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Ecological and Sanitary Basics of Landscaping of Classrooms and Adjacent Areas

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ABSTRACT

The scientific article discusses the principles of ecological landscaping of the classroom related to the creation and development of a safe educational environment. The functions of vertical landscaping of the classroom and the territory, as well as the plants used in it, are defined. The ways of creating the principle of "tieredness" in ecological gardening are determined. The conformity of the measurements of landscaping inside the classroom with the norms of safety of landscaping according to SanPiN KR was determined and their results were presented. In our study, we took the green component of ecological safety as the basis of the educational environment. After all, the ecological landscaping of the educational room is an important and indispensable part of creating a favorable environment for the health of students and the development of complex: aesthetic, ecological culture. Greening plays a decisive role in maintaining a microclimate favorable for health. When plants are properly placed according to safety standards in the classroom and on the territory, they provide shade, reduce dust, kill microorganisms causing infectious diseases and clean the air. Therefore, many species of native plants grown in Central Asia are used for the landscaping of educational buildings.

Keywords: Landscaping; Learning Spaces; Safe Educational Environment; Environmental Safety

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1. Introduction

Creating safe conditions for children to live healthy lives is one of the most pressing issues in ensuring the effectiveness of the educational process in all educational institutions. Many scientists: Alexandrov A.A., Alisov E.A., Gabibova N., Golitsyn A.N., Domashov I.A., Kirillenko A.V., Korotenko V.A., Tugova T.A., Shukurov E.D., Khessayon D.G., and others have conducted a number of notable studies on these issues.

Shukurov E.D. emphasised that ecological greening of school grounds is an important and indispensable part of creating a favourable environment for the health and comprehensive development of children: aesthetic and ecological culture [1]. When greening the areas around school buildings, it is necessary to choose plants that are closest to the natural environment.

Landscaping the surrounding area is important for health reasons. It is recommended to use medium-sized phytoncide-producing trees that provide dense shade: field maple, Japanese pagoda tree, Virginia juniper, thuja, linden, as well as beautifully flowering non-prickly and non-poisonous shrubs [2].

Prominent scientists Alisov E.A. [3], Shukurov E.Dj. [4], Kirilenko A.V. [5] have established that planting plants in a multi-tiered manner allows:

- attract many beneficial organisms (insects, birds), feed on pests and regulate their numbers;
- contribute to an increase in the area of combined leaves per unit area. This, in turn, increases air ionisation, the intensity of its purification from pollutants and reduces the content of carbon dioxide, which provides natural immunity against infectious diseases, increases gas absorption, filling the air with oxygen and phytoncides – beneficial substances;
- reduces the negative impact of natural extreme factors on both plants and students of the greened school. Multi-layered greening helps to mitigate negative factors such as strong winds, high and low temperatures, dust storms, etc.;
- increases the visual appeal of the school grounds.

In our study, we took ecological greening as the basis for a safe educational environment. After all, ecological greening of educational premises is an important and indispensable part of creating a favourable environment for the health of students and schoolchildren and the development of aesthetic and ecological culture.

When examining educational institutions for the ecological improvement of educational premises, a number of shortcomings in greening were identified in practice:

- random landscaping and lack of vertical landscaping;
- lack of attention to the composition of plants used in ecological greening, which differ from each other in terms of ecological and biological properties and quality of finish, and their incorrect use.
- such problems have led to the need to develop environmentally safe methods of greening educational premises.

The above-mentioned problems and needs determine the relevance of the research.

Research objective: to study the compliance of the level of greening of educational premises and adjacent areas with safety standards.

Research tasks:

- to reveal the essence of ecological improvement of educational premises, analyse its principles;
- to determine the functions of vertical greening and the plants used in it;
- to establish and comply with the principle of 'multi-tiered' greening around educational institutions;
- to determine the compliance of greening measurements inside educational premises with SanPiN safety standards and to present the results.

When plants are correctly placed in accordance with safety standards in classrooms and on school grounds, they provide shade, reduce dust, kill microorganisms that cause infectious diseases, and purify the air. Therefore, many species of local plants grown in Central Asia are used for landscaping school buildings.

In ecological greening, we need to create a sustainable biosystem around the school building, including various types of trees, shrubs and grasses. The creation of such a biosystem is achieved through a combination of vertical, horizontal and multi-level greening. To do this, it is necessary to rely on the principles of ecological greening of educational buildings (**Figure 1**), according to Professor Shukurov E.D. [4].

