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Factors Influencing the Rural Settlement Development

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Abstract: The paper contains research results in modelling settlement basic framework. The settlement basic framework components were considered. They are historical-cultural, natural-ecological, transport-communication and settlement frameworks. Necessary and sufficient criteria for an integrated assessment of rural settlement basic framework were justified. The research methodological basis were system approach, comparative method and cartographic modeling. A settlement potential cartogram for Mogilev region has been compiled. Based on research results some recommendations have been formulated for determining the strategic approaches of Mogilev region sustainable development, taking into account the perspective of rural settlement.

Keywords: urban planning, settlement basic framework, rural settlement, settlement system, integrated assessment, cartographic modeling, systemic approach.

1. INTRODUCTION

Today, transformation processes are typical for post-Soviet countries and associated with numerous challenges, such as increasing settlement polarization, land misuse, environmental degradation, etc. (Lezhava (2013), Ljubovnyj (2016)). Overall, the «conservative model» of formation and development of the settlement system requires changes, as shown in researches Shubenkov (2018), Shubenkov et al. (2016), Yusin et al. (2015), Ilyichev et al. (2019).

It should be noted that qualitative improving the main functional settlement indicators is necessary for ensuring the overall settlement system modification. Therefore, it is quite evident that urban planning methodological background should be based on systematic approach requirements (Mezentsev (2012)). Systematic approach provide insight into object background and relies on the most significant factors that determine a system and subsystem components» (Shcherbina et al. (2018)). Today, the systematic approach along with model-based analysis is widely used in domestic and foreign scientific research. Besides innovative technologies are effectively used in territorial planning, such as modelling the spatial-temporal development in research of Ilvitskaya et al. (2018). It is submitted that effective and convenient model is necessary for solving the problems in rural settlement system planning. All this is necessary for improving the planning, renovation and reform of rural settlement system.

Interesting and important researches are devoted to the problem of settlement development all over the world.

Thus, urban spatial environmental planning is the purpose of research of such authors as Shcherbina et al. (2017), Pilipenko et al. (2017) and Bakaeva et al. (2017). According to authors' earlier researches, socio-demographic aspects are equally important. Researchers Perkova et al. (2017), Bakaeva et al. (2017), Ilyichev et al. (2015), Petković-Grozdanović et al. (2016), Davidenko et al. (2018) and Shcherbina et al. (2018) discuss spatial planning influence. Besides, according to Esaulov G.V. (2018), the architecture provides the identity (recognition) of the region / rural settlement. The transport component importance described in researches Danilina et al. (2017). Socio-economic and infrastructure components, among others, are of particular importance for post-conflict areas (Belal et al. (2018), Shcherbina et al. (2019)).

Foreign studies deal with a numerous challenges in rural settlement development. Thus, the issues of Europe rural settlement transformation are considered in research Van Vliet et al. (2015). The importance of natural, historical and cultural components is underlined Forleo et al. (2017). The significance of planning component is noted Krčílková et al. 2016. The influence of socio-demographic and economic factors is revealed Ferdous et al. (2017), Bournaris et al. (2014) and Vercillo (2016). Studies on the modelling of rural-urban settlement are of special interest (Zhao et al. (2018, 2019)).

Actual scientific researches and issues analysis allowed identifying the fundamental factors for determining the rural settlement development: economic, technological, administrative, geographical, historical-cultural and socio-demographic.

2. MATERIALS AND METHODS

The formation and development of a settlement system occurs by the influence of various factors. Key determining factors are historical, cultural, natural-ecological, transport-

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communication and settlement factors, which are interrelated and are a settlement system model (Figure 1). The factors identifying based of systemic and historical genetic analysis using the mapping method. Therefore, the settlement system model includes natural-ecological, historical-cultural, transport-communication and settlement frameworks.

The natural-ecological framework consists of interconnected natural territories; it is a system performing the environmental and recreational functions: ensuring the ecological compliance of recreational areas, environment improvement, maintaining the flora and fauna reproduction, and creating the high standard of living.

