Landscape Rehabilitation And Ecological Problems Of Tashkent City

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ABSTRACT

This article discusses the identification of degraded ecological layers of the Tashkent urban environment and ways to restore them. Based on international experience, local ecological situation, current air quality indicators, and scientific analyses of the natural balance, rehabilitation approaches suitable for Tashkent conditions have been developed. The main part of the article shows that if the urban landscape is purposefully restored, air quality will stabilize, wind circulation will be restored, and green infrastructure will become a real protective layer for the health of the population

Keywords: *urbanization, urban environment, rehabilitation landscape, environmental problems, wind directions, green areas*

Introduction. Tashkent today may seem like a rapidly developing city, with multi-story buildings stretching into the sky and traffic jams. But behind this bright image lies a collection of internal problems of its own. The air quality has become increasingly poor, and the thick fog that spreads over the city in the winter is actually a layer of toxic dust that we have become accustomed to. The burning of coal and waste in greenhouses due to a lack of gas, the complete change in wind directions caused by large construction projects, and the failure to modernize old sewage plants in a timely manner - all of this is slowly destroying the city's ecology.

Where urbanization is strong, the problems are also acute. Tashkent is one of the cities under such pressure. Once upon a time, the wind flowed freely through the city center, purifying the air. Today, these routes are blocked by tall buildings and densely built-up areas, and the wind cannot move through the city. The cutting down of trees has further intensified this process. As a result, dust remains suspended at high altitudes, with almost no air exchange.

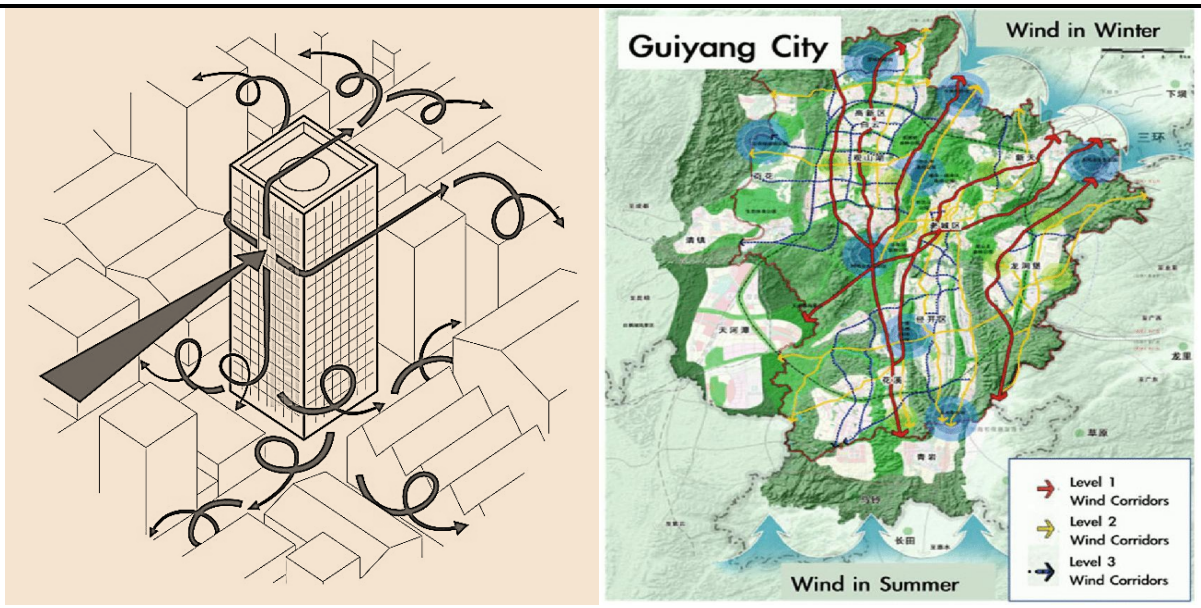

Figure 1. *Green corridors in cities*

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This is where the concept of a rehabilitation landscape comes in. Although the word actually means “restoring nature,” in urban settings it has a much broader meaning. It is a complex system aimed at restoring the urban microclimate, reopening natural wind directions, strengthening the interconnection of green areas, as well as normalizing water and land resources. In this study, I tried to demonstrate a rehabilitation model that is specifically tailored to the current ecological situation in Tashkent, addresses real problems, and is practically feasible.

Methods: While conducting the research, I realized that it is not enough to look at the problem from only one direction. The urban landscape is like a living organism. Its air flow, water circulation, land cover, social life, and even people's movement habits are closely interconnected. Several interconnected scientific methods were used in the preparation of this study. These approaches allow for a comprehensive consideration of the issue of landscape rehabilitation, identification of points of failure of urban ecological systems, and development of practical solutions.

Landscape-analytical method: Through this method, natural-relief features of the city of Tashkent, wind directions, land cover changes, the dynamics of the number and quality of green areas were studied. Aerospace imagery has revealed: a trend of shrinking green areas over the past 20 years, an increase in hardscapes (main heat island zones), areas of blocked wind corridors, ecological hotspots, and "black spots”.

