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Article

The Landscape Structure of the Dnipro River Islands in Kyiv, Ukraine: the Venetsiansky (Hydropark) Island Case Study

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Abstract: The article studies the Venetsiansky (Hydropark) Island (the Dnipro River, Kyiv, Ukraine) landscape structure applying the genetic landscape science method and the European landscape classification (LANMAP) approach. The aim of the article is to determine the best way to study the river islands landscapes analyzing the Venetsiansky Island landscape structure by the both methods. Methodology. The genetic landscape science method consists in the next steps: 1) the island's territory information collecting; 2) the preliminary landscape map creating; 3) field study; 4) the final landscape map creating. The LANMAP method consists on: 1) the climate study; 2) the altitude study; 3) the parent material study; 4) the land cover study. The results. The genetic landscape science method demonstrates that the Venetsiansky Island is not a landscape, but a structural part of the landscape – the tract. The LANMAP study reveals that the Venetsiansky Island is naturally homogeneous, but land cover differs. The conclusion. The both methods' study shows that the river island cannot be the entire landscape by the natural criteria, but only the part of it. The genetic landscape science explores the landscape forming while the LANMAP reveals the current state of the landscape.

Keywords: the landscape structure; the river island; the Venetsiansky (Hydropark) Island; the genetic landscape study; the European Landscape Classification (LANMAP).

1. Introduction

The river islands are the specific object of the study: they are both the part of the landscape and the riverscape. The scientists explore mainly the flora and the fauna, the forming and evolving features [1]. The landscape study of the river islands provide the following trends: the Russian scientists explore the river islands as the part of the floodplain and apple the genetic landscape study method (for instance, the Sarpinskij island study (the Volgograd city, the Volga river, Russia)) [2,3]. The other popular method is the European landscape classification [4].

The Dnipro River is one of the largest European rivers. Flowing Kyiv it forms the quite large islands on its territory: the Trukhaniv, the Venetsiansky, the Dolobetsky islands. Some of them reserve the rare flora and fauna species [5]. The scientists study these islands' landscapes mostly as the part of the Kyiv's landscapes. Therefore the following papers are generalized and fragmentary, often outdated. The most studied is the Venetsiansky Island. But there is no landscape study dedicated to this island. Therefore the landscape study of the Dnipro River islands in Kyiv is needed taking into account the latest trends in the landscape study.

This article aims to create the landscape map of the Venetsiansky Island using the genetic and the LANMAP methods and to identify the most attractive one.

The genetic theory author is Solntsev. According to his meaning the main landscape study object is a landscape – the genetically homogeneous natural territorial complex with the same geological foundation, the same type of relief, the same climate, and consisting of an unique combination of dynamically conjugates and regularly repeated in

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space primary and secondary tracts [6]. Solntsev and his followers [6-8] developed the landscape research methodology in the large scale. Nikolaev [9] proposed the floodplain landscape study method. The method of the landscape identification applied by the Solntsev's followers can be called *the genetic method*.

According the genetic landscape study the landscape consists of the tracts – the natural territorial complexes, which consist of regularly combination of so-called undertracts and facies, which are usually combined with mesorelief form and therefore have a strong genetic unity and dynamic conjugation. The tract is usually clearly allocated in space. Sometimes the tracts can be united into the larger unites – the districts. The parts of the tract are facies - a natural territorial complex, the entire area of which retains the same lithology of surface rocks, the same nature of relief and moisture, one microclimate, one soil separation, one biocenosis [6-8].

The structural-genetic landscape study consists of the three steps: the preliminary study, the field study and the office study.

At the preliminary study the maximum data is collected: the geological, geomorphological, hydrological, soil and vegetation maps and plans of the territory. The remote sensing (aerial and space) data (in scale 1:10000 – 1:17000) analysis founds the preliminary landscape map.

The next step is the field study. A network of the routes and observation points on the preliminary map is selected. During the field phase the researcher make the reconnaissance of the territory. The relief, the parent material, the soils and the vegetation study on the determined points name the natural territorial complexes. The result of the field study is the field landscape map.

At the office study the final landscape map is made according to the preliminary and the field research.

The methodology of the European landscape classification was elaborated in the XXI century by Mücher and his colleagues [10]. According to this methodology the landscapes are resulted from long-term interactions of natural abiotic, biotic and anthropogenic processes. Landscapes are regarded as forming recognizable parts of the earth's surface and as showing a characteristic ordering of elements [10]. For convenience the method used by Mücher and his colleagues can be called *the LANMAP method*.

