astronomy, and mechanics that stimulated not only the invention of curiosities, but also the construction of practical mechanisms and tools. Knowledge transfer from mechanics to applied and fine arts brought moments of mystery and wonder into the fields of performing arts and the spheres of representation and liturgy. The use of automatons helped to invent new mechanisms, making the mechanical movement of "animated sculptures" an attractive public entertainment.**
**Both written evidence and artefacts preserved in museums and churches bear witness to the social demand for the integration of theatrical elements into the formerly conservative environment, for example, the church. Drawing inspiration from the culturally linked region of former Prussia, the current paper concentrates on moving figures in the interior space of Lutheran churches in Latvia to expose the variety of fascinating objects, including organ facades and baptismal fonts.**

**Key words: Deus ex machina, automaton, church, theatre, mechanic, moving sculpture, baptismal device**

## Introduction

The interdisciplinary orientation of this publication is characterized by the author's efforts to exhibit a completely unique phenomenon in the sacred culture of Latvia and Europe of the 17th and 18th centuries - decorative sculptural artefacts used in the baptism ceremony and partially preserved until today - baptismal devices, also colloquially called "baptism machines" (German Taufmaschine). They can be described as movable constructions suspended from the church ceiling in front of the altar. Their manipulation with the help of ropes caused a theatrical experience before the eyes of the congregation. It is this kind of mechanically operable theatrical structure, specially created for the baptism ceremony, that is most directly associated with the "deus ex machina" appearance and the effect characteristic of the stage culture of the Greek theatre. The Encyclopaedia Britannica describes it as follows: "Deus ex machina is a person or thing that appears or is introduced into a situation suddenly and unexpectedly and provides an artificial or contrived solution to an apparently insoluble difficulty" [1]. The term was first used in ancient Greek and Roman drama, where it meant the timely appearance of a god to unravel and resolve the plot. This tells us that in the history of theatre such a technical means is known since the performance of Sophocles' drama Philoctetes in the 5th century BC, when the unexpected appearance of a god at the ceiling of the stage was ensured by a crane - mēchane in Greek. Greek and Roman devices of stage technique were "rediscovered" in the liturgical performances of the Italian Renaissance church holidays, having a singing choir of angels descend from heaven on a platform powered by ropes and trivets. In the 18th century, the Jesuits, who promoted the introduction of moving mechanisms in the interiors of churches, resorted to the use of similar technical means in churches and Jesuit collegiate theatre performances.

After the division of Catholic Livonia into separate administrative parts – Latgalia, called Polish-Inflanty, included in the Polish-Lithuanian Kingdom, Livonia conquered by the Swedes, and the Duchy of Courland and Semigallia having gained nominal independence - each of the mentioned state formations was included in a disparate region of cultural influence and exchange from which they received creative impulses for the court, aristocratic or sacred art. Examples of deus-ex-machina-related mechanisms in Latvian cultural heritage could be identified as moving sculptures decorating facades of organs and complicated constructions of movable baptismal fonts. To achieve mentioned aim author uses methods of field observation on different types of sacred art in church interiors, historical and chronological survey for description of artifacts, studies of limited bibliography on regional phenomena, as well as comparativistic approach to stylistic and inconographic analysis. As to the topic oriented publications articles by architect Paul Campe and author of the current survey could be mentioned, as well as a collection of letters among the pastor of St. Jacob's Church in Riga and organ builder Heinrich Andreas Contius, translated by Valda Kvaskova and interpreted by Elita Grosmane [2].

Investigating existing and documented artifacts of moving sculptures in sacred art of Latvia the purpose of the author of the article is to search for those paths of cultural contacts and borrowing of ideas that could have influenced the emergence and use of deus-ex-machina-related mechanisms in the territory of Latvia and the nearby regions. In this context, the evolution of moving mechanisms - automatons - in the Baroque era applied and fine arts for the purpose of entertainment deserves attention which could, directly or indirectly, influence the inclusion of powered mechanisms in sacral interior installations.

The novelty of the research is based on analysis of artifacts in Latvian sacred art as well as in description of use and functioning of mechanically moving sculptures in complex pieces of an interior. An innovative point in the present survey is a presentation of movable baptismal font from the Holy Trinity Church in Jelgava as a complex construction, that allows to identify in different locations of Latvia preserved details of similar but destroyed baptismal fonts.

## Historical background of arcade machines and robots

Ever since the dawn of civilization, the engineering thought of gifted personalities has sought to create various mechanisms that facilitate the work of human hands. They have been invented for building, transport, domestic use and, of

Fig. 1. Centaur automaton. Hans Jacob I. Bachmann, 1602-1606. [photo by author, 2019]

Fig. 2. Wooden sculpture "Drummer". Michael Brinkmann, 1688. [photo by author, 2024]

course, also for military purposes. From the physics course we know about the inventions of Archimedes for moving various weights in ancient Greece; no less amazing are the devices constructed by Arab and ancient Roman engineers for throwing arrows, stones and incendiaries over the walls of besieged cities. Medieval miniatures depict the lifting mechanisms used in the construction of castles and cathedrals whose structures were also used to load goods onto ships. The intellectual power of Renaissance engineers and the hand-crafted mechanisms could also provide worthy entertainment for rulers and bishops. Not far from Florence there is Villa Demidoff, which, with its 160-hectare park, was the property of Francesco I de Medici in the 16th century, called Pratolino. In the 1570s -1580s, the ingenuity of the great engineer and architect Bernardo Buontalenti created a surprise and amusement park here, in which, in addition to bridges and cascades of ponds, grottoes and fountains, water-powered machines were also installed. This not only allowed the intellectual guests of the park to solve mysteries of cabalas, alchemy, and the occult sciences, but also provided surprises with the enigmatic nature of noises, music, moving sculptures and capricious water cascades.

The task of the article is neither to retell the history of automatons and mechanisms, nor to outline the action principles of the early robotics predecessors, but rather to emphasise that the evolution of mechanics and engineering thinking in the world has been related to both solving practical tasks as well as providing entertainment. The story of the so-called Centaur automaton in the Kunstkammer collection of the Kunsthistorisches Museum Wien will demonstrate this sophisticated mechanical world whose masterpieces had only one task - to surprise and entertain the elite society of the ruling Habsburg dynasty [1]. This 40-cm-tall masterpiece of jewellery and mechanics, designed for the amusement of the invited guests, was made of silver, precious stones and gold in 1602-1606 by Augsburg goldsmith Hans Jakob I. Bachmann [3].

The visual image of the complex mechanism on a pedestal is formed by the figural composition of the mythical Centaur, half-human, half-animal; riding on his back is Diana, goddess of hunting, and two accompanying hunting dogs. The mechanism hidden inside the automaton rotates the wheels under the pedestal and makes the heads and arms of the sculptural figures move. At a certain time, the clock mechanism starts the automaton and, as one of the guests stops in front of it, the Centaur shoots an arrow in his direction. The task of the guest, who is thus "injured", is to call out a loud toast to the other guests and empty his cup. Accordingly, the function of the Trinkspiel-automaton is accomplished. In the 16th and 17th centuries, a number of such admirable machines for entertaining guests were commissioned by royal houses, whose artistic and technically virtuoso execution can surprise even modern engineers.

With a significant time lag, but already following the aesthetics of the Baroque era, the Swedish military administration gave the woodcarver Michael Brinkman commission for 20 wooden sculptures to decorate the interiors of the Riga Arsenal [4]. After the reconstruction of the Riga Castle in the 18th century and the demolition of the Arsenal building, only two pinewood and painted sculptures of drummers from the entire considerable number of sculptures have survived to the present day [2]. The full-size drummers in army uniforms are placed on wooden pedestals and are preserved in the collection of the Museum of the History of Riga and Navigation [5]. One of the two sculptures is particularly remarkable because it is equipped with an ingenious lever-and-gear mechanism that can turn the sculpture's head and move its arms. Presumably, the mechanical drummer of the 17th century could create the planned surprise effect when the guest crossed the threshold of the Arsenal or stepped on a particular floorboard which released the spring and made the sculpture beat the shoulder-hung drums with the drumsticks in the drummer's hands.

The example of the Swedish period drummer of the Riga Arsenal shows that the construction of precise mechanisms for scientific purposes as well as for navigation, astronomy or military needs, the construction of automatons and early robots for the purpose of entertainment in the 16th and 17th centuries, facilitated transfer of the technical knowledge of mathematics, physics, optics, mechanics not only to applied art, but also to fine arts. The ability of a moving mechanism to create not only the effect of surprise, but even the effect of "miracle" and mysticism was very cleverly captured and exploited by theatre, opera, and the church. The task of actors who imitated moving sculptures or mechanisms was to offer the viewer a certain dilemma: moving, thus alive? The situation, logical for the evolution of technology and mechanics of the Renaissance and Baroque eras, though unusual for the consciousness of the individual, prompted the question: can a moving doll, capable of imitating a person, have a soul? Until very recently, the church had tried to stifle the progress of scientific thought with various methods and punishments, seeing in it "Satan's cunning", but, unable to stop the development of engineering thought, it adapted to the new conditions and began to use technical achievements

for its own purposes. The Jesuits especially stood out among the religious orders with their rational methods and means, who, for mission purposes, did not hesitate to combine modern scientific achievements not only with business, but also to turn believers to spirituality. To influence their emotional world, they used refined artistic and even technical means.
However, in the era of the spread of knowledge obtained from books, it is not always possible to identify the birthplace of an idea or the author of a technical innovation. The migration of builders, artists and various craftsmen endowed with specific knowledge, which ensured the exchange of ideas and technical solutions in a certain geographical area, can be considered quite common. Among the pioneers who researched Baltic cultural contacts was the German art historian Niels von Holst. In his book "Die deutsche Kunst des Baltenlandes im Lichte neuer Forschung", published in Munich in 1942, he outlined the west-east migration routes of artisans based on the facts found in publications and logistical routes marked on maps [6]. Although the purpose of his publication was quite tendentious - to prove that the roots of Livonian culture were created by the German mission, modern research also confirms the leading role of architects and artists who came from Germany, Austria, Denmark and East Prussia in the origin of the cultural heritage of Estonia and Latvia in the 13th-19th centuries.

**Moving sculptures in the sacred interior**

In sacred culture, the use of automatons and moving sculptures largely corresponds to the idea of "deus ex machina" in the ancient theatre where a solution to a conflict or impasse situation was achieved with the help of stage equipment. The difference between a liturgical theatre performance, a service or a musical performance and the ancient theatre in the sacred practice of the 17th and 18th centuries was determined by narrowing the range of perception and influencing the consciousness of believers with mechanical means. During these centuries, there was a truly intensive migration of craftsmen and artists between East Prussia and Livonia, and this serves as a motive to look for parallels with the sacred culture of Latvia in this cultural region. A notable example is the Oliwa organ of the Archbishop's Cathedral of Gdańsk (Danzig), whose universal musical possibilities, monumental construction and impressive Rococo façade are a masterpiece of the organ building and art of its time. From 1763 to 1788, this 83-register, 5,100-pipe instrument was created by the organ builder Johann Wilhelm Wulff who incorporated into its façade several rotating stars and suns, as well as sculptures moving with the help of hidden mechanisms. They imitated an orchestra of angels who theatrically "participated" in a musical performance and, when the music was playing, they raised the trumpets to their mouths with the help of movable hands. Another example, even closer to Latvia, can be found in the northeastern part of Poland, in the popular pilgrimage site since the 15th century - the Święta Lipka (Heiligelinde, Holy Linden) basilica dedicated to Our Lady. During the reign of the Polish king Augustus II, called Augustus II the Strong, 1670-1733), an impressive Baroque ensemble was created during the reconstruction of the church from 1687 to 1730. In 1719-1721, the luxurious interior of the church was supplemented by an instrument built by the prominent Königsberg organ builder Johann Joshua Mosengel (1663-1731). As the basilica of Święta Lipka was handed over to the Jesuit order, the cultural policy arsenal of the Jesuit priests had room for various means, including technical ones, to manage the emotional mood of the faithful. As the last piece of music was played at the end of the liturgical part of the service, the organist could, with the help of pedals, pulleys and air turbines,

Fig. 3. Organ of the Ugāle church [photo by author, 2015]

Fig. 4. Sculpture of an Angel and rotating Zimbelstern (cymbal star). 1697-1701. [photo by author, 2015]

make the built-in sculptures move their heads and blow trumpets, as well as operate other moving parts, causing the congregation look at the instrument in the organ balcony [7]. The creators of the Lutheran sacred art of the Duchy of Courland maintained a certain restraint in decorating the churches with outwardly effective equipment compared to the interiors of the Catholic churches built in the cultural space of East Prussia. However, even in the Lutheran Courland, one cannot detect any backwardness concerning the trends characteristic of the era such as to integrate automata-related moving sculptures into the interior objects of the church. The construction of the Ugāle (Ugahlen) church was started in 1694 and was completed in a few years at the expense of Baron Johann von Behr [7]. In the context of this publication, the two-part instrument and its façade built in 1697-1701, a collaborative effort of the woodcarver Michael Marquardt (Marquardt) who belonged to the Ventspils (Windau) school of sculpture, and the organ builder Cornelius Rhaneus who was born in Liepāja (Libau), deserves special attention [11].
The main parts of the instrument at the back of the of the Ugāle church balcony and the façade, called Hauptwerk in German terminology, are decorated with a wood-carved sculpture of an eagle [3]. In Christian iconography, it is identified as a symbol of the resurrection of Christ and the evangelist John. With a pedal next to the organ pedals, the organist could move the eagle's wings. In addition, on the front of the organ balcony, on the top of the smallest part of the instrument called reverse positive (Rückpositiv in German), there was a wood-carved sculpture of an angel, and the organist could use a drive mechanism to raise its hand that holds a baton. Under the angel's feet there was a star connected to several bells on an axis, which was turned by a wind rotor and ringing the bells [4]. German organ builders have also given

Fig. 5. Riga. St Jacob's church. Angel with tympanum. 1761. [photo by S. Bitko, 2022]

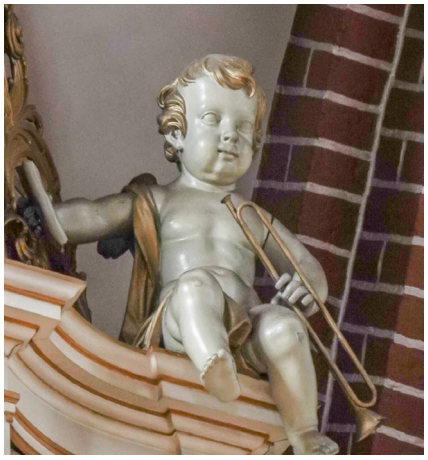

Fig. 6. Riga. St Jacob's church. Angel with trumpet. 1761. [photo by S. Bitko, 2022]

this rotating and playful-sounding element the terminological designation Zimbelstern (cymbal star). The moving parts powered by muscle power and wind energy give the Ugāle church organ the status of an exclusive instrument to be included in the typological group of musical machines created for the space of Latvian sacred culture.

Similar to the decoration of the Ugāle church organ façade, the organ of the Piltene church was also given a sculpture of an eagle in 1721. The epitaph of Wilhelm Alexander von Heyking, owner of the Ziru manor who died in 1714, with the family coat-of-arms on its decorative façade, is accompanied by a record of a bequest of funds for the construction of a new instrument. His son, Ernst Ewald von Heyking, fulfilled his father's wish and commissioned a master for building a new instrument. The craftsman of the decorative part of the organ is the woodcarver Joachim Creutzfeld, who had moved from Lübeck to Courland and who was familiar with the Baroque era tendency to "revive" the static objects of the equipment with theatrically moving sculptures [10]. Thus, adapted to the space of sacred culture, even in the Duchy of Courland with its active construction of churches and furnishing them with artistically high-value equipment, the tradition of building and public display of automatons, which began during the Renaissance, was continued.