Urban environmental diagnostics: This diagnostics was aimed at identifying the causes of environmental problems. Including: sources of harmful substances in the air (transport, greenhouses, construction), sewage system indicators, waste incineration statistics, data on tree felling in recent years, and statistics on the health of the population, including respiratory diseases, were analyzed. As a result, the geography of problems was identified and rehabilitation landscape solutions were developed to eliminate them.

Comparative analysis of international experiences (Benchmarking): The experiences of cities such as Berlin, Seoul, Singapore, Rotterdam, Tokyo, and Barcelona in urban ecological rehabilitation were studied. A comparative analysis was conducted in the following areas: wind direction restoration policies, green corridors, constructed wetlands, transport emission reduction, and ecological

rehabilitation programs ("Green Seoul", "Singapore City in Nature"). These experiments were adapted to the conditions of Tashkent.

GIS (Geographic Information Systems) analysis: The following maps were created by layering: air pollution intensity, greenhouse activity and waste incineration zones, wind directions and air circulation patterns, tree cover density map, and urban development density. GIS analysis clearly showed urban and ecological changes in space and helped to scientifically substantiate rehabilitation landscape projects.

Sociological surveys: Mini-surveys were conducted among the population on the following topics: level of dissatisfaction with the ecological environment, lack of green areas, complaints related to dust levels and air quality, impact of summer heat and hard surfaces, opinions on the quality of recreation areas. These surveys revealed the social side of the city's problems.

Figure 2. *Water and drainage + landscape integration - biofilters, artificial wetlands and green drainage zones*

Development of a rehabilitation landscape model: As the final stage of the methodology, an ecological rehabilitation model suitable for Tashkent conditions was developed. The model includes the following stages: Ecological diagnostics of the problem, Restoration of internal wind corridors, Reconstruction of green infrastructure as a connected system, Transition to ecological energy in greenhouses, Biofiltration and natural drainage systems, Landscape solutions that improve the health and psychological well-being of the population.

Continuing in this way, I analyzed space images taken over the city in different years. Through them, it was possible to clearly see in which areas of Tashkent green spaces have disappeared, in which areas hot areas have appeared, in which directions the wind has been blocked. Looking at the city from above, you can feel how it breathes.

The next step was to identify the sources of existing environmental problems. I compared how traffic flow, greenhouse activity, waste incineration areas, old infrastructure and building density are related to air quality. Official statistics, local monitoring results and seasonal changes in dust concentration in the air played an important role in this.

At the same time, it was very useful for me to address international cities. Seoul's green corridor system, Singapore's "nature in the city" concept, Berlin's wind-friendly policy, Rotterdam's waterscape - all of these can be a source of inspiration for Tashkent. Of course, their experience cannot be copied completely, but the basic principles can be adapted to our conditions.

During the research, I prepared special maps using GIS technologies. They clearly showed where the air was heavier, where the wind did not reach, and where green areas were cut off. “Black zones” that are not visible at first glance, but are killing the ecology of the city, are clearly visible on such maps. Interviews with residents were also very important. Many people spoke about the feeling of heaviness in the air, the unbearable heat in the summer, and the eye-soreness of the dust. Their complaints once again confirmed the deterioration of the urban ecology. All the methods were aimed at one goal. To clearly identify where the urban landscape is broken, where there is a possibility of restoration, and where it is necessary to take measures before it is too late.

Results. During the research, the ecological state of Tashkent and the processes of degradation in the urban environment were revealed as a system interconnected in several main directions. One of the initial results was that there is no single cause of urban air pollution, but rather a set of multi-source and complex processes. According to the results of the monitoring, in recent years, the concentration of PM2.5 and PM10 particles in the atmosphere has increased sharply, especially in the autumn-winter season, when pollution reaches its highest level. In addition, the transition to burning coal and even plastic waste due to the lack of gas supply of greenhouse farms is causing a significant increase in harmful substances emitted into the air.

The second area of the study revealed that the city's wind corridors have been disrupted and natural air exchange has sharply decreased. Map analysis showed that in recent years, along the main air flow corridors of Tashkent, blowing from the northwest, dense multi-storey residential buildings have been erected. The location of some of them contradicts the aerodynamic guidelines of the city's master plan. As a result, the wind flow is unable to perform its natural "filtering" function, which purifies the air.

The results of greening are also not satisfactory. In previous years, there are many areas in the city where large trees that formed a layered green structure were cut down due to construction. Regional observations conducted as part of the study showed that in some new areas, the root system of trees was damaged, and in some places, the entire tree canopy was cut down. This can lead not only to changes in the microclimate, but also to the intensification of urban heat islands.

