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Electronic Information Technologies in Life Science: Assessments of The State and Health Benefits of Garden and Park Plantings

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Abstract: As a substantial part of urban parks and green spaces, plant landscapes can favor people's physical health by raising surrounding negative air ions and oxygen released, and also decreasing harmful particulate matters and noises. In the prevailing era, the description of the special computer program "PLANT-EST-KZ" developed in the MEBG is given, the database of which currently includes the most complete information about 94 green devices of residential and industrial zones of 5 settlements of the Mangystau region of 13 districts. The aim of the study is mainly intends to analyze the role of electronic information technologies in life science, especially the assessments of the state and health benefits of garden and park plantings. Over the course of this study, a comprehensive scale for assessing the health benefits and aesthetics of green devices, which takes into account 37 structural, commemorative, ecological, biological, chemical and agrotechnical characteristics of garden and park objects, is considered in relation to the arid conditions of Mangystau. A comparative analysis of the health benefits and aesthetics of green devices for various functional purposes is given. Based on the results obtained, it is necessary to activate the implementation of the assortment of wood lianas (4.3%), varietal roses (18.4%) and flower and ornamental plants (14.9%) in the coming years. The improvement and implementation of the "PLANT-EST-KZ" program in the practice of green construction will grow to be the foundation for a proper evaluation of the decorative nature of Mangystau landscaping and the development of efficient means for the reconstruction of existing and creation of new garden and Park plantations.

Keywords: Health Benefits, Computer Program , Green Devices, Mangistau.

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1. INTRODUCTION

Green spaces can promote exercise, supply spaces for socializing, reduce air pollution and noise, and enhance immune function by supplying exposure to a healthy microbiota. Plus, they can assist with psychological restoration. In other words, green space provides a respite for over-stimulated minds[1,2]. In the extra-arid conditions of the Mangystau desert zone, green spaces, in addition to sanitary and hygienic ones, have an important landscape design, architectural and artistic significance [2-4]. Against the background of a poor natural landscape, all green devices (GD) acquire significant aesthetic value. When considered, its level is very heterogeneous and depends on a whole complex of factors: the type of planting, the range of plants, the presence of decorative compositions, the state of the plantings [5-7]. In addition, the degree of decorative plantings is to some extent an assessment of the success of the work of introducers and gardeners. From the very beginning of landscaping in the Mangystau desert, there is an acute problem of comparative assessment of the overall decorative effect of green devices in the system of a specific natural and urban landscape, which the Mangyshlak Experimental Botanical Garden (MEBG) has been dealing with since 2018 as part of the implementation of scientific and technical target programs [8-12]. Overall, this study revolves around the role of electronic information technologies in life science, especially assessing the state and health benefits of garden and park plantings. It is attempted to analyze the role of the implementation of the "PLANT-EST-KZ" program in the practice of green construction as the basis for an objective assessment of the decorative nature of Mangystau landscaping. This study mainly intends to analyze the role of electronic information technologies in life science, especially the assessments of the state and health benefits of garden and park plantings.