A normal biosystem can be created by combining vertical greening with horizontal multi-level greening.

The advantage of vertical greening in educational institutions is that it does not require much space and, like forest plants, helps regulate the microclimate of the environment. For example, vertical greening performs several important functions (**Figure 2**).

Another key feature of plants used in vertical landscaping is that they regulate atmospheric humidity.

The composition of plants used in all vertical landscaping projects differs significantly in terms of ecological and biological properties and decorative qualities (**Figure 3**). Ignoring these characteristics, for example, by planting plants chaotically or using them incorrectly, leads to a decrease in the aesthetic quality of the landscaped area (**Figure 4**).

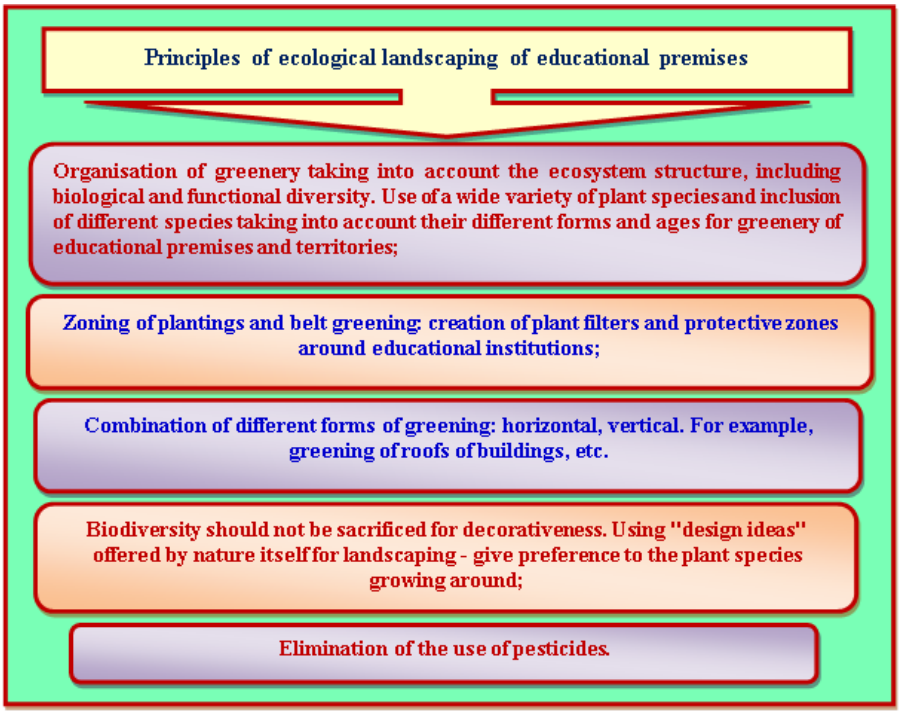

Figure 1. Ecological principles of landscaping.

