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INDUSTRIAL SETTLEMENT SYSTEM DENSITY
AS A BASIS FOR MEASURES FOR CULTURAL REGENERATION
OF SMALL TOWNS OF THE URALS

Abstract. The settlement system of the Urals (Russia), established in the 18th century with the participation of Wilhelm de Gennin (1676–1750), a German immigrant, today has over 200 small factory towns. Nowadays socio-economic, demographic, and cultural situation in most of them is a difficult one. Meanwhile, they, as elements of the dense and well-developed settlement system existing since the late Bronze Age (2nd millennium BC) and regularly reproduced until the mid-20th century, have great potential for the development of new high-tech production facilities, secondary special education, domestic and inbound tourism, crafts and sports.

The article briefly describes the origin of settlement system in the Urals, and compares the development thereof with that of a number of other metallurgical provinces in different countries. All factory towns in the Urals are located at a distance of 15–40 km from one another within the area of 400x250 km. They have a streamlined, compact planning structure, with a dam, a factory, a factory management office, a church, and a house of factory owners (until the 1917 Socialist Revolution) in the centre. Dams – the unique hydraulic engineering structures – were created to be used for hundreds of years, and transformed the landscape significantly, making ponds an integral part thereof. Factory shops and other mentioned buildings made of stone are not always still well preserved but may be considered as centres of cultural and industrial clusters.

This article analyses data for 3 small industrial towns of the Urals located at different distances from a big city, where population is decreasing fast enough. Their critical situation is caused by resource depletion and factory shut-downs, and the fact that the population and the town administrations underestimate the resources of towns in their interaction. The article defines measures for culture

regeneration of these towns not as individual entities but as elements of a streamlined sustainable settlement system.

Introduction

The industrial towns that emerged in Russia within the period of industrialization (18th–20th centuries) had fairly similar functions and structure. Nowadays old industrial areas are represented by factory towns with small population (10–150 thousand of people); these towns have one leading large enterprise, their urban-planning structure and lifestyle complying with the activities thereof. Not only the production facilities (buildings, technologies) are of historical, architectural, urban-planning, social, and economic value; the same is true for the way of life and the system of values of the population, which are being set by a planning solution, and in the course of time become important elements of regional identity that is often not recognized by the local population.

The Ural Region of Russia has more than 200 such entities within the area of approximately 400x250 km. Ekaterinburg, the capital of the Urals, also was founded as a factory town and possesses all its characteristic features. According to the statistics of 2010, 32.9% of the population of the Ural Federal District lived in factory towns [Mazaev, 2018], whereas nowadays the number of their residents has been steadily declining, although the dense settlement system with predominantly urban population still exists. It can be said that the framework of the Urals mining and metallurgical civilization has been maintained, while its life processes are to a large extent failing, become less massive and sizeable. We believe that the crisis originated in rather distant past and is related to the unjustified increase of production scale within the period since the mid-19th century till the late 20th century [Mumford, 1966]. Nowadays the activities of the residents are mainly concentrated on private life, survival issues, well-being, and finding unusual ways

to implement their skills and knowledge. This makes it essential for the experts to find ways of rehabilitation and regeneration of large areas.

The notes by W. de Gennin [Gennin, 2009], a founder of many factory towns in the Urals, contain invaluable material on the establishment of the settlement system. The recent three decades saw a development of an extensive corpus of historical, economic, regional studies in Russian, dedicated to the issue of emergence and development of small mining and metallurgical settlements in the Urals [Minenko; Ryabov; Ural town…; Alferov], but these studies have not yet become a part of the world science. Individual factory towns of the Urals from different periods [Baydin, 2011; Vasina, 2006; Veselkova, 2016; Kurlaev, 2002; Ponomarenko, 2005; Stoyak, 2015], and the peculiarities of their landscape [Fedorov] have been studied. The issues of working with architectural and urban heritage of the mining and metallurgical settlements of the region [Slukin, 26; Stoyak, 2015] have also been touched upon, though to a lesser extent. However, the heritage is mostly studied as individual discrete facilities deprived of systemic connections and qualities.

