

Conference Paper

Open Ground Collections of Saint Petersburg Botanic Garden for the Benefit of Botanic and Environmental Education

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Abstract

Botanic gardens with their rich collections and scientific resources have a unique potential that attracts the attention of the society to the problems of preserving biodiversity, ensuring environmental education, conserving nature, providing leisure, serving the place for relaxation and entertainment. One of the oldest Botanic gardens of Russia is the Saint Petersburg Botanic Garden of the Komarov Botanic Institute of the Russian Academy of Sciences demonstrates the experience of utilizing the open ground collections for Botanic and environmental education. The experts share various aspects of interaction between a Botanic garden and its visitors. The paper provides examples of excursions and other forms of work on the open ground. The paper analyzes the experience of foreign colleagues related to the motivation for visiting Botanic gardens by different age and social groups. The authors provide data of sociological surveys of visitors and the analysis of their motives to visit the Saint Petersburg Botanic Garden in particular. It also shows the growth of interest in the open ground collections.

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1. Introduction

Botanic gardens with their rich collections and scientific resources have a unique potential that attracts the attention of the society to the problems of preserving biodiversity, ensuring environmental education, conserving nature, providing leisure, serving the place for relaxation and entertainment.

However, Russia still lacks key stereotypes on such gardens and knowledge of the population on the potential of collections. Moreover, the motivation for visiting Botanic gardens is poorly studied and is not sufficiently reflected in domestic publications. Thus, the experience of Saint Petersburg Botanic Garden of the Komarov Botanic Institute of the Russian Academy of Sciences related to the utilization of the open

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ground collections for Botanic and environmental education, as well as the survey on the matter "what do the visitors of Botanic gardens associate them with" seem quite relevant.

2. Methods and Materials

We often hear that botanic gardens "are a magic place -- here you can relax your body and soul". However, this phrase does not reveal all characteristics of a special environment of a botanic garden. Complex and recognized definition of botanic gardens is given in the International Agenda for Botanic Gardens in Conservation [10]: "Botanic gardens are institutions holding documented collections of living plants for the purposes of scientific research, conservation, display and education". In fact, the scientific principles forming the basis for the collections of plants distinguish the environment of a botanic garden from a standard garden on a suburban site. The collections added with various forms of information, resources of the garden, a person with his motives and intentions give a balanced mutually advantageous system (Figure 1) with its laws of functioning and development.

Despite the fact that due to climatic features Saint Petersburg Botanic Garden traditionally attracts people with its glasshouse collections, the open ground represents the same unique material for the development of esthetic needs and cognitive interests in the field of conservation.

Unique open ground collections of the Saint Petersburg Botanic Garden allow describing brightly and visually the biomorphological and systematic floral diversity [4]. Traditionally, the botanic knowledge of people is based on the study of vegetation of the Tropical and Subtropical climatic zones surrounding a person in life, offices, public places, healthcare institutions. Therefore, one of the tasks of the study is to get an insight into rare exotic plants and widely used plants of the open ground (woody, herbaceous, bulbiferous or yearling plants) (Table 1).

Various relations and links (from the history of evolution, use and cultivation of plants) between the studied plant species of the open ground collection allow achieving a qualitatively new level of botanical knowledge. This feature is typical for permanent and open ground expositions where the plants are considered beyond any particular scientific discipline (Table 2).

The new programs on the open ground pay special attention to interactive activities, such as excursion with quest elements for groups of students or a game quest for

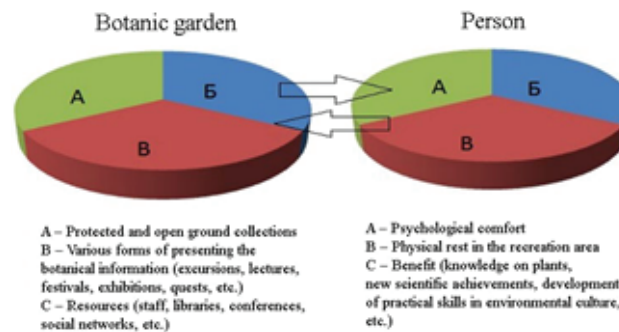


Figure 1: "Botanic garden -- person" interaction system.