The historical and cultural framework is one of the most conservative spatial urban layout. It is a system of objects historically grouped into territorial special complexes (axes, cores and zones). This system have a high potential in the context of organizing various types of activities for opening the cultural resources, including tourism and recreation activities.

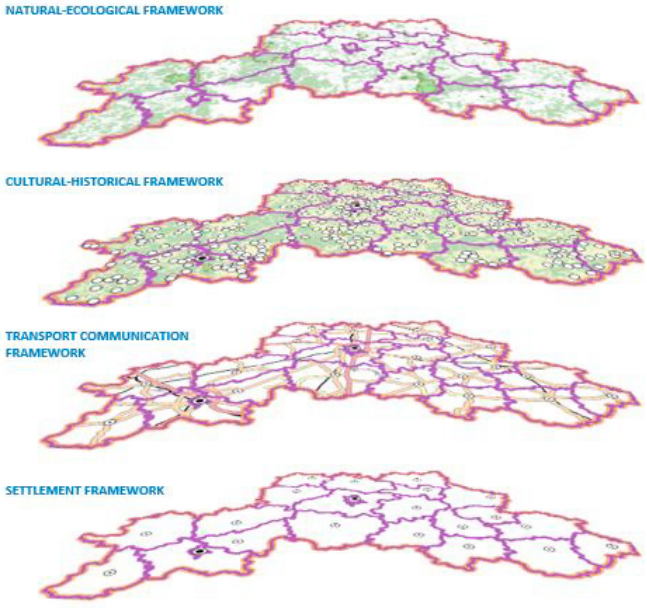

Fig. 1. Cartographic model components of rural framework

The transport and communication framework bases on the interaction and interdependence of communication lines and transportation facilities.

The settlement framework reflects the main layout features of settlement planning elements.

The quantifying method of the settlement system development involves the following steps: 1) finding the development indicators for each group; 2) integral estimating the indicators for each group by comparative analysis; 3) graphing by potential type for the areas comparative analysis; 4) areas ranking.

We should notice that the estimation of territory development index evaluates by four groups of indicators: natural-ecological, historical-cultural, transport-communication and settlement ones. The development index calculation bases on comparative analysis. First, we determine the intermediate values for the groups, and then the summary index for each area.

3. RESULTS

We chose Mogilev region of Belarus for evaluation. There are 15 cities, 6 urban-type settlements, 2 workers' settlements and 3015 rural settlements, including villages without standard residential population located in the region. The «agro-towns» status assigned to 203 rural settlements by the end of 2010. According to function typing, 15 districts out of 21 classifying as agrarian and agro industrial.

The natural-ecological framework formed by nodal and linear elements of ecological activity (fig. 2). The area includes a low proportion (less than 3%) of protected area (PAs). The largest and most representative PAs are identified as essential elements of the national and European ecological network. The territory of the reserves «Islands Duleba – Zaozerje» received international recognition and was included in the List of Wetlands of International Importance World (Ramsar List). At the same time, the limiting factor of region development is the introduction on regimes and restrictions on living conditions and economic activities in contaminated areas after Chernobyl NPP accident.

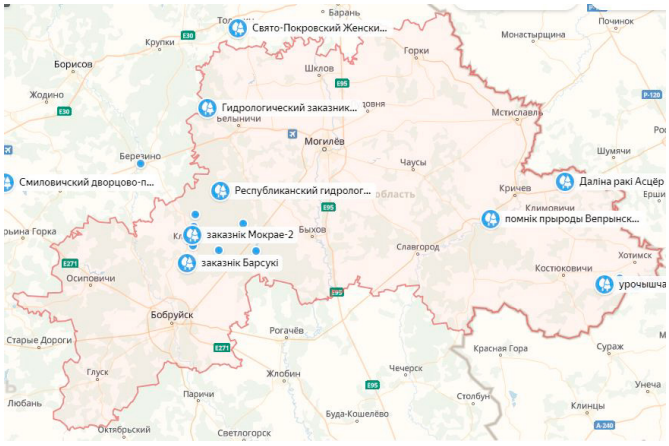

Fig. 2. Environmental network objects of Mogilev region

The historical and cultural framework is represented by cultural heritage sites located in urban and rural settlements of the region, primarily the cities: Mogilev, Bobruisk, Bykhov, Mstislavl and Gorki (fig. 3).