The following factors can be at present considered problematic for the existence of small mining and metallurgical settlements [Lavrikova, 2014; Lyubovny, 2009; Factory Towns.., 2009; Turgel, 2014; etc.]: 1) low level of economy diversification, particularly in factory towns; 2) high dependence of municipal budgets on tax payments from town-forming enterprises; 3) existence of environmental problems related to the industrial nature of the town's economy; 4) depreciation of fixed assets, technological backwardness, lack of new jobs; 5) negative demographic trends, high mortality rate, migration of young people to big cities; 6) weak development of social infrastructure, health care and education systems; 7) people's ignorance of their own history resulting in the underestimation of the town's potential (for example, during the development of tourism projects), lack of concentration on the future; 8) institutional and cultural barriers impeding social and economic renewal.

Global experience with the areas having industrial past (the Ruhr region in Germany, Pécs in Hungary, State of Monterrey in Mexico, northern part of Great Britain, Canada [Maksakovsky, 1996], etc.), and Russian experience of updating architectural and urban planning heritage (Kitay-Gorod in Moscow, the area of Caucasus Mineral waters, Kargopolye, Yalutorovsk, etc.) shows that update, preservation and development of architectural and urban planning heritage may be a significant factor of regeneration, renovation, and way out of economic stagnation. This experience should be studied while looking for our own ways, which take into account the originality of Russia to the largest extent possible.

Methodology

The basic deep difference of this study from the previous ones is that the situation in the town is analysed with a town being understood as an element of a dense, streamlined and sustainable *settlement system* having a long history. In this respect, we can speak about the use of a synergistic approach, which allows to see the settlement system of the Ural industrial towns as an open multi-level self-organizing whole, where each element is not just linked with the others through linear and non-linear relationships, but is at a bifurcation point nowadays. The understanding of how to use internal and external benefits of the settlement system in the development of certain towns will allow them to get out of stagnation and to overcome negative trends. It also provides harmony of the proposed moves with the current socio-economic and cultural state of the Ural Region.

In this paper we adhere to *the principle of non-simultaneity*. This means that the economic theories, which have emerged in the recent decades, can easily be used to understand the processes from 100 or 200 years ago. The author includes the concept of network economy by M. Castells [Castells, 2010] and the cluster approach by M. Porter [Porter, 1998] in such theories. Both of them emphasize sustainability and dynamism of the systems, where the horizontal relationships prevail over the vertical ones, this fact being relevant for the study of the settlement system of the Urals between the 18th and the 21st centuries.

The principle of holism (J. Smuts, T. Kuhn, P. Feyerabend et al.) used in the research involves the study of a settlement system as a whole, without banal and unproductive separation of material and spiritual parts, without detaching qualitative and quantitative features of the settlement system from way of being, traditions, way of life etc. The concept of *everyday life* (M. Block, E. Le Roy Ladurie, M. Heidegger, A. Schutz etc.) helps to combine these components. Through the lens of this concept analysis is made of architectural facilities, service lines, and even production processes. It also provides a connection of the research methodology with the theme of cultural landscape [The cultural landscape…, 1988; Minenko et al., 2006].

We use the terms "factory towns of the Urals" and "small mining and metallurgical settlements" as interchangeable synonyms. They mean urban settlements that emerged in the 18th–19th centuries, where urban planning structure, architectural solutions, and lifestyle of their population depend on the concerns of metallurgical production and heavy industry.

