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Four Ecological Strategies for Urban Natural Environment Protection

Athanasios V. Serafeim*

Centre of Excellence for Research and Applied Studies on Climate Change and Sustainable Development, Water Pollution Research Department, National Research Centre, 33 El Buhouth St., Dokki 12622, Egypt

**corresponding author*

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Abstract: Human intervention in the natural ecological environment of cities has led to the need for cities to bear the urban ecological problems brought about by human activities. Some regions are pursuing economic growth by strongly transforming nature to achieve a better living environment. These deviations from natural ecological principles have led to the continuous destruction and devouring of the green ecological substrate that sustains urban development. In this paper, we analyze the current situation of pollution in the air environment, water environment and soil environment of city A, and propose protection strategies to improve the natural environment of city A. Then, we propose ecological restoration strategies, ecological development strategies, ecological design strategies and ecological protection strategies to improve the environment of city A for the ecological construction of city A. It is hoped that the research of this paper can provide reference suggestions for urban natural environment (UNE) protection.

1. Introduction

Research on UNE protection helps to clarify the main problems in UNE protection, to comprehensively study the relationship between various socio-economic aspects and urban environmental protection, to put forward targeted opinions, to coordinate the relationship between various urban departments and urban environmental protection departments, to jointly promote the improvement of urban environmental quality, and to maintain the balance of various urban ecosystems.

Research on UNE protection has made some progress. Many developed Western countries, which previously experienced industrial development at the expense of environmental protection, now feel more aware of the importance of ecological environment. In particular, many western countries will do a better job in environmental protection planning [1]. At the same time, Western theoretical research on environmental protection planning is also earlier than that of China. Some scholars point out that in recent years, in the process of urban construction and development, urban environmental protection planning has lagged behind the pace of urban development, so that the urban environment has been damaged to a certain extent, and in the long run, urban development will fall into a deadlock, so it is necessary to pay attention to urban environmental protection issues and improve the environmental quality of cities [2]. Some researchers point out the connection between environmental protection planning and economic development, and they believe that environmental protection planning has a vital role in the healthy development of our national economy, and mention that the concept of harmony between human beings and nature must become the leading concept of future urban development [3]. China's UNE protection planning has gone through the initial, development and upgrading stages, and the relationship between environmental protection and overall urban development will become closer and closer in the future.

In this paper, we firstly introduce the ecological network of UNE and put forward the evaluation factors of ecologically sensitive areas, then analyze the pollution of natural environment in city A from 2015 to 2020 and give solution measures for the current situation of pollution, and finally propose four ecological strategies to improve the ecological environment of city A and effectively build the ecological balance of city A.

2. Basic Overview

2.1. Ecological Protection Network of UNE

The primary principle of ecological network construction is to respect the basic landscape pattern of the city, and the basic pattern of nature is the framework of the ecological network; on the basis of respecting nature, ecologically fragile and sensitive areas should be transformed, and green spaces with fragmented habitats should be organized. Ecological nodes are ecologically important patches in the city, including block spaces such as forests, parks and lakes [4]; ecological corridors are free and controllable network building factors, so greenway construction is the main task of ecological network construction [5]. The nodes or corridors with the richest biodiversity in the ecological network are called ecological source sites, which are the source of biological habitat and species dispersal, and identifying and protecting ecological source sites is an important method to improve urban biodiversity [6]. The use of GIS can analyze the geographic characteristics of cities more scientifically and make the identification and connection of ecological corridors and ecological nodes more and more scientific, and it is also increasingly becoming an analytical tool for constructing urban ecological networks. As Figure 1 shows the process of urban ecological network construction and optimization design.

