ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 11| Issue: 4| April 2025|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2025: 8.691 || ISI Value: 1.188

FOREIGN EXPERIENCES AND INNOVATIVE PROPOSALS IN GREENING EXTREME SETTLEMENTS IN THE ARAL SEA CLIMATE REGION

Pirniyazov Sadikbay Koyshibayevich
Independent Researcher, Karakalpak State University, Karakalpakstan, Nukus city

Article DOI: https://doi.org/10.36713/epra20870
DOI No: 10.36713/epra20870

ABSTRACT

The aim of this study is to explore foreign and local innovative practices in greening regions of Uzbekistan that are considered climatically unfavorable for plant cultivation, and based on this, to develop proposals and recommendations for greening desert areas and populated places in the Aral Sea region and improving their environmental conditions. The article examines plant cultivation and landscaping practices in large desert and sandy areas, particularly in China and Egypt, including the ongoing creation of the Serapium forests in the Egyptian deserts. The study analyzes how these practices could be applied in Uzbekistan's regions unsuitable for plant growth, including saline and desert areas of the Aral Sea region. It also offers suggestions and recommendations for plant cultivation, desert greening, preventing sand drift in the Aral Sea deserts, and the use of wastewater (sewage water) for landscaping and reclamation in saline and desertified zones.

KEYWORDS: *Karakalpakstan, Aral Sea region, areas unfavorable for plant growth, greening activities, Uzbekistan and foreign countries, Egypt, China experiences.*

INTRODUCTION

A significant portion of Uzbekistan consists of regions with harsh climates for plant growth — areas that are hot and dry in summer, cold in winter, and characterized by saline soils and deserts. In such territories, preserving flora and fauna, combating erosion, and carrying out greening activities in settlements are complex and concerning challenges. In Uzbekistan, such territories primarily include Karakalpakstan, the Aral Sea region, and the northwestern part of Karakalpakstan. The landscape and nature of this region have suffered severe erosion and degradation due to the reduction of Amudarya water levels and the desiccation of the Aral Sea.

Although the Government of the Republic of Uzbekistan and the international community have undertaken planned efforts to mitigate and eliminate the negative impact of this situation — such as planting haloxylon in the dried seabed of the Aral Sea and growing the indigofera plant in the region by scientists from the Tashkent Agricultural Academy [1; 6] — achieving a satisfactory level of landscape and environmental restoration, including greening of settlements, has become a pressing issue of national importance.

Therefore, this research is devoted to studying global experiences in improving the ecological environment and climate conditions of desert zones where plant growth is unfavorable and evaluating how such experiences could be implemented in greening activities of settlements located in the Aral Sea zone of Karakalpakstan. Local scholars such as A.S. Uralov, A.N. Gadayev, and B.Yu. Kidirboyev have paid attention to this problem [4]. However, broader innovative scientific approaches based on international experience have not yet been adequately applied.

RESEARCH METHODOLOGY

The research methodology is based on a complex scientific approach and includes the following specific scientific research methods: comparative analysis of data obtained from the study of scientific and specialized literature, projects and documents related to the problem; and the development of new proposals and recommendations for greening territories of cities with hot and dry climates.

RESULTS

It is known that the Aral Sea regions of Karakalpakstan, which is part of the Republic of Uzbekistan, are among the most climatically unsuitable areas for plant cultivation and care. The natural climate and soil conditions in these areas present significant difficulties in forming a plant ecosystem. To effectively carry out plant cultivation and greening activities in these territories, it is necessary to lower the groundwater level and conduct soil leaching operations in winter to reduce salinity. These processes require substantial financial investment.

In addressing this issue, studying the experiences of foreign countries with desert landscapes similar to the Aral Sea region is of great importance. We examined the solutions to this problem using the experiences of the People's Republic of China and

Egypt in Africa. In China, a national program was adopted to combat desertification of arable land used in agriculture [5]. According to this program, measures were taken to halt the movement of sand dunes carried by strong winds from the desert toward fields and settlements, to strengthen desert soils by planting specific vegetation, thereby improving the ecology of rural and urban areas located in desert and steppe zones, and to create employment opportunities for the local population [5].