Discussion

**1.1 A Brief History of Establishment of the Settlement System in the Ural Region**

Ural Region (which practically coincides with the Ural Federal District) is an administrative area, which nowadays covers 10.62% of the territory of modern Russia, and includes six major administrative units (Picture 1). We are analysing only the settlement system of the Middle and the Southern Urals. Historically this system was the first to arrive to urbanization and industrialization (Chelyabinsk Oblast and Sverdlovsk Oblast), and still has a higher level of population density. The emergence of this so-called "middle region" (term by E. G. Animitsa) was conditioned by the following climatic, social and political circumstances: "The northern regions were not favourable for search because they had not been populated and because polar summer was short. The southern regions of the Urals were populated by nomadic tribes (Bashkirs, Kalmyks, Kazakhs), who impeded the expansion of Russian population in this area" [Kurlaev, p.43].
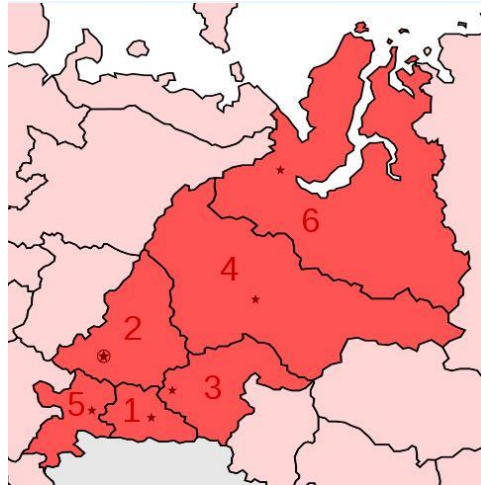
Picture 1. Ural Federal District on the map of Russia. 1 – Kurgan Oblast, 2 – Sverdlovsk Oblast, 3 – Tyumen Oblast, 4 – Khanty-Mansiysk Autonomous Okrug-Yugra, 5 – Chelyabinsk Oblast, 6 – Yamalo-Nenets Autonomous Okrug.

Thirteen settlements out of a total of 107 towns of the Ural Region were founded during the first period of development of the Ural macro-region by Russians (1590–1700). Afterwards the majority of them became towns. These are: Dalmatovo (1644), Kurgan (1662), Aramil (1675), Verkhoturye (1598), Irbit (1633), Kamensk-Uralsky (1682), Kamyshlov (1668), Surgut (1594), Salekhard (1595), Verkhnyaya Pyshma (1660), Turinsk (1600), Ishim (1687), Yalutorovsk (1639). Picture 2 shows the example of the density of the Urals settlement system in the 17th–18th centuries.

The development of urban settlements' network has quickened since the beginning of the 18th century. The start of the Ural factories' construction gave impetus to the emergence of a greater part of the Urals settlement system, which still exists. More than 20 factories emerged within 12 years due to the activity of such factory owners as the Demidovs, who were given the property rights for the Nevyansk state-owned factory.
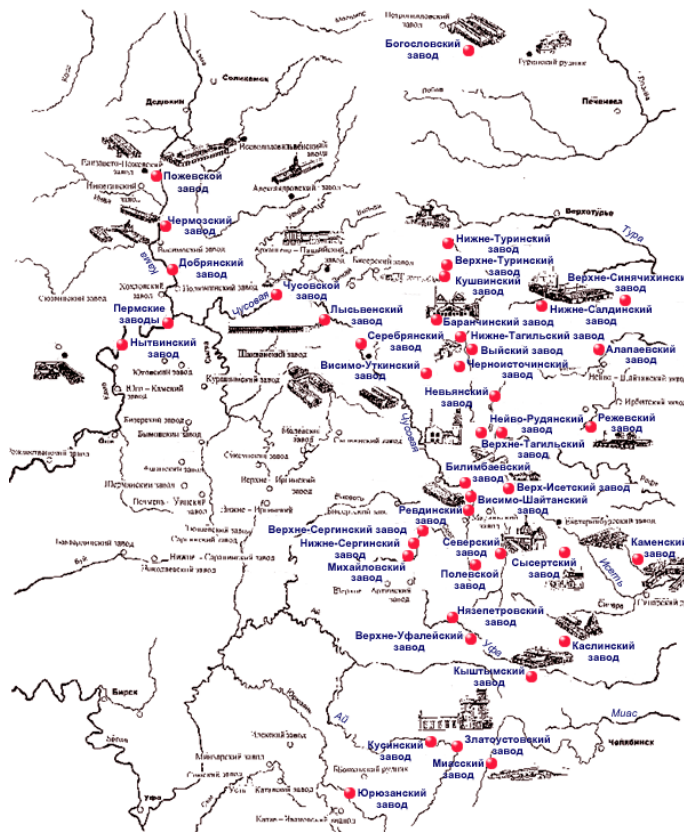
Picture 2. Factories in the Middle and the Southern Urals in the 18th–19th Centuries.
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http://www.bashturist.ru/maps/sity/details.php?image_id=295&mode=search&sessionid=98g738
telqkf1cpcktrl2h4hf5 10.04.2018.

