BIOPHILIC CITY

Development of biophilic cities in Russia: From ideal scientific town and Ecopolis to the green strategy of the modern megapolis

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Abstract

In Russia, one of the most important steps in developing a biophilic vision and including nature as an important component of urban planning and design was the development of special *'academic towns'* (*akademgorodok*) in late 1950s-early1960s. Biophilic principles were perfectly expressed in the planning, design and management practices of such specially designed ideal towns. This was the first manifestation of Soviet progressive urban planning principles and of attempts to design sustainable green cities for the future. The vision had strong theoretical and philosophical foundations and aimed to create ideal living conditions for Soviet scientists, who would have daily contact with nature and receive emotional and physical inspiration (live in harmony with nature) and thus work productively and make scientific discoveries. A special urban planning department in Moscow and numerous botanical gardens (important scientific research institutions in Russia) dedicated their efforts to designing green areas for such new scientific towns. Green belts surrounding cities and forest patches of various sizes were included in all city zones.

The next step towards the truly biophilic city was the programme Ecopolis in the late 1970s. Its foundation was the principle of constructive ecology, which aims to help humans manage the natural environment as a tool in coherent evolution of nature and society towards the noosphere. One of the main goals of Ecopolis was to create an optimal ecological and socio-psychological urban environment that could also incorporate nature protection functions in urban areas. For the first time in Russia, urban ecology and sustainable design practices were

implemented in a real town, Pouschino (located 120 km from Moscow). Later, Ecopolis ideas emerged in other small, medium and large cities (Kosino, Korolev, Vologda and Uliyanovsk).

After 10 years of sweeping political and economic changes in Russian society in the 1990s, many cities revisited existing planning and design norms. In the past five years, a strong movement aiming to solve ecological crises has arisen in Russian megapolises (Moscow, St. Petersburg, Nizhniy Novgorod, Kazan, Novosibirsk, Vladivostok). Municipalities are revisiting planning and design policies and suggesting new visions for urban green infrastructure within their masterplans. In Russia, biophilia is traditionally associated with existing remnants of forests within city boundaries and protection strategies for these, especially trees. Concrete examples of using ecological design (design with nature) can be found in microdistricts of St. Petersburg and Moscow. Results from the research of academic towns, Ecopolis and examples from megacities are also discussed in this paper.

Keywords biophilic cities in Russia;academic town; academgorodok;Ecopolis; technopolis

1. Introduction

In this paper, we chart the development within Russia of biophilic cities, defined as cities that allow humans to connect with nature within urban environments on a daily basis [1]

In Russia, a very important step in developing a biophilic vision with nature as an important component of urban planning and design at all scales (from master plan through neighbourhood level to the gardens of multifamily houses) was the creation of special ‘academic towns’ (akademgorodok) in late 1950s-early 1960s. These were a special type of settlement mode within the ideology of socialism, with one of the postulates being to create a sustainable urban environment based on a harmonic relationship between man and nature [2]

Biophilic principles were perfectly expressed in the planning, design and management practices of Russia’s academic towns. They were the manifestation of Soviet progressive urban planning principles and of attempts to design sustainable green cities for the future. The vision had strong theoretical and philosophical foundations and aimed to create the most comfortable living conditions possible for Soviet scientists, who would have daily contact with nature, gain receive emotional and physical inspiration (live in harmony with nature) and thus work productively and make scientific discoveries [3]. Academic towns were also accepted the microdistrict (mycrorayon), the innovative Soviet urban planning concept, which intended to reflect the ideas of the socialist society where people should be tolerant and unselfish, respect collective bargaining, debate for the collective good and hold socio-cultural values and harmonious ‘brotherly’ living in high esteem. Microdistrict (microrayon), residential clusters of 30-50 hectares for 12,000-15,000 people, consisted of multifamily 5-7-9-12 storey houses, shops, laundries, cleaning and repair stores, dining-rooms, schools and pre-school facilities [4]. This unified and standardised planning, design and greening strategy included quite extensive green areas as an important tool for improving quality of life and

environmental health. Microdistrict principles were also used in the academic towns, but in more progressive interpretations because of the availability of native forests.

The task of providing a suitable environment for academic excellence demanded new principles of planning structure and use of a functional zoning system. Thus a working zone (where research institutes were located), living zone, public administration zone, a rest and recreation and a provision zone were suggested for academic towns [3]. The academic towns were designed by specialist urban planning units in Moscow (e.g. GIPRONII, All-Union State Institute for Planning Scientific Research of the USSR Academy of Sciences), with the help of numerous botanical gardens. In the Soviet era, botanical gardens were also under the umbrella of the USSR Academy of Science and were considered important scientific research institutions. They were responsible for developing theoretical knowledge, but also for the application of findings within biological science in practice, and were thereby called upon for drawing up planting design and plant material recommendations for the new academic towns.