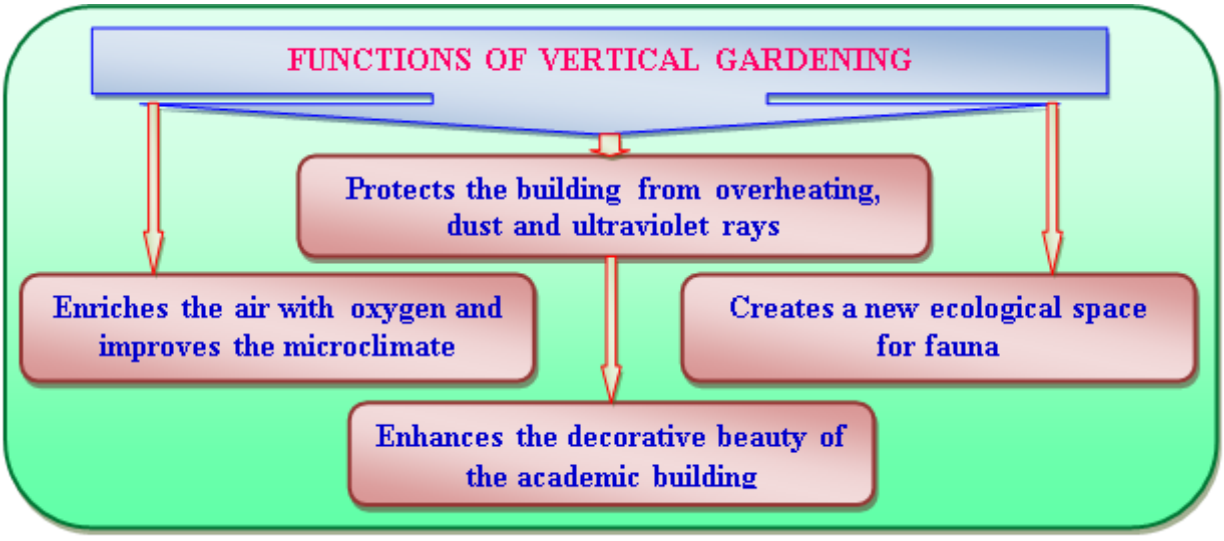

Figure 2. Functions of vertical gardening.

Figure 3. Vertical landscaping of classrooms.

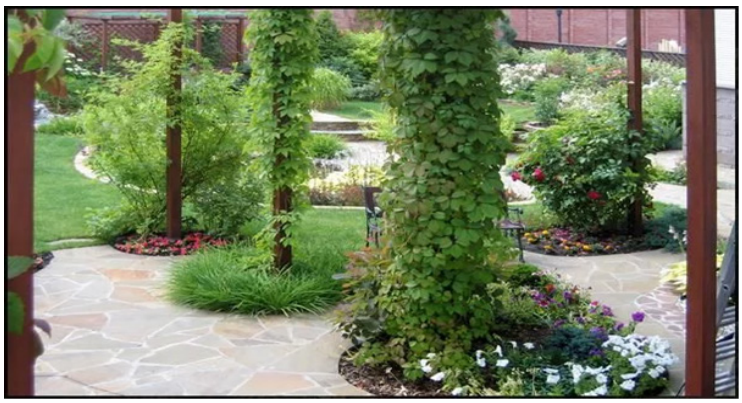

Figure 4. Landscaping of adjacent territories.

The main plants used in vertical gardening in adjacent areas are: hanging ivy, hanging roses, vines, honeysuckle, pruned trees and shrubs, and hops (**Figure 5**).

The composition of plants used in all vertical landscaping projects differs in terms of ecological and biological properties and decorative qualities (**Figure 6**).

Figure 5. Species of hanging ivy, rose, vines.

Figure 6. Honeysuckle, hops and pruned trees and shrubs.

It is important to create biodiversity. To do this, it is necessary to adhere to the principle of multi-tieredness. This includes:

- 1-grass layer;
- 2-shrub layer;
- 3-tree layer.

This 'multi-layered' structure is illustrated in **Figure 7** below.

Figure 7. Multi-tiered.

Planting should be carried out according to the principle of ascending hierarchy, whereby many types of grasses should be planted first, followed by shrubs, then low-growing trees, and finally tall trees. Such a planting arrangement should include a wide variety of plants, as well as representatives of the main functional groups of the ecosystem: decomposers, i.e. waste destroyers (bacteria, fungi); organisms that produce organic matter, i.e. producers (plants); and its users, or consumers (insects, amphibians, reptiles, birds). The more complete and diverse the composition of functional groups, the more stable the biotic community will be and the more effective it will be in creating a comfortable environment for life [1].

Landscaping on adjacent areas should cover 50% of the perimeter of the educational building. Trees should be planted no more than 15 metres from the educational building, and shrubs no more than 5 m away. It is prohibited to plant shrubs and trees with poisonous fruits. Plants should not block sunlight in classrooms. It is better to choose unpretentious and safe plants that do not cause allergies and do not have thorns [6,7].

Also, Korotenko V. A. [8,9], Domashov I. A. [10], and Kessayon D. G. [11] in their book 'Landscaping with Local and Endemic Plant Species' provided several simple rules and useful tips for caring for indoor plants. For example,

1. Consider the environment in which the indoor plant will grow and place each flower correctly.
2. Plants also need a period of rest (some do not require watering or touching in winter).
3. If necessary, use additional lighting for indoor plants.
4. Review useful tips on growing indoor plants and their use.

Following the above rules, we must take into account the requirements of indoor plants for light, heat, humidity and drought. For example, light-loving plants are placed on windowsills, drought-resistant plants on radiators, and plants adapted to humidity on both sides of aquariums.