Neither did it pass by Riga as the metropolis of the economic and spiritual life of Livonia, although there is little surviving evidence of the use of moving sculptures to complement church facilities. After the Reformation, St. Jacob's church was handed over to the Latvian Lutheran congregation and, after forty years of the Counter-Reformation (1582-1621), when Riga was under the dominant influence of the Polish king and the Catholic Church, it became again a Lutheran church. According to the agreement between the parish priest H. F. Herwagen and the prominent organ builder Heinrich Andreas Contius, in 1760 the new instrument was transported by water from the master's workshop in Halle to Riga [11]. The organ builder had expressed an offer to come to Riga again, which he did and supplemented the instrument with attractive details – trumpetists, drummers and carillon, which had already been marked as "Stern" in the disposition offer sent in 1759. A quote from a letter from the organ builder Heinrich Andreas Contius on December 14, 1761: "Having arrived here, I found that in this church (St. Jacob's - O.S.) no real church music is played, and that there are even no timpani here; the organ already has a built-in trumpet (a special register of voice - O.S.), and in this connection I have supplemented the external decorations of the organ with a couple of sculptures that, with the help of a special fastening, raise the trumpets to the mouths when the relevant register is turned on and then lower them again. That is why I now want to most humbly make a modest proposal to the High Collegium of the Imperial Church if they could be so kind and give permission to install another register in the organ pedal for playing two timpani. Nothing more would be required than a pair of tympani 2 and 1/2 feet in diameter, and two sculptures, each having a tympanum in front which they strike by means of a special contrivance so as to harmonize with each other and with the trumpet from the organ. If, finally, in order to achieve complete perfection, your High Collegium of the Imperial Church would like to give permission to install carillon through the whole keyboard, it would not cause much effort now, and this organ would gain great advantages compared to other instruments" [12].

The complement of the carillon has not survived to our day, but it could have been similar to the mechanism of the rotating star and bells (German Zimbelstern) installed in the Ugāle organ. However, the finished façade of the organ shows that H. A. Contius's offer had been partially accepted and the organ had received one timpanum striker and one trumpet player sculpture [5; 6]. The angel figure with a tympanum on the left side of the instrument has the mobile right arm flexibly attached to the shoulder to be able to strike a rhythm. In addition, the angel on the right side of the organ façade is made with a movable left hand holding a trumpet, which, when raised to the mouth, resonated with the sounds of the trumpet voice register of the organ. Master H. A. Contius's second arrival in Riga to complement the instrument with the sculptures imitating the sounds and movements testifies to the approval on the part of the priest and the church collegium of the automatons in the organ as a synthesis of several arts. Although the two sculptures are no longer operable nowadays, their construction and iconographic content demonstrate the demand of the Baroque society for the synthesis of music and movement in a mechanical instrument.

## "Deus ex machina" as an automaton in the presentation of the sacrament of baptism

The meaning of the sacrament of baptism is to symbolically unite each new member of society with Christ and integrate them in the Christian community. Baptism is one of the most important sacraments of the church and, following the instructions of Christ, it is like a contract that is accomplished in liturgical action. In later centuries, it was strengthened by the ceremonial procedure developed by St Augustine (Augustinum). Reformation ideologist Martin Luther also highlighted the importance of the sacrament of baptism and based it on the three most important references in the Bible. The first is a

Fig. 7. Nurmuža Lutheran church. Baptismal font. 1687. [photo by S. Bitko, 2023]

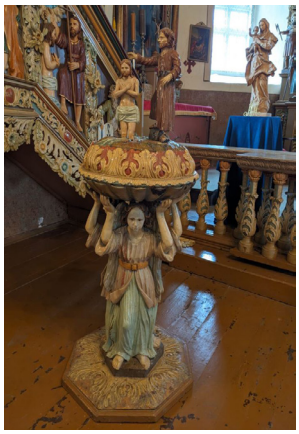

Fig. 8. Vecpils Catholic church. Baptismal font. Early 18th cent. [photo by S. Bitko, 2023

reference to the situation described in Mark 16:16: "Whoever believes and is baptized will be saved, but whoever does not believe, will be condemned" [13]. An important indication of the presence of holy water in the baptism ritual as a guarantee of salvation is also found in verses 4 and 5 of the Apostle Paul's 3rd letter to Titus: "But when the kindness and love of God our Savior for people appeared, he saved us, not because of works of righteousness, what would we have done, but for our mercy, with washing for rebirth and renewal by the Holy Spirit" [16]. As the third important pillar, the lines of Chapter 6 from the Apostle Paul's letter to the Romans are mentioned, with an indication of the importance of baptism in the "renewed life", that is, after the resurrection. Quote: "We were therefore buried with him through baptism into death in order that, just as Christ was raised from the dead through the glory of the Father, we too may live a new life" [15]. At the conclusion of the baptism ceremony in all churches of Christian denominations, priests apply the formula that ends the Gospel of Matthew as a wish to the new member admitted to the congregation: "Therefore go and make disciples of all nations, baptizing them in the name of the Father, and of the Son and the Holy Spirit" [16].

The above-mentioned biblical texts are used in all baptism ceremonies and the interpretation of their literal and as well as allegorical meaning has inspired sculptors and woodcarvers when creating the artistic setting for the baptism ritual in churches. From the baptistery added to the side of the church to the total immersion pool in the church interior, the placement of pedestals for the baptism ritual, holy water vessels or devices suspended from the ceiling in the interior, the evolution of construction and form has come a long way of discovery. 17th and 18th century examples in the cultural heritage of Latvia show a pedestal placed on the floor made in traditional woodcarving or carpentry techniques, such as can be seen in the Strazde (Strasden), Kabile (Kabillen), Dobele (Doblen), Mežmuiža (Grenzhof), Saldus (Frauenburg) and other churches. The smooth upper surface of such pedestals served for the plate with baptismal water. More complex and richer in terms of imagery are those pedestals for baptismal vessels which are equipped with a lid whose lifting gave access to the plate with water.

In the Nurmuiža (Nurmhusen) Lutheran, church children were baptized at an elaborate pedestal, decorated with twisted columns, painting and gilding, the top of which was shaped like a cup with a lid [7]. At the end of the 17th century, a monumental pedestal of the baptismal font was made for the Subate (Subbath) Lutheran church, the lid of which could not be removed by hand, but to lift it, there was a pulley attached to the ceiling with a chain or a rope. The pedestals of the baptismal fonts of the Vecpils (Altenburg), Kaldabruņa (Kaltenbrunn) and Bebrene (Bewern) churches at the beginning of the 18th century were made according to the same compositional scheme and in the same woodcarvers' workshop [8]. The support part of the pedestal was formed by two angels with a large conch in their raised hands. The other part of the conch was the pedestal cover with the sculptures of John the Baptist and Jesus depicting the sacramental rite of the first baptism. The Kaldabruņa baptismal font had been equipped with a similar cover, but it is unfortunately lost.

In Latvia's heritage of sacred culture, there are no elder written documents neither in churches preserved "baptism angel" (German Taufengel) type sculptures. Art historian E. Grosmane has identified in the collection of Latvian National Museum of History one engel's sculpture from the church of Ugāle as possible example of "baptism engel" type [17]. Such sculptures of "flying" angels made in the 17th and 18th centuries and hung from the ceilings of churches were often found in the Lutheran churches of Central and Northern Germany. Their function was to hold a plate with baptismal water in their outstretched hands [18].These decorative sculptures could either be hung at a constant height near the altar or the pulpit, or they could be lifted with the help of a winch installed in the attic, a pulley or just ropes. The church servants lowered the vertically movable baptismal angel sculpture to the required height before the service but raised it to the ceiling again after the ceremony of baptism. The brightly painted and expressively shaped wood-carved angels with baptismal water vessels in their hands revitalized the otherwise solemn and sober atmosphere of the church and endowed it with a certain theatricality.

When evaluating the typological diversity of baptismal angels found in the cultural space of the German sacred heritage, in the context of this publication more attention is paid to the more intricate constructions in terms of their composition and structure, which are very few also in German Lutheran churches. The authors of the book "Taufengel in Mitteldeutschland" identify the early 18th century baptismal angels that have been preserved in the churches of the villages of Jeetze (Getche) and Kerkau as a type characteristic of the Altmark region [19]. The singularity of the Jeetze church baptismal angel is manifested in its three-part structure which is suspended on an iron rod at a fixed height, and its iconographic composition [7]. A second sculptural group is attached to the same iron bar at a short distance and above the back of the traditionally shaped angel. This group with miniature sculptures of John the Baptist and Jesus above a blue-painted wood-carved cloud, which at the same time symbolizes the water of the Jordan River, represents the scene of the baptism of Jesus. Even higher above the group

Fig. 9. Baptismal Angel of the Jeetze Lutheran church, Germany. 1717. Taufengel in Mitteldeutschland, 2009, p. 247.

Fig. 10. Two-part baptismal device of the Gramzda Lutheran church. 1743. [photo by S. Bitko, 2023]

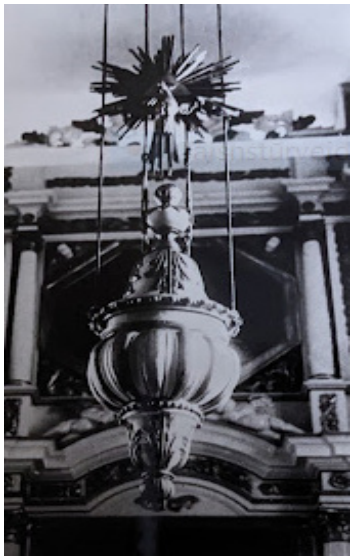

Fig. 11. Two-part baptismal device of St. Anna's church in Jelgava, mid-18th cent. [Bildarchiv Foto Marburg]

of sculptures depicting the first rites of baptism is the third component of the composition. It also depicts clouds and the symbol of the Holy Spirit - a dove [20]. The baptismal angel composition at the church of Kerkau, similar to that of the Jeetze church, has only two components; the anonymous sculptor has not included the sculptural group with the cloud and the dove of the Holy Spirit.

Historically, the Lutheran Church within the current geographic borders of Latvia had maintained active cultural contacts with East Prussia, the states of the central and northern parts of Germany, and Sweden, which influenced the mutual exchange of both masters as well as creative ideas and works of sacred art. It will be difficult to unambiguously argue for the information on the noble families and pastors as customers, as well as parishes and artists about the make or purchase of items of the church furnishings. However, evidence - fragmentary and also in photo documents - of visually attractive baptismal devices in Lutheran churches has been preserved in modern Latvian cultural heritage. During the construction of the Gramzda (Gramsden) church in 1740-1744, a two-part baptismal device had been made to be suspended from the church ceiling [8]. Its donors were representatives of the von Korff family, the lords of the manor. The lower part of the baptismal device, dated 1743 and made of wood, was shaped like a flower-shaped console, the lid of which is raised by ropes to reveal the petal-shaped baptismal water vessel.

The image preserved in the archives Bildarchiv Foto Marburg of the University of Marburg shows a Baroque-shaped baptismal device in St. Anna's church in Jelgava (Mitau), hung high in front of the altar by four ropes [9; 21]. Its style makes it attributable to the art of the mid-18th century, while its construction demonstrates a three-part structure. The artefact consists of a grooved fruit-shaped base with a cone-shaped lid. A flat wood-carving presents a crown of rays symbolizing God's glory - Gloria - and a tiny sculpture of the dove of the Holy Spirit in front. The photo shows the device that was destroyed during the Second World War, and it can be concluded that the baptismal device could perform certain theatrical functions. First, it had to be lowered, and then, by manipulating the ropes, the cover was lifted and separated from the base. The emotional effect was significantly enhanced by the crown of rays sliding up along with the lid, which had to descend again together with the lid at the end of the ceremony.

**Baptismal devices by the same hand**

The ecclesiastical art collection of the National History Museum of Latvia contains four sculptural works dating from the end of the 17th century, which were known to be parts of the "baptismal vessel frame" of the Umurga (Ubbenorm) church [20]. However, Rūta Muižniece, author of the 1984 catalogue "Wooden Sculptures of the Latvian SSR History Museum", at the time lacked information about what the construction that was intended for the baptism ceremony might have looked like. Preserved from the dismantled wood-carved installation are two sculptures of half-naked angels facing the viewer, with Baroque-style rich acanthus spirals for legs [10; 11], and a sculpture of an angel immersed up to the waist in a cup of acanthus leaves [12]. All the figures have broken-off arms and wings, many fragments of the acanthus ornaments also are lost, but the sculptures have partially preserved painting and gilding which indicates that the perished baptismal device had been luxurious.

The Līvbērze (Behrsen) church parish keeps a fragment of the lost church furnishings: a wooden arch-shaped construction with two half-figures of angels attached to its sides, identical to the two sculptures of the Umurga church baptismal device [15]. Unlike the case of the Umurga church, the Līvbērze

Fig. 12.-13. Two sculptures from the baptismal font of the Umurga Lutheran church. CVVM 27921 VS 139 Umurga, CVVM 27920 VS 138 Umurga [photo from the National History Museum of Latvia, 2023]

Fig. 14. Sculpture of an angel from the baptismal font of the Umurga Lutheran church. CVVM 27999 VS 142 Umurga [photo from the National History Museum of Latvia, 2023]

Fig. 15. Fragment of the baptismal device from the Līvbērze church [photo by author, 2018]

angels' wings and hands raised in prayer have been fully pre served. The unusual function of the arch is suggested by the vertically drilled holes in its uprights where ropes for lifting the structure might have been hidden. At the top of the arch there is a relief of the dove of the Holy Spirit and a stylized crown of rays. In the lower part of the arch, an extended platform had been made the upper surface of which is covered with a wave-like pattern in blue that imitates the waters of the Jordan River. In the middle of the stylized water, the imprint of the irrecoverable feet of John the Baptist and the sculpted body of Jesus has been preserved, testifying to the depiction of the scene of baptism in the centre of the arch. Although the arch of the Līvbērze baptismal device with the sculptures of angels is fully preserved and still is in the church, it is just one part of the ancient construction. The other remaining detail – an angel – is in the collection of the Rundāle Palace Museum [23].

After marrying the Catholic countess Martha Philippine von Lancy in 1729, Wilhelm Heinrich von Lieven, owner of the Līvbērze manor, converted to Catholicism and consequently changed the denominational affiliation of the church and the paris [24]. Such changes led to the need for renovated or completely new church furnishings. Since the preachers of the Jesuit order were active in Jelgava, the capital of the Duchy of Courland, and in Skaistkalne (Schönberg), on the border with the Kingdom of Poland and Lithuania, it is possible that the influence of Jesuit teachings among the nobility could have contributed to the introduction of attractive items into the austere environment of the Lutheran Church. From the point of style, the evaluation of the formal features of the church interior items - the altar, the pulpit, and the confessionals - allows to date them to the 1830s, and it is on this ground that this dating is also attributable to the baptismal device. Within the context of this article, it gives the time frame for the dating of the typological group of baptismal devices called "baptism machines" (Taufmaschine) as such.

The preserved artefacts demonstrate that in at least two churches - Umurga and Līvbērze - baptismal devices of similar design had been located and had also been used. The stylistic identity of both their sculptures and ornaments point to the handwriting of one particular master or the work of one particular workshop. Photographs taken in the 1930s of the Jelgava Holy Trinity Church interior and found in the archives of the Herder Institute in Marburg unexpectedly show a baptismal device of impressive size, made in the same woodcarver's handwriting, in full complement and of an excellent degree of preservation. The said device is suspended by ropes high at the ceiling and faces the upper floor of the altar retable. The photo of the lowered angel as the bottom part of the baptismal device shows its position directly in front of the altar, thus providing the best visibility of the priest-conducted ceremony.

