Creating maps of the age of houses on the example of Krasnodar

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Abstract: The article proposes a methodology for creating maps of the age of houses, applicable to Russian cities and uses the experience of Russian and foreign cartographers. In the work the toolkit was used, which allows receiving and combining graphic and descriptive data from several open sources. The proposed methodology also allows the data collected to be prepared for publication on the Internet. The objects of the study were buildings and structures of the city. As a result we created a map of the city of Krasnodar for the project "how-old-is-this.house", which reflects the year of construction and contains information about the address, number of floors, architects and links to additional resources. According to the data obtained, the analysis was made for the whole city of Krasnodar and its districts. The most active building periods are highlighted and graphically illustrated. An explanation of the highlighted periods of building activity and the description of the main architectural styles of the city of Krasnodar is given.

1 INTRODUCTION

In recent years the face of the city of Krasnodar is rapidly changing. Areas are changing their functional purpose, and on the new territories modern residential and office quarters are built. This is an inevitable course of development of any city nowadays. In such a situation it is necessary to draw attention to the preservation of the historic appearance of the city. Historical buildings, consisting of layers of different eras, determines the identity of the city, helps to learn the culture and traits of the people who lived in this area. Krasnodar is a wonderful city where in one quarter can be adjacent to each other houses completely different years of construction: pre-revolutionary merchant houses and modern buildings.

Currently created maps are showing the age of buildings, their architectural style for foreign cities such as Reykjavik, the borough of Manhattan, Vienna. There are projects covering the country - the Netherlands. There are also maps for Russian cities: Moscow, St. Petersburg, Kazan, Volgograd.

Local and foreign authors have created similar maps in different ways. One of the available methods is vectorization of analogue maps of cities of the past. So in the studies "Data description of "building age map, Vienna, around 1920" (Reimer, 2022) and "Data description of "City boundary and urban district boundaries, Vienna, 1920" (Kral, 2021) were used different time maps of Vienna and analyzed the localization of buildings and their age, defined the city and urban district boundaries.

The authors of this article previously used a similar approach to create a map of the age of houses. In the work "Review and Use of Cartographic Materials for Creating a Map of the Age of Krasnodar" we used for vectorization scan-copies of maps of Ekaterinodar (the historical name of Krasnodar before 1920) and Krasnodar for different

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time intervals, as well as satellite images (Daisheva, 2022).

Another way to create maps of age is to collect cartographic information from online maps and supplement them with textual descriptions from various sources. Such a way of creating maps was realized by the authors in the work “Making a map “Periods of Urban Development” for the Centralny Microdistrict of the city of Krasnodar” (Daisheva, 2021).

A major Russian project is devoted to maps of the age of houses is “how-old-is-this.house”. When creating maps of the project the authors have used combined methods of creation, but nowadays a semi-automatic method of embodiment of maps is used. In this way the map of the age of houses in the city of Krasnodar was created.

2 MATERIALS AND METHODS

Let's introduce the concept of the script. In case of geoinformatics, a script is a set of sequential commands-tools performing specific tasks.

Alexander Kachkaev (Kachkaev, 2021) has written a script for automatically collecting information from 7 different sources to create house age maps of the “how-old-is-this.house” project: Ministry of Housing and Utilities, Ministry of Culture of the Russian Federation, OpenStreetMap (OSM), Rosreestr, Wikidata, Wikimapia, Wikivoyage.

The toolkit allows to collect a set of attributive data, such as: year of construction, numbers of floors, address, architect, photo, links to additional information.

Certain data was taken from each of the sources. OSM map was the source of geometry of buildings and structures, address, architects; Ministry of Culture, Rosreestr - sources of year of construction; Wikidata - photo and architectural style.

Figure 1 shows the number of buildings obtained from the OSM source, by districts of Krasnodar, whose age is known. It is worth noting that for Krasnodar a total of 169101 buildings and constructions was obtained. Krasnodar municipality is divided into 4 inner-city districts: Centralny, Prikubansky, Zapadny and Karasunsky. For Centralny district – 19640 buildings, Prikubansky – 93280 buildings, Zapadny- 17419 buildings, Karasunsky – 38762 buildings. This numbers can be explained by the size of the area of each of the districts - Centralny - 28.5 km^2, Prikubansky – 474 km^2, Zapadny- 22 km^2, Karasunsky - 152 km^2.