2. MATERIALS AND METHODS OF RESEARCH

The objects of research were to analyze the green devices of cities and settlements of the Mangystau region (94 garden and park plantings of 13 types: residential neighborhoods, parks, squares, office buildings, slopes to the sea). Long-term foreign and domestic experience in assessing the aesthetics of cultigenic and natural landscapes [13,14], green construction [5, 10, 11], and landscape architecture [2, 7-13] was taken into account when compiling the scale for diagnosing the decorative nature of the memory. The collection of primary materials for analysis and input into the database (DB) was carried out by examining the landscaping plantings of Mangystau in a pre-developed form, including 5 groups of accounting indicators: 1) general information; 2) the composition of the most common (main) ornamental plants; 3) photographic and cartographic materials; 4) additional characteristics; and 5) the actual "Integrated scale for evaluating the aesthetics of green devices". The general information included: the name of the institution, the address, the name and type of the green device, the year of its creation and age, the area and coordinates, the height above sea level, the description of the history of creation and reconstruction, the relief and soil, the degree of their cultivation, a brief description of agro-technical care and the state of the irrigation system, damage to ornamental plants (various), indicating the main pests and diseases. When studying the most common plant taxa, special questionnaires were filled out and their division into both the main morphological and systematic groups and the types of compositions created (coniferous and deciduous trees and shrubs, single plantings, biogroups, green fences, rose gardens, flower beds, lawn coverings) was taken into account. The characteristics of the natural vegetation cover (if any), including the name of the natural population, the total projective cover, and the taxonomic composition, were taken into account as additional information about the land area. To compile the computer program "PLANT-EST-KZ", the programming languages Microsoft Visual FoxPro 9 SP2 and Visual Basic For Applications 7.0 were used; for automatic generation and output of Internet maps and site pages in browsers-JavaScript API 2.1, HTML 4 and PHP v7. 3. 68.

3. RESULTS AND DISCUSSION

Initially, an attempt was made to evaluate urban plantings as objects of landscape architecture according to the scheme [14], which includes as the main indicators of the formation (completeness) of lawns, flower beds, plantings of woody and shrubby plants and the structure of their areas. In practice, attention was immediately drawn to a number of shortcomings of this scale, namely, the limited number of evaluation features, the relativity of the concepts of formation and completeness, the lack of validity and detail of the allocation of structural units of the balance of territories and a single point assessment of indicators. Therefore, it was recognized that the assessment of GD by the method of Cho et al. [14], especially in the extra-arid natural conditions of Mangystau, will not give an objective comparative characteristic of the aesthetics of garden and park plantings. The "Method of assessing the aesthetics of landscape features" used in landscape architecture [3, 4], is also unsuitable for the desert of the research region, since it is designed for a forest zone, where a large role in the formation of the landscape belongs to natural plantings and water surfaces. Based on the above and on the general principles of green construction [5, 10, 11], landscape architecture [2, 12, 13], landscape aesthetics [3, 4], long-term experience of the botanical garden of introduction and landscaping works [7-9], as well as the survey of existing green spaces in the Mangystau region, a "Comprehensive scale for assessing the aesthetics of green devices in arid regions of Kazakhstan" was developed, taking into account both structural and commemorative, as well as ecological, biological and agrotechnical characteristics of garden and park objects (Table 1). The scale includes 37 diagnostic signs, grouped into five groups (sections): 1) general characteristics and aesthetics of the objects; 2) decorative properties, condition and abundance of green spaces; 3) landscaping; 4) cultural, historical and scientific value; and 5) the level of maintenance of green spaces (Table 1).

Table 1. Comprehensive scale for assessing the aesthetics of green devices in arid regions of Kazakhstan

Feature No.	Name of the evaluation features	Evaluation options and conditions	Score in points
I. GENERAL CHARACTERISTICS AND AESTHETICS OF OBJECTS			
1.1	Fit into the surrounding landscape	doesn't fit in	0
		Fits in	1
		fits in well	2
1.2	Picturesque terrain	low	0
		medium	1
		high	2
1.3	Functional zoning	not observed	0
		Zones are highlighted:	
		- entertainment facilities	3
		- cultural and educational events	3
		- physical education and sports facilities	2
		- children's recreation	2
		- adult recreation	1
		- composition center	3
		TOTAL POINTS (no more than 6 points per credit)):	0-6 (14)
1.4	Compositional mosaicity	there are no garden and park compositions	0
		They meet:	
		- wood arrays	1
		- groves	1
		- tapeworms	3
		- linear landings	1
		- group landings	2
		- hedges	2
		- compositions of climbing plants	2
		- flower beds	3
		- rose gardens	4
		- lawns	4
		- glades and lawns	2
		- water surfaces	3
		- compositions of aquatic plants	5
		TOTAL POINTS (no more than 7 points per credit)):	0-7 (33)
1.5	Compositional unity and design	absent	0
		Expressed by:	
		- weak	1
		- average	2
		- good	3
		- very good	4
1.6	Nature of the landscape perspective	short	0
		medium or long range	1
		combination of medium and long range	2
1.7	Dynamism of perception of light, shadow, shapes, contours, compositions of plants and other objects	absent or expressed weakly	0
		expressed well	1
1.8	A variety of colors and shades	not expressed	0
		expressed	1
1.9	Design of the perimeter	it is not decorated or borders on territories of low decorativeness	0
		limited to streets, roads, boulevards, etc.	1
		decorated with a protective strip or fence	2
TOTAL POINTS:			0-27
II. DECORATIVE PROPERTIES, CONDITION AND ABUNDANCE GREEN SPACES			
2.1. WOODY VEGETATION			