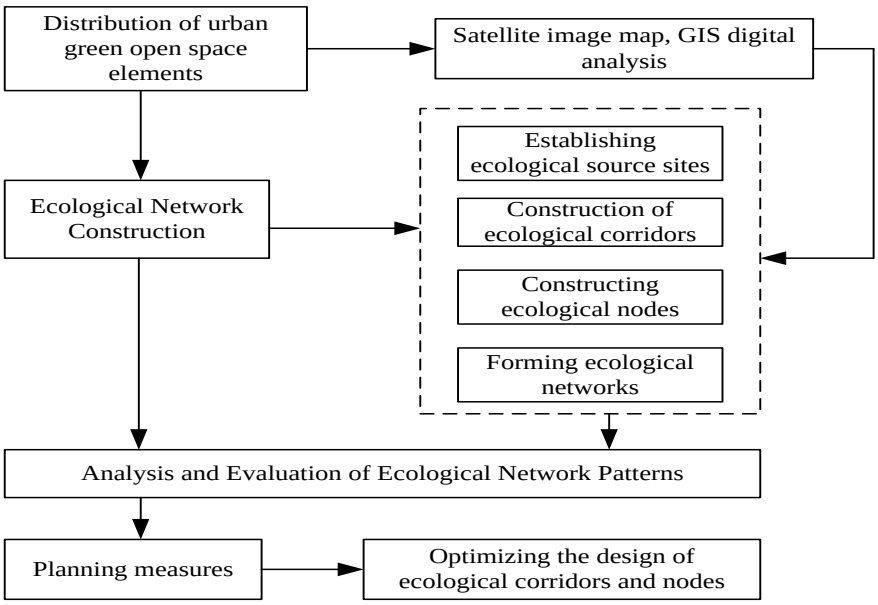

Figure 1. Urban ecological network construction

Systematization and networking are the trends of urban green open space development. The planning focuses on both the construction of the overall pattern and the design of local details. Only a systematic and networked green open space system can establish a safe ecological pattern of a city, so that a good ecological environment can be formed from the whole to the local and from the city center to the periphery of the city [7]. The networked layout is not a homogeneous average distribution, but should focus on the construction of major ecological corridors and large ecological patches of key significance, such as river ecological corridors and urban ecological parks, and incorporate them into the overall ecological network. After the urban ecological network is constructed, the connection with regional ecological environment needs to be established to realize the sharing and connection of ecological resources in urban clusters [8].

2.2. Evaluation of Ecologically Sensitive Areas

(1) Rainfall erosion force factor

The most direct external influence factor of soil erosion is sudden rainfall, so the intensity of rainfall and its effect on soil erosion can be used as an erosion evaluation factor. This factor indicates the erosion capacity of the ground surface produced during the rainfall process, and two rainfall intensity factors, rainfall kinetic energy and maximum half-hour rainfall intensity, work together to form the rainfall erosion force [9, 10]. The regression equation of rainfall kinetic energy E during rainfall is shown in equation (1), where T denotes the amount of rainfall.

$$E = 1.213 + 0.89 \lg T \tag{1}$$

(2) Cover management factor

The degree and type of cover of surface vegetation is also one of the important factors contributing to the sensitivity of soil erosion, and the soil-fixing capacity of plant roots and plant water absorption jointly contribute to the strength of this factor [11]. Plant types such as trees, shrubs, farmland and grassland can be extracted from the land use status map interpreted from remote sensing images, and values are assigned to each type as in equation (2).

$$C = a \cdot eb \cdot f \tag{2}$$

C denotes vegetation factor; f denotes vegetation cover degree, which can be obtained from remote sensing images; a and b are regression coefficients; e is the base of natural logarithm.

3. Analysis of Natural Environment Pollution in City A

3.1. Atmospheric Environment Pollution

(1) Precipitation detection

Table 1. Precipitation detection results

	Number of samples	Annual average pH	Number of acid rain	Percentage (%)
2015	35	6.14	7	20
2016	27	6.05	4	14.81
2017	46	6.11	3	6.52
2018	10	5.83	1	10
2019	71	6.08	6	8.45
2020	120	5.97	31	28.83