The process of collecting and processing itself consists of running commands in the terminal (command line) in a certain sequence. To start the script, it is necessary to specify the territory of information collection and additional characteristics.

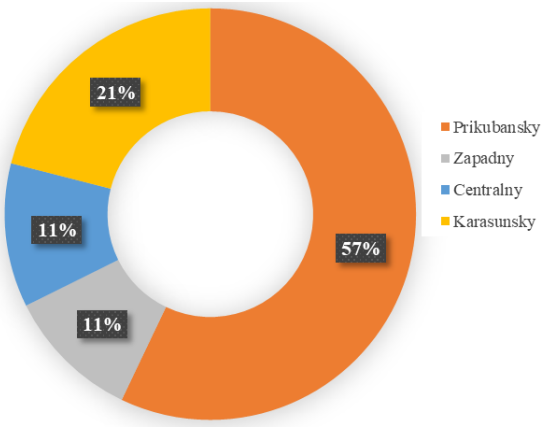

Figure 1: Number of digitized buildings by districts of Krasnodar.

It is also necessary to define the API (Application Programming Interface) - a set of methods and rules by which programs communicate with each other and exchange data.

The script comes to work with API of the following information resources: Rosreestr, Ministry of Housing and Communal Services, OSM and others listed above. As a result, the script processes the responses received, cutting off the information that is not required in the future and saves the information on your computer.

After collecting data from the above sources, the script creates a local coordinate catalog. Geocoding - linking object coordinates and its address. In this way, the number of buildings without coordinates will be reduced. Then the source data and coordinate catalog are brought to the same format.

In the process, you can analyze the intermediate result. In case of finding incorrect data, additional layers with correct information were created or the data in the OSM source was edited. Subsequently, the edits were made directly in the published project.

In the work “Making a map “Periods of Urban Development” for the Centralny Microdistrict of the city of Krasnodar” (Daisheva, 2021) the historical eras and periods of construction were divided according to the years of Soviet and Russian heads of the USSR and Russian Federation. This approach is implemented in the maps of Moscow and Kaliningrad of the project “how-old-is-this.house”. The map of Yekaterinburg, for example, has a division according

to the urban transformations. However, in this study, it was decided to abandon any of the above approaches and divide the entire building stock into decades, as other solutions to the division may cause misunderstanding on the part of the map user. Only the oldest buildings were combined into larger time intervals, due to their small number relative to other periods.

The author's colour scale was developed for the map. The approach of transition from warm tones to cold ones is implemented, because in this case the readability of the map is improved and the transitions between the decades are visible. Thus, the pre-revolutionary building has a red colour - the colour of burnt brick, which is mainly used for historic buildings. Soviet construction in shades of orange and green. The most modern buildings are in shades of blue (Figure 2).

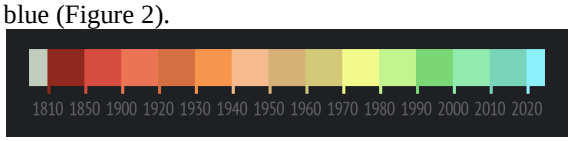

Figure 2: Colour scale.

The finished map was published on the Geosemantica portal for the “how-old-is-this.house” project by Kon-Tiki cartographic publishing house (Figure 3).

3 RESULTS AND DISCUSSION

Figure 4 shows the histogram of the maximum number of buildings for Russian cities of the “how-old-is-this.house” project, from which we can see that the maximum number of houses is typical for millionaire cities: Krasnodar, Moscow, Saint-Petersburg, Volgograd, as well as for Kaliningrad.

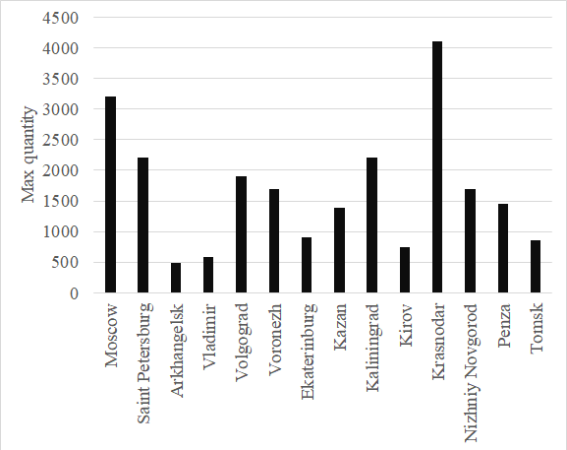

Figure 4: Maximum number of buildings by city in the project “how-old-is-this.house”.