TABLE 1: Open ground collections of Saint Petersburg Botanic Garden as of 2018.

Tree nursery	over 1000 taxons
Open ground herbaceous perennial plants	over 1000 taxons
Collection of rock garden plants	over 900 taxons
Collection of continuously flowering plants	over 1100 taxons
Collection of bulbiferous and other monocotyledon plants	over 600 taxons
Collection of rose nursery	over 300 taxons
Collection of food, forage and medical plants	over 650 taxons
Collection of Far East and East Asia flora (Japanese Garden)	over 200 taxons

individual visitors during festivals [1]. Table III shows the review of quests and excursions with quest elements conducted over 2015--2019.

As an example let us give *The Birch Route* excursion for 8--11-year-old children based on a wide popularity of birch trees (*Betula pendula* Roth) since this species are mentioned multiple times in various school disciplines (Environmental Studies, Botany, History, Literature). The associative bonds from various fields of knowledge allow telling about other 36 taxons in the collection of *Betula L.* during a fascinating walk on the open ground (Figure 2). During the tour the students get an opportunity to compare the following:

A) Ecology of different species. For example, it is mentioned that a Siberian Yellow Birch (*Betula costata* Trautv.) has shade tolerance not typical for this type of species.

B) Life forms, as well as internal and external factors defining plant habitat. For example, the Kuzmishchev Birch (*Betula. x kusmisscheffii* (Regel) Sukacz.) has gnarly flexuose trunks in its homeland in the north of Europe and Western Siberia, while in the conditions of plant introduction it changed its life form.

C) Phenological rhythms of local species of birches and introduced species. For example, having changed its life form the Kuzmishchev Birch (*Betula. x kusmisscheffii*

(Regel) Sukacz.) fully maintained phenological rhythms and is characterized by very short period of vegetation.

D) Key features typical for different types. For example, the Cherry Birch (*Betula lenta* L.) has dark and blackish bark, its leaves have 9--12 pairs of veins unlike white-trunked North American *Betula papyrifera* Marshall, which leaf has 6--8 pairs of veins, etc.

TABLE 2: Subjects for the study of open ground plants.

Discipline	Topics of open ground excursions
History	1. History of the oldest botanic garden in Russia 2. Botanic gardens during the Great Patriotic War
Geography	1. Continents and parts of the world 2. Economic geography 3. Geographical discoveries
Biology	1. Life forms 2. Living habitat 3. Ethnobotany 4. Methods of nature study 5. Convergent evolution 6. Biocenoses
Ecology	Ecological factors and their influence on living organisms Ecological groups of plants (e.g. ephemeroids, epiphytes) Natural ecosystems
Medicine	1. Herbs 2. Poisonous plants
Sciences at the intersection of art, design, architecture, philosophy	Landscaping Gardening Japanese gardens Development of architectural complexes

TABLE 3: Review of excursions and quests on the open ground in Saint Petersburg Botanic Garden.

	Winter	Spring	Summer	Autumn
Students of elementary and secondary schools	Coniferous and deciduous plants of the tree nursery park			
		Secrets of Spring Kingdom		
			Birch Route	
			Maple Route	
		Kingdom of Plants		
Individual visitors		<i>The Day of Snowdrop</i> quest	<i>Round the Peony</i> quest	<i>Round the Maple</i> quest
			Immigrants of the New World	

During the excursion the students learn different features of the Iron Birch (*Betula schmidtii* Regel). The following is considered: 1) habitat (in the Russian Federation – Primorsky Krai, outside the Russian Federation – Northeast China, northern part of Korea and Japan, Honshu island); 2) exclusive wood strength; 3) status (VU) of vulnerable species in the Red Book of the Russian Federation.



Figure 2: The Birch Route for students in Saint Petersburg Botanic Garden.