According to the LANMAP theory the landscape is by the four main factors formed: the climate, the relief, the parent material and the land use. In obedience to the factors the four hierarchical levels are defined. The researcher uses the digital data on climate , altitude, parent material and land use and according to this factors define the landscape. The climate can be determined be the European Environmental Stratification [11] and the Biogeographical Regions Map of Europe [12]. The altitude can be defined by the European Soil Database [13] and the FAO Soil Map of the World [14]. Due to the lack or low quality of soil data, data on the parent breed can be used. The land use/land cover data can be taken from the next interactive data bases: CORINE [15, 16], GLC2000 [17] and PELCOM [18, 19].

2. Materials and Methods

The methods of genetic landscape study and the LANMAP method were used to create a large-scale landscape map.

1. Creating a landscape map by the method of genetic landscape study.

1.1. The preliminary step.

The existing data on the Venetsiansky Island contains:

- the soil map [20];
- the map of the landscape-architectural complexes [21];
- the candidate's dissertation of Savytska [22];
- the Dmytruk's monograph [23];
- the Parnikoza's monograph [5];
- the report and the monograph of Galytskyj, Davydchuk, Shevchenko [24, 25];

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- the candidate's dissertation of Tsukanova [26];
- the Klymenko's article [27].

This data suggest that tectonically the Dnipro valley (and, accordingly, the Venetsiansky Island) lies in the fault among the Ukrainian crystal shield and the Dnipro-Donetsk depression [24]. The parent material is the modern alluvial deposits lying close to the surface (0.3 -0.6 m). The relief is slightly waving with insignificant height differences (absolute heights – 90 - 100 m). The river Dnipro strongly influences the island. The microclimate of the island corresponds to the Kyiv's suburbs climate. The soils are identified as alluvial soddy or floodplain soils. In vegetation the restored poplar-oak forests dominate.

Data from the Bing Aerial service were used to create a preliminary map of the natural territorial complexes. The following natural territorial complexes can be distinguished by the tone, structure and color of the image:

- coastal white stripes - beaches;
- dense coarse-grained dark green image - woody vegetation;
- light green fine-grained - meadow vegetation;
- mixing of coarse-grained dark green and fine-grained light green image - mixing of meadow and woody vegetation.

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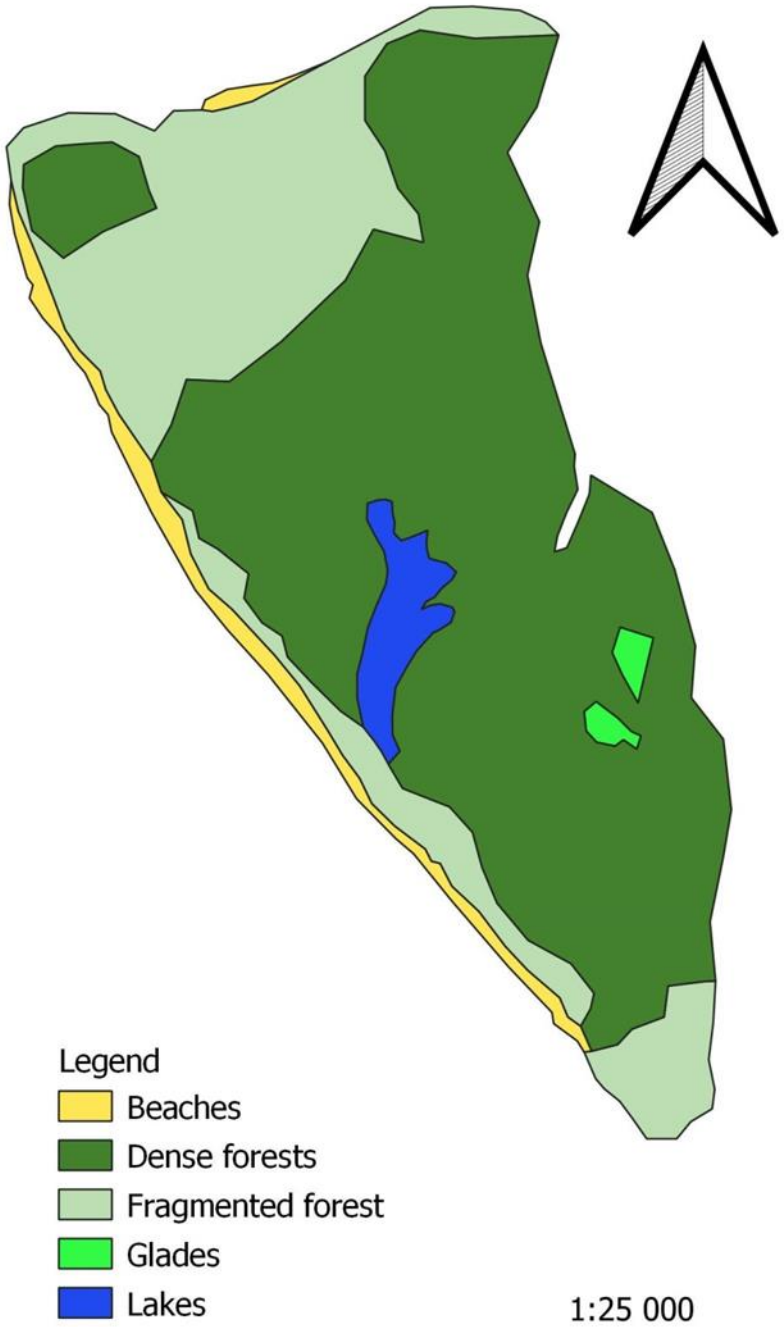