When renovating the interior of an educational building, you can improve the ecological condition of classrooms by choosing the right indoor plants.

There is a great opportunity to purify the air in the room with the help of indoor plants. Volatile substances and phytoncides of plants have bactericidal, bacteriostatic and fungicidal effects due to their biological activity and microscopic size (6–10 mg/cm^3). All indoor plants are beneficial. For example, aloe, geranium, sansevieria, fern, begonia, pelargonium [12–14] (**Figure 8**).

Figure 8. Sansevieria, geranium, fern, begonia, pelargonium, aloe.

Sansevieria is beneficial for classrooms, it absorbs foreign odors, cleans the air. It contains many organic substances, releases oxygen, absorbs dangerous radiation, as an immunomodulator, contributing to the overall health of the body.

Geranium is one of the most popular indoor plants. The fragrant leaves have anti-inflammatory and antimicrobial properties. Geranium improves the microclimate in the room, increases humidity, releases a large amount of oxygen, destroys mold spores, copes with pathogenic bacteria.

Fern strengthens immunity, cardiovascular, endocrine and nervous systems. Its root, containing many vitamins and minerals, is useful as a biologically active supplement during the treatment of diseases such as diabetes, cholecystitis.

Begonia purifies the air from bacteria, as well as from dust and toxins. Therefore, it is recommended to place vases with the plant indoors. The juice of the plant has an anti-allergic, antiseptic and analgesic effect. It improves blood circulation and reduces blood pressure.

Pelargonium is used externally and internally. It has antimicrobial, anti-inflammatory properties, is a powerful antidepressant, having a positive effect on the physical state and mental productivity. It is worth paying attention to the benefits of tea with geranium. The drink removes anxiety, improves mood, stimulates brain function without harming the body.

Aloe is a highly effective air purifier. It has bactericidal properties and is active against bacteria such as streptococcus, staphylococcus, diphtheria and dysentery bacilli. It is effective in irradiation, inflammatory diseases, fresh wounds, accelerating the regeneration process [15–17].

Thus, we can green the interior of the classroom with the above-mentioned indoor plants in accordance with the norms of "Sanitary and Epidemiological Requirements to the conditions and organization of education in general educational organizations" of the Kyrgyz Republic.

2. Materials and Methods

The objects of research in this work were plants located on the adjacent territory and inside the classrooms of the Institute of Natural History, Physical Education, Tourism and Agrarian Technologies of Osh State University, secondary school No. 77 named after H. Khamza of Kara-Suu district. Analysis, processing of results was conducted at the Department of Botany, general biological disciplines and methods of teaching biology of Osh State University.

Methods of research: measurements, comparison, analysis, processing of results, compliance of these results with sanitary-epidemiological norms.

Form: Sanitary and epidemiological requirements to the conditions and organization of training in general educational organizations (landscaping).

Tools: special measuring ruler or tape measure [18].

3. Results

According to the norms of SanPiNa KR for every 10 m^3 of room inside the building there should be 0.33 m^3 of indoor plants. Therefore, the corridor and classroom inside the building should be greeted by 30% [7].

In our study, the following components were taken for study: greening of the classroom (aud. No. 216) and corridor (2nd floor).

Together with the students, measurements were made.

Greening of auditorium No. 216.

1. Area of the room in m^3 (length (L) × width (T) × height (H)):
   V (K) = L × T × H = 9 m × 3 m × 6 m = 162 m^3
2. Planting rate for the given room:
   V plants = 162 : 10 × 0.33 × 0.33 = 5.35 m^3
3. Measurement of the actual area of plants in the classroom (length (L) × width (T) × height (H)):
   V plants = L × T × H = 11 × 0.6 × 0.7 = 4.62 m^3.

Corridor landscaping (2nd floor).

1. Area of the room in m^3 (length (L) × width (T) × height (H)):
   V (K) = L × T × H = 6.2 m × 3 m × 2.9 m = 54 m^3
2. The planting rate for the given room:
   V plants = 54 : 10 × 0.33 × 0.33 = 1.78 m^3
3. Measurement of the actual area of plants in the classroom (length (L) × width (T) × height (H)):
   V plants = L × T × H = 5.8 × 0.6 × 0.5 = 1.74 m^3.

When landscaping the training room it is necessary to take into account its peculiarities: the location of furniture, windows, heaters. The variety of plants and their

qualitative composition are also taken into account.

