

Current systems of protected areas integrated with urban agglomerations

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Abstract. The article considers current systems of national parks and reserves mutually integrated with urbanized territories located in close proximity to cities: the “Stolby” natural reserve near the city of Krasnoyarsk, Krasnoyarsk Territory, Russia, and the Vesuvius National Park, the municipality of Naples, Italy, and gives a characteristic of their geographical position, their relief and stages of its formation, along with the climatic conditions and history of their development. Here the authors regard the role of geomorphological objects as pivotal city-forming dominants in the formation of a human environment and compare aspects of historical and geographical development of the specially protected natural areas with the current state of the studied regions. We implemented the analytical methods based on studying the scientific, historical and cultural sources, and used the materials of field research in 2016-2017. The analysis resulted in conclusions on the influence of geological structures and reliefs on the complex development of the city-forming structures of large urban entities, but with that, legislative programs for integrated environmental development of urbanized areas in connection with the adjacent natural objects are necessary to create a comfortable self-reproducing urban environment.

Introduction

The topicality of this research is stipulated by the analysis of the current systems of protected natural objects integrated by large urban agglomerations, namely, the case of “Stolby” natural reserve with the neighbouring territories, Krasnoyarsk, Russia, and the Vesuvius National Park, Naples, Italy.

From ancient times human lived in harmony with nature being a part of it. The places people chose to settle were the most beautiful, accessible and convenient in terms of life support [1]. The process of evolution formed territories which later became large urban centres with a high-density development and adjoining recreational zones [7].

Near large settlements, impacted by human, the natural environment undergoes dramatic structural changes, which during the recent centuries is leading to degradation and destruction of many natural

landscape zones, reduction of biological diversity, water and air pollution, depletion of ground cover vegetation and wildlife [5, 6, 10].

There is irrefutable evidence of destructive and uncontrolled land use, which has led to understanding of the need to integrate residential and natural areas. Analyzing the territories with environmentally protected sites, we see that the largest number of them is concentrated in places with increased urban density, which indicates the need to analyze the processes of integration of nature sanctuaries and residential areas. Millions of years of the terrestrial life formation polished perfect interactions of natural structures, and this is a great powerful fostering factor, irreplaceable, multifaceted and comprehensive. The first nature sanctuaries appear [9-11].

The purpose of this work is to analyze the influence of geomorphological objects on formation and development of urbanized territories in the historical aspect from Antiquity to the present, along with the prospects for integrated interacting of residential areas, natural objects.

The objectives of the study are, firstly, to analyze the development of anthropogenic relations between the nature and human in urbanized territories, the periods of positive and negative movement in work with a natural relief, and secondly, prospects for formation of the factors affecting a maximum self-reproducibility or substantiality in the rational and harmonious use of adjacent protected areas.

Tools and means of exploring the topic: the research is based on the results of field research during the expedition of 2016-2017 and the analysis of historical scientific, cultural, artistic sources.

1. Geomorphological features and anthropogenic processes in the historical transformation of residential areas.

The issues of the influence of the relief and its interaction with the surrounding world have been rising since the ancient times, starting with petroglyphs, ancient works of philosophers, scientists, artists and writers. The first philosophical interpretations touching on the meaning of the earth's surfaces in a broad and extensive sense before the Antiquity, as well as the knowledge of the Ancient East, China, India, are found after the III-I millennium BC. With the appearance of the first Homo sapiens, the late Paleolithic (40-45 thousand years ago) also means the beginning of the anthropogenic stage in the evolution of the Earth's landscape shell. Since then, the planetary system "nature-society" has been forming for thousands of years. Now its systemic integrity (emergence) is such that the individual, independent existence of nature and society is nearly impossible. They are evolving coherently. This gives grounds for talking about the co-evolution of nature and human society [2, 13, 15].

The first cities were formed according to geological and geomorphological features, then climate, flora and fauna (protection, hunting, and agriculture), availability of water resources (potable water, irrigation, transport and trade). Examples can be the cities of Gournia, Akhetaten, Luxor, etc. Later, the cities were developing primarily by a linear planning structure, a regular building arranged along the coast of navigable water bodies with a central square on a higher ground and temple complexes at the highest points of a city (e.g. the cities of Greece). Then the radial structure of the cities was formed (i.e. the cities of Byzantium) which in most cases is common for the ancient Russian cities. In the future, both the structures gained traction. In all cases, the geomorphological features and landscapes were those natural city-forming governing factors [1, 7, 8].