This tradition adopted in the Lutheran Church begins with Martin Luther's proposal to place not only the altar and the pulpit in front of the congregation, but also to find a place for the sacrament of baptism to be truly memorable. The procedure of religious services as developed by the Reformation theologians in 1564 and adopted in Wolfenbüttel provided for the sacrament of baptism to be performed "Not round the corner or secretly, but in facie Ecclesiae (in front of the eyes) - at an open meeting of the congregation", i.e., during a church service [22]. These instructions were also binding on other countries that implemented the reformation following the example of the German lands. By the order of Duke Gotthard Kettler on September 18, 1570, the Duchy of Courland approved and in 1572 in Rostock published its own procedure of worship in a separate book [28]. Since the Jelgava Holy Trinity Church was not only the cathedral of the Duchy of Courland, but also the administrative centre of church politics and the seat of the Superintendent, so it goes without saying that the procedure of services announced from the pulpit of this church, as well as other theological aspects and instructions for the layout of churches, served as a standard for imitation in all Lutheran parishes.

The baptismal device of the Jelgava Holy Trinity Church was a real masterpiece of woodcarving, liturgical performance and

Fig. 16. The baptismal device of the Jelgava Holy Trinity church. Heinrich von Bergen, 1737. Bildarchiv Foto Marburg

Fig. 17. Angel from the bottom part of the baptismal device, the Jelgava Holy Trinity church. Heinrich von Bergen, 1737. Bildarchiv Foto Marburg

also machinery, which, thanks to the donation made in 1731 by the organist Daniel Gudwich's widow to the church treasury, in 1737 the parish saw it installed in the place intended for it [14]. The names of the donor and her late husband appear in the dedication inscription on the side of the baptismal device: "Frau Catharina gbohrne gebk. Seel. Herrn Daniel Gudwich beider teutschen Kirchen zu Mitau gewesenen organisten nachgelassene Frau Wittwe Gottes Haus zu Ehren ein Tauffe verehret anno 1737". The approximately three-metre-high baptismal device that she donated outshone the those of Umurga and Līvbērze both in terms of scale as well as artistic quality and wealth of details.

The rope-suspended baptismal device consisted of three parts. The bottom one was made in the form of an angel sitting in a bunch of acanthus leaves, above the head with both hands holding a platform for the baptismal water dish [15]. Manipulating the ropes, the minister of the church lowered the entire baptismal device and revealed access to the holy water plate by separating the lower and middle parts. The middle part of the structure was the most magnificent element of the baptismal device. It was framed by a wooden arch with sculptures of praying angels on the sides and a base with the sculptures of John the Baptist and Jesus. The top of the arch was decorated with a wood-carved ruler's crown that characterized the Holy Trinity church as a place of worship under the Duke's patronage. As the baptismal device was operated for the purpose of the ceremony, its lower part with the weight angel was being pulled down. The middle part of the structure, connected by ropes and three mechanisms, simultaneously rose up together with the third – the uppermost – part of the device: a crown of rays with a triangle symbol as a sign of God's triune substance, and a sculpture of a dove personifying the Holy Spirit.

The artistically bright overall image of the richly gilded and painted baptismal device, the theatrical movement of its parts up and down certainly attracted the eyes of the congregation and formed direct associations with the moving decorations powered by theatre machinery or other movement-imitating mechanisms in Baroque art works. The effect created by the baptismal device helped to eliminate all the inconveniences associated with the practical use of the altar space which was recessed far from the rows of congregation pews. On the other hand, the multiple use of the allegorical image of angels as divine messengers in the sculptural decoration of the baptismal device served to transform the mechanical movement into a spiritual experience and heighten the emotional charge of the celebration.

By arranging the similar baptismal devices in a chronological order, the picture of the time frame of when the last three, as the most effective masterpieces of decorative sculpture, could have been made. The baptismal device could have been installed in the ensemble of the Līvbērze church around 1729-1730 to attract the congregation's attention to a theatrical activity at the time of the controversial confessional changes. The period of the Umurga church repairs and the production of new furnishings lasted from 1728 to 1739, when new equipment was made and a new painting was ordered for the altar. It is at this time that the outwardly effective baptismal device could have been added to the interior of the church [27]. The Jelgava Holy Trinity Church baptismal device, both artistically and chronologically, closes the series of theatrical masterpieces because after that no other mechanically operated baptismal device suspended from the ceiling was made for Latvia's churches.

The search for the maker of these three sculptural and mechanical masterpieces leads to Heinrich von Bergen, a Russian court sculptor, who was employed, between 1723 and 1725, to make the stucco decoration and fountains of the Kadriorg (Katharinental) palace hall [28]. From 1731 to 1739, his stay in Latvia was connected with several commissions for making sculptures of the Riga St. Peter's Church organ front (1731-1733), creating coats-of-arms and sculptures for the Šāļu, Grēcinieku and Cūku Gates (Schal, Sünder und Schweinepforte, 1737-1739) built into the Riga bastions, as well as making for the Jelgava Holy Trinity church an operable baptismal device (Taufmaschine) to be suspended from the ceiling with ropes [29]. The status of H. von Bergen as a court sculptor and the importance of the large number of commissioned works he had carried out leave no doubt about

the qualifications of this master. This is fully proven by the Jelgava Holy Trinity church baptismal device's sculptural quality and virtuosity of the technical solution, and the quality of sculpture and technical ingenuity even in smaller scale works such as the baptismal devices of the churches at Līvbērze and Umurga are not far behind.

## Conclusion

The ascertained name of the sculptor and the scanty information about his activities only allow us to make assumptions about his origins in the German-speaking cultural space, which could have been very wide geographically. On the other hand, his skill as a sculptor in the management of stucco, stone, wood and other materials could have been acquired in lands with generations-cultivated monarchist and aristocratic tastes. Russia, modernized by Peter I's reforms, was also oriented towards high artistic criteria, and H. von Bergen had the power to adapt everything new and European to meet the requirements of the Petersburg court and aristocracy. The range of his works that stretches from the stucco mouldings of the Kadriorg Palace and the sculptures of the organ front of St. Peter's church, to the coats-of-arms at the gates of the Riga city fortress manifests episodic but quite regular cooperation with the parishes and nobility of Tallinn, Riga, and towns in their immediate surroundings. Among them, the execution of less important commissions for attractive baptismal devices for several churches in the vicinity of Riga, is to be considered completely natural.

In accordance with the orientation of the Baroque and Rococo eras towards the involvement of technical solutions for the entertainment of high society life, a social and philosophical basis was created for the "reanimation" of technically ingenious theatrical decorations, moving sculptures and other everyday mechanisms in the processes of public life. Church institutions in the 17th and 18th centuries also used the mechanisms invented for industry, work and practical functions for the emotional and spiritual guidance of society and adapted them for the "theatricalization" of sacred culture. Moving musician figures linked up with the organ bellows or playing mechanisms, angel sculptures and baptismal water vessels hung from the church ceilings with ropes and trivets, as well as the so-called "baptismal machines" undeniably became attractive components of church interiors. The "deus ex machina" technique used in the ancient theatre encouraged the introduction of theatrical artefacts into the contemplative environment of the modern church to influence the emotional world of the church ritual participants with the help of moving images.

Reconstructing the social role of moving figures in sacred art and analysing the evolution of theatrical and emotional effect achieved by mechanically driven sculptures and sound creating machines in studies of mentioned artifacts there were used different methods, such as historical, chronological, typological and iconographic. The investigation different types of moving sculptures in sacred art of Northern and Central part of Germany, former East Prussia, now Northeastern part of Poland and Latvia led to understanding of former cognitive process in designing of a religious practice by means of visualisation of ideas from material world to the spiritual and emotional experience. The achievement of psychological and social effect during the church services realised by help of simple mechanic and technic tools in organ facade sculptures and hanging baptismal fonts has created an evolutionary link from ancient "deus ex machina" stage mechanisms to renaissance and barocco time performing arts, adapted for sacred art.

Noting that the thesis rooted in Aristotle's poetics about the task of theatrical action - to cause an individual's educational, spiritually and morally experiential development - in the sacred culture of the 17th and 18th centuries has turned into its shocking, surprising or entertaining contrary, it may testify both to a change in the public awareness in favour of a liberalized attitude towards the sacraments and the form of their performance, as well as to a certain democratization of church institutions.

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## Kopsavilkums

"Deus ex Machina" vai kustīgās skulptūras Latvijas luterāņu baznīcu interjerā. Rakstā aplūkota no antīkā grieķu teātra aizgūtā un par "Deus ex Machina" (Dievs no (tehniskas, mākslīgas) ierīces" sauktā paņēmiena – ar tehniskiem līdzekļiem un kustības izmantojumu skatuviskā darbībā, lai atrisinātu dramaturģiska strupceļa situāciju. Uz antīkā teātra skatuves aktieris, kura uzdevums bija iesaistīties darbībā kā augstākas varas pārstāvim vai dievišķam varonim tika nogādāts ar virvju un trīšu, sviru vai pat hidraulisku paceļamo mehānismu palīdzību. Uz šo darbību attiecinātais žanriskas apzīmējums "Deus ex Machina" raksturo sarežģītu tehnisko risinājumu aktieru un dekorāciju kustīgai pārvietošanai skatuves telpā.
Renesanses un baroka laikmetā vienlaikus ar mehānikas un inženierzinātnes attīstību atdzima interese par kustīgu skulptūru – automātu – izmantošanu augstdzimušo personu apbrīnai un izklaidei. Mūsdienu robotu priekšteču – automātu un kustīgo skulptūru - spēja piesaistīt sabiedrības uzmanību no aristokrātijas mājokļiem tika pārcelta uz baznīcu interjeriem un piemērota reliģiskā pārdzīvojuma kāpināšanai. Iebūvējot kustīgas skulptūras ērģelēs vai attīstot pēc teātra dekorāciju principa kustināmas kristību ierīces Latvijas dievnamu interjeri glabā gan 17.-18. gadsimtu mākslai tipisko, gan tikai mūsu zemei raksturīgo unikālo kultūras mantojuma daļu.

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# FEATURES OF VISUAL PERCEPTION OF THE HISTORICAL ENVIRONMENT OF THE DESYATYNNA CHURCH IN KYIV

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**Abstract. Landscape, especially urban landscape, contributes to the formation of a sense of place. The identification of the perception characteristics of the historical image of Kyiv city, based on visual landscape research, was conducted with the aim of establishing visual connections and areas between sacred structures in the complex relief conditions of the Starokyivska Hill. The study applied methods for determining the quantitative indicators of spatial-visual characteristics of the studied locality based on a planned route survey. The parameters of the main selected points were determined by depth of visibility, horizontal viewing angle, presence of focal points, accents, types of perspectives, and types of space. Through visual landscape research, the dynamics of visual connections and areas between elements in the historical landscape of Kyiv were identified. The absence of changes in the spatial-visual characteristics was established at three selected points, while changes were found in others. Specifically, the changes are characterized by a decrease in the depth of visibility along the visual axis between the Desyatynna Church and the St. Andrew's Church. The need to search for ways to model the outline of the landscape in the complex relief conditions of the Starokyivska Hill is revealed for the perspective of preserving the historical image and improving spatial solutions in the urban environment.**

**Keywords: historical landscape, depth of visibility, horizontal viewing angle, landscape outline modeling**

## Introduction

The landscape plays a crucial role in the quality of urban life, as people identify with it, and landscapes contribute to a sense of place. Landscapes and people are dynamic, and over time, new elements emerge that overlay traditional landscapes, changing both the overall character of the locality and people's attitudes towards them [34]. Visual landscape studies are significant for landscape and urban planning, encompassing approaches to landscape perception, exploring its openness, and analyzing the vertical building density concerning the historic urban landscape [19].

Research strategy in landscape architecture should be based on obtaining quantitative and qualitative data to shape the formal composition that envisions the spatial possibilities of the landscape. The landscape's form is an expression of its organization and the result of its development process. Spatial design is considered a form of investigation that relates to other traditional research methods, particularly in landscape architectural design processes. Research and design mechanisms blend with imagination, creativity, and innovation. Unique spatial solutions can be achieved through specific problem characteristics, space, and time [17; 18]. Methods for describing and analyzing the built urban environment as a search for spatially optimal artificial environments should be based on the conservation-optimization hypothesis, which establishes the conceptual basis for progressive and regressive urban planning practices [11].

The description of spatial-visual landscape design includes four main categories [9]: sequence (visual perception during movement through the landscape), orientation (creating focal points to establish a sense of direction), continuity (formed through the openness of space, permeability of edges, and provision of multi-dimensionality), and complexity (perceiving complex environments through variations in texture, form, patterns, and colors). Dai, Maruthaveeran, Shahidan, Chu [4] noted a lack of information regarding landscape perception and preferences among urban dwellers in historical areas. The analysis of the historical urban space demonstrates the need to stabilize the topometric characteristics of urban planning in relation to the human scale. There should be spatial and social logic in the physical and spatial characteristics of open green spaces [10; 28].

Starokyivska Hill contains numerous archaeological findings and traces. Currently, studies of such significant architectural landmarks are considered separately, without a broad historical and environmental approach. Insufficient attention is given to the interconnections with other temples and urban development in a unified complex as components of the gradually formed historical center of Kyiv [24].

The objective of this research is to establish visual connections and areas between historical elements of Kyiv in the complex terrain to identify the specifics of city image perception, locate viewing points, and reveal panoramic views of the landscape while considering modern developments and existing plantings. The inevitable dynamism of the landscape requires planning to explain emerging changes and the ability to consider them, as the contemporary landscape system should be seen as the result of past processes and a basis for future changes [7].

The tasks of this research are to identify landscape changes in the historical areas of Kyiv around Starokyivska Hill, conduct monitoring of contemporary development and existing plantings to find a balance between open spaces and sufficient green areas for the preservation of visual connections between elements of the city.

The scientific novelty of the research lies in obtaining data related to the spatial changes in the historical center of Kyiv city based on monitoring the impact of landscape changes on its openness. This includes conducting quantitative measurements and further preserving and organizing the visual spatial connections between city elements.

## Materials and Methods

There are several methods of visual landscape analysis based on its transformations, each serving different purposes: 1) studying the characteristics of landscape visual perception; 2) monitoring the current state of landscape space; 3) monitoring the impact of changes in landscape openness in urban areas; 4) methods for assessing spatial changes in landscape quality in urban planning.

Visual perception physiology refers to the processes and

mechanisms of vision, light perception, and its limitations. Humans have an almost 120-degree horizontal binocular field of vision directed forward, allowing depth perception. Image recognition is concentrated in the central field of vision, covering approximately 20-60 degrees. The range of clear vision depends on the observer's position and line of sight, with the critical depth of clear vision being 1200-1400 meters [19].

Landscape modeling depends on identifying the relationships between visual focal points that form the perception of a unified historical space. Research on visual connections between landscape attributes and preferences is conducted based on the analysis of landscape images generated by processing real-world photographs to create types of visual openness, richness of compositional elements, organization regularity, and depth of view while maintaining other attributes constant [35].

To analyze changes in visual connections over different historical periods, a description and mapping of a series of spatial data layers considering landscape transformation were conducted. Historical topographic maps and orthophoto plans from various periods allow analyzing the temporal depth and stability of the landscape by defining visual areas and axes [26; 32]. For graphical construction of landscape images, profiles, and pedestrian route plans, the software package ArchiCAD 2021 by Graphisoft was used [6].