Measurement of greenery in secondary school #77 named after H.Hamza of Kara-Suu district. Together with students measurements were made.

Greening in the corridor. The school has 2 buildings - one for junior classes, the other for senior classes. We measured the corridor of the 1st building.

1. Area of the room in m^3 (length (L) × width (T) × height (H)):
   V (K) = L × T × H = 4.8 m × 3.9 m × 2.1 m = 39.3 m^3
2. Planting rate for the given room:
   V plants = 39.3 : 10 × 0.33 × 0.33 = 1.3 m^3
3. Measurement of the actual area of plants in the classroom (length (L) × width (T) × height (H)):
   V plants = L × T × H = 4 × 0.3 × 0.6 = 0.7 m^3
   The landscaping of the junior high school classroom.
1. Area of the room in m^3 (length (L) × width (T) × height (H)):
   V (K) = L × T × H = 7 m × 5 m × 2.1 m = 73.5 m^3
2. Planting rate for the given room:
   V plants = 73.5 : 10 × 0.33 × 0.33 = 2.2 m^3
3. Measurement of the actual plant area in the room (length (L) × width (T) × height (H)):
   V plants = L × T × H = 3.6 × 0.3 × 0.6 = 0.65 m^3

4. Discussion

Measurement of greening. Measurement of landscaping in the adjacent territories showed that 50% of the school territory of school No. 77 named after H. Hamza in Kara-Suu district is landscaped, in compliance with the principle of "tieredness". The school has plants of different tiers: herbaceous plants (lawns), there are shrubs, small seedlings of fruit trees (apples, peaches), most of all planted coniferous trees, as well as one walnut tree.

1. The distance between the small fir tree and the school wall—1.4 m.
2. The distance between a small shrub and the school wall—1.6 m.
3. Distance between a large coniferous tree and the school wall—1.6 m.
4. Distance between a large walnut tree and the school wall—5.5 m.

5. Conclusions

1. The level of landscaping of the auditorium No. 216 of the Institute of Natural Sciences, Tourism and Agrarian Technologies of Osh State University does not meet the standards prescribed in the "Sanitary and Epidemiological Requirements for the conditions and organization of education in general educational organizations" of the Kyrgyz Republic, as the real area of plants is less than the norm of landscaping for this room.

2. The level of landscaping of the corridor (2nd floor) of the Institute of Natural Science, Tourism and Agrarian Technologies of Osh State University corresponds to the norms prescribed in the "Sanitary and Epidemiological Requirements to the conditions and organization of training in general educational organizations" of the Kyrgyz Republic.

3. The level of landscaping of the corridor of the school No. 77 named after H. Hamza does not meet the standards prescribed in the SanPiNs of the Kyrgyz Republic, as the real area of plants is less than the norm of landscaping for this room.

4. The level of landscaping of the junior school room of school No. 77 named after H.Hamza does not meet the norms prescribed in the SanPiNa of the Kyrgyz Republic, as the real area of plants is less than the norms of landscaping for this room.

5. The area of landscaping of the school territory (50%) of the school No. 77 named after H. Hamza corresponds to the norms given in the SanPiNa of the Kyrgyz Republic and complies with the principle of "tiering".

6. The distances between the school wall and many large trees and bushes do not comply with the norms given in the SanPiNs of the Kyrgyz Republic. Their crowns block the sunlight entering the classrooms, as well as their roots are near or under the foundation.

7. The survey of educational institutions on ecological improvement of educational buildings and classrooms revealed a number of shortcomings in landscaping:

- haphazard landscaping and lack of vertical landscaping, i.e. non-compliance of the level of landscaping with the norms given in the SanPiNs of the KR.
- Lack of attention to the composition of plants used in ecological landscaping, differing from each other in

ecological and biological properties and quality, their improper use.

Recommendations:

1. To familiarize the staff with the requirements for environmental safety in SanPiNs of the Kyrgyz Republic, it is necessary to conduct educational activities, as well as school "round tables", conferences, class hours and other activities with an explanatory bias together with students and relevant structures on the issues of ecology, hygiene and sanitation.

2. Each educational institution should have its own strategy or development program for 4–5 years to implement the minimum basic requirements and norms of SanPiNa, including landscaping.

3. Within the framework of the current SanPiN and the system of requirements for environmental safety formed by it, it is necessary to increase the level and quality of the following services: arrangement of educational institutions in accordance with SanPiN norms and increase the level of environmental safety, condition of buildings, classrooms and equipment of institutions that meet the requirements of SanPiN.