Leonardo da Vinci (1452-1519) considered ennobling of nature as a way to create a perfect environment for people's lives together with it. He was convinced that man forms a perfect society by their work, by cultivated fields and gardens full of delight. Agriculture was regarded as a great applied art. Landscapes also form an ethnic culture which as a result led to the separation of people according to their ethnical and religious attributes [13].

By the end of the 18th century, a number of natural scientists asserted that only man could create an order and harmony of nature and economy. By this time there had already appeared harmonious natural-park ensembles, the first botanical gardens with an attempt to combine natural landscapes and those comfortable in terms of accessibility and arrangement. A case of a harmonious continuation of natural parks can be the ensembles of Caserta (Italy), Versailles (France), and Peterhof (Russia) [12, 14].

Human began creating a comfortable environment by taking the nature's territory away from it. The idea of the Eternal City was transformed into the idea of an accumulative centripetal formation of anthropogenic society and into the development of degrading settlements with a predominance of feedback, steadily leading to its self-exhaustion and disappearance.

Modern landscape science distinguishes two principal structural types: natural (genuine) and natural-anthropogenic landscapes. Today, natural landscapes occupy only about 40% of land, with natural-anthropogenic ones of up to 60%. Scholars define a number of main consequences of landscapes anthropogenization: urbanization, land development, environmental pollution with industrial waste, air pollution (greenhouse gas emission), implantation of anthropogenic energy and man-made substances into landscapes, deforestation and plowing of land, accelerated erosion, aridization, desert advancing, weathering and dust storms, irrigation of arid lands, marshland reclamation and overwetting of lands, interruption of the natural biochemical circulation. Thus, under human influence, the natural environment near large settlements undergoes severe structural changes, which, in the recent century, leads to destruction of many natural landscape zones, loss of biodiversity, water and air pollution, depletion of ground vegetation cover and wildlife [14, 20].

2. Protected areas

After the XVIII century, the first mentions of protected areas are found. There are several categories according to their status and features of the Management Categories of specially protected areas [8]: state nature reserves (including biosphere reserves), national parks, nature parks, state nature sanctuaries, nature monuments, dendrological parks and botanical gardens, health and recreational areas and resorts [11].

The first natural reserve on the territory of Russia was the Barguzin Nature Reserve, founded on January 11, 1916, in the territory of Buryatia. At present, there are 51 national parks in the Russian Federation, 103 natural reserves, 58 wildlife sanctuaries. In total, Russian specially protected areas comprise 11.75% of the total territory of the country, including 71 objects with international status [7].

In the developed countries of the World, programs for maintaining and improving the quality of the environment were adopted in the late 60s – the beginning of the 70s of the XX century. The United States, Japan, Germany, France, Sweden and Italy established special state agencies to ensure their programs during this period. Italy has an extensive protected area and includes 23 national parks, 89 regional parks, 270 regional and 142 state natural reserves, 47 protected marsh ecosystems and 7 marine reserves, which is almost 10% of the country's territory. 42 sites on the territory of Italy are candidates for entering the World Heritage List [18]. We can distinguish some characteristic patterns of the basic structural principles of locating environmental park zones near residential areas: parallel (linear), radial-circular, radial-circular, peripheral, peripheral-group and hybrid systems.

3. The nature reserve “Stolby” in interrelation with the Krasnoyarsk agglomeration (Russia)

An outstanding example of a parallel location of natural objects and residential areas is the city of Krasnoyarsk and the “Stolby” (literary "Rock Pillars") natural reserve (fig. 1). The reserve is a main landscape dominant for Krasnoyarsk and is in close proximity to the city. It is located in the low-mountain relief in the north-western spurs of the Eastern Sayan; its area is 47.2 hectares. The territory stretches for 34 km from the north-west to the southeast, and from 200 to 840 metres above sea level. The territory of the reserve lies parallelly to a large residential area of the city of Krasnoyarsk [2]. The entire territory of the natural reserve is divided into three parts with a different regime of protection, with a tourist and excursion area occupying no more than 3% of the reserve which is open for free visits provided that the rules governing the norms of behaviour and attitude in the reserve are observed by tourists. The main recreational load is manifested in a massive visiting of the Central “Pillars” (the central part of the nature reserve, about 200 thousand tourists per year). The other zones are a fully restricted for visiting zone (90% of the area) and a buffer zone (about 7%) with limited access regulated by special permission of the reserve administration [4, 17]. Параллельно