The field of view method is based on measuring view fields and mapping sightlines from the observer's position in the landscape. View zones represent areas visible from a given position [3; 19]. The measurement of landscape openness involves the following stages [34]: 1) choosing a survey route; 2) plotting topographic data and creating contour line diagrams; 3) defining visual limitations (viewing depth); 4) determining boundaries of visible space. Viewpoints along the route are characterized according to Sydorenko & Minder [27]: by the horizontal angle of view (prospective - up to 30 degrees, sector - 30-60 degrees, diorama - 60-120 degrees, panoramic - 120-240 degrees, circular - 240-360 degrees); by viewing depth (short - up to 50 meters, medium - 50-100 meters, distant - over 100 meters).

**Results and Discussion**

The uniqueness of Kyiv's cityscape and its panoramic perception are primarily characterized by the revelation of its unique natural landscape qualities and historical architecture. The subject of this research is the territory of Starokyivska Hill, an area of historical significance located in the Shevchenkivskyi District of Kyiv. This plateau houses the remnants of the foundation of the Desyatynna Church, along with visual connections to surrounding sacred structures, which contribute to the identity of this locality. Currently, this area represents a hill with steep northern and moderate southern slopes, with height variations of approximately 65 meters.

Urbanization has rapidly transformed the image of Kyiv, leading to the replacement of natural environmental connections with artificial ones. During the time of Kyivan Rus, changes were relatively minor (Fig. 1). The city's topography had a rather rugged character with elevation differences reaching up to 100 meters. Sacred structures played a dominant role and were pivotal in shaping the cityscape [13].

During the analysis of the changes in visual areas and connections of the territory of the Desyatynna Church, it was found that before the beginning of the 20th century, there was a trend of increasing visual connections between these structures. At the turn of the 19th and 20th centuries, changes in the topography occurred through the filling of ravines and leveling of certain hills [1; 22]. From the second half of the 20th century, buildings were constructed in these areas that disrupted the integrity of the historical environment. Over time, the impact of urbanization increased to the point where the optimal relationships and connections between the natural landscape and architectural elements and visual connections between sacred structures have been disrupted.

Since the Desyatynna Church, St. Andrew's Church, and St. Michael's Golden-Domed Monastery are located in areas where new construction is not permitted and the height of surrounding buildings should not exceed 15 meters according to acceptable height regulations [20], most of the visual connections between them have been preserved (Fig. 1). However, there is an overlap of views in the area of visual connections due to new buildings and tree plantations.

The perception of the landscape is the result of the interaction between humans and the environment. The urban landscape is a common asset for local residents and guests [7]. The studied historical landscape should remain distinct, unique, and easily recognizable, which can be achieved through the identification, preservation, or restoration of axes and areas of visual connections.

According to data [15], the studied territories belong to monument protection zones, with the Desyatynna Church being an archaeological monument, St. Andrew's Church - a cultural heritage site, and others - historical monuments. Traditional landscapes with their ecological and cultural values are becoming highly fragmented and gradually losing their identity [2; 23]. Therefore, it is essential to study key visual concepts aimed at identifying violations, establishing consistency, considering historical context, visual scale, complexity, and naturalness [30].

According to normative documentation [25], in monument protection zones, it is necessary to preserve and restore valuable natural and landscape qualities, viewpoints, and areas that offer views of monuments and their complexes. Buildings, structures, and plantations that distort this landscape should be removed or visually neutralized.

In the process of shaping the urban environment, the historical layer becomes an integral part of the natural landscape, emphasizing cultural heritage and symbolism of the area [5; 31]. However, the conservation of the natural background remains equally important for the emotional effect [8]. Historical structures, as architectural dominants, become focal points that require consideration of the openness of spatial landmarks and the background natural environment in terms of texture, form, and color variations.

Integrated historical spaces play a significant role in urban planning as they act as reference points. They are more frequently visited and provide clear navigation [11]. The studied area is included in an excursion route, making panoramic views of the urban landscape particularly important. According to the forecast distribution of the average annual excursion flow of visitors to the Old Kyiv part of the city [21], the share of visitors from Kyiv is 20%. Therefore, this route is a crucial element of the city's tourist infrastructure and contributes to its identification.

The research on the spatial-visual qualities of the historical environment of the Desyatynna Church in Kyiv comprises four main stages according to Liu & Nijhuis [9]. The sequence of spatial perception is embedded in a survey route spanning 750 meters, starting from the central entrance, including remnants of the Desyatynna Church foundation, and offering a panoramic view of the city. Along the established route, six viewpoints have been selected (see Figure 2), with the main visual characteristics outlined in Table 1. Orientation, intended to guide movement, is represented by focal points, which

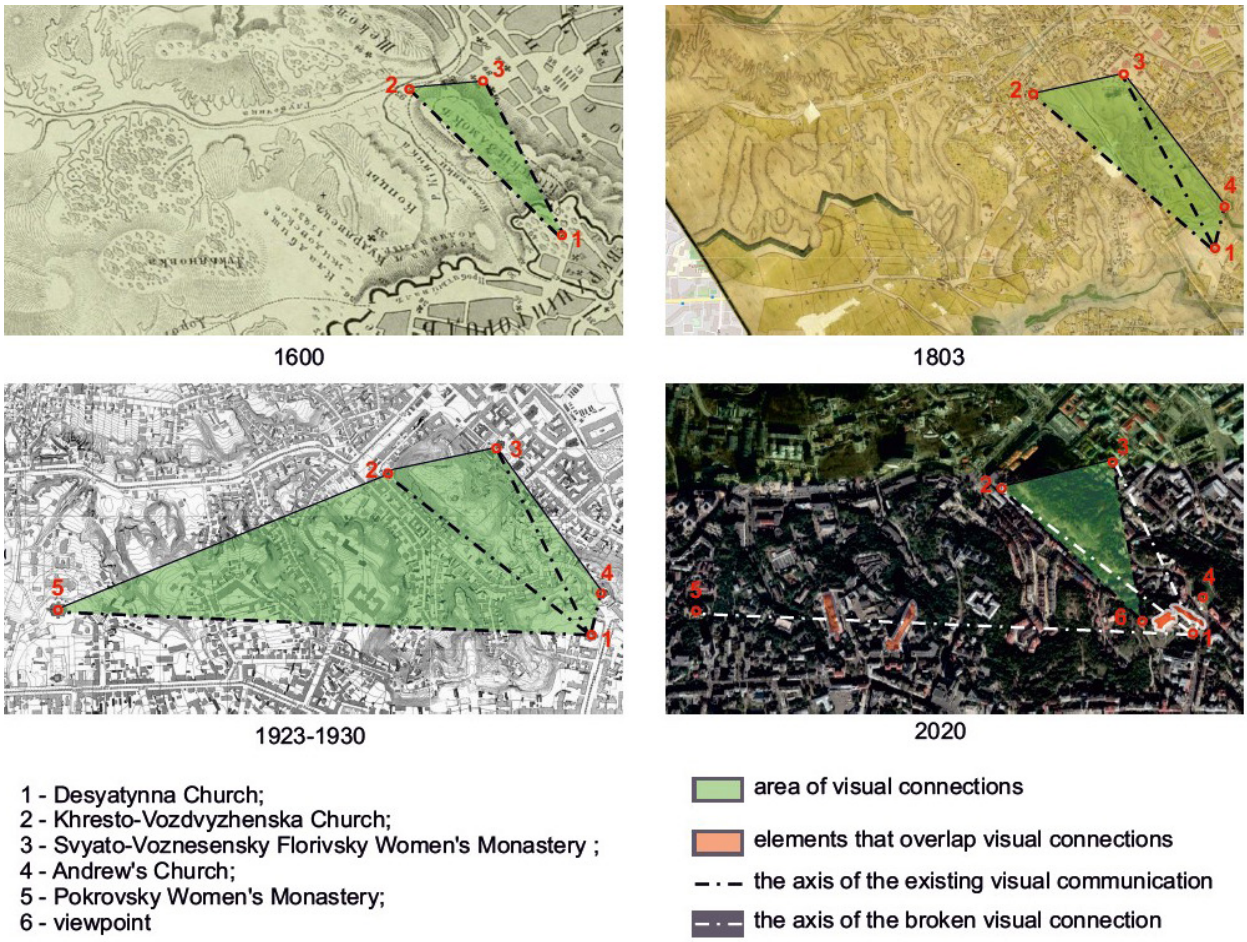


Fig. 1. Changes in visual areas and connections of the territory of the Desyatynna Church with other sacred structures (17th-21st centuries) [developed by the authors based on maps from the website http://museum.kpi.ua/map]

are sacred objects. The continuity of perception is based on an analysis of space types, viewing depths, horizontal viewing angles, and perspectives that characterize existing visual connections and areas (Table 1). The diversity of urban landscapes is considered based on the combination of landscape and architectural elements in the environment.

Viewpoints 1-4 represent urban perspectives directed towards the foundations of the Desyatynna Church and the elements of its approaches. Among them, viewpoint 4 stands out, where over the last 40 years, the visual connection with St. Andrew's Church has been almost completely lost. Additionally, the visual axis has reduced from 150 meters to 70 meters due to the growth of tree plantations on the northeastern slope, mainly dominated by the Norway maple (Acer platanoides L.) and the black locust (Robinia pseudoacacia L.) reaching a height of over 20 meters.

The specific locations of viewpoints 5 and 6 on elevated terrain allow for panoramic views towards the urban landscape. The most significant changes in the horizontal viewing angles are observed at viewpoints 5 and 6, situated on observation platforms of the upper and lower terraces of the Starokyivska Hill. The detected narrowing of the horizontal viewing angles (Table 1) occurred due to the growth of tree plantations on the slopes, leading to a transition from an open space to a semi-open space.

The most impressive viewpoint for observing the urban landscape along the investigated route is the panoramic observation point. The impact of changes in vegetation on the openness of the urban space on the upper terrace of the Starokyivska Hill is shown in Fig. 3.

Currently, there is a trend towards the disruption of the natural order in the urban environment due to the introduction of modern architectural elements, fragments of industrial landscapes, alteration of the natural lighting of the landscape, and changes in the ratio of natural and artificial elements [33]. A similar trend is observed at viewpoints 4, 5, and 6.

The current multi-perspective view of the landscape from the main viewpoint is illustrated in Fig. 4. Urbanized landscapes are dynamic, complex, multifunctional, and require continuous monitoring and inventory of landscape conditions [2]. The plantations on the slopes of the Starokyivska Hill are under the authority of the Communal Enterprise for Greenery Maintenance of the Podil District in Kyiv city. They cover an area of 2.74 hectares, of which 2.41 hectares (88%) are covered by tree plantations. There are 1200 trees and 1019 bushes. The dominant species among the trees are the Norway maple (78%) and the black locust (19%) with a smaller share of birch and apple trees. The condition of the plantations is mostly good. Among the bushes, decorative deciduous species account for 79%, while the rest are ornamental flowering plants.

When solving urban planning issues in areas with complex topography, there is a necessity to utilize both engineering and meliorative measures to address soil erosion problems [14]. The plantations created for this purpose on the studied hills with significant elevation differences do not disrupt visual connections in depth, enhancing the urban development situation (Fig. 5).

The overall panorama of the city should be characterized by landscapes with high openness and a well-organized balance of elements. The visual exposure significantly improves the landscape view with moderate openness [32; 35]. From view-

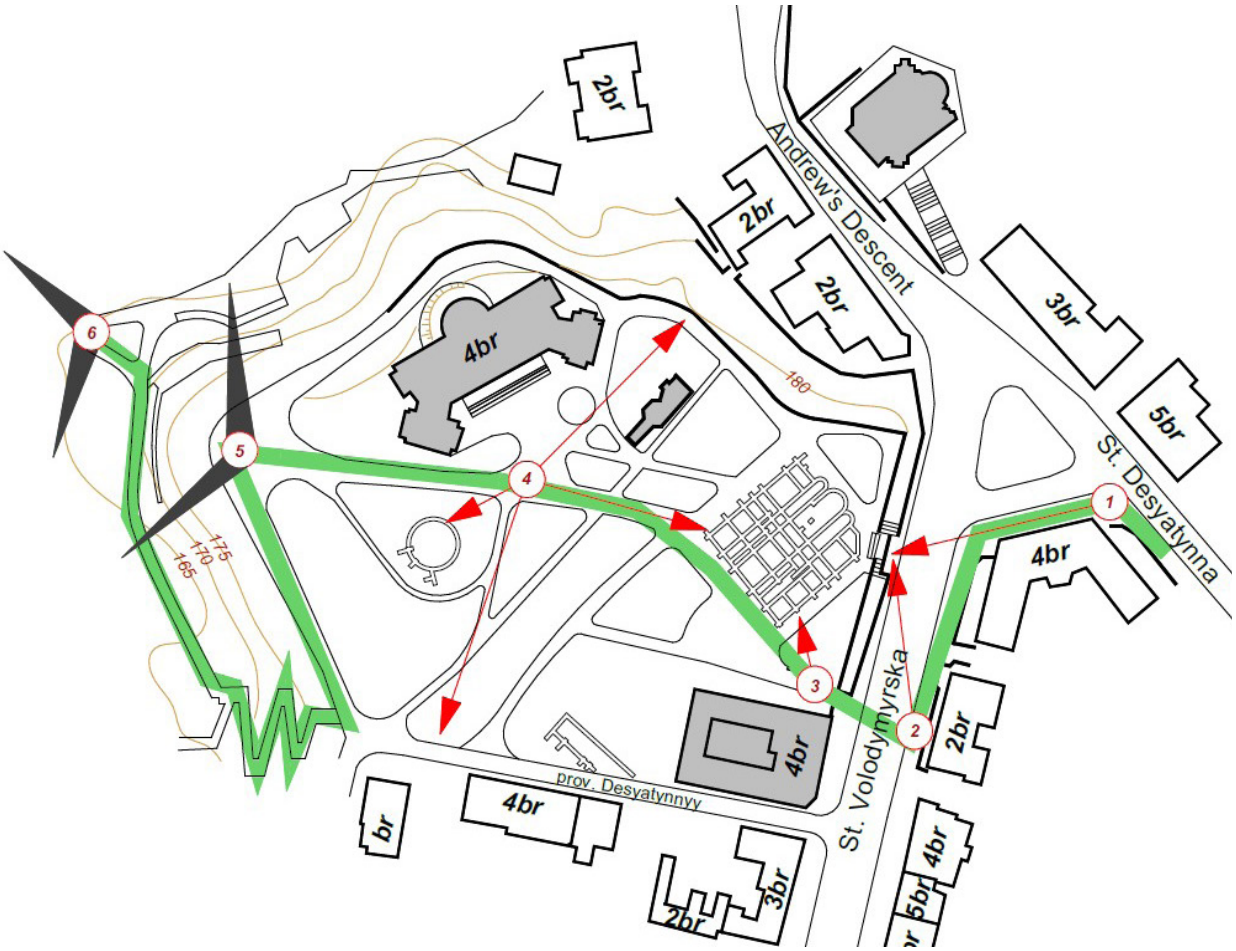


Fig. 2. Route Overview Scheme of the Desyatynna Church Territory [developed by the authors based on field surveys and topographic mapping of Kyiv city in a scale of 1:2000 (topographic maps)]

Table 1. Description of the parameters of the main viewpoints of the route

| Viewpoint Number | Depth of View, m | Horizontal Viewing Angle, degrees | Focal Points, Accents | Perspective View | Type of Space and Its Changes over the Last 40 Years |
|---|---|---|---|---|---|
| 1 | 70 Medium | 50 Sectorial | The central passage stairs to the foundations of the Desyatynna Church | Single-plane, urban interior | Open, no changes detected |
| 2 | 50 Short | 25 Perspective | The central passage stairs to the foundations of the Desyatynna Church | Single-plane, urban interior | Open, no changes detected |
| 3 | 20 Short | 90 Dioramic | The foundations of the Desyatynna Church | Single-plane, urban interior | Open, no changes detected |
| 4 | 60 Medium | 280 Circular | The foundations of the Desyatynna Church | Multi-plane, urban interior | Open, depth of view reduced by 80 m towards St. Andrew's Church |
| 5 | Over 700 Far | 130 Panoramic | Svyato-Voznesensky Florivsky Women's Monastery, Khresto-Vozdvyzhenska Church | Multi-plane, urban interior | Semi-open, angle narrowed from 270° to 140° |
| 6 | Over 500 Far | 110 Dioramic | Vozdvizhenska outskirts | Multi-plane, urban interior | Semi-open, angle narrowed from 180° to 70° |

[developed by the authors based on field surveys and topographic mapping of Kyiv city at a scale of 1:2000 (tpographic maps)]

point 5, there are distant perspectives that establish visual connections with the buildings of the Svyato-Voznesensky Florivsky Women's Monastery at distances of 600 and 780 meters, as well as with the building of the Khresto-Vozdvyzhenska Church at a distance of 650 meters. However, it is noted that the current state of the green plantations on the slopes of the Starokyivska Hill hinders the exposure of a comprehensive panorama of the sacred cultural heritage structures. This issue has not been properly addressed yet, and there is a trend of further deterioration of visual connections, including those with the Pokrovsky Women's Monastery (Fig. 1), and a disruption of the balance between existing architectural and natural elements in the landscape.