It was recommended that the academic towns be located within or near pristine nature, but also in close proximity to public transport links to major cities. One of the approaches during the planning stage was preservation of existing patches of natural ecosystems and including them in different town planning zones. Academic towns were planned as "cities of a new type, which are closer to modern and future urban planning ideals" [5].

Biophilic principles also applied in the planting design. Drawing inspiration from surrounding native plant communities called for use of native species that could also sustain local climate conditions in the most effective way. One of the important principles of green infrastructure in scientific towns was maximum protection of surrounding native ecosystems and organising the network of protected reserves within the city's boundaries. The list of plants for newly designed living neighbourhood also included decorative exotic species, which were intended to add a touch of interesting colour and texture, and thus reinforce the aesthetic appearance of novel urban vegetation.

2. Case study: Novosibirsk Academgorodok

One of the best examples of academic towns was Novosibirsk Academgorodok, located 30 km south of Novosibirsk city centre. The aim was to build an educational and scientific centre for Siberia. The site of the future town was on the shore of the Ob Sea (an artificially created reservoir on the river Ob), surrounded by birch and pine forests (Figure 1).

Fig. 1. Aerial view of Novosibirsk Academgorodok.

The town was founded in 1957, under the close patronage of the Academy of Sciences

of the USSR. In the 1970-1980s, the most prosperous years, Novosibirsk Akademgorodok was home to 65,000 scientists and their families. At that time the town had a good reputation and was a privileged residential area. Most of the population lived in nine-storey and four-storey multi-apartment buildings. Novosibirsk State University, 35 research institutes and a medical academy were located there, which created a good reputation and recognition of Novosibirsk Academgorodok as a truly 'academic' town.

In the general plan for the town, every aspect of planning was subordinate to clear functional zoning. The zones were established in a very logical, scientifically proven sequence, with a zone of research institutes, a provision zone, residential areas and a green protective zone, beyond which was a reservoir and finally a recreation area. Zoning preserved as much of the existing forest and open natural ecosystems as possible. The forest on the shore of the reservoir was saved as an important windbreak from the prevailing south-westerly winds and as a protection buffer from traffic noise on the transit highways passing the outskirts of the town [6].

The zone of research institutes was located in the north-eastern part of the town, where the institutes were clustered according their scientific interests and themes. This zone was built in an open spot where there was no existing forest, located on the leeward side of the residential area. The institutes' buildings were positioned taking into account their transport connection with the provision zone. The provision zone was separated from the residential area by a protective forest belt. The residential zone was bordered by a large forest area. The concept of using a 'green ring' of protected forests and including green wedges in residential developments was very innovative and aimed to maximise everyday contact with nature. Green areas in the residential zone consisted of public parks and inner courtyard gardens. In each neighbourhood, optimal orientation and aspect of buildings was again ensured. One of the main planning themes of the entire town was preservation of natural forests and their use for recreational activities. The amount of green area allocated per person was very high, 26 m2 of common green area and 200 m2 of other types of greenery per person (Figure 2).

Fig. 2. Green areas in one of the microdistrict in Novosibirsk Academgorodok.

The recreation zone was placed along the shoreline of the reservoir (Ob Sea), where, as a result of shore protection works, a 2.5 km long beach was created. Part of the zone was located within the town's administrative border, but the remainder continued further along the banks of the reservoir.

The Central Siberian Botanical Garden helped with designing the green areas. A specially created Forest Protection Station was made responsible for monitoring forest conditions, conserving, restoring and reconstructing forest ecosystems and helping with the greening of residential areas.

The architectural and planning structure of Novosibirsk Academgorodok can be seen as a very successful case of using existing natural conditions (topography, vegetation and hydrology) and including nature as a crucial structural element of urban spatial organisation. Another important outcome was the creation of a unified transport and pedestrian system, which provided convenient connections both between the city zones and within each zone, ensuring maximum safety for pedestrians, and excluded all types of transit through the territory of Novosibirsk Academgorodok. One of the positive features was organisation of cultural and consumer support services and creation of the novel architectural and aesthetic image of the city.

Taking into consideration its unique character as of one of the first academic towns and its special planning, architectural structure and urban development characteristics, in 2014 Novosibirsk Academgorodok was declared an object of cultural heritage (monument of history and culture) of the Russian Federation (cultural heritage of regional significance).

3. Case study: the Ecopolis programme and the academic town of Pushchino

The next step towards the truly biophilic Russian city was implementation of the Ecopolis programme in the late 1970s. Academics and scientists from Moscow State University were initiators of this project, the scientific foundation for which was the principle of constructive ecology, "which aims to help humans manage the natural environment as a tool in coherent evolution of nature and society" [7]. One of the main goals of Ecopolis was to create an optimal ecological and socio-psychological urban environment based on native landscapes and man-made plant communities. For the first time in Russia, urban ecology and sustainable design practices were combined within a major interdisciplinary project and implemented in the real town of Pushchino.