2.1.1	Age	very young-1-2 years	0
		very young-2-5 years	I
		young-5-10 years	2
		young-10-15 years	3
		old-15-25 years	4
		old-25-35 years	5
		old-35-45 years	4
		old-45-60 years and more	2
2.1.2	Tiering of tree stands	simple structure – 1 tier or absent	0
		complicated structure - 2	I
		complex structure - more than 2	2
2.1.3	Height of the main (predominant) garden and park tree species	very low – less than 3 m	0
		low-3-5 m	I
		medium-5-10 m	2
		high – 10-15 m	3
		very high 15-20 and more	4
2.1.4	Vital condition	bad	0
		satisfactory	I
		good	2
		very good	3
2.1.5	Variety of species assortment of woody plants	very poor – less than 5 species (taxa)	0
		poor-5-10	I
		narrow-10-15	2
		wide – 15-20	3
		diverse – 20-25	4
		highly diverse – more than 25	5
2.1.6	Picturesque compositions of trees and shrubs	missing	0
		They meet:	
		- rarely	I
		- quite often	2
		- often	3
2.1.7	Decorative forms of the crown of trees and shrubs	don't meet	0
		meet	I
2.1.8	Decorative qualities of the trunk	don't meet	0
		meet	I
2.1.9	Application of coniferous woody plants	not applicable	0
		Apply:	
		- rarely-less than 1 % of the total	I
		- relatively wide – 1-5	2
		- wide - more than 5	3
2.1.10	Availability of rose gardens	no	0
		They meet:	
		- rarely	I
		- quite often	2
2.1.11	Hedges	no	0
		little	I
		applied widely	2
2.1.12	Density of woody vegetation	very low	0
		low	I
		optimal	2
		high	I
		excessively high	0
2.1.13	Specific weight of woody vegetation in the total area	very low	0
		low	I
		optimal	2
		high	I
		excessively high	0
	2.2. FLOWER BEDS		
2.2.1	Decorative effect	low (or no flower beds)	0
		medium	I
		high	2

		very high	3
2.2.2	Square	% of total area:	
		0	0
		less than 1	1
		1-3	2
		3-5 more	3
		than 5	4
	2.3. LAWNS		
2.3.1	Decorative effect	low (or no lawns)	0
		medium	1
		high	2
2.3.2	Square	% of total area:	
		0	0
		less than 5	1
		5-10	2
		more than 10	3
	TOTAL POINTS:		0-48
	III. LANDSCAPING OF THE TERRITORY		
3.1	Arrangement of the road and path network	there is	0
		no ground covering	1
		hard (gravel, asphalt, ordinary paving stones-tiles, etc.)	2
		decorative (colored or shaped paving stones-tiles, stone, etc.)	3
3.2	Availability of recreational facilities for visitors	not	0
		few	1
		quite a lot	2
3.3	Visibility conditions	there are no developed routes, viewpoints or observation platforms	0
		there are specially designed viewpoints and developed routes	1
3.4	Small architectural forms	no	0
		little	1
		enough is a lot, does not fit into the	1
		overall composition of the green device	2
	TOTAL POINTS:		0-8
	IV. CULTURAL, HISTORICAL AND SCIENTIFIC VALUE		
4.1	The presence of cultural and educational and memorial buildings	missing	0
		Are:	
		- busts	1
		- monuments	2
		- stelae	2
		- eternal flame	3
		- exhibitions	1
		- museums	2
		- other objects	1
		TOTAL POINTS (no more than 3 points per credit)):	0-3 (12)
4.2	The presence of historical or related places	there is not	0
		there is	1
4.3	Scientific value	does not represent	0
		represents	1
	TOTAL POINTS:		0-5
	V. LEVEL OF GREEN SPACE CONTENT		
5.1	General well-grooming of plants and their compositions	no care	0
		bad	1
		unsatisfactory	2
		satisfactory	3
		good	4
		very good	5
5.2		not observed	2