The results obtained in the field of municipal infrastructure are particularly noteworthy. Sewerage networks, which have not been fully modernized for many years, are working beyond their capacity in some areas. Waterlogging, the release of wastewater or the spread of waste odors further aggravate the ecological environment. These situations often also harm green areas within cities - consequences such as soil salinization, loss of biodiversity, and drying up of green areas are observed.

One of the important aspects of the results is that the city's population is aware of the ecological changes in their environment and is not indifferent to them. The most frequently mentioned issues in public opinion are the lack of green spaces, dust, fuel odors, construction noise, and the health effects of poor air quality. This, in turn, indicates that the rehabilitation landscape is important not only for ecological, but also for psychological and social needs.

Discussion. The results obtained show that the disruption of the ecological balance in Tashkent is not accidental, but rather the result of many years of systemic problems. It can be seen that the deepening of the urban crisis is a natural process when urban growth and socio-economic pressures do not develop in harmony with the environment. First, urban air pollution is not the result of deficiencies in individual sectors, but a complex process associated with the simultaneous increase in transport,

industry, greenhouse gases and household waste. As the load on the transport system increases, the concentration of gases in the central points of the city increases. In areas where new buildings block wind corridors, polluted air remains for a long time, without dispersing. Therefore, ecological restoration is not only about reducing the number of sources, but also about restoring the city's aerodynamic system.

Secondly, tree felling has become one of the most controversial issues among experts. The scale of tree felling is sometimes explained by the acceleration of construction or the need to lay communications. However, international experience has shown that the reduction of greenery causes more harm in the form of deterioration of the microclimate, increased dust, increased noise, and a sharp increase in the negative impact on human health. The principles of rehabilitation landscape do not require compensating for dead trees - but rather their systematic restoration, creating a layered green architecture, and ensuring the priority of perennial species.

The third important debate is the importance of psychological factors in improving the health of the city. The study confirmed that the population is experiencing environmental stress. Dust, noise, construction, bad smells, traffic jams also affect the mental state of a person. Rehabilitation landscaping is not just planting trees, but the development of special landscape compositions to create a restorative environment, instill a sense of calm, safety and cleanliness in the city population, and reduce stress.

Based on the analysis, it should be emphasized that urbanization processes are still ongoing in Tashkent, but the city is not physically and communicationally ready to bear such a load. Much of the infrastructure is outdated, environmental control mechanisms are not functioning adequately, and the green space policy does not have a holistic system. In this context, landscape rehabilitation should be considered not only as an architectural approach, but also as a strategy for rebuilding the city for the future. The information obtained shows that in order to make Tashkent healthy, it is necessary to rebuild the ecological system not on a regional basis, but as an integral system throughout the city. Restoring wind corridors, creating landscape rehabilitation centers in ecologically blocked districts, forming a system of multi-layered green belts, and harmonizing green infrastructure and transport morphology should be the main directions of urban sustainability.

Conclusion. During the research process, it became clear that the environmental problems of the city of Tashkent are not simple local issues, both in terms of scale and scope, but consist of complex processes that affect the entire urban system. Urban air pollution, disruption of wind corridors, felling of trees, disorderly construction, a sharp increase in transport pressure, greenhouses and households switching to waste incineration - all these are interconnected and mutually reinforcing factors. As a result of these processes, the microclimate of the city is changing, and the level of ecological safety is significantly decreasing.

At the same time, the conducted analyses show that there is no single way to ecologically restore Tashkent; this requires an integrated approach. The “Rehabilitation Landscape” should be viewed as such an integrated system. This approach is not just about planting trees or building a new park, but is a process related to the reorganization of the city’s ecological system from the ground up, restoring the broken connection between nature and the city, and creating favorable conditions for people’s mental health and well-being.

The following main conclusions were drawn from the study:

Firstly, the Tashkent ventilation system will not be restored, and no external measures to clean the air will give either a complete or long-term result. The aerodynamic structure of the city must be reviewed based on cartographic and modeling analyses.

Secondly, the green space policy must be continuous and systematic. Planting trees at the same time and continuing to cut down trees will not improve the ecology of the city. Layered green structures—large trees, low shrubs,

ground cover, and water bodies—should be considered as a single ecological unit.

Thirdly, the rehabilitation landscape can be used more actively as a restorative environment for a person. This will serve not only ecological benefits, but also processes such as psychological stability, stress reduction, and restoration of social balance. It is necessary to design a system of "green shelters", quiet areas, pedestrian parks, and green corridors within the city, not geometrically, but in a way that is close to the logic of the natural landscape.

Fourth, the modernization of municipal infrastructure is an integral part of ecological restoration. Without the reorganization of outdated sewage networks, drainage systems, and waste management activities, any ecological projects will be ineffective.

In short, the current ecological state of Tashkent requires a comprehensive restoration strategy based on the principles of rehabilitation landscapes and developed with a scientific approach. This strategy allows the city to become healthier not only ecologically, but also spatially, socially and psychologically. Urban regeneration is not just about preserving nature - it is about creating a livable, safe and clean urban environment for future generations.

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