Pushchino (population 20,000) is located 120 km south of Moscow, on the bank of the river Oka. It was founded in 1963 as the Scientific Centre of Biological Research of the USSR Academy of Sciences. It brought together the following research institutes and centres: Institute of Protein, Institute of Biological Physics, Institute of Biochemistry & Microbiology, Institute of Photosynthesis, Institute of Agrochemistry & Soil Sciences, Scientific Computer Center, Constructor Bureau of Biological Apparatus and Radioastronomy Station. These were tasked with making breakthroughs in biological science in Russia.

The urban design concept applied for Pushchino was very innovative and had strong scientific foundations. The town was created as three parallel zones: an institute zone (working space) and a residential zone (living space), separated by a green zone (broad pedestrian boulevard). An additional (functional) zone was located at the periphery of the town. The green zone became the compositional axis of the town. The boulevard consisted of five groves (birch, pine, oak, larch and lime), which gave special ecological and aesthetic meaning to the whole town. Pushchino is

surrounded by native forests and meadows, while on the opposite bank of the Oka river there is a huge green 'sea' of Prioksko-Terrassny Biosphere Reserve (5000 hectares) (Figure 3).

Figure 3. Location of Pushchino and the view from the town to the Prioksko-Terrassny Biosphere Reserve.

Patches of native plant communities with high biodiversity value (e.g. unique native meadows, Figure 4) were included with the city boundaries and acted as the 'skeleton' of the urban green infrastructure system.

Fig. 4. Natural floodplain landscape at Pushchino (the Ostrov protected reserve).

Most indigenous vegetation patches were included in the network of urban nature reserves. The town is also very rich in cultural heritage landscapes. Just on its outskirts is the Teschilov Gorodische archaeological monument from the 12-14th century and a mansion house with the landscape park of the 18th -19th century. Nature is so close to residential areas in Pushchino that people can collect wild strawberries and forest mushrooms just 5 minutes' walk from their homes.

The Ecopolis programme ran for 18 years (1978-1996) and since then there have been broad investigations of different aspects of its urban ecosystems [8]. The local community was actively involved in the programme. People participated in conferences, surveys, excursions, lectures, discussions on Pushchino themes, film showings and simulation games. With local government support and the participation of local citizens, there were numerous implementations of ideas in practice, for example the special decision on nature conservation, the establishment of new nature reserves, improvement measures for the town's waste treatment system and introduction of ecological programmes in secondary and upper-secondary schools (Figure 5).

Fig. 5. Teaching session on botany in one of the nature reserves in Pushchino, 1991.

Later, Ecopolis ideas emerged in other small, medium and large cities in Russia, such as Kosino, Korolev, Vologda and Uliyanovsk.

4. Towards naukograd (technopolis)

The altered economic and political situation after 1991 resulted in re-evaluation of the approach to academic towns. In 1991, the new term 'science city' (*naukograd*) was introduced for the town of Zhukovski in the Moscow region, signifying the formation of a new Union for the Development of Science Towns. Since that time, science cities have emerged as targeted scientific and industrial complexes created specifically for the development of new science-intensive technologies. Such cities have to be based exclusively on close relations and interactions with universities and scientific and technical centres and with large industrial companies. Like the Soviet academic towns, the science city is designed as a special compact settlement with developed infrastructure that aims to provide productive and comfortable living and working conditions for researchers and

associated industrial staff. However, compared with the more idealistic academic emphasis of academic towns, the new technopolis is strictly pragmatic and orientated primarily towards housing scientifically progressive institutes and universities that produce new technologies and can contribute to economic growth.

Science cities are divided into seven research specialisations (aviation, rocket science and space research; electronics and radio engineering; mechanical engineering and instrumentation; chemistry, chemical physics and the creation of new materials; nuclear complex; power engineering; and biology and biotechnology). The size of science cities is not restricted and can vary. Pushchino town received the status of *naukograd* (among 13 officially recognised science cities) in 2005. The idea of the technopolis was taken from the West (USA and Western Europe). Nowadays the technopolis is a very attractive concept for many countries and is also reflected in current globalisation trends.

4.1. Case study: The town of Tsiolkovsky

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One of the latest examples of using planning and design ideas for academic towns can be seen in the town of Tsiolkovsky (population 5000), a new settlement built next to the Vostochny space centre in Amur Oblast on the Bolshaya Pyora River, 110 km from the border with China. The most essential legacy of the classical Soviet academic towns, i.e. the interconnection with surrounding natural landscapes and the use of natural existing landscapes as part of the planning structure, is clearly visible in one of the proposed design of residential neighbourhoods in Tsiolkovsky (Figure 6).

