The geographical analysis of the nature management structure in the steppe regions of European Russia

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Abstract. Median models of the nature management structure of the municipal districts in the steppe zone of Russia are considered in the paper. A review of modern publications reflects special features of spatial models of nature management within the Russian Federation's municipal districts. The clustering methods (cluster groups) and geo-informational mapping are used as leading methods of geographical analysis. The method of B.B. Rodoman's geocartoids (geographical carotids) is used to visualize the received data. A concept of space polarization and the inductive approach averaging geographical conditions and economic factors in the formation of the municipal economic structure lies on the base of the construction. The problem of the harmonious building of municipal nature management in Russia's steppe zone is urgent due to the discrepancy of different conditions and processes. Six models of cluster groups of municipal districts in the steppe zone of Russia were built and described. Based on them, three averaged (median) models were received: urbanized (suburban), harmonious (landscape-adaptive), peripheral (homogeneous). The conceptual model of steppe nature management was offered. It reflects the priority of stable development of municipality and comfort for population residence with a necessity of spare nature management and steppe etalons' conservation. The designs' principal purpose is to secure spatial development schemes and general programs of settlements by scientifically grounded concepts of municipal development.

1. Introduction
The steppe space of Russia occupies 1.7 million km$^2$ or 10% of the country [1]. An administrative-territorial division often does not correspond to latitudinal-climatic differentiation of landscape geosystems. Therefore, there are no absolute steppe regions located exceptionally within the steppe zone. The combination of steppe geosystems with other landscapes is a reality that should be taken into account in municipal and regional planning.

Moreover, the steppe can be in the south part of East Siberia and the Far East. These sites are distinguished by steppe "island" presence in inter mountainous hollows of Tyva, Khakassia, Buryatia, Zabaikalskiy Kray, and Irkutskaya oblast. In the east, they reach Amurskaya oblast and Khabarovskiy Kray [2].

The study's object is ten regions of the steppe zone in European Russia, including 268 municipal districts and 64 urban districts (figure 1).
2. Materials and Methods

Modern problems of economic use of the socio-economical and demographic situation in the steppe regions of Russia are described in works by T.G. Nefyodova, A.I. Treyvish, N.V. Zubarevich, G.V. Yoffe, Zh. A. Zayonchkovskaya et al. These works represent patterns of geographical discrecity of steppe areas of the Chernozem region, the south of Russia, Povolzhye, South Ural and the south of West Siberia.

In her papers, T.G. Nefyodova [3-5] often touches on polarization issues of the current Russian space, emergence of centralization, and periphery. She pays great attention to the effect of the geographical contraction of the rural area. Publications of G.M. Lappo [6] describe the urbanization process in Russia and its trends in the country's steppe regions. N.V.Zubarevich [7, 8] writes about heterogeneity and regional spatial differences in Russia. Practically any author pays special attention to migration problems from the rural areas to cities and from depressive regions to more favorable [9-11].

T.G. Nefyodova and A.I. Treyvish ascertained [8] that beginning from the 1990s to the present days, a shift of agricultural productivity has become stronger to regions with more comfortable agroclimatic conditions, for example to the steppe south of European Russia.

Several scientific papers of A.I. Treyvish are devoted to the development of the model of the "averaged" region of Russia and its separate parts [13-15], where ideas by the scientists of spatial economics and economic geography – J. von Thünen, W. Launhardt, A. Weber, W. Christaller, A. Lösch, and others laid on a basis.

Theoretical works of B.B. Rodoman in the sphere of spatial models and polarization of space are a significant methodological component of our study [16]. Opposite parts of a country can be the core and periphery of any district. Their isolation is an example of territorial polarization. All spatial
differentiation cannot be considered as polarization. In the first line, contrasting elements are not only opposite in quality but comparable and equal in size, meaning, and space placing.

The geocartoids method was described for the first time by B.B. Rodoman in the 60-70s of the XX century. On his definition, the geographical carotid can be called a draft showing real or invented territory without observance of any regulations of classical cartography (projection, scale). As scientific models, geocartoids considerably widen geographical opportunities because they promote to analyze peculiarities of real geographical models, build new models (including ideal) based on different indicators, compare and explain divergences, territorial project structures, systems, and complexes, etc.

3. Results and Discussion

Based on indicators of municipal statistics data [17] (a bulk of agricultural and industrial production, retail business, investments), cluster differentiation of municipal regions was conducted in the steppe zone of the European part of Russia [18, 19]. In dependence on prevalence and combination of indicators according to the cluster analysis, the region was divided into cluster groups: trade-logistic, industrial-logistic, agricultural industrial, agrarian, trade-agrarian-industrial, stagnant [20].

The averaged (median) model reflecting the general features of the spatial structure of nature management was developed for each cluster group using space planning data [21] (figure 2). Based on theoretical and expedition studies, we analyzed 33 districts from various cluster groups of each district in detail examined by the authors. The method of geocartoids was used in the graphical interpretation of median models. According to cluster groups of municipalities in the steppe zone of the European part of Russia, peculiarities of the nature management structure are represented below.