The collected data on the development of the Krasnodar Municipality is a database (DB). First of all, the number of buildings and structures built in each of the decades was determined. It is worth noting that the 19th century buildings were combined into one period due to their small number. Figure 5 shows a histogram of the number of houses erected in the city of Krasnodar in the context of the decades.

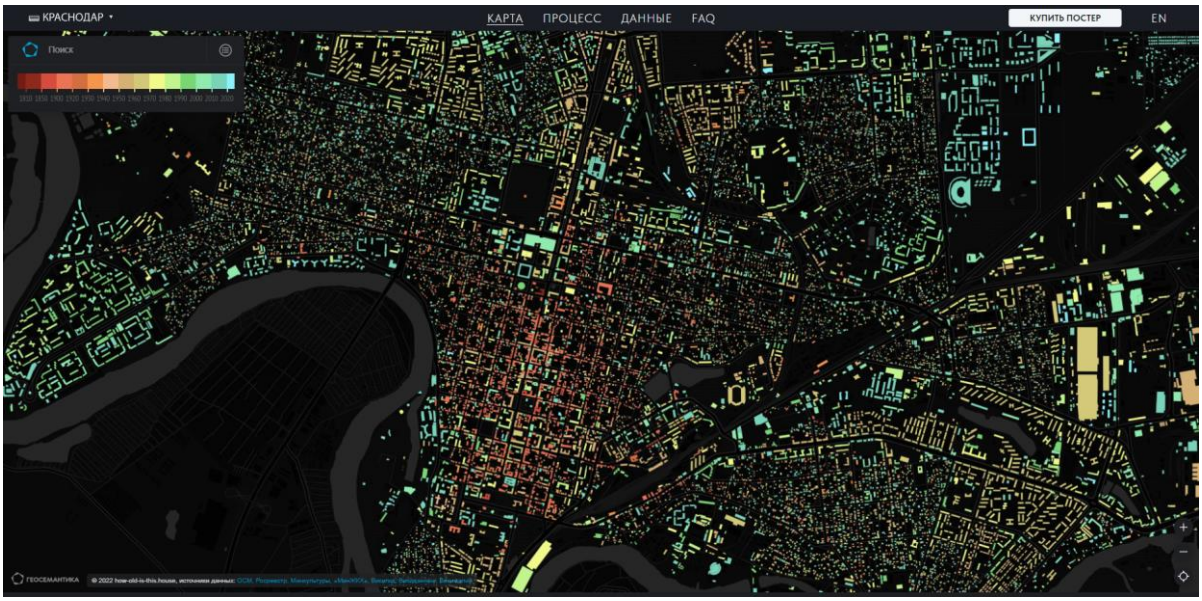

Figure 3: A map made on the Geosemantica portal for the “how-old-is-this.house”.

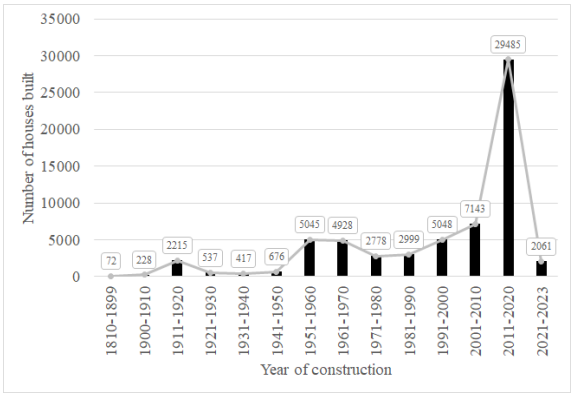

Figure 5: Histogram of the number of houses built in Krasnodar by decades.

Analyzing the data, we can distinguish three most notable differences, with a sharp increase in the number of buildings built compared to the previous decade. It was decided to look at the largest drops in more detail and analyze the distribution of buildings erected within the decade.