3.1 Physical and geographical conditions, relief and geological features.

The “Stolby” natural reserve is an interfluvium of the right tributaries of the river Yenisei: Bazaiha, Mana and Bolshaya Sliznevaya (55°31' - 55°55' N and 92°20' - 93°20' E), has a mountain relief formed in the Paleozoic Era and rejuvenated in the Tertiary-Quaternary period, and today is a transitional landscape belt from the mountain taiga to the island Krasnoyarsk forest-steppe.

The flora and fauna are rich and diverse. An upper belt (80% of the total area of the reserve) is represented by the mid-mountain dark coniferous taiga (fir, spruce, pine), and a lower belt - by thin-leaved and light coniferous forests of low mountains (pine, larch, birch, aspen, bird cherry), endemics are encountered. Wildlife is very diverse and typical for the Siberian taiga, and includes bears, wolves, red deer, elks, lynx, and wolverines.

The relief is marked Stolbinskoye Highlands and narrow ridges branching from it: the Kashtak, Takmak and the Otklikny Ranges. This is a region of syenite intrusion, with a height of 600 to 800 m a.s.l., intensively sheared by creeks. The rocks in the “Stolby” area are sedimentary and volcanic strata dated by the Cambrian to the Carboniferous, and Mesozoic and Cenozoic sediments [3].

The rocks most resistant to weathering - granites and quartz syenites - gradually formed the dominant heights of the reserve: the Kaidynsky Range, the mount of Abakat, the Stolbinskoye Highlands.

3.2 Ecological status

In accordance with the climatic zoning, the natural reserve is located in a temperate climatic zone. The location of the mountain range affects aeration, interrupting the wind currents and confining the development area from the south. Today the anthropogenic processes and activities aimed at advancing to the protected areas of the tourist zone of “Bobrov Log” and the territories along the Bazaikha River adjacent to the protected area lead to the loss of existing forest areas, degradation of the green zone in the tourist part of the reserve.

Assessment of the ecological state of the natural environment of the reserve is based on the results of a five-year multidisciplinary monitoring at 35-45 fixed sites. It was found out that in a 5 to 10 km wide strip adjacent to the city, and occasionally on mountain tops, a concentration of some chemical elements in the sediments 4-7 times exceeds the near background, with initial stages of soil acidification found atop of the mountains [6].

The planning of new districts of Krasnoyarsk implied the support of construction of new green sites, but in fact, commercialization and the absence of strict regulations for building and greening in the city led to an imbalance of residential areas and green plantings, as well as degradation of the existing elements of beautification. The situation leads to the need to solve the issues of reconstruction of the urban areas with the introduction of a program of an environmental frame of the city and suburban areas, which is able to make a comfortable environment for life in the region, into the urban planning documentation on the legislative level.

4. National Park Vesuvius, Naples, Italy

The Municipality of Naples and an area of Mount Vesuvius along with the historical territories form a national park conserved as a state heritage since 1995. It is one of the most significant radial circular objects. Since the eruption in 1944 the volcanic activity is negligible. In the current state the volcano is safe for touristic visits. The park is located in a peripheral zone 15 km away from the city of Naples in the southwestern part of the former Naples province; it has a movable relief and a chain of active and extinct volcanoes. The territory of the national park is 339.3 hectares; it includes 13 municipalities, the biosphere reserve under the protection of the Italian government, and a forest reserve [19].

Historically, a densely populated residential area has been formed around the volcano. The geography of the cities located at the foot of the volcano is largely determined by the movable relief and a coastline formed as a result of volcanic activity in the region [18].