At the same time, it remains essential to explore ways of developing the city that would define its architectural and compositional uniqueness in the historical part, considering the interplay of landscape and relief, including vegetation, as a three-dimensional shaping element [12]. Various methods for measuring 2D and 3D visibility of urban spaces exist to predict the visual impact of new constructions and plantations to address urban design problems, allowing the utilization of open spaces based on visibility characteristics [16]. In areas with complex topography, preserving panoramic views with distant perspectives can be achieved by modeling the outlines of the existing landscape using levelling or repetition techniques with the help of tree plantations [27]. It is important to select plants in such a way that mature plants, reaching their maximum height, do not disrupt historically valuable visual areas and connections. For example, to restore visual connection from viewpoint 4 to the Andriyivska Church on the slope with a height difference of 15 meters: in the upper


Fig. 3. Changes in the openness of the Starokyivska Hill landscape at the upper observation platform [developed by the authors based on https://kotsiuba.com/project/renovation-of-starokyivska-mountain and Google Earth]

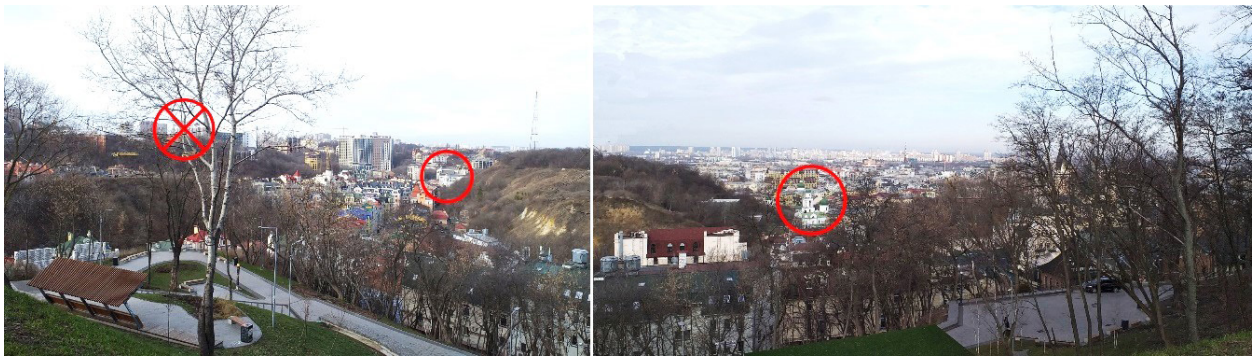

Fig. 4. Panorama of the visual exposure of the urban space from viewpoint 5 with preserved (◯) and disrupted visual connections (⊗) [developed by the authors based on field surveys]

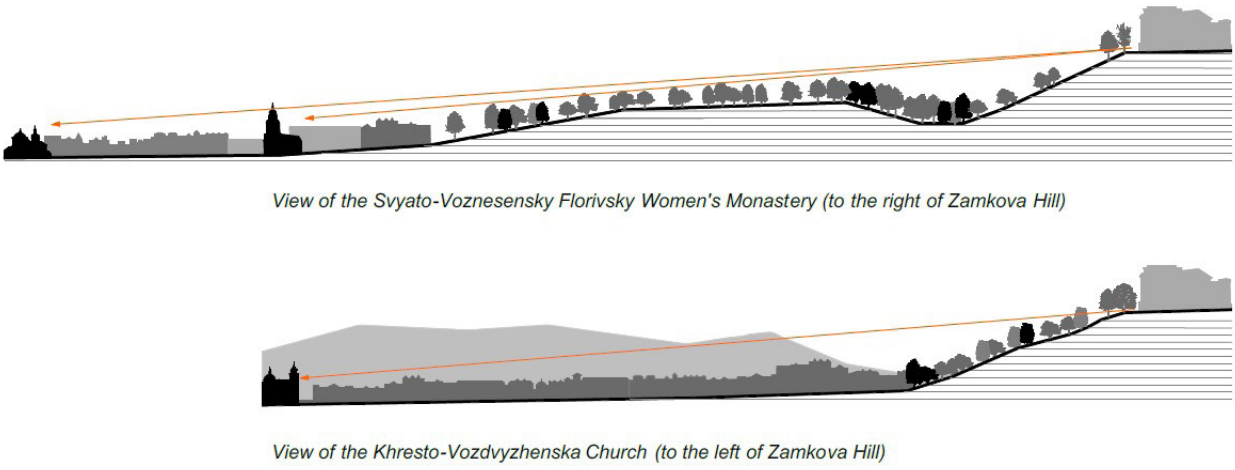


Fig. 5. Vertical profiles of viewpoint 5 (horizontal distances shown every 5 meters) [developed by the authors based on topographic mapping of Kyiv at a scale of 1:2000, Google Earth, and field surveys]

part - up to 1 meter in height, in the middle - up to 5-8 meters, and in the lower part of the slope - up to 10-15 meters. Based on this planting technique, further reconstructive measures should be taken to restore the horizontal viewing angle of distant perspectives visible from viewpoints 4 and 5.

## Conclusions

As a result of the conducted research, the dynamics of visual connections and areas between sacred architectural objects in the historical landscape of Kyiv city have been analyzed, considering the complex relief conditions. The peculiarities of perceiving the territory of the Desyatynna Church in the Starokyivska Hill region as a complex urbanized area, which serves as an identifier of the city, have been outlined.

It has been established that throughout the historical development of the territory, there have been changes in visual connections. From the 17th to the 18th centuries, there were minor landscape transformations, while at the turn of the 19th to the 20th century, landscape changes occurred due to alterations in the natural relief. Furthermore, from the second half of the 20th century, these changes were influenced by vertical development. As a result, there has been an increase in the area of visual connections between sacred structures until the beginning of the 20th century, followed by active reduction at the beginning of the 21st century. Notably, the

connection with the Andriyivska Church was disrupted by plantations, and the vertical development disrupted the connection with the Pokrovske Women's Monastery.

During the analysis, changes in the openness of the investigated landscape have been identified, expressed through the parameters of view points. Specifically, the disruption of visual connections between the Desyatynna Church and the Andriyivska Church, with a reduction of the visual axis depth from 150 m to 70 m, was observed. On the main observation platforms of this area, a narrowing of the horizontal viewing angle from 270 degrees to 130 degrees on the upper platform and from 180 degrees to 110 degrees on the lower platform was noted, which overall reduces the visual quality of the historical landscape. These changes occurred due to modern city development and the expansion of tree plantations, which transformed the open-type space into semi-open. However, it is important to emphasize the preservation of deep perspectives on the cultural heritage objects of Kyiv city, such as the Svyato-Voznesensky Florivsky Women's Monastery and the Khresto-Vozdvyzhenska Church.

Highlighting the important role of the historical layer as an integral part of the urban landscape, the article emphasizes the holistic visual perception of the silhouette of ancient Kyiv, considering the influence of tree plantations in the conditions of complex relief. Recommendations for selecting plants to model the landscape outlines are provided.

The results of these studies can inform future efforts aimed at altering the existing landscape while adhering to legislation regarding the peculiarities of development in the historical part of the city. This will help avoid the obstruction of currently preserved visual connections between the city's sacred objects and restore those that have been disrupted or lost. Restoration of visual connections should be carried out considering the sequential perception of space along the route, with the identification of viewpoints from which the sacred objects are best revealed. The continuity of unveiling the historical space and ensuring the diversity of its urban landscapes is proposed to be achieved through architectural and landscape elements.

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## Kopsavilkums

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# CULTURAL AND HISTORICAL RESEARCH OF NĪTAURE MANOR

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**Abstract. The manor of Nitaure (Nitau) is located in Cesis County, where the roads to Riga, Sigulda, Piebalga and Ieriķi meet. The village of Nitaure began to develop only after 1887, when separate plots of land were separated from the manor for residential purposes. This time, however, the subject of research is the manor house and its owners, as well as the park, which, tidy and well-kept, delights not only the local residents. The history of the manor is closely linked to the von Fermor and von Stenbock-Fermor families. Research into the history of the manor is topical, as it is rich in events that have taken place throughout the ages. There is also a lot of evidence in the archives and other historical material.**

**Keywords: protection and preservation of architectural and cultural heritage, parks and gardens**

## Introduction

In this picturesque corner of Vidzeme, through which the Mergupe River runs, a group of buildings typical of a Latvian rural settlement can be found in one place, forming an image of the environment and landscape that has been preserved over time. These include the Evangelical Lutheran Church (1762– 1769), the rectory (19th century), the ruins of the Order's castle (15th century), which have already been studied several times, the parish house 1, the mill and the manor house with a park and some outbuildings. The manor house is not an outstanding architectural monument, as it has been extensively rebuilt over time. However, it once reflected well the artistic style, taste and life of its time. It was surrounded by the rest of the manor centre, the park with ponds, and the environmental and landscape elements that corresponded to it. The Gentlemen's House is also a witness to all the events that took place here - grey everyday work, colourful festivities, passionate love, sadness and hope. It is also no stranger to the 1905 riots and the misery that followed. Perhaps that is why it is worth looking into the past of Nītaure Manor, and trying to conjure up for us what no longer exists and perhaps never will.

## History and Owners

In 1759, the Russian Empress Elisabeth Petrovna (reign 1741–1761) granted the Nitaure manor together with other manors (Annenhof, Martzen and Moritzberg) to General Count Wilhelm Georg von Fermor (1702– 1771) as a reward for his participation in the Seven Years' War2 . He came from a small family of Scottish nobility. He began his career in the service of Tsar Peter I of Russia (reign 1682– 1725) and was promoted to the rank of colonel in 1725. He successfully participated in several battles in Europe and also in the East. By 1740 he was already Commandant of Viborg, and from 1746 Lieutenant-General and head of the building chancellery in St Petersburg. In 1751 he was appointed Governor-General of St Petersburg, Finland and Novgorod. In 1757 he was promoted Field Marshal, in 1758 he was created Count. He was admitted to the matriculate of the nobility of Vidzeme at the Landtag in 1759 [3]. In 1762, W. G. von Fermor was retired and the general was able to spend his old age in a quiet corner of the Vidzeme countryside. He chose Nitauri as his place of residence from the manors he received. Prestige and the desire to create a place for himself and his descendants to live in the best style of the time led him to build a manor house.

The aim of the study is to summarise the solutions of the architectonic-historical construction of the manor and the compositional structure of the park. It includes the following tasks:

- research of the archives of the Barons Stenbock-Fermor family, owners of Nītaure manor;
- assessment of the architectural stylistics of the existing and lost parts of the manor house;
- study of the compositional structure of the park.

The comparative method, based on archival material, is used to study the current and historical functional and compositional structure of the manor complex, considering the current situation of its functional circulation.

The work is believed to have begun after 1762. The earliest known depictions of the new manor house are drawings by J. K. Brotze from 1796 [4]. Other buildings are depicted next to the residence of W. G. von Fermor, such as the household servants' organ, the master's house, the barn, the cattle shed, etc. Gradually, a park was also created, first in French regular, later in English landscape. In the drawings by J.K. Brotze, the manor house was different from the one we see now. It was a two-storey building with a steeply pitched roof, the ends of which were partly chamfered. In the centre of the long facade was a three-bay bay with a triangular pediment and a Baroque double staircase leading to the ground floor, as the building had a high plinth. The corners and sides of the bay were decorated with rosettes. The architecture of the building can be attributed to the late Baroque period in Vidzeme [5]. However, it differed from other manor houses of the period whose construction is attributed to the Riga builder Johann Andreas Haberland, such as the manor house at Liepupe Manor (Pernigel).

The Count did not live alone in the newly built house. Already in 1738 he was married to Dorothea Elisabeth von Bruce (1714–1762). They had two children, the later Count Wilhelm (William) Georg von Fermor (1749–1828) and Zara Eleonora (1740–1818), who married Countess von Stenbock. Her husband was Count Jakob

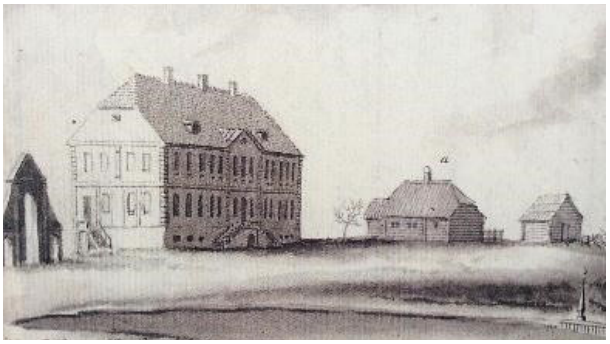

Fig. 1. Nītaures manor house. Drawing by J. K. Brotze, 1796 (fragment)

Fig. 2. Jakob Pontus Magnus von Stenbock [internet resources]

Fig. 3. JPortrait of Zara Eleonora von Fermor (1740 - c.1818). Ivan Vishnyakov, 1749. St Petersburg Academy of Arts Museum [internet resources]

Fig. 4. Portrait of Wilhelm (William) Georg von Fermor (1749 - 1828). Ivan Vishnyakov. 1759. Museum of the St Petersburg Academy of Arts [internet resources]

Fig. 5. Portrait of Wilhelm Georg von Fermor. Alexey Antropov. 1765. St Petersburg Academy of Arts Museum [internet resources]

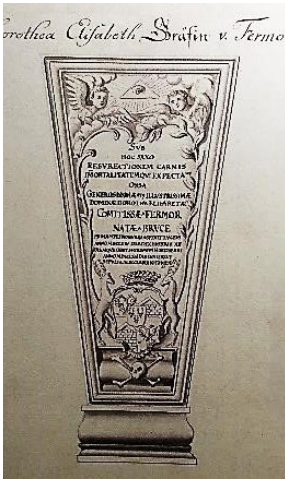

Fig. 6. The tomb monument of Countess Dorothea Elisabeth von Fermor in the Lutheran Church in Nitaure. Drawing by J. K. Brotze, 1796

Fig. 7. The tomb monument of Count Wilhelm Georg von Fermor in the Lutheran Church in Nītaure. Drawing by J. K. Brotze, 1796

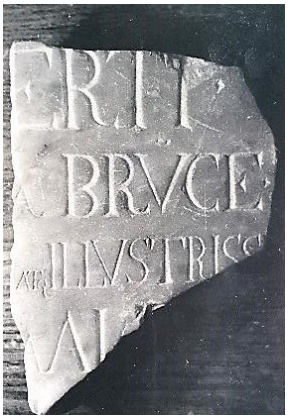

Fig. 8. A fragment of the tombstone of Dorothea Elisabeth von Bruus from the Lutheran Church in Nitaure [photo by the author, 1978]

Fig. 9. The graves of the Count's descendants and relatives preserved in a special compartment in the Nītaure cemetery. During the Soviet period, they were periodically and cruelly vandalised, but now the remaining monuments have been cleaned up [photo by the author, 2023]

Fig. 10. Maria von Stenbock Fermor, b. Countess Kropotkin [internet resources]

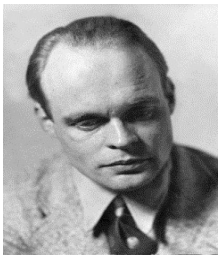

Fig.11. Alexander Stanbock - Fermor [internet resources]

Pontus Magnus von Stenbock (1744–1824).