The transport and communication framework is characterized by the most important transport communications included in the system Pan-European transport corridors No.9 and No.9B (Figure 4), through which both external and intraregional links are realized. These are main motorways and railways of directions St. Petersburg - Vitebsk - Gomel - Kiev - Odessa and Kaunas - Vilnius - Minsk - Gomel. Among the most important areas are the Podolsk-Krichev-Bobruisk-Ivatsevichi highway, connecting Russia with European countries and duplicating the main transport corridor of the republic – East-West Transport Corridor II (EWTC II).

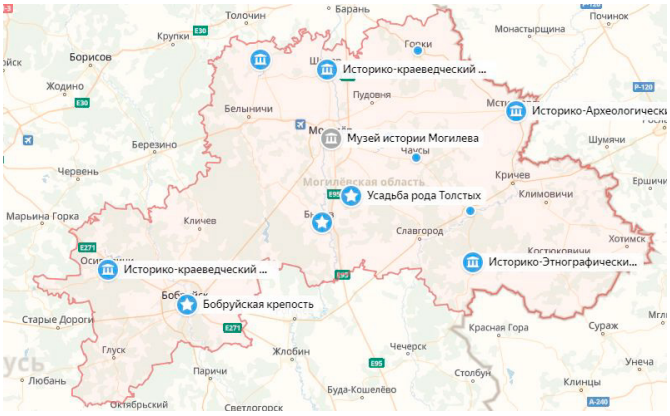

Fig. 3. Historical and cultural objects of Mogilev region

Fig. 4. International transport corridors in Belarus/Mogilev region

Settlement framework. Urban settlements, depending on their size and location, are characterized by different demographic potential; the countryside is characterized by an unfavorable demographic conditions. The region occupies 14% of the republic territory, only 11.3% of Belarus population lives in Mogilev region. The regional population density indicator (37 people per km^2) is lower than national average and it reaches 92 people per km^2 in intensively used territories. The average density of the rural population is 6.9 people per km^2 (Figure 5).

Fig. 5. Cartogram of rural population density

Indicators taken for obtaining an assessment of Mogilev region settlement system potential are shown in Figure 6.

NATURAL-ECOLOGICAL FRAMEWORK	**The number of natural objects, units**
	The proportion of protected areas, %
	The proportion of non-contaminated land, %
CULTURAL-HISTORICAL FRAMEWORK	**The number of objects, units**
	Number of tourism types, units
SETTLEMENT FRAMEWORK	**Rural population density, persons per ha**
	The average population in rural areas persons
TRANSPORT-COMMUNICATION FRAMEWORK	**Availability of international transport corridor**
	Density of the road network, km per km^2
	Railway network density, km per km2

Fig. 6. Indicators classification for estimating the settlement system

The results of the integral assessment of Mogilev region potential for main development directions are shown in Figure 7. Clarification drawing of the final index is presented as a cartogram in Figure 8.

DISTRICT	NATURAL-ECOLOGICAL FRAMEWORK	CULTURAL-HISTORICAL FRAMEWORK	SETTLEMENT FRAMEWORK	TRANSPORT COMMUNICATION FRAMEWORK	SUMMARY INDEX
Belynichy district	1,71	0,50	0,59	0,53	3,33
Bobruisk district	1,37	1,44	1,02	2,38	6,21
Bykhov district	0,65	1,67	0,69	1,80	4,81
Glussk district	1,60	0,25	0,61	0,53	2,99
Gorki district	1,11	1,08	0,89	0,95	4,04
Dribin district	1,52	0,75	0,85	0,78	3,90
Kirovsk district	1,25	1,11	0,96	1,59	4,92
Klimovichi district	1,10	1,42	0,65	0,83	3,99
Klichev district	2,64	0,86	0,56	0,70	4,76
Kostyukovichi district	0,63	0,86	0,55	0,79	2,82
Krasnopol'e district	0,40	0,75	0,43	0,41	1,98
Krichev district	0,98	0,47	0,71	1,11	3,28
Krugloe district	1,31	0,61	0,61	0,53	3,05
Mogilev district	1,28	1,67	2,00	2,51	7,45
Mstislavl district	1,20	1,75	0,80	0,76	4,51
Osipovichi district	1,55	1,19	0,90	2,63	6,28
Slavgorod district	0,25	1,08	0,60	0,50	2,44
Khotimsk district	1,63	0,25	0,52	0,51	2,91
Chausy district	1,36	0,25	0,55	0,74	2,89
Cherikov district	1,36	0,61	0,52	0,59	3,08
Shklov district	1,23	1,44	0,76	2,20	5,64