The majority of factories of those times were located on the banks of such rivers as the Chusovaya, the Iset, the Tagil, the Neyva, the Pyshma etc., which were relatively narrow, and that allowed quick construction of dams on them [Gennin, 2009; Lotareva, 2011; Rogers, 2016]. A waterwheel and a pond became systemically important elements for the settlement system of the Urals as they had also influenced landscape and increased the water surface area many times. 24 more factories had been built by the mid-18th century. They strengthened the status of the Urals as a basis of the Russian economy.

By the end of the 18th century the Middle Urals held a firm leading position in the economy of Russia [Ryabov, 2016]. Basically, this area became a key economic region of the country. 81% of all Russian iron and 95% of all Russian copper was produced within this area at that time, and this was the only gold

mining region of Russia. Lapidary, barrel-making, furniture-making, sewing and other crafts existed here. The total of 38 new towns and settlements, which eventually turned into towns, were founded within the Ural Region during the 18th century.

According to [Mazaev, 2018], this constitutes 35.5% from a total number of towns that currently exist within the area of the Ural Federal District. If we take into account 13 towns that were founded in the 17th century, this number increases up to 51, or 47.6% from a total number of towns in the Urals. The end of the 18th century saw the establishment of the basis for the settlement system of the Ural Region, and the formation of all major and important settlement centres, which still exist. That said, it can be observed that the development was directed from the periphery to the centre of the region.

Foundation Years of the Factory Towns of the Ural Region	Town Name	Town Population as per 2017, thousand of people
1590–1700		
1587	Tyumen	744.6
1587	Tobolsk	98.9
1594	Surgut	360.6
1598	Verkhoturye	8.7
1600	Turinsk	17.3
1633	Irbit	37.4
1639	Yalutorovsk	39.8
1644	Dalmatovo	12.8
1662	Kurgan	322.0
1663	Verkhnyaya Pyshma	69.1
1668	Kamyshlov	26.5
1675	Aramil	15.2
1682	Ishim	65.3
1682	Kamensk-Uralsky	169.9
1700–1800		

1700	Nevyansk	23.3
1708	Polevskoy	62.3
1716	Verkhny Tagil	11.2
1716	Nizhny Tagil	355.7
1723	Ekaterinburg	1455.9
1723	Novaya Lyalya	11.9
1729	Zavodoukovsk	26.0
1732	Sysert	21.0
1732	Pervouralsk	124.4
1734	Verkhneuralsk	9.3
1736	Chebarkul	40.0
1736	Chelyabinsk	1198.9
1737	Verknyaya Tura	9.1
1743	Troitsk	39.9
1743	Nizhniye Sergi	9.4
1747	Kasli	16.3
1747	Nyazepetrovsk	11.8
1752	Berezovsky	57.2
1754	Nizhnyaya Tura	20.2
1754	Zlatoust	168.0
1755	Katav-Ivanovsk	16.0
1756	Satka	42.2
1758	Ust-Katav	22.5
1759	Sim	13.2
1759	Karpinsk	27.0
1761	Verkhny Ufaley	27.9
1763	Nizhnyaya Salda	17.4
1771	Minyar	9.3
1773	Miass	151.9
1773	Rezh	37.4

| 1778 | Kusa | 17.4 |
| 1778 | Verkhnyaya Salda | 42.7 |

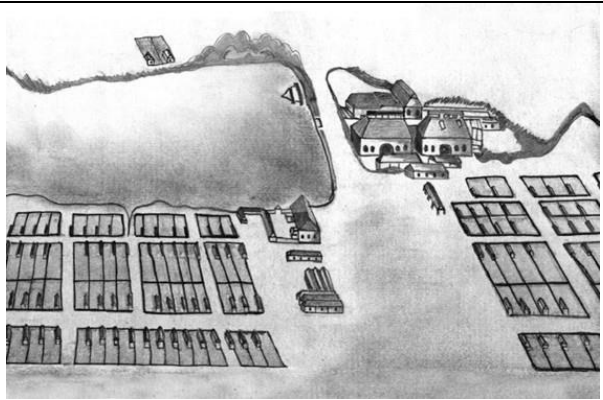## 1.2. Origin of Settlement System in the Urals