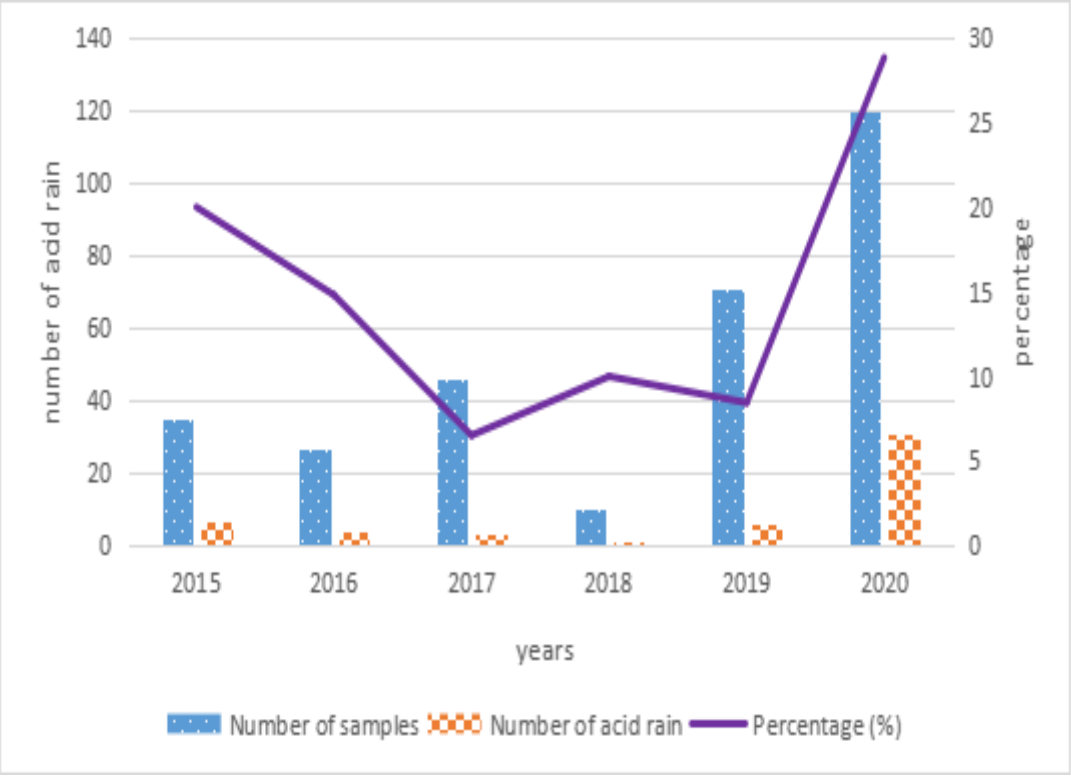

Figure 2. Number and percentage of acid rain samples

It can be seen from Table 1 and Figure 2 that the occurrence of acid rain in City A is relatively unstable, especially in 2020 when the frequency of acid rain is again on the rise. There are comprehensive reasons for the occurrence of acid rain, which is not only influenced by the decline of atmospheric pollutant emissions, but also by the climate environment. According to preliminary analysis, the main reason for the increase in the frequency of acid rain in Taiyuan during 2020 is due to the increase in precipitation in that year.

(2) Air quality

Table 2. Air pollutants

	SO_2	NO_x	PM10	Air Pollution Composite Index
2015	4.75	1.61	3.28	9.37
2016	4.33	2.15	2.94	9.52
2017	3.51	1.24	2.36	7.83
2018	2.64	0.78	1.75	6.23
2019	2.09	0.54	1.34	4.95
2020	1.72	0.35	1.46	3.88

As shown in Table 2, A is the pollutants affecting air quality are mainly SO2, NOx, PM10. the overall trend of air quality in city A is improving, and the pollution composite index of late Kongming in 2015 is 9.37, while it decreases to 3.88 in 2020, the air quality is obviously improving. The pollution generated by the exhaust gas emissions of large industrial enterprises is called point pollution, and the air pollution caused by coal-fired boilers in large and dense residential areas during the heating period becomes surface pollution.