It is interesting to note that one of the greatest Russian painters of the time, Ivan Vishnyakov (1699–1761), immortalised both of the Count's children on canvas when the family lived in St Petersburg. Portraits of children and ladies occupy a special place in his oeuvre. They are painted with particular care and feeling, delving into the inner world of the sitter. The little Countess Zara Eleonora in 1749 was painted according to all the rules of an adult parade portrait, full-figured, in sumptuous dress against a background of heavy drapery and theatrical scenery. According to Tatiana Ilyina, a scholar of Vishnyakov's work, this painting is a jewel of mid-18th century Russian painting [6].

The death of his wife Dorothea Elisabeth in 1762 brought changes to the Count's life in Nītaura. In her memory, W. G. von Fermor had a new stone church built on the foundations of the Order's castle, instead of the old wooden church, and gave it Dorothea's name. The church also houses her tomb. A trapezoidal plaque with a finely moulded cornice was placed on the plinth, with the text in the central part and the family coat of arms below. The top of the monument was decorated with angel figures. The monument was made of marble. The text mentioned, among other things, that D. E. Bruce was born in St Petersburg and died in the manor of Moritzberg [7].

Shortly after the church was built in 1771, the Earl died. Like his wife, he had a tombstone erected in the church. The work of art represents the Classical period, when memorial sculpture flourished in Latvia. The text on the monument, translated from a drawing by J.K. Brosse and published by Vitolds Mašnovskis, reads as follows "Here, under this sacred stone, rest the mortal remains of Wilhelm de Fermor, the highborn husband of the most holy friend of the German Emperor, the Supreme Military Commander of Ruthenia, Governor of Smolensk, who was a hero in both public and military life. He was a knight of the Russian orders of St Andrew, St Alexander, the White Eagle and St Anne, heir to the manors of Nitaure, Mores, Milgravis, Anna and Marciena. Born in Pskov on 27 September 1702, died in Nitaure on 8 February 1771. The last frontier of all – death" [8]. The monument was crowned with an image of a mourning angel with a shield at its foot.

The two von Fermor monuments were drawn by J. K. Broce in 1796 [9]. They are the only source of information about the works of art that perished during the war.10 However, during a visit to the church in 1978, when the floor of the parish hall was being changed, the author of these lines managed to find a fragment of a marble memorial plaque with von Bruce's surname underneath, right next to the altar. The fragment has been lost over time, but the photograph is also a unique testimony of sorts [11].

The passing of W. G. von Fermor marked the end of a period in the development of the Nītaure Estate in which architecture and art played a significant role. From then on, such times

Fig. 12. The Lord's House after its burning in 1905. Livlands Zerstörte Schlösser

Fig. 13. The Gentlemen's House from the park side [photo by the author, 2021]

Fig. 14. The Gentlemen's House from the park side
[photo by the author, 2023]

Fig. 15. View from the porch of the manor house to the park
[photo by the author, 2023]

Fig. 16. Parks [photo by the author, 2023]

Fig. 17. Plan of the Nītaures manor lands. 1885 - 1888. [Latvia State Historical Archive, 1679. f., descr. 194, p.134]

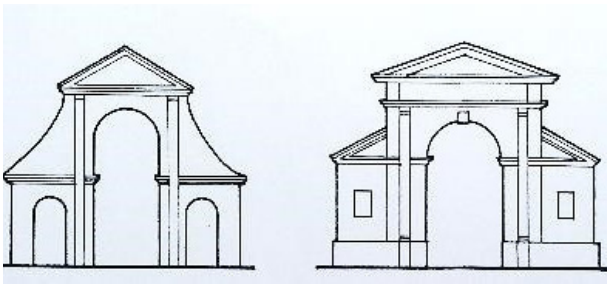

Fig. 18. Nītaure Manor Park Gate after the drawing by J. K. Brotze (left) and K. K. L. Hirschfeldt's Theory of Garden Art [drawing by the author]

of prosperity did not occur. Nitaure and other manors were inherited by the aforementioned son, also Wilhelm Georg (1823–1881), who married the daughter of General Count von Essen. They had no descendants. In 1785, W. G. von Fermor sold the Marzen estate, in 1786 he mortgaged the Mores estate and later also the Anna estate, which he had bought from his sister. After his death, the manor was inherited by Zara Eleonora's son, who added his grandfather's surname to his own and was called Stenbock - Fermor. In 1851, Lieutenant Count Friedrich von Stenbock - Fermor bought the manor from his relatives. From 1887 he lived independently in Riga. Only the manager P. Šmits stayed in the manor. After the Latvian agrarian reform, the manor was expropriated in 1920 to its last owner, Wilhelm Konstantin Stenbock - Fermor (1863–1937). His wife was Marija née Stenmor. Princess Kropotkin (1879–1958), sister of Prince Nikolai Kropotkin, a lady-in-waiting to Tsarina Alexandra Feodorovna. Herbert von Blanchenhagen described V.K. Stenbock-Fermor in his memoirs in a peculiar way - he was distinguished more by his stiff dryness than by his count-like appearance [12]. W. K. Stenbock - Fermor was the father of the writer, screenwriter and politician Alexander Stenbock - Fermor. A. Stanbok - Fermor was born in 1902 in Nītaure, died in 1972 West Berlin. He fought in the Landwehr and later emigrated to Germany. He described his life in Nitaure Manor in his book The Red Count, published in Germany in 1973 [13].

In 1905 the manor house was burnt down. Only the walls remained, as seen in the Livlands publication Zerstörte Schlösser [14]. In the 1920s, after the Latvian agrarian reform, the building was renovated to house a school – new roof extensions, the central bay gable was removed and the layout was changed. It is not known exactly when the asymmetrical extension to the rear of the building, facing the church, was built. It was most probably in the second half of the 19th century, to which date the addition of the porch at the main entrance instead of the Baroque staircase can also be attributed. The building, renovated and reconstructed in the 1920s, has survived to the present day. It is the school that has brought this historic building to the present day and to the use it has enjoyed.

Fig. 19. Alley in the park [photo by the author, 2023]

Fig. 20. The lost barn near the manor house [photo by the author, 1978]

Fig. 21. The Lord's house and barn [photo by the author, 1978]

Fig. 22. Ruins of the gardener's house (?) [photo by the author, 1978]

## The Park

The park has also been preserved to this day and, as already mentioned, is a pleasure to visit not only for Nitaurians, but also for visitors. At first it was a regular French-style park, but later it was transformed into a romantic landscape park.

The analysis of the old manor parks shows that the Italian parks were characterised by their small size and narrow paths, as in Nītaura, while the French parks were characterised by flat terrain and gently sloping terraces leading to a pool of water, as in Nītaura [15]. Opposite the main entrance to the manor house is an avenue with a small circular pond in the middle. The park has benches with historic granite side supports, now restored. The ponds are also visible on the other side of the manor house, facing the church. J.K. Broce preferred to depict buildings in his drawings, but the park also contains a number of interesting features. One of them is a rather unusual structure, a free-standing gate at both ends of the manor house. It has three openings (the middle one is about twice as high) and artistic facade decoration. J.K. Broce writes in his comments on the drawings that the courtyard of the manor is not surrounded by a stone fence and the gate (portal) stands alone. It was apparently the entrance to the park or one of its parts, the so-called pleasure garden. Such gates were not uncommon in 18th-century estate parks in Europe. They are also to be found in K. C. L. Hirschfeld's Theorie der Gartenkunst, a popular book of the time, which served as a compendium of ideas and models [16]. According to K. C. L. Hirschfeld, gates can be used both as the main entrance to a garden and as a means of division. Looking at the Nitaure gate and one of the models, we can see the commonalities and also the differences. The Nitaure gate has a simpler decor and is closer to the Baroque style, but it is significant that the designers of our manor parks were no strangers to the most recent European findings. I would disagree that the ornate gates are not in keeping with the intended stone enclosure.17 Where could there have been an enclosure next to the manor house when it was and is closely linked to the park avenue and the surrounding natural environment, which is intimate, without expansive open spaces and distant vistas? It is also difficult to imagine the existence of a so-called enclosed garden in this location. Interestingly, the park was also created relatively late. For example, the commercial horticultural firm C. W. Schoch Nursery in 1898, 1896 and 1915–1920 included the customer from the Nītaures estate – Count von Stenbock, and the authorised recipient (gardener) was Jānis Bērziņš [18].

Manor buildings Little of the manor's historic outbuildings have survived to the present day. The land plan drawn up by the Reviser R. Mueller in 1885-1888 shows more than 15 larger or smaller buildings.19 Further away from the centre were the Big Inn or the so-called Yellow Inn on the old Riga - Pskov highway and a water mill, which today functions successfully as a guest house and inn. The barn almost next to the manor house, which was still in use in 1978, has been lost. It was a large, unwieldy building with a steeply pitched roof, the ends of which had been partially torn off. In 1978, the ruins were already occupied by the manor gardener's (?) house, a log building on a high rubble stone foundation.

## Conclusions

1. The Nitaure Manor is not included in the list of national cultural monuments. It is a characteristic example of Vidzeme manor architecture from the second half of the 18th century, whose authenticity and historical patina, which has been partially lost over time, should be preserved.
2. The Gentleman's House is of great importance as part of the buildings of the manor centre, as it is an important element of the surrounding cultural and historical environment and landscape. This requires a serious approach to the management of the site and respect for the conservation areas. This includes not obstructing views of the landscape. This is particularly true of the compositional and spatial unity of the manor house, park and church. At present, anthropogenic pressures tend to erode the historically established spatial harmony.

3. Of particular value in Latvian cultural history is the connection with important personalities who lived and developed their quality of life on the territory of Latvia during the Russian Empire.
4. The study includes the author's first publication of photographs (1970) and provides additional unique information on the character and composition of the manor.
5. The material presented in the publication requires further research using digital scanning software, both for the location of historical footpaths in the park area and for the clarification of the historical layout of the rooms in the manor house before it was converted into a school, as well as for the interior design.

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## Author

In 1979, **Jānis Zilgalvis** graduates from the Faculty of Architecture of the Riga Technical University.
In 1990, he defends his doctoral thesis on the theme "The Latvian manor architecture from the second half of the 19th century until the beginning of the 20th century. Since 1995, he heads the Department of Architecture of the State Inspection for Heritage Protection and from 2001 until 2014 – he is the dean of the Faculty of Architecture and Urban Planning of Riga Technical University. Since 2012, he is a full member of the Latvian Academy of Sciences. He has more than 180 scientific and popular scientific publications, and he is the author of 21 books (for some books – a co-author). His main research directions are as follows: manor architecture and history of culture, sacred architecture, protection and utilization of the cultural heritage.

## Kopsavilkums

Nītaures muiža (*Nitau*) atrodas Cēsu rajonā, vietā, kur sadalās ceļi uz Rīgu, Siguldu, Piebalgu un Ieriķiem. Nītaures ciema apbūve sāka veidoties tikai pēc 1887. gada, kad no muižas zemes tika atdalīti atsevišķi zemesgabali apbūvei. Taču šoreiz izpētes objekts ir kungu māja un tās īpašnieki, kā arī parks – kas sakopts un saudzēts priecē ne tikai vietējos iedzīvotājus. Muižas vēsture ir cieši saistīta ar fon Fermoru un fon Stenboku - Fermoru dzimtu. Tās izpēte ir aktuāla, jo muižas vēsture ir bagāta ar daudziem laikmetu gaitā noritējušiem notikumiem. Daudz liecību ir saglabājies arī arhīvu un citos vēsturiskos materiālos.

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# LANDSCAPE SENSITIVITY ASSESSMENT WITHIN SPATIAL DEVELOPMENT SCENARIOS. LATVIA CASE STUDY

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**Abstract. Abstract. European countries have different experience in landscape characterisation and assessment. Comparing the different approaches used in different European countries, it is proposed to use the method developed and validated in the United Kingdom - Landscape Character Assessment, adapted and modified for the Latvian situation. This approach has also been used in most other European countries, which have chosen to use the UK approach to landscape characterisation, adapting it to their specific national situation. The need for a landscape assessment in Latvia is highlighted in the Latvian Landscape Policy Guidelines 2013-2019 and Latvian Landscape Policy Implementation Plan 2024-2027, taking into account the actions set out in the European Landscape Convention to be taken by all Parties to the Convention. The purpose of the research was to carry out the analysis of Latvian landscape sensitivity within spatial planning scenarios important for local municipalities. It is of high importance to assess landscape sensitivity for changes of build and natural environment influencing pace and scale of development of the rural areas of Latvia. As local municipalities set different goals for their spatial development, common spatial development scenarios were chosen to make analysis of landscape sensitivity in Latvian landscapes. Results from the analysis of landscape sensitivity show variation of suitable actions to be implemented if different places in Latvia. The results also can be used for defining landscape quality goals to harmonise scope of activities to be implemented by local municipalities of Latvia.**

**Keywords: landscape assessment, landscape sensitivity, landscape capacity, European Landscape Convention**

## Introduction

Considering the multidisciplinary nature of landscape, there are different approaches and methods used in landscape research in different disciplines (geography, geology, geomorphology, ecology, history, archaeology, landscape architecture, etc.), based on the traditions and experience of the specific disciplines [2; 9; 13; 21; 23]. Within the framework of these different sectors, the concept of landscape emphasises different qualities or characteristics, and consequently landscape studies use only discipline-specific approaches and criteria [5; 6; 21; 23; 26].

Historically, two distinct blocks of landscape research have emerged. One is based on the appreciation of landscape character as reflected in the arts and humanities (painting, literature, etc.), the other on the biophysical properties of landscape, which are emphasized in the natural sciences, and also the use of land resources [5; 21; 23]. The priority given to the use of land resources also meant that, until the 1970s, landscape assessment was based on economic objectives, aiming to increase productivity and make the most efficient use of resources, which clearly led to the intensification of land use [25; 27]. At that time, the negative impact of this one-sided use of large areas, and hence of landscapes, on ecosystem functioning and the rural environment was not addressed.

Following the adoption of major environmental legislation [3] in the 1960s and 1970s, the development of ecological assessment methodologies was encouraged. This made it possible to assess the structure, function and potential of a site in relation to the natural equilibrium capacity of the landscape. As these theories developed, the fact remained that landscape assessment always involves anthropogenic interference with the natural balance [23; 25; 27]. This interaction between nature and man makes it necessary to value ecosystems that are otherwise virtually value-free, since valuations are to a certain extent the result of certain social settings and are therefore subject to change.