	Damage (varied): leaves, bark, trunk, shoots, flowers, etc.	weak and medium	1
		strong	0
5.3	Littering of the territory (weeds, garbage, etc.)	absent	3
		weak	2
		medium	1
		strong	0
5.4	The state of the irrigation network	bad or absent	0
		satisfactory	1
		good	2
POINTS:			0-12
TOTAL POINTS:			0-100

source: compiled by the authors

Each feature is evaluated in proportion to its significance in the formation of overall decorativeness by a certain number of points, which are eventually summed up. The scale is stobal, ranked into 10 classes (groups) and indices of the productivity of garden and park plantings (Table 2). The sum of points 91-100 corresponds to the reference green device (the highest possible), 81-90-a MEMORY with very high aesthetics, 71-80-high, 61-70-increased, 51-60-medium, 41-50-reduced, 31-40 – low, 21-30 - very low, 11-20 - extremely low. If the total score is 0-10, the memory has no aesthetic value.The decorative significance of the signs is determined by the results of a detailed survey of plantings, during which functional zones, types of compositions, age and height of woody plants, tiering, species composition, areas of woody vegetation, flower beds, rose gardens and ha-zones, the number of memorable (cultural) objects are identified. At the same time, a number of indicators that are of a formalized nature are recommended to be evaluated subjectively by several (4-5 or more) specialists in garden and park construction and landscape architecture. These are indicators of the fit into the surrounding landscape, the picturesque relief, the dynamism of perception, the decorative nature of flower beds and lawns.

Table 2. Classes, scores and indices of aesthetics of green devices

Class	Total score	The index of aesthetics
I	0-10	having no aesthetic value
II	11-20	extremely low
III	21-30	very low
IV	31-40	low
V	41-50	low
VI	51-60	medium
VII	61-70	elevated
VIII	71-80	high
IX	81-90	very high
X	91-100	maximum high (reference)

source: compiled by the authors

It should be noted that the compositional unity and the idea should correspond to the purpose of landscaping objects and the type of green devices (parks, squares, boulevards, residential areas, streets, preschool institutions, etc.)[3-5]. For large-area storage facilities, a composition center, arrays of tree plantations, recreation areas for children and adults are usually allocated. In the squares, the emphasis is on recreation areas and dense woodlands. For streets, much attention is paid to linear landings. The placement of plant compositions and functional zones should carry an explicit or hidden semantic load on all objects[7,11,12]. The nature of the landscape perspective represents the peculiarities of changes in elements and plant groupings when they are removed from the observer. The near perspective is usually present in all green devices and is created due to massive tree plantings; the middle one is represented as linear plantings that converge as they move away, and the far one is formed by structures, groups or single trees (tapeworms). Dynamic perception is expressed in the contrast of illumination, the speed of changing shapes, contours, compositions, etc[5,13]. The overall well-grooming of plants and their compositions is estimated on average by the level of their maintenance, as well as maintaining their compositions in a formed state. This is expressed in the regularity of pruning and forming tree crowns, cutting hedges and mowing lawns, loosening and weeding the soil, harvesting dead wood, etc[15,16]. In 2017, the "Complex Scale ..." was mediated in a special computer program called "PLANT-EST-KZ", the scope of which, in addition to diagnosing the aesthetics of the storage in arid conditions of Mangystau, is the input and storage in computer memory of various geographical, structural, historical and ecological-biological information about garden and park plantings; compilation of various lists; balance of territories, printing information and exporting it to various formats for use in external graphic and text editors[1,9,12]. There are several ways to quickly search for plants, which are available when you select the "Search" item in the Main menu: "Identifier"; "Name of green devices", "Type and name of green devices", "Locality", "Type of green device", "Any word". A specially created form in the program allows you to export materials in 6 formats: txt, doc, docx, rtf, pdf and xml. In addition, information can be filtered by localities and types of green devices[8-10]. The selection of the necessary green devices can be performed in the program in two ways: by evaluation