(3) Industrial pollution

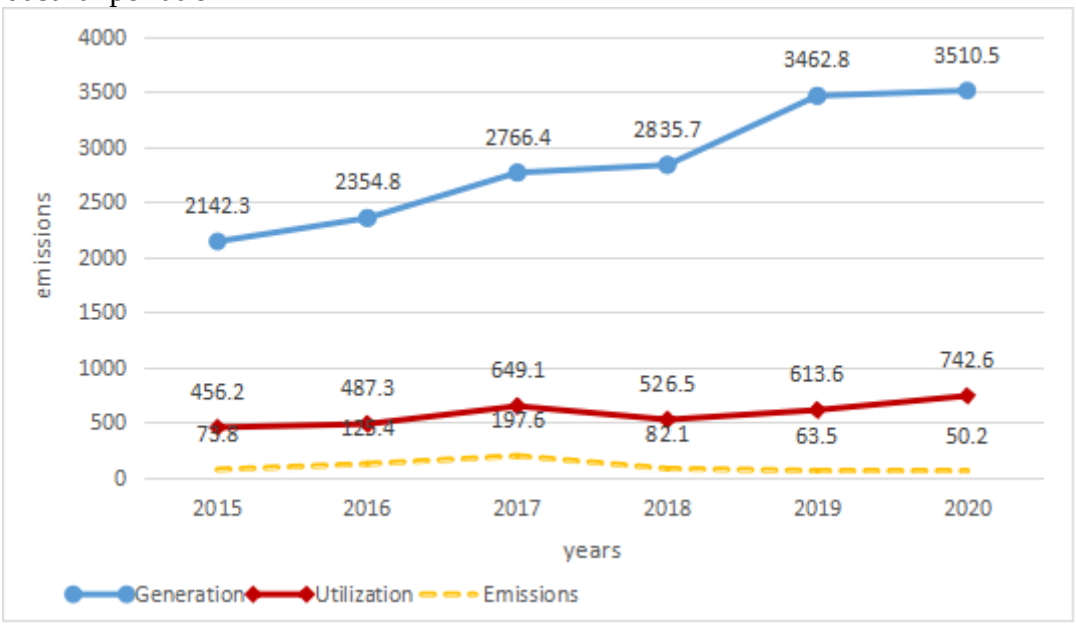

Figure 3. Industrial solid waste emission (million tons)

As shown in Figure 3, the amount of industrial solid waste generated in City A from 2015 to 2020 shows an increasing trend year by year, to 35.105 million tons in 2020. The amount of industrial solid waste comprehensive utilization in City A shows a trend of increasing to decreasing to increasing, with the utilization amount in 2020 being 7.426 million tons, an increase of 1.29 million tons compared with 2019, an increase of 21.02%. city A Industrial solid waste emissions show a trend of increasing and then decreasing, with emissions of 502,000 tons in 2020, a decrease of 133,000 tons compared with 2019, a decrease of 20.94%, with the main emission sources being coking, metal smelting and other enterprises.

3.2. Soil Environment Pollution

City A soil environment, in addition to the impact of natural factors, is also affected by industrial wastewater, exhaust gas, acid rain and other factors, the most direct and largest impact is currently the discharge of industrial wastewater, industrial sewage irrigation, mainly manifested in the soil of the sewage irrigation area with high concentrations of copper, lead, chromium, cadmium and

mercury. In addition, soil pollution caused by improper disposal of municipal waste, municipal solid waste or occupied land should not be ignored.

3.3. Water Environment Pollution

Water pollution occurs mainly according to the discharge of sewage and the distribution of the watershed receiving the sewage body.A large amount of sewage from industrial production in city A is directly discharged into the nearby low-lying areas or river ditches. The contribution of agricultural production to water pollution is small. Therefore, the areas with high probability of water pollution are mainly concentrated in the iron and steel industrial area, mining integrated industrial area, chemical enterprise concentration area, and other polluting enterprise areas in the urban area of city A. The next areas with high probability of sewage pollution are the urban and rural settlements and the areas with frequent human activities such as various types of arable land and dry land; the areas with the lowest probability of water pollution are the current mountainous areas, woodland and water protection areas.

4. Ecological Strategies for Natural Environment Protection in City A

4.1. Environmental Protection Strategy

For air environment protection, we should resolutely implement the strategy of "moving out" or ecological transformation for the serious polluting enterprises, and restrict the introduction of serious air pollution industrial enterprises in industrial parks, economic development zones and high-tech parks. The establishment of the sewage declaration and registration system and the sewage permit system; strengthening air pollution monitoring, setting up additional air monitoring stations, implementing 24-hour real-time monitoring of individual enterprises, and implementing total pollutant control [12]. Implement clean production, promote new technologies and techniques, and promote industrial waste gas to meet the standard emission; increase the investment in environmental protection; strengthen the construction of gardening and green space, increase the green space rate, and improve the self-balancing ability of urban atmospheric system [13]. For example, to protect the greening of mountains in city A, to strictly control the green belts on both sides of the bypass highway, and to strengthen the construction of road greening, courtyard greening, and street greening within the city.

To protect the land resources, we should promote the project of "closing the mountains to grazing, returning the cultivated land to forest and grass"; increase the compensation mechanism for farmers to reduce the harm of rough agricultural production to forest and grass; develop efficient agriculture, ban grazing, and implement the ecological migration policy to reduce the pressure of agricultural production in yellow land [14].