During the research we found a large number of similarities between the settlement system of the Urals in the 18th–21st centuries described above, and the system of proto-town settlement in the Southern Urals of the late Bronze Age, when each settlement was engaged in metallurgical production, and some of them even were mining copper ore [Bystrova, 2017]. Archaeologists say that these settlements were 30–40 kilometres apart, and existed for about one thousand years. Some of them, Kargaly, for instance, were located within the area that was so rich in copper deposits that they were functioning without any substantial technological changes till the 18th century. If we talk about the settlement process of the Urals, then "... in the early 17th century... the Russians repeated... the rapid "march" done by... the groups of metallurgists in the first half of the 2nd millennium BC. (…) There was just one difference: the Russians did in in the other direction" [Chernykh, 1997, p. 85].

It is significant that when in the 17th century the new generation of factory owners tried to supply copper to a larger Bogoslovsky plant located 350 kilometres north-west of Sintashta replacing old-fashioned technologies with new ones, it turned out to be unprofitable and eventually led to the decline of the settlement.

Despite the fact that there are very few research materials, we can assume that the Russian settlers, which came to the Urals from north-west and south, involuntarily reproduced a settlement structure choosing most adaptive and sustainable architectural (buildings made of wood and stone) and urban-planning solutions. The difference between the factory towns of the 18th–19th centuries and the previous industrial settlements lies in the use of waterwheel as a source of energy. A reputable researcher notes that: "... Russian mining works of the 18th–19th centuries had not actually gone beyond the topographic boundaries of discoveries of mineral deposits... It is on the shafts of ancient semi-collapsed mines

along which they began going deeper, under those layers that had already been exhausted during the Bronze Age" [Chernykh, 1997, 49]. The emergence of a waterwheel changes the structure of the settlement but not its framework. The waterwheel requires the dam to be constructed but not on the river, which is too wide (wide rivers were used for the floating of the finished products during the warm season).

The technology development directly influences urban-planning forms. Earlier the towns used to have circular planning (Picture 3). Since the 18th century "the master plan designing was based on the cruciform frame of hydraulic engineering facilities at the factories. The axis of the dam usually coincided with the main street of the settlement, whereas the axis of the river and the pond corresponded to the direction of territorial development. The network of streets and roads was being shaped in parallel to them" [Golikova, 2003, p. 77] (Picture 4). 90% of the Ural settlements used to have such an urban-planning layout [Lotareva, 2011, p. 120]. The author also emphasizes that the planning structure of factory towns was related to terrain. She calls landscape "a third element of the space" and "a major determining element of the settlement," and says that landscape should be included into the regular (by now) built-up environment, "despite the straightness of the streets wrapping around it in accordance with the changes in elevation" [Lotareva, 2011, p. 113].

Picture 3. Arkaim proto-town. Remains of the town walls and buildings. Late 2nd millennium BC.	Picture 4. Layout of the Bilimbai factory [Gennin, 2009].

The main distinctive features of factory towns of the Urals are the following:

- minimal impact on the landscape,

- small size ensuring the economy of heat and resources, and the reduction of distances between the production facilities etc.

- availability of a hydraulic engineering structure (a dam) and a factory in the very centre of the settlement.

The main features of settlement system in the industrial belt in the Middle and Southern Urals are the following: small size, effectiveness of transport and other service lines, connection between the way of life of urban population and the nature (vegetable gardens in towns in the 18th–19th centuries, fishing and hunting, gardening in the 20th–21st centuries).