- Figure 6. Proposed design for the town of Tsiolkovsky.
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This ‘city of the future’ uses modern technology and new innovative architectural and building construction techniques, together with more modern architectural forms and material. However, the main ideology of *academgorodok* is still evident, as Tsiolkovsky is intended to be a special place for living and creative work by people united by one ideal, performing research that derives inspiration from biophilic landscapes. The future for Tsiolkovsky town is as an innovative *naukograd*.

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5. Understanding biophilia in modern Russian megapolis

After 10 years of sweeping political and economic changes in Russian society in the 1990s, many cities revisited existing planning and design norms. In the past five years, a strong movement aiming to solve ecological crises has arisen in Russian megapolises (Moscow, St. Petersburg, Nizhniy Novgorod, Kazan, Novosibirsk, Vladivostok). Municipalities are reviewing planning and design policies and suggesting new visions for urban green infrastructure within their masterplans. In Russia, biophilia is traditionally associated with existing remnants of forests within city boundaries

and protection strategies for these, especially trees. For example, 15 specially protected natural areas occupying a total area of 6142.5 hectares have been established in St. Petersburg. In the past decade, examples of using ecological design (design with nature) at the fine level scale have emerged in the microdistricts of St. Petersburg and Moscow [9]. For example, green roofs and principles of integrated stormwater management (low impact design) have been implemented in the St. Petersburg suburb of Devyatkino [10]. One of the crucial concepts of modern masterplan strategies in megapolises is the green belt (involving urban forests) and green corridor and integration of all green and water-based elements into one united green-blue infrastructure system.

6. Conclusion

Recent decades have seen a tendency for re
evaluation of the positive Soviet urban planning and
landscape architecture legacy. Innovative practices of
Soviet planning included the creation of
microdistricts (*microrayon*), a unified planning,
design and greening strategy using extensive green
areas to improve quality of life and environmental
health, and academic towns (*akademgorodok*), where
nature was seen as an important planning and design
element and a major socio-ecological tool in creating
a harmonious relationship with nature. This biophilic
approach, in combination with the concept of creating
compact pedestrian and public transport-friendly settlements within a safe environment, can be seen as a progressive achievement of the Soviet planning system. Some of the academic towns from this era, for example Novosibirsk Academgorodok, have even been recognised as cultural heritage, mostly because of the unique zoning structure, abundant vegetation and proximity to natural forests giving an identity of whole city (“the town-forest”). The character and features of the academic cities were very much in line with the Soviet aim of creating a new generation of settlements that would fulfil the task of creating a good living environment.

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- After years of turbulence and neglect of the past Soviet heritage in the 1990s, there is now a growing interest among urban planners and landscape architects in the academic town legacy. The new movement of the scientific city (*naukograd*) can be seen as today’s answer to market demand for advanced innovative technologies as an essential condition for societal progress. The scientific city model uses some ideas of academic towns, but the Ecopolis of co-evolution of man with nature has been subsumed within a more pragmatic model of technological development that is typical of a market economy.

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Appendix

Fig. 1. Aerial view of Novosibirsk Academgorodok.

Fig. 2. Green areas in one of the microdistrict in Novosibirsk Academgorodok.

Figure 3. Location of Pushchino and the view from the town to the Prioksko-Terrassny Biosphere Reserve.

Fig. 4. Natural floodplain landscape at Pushchino (the Ostrov protected reserve).

Fig. 5. Teaching session on botany in one of the nature reserves in Pushchino, 1991.

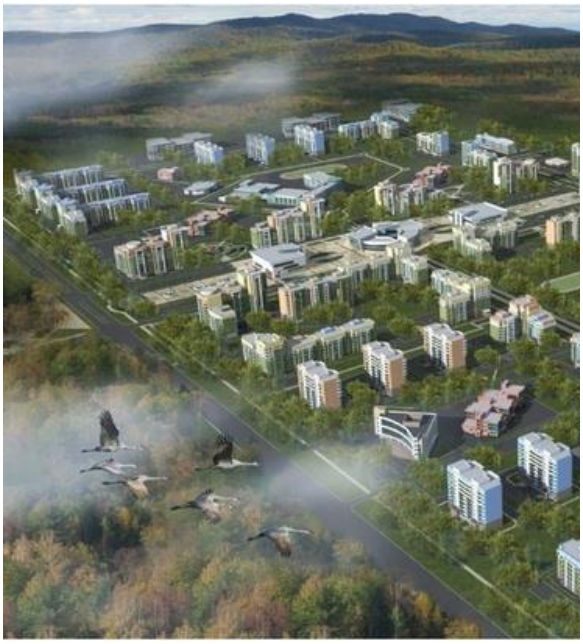

Figure 6. Proposed design for the town of Tsiolkovsky.