For water environmental protection, since urban waters are the most concentrated manifestation of pollution in the whole waters, the main aspects of its control planning are: setting standards for industrial production effluent discharge, including discharge volumes and discharge levels, prohibiting certain sources of pollution that are technically difficult to purify and treat from entering the waters, and enforcing the installation of sewage purification equipment according to the scale of production and discharge of industrial enterprises [15]. Construct and improve sewage treatment plants, improve the capacity of sewage treatment and reuse, and enterprises with large water demand and discharge should provide their own sewage treatment facilities and reuse facilities; strengthen the construction of water supply and drainage pipeline networks and improve the coverage of pipeline networks; promote water-saving technologies, improve production processes, and promote water-saving equipment [16].

4.2. Four Ecological Strategies to Improve the Environment of City A

(1) Ecological restoration strategy: ecological restoration refers to the restorative construction for damaged ecosystems. There are two ways of ecological restoration. If the damage to the ecosystem is reversible, the removal of external pressure and disturbance can be improved by the self-recovery ability of the ecosystem; if the damage to the ecosystem is irreversible and overloaded and cannot be improved by natural recovery, external improvement can be appropriately carried out by artificial means. Ecological restoration can restore the ecological capacity of the damaged mountain woodlands, wetlands, and rivers, therefore improving the ecological quality of the whole city [17, 18]. Ecological restoration is not only planting trees and grasses; influenced by the idea of sustainable development and the rise of ecological conservation awareness in all walks of life, the goal of ecological restoration began to rise from the reclamation work at the level of repairing the soil environment and productivity to the level of repairing and rebuilding the ecosystem and ensuring the self-sustainability of the system, i.e., focusing on biodiversity recovery under human-assisted control, using community succession and self-restoration capacity to bring the damaged The ecosystem is restored to a state close to its natural state before it was disturbed. For example, for the vegetation restoration in City A, different vegetation communities are adopted to cover the area according to the local climatic conditions, topography, and soil conditions. Attention should also be paid to the drought resistance, insect resistance, and reproductive capacity of the vegetation communities. For the severely damaged ecosystem, it should be repaired by the comprehensive means of "closure + transformation".

(2) Ecological design strategy: This strategy covers a wide range of areas, such as the ecological design of plant systems and the ecological design of livable buildings. The development of city dwellings in City A, and the selection of a gentle terrain with good geological conditions to build houses. This is not only for the construction and use of buildings, but also to reduce the pressure of the building system on the ecological system. The flat terrain is conducive to the connection between the building system and the outside world, reducing the additional environmental load added by the material transportation process and facilitating the relief and dispersion of the local pressure of the building on the surrounding environment; the good geological condition can ensure the simplicity and superficiality of the treatment of the building base and avoid the damage caused by the excessive treatment of the surface of the building site.

(3) Ecological development strategy: the goal of ecological development is to realize the development of man and nature in harmony. For the ecological development zoning, the ecological development suitability evaluation in the area will be combined with the existing technology to further refine the ecological development governance plan in the area. This includes engineering measures, land use methods, investment and financing, and management methods for each ecological function area. For example, for the tourism ecology of City A, it is necessary to both develop tourism resources rationally and protect the sustainability of ecological tourism.

(4) Ecological protection strategy: A city's flora and fauna resources are an important part of the natural landscape resources, in the planning and design of tourism scenic architectural design, the protection of scenic flora and fauna need to focus on consideration. First, in the site selection of scenic spots, try to avoid the destruction of natural environment and natural landscape, consider the characteristics of native vegetation, and help shape the overall image of vegetation in the selected site, so that the building and vegetation are integrated; second, in the scenic site, the ecology of the scenic area is fragile, and the ecologically sensitive zone should be protected when the overall layout is carried out, and moderate and reasonable development should be carried out, such as protecting the existing vegetation zone, and in the vegetation cover For example, the existing vegetation zone should be protected, and in the area with high vegetation cover, a decentralized

layout should be chosen to turn the whole into zero, and plants and buildings should be interspersed and interdependent, so as to reduce the changes to the vegetation cover and vegetation nature.

5. Conclusion

Faced with the global phenomenon of urban sprawl and urban fragmentation, we should change the traditional defensive ecological design and adopt a comprehensive and proactive approach to ecological planning. Under the basic principle of respecting nature, we should be more proactive in using relevant technical means to improve the ecology of cities. In this regard, this paper takes City A as an example to study the air quality, industrial pollution, water pollution and other conditions in City A. It is found that although the ecological quality of City A has improved, there are still ecological problems, so this paper proposes corresponding environmental protection measures and ecological strategies to help City A achieve ecological sustainable development.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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