The cities have characteristics of developed residential areas that are formed in the vicinity of sea routes. They surround the mountain as a ring of municipalities. Nowadays there are 13 municipalities, 8

of which are located in the close proximity to the volcano. Viticulture and horticulture are developed on the slopes; cereals are cultivated on the plains with benevolent climatic conditions. In addition, the proximity of the sea and the beautiful populated valley around the cone create a landscape dominant of the rapidly developing Neapolitan agglomeration.

4.1. Physical and geographical conditions, relief and geological features

Vesuvius (40° 49' 15" N, 14° 25' 30" E) is divided into 4 zones [7]: a large cone of Vesuvius and nude lava, the southern slopes of Vesuvius, the northern slopes and southern slopes of Monte Somma, the lower slopes of Monte Somma and Vesuvius. It is the only active volcano in continental Europe. It is often called the younger brother of Etna (Sicily) for its unpredictability and quite hot temper. Vesuvius (Vesuvio in Italian) is located in the south of Italy. It is a part of the Apennines and a volcanic belt of the Gulf of Naples. The height of the cone varies from 1150 to 1281 metres, the crater diameter is about 500 metres, and the depth is 230 metres. Italy is referred to the zone of Alpine orogeny as well as to Hercynian and Precambrian granite-gneiss massifs (Sicily, Sardinia, etc.) with the cover of limestone of the Mesozoic and Cenozoic periods and porous soil of the Tertiary period [18].

The most part of the territory is covered with mountains and hills. In the north there are the Alps, in the south is the Padan plain with heights from 200 to 500 m. Then the medium-altitude Apennine Mountains with several extinct and active volcanoes, including Vesuvius (1277 m) and Amiata (1734 m), extend for almost 1200 km along the Apennine peninsula.

There is a natural vegetation cover at the foot and on the slopes of the volcano, which was formed because of the specific relief and geological history of the development of the territory. The broad-leaved forests dominate on Monte Somma with different species such as robinia pseudacacia L. (*Robinia pseudacacia* L.), sowing chestnut (*Castanea sativa* Mill.), and shrubs; southern slopes are covered with forests of stone pine, Aleppo pine and black pine (*Pinus pinea* L. *Pinus halpensis* Miller, *Pinus nigra* Arnold). They perform forest-forming, hydro-technical, climatic and other functions and require measures aimed at improving the processes of natural drainage. In the Neapolitan zone there is a Mediterranean subtropical climate with rainy winters and hot dry summers. The prevailing winds are the northern wind in winter, and dry southern wind blows in summer.

4.2 Ecological and economic situation in the region

The Vesuvius National Park is a main visual dominant of the Neapolitan urban agglomeration today. The territory is replete with historical and cultural monuments, constantly replenished in the collection of protected cultural and historical sites. In addition, the contrast in the ecological state of the resort and other areas is striking. Today, the tourist routes lay along the coastal part of the region on major highways. The provinces are excluded from the cluster, and there is a depressing economic and environmental situation. The municipalities are not able to solve issues on maintaining the state of the environment. There are practically no green recreational areas in the territories adjacent to the park. Currently there is no organized structure for comfortable tourism and recreation of the local residents. The park requires global modernization with a buffer zone included in the complex of public recreational territory with comfortable transport routes of annular and radial type, development of attractive museum and historical complexes, solution of engineering problems for protection population from possible risks of acts of nature.

Conclusion

Geographical landscapes are an important component of the research aimed to solve scientific problems and ensure rational nature management based on the connection between natural objects and urbanized territories. The complex study of the landscape allows calculating its natural resource potential to determine its capabilities and ways of their utilization.

We can conclude that:

- Geological structure and relief are the basis for the development of human infrastructure and the formation of residential groups and territories;
- The geographical landscape influences the focus areas for development of the territories (transport, residential development, industrial and recreational zones, agro-industrial enterprises, farms, personal subsidiary plots, etc.), with utilizing different (from large to morphological) taxonomic units of zoning;
- There is a need for further research and to consider the educational role of nature in order to develop and implement an optimized environmental technology. The creation and maintenance of national parks will allow us to start the complicated process;
- To form a healthy society, it is necessary to create a comfortable, favorable urban environment. At the same time, the city should not advance aggressively the surrounding nature but ought to create an internal self-reproducing environment. So it is necessary to formulate a program of the city's environmental structure, which is legally set as an integrated environmental framework.

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