The images below illustrate the partial implementation of the tasks of this program (Figures 1 and 2).

Figure 1

Figure 2

In African countries as well, preventing the movement of desert sands is considered a serious issue. Egypt has implemented a unique and effective method to address this problem — covering desert areas with forests. However, one might wonder: how is it possible to grow trees, especially entire forests, in regions where there is little or no rainfall or natural water sources? Scientists have found an excellent solution to this challenge. The Serapium Forest, an artificially created forest in the Egyptian desert, stands as the best example of the effectiveness of this solution. The Serapium Forest was established in the Egyptian desert and is irrigated using treated wastewater (sewage water) [1].

Egyptian scientists, in an effort to prevent sand movement in the desert and to create a favorable ecological environment in those areas, have treated the wastewater produced in Cairo and other Egyptian cities and used it to irrigate and grow artificial forests [2]. Through this irrigation method using wastewater, desert and arid zones have been transformed into forested areas. As a result, valuable tree species such as eucalyptus and redwood have been cultivated, leading to improvements in the region's ecological landscape and climatic conditions.

Since the 1990s, more than 200 hectares of land in Egypt have been planted with ornamental trees [3]. This extraordinary forest continues to flourish in the heart of the Egyptian desert. The Serapium Forest is indeed considered an innovative project, the result of collaboration between Egyptian and German scientists. The results of the work being carried out under this project and general visual representations of the forest are provided below (Figures 3 and 4).

ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 11| Issue: 4| April 2025|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2025: 8.691 || ISI Value: 1.188

Figure 3

The project is not based on expectations of natural rainfall or available water resources but relies on an adapted irrigation system using treated wastewater (sewage water). Through this method, trees are provided not only with moisture but also with essential nutrients that aid in plant growth [1].

Figure 4

The wastewater used for irrigation under this method undergoes a two-stage treatment process: 1) mechanical filtration; 2) biological treatment and oxygen enrichment. Wastewater treated through this method becomes rich in phosphates and nitrogen, turning into highly beneficial nutrients for crops and forests when used in irrigation systems [2].

Although the wastewater used for irrigation goes through specific purification stages, this type of irrigation is applied exclusively for growing ornamental trees and plants that are not intended for human consumption. This alternative method is considered ideal for Egyptian conditions: moisture from the wastewater treatment plant is delivered directly to the forest through a system of pipes and hoses covering hundreds of hectares of sandy terrain (Figures 4–5).

ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 11| Issue: 4| April 2025|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2025: 8.691 || ISI Value: 1.188

Figure 5

According to the project authors, "the trees in Serapium grow four times faster than those in Germany. If 80% of Egypt's wastewater is used, it would be possible to transform 650 thousand hectares of desert into forest," the project authors write [1;2] (Figure 6).

Now, regarding the Aral Sea region, this method could potentially be applied in the desert, sandy, and steppe areas surrounding the city of Nukus. The wastewater (sewage water) discharged from the city of Nukus can be treated and used in this system. Taking into account the expected population growth in Nukus and the availability of such treatment facilities on the outskirts of the city, it would be possible to transform the desertified lands around the city, as well as the deserts surrounding the city of Muynak in the Aral Sea zone, into forest using the Egyptian method and thus improve the ecological conditions of the region.

Figure 6

This system can also incorporate the wastewater discharged from cities such as Takhiyatosh and other urban settlements located near desert zones. The use of treated wastewater for irrigating non-fruit-bearing, i.e., ornamental trees and crops in greening desert areas of the Aral Sea region is considered appropriate based on the following reasons:

1. It prevents the spread of sand into the surrounding environment;
2. The establishment of forested and cultivated areas improves the ecological state of the environment;
3. Agricultural enterprises will be established to care for and utilize these forests and croplands, which in turn creates new job opportunities;
4. The improvement of the region's landscape will enable the development of other engineering infrastructures;
5. Treated wastewater, which does not pollute the environment, will contribute to irrigation systems and the formation of a local microclimate.