The *Maple Route* tells about several maple species (*Acer* L.), including: *Acer platanoides* L., *Acer tataricum* L., *Acer henryi* Pax, *Acer tegmentosum* (Maxim.) Maxim., *Acer rubrum* L., *Acer barbinerve* Maxim., *Acer ginnala* (Maxim.) Maxim., *Acer saccharum* Marshall, *Acer saccharinum* L., *Acer cissifolium* (Siebold & Zucc.) K.Koch, *Acer triflorum* (Kom.) Kom., etc.

Educational quests for adults and children are held within various festivals and holidays. For example, a quest devoted to the *Day of Snowdrop* makes the visitors in a fascinating playful manner aware of seasonal changes and primrose plants, for example *Galanthus woronowii* Losinsk.; 1935; *Muscari* Mill., 1754; *Crocus vernus* (L.) Hill, etc.

The *Immigrants of the New World* includes questions about all species typical for urban gardening, such as *Picea pungens* ENGELM., *Symphoricarpos occidentalis* Hook. and unpopular exotic species, such as *Pseudotsuga menziesii* (MIRB.) FRANCO (1950), *Fraxinus pennsylvanica* MARSH., *Thuja plicata* DONN EX D.DON having the North American origin.

The visitors of thematic holidays (Maple Holiday, Festival of Peonies, Festival of Phloxes, Day of Snowdrop) on the example of live plants of the open ground can evaluate and draw conclusions on the stability of plants of the Far East and the East Asian

region in the conditions of the Northwest of Russia and define the most perspective types for cultivation in their gardens.

The exhibitions thematically united by one subject, for example plants of Peony species (*Paeonia* L.) and Phlox (*Phlox* L.), attract the fans of certain plant species. In the park the visitors satisfy their botanical interest through their acquaintance with the open ground species and specially organized exposition of plants – with plants presented by the clubs of certain flower cultures. Besides, due to special technologies the experts of the garden can show plants not only belonging to different groups of species, but also to different terms of blossoming, for example peonies.

The popularity of the open ground collections is steadily growing. For example, the number of visitors to the collection of primroses during the Day of Snowdrop grew up almost twice in comparison with 2017. However, in 2018 the total number of visitors to the open ground was 109,120 people (Table 4). It is slightly less than the same number in the previous year due to decrease in the second half of June-beginning of July caused by the 2018 FIFA World Cup in St. Petersburg and the potential outflow to the sites of the championship.

TABLE 4: Number of visitors to the open ground collections in 2017-2018.

Number of visitors, people	2017	2018
Number of visitors to specialized excursions and quests within a group, ppl	120	360
Number of visitors to the open ground collections, ppl	110,454	109,120
Number of visitors to the open ground collection during the Day of Snowdrop (April), ppl	1,366	2,510
Number of participants of the family quest devoted to the Maple Holiday, ppl	31	95

The Global Strategy for Plant Conservation 2011–2020 of the Botanic Gardens Conservation International (BGCI) states education and conservation of biodiversity as the objectives of botanic gardens.

Located in urbanized environment, the gardens may attract a large number of visitors (for example, over 300,000 people per year visit the botanic gardens in Berlin). Thus, following the topic *The World in a Garden* [7], the Berlin Botanic Garden contains plants located according to phytogeographical and systematic aspects. The Berlin example also shows that a scientifically developed Botanic Garden may at the same time be quite decorative [2].

Foreign scientists made various attempts to study the motivation of visitors for botanic gardens from different perspectives. It is interesting that needs of the society to visit botanic gardens are not unambiguous.

The study of the motivation of people for visiting botanic gardens confirms that "the visitors of gardens are less concerned with conservation and are interested in them, and are less motivated for education than visitors of other educational institutions of the free choice, such as museums, zoos, aquariums, objects of cultural heritage, natural zones and tourism events in the wild nature" [8].