4. Elimination of deficiencies in landscaping identified during the study of the educational institutions inspected.

Author Contributions

Z.A. developed the study concept; E.B. and N.M. developed the methodology; M.U. contributed to data collection and resources; G.T. supervised the data; A.O.u. prepared the initial draft, and B.Z. reviewed and edited the manuscript. D.E. supervised the study. All authors read and approved the final manuscript.

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All data supporting the reported results are provided within the manuscript. Additional data can be made available upon reasonable request.

Conflict of Interest

All the authors declare that there is no conflict of interest in relation to the research, authorship, and publication of this study.

References

[1] Shukurov, E.J., Korotenko, V.A., Kirilenko, A.V., et al. (Eds.), 2015. Environmental safety in Kyrgyzstan: points of application of forces . V.R.S.Company LLC: Bishkek, Kyrgyzstan. 56p.

[2] Tugova, T.A. (Ed.), 2014. Greening of urban areas: Teaching and methodological manual. KRSU: Bishkek, Kyrgyzstan. 47p.

[3] Alisov, E.A., Podymova, L.S. (Eds.), 2021. History of the Development of Educational Models and Technologies. Direct-Media: Moscow, Russia; Berlin, Germany. 352p.

[4] Shukurov, E.J., Korotenko, V.A. (Eds.), 2015. Environmental safety in the context of sustainable development in Kyrgyzstan. V.R.S.Company LLC: Bishkek, Kyrgyzstan. 90p.

[5] Kirilenko, A.V., Domashev, I.A., Korotenko, V.A. (Eds.), 2013. Public participation in environmentally significant decision-making. Methodological guidelines. The BIOM environmental movement: Bishkek, Kyrgyzstan. 93p.

[6] Gabibova, N., Mukhortova, V.K. (Eds.), 2018. Design and Landscaping of Populated Areas. Don State Agrarian University: Persianovsky, Russia.

[7] Kirilenko, A.V., (Ed.), 2018. Complex of safety standards for the school educational environment. Collection of normative legal acts of the Kyrgyz Republic. PE "Sarybaev T.T.: Bishkek, Kyrgyzstan. 580 p.

[8] Korotenko, V.A., Domashev, I.A., Krivykh, A.V. (Eds.), 2013. Greening of the territory with local and endemic plant species. Printing House "Altyn Tamga": Bishkek, Kyrgyzstan. 5p.

[9] Korotenko, V.A., Domashev, I.A., Postnova, E.A. (Eds.), 2003. School of sustainable development. Mugalimder uchun koldonmo. Printing House "Salam": Bishkek, Kyrgyzstan. 38p.

[10] Domashov, I.A., Korotenko, V.A., Koshoev M. et al., 2012. Climate Change: Examples of Adaptation Practices at the Community Level. The BIOM environmental movement: Bishkek, Kyrgyzstan. 45p.

[11] Hessayon, D.G. (Ed.), 2013. All about Indoor Plants. AST, Kladez: Moscow, Russia. 255p.

[12] Golitsyn, A.N. (Ed.), 2003. Ecology of Your Home. SOLON Press: Moscow, Russia. 240p.

[13] Aleksandrov, A.A. (Ed.), 2010. Ecology in School: from Planet to Man. Bereginya: Moscow, Russia.

[14] Greening school grounds. Visual aid. Available from: http://www.safe.edu.kg/publications/greening-school/ (cited 21 March 2025). (in Russian)

[15] Greening with local and adapted plant species. Available from: http://www.safe.edu.kg/presentations/ozelenenie (cited 21 March 2025). (in Russian)

[16] Top plants for air purification according to NASA. Available from: https://safe.edu.kg/articles/tips/top-15-rastenij-nasa/ (cited 21 March 2025). (in Russian)

[17] How to properly green a school. Available from: https://safe.edu.kg/articles/tips/kak-pravilno-ozelenit-shkolu/ (cited 21 March 2025). (in Russian)

[18] Bogatova, N.A., Mendikulova, Z.K., Savochkina, V.V., et al. (Eds.), 2017. Pilot Monitoring: Safety of the Educational Environment in Schools of the Kyrgyz Republic. The BIOM environmental movement: Bishkek, Kyrgyzstan. 173p.