The Figure 6 shows the largest peak for Ekaterinodar. It can be explained by the fact that all the houses of the beginning of the last century, the dates of the construction of which were unknown, were attributed to 1918. It is likely that most of these buildings are older than this date (Daisheva, 2021). After reviewing similar maps for other cities for Krasnodar characterized the record of houses to 1918, while in other cities in a similar situation used the record of 1917.

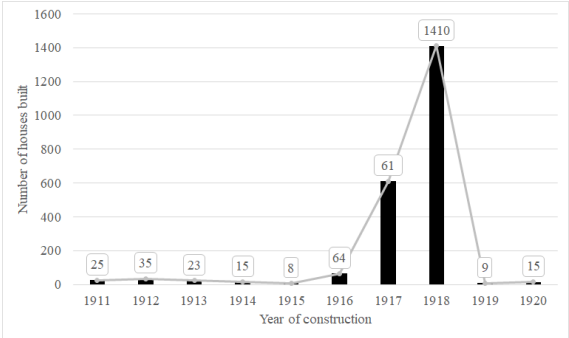

Figure 6: Number of buildings constructed (1911-1920).

The second peak (Figure 7) is the 1950s-1960s. During the Great Patriotic War (The Eastern Front of World War II) Krasnodar destroyed a lot, respectively, in subsequent years was under reconstruction (Daisheva, 2022). In this decade, mass housing was commissioned. This peak is also characteristic of many Russian cities and is noted on other maps of the “how-old-is-this.house” project.

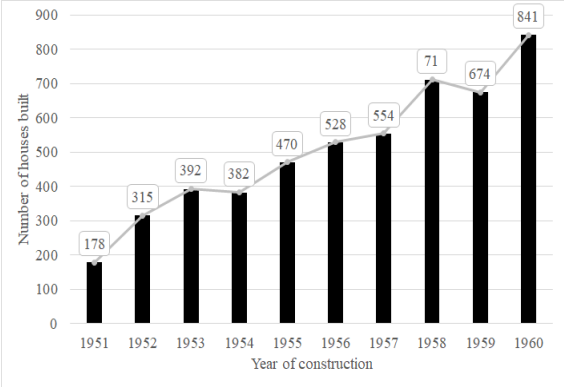

Figure 7: Number of buildings constructed (1951-1960).

The third peak (Figure 8), the most noticeable and covering the decade 2011-2020, is explained by the fact that due to its geographical location Krasnodar has comfortable climatic conditions for living. Many people move to the city from other regions. With the growth of the population increases and the number of houses being built. However, it should be noted that Krasnodar since the 70s of the last century is characterized by a smooth growth in the number of buildings erected (Daisheva, 2022). It is worth noting that since the middle of the last century there has been a tendency to increase the height and area of buildings erected. Accordingly, taking into account the described indicators, the number of buildings per square meter of housing, significantly higher values obtained from the analysis of the development of the twentieth century.

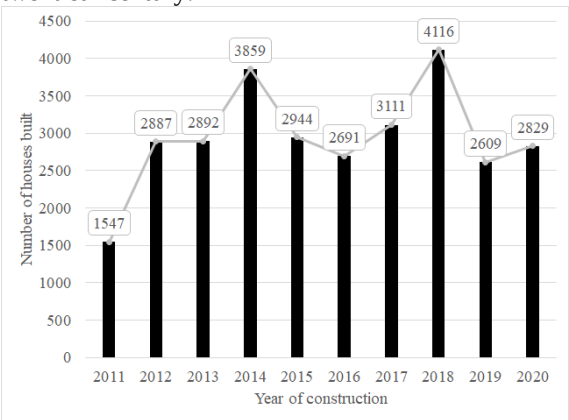

Figure 8: Number of buildings constructed (2011-2020).

Krasnodar municipality is divided into 4 inner-city districts: Centralny, Prikubansky, Zapadny and Karasunsky. For each of the districts was obtained the number of buildings, whose age is known and according to these data plots of development by decades, presented in the Figure 9.