![Models of cluster groups of municipal districts in the steppe zone of European Russia.](image)

1) Municipalities in which economics has a trade-logistic direction. They often surround large cities ("including suburban ring"). Municipal districts have a developed transport infrastructure (highways, large railways, and airports). Besides large administrative downtown, the settlement system is represented by as large rural settlements so suburban cottage estates. The agriculture of the region has a suburban character. Industry closely connects with the city's specialization; the food industry is well developed. Special protected natural areas are almost absent. The nature management structure practically does not correspond to landscape borders. Examples of such districts are the Belgorodskiy district, Ramonskiy district (Voronezhskaya oblast).
2) Industrial-logistic districts are crossed by large transport highways and settlements stringed on them. Municipal economics is characterized by the extraction of mineral resources (often raw hydrocarbon deposits) and/or by large agricultural enterprises (pig farms, commercial dairy farms, and others). Simultaneously, the nature management structure is hardly determined by an altitude-genetic ordinate of landscape geosystems. Examples of such districts are the Sergievskiy district (Samarskaya oblast), Korochanskiy district (Belgorodskaya oblast).

3) Agrarian-industrial districts. They have transport highways. However, they do not play a structure-forming role concerning nature management types. One center dominates in the settlement system (urban or rural settlement). Such districts are characterized by not a successive change of various plans of nature management, but localization of different types of nature management in accordance with a landscape structure or landscape-adaptive models of nature management.

The periphery parts of municipalities can have progressive forms of plant growing and pasturable livestock sector and include special protected natural areas. Such regions are Novoaleksandrovskiy district (Stavropoliskiy Kray), Vyselkovskiy district (Krasnodarskiy Kray), Volokonovskiy district (Belgorodskaya oblast).

4) Agrarian districts. Transport arterial highways, often having a regional significance, present there. The primary type of nature management is agricultural, corresponding to the Soviet extensive land use. Large special protected natural areas are often placed in such districts. Examples of these regions are Novokhoperskiy district (Voronezhskaya oblast), Mostovskiy district (Krasnodarsky Kray), Borisovskiy district (Belgorodskaya oblast).

5) Trade-agrarian-industrial districts often adjoin a city or are located at some distance from it (40-80 km). Large transport highways cross the municipality area. There are significant recreational zones for citizens' rest. Agriculture has a partly suburban direction (vegetable growing, gardening, poultry factories). Such regions are Gorodnishchenskiy district (Volgogradskaya oblast), Bobrovskiy district (Voronezhskaya oblast), Severskiy district (Krasnodarskiy Kray), Azovskiy district (Rostovskaya oblast).

6) Stagnant district. Arterial transport highways are absent or go through the area's periphery and do not influence its development. Municipality economics are oriented to agriculture only, which, in its line, is represented by rare small peasant farms and semi-abandoned agro-productions of the Soviet epoch. Olkhovatskiy district (Voronezhskaya oblast), Sovetskiy district (Stavropoliskiy Kray), Krasnogvardeyskiy district (Orenburgskaya oblast), Yashkulskiy district (the Kalmyk Republic) are among stagnant districts.

Median models building under the analysis of the nature management structure happens by comparing averaged indicators reflecting the total features of municipal economics. In median model building, the inductive approach is used to better understand as typical so original features of municipal models' development.

Municipal districts of the steppe zone in European Russia are characterized by three median models (figure 3):

1 model – suburban regions with the developed transport and industrial infrastructure oriented to large city service.

2 model – harmonious developed agro-industrial regions with brightly expressed landscape differentiation.

3 model – periphery stagnant districts with landscapes of the same type.

Each of the median models has its trend of development. Firstly, a movement is oriented to peculiarities of city development affecting the adjacent region's economy and settlement. Secondly, a trend directs to the rational use of landscape diversity of the area and its rich natural-resources potential. Thirdly, a tendency leads to the diversification of agriculture, its intensification, and landscape-adaptive land tenure. The third model can include a variant of reservation of a part of the territory (especially under low productivity of arable lands and pastures) and its transformation in natural preserves with the restoration of wild steppe vegetation.
Figure 3. Median models of municipal districts of the region in the steppe zone.

Averaged median schemes of municipal districts in the steppe region play a significant role in analyzing the regional structure, specialization, and spatial correlation. It is necessary to correlate median schemes with conceptual models to the following modeling of the economy and planning of nature management in the region (figure 4).

Figure 4. The conceptual model of a municipal district in the steppe zone.

The conceptual model combines harmoniously developed spheres of economics and nature management. A relatively developed transport network is in this model. The transport network promotes trade-logistic connections of the region and, simultaneously, does not overload the landscape. Agriculture of the districts of 5 types is more diversified and often intensified. High speed of development of plant growing and livestock farming is supplied by introducing landscape-adaptive land-use systems into practice. The industry is often oriented to processing raw material produced in agriculture, at the least degree, directs to mineral resources extraction. The settlement system is polycentric in such a conceptual model of development, though it is influenced by large cities located outside borders of the region, heavily affecting it. A multilevel system of strictly protected natural areas (SPNA) required to stabilize the nature management system and reduce the load on the landscape is in the region.

4. Conclusion

The construction of median and conceptual models of steppe nature management can serve as a basis for building the concept of municipal development under compiling of territorial planning documents. They can add territorial development scenarios in town planning documentation (pessimistic, inertial, stabilization, and optimistic). Moreover, geocartoid of various models (as typological so individual) promotes a visualization of complex assessment of the area often represented as tables and text in documentations. The significant component of model formation reflecting the nature management structure is assessing the inner interaction of municipal economics elements and the opportunity of its
integration in the economics of the region. It concerns as a sectoral sphere so directions have mediated significance – nature conservation, tourism, and education.

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