Figure 1. The preliminary map of the natural territorial complexes of the Venetsiansky Island (Source: author development)

1.2. The field study, the field map creating.

To clarify the natural complexes data the seventh-point route was paved.

The point 1 was located in the southwestern part of the island with a mixed coarse-grained dark green and fine-grained light green image. It was found that in this area the fragmented forests are caused by the anthropogenic activity.

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The point 2 is located in the central part of the Venetsiansky Island depicted as a thick dark green background on the satellite images. This part of the island is grown by the mixed oak-poplar-maple forests with Virginia creeper (Parthenocíssus quinquefolia) and nettle (Urtica dioica) undergrowth.

The point 3 is located in the center of the island in the area with the meadow vegetation.

The point 4 is located in the pine-oak forest.

The point 5 is located near the south-eastern coast of the Berizka Lake, situated in the center of the Venetsiansky Island. The shores of the lake are grown be the hydrophytic vegetation.

The point 6 is located in the fragmented forest near the southwestern coast with tree vegetation of Norway maple, poplar white and black. The undergrowth and the grass were destroyed be the tourists.

The point 7 is located on the sand beach forest near the southwestern coast of the Venetsiansky Island, where there is no permanent vegetation.

The field study data contributed to the field landscape map creation:

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Figure 2. The field landscape map of the natural territorial complexes of the Venetsiansky Island (Source: author development)

1.3. The final landscape map creation.

According to the preliminary and the office study the final landscape map of the Venetsiansky Island was created:

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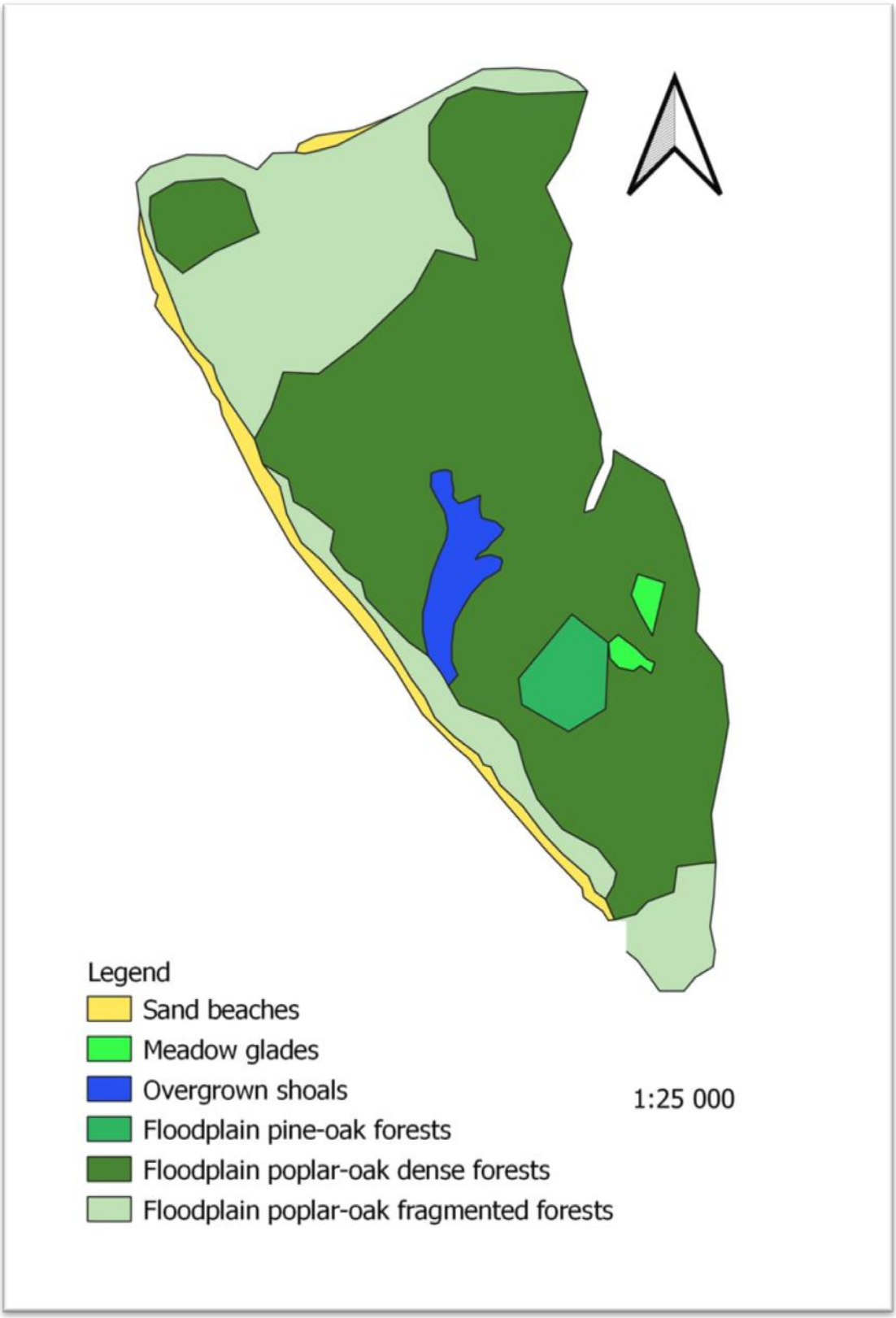

Figure 3. The final landscape map of the natural territorial complexes of the Venetsiansky Island (Source: author development)

2. Creating a landscape map using the LANMAP method.

2.1. The climate

According to European Environmental Stratification [11] and the Biogeographical Regions Map of Europe the Venetsiansky Island is located in the continental climate zone.

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2.2. The relief

Due to the Digital Elevation Model [28] the Venetsiansky Island belongs to the lowlands with elevation of 50-100 m above the sea level. According to the class of the relief the Venetsiansky Island is flat to undulating (dominant slopes between 0 and 8% gradient slope).

2.3. The soils.

According to the European Soil Database and the FAO Soil Map of the World the Venetsiansky Island is covered with rich fluvisols (Je) – soil of the modern alluvial deposits.

2.4. The land cover/land use.

Due to the CORINE database the Venetsiansky Island contains beaches, water bodies, roads, sport and leisure facilities, broad-leaved forests, coniferous forests.

Using the LANMAP method the landscape map was created:

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Figure 4. The landscape map of the Venetsiansky Island (LANMAP) (Source: author development)

3. Results

Due to the created landscape maps data the following conclusions can be made about the landscape structure of the Venetsiansky Island:

1. The landscape structure of the Venetsiansky Island (the genetic landscape study):

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The Venetsiansky Island is clearly outlined by the Dnipro river water and occupies the one mesoform of the relief, therefore is the tract. The Venetsiansky Island tract is complicated and contains two undertracts: the coastal sandy alluvial beaches undertract with no permanent soil and vegetation cover and the floodplain restored poplar-oak forests undertract.

The coastal sandy alluvial beaches undertract is simple and contains the sandy beaches facies.