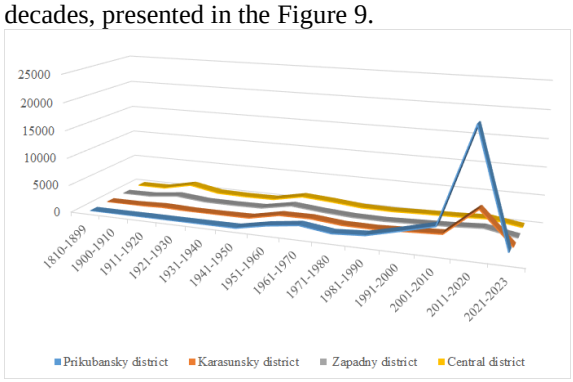

Figure 9: Distribution of buildings by decades for the city's districts.

In addition to the number of buildings, divided by decades and districts, studied architectural features, styles and architects Krasnodar.

We can distinguish 5 main, mass architectural styles represented in the city of Krasnodar:

Eclectic - the direction in architecture, focused on the use in one structure of different forms of art and different architectural styles.

Modern - is characterized by rejection of classical lines and angles in favor of more decorative (neo-Gothic, neo-Russian) lines using new materials such as metal, concrete, glass. The Art Nouveau style includes the State Bank building and the House with Rose.

Constructivism is the only style in the architecture of the XX century invented in Russia. It is characterized by severity, geometricity, laconic forms and monolithic appearance. The first building in this style in Krasnodar appeared in 1924 and survived to the present day. It is located on the Kommunarov Street, 1.

Soviet monumental classicism - combines elements of Renaissance, baroque, Empire period of Napoleon, late classicism, post-constructivism, art deco and neo-gothic. It combines pomp, luxury, grandeur and monumentality. In this style are made buildings: Krasnodar Station I, the Administration of the Krasnodar Territory, the Administration of the Zapadny intra city.

Soviet architectural modernism - came to replace the monumental classicism. It is distinguished by the mass, severity of forms, compliance of buildings and structures to the processes occurring in them, mass glazing of the surfaces of buildings, partly reminiscent of constructivism. In this style are made

buildings cinema “Aurora”, Drama Theater, the main building of the Kuban State University.

At present it is difficult to identify a particular style in modern architecture in Krasnodar. The lack of state control over the architectural style, height, shape of buildings gives considerable freedom to architects. Of modern buildings of the greatest interest are the stadium of football club Krasnodar, shopping and entertainment center Oz-mall.

Over the appearance of Ekaterinodar and Krasnodar worked many architects, both domestic and foreign specialists: Fyodor Shekhtel, Alexander Kozlov, Nikolai Kozo-Polyansky, Vladimir Shukhov, Ivan Malgerb, Zachary Korshevets, Mikhail Ishunin, Alexander Kosyakin, V. Romanovskaya, Alexander Titov, Nadezhda Sukhanovskaya, Evgeny Serdyukov, Oleg Kobzar, Semen Galkin, Philip Ball, Sergey Kuznetsov. Each of these architects worked in a particular style and made an invaluable contribution to the development and attractiveness of the city.

4 CONCLUSIONS

As a result of the work a map of the age of houses of Krasnodar was made and published on the Geosemantica portal for the project “how-old-is-this.house”, graphs and charts of building development of the whole city and individual administrative districts were compiled and analyzed (Osennyaya, 2023). It can be concluded that in the next years will develop Prikubansky and Karasunsky districts, the rate of construction of buildings and structures will remain at a high level (Kuzyakina, 2020).

The obtained data can be used for research in the field of urban planning and architecture. For example, to determine energy efficiency classes. The energy policy about energy performance of buildings, including minimum energy requirements and energy performance certificate (EPC), is applied to new and existing buildings, especially in the case of energy retrofit (Gura, 2021). Among existing buildings, heritage buildings are a special case (Fabbri, 2012). The age of a building influences its form and fabric composition and this in turn is critical to inferring its energy performance (Rosser, 2019).

Similar to the study “A GIS-based methodology for the appraisal of historical, architectural, and social values in historic urban cores” (García-Esparza, 2020) the obtained materials can be applied to the evaluation of historical, architectural values in the city of Krasnodar.

Also the obtained results can be used to develop tourist routes on the historical buildings of the city of Krasnodar and cartographic material to them.

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