Legend

Index limits			Potential
over 0,00	to	2,00	very low
over 2,01	to	4,00	low
over 4,01	to	6,00	medium
over 6,01	to	8,00	high
over 8,01	to	10,00	very high

Fig. 7. Integral assessment results of Mogilev region potential

The research results show that the regional position in natural, historical-cultural, transport and settlement frameworks affects the resource conditions and development potential. Thus, the most urbanized living environment formed in Mogilev and Bobruisk districts. Significance of natural-ecological resources in Osipovichi and Klichev

districts, scientific and educational in Gorki district, historical and cultural - in Mstislavl, Bykhov and Klimovichi districts, transport - in Osipovichi and Krichev districts determines the priorities of planning development. At the same time, special attention should be given to districts near Russian border border (Khotymsk district) and contaminated districts after Chernobyl NPP accident (Kostyukovichi, Krasnopol'e, Slavgorod and Cherikov districts).

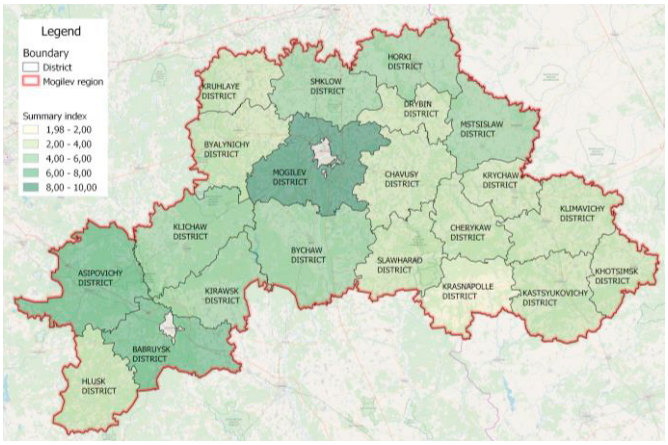

Fig. 8. Cartogram of Mogilev region settlement resources

Based on research results some recommendations have been formulated for determining the strategic approaches of Mogilev region sustainable development, taking into account the perspective of rural settlement (table 1).

Table 1. Recommendations for Mogilev region planning

Framework	Recommendations
Natural-ecological framework	Creating a unified system of landscape and recreational region areas, which form natural-ecological framework
	PA network development
	Environmental protection measures
Cultural-historical framework	Resort and recreation infrastructure development in regional and local levels
	Protection and restoration of historical and cultural heritage
	Development of tourism industry objects
Settlement framework	Forming the optimal interrelation pattern: regional centers - district centers - small towns and rural centers - rural settlements
	Development of district centers (Osipovichi, Krichev, Gorki, Mstislavl), as sub-centers of intraregional regions
	Rural centers formation on the basis of agro-towns and small urban-type settlements
Transport communication framework	Communication network development between border areas of Mogilev region and Russian regions
	Development of motorway service in administrative districts intersected by international transport corridors
	Transport infrastructure improving

4. CONCLUSIONS

Using systematic approach and cartographic model of settlement basic framework is an effective tool for estimating rural settlement framework for district territory.

The necessary and sufficient criteria were grounded for obtaining integrated assessment of rural settlement basic framework and determining the strategic directions of sustainable territorial development.

Improving the rural settlement basic framework of Mogilev region should be based on rational organizing the rural settlement system, optimizing the natural, ecological, historical and cultural frameworks and the improving the transport and communication frameworks.

Directions for future research are the creation of advanced development models of settlement, natural-ecological, historical-cultural and transport-communication frameworks.

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