As a whole, these facts make it possible to speak about the network nature of the settlement system in the Urals, which possessed both a very high degree of adaptability to natural environment and resistance to external and internal effects. Every time when an attempt was made to embed larger or unrelated elements into this rationally organised system, the balance between natural and civilizational was disturbed, and industrial and environmental failures, and even disasters, occurred. It turned out that it is possible to combine the traditional way of life of most Russian and even foreign settlers with the emerging industrial needs and mineral wealth of the Urals. Fixation on the growth of production scale has led to a crisis in the region (in 1880s, and within the period of 1990–2010s.). However, the stability of not just economic but also social, family, and cultural ties is so high that most of the factory towns continue to exist. They represent a tremendous resource for the region's development, particularly because of high level of skilled workforce, number of secondary and higher educational institutions, huge tourist potential etc.

However, there can be no universal depersonalised development formula, so the following parts of the paper outline several models of culture regeneration and diversification of functions for small factory towns. Here due account has been taken of the benefits of their settlement system, economic and geographical position, and culture.

1.3. **Paradigm and Methodological Contexts of the Concept of "Culture Regeneration"**

The concept of "culture regeneration" certainly refers to the categorical framework of interdisciplinary research. The use of this concept is accompanied by a number of implications.

First, a town or an area should be recognized as a living (integral and changeable) organism, whose parts interact, and influence each other. R. Florida, an influential American urbanist, defines cities of the 21st century as "fundamental economic, political, and social organizing units" [Florida, 2014], which take the responsibility for sustainable development in general. Such an approach suggests that not certain autonomous units but the relationships among them should take the lead in the analysis or the arrangement of territorial or urban processes. Here there is a distinctive difference from the terms "reconstruction" and "renovation", which are sometimes used as synonymous. These terms imply a technological view on a place as a mechanism. The term "rehabilitation" seems to be the closest one to the term in question. As for the terms "transformation" or "conversion", which had already been mentioned, their conceptual area does not have any direction or vector that can be felt or visualised by experts and residents.

Second, we should withdraw from a purely modernization doctrine and focus on unleashing / reviewing the potential of what already is within the area, including, for example, historical and cultural heritage. In this regard, the project, which is now being implemented within the area of ZiL (Likhachov Plant) in Moscow, does not meet the criteria of "urban planning rehabilitation" although referred to as such. This is simply because plant buildings, all engineering utilities, and much of the soil have just been removed, destroyed or taken from the former territory of the plant.

Third, the area should be included in the set of historical coordinates. It is not just about the connection with the past implied by the prefix "re-". If an area or a town are being considered as a process, then there is an opportunity to predict, to simulate, to think of their near and distant future, to include immediate past in their

"history", and to see diachronic nature of the development of separate parts or facilities [Schicchi, 2015] etc.

Here we may come back to the ideas of synergetics. If the goal is to regenerate an area (former industrial territory, urban area, territory of transport service lines etc.) or even an entire region, then the understanding of the area as an open multilevel dynamic system leads us to the need to restore the integrity ("liveliness") of this area, its way of life, values, technologies [Hagberg, 2012], as well as its external relations with the surrounding world. The area "comes back" into a greater entity at different levels, from environmental to axiological, and does so even when its functions are completely or partially changed. In other words, the directions for rehabilitation are not set arbitrarily as it happens with standard projects for the repurposing of former industrial areas into residential neighbourhoods. They naturally come from the needs of the whole. The compliance with those needs ensures the effectiveness of interactions and communications resulting in the "revival".

1.4. Peculiarities of Today's Dealing with the Historical and Architectural Heritage of the Region

We offer some practical moves to work with historical and architectural heritage in the context of socio-economic development of small industrial settlements of the Urals. In view of the above, they fully comply with Article 5 of the UNESCO Convention for the Protection of the Cultural and Natural World Heritage, which tells about the need "...to adopt a general policy which aims to give the cultural and natural heritage a function in the life of the community..."[Cit. ex: Shulgin, 2004, p. 123]. To this effect, focus should be made on the following parameters:

- transfer from preservation and conservation of historical and architectural heritage to its utilization and updating;