The adoption of the European Landscape Convention [12] in 2000 included a much broader understanding of landscape, going beyond the physiographic characteristics of landscape to include cultural, historical, social and economic aspects, everyone's right to landscape and the transmission of landscape values to future generations, as well as educational issues. The lessons of the European Landscape Convention are therefore geared towards action and the implementation of a comprehensive and integrated landscape policy through mutual cooperation between the different sectors involved at all levels of landscape planning and management.

Latvia's landscapes, natural and cultural resources are constantly changing in response to the direct and indirect impacts of human activities and natural processes, leaving a historical record in particular places. Over time, changes in agriculture, industry, society and the environment have had a significant impact on the intensity of landscape change. In many cases, change has been rapid, driven by changes in political or administrative regimes, land ownership patterns or population fluctuations. The result of these changes and the breadth of their impact is particularly evident at the larger scale of the rural landscape [4; 5; 6; 13]. For example, the wide range of infrastructure improvements that have taken place over different periods, including rural electrification and road improvements, have contributed to changes in the Latvian countryside, in places expanding rural settlements. In many parts of rural Latvia, EU-supported investments in the agricultural sector have changed the scale and management approach of farming, contributing to farm income sufficiency and the sustainability of the agricultural sector [27].

The ability of each spatial unit of the landscape to absorb new development pressures will depend to a large extent on its sensitivity, and it is therefore necessary to assess the impact of different options on the landscape (Fig.1) [17; 18]. Landscapes are not only variable because of their different perceptions or scales, they are constantly being affected by various biological and social processes, such as urban and village sprawl or uncontrolled construction, transport and energy

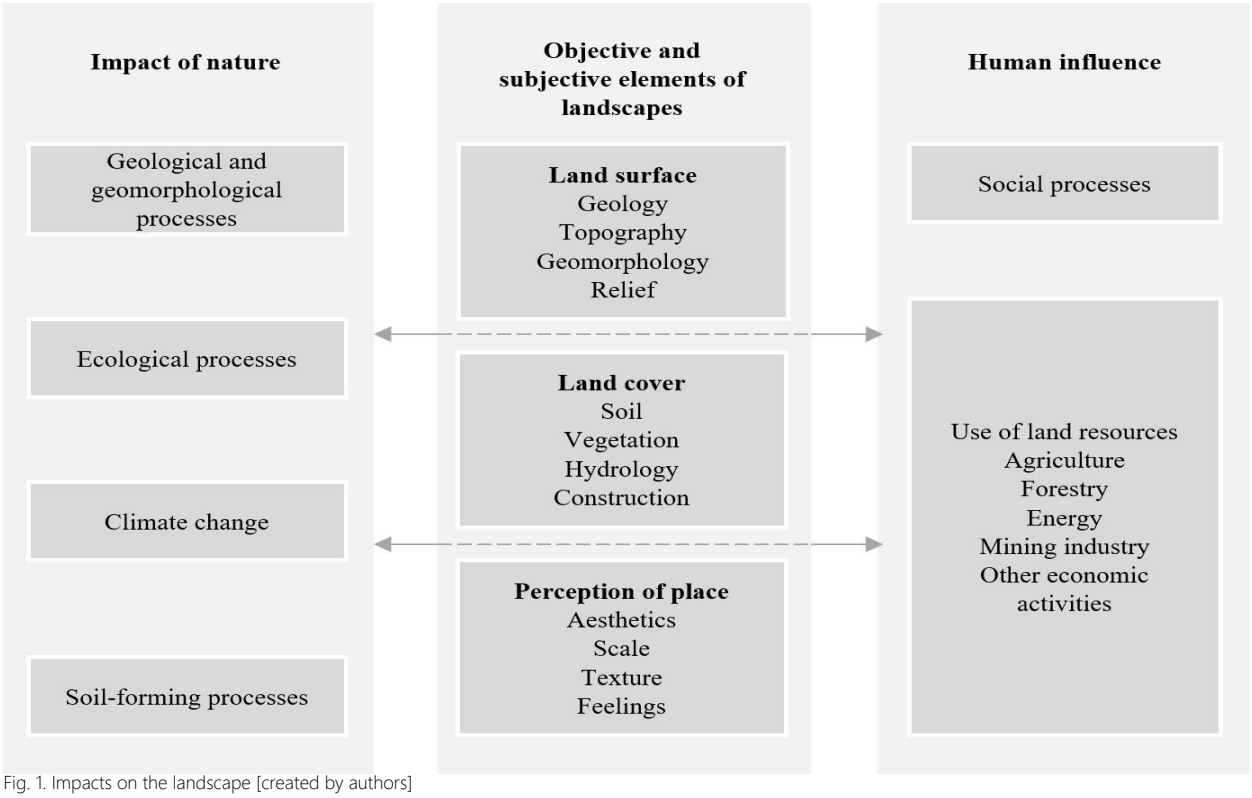


Fig. 1. Impacts on the landscape [created by authors]

infrastructure development, waste management and habitat loss, climate change and pollution, agricultural intensification or other changes in land use. It is therefore important to bear in mind the significance, nature and context of the impacts of development in order to ensure landscape quality while allowing development to take place [9; 15; 16; 22; 24; 25].

In a process of continuous change, the landscape continues to be transformed by different and changing patterns of land use and transformation, infrastructure and management. The consequences and significance of these changes cannot always be immediately assessed. People's perceptions change over time and new features can become valuable elements of the landscape [5; 7; 8; 11]. Development which will have a significant environmental and particularly visual impact will be best absorbed in spatial units where the landscape is resilient and able to absorb the pressures of development solutions. All developments and impacts should be assessed on a site-by-site basis in order to avoid, prevent or minimize potential adverse environmental effects. However, it is essential that change is managed in such a way as to maintain or enhance the qualities that make the Latvian landscape special and to preserve the diversity of its historical, cultural and ecological resources.

## Methods

The Landscape Character Assessment (LCA) approach [17; 18], developed in England and Scotland in 2002, provided the basis for a comprehensive, integrated and action-oriented methodological approach to landscape assessment. Landscape Character Assessment (LCA) is a tool that integrates natural and cultural landscapes and human perception, describing the spatial framework for the implementation of the European Landscape Convention (ELC). Landscape character is defined as "a discrete, repeatable and consistent pattern of elements in a landscape that makes one landscape different from another, rather than better or worse" [12].

In order to carry out the Latvian landscape assessment, the Kamils Ramans' classification [19; 20] based on large-scale landforms dividing Latvian landscape spatial units into 16 landscapes (ainavzeme) was used, where relief is the main criterion for defining them. However, other criteria such as river basin boundaries, cultural and historical criteria, geographical location also play a role. The 89 landscape areas (ainavapvidi), on the other hand, also include as an important criterion the land cover represented in the name, which is a synthesis of relief and land use, supplemented by the names of places or objects in the area, which create a landscape perception that recognises the area [15; 16; 20].

The mapping of the rural landscape into 406 landscape character areas (ainavu areāli) areas has been developed within the LandLat4Pol project, initially defining the preliminary boundaries of the areas taking into account the land cover and the landscape structure it creates (e.g. areas with a mosaic of different densities of forest and open areas), topography, water structures and built-up areas. The boundaries of the landscape areas were later refined following field surveys, considering human perception in addition.

Using current spatial data, the LandLat4Pol project has refined and adjusted the boundaries of two upper levels of landscape division (Fig.2) based on cartographic maps of relief, topography, geomorphology, catchments, soils, as well as taking into account the boundaries of the lower spatial landscape units - landscape character areas - which have been refined after field surveys.

The capacity of each spatial unit of the landscape to absorb new development pressures will depend to a large extent on its sensitivity and therefore the impact of different options/scenarios on the landscape needs to be assessed (Fig.3).

The context in which a landscape is assessed will always be important. Depending on the objective of the landscape assessment, the tasks to be carried out and the scope of the work will vary. In addition to landscape characterisation based on data analysis and field surveys, it is recommended that landscape assessment includes an assessment of landscape impacts, landscape functions and values, highlighting existing and changing landscape structures and elements.

One of the most common purposes of landscape assessment

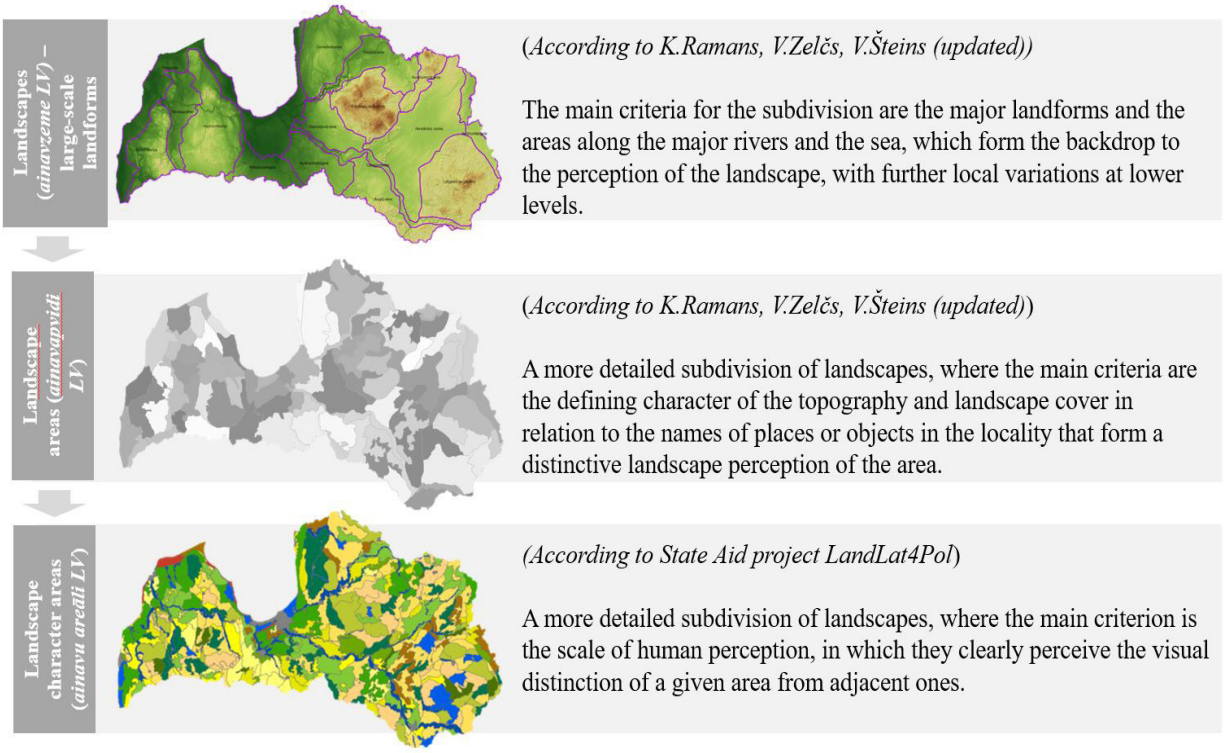


Fig. 2. Landscape division at different levels [created by authors]

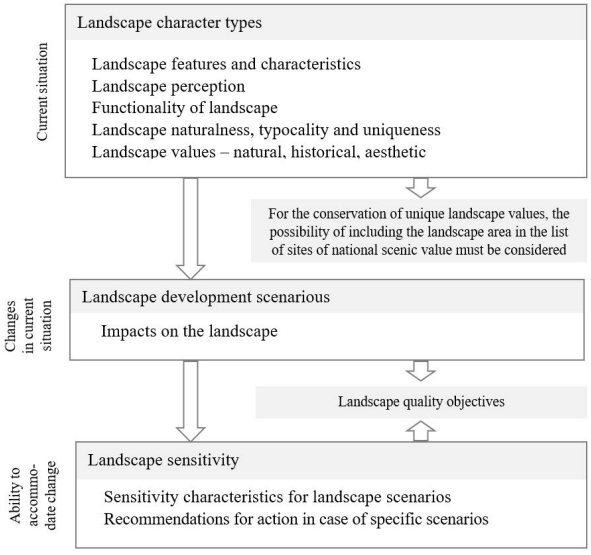


Fig. 3. Landscape sensitivity assessment process [created by authors]

is to determine the sensitivity or resilience of the landscape to environmental change as a result of various pressures. Landscape assessment leads to the preliminary setting of potential landscape quality objectives, which describe the condition to which the future landscape should aspire when planning and implementing different activities in a given area.

In order to ensure the quality of the landscape while allowing development to take place, it is important to bear in mind the significance, nature and context of the impacts of development. Landscape sensitivity thresholds can be used to describe the potential of a landscape as well as its sensitivity to change [18]:

- High sensitivity - Key landscape features and valuable qualities are highly sensitive to change due to changes in the type (area) and scale of development included in the assessment. They are unable to adapt to the proposed development without undue consequences for the maintenance of the baseline situation and/or the achievement of the landscape planning policy and strategy.
- Medium sensitivity - Key landscape features and valuable qualities are moderately sensitive to change (with the potential to be resistant to change) from changes in the type (area) and scale of development included in the assessment. They have some capacity to adapt to the proposed development without undue consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policy and strategy.
- Low sensitivity - The key landscape features and valuable qualities have a low sensitivity to change due to changes in the type (area) and scale of development included in the assessment. Planned changes can be accommodated without significant change in landscape quality. They have the capacity to adapt to the proposed development without undue consequences for the maintenance of the baseline situation and/or the achievement of landscape planning policy and strategy.
- The rating scale has intermediate values for the classification of landscape sensitivity, where for medium - high landscape sensitivity the proposed changes can be accepted minimally and only in some places, while for low - medium landscape sensitivity the proposed changes can be accepted to a reasonable extent in many places without significant change to landscape quality.
- Groups of landscape character and visual quality criteria can be used to determine the landscape sensitivity (at a pre-defined scale mentioned before) of a particular site [17; 18], where landscape character is defined by:
- Physical condition of the landscape - Landform, relief (predominantly flat, gently undulating or hilly terrain); Land cover, vegetation (predominantly cultivated fields, mix of rural woodland forming a mosaic or forest, woodland); Quality of agricultural land (assessment of the fertility of agricultural land); Proportion of protected areas (nature reserves, national parks, nature reserves) (these are small in area, uneven in distribution or dominated

by protected areas and form an important part of the identity of the area); Presence of water bodies (density of water bodies); Presence of watercourses (density of river network); Drainage systems (density of drainage systems in the area).

- Cultural/Social status - Land use (predominantly agricultural production or interspersed with forestry, or predominantly forestry); Cultural heritage (density and dispersion of cultural monuments in the area); Variety of cultural monuments (variety of types and types of cultural monuments in the area); Settlement structure (the territory is not settled, there are some settlements (homesteads) and the settlement is unevenly distributed in the territory or there are several concentrations of settlements (villages, towns) and the settlement is relatively evenly distributed, historical built characteristics); Location and density of tourist facilities (density and concentration of tourist facilities in different locations); Recreational facilities (diversity of tourist infrastructure); Cycling routes (presence of cycling routes in the territory).
- Aesthetic attractiveness - Naturalness (the landscape is based on natural and little modified landscapes, the natural areas are homogeneous in structure, without pronounced fragmentation or the landscapes are modified or partially modified, they are intensively used for agriculture or production and the natural areas are small in size and are fragmented or pronounced); Diversity of landscape elements (uniform landscape predominates or landscape is diverse (different landscape elements, groups of landscape elements are visible or a large variety of landscape elements (in terms of shape, colour, size) is visible); Movement (static, silent or noisy, with heavy traffic creating a constant noise in the landscape; Genius loci (not readable, readable in individual elements or viewpoints, or readable expressively or even at several levels of perception (architecture, atmosphere, nature, etc.)
- Landscape values - Rarity (common, rare, peculiar or unique); Typicality, uniqueness (typical or unique at national level); Associations (no intangible cultural values, or some intangible cultural values, or the area has certain local traditions, a strong cultural space).