criteria and by esthetics indicators. In the first one, up to 8 parameters of the state of interest, growth and decorative indicators, as well as the grooming of green spaces can be launched simultaneously. The second is the use of a general esthetic assessment of each group of diagnostic features as a whole[6,16,17]. There is a separate form for working with the taxonomic composition of plants, which allows to enter, edit and view information on their condition, decorative qualities and biometric growth indicators for each green device Formation of cartographic material for landscaping is possible in "PLANT-EST-KZ" in two versions: 1) as a graphic file (jpeg, bmp, tiff, etc.) contained in the database, or 2) creation in automatic mode using a special form of Internet maps with the determination of location by decimal degrees. The Internet version of the computer program (https://dincer.kz/PLANT-EST-KZ/index.html) was completed this year, which is freely available and has expanded functionality, including automatic creation of tags and building perimeters of green devices, search and output of the most complete text and graphic information[3,17]. The program is registered in the Ministry of Justice of the Republic of Kazakhstan - Certificate of state registration of rights to the object of copyright No. 1691 dated 11.07.2017 – IS 009271 [1]. A detailed survey of 94 green devices of residential and industrial zones of 5 settlements of Mangistau region of 13 species over the past four years, including 58 residential microdistricts, 9 urban and Central squares, 6 landscaping along streets, avenues and roads, 3 green spaces near office buildings, slopes to the sea in the coastal zone of the Caspian sea and on the Central squares of the city of Aktau, 2 parks of culture and recreation of urban and regional significance, green spaces at industrial enterprises, medical and preventive institutions and shopping and entertainment establishments, and one children's and memorial Park. All materials collected during the survey of green devices were immediately processed and entered together with the graphic files in the "PLANT-EST-KZ" database with simultaneous diagnostics of their aesthetic value on the "Complex scale..". The research found significant variation in the level of decoration and landscaping of planting - 17 points (2nd class, green spaces at the office building of LLP "MunaiGazKurylys") to 88 points (9th grade, square in 7 microdistrict, Aktau). "Very low "and" low " esthetics (grades 3-4) are mainly characterized by green devices under construction or recently built micro-districts of Aktau - № 19, 20, 21, 23, 31A, 31B, 32A, 32B, and 37 (Table 2).

4. CONCLUSION

Based on the results of the study, it is necessary to activate the implementation of the assortment of wood lianas (4.3%), varietal roses (18.4%) and flower and ornamental plants (14.9%) in the coming years. It is also necessary to resume work on the introduction testing of various varieties of lawn grass mixtures. The improvement and implementation of the "PLANT-EST-KZ" program in the practice of green construction will become the basis for an objective assessment of the decorative nature of Mangystau landscaping and the development of effective measures for the reconstruction of existing and creation of new garden and Park plantations and will serve to improve the sanitary, environmental and recreational functions of landscaping facilities.

5. AUTHORS CONTRIBUTION

A.A.I., I.F.B., G.G.G., S.S., and A.S.O. carried out the survey. S.S., and A.S.O. supervised the study. A.A.I., and I.F.B., helped organize and edit the manuscript.

6. CONFLICT OF INTEREST

Conflict of interest declared none.

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