When implementing these proposals, it is crucial to strictly adhere to sanitary and epidemiological standards that regulate the use of treated wastewater for irrigation systems, especially in local hot and arid desert zones.

If soil improvement is not feasible when planting vegetation, the most appropriate approach is to select plant species that are adapted to the existing soil. In this regard, the following plant species are recommended for saline soils:
Ailantus (tree of heaven), Caspian gleditsia, amorpha, fuzzy sumac, tamarisk, and indigofera (Figure 7).

For sandy soils, plants from the *psammophyte* group are recommended. These include:
Ailantus, wart birch, purple and Caspian willow, ash-leaved maple (acer negundo), silver and Tatar maple, pine, narrow-leaved and silver Russian olive (Elaeagnus), white and Canadian poplar, golden currant, yellow acacia, meadowsweet (tavolga), and snowberry (Symphoricarpos).

Figure 7

In addition to the aforementioned recommendations, we suggest the use of ornamental shrubs and flowering plants grown in containers and pots, as well as artificial turf coverings, for greening residential areas within the Aral Sea region. Furthermore, it is advisable to implement hydroponic and hydroseeding methods for plant cultivation (Figures 8–9).

Figure 8

ISSN (Online): 2455-3662
EPRA International Journal of Multidisciplinary Research (IJMR) - Peer Reviewed Journal
Volume: 11| Issue: 4| April 2025|| Journal DOI: 10.36713/epra2013 || SJIF Impact Factor 2025: 8.691 || ISI Value: 1.188

Figure 9

This line of scientific research is being conducted in collaboration between the Samarkand State Institute of Architecture and Construction and Karakalpak State University. The implementation of the proposals developed based on scientific studies, their technical and economic substantiation, and adaptation to the specific climatic conditions of the region—that is, further refinement—are ongoing.

DISCUSSION

By utilizing wastewater in cities surrounded by deserts and arid zones such as Nukus, Muynak, Navoi, Karmana, Zarafshan, Konimekh, Muborak, and other similarly located settlements, it is possible to improve the ecological environment and climate of the surrounding desert landscapes.

Applying the same method to local settlements—district centers, small towns, and sanatoriums—and utilizing their wastewater is also of great importance. In particular, the experience of using wastewater from the town and industrial zone of Muborak in Kashkadarya region and the Akkurgan sanatorium in Surkhandarya has already been implemented.

In order to widely implement such foreign and local eco-methods for revitalizing desert landscapes with extreme climatic conditions, **inviting scientists and investors from Egypt, Germany, and China**—countries with extensive experience in this field—can lay the foundation for solving important economic and ecological problems of national significance.

REFERENCES:

1. *Resolution No. 132 of the Cabinet of Ministers of the Republic of Uzbekistan dated February 15, 2019 "On measures to accelerate the creation of 'green covers' – protective forests – on the dried seabed of the Aral Sea." Tashkent, 2019.*
2. *Webster G. L. Sapium. In: Kubitzki K. (Ed.) The Families and Genera of Vascular Plants, Vol. 11: Flowering Plants. Eudicots: Malpighiales. Berlin: Springer, 2014. pp. 203–204.*
3. *Andrey Nikonov. "Egyptian scientists have found a way to grow green forests in the desert." // Information Bulletin on the Use and Protection of Natural Resources in Russia. Moscow, 1998. pp. 6–7.*
4. *A.S. Uralov, A.N. Gadayev, B.Yu. Kidirbaev. "Innovative proposals for greening the Aral Sea region" // Proceedings of the International Scientific and Technical Conference on "Issues of Sustainable Development of Architecture and Urban Planning in the Aral Sea Region." Nukus, June 20–21, 2019. pp. 42–48.*
5. *https://uza.uz/uz/posts/orol-dengizi-mintaqasidagi-ekologik-ofat-oqibatlarini-yumsha. "International conference on developing cooperation to mitigate the consequences of the ecological disaster in the Aral Sea region." October 9, 2014.*