On the other hand, the visual qualities of the landscape are characterised by visual perception - Scale of perception (small/closed/intimate; medium/limited openness or large/wide/open); Openness of the landscape (open landscapes with distant and wide views or limited views); High quality views and scenic roads (no or many high-quality views and scenic roads and a variety of scenic roads and sections).

Landscape sensitivity can be used to assess the susceptibility of a landscape to a particular type of change or development. It is an important process for planning for change in a particular place, taking into account the interaction between the landscape itself, its perception and the specific nature of the type of change or development in question. Although the landscape is constantly changing and influenced by the actions and decisions of society as a whole and of individuals, it is possible to identify key spatial development directions that are strategically planned and guided in local authority development documents. It should be noted that the landscape sensitivity criteria may be refined and/or supplemented, as well as randomly selected in the case of different landscape development directions/scenarios.

Considering the spatial development directions for the short and long term set by Latvian municipalities in strategic spatial development planning documents, potential spatial development scenarios have been presented which, if applied in a given area (landscape area), may lead to further landscape changes. In the process of landscape assessment, it is important to provide (practical) recommendations for mitigation measures, the implementation of which can help to mitigate irreversible changes in the landscape, contribute to the restoration and maintenance of the historic and existing condition, or improve the quality and value of the landscape.

In order to determine the sensitivity of the landscape of a specific landscape area to potential changes in the spatial unit of the landscape, a landscape assessment was carried out within different potential development directions/scenarios for the area. As different development processes affect biophysical and visual qualities differently, all or some of the proposed landscape sensitivity criteria can be used to assess sensitivity, assessing on a case-by-case basis what most directly affects landscape sensitivity under potential change and what should be addressed under the chosen development scenario. The sensitivity threshold for a given spatial landscape unit is derived from the dominant characteristic of all selected landscape sensitivity criteria on the rating scale, which then also constitutes the sensitivity threshold for that spatial landscape unit, describing the sensitivity of the landscape to the specific dimensions of landscape sensitivity.

## Results

In Latvia, landscape assessment has been carried out for all landscape areas, assessing the sensitivity of a particular spatial unit of landscape to different potential changes under different development directions/scenarios. The following is a description of the potential development scenarios analysed and the common sensitivity characteristics, referring to a general analysis of the situation in the landscape areas, assessing the criteria of landscape character and visual quality, and providing conditions for determining landscape sensitivity.

Formation or intensification of agricultural lands and agricultural production, which includes transformation of forest land, conversion of permanent grassland into arable land, consolidation of individual agricultural land, removal of individual clusters of trees, bushes, demolition of individual farmsteads (in sense of marginalisation).

Characteristics and conditions for determining landscape sensitivity (Fig.4) - a landscape is less sensitive if it is already visually dominated by agricultural production buildings and clearly perceptible agricultural areas; high-value agricultural areas are less sensitive to agricultural intensification; green corridors are an important element in agricultural land, the more developed the green corridors, the less sensitive the landscape; biodiverse areas, tree clusters, watercourses and water bodies that need to be preserved and/or developed, created are important landscape elements that make the landscape sensitive; the development of energy crops increases the sensitivity of the landscape; the landscape is more sensitive if it contains cultural monuments.

**Afforestation, the creation of new forest stands**, which involves afforesting land that is not or is not suitable for agricultural use.

Characteristics and conditions for determining landscape sensitivity (Fig.5) - the sensitivity of a landscape is influenced by its degree of visibility, and the more landscape with distant and prominent views from roads, the more sensitive the landscape; the larger the area of agricultural land with high soil fertility, the more susceptible the landscape is to afforestation; reclaimed agricultural land is susceptible to afforestation, when planning afforestation of an area, consideration

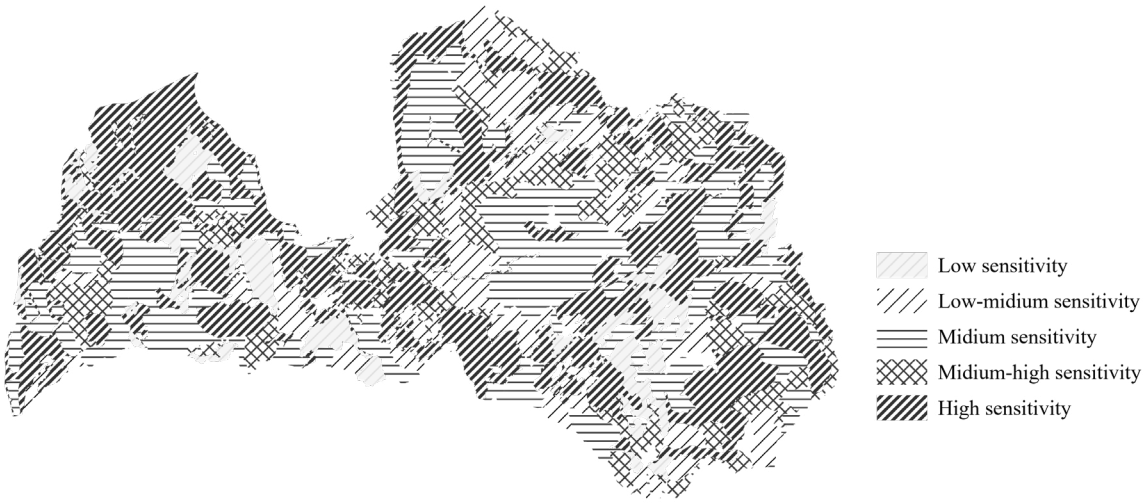


Fig. 4. Landscape sensitivity to formation or intensification of agricultural lands and agricultural production [created by authors]


Fig. 5. Landscape sensitivity to afforestation [created by authors]

should be given to whether high quality views from public vantage points and cultural monuments (churches, manor houses, avenues, etc.) will be obstructed; the more specially protected natural areas (protected habitats, habitats of specially protected species, biologically valuable grasslands), the more sensitive the site.

**Development of settlements (low-rise residential and small-scale industrial)**, more specifically in the case of landscape sensitivity to the development of buildings, low-rise residential buildings and small production facilities clustered (more than 3 buildings, up to 3 stores in height), new settlements or proposed extensions to existing development that significantly change the area and/or intensity and spatial structure of existing development.

The characteristics and conditions for determining landscape sensitivity (Fig.6), or the conflict situations in which landscape sensitivity manifests itself, are as follows:

- The scale of development is inappropriate to the existing scale of the landscape;
- The development dominates the landscape and creates disharmony;
- The character and style of the development is inconsistent or in conflict with the existing identity/character of the landscape;
- Buildings obscure valuable views;
- The development creates narrow 'visual corridors' in the streetscape;
- The development encroaches on the boundaries of a heritage landscape;
- Development encroaches into a valuable natural landscape;
- The development boundary is not gradual;
- Development breaks up green corridors in the landscape;
- Development fragments the existing spatial structure of the landscape.

Development of transport and engineering infrastructure, including development of railways, main national roads, flyovers, noise barriers/fences, overhead power lines up to 110kV where existing, as well as completely new transport and engineering infrastructure.

Characteristics and conditions for determining landscape sensitivity (Fig.7) - the landscape will be less sensitive to the development of new transport infrastructure in areas where existing transport infrastructure already exists, with provision for its reconstruction or improvement, and where new development makes maximum use of existing infrastructure routes and channels. On the other hand, the creation of entirely new infrastructure should take account of local conditions and avoid direct visual fragmentation of the landscape that changes its character or identity.

**The integration and construction of large-scale production facilities** (large-scale biogas plants, industrial wind farms, industrial solar farms) into the landscape changes the


Fig. 6. Landscape sensitivity to development of settlements [created by authors]


Fig. 7. Landscape sensitivity to development of transport and engineering infrastructure [created by authors]

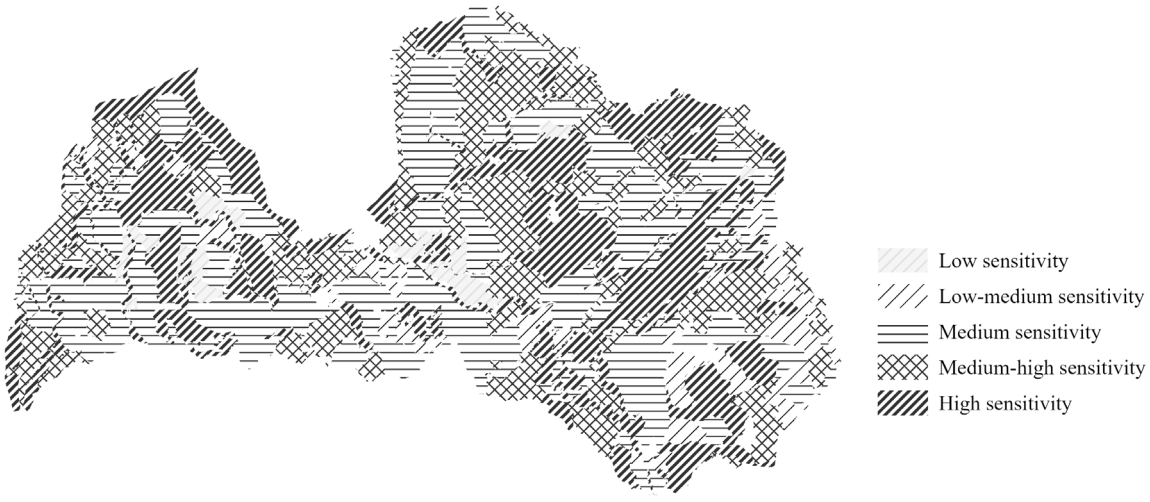


Fig. 8. Landscape sensitivity to the integration and construction of large-scale production facilities [created by authors]

overall appearance, identity and visual quality of the landscape. Therefore, a detailed feasibility study and landscape assessment (viewpoints, silhouettes, conflict points, etc.) is needed to identify the high value areas of the landscape that need to be preserved in their current state and quality, without losing their values, status and adjacent cultural monuments.

Characteristics and conditions for determining landscape sensitivity (Fig.8) - larger-scale landscapes will be less sensitive to changes resulting from the integration of large-scale production facilities, while landscape with smaller scales or with more distinct topography will be more sensitive to changes resulting from the integration of large-scale production facilities into the landscape.


Fig. 9. Landscape sensitivity to development and seasonal flows of tourism and recreation infrastructure [created by authors]


Fig. 10. Landscape sensitivity to the potential for the protection of natural areas and values [created by authors]

Development and seasonal flows of tourism and recreation infrastructure (leisure and recreation centres, campsites, guesthouses), i.e. development of various types of tourism and recreation infrastructure, including consideration of tourist and visitor flows and their seasonal nature (intensity and conditions of use of the site).

Characteristics and conditions for determining landscape sensitivity (Fig.9) - tourism is a sector that does not directly affect the extraction of a resource, but does affect its use. Particular attention should be paid to the organisation of tourism flows in heritage and nature conservation sites, ensuring their proper conservation while at the same time using them for education and learning.

**The potential for the protection of natural areas and values** is a scenario that outlines the possible development of a landscape area or part of a landscape area, giving priority to nature or landscape conservation, where appropriate spatial development should be planned, taking into account human impacts and risks on specially protected areas (SPA) or sites, and minimising the risk of fragmentation of these areas. Depending on the purpose of the SPAs or sites in the area (e.g. landscape or protection of a specific species or habitat), the scenario can range from ensuring the full nature conservation function to the possibility of combining nature conservation with nature tourism.

Characteristics and conditions for determining landscape sensitivity (Fig.10) - sensitivity is influenced by the conservation status and objectives of the natural areas within the site, the extent and interrelationship of these areas.

Conclusions and Discussion

Thanks to the European Landscape Convention, landscape as a resource has gained a stronger place in spatial planning in many European countries and is now widely recognised for its contribution to both social well-being and sustainable development. Despite its apparent abstractness, landscape, through its physical presence and its psychological aspect, meets important social and cultural needs, as well as fulfilling ecological and economic functions. This combination of characteristics, reflecting the diversity of landscape functions, is unique.

Landscape impacts and their intensity or lasting changes may vary considerably from place to place in Latvia, characterised by different site, ecological, geological, land use, vegetation (vegetation), water resources (or their availability), cultural or visual features, or a variable combination of these features.

The characterisation of landscape sensitivity in potential development scenarios takes into account not only the visual-spatial perception of the site, but also the ecological, aesthetic and cultural-historical values of the landscape spatial unit. A finding of 'high' sensitivity does not mean that

no development is possible, and a finding of 'low' sensitivity does not mean that there is definite development potential. The Landscape Sensitivity Assessment provides additional information for some types of development within the spatial planning framework.

Based on the sensitivity of the landscape to different types of development scenarios in a given location, it is possible to set landscape quality objectives, as mentioned in the European Landscape Convention, which invites European countries to set their own landscape quality objectives, defined as "landscape-specific ... public expectations, formulated by the competent public authorities, regarding the landscape characteristics of their neighbourhood". It is necessary to identify the essential needs and aspirations of stakeholders in the use of a particular landscape, and the opportunities (sensitivity and development potential) of a particular landscape to meet these needs and aspirations, by setting specific landscape quality objectives and incorporating them into local development planning documents, such as landscape thematic plans, which are used as a basis for zoning. The landscape quality objectives then become a reference point for land and sectoral policies, for the work of various organisations and for society as a whole to continue moving towards an area with a sustainable landscape that has a positive impact on the quality of life of local residents and visitors to the area.

It is important to convince the public and decision-makers of the current and potential richness of all landscapes and the need to take this into account in all policies.

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## Kopsavilkums

Eiropas valstīm ir atšķirīga pieredze ainavu raksturošanā un novērtēšanā. Salīdzinot dažādās Eiropas valstīs izmantotās pieejas, tiek piedāvāts izmantot Lielbritānijā izstrādāto un apstiprināto metodi - Ainavu raksturojuma novērtējumu, kas pielāgota un modificēta Latvijas situācijai. Šī pieeja ir izmantota arī lielākajā daļā citu Eiropas valstu, kuras ir izvēlējušās izmantot Apvienotās Karalistes pieeju ainavu raksturošanai, pielāgojot to savai konkrētajai valsts situācijai. Latvijas ainavu novērtējuma nepieciešamība ir uzsvērta Latvijas ainavu politikas pamatnostādnēs 2013-2019 un Latvijas ainavu politikas īstenošanas plānā 2024-2027, ņemot vērā Eiropas ainavu konvencijā noteiktos pasākumus, kas jāveic visām konvencijas dalībvalstīm. Pētījuma mērķis bija veikt Latvijas ainavu jutīguma analīzi vietējām pašvaldībām nozīmīgu teritorijas plānošanas scenāriju ietvaros. Ļoti svarīgi ir novērtēt ainavu jutīgumu ņemot vērā apbūves un dabas vides pārmaiņas, kas ietekmē Latvijas lauku teritoriju attīstības tempus un mērogu. Tā kā vietējās pašvaldības izvirza atšķirīgus telpiskās attīstības mērķus, ainavu jutīguma analīzei Latvijas ainavās tika izvēlēti kopīgi telpiskās attīstības scenāriji. Ainavu jutīguma analīzes rezultāti liecina par to, ka dažādās Latvijas vietās ir atšķirīgi īstenojami piemēroti pasākumi. Rezultātus var izmantot arī ainavu kvalitātes mērķu noteikšanai, lai saskaņotu Latvijas pašvaldību īstenojamo pasākumu apjomu.