- transfer from a "localized" vision to an "environmental" one, i.e. the desire to preserve and update not just isolated facilities but complexes, space, environment (the scales of which in the Urals can be raised to the regional level),

as well as *historical technologies and traditional forms of environmental management* [Shulgin, 2004, p. 117]. Establishment of historical and cultural areas as special integral entities;

- understanding the drawbacks of reducing the entire work with historical and architectural heritage solely to the development of mass tourism;

- taking into account the peculiarities of historical and architectural heritage of small mining and metallurgical settlements in the Urals, where factory and residential buildings prevail;

- impossibility to rely only on federal funding, and coping with the situation, where the institutional approach is considered to be the only possible way of working with historical and cultural heritage [Turgel, 2014; Lux et al., 2016].

Both density of the settlement system and its network nature allow industrial towns to choose new functions, not only manufacturing ones, but with the utmost regard for external systemic relationships.

1.5. Recommendations for culture regeneration of three factory towns

We have chosen the following towns having common invariant historic features to be the "pilot" ones. Nowadays these towns: a) are in an asynchronous state with regard to the processes of urbanization and agglomeration; b) are in different social and economic situations, and c) have different ideas about their potential and strategic objectives.

This is **Berezovsky** – a town located 12 km away from Ekaterinburg and gradually becoming a commuter belt, which relies on the development of the logistics cluster and the construction of low-cost mass housing. The growing number of young townspeople and the proximity of large forests allow to consider this town as a place for constructing sports and recreation facilities that seem attractive to the residents of neighbouring five towns (Ekaterinburg, Verkhnyaya Pyshma, Pervoualsk, Aramil, Revda), which already form a polycentric agglomeration. The pond, the dam, declining gold mines, a few stone buildings of the 19th and early 20th centuries can be redefined in the context of cycling and walking routes, or adventure tourism.

This is **Pervouralsk** and the nearest Bilimbai settlement, which used to be an independent factory settlement in the 18th–19th centuries. Both are located at a distance of about 40 km from Ekaterinburg. As they possess all the typical features of the elements of the Urals settlement system, they can take over the role of social memory keepers, thus forming a cultural, educational, and learning cluster.

This is **Sredneuralsk**, located within 21 kilometres away from Ekaterinburg. The pond of this town nowadays is officially called "lake Iset". This town possesses good urban planning, housing built in the second half of the 20th century, and a number of dilapidated facilities of the Stalinist period, so specialized secondary education and water sports can be developed there.

These new functions will be in demand only during active contacts of these towns with other elements of the settlement system.

Conclusion

The paper is the first to represent the settlement system of the factory towns of the Ural Region of Russia as having network and sustainable nature. Without such a system, there would be no established civilization of the mining and metallurgical Urals in the 18th–21st centuries. This streamlined and sustainable system, in its turn, inherits the settlement features of the mining and metallurgical prototowns of the Southern Urals of the 2nd millennium BC. Part of these towns had existed for more than three thousand years. The northward migration with optimal features of the settlement system being retained resulted from technological changes (such as waterwheel) and the discovery of iron and copper ore deposits in the Middle and Southern Urals, which are still called a "backbone of the nation".

This gives grounds to consider the settlement system as an important element of the region's historical and cultural heritage, which influences cultural, social, and mental peculiarities of its residents. In this case, the culture regeneration measures shall imply working not with single entities but with the system as a whole. The culture regeneration itself is becoming a programme for the development of traditions and forms of the past for the objectives of the present.

The suggested measures for culture regeneration of a number of factory towns of the Urals that are included into a single, historically established settlement system and possess historical and cultural heritage, are possible to be implemented only in connection with the processes of agglomeration. These processes highlight the opportunities of the network settlement system at a new historical stage. On the one hand, they are related to the development of transport, human, and cultural communications on the basis of the existing framework. On the other hand, they allow old industrial towns to get away from non-diversified production and to diversify it. Finally, historical and architectural heritage (dams, factory buildings and shops, factory management buildings), which is compact and possesses high qualities of style, may play a crucial role in the processes of modernization.

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