The floodplain restored poplar-oak forests undertract is complicated and consists on the next facies:

- the facies of wavy floodplain restored poplar-oak forests with the poorly developed soddy soils in the river alluvium;
- the facies of the wavy floodplain pine-oak forests with the poorly developed soddy soils in the river alluvium;
- the facies of the fragmented poplar-oak forests without the undergrowth with the poorly developed soddy soils in the river alluvium;
- the facies of the meadow glades with the poorly developed soddy soils in the river alluvium;
- the facies of the overgrown shoals with the hydrophytic vegetation with the wet soils in the river alluvium.

2. The landscape structure of the Venetsiansky Island.

Regarding the LANMAP classification, the Venetsiansky Island is homogeneous according to the all natural criteria (climate, altitude, parent material). However, due to the land use, landscapes of the beaches, water bodies, roads, sport and leisure facilities, broad-leaved forests, coniferous forests can be distinguished.

4. Discussion

The LANMAP classification is essentially typological. It divides the Earth into the certain types of the landscapes forming in the certain conditions. The classification proceeds “from top to bottom”: from the largest taxonomic unis to the smallest. According to this classification in the territorially separated locations within the same climate, altitude, parent material and land use characteristics, the same landscapes are formed. This classification was conceived for the European region, respectively, operates in the relatively large territorial units. The proper landscape is the final product of the classification; there are no smaller territorial units. The considerable attention is paid to the economic use of the territory. In fact, at the lowest hierarchical level, the anthropogenic changes are a decisive factor in the landscape allocation.

The genetic landscape study distinguishes the landscape units “from bottom to top”: from the smallest to the largest. The genetic landscape science aims to find out the natural factors of the landscape differentiation. The anthropogenic variability of the territory is taken into account as a landscape differentiation factor into the natural (native) and altered (derivative). The landscape morphological parts distinguishing criteria are subjective, so the landscape distinction is in fact the personal opinion of private scientist.

According to landscape differentiation in the genetic landscape study the Venetsiansky Island is too small to be the independent landscape. But the Venetsiansky Island is not the only island composed be the Dnipro river sediments. The following islands are situated on the territory of the Dnipro river floodplain in Kyiv.

Therefore, it is appropriate to talk about the Dnipro floodplain-island landscape formed by the direct influence of the Dnipro River. Galytskyj, Davidchuk and Shevchenko came to a similar conclusion in their monograph [25]. The Dnipro moves from the east to the west undermining the Ukrainian crystal shield on the right bank and leaving the flattening area on the right bank. Thereby the left-bank floodplain is not completely identical to the right-bank floodplain. The Dnipro river islands also differ from the right-bank and the left-bank floodplains. Therefore the right-bank floodplain district, the left-bank floodplain district and the river islands district can be distin-

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guished. Accordingly, the Venetsiansky and other islands in the Dnipro river territory can be called tracts because of their natural distinction in the relief.

Authors should discuss the results and how they can be interpreted from the perspective of previous studies and of the working hypotheses. The findings and their implications should be discussed in the broadest context possible. Future research directions may also be highlighted.

5. Conclusions

Applying the genetic landscape study method and the LANMAP method to determine the Venetsiansky Island landscape structure it can be concluded that the both classifications at the level of the natural landscape cover a larger than a river island area. Differentiation into the smaller landscape structures in the LANMAP classification occurs due to the definition of economic use of the territory, and in the classification of genetic landscape – due to the local natural processes.

The genetic method is more complicated to apply because of the non-automatic work's significant number. The time consuming and the resource-intensive field study are needed to conduct. However, this technique helps to understand better the genesis of the landscapes, and, consequently, to predict their future processes.

The LANMAP method is faster, easier and cheaper to find out the current state of the area without deepening into the causal relationships of the natural processes, especially for the remote regions. The genetic method is better to use to the unchanged or little changed by the human activity territories, where the field study are possible. Also is possible to apply the method to the changed by the human activity, abandoned and, thereby, nature restored areas.

The plain river island landscapes are not well-explored in the landscape study. The Venetsiansky Island genetic study proves that, with the high probability, the plain river island is the tract with the inner undertracts and facies differentiation. The group of the islands forms a district, and the whole floodplain area with the islands in a certain geological-geomorphological and climatic region forms a landscape. The same floodplain territory with the islands has the equal natural criteria and forms the landscape according to the LANMAP classification, but differs by the land use.

The genetic and the LANMAP methods application conclude that both of them have the strengths and the weaknesses. For the river island landscape study it needs to combine the strengths of both methods.

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