The 2011 survey of visitors of the Botanical gardens in California showed that a botanic garden and plants were the most significant attributes of a garden for them inducing the participants to be influenced by the consequences of new experience and education. All respondents marked that the Botanic garden relieves stress and ensures relaxation, as well as improves the quality of life. Some students noted that their visits increase joy and pleasure from life. The analysis did not reveal considerable differences between men and women. Those participants that work or attend school in the campus also consider a garden an important place, which helps to escape from stress and reach relaxation. Analyzing the results of the survey, Christopher L. Wassenberg, Marni A. Goldenberg, Katherine E. Soule note that the administration of Botanic gardens shall pay more attention not only to the maintenance of healthy, interesting and diverse collection of plants, but also give visitors more opportunities for self-education and acquisition of new experience [5].

At present, China is characterized by the tendency towards the creation of education centers for visitors in Botanic gardens. The study conducted in five Botanic gardens having such education centers across all continental China proved their efficiency. The visitors of VECs (visitor education centers) in Botanic gardens say they gain more knowledge than those who do not attend them. In the majority of Botanic gardens more senior visitors with lower level of education and living outside the local province, as well as those who visited a garden more than once had the best educational experience in comparison with those who did not visit a garden at all. Besides, in two out of five gardens the visitors of education centers noted the considerable level of satisfaction compared to those that did not attend them. The results of the survey emphasize the importance of improving educational institutions through, for instance, such VECs for Botanic gardens to play a more crucial role in the conservation of biodiversity [6].

The recreational influence of plants has been practiced successfully in Europe, America, and Asia for quite a long time. It is known that in modern conditions a person is under continuous technogenic stress lacking contacts with nature, which inevitably leads to stress, accumulation of psychoemotional pressure thus resulting in aggression, depressions, psychosomatic disorders. To relief psychoemotional pressure

people traditionally use natural mechanisms of restoration ensuring the integrated effect on all sense organs [3].

However, we failed to find any research related to the study of the motivation for visiting botanic gardens in domestic literature. Our early studies in this field were for the first time published in 2016 [2]. This is the sociological survey in VKontakte group of Saint Petersburg Botanic Garden of Komarov Botanic Institute of the Russian Academy of Sciences (https://vk.com/botsad_spb). We offered the participants of the group to answer the following question -- "What is the visit to the Botanic Garden for you?" and to vote for the sequence of concepts concerning the degree of their importance for everyone: "development", "rest", "entertainment" (the term "rest" was replaced with the term "relaxation" as having the same meaning – lat. *relaxatio* – weakening, relaxation). The results of the survey showed that the majority of respondents above 18 years old considers a visit to the Botanic garden as a way of "relaxation" -- removal of nervous and emotional pressure -- 39.8 % out of 284 people, while younger respondents under 18 put "development" first -- 25 % out of 405 people. Young people were more active voters. In 2016 we made a conclusion on the perception of information by children and young people, their eagerness for development. Besides, we highlighted the fact of interrelation of real and virtual environments since all participants of remote voting were regular visitors of the Botanic garden.

In 2018--2019 we conducted social surveys among the visitors of Saint Petersburg Botanic Garden and defined their attitude to its open ground collections.

The survey itself was conducted on 1--2 November 2018 among 77 parents who came to Saint Petersburg Botanic Garden with their children for an excursion. The survey showed that the majority of respondents -- 40 % -- consider a Botanic garden "a place for education and relaxation", 21 % -- only "as a place for education", none of respondents consider a garden "as a place for entertainment", nevertheless 21 % of respondents voted for all three options ("a place for education", "a place for relaxation" and "a place for entertainment") (Table 5).

In 2019 we expanded the range of objectives and motives by adding "conservation" to the purpose of the visit. We based the study on the content of open ground excursions mainly devoted to the conservation of biodiversity of plants, as well as the probable environmental motives of our visitors.

On 7 March 2019 we asked the participants of the VKontakte group of Saint Petersburg Botanic Garden to share their associations with the Botanic garden. Out of 1,165 people the majority -- 79.48 % answered "with beauty", on the second place was "with research" -- 13.48 %; "with benefit" and "with conservation" -- 3.52 % each (Fig. 3).

TABLE 5: Results of the survey of adult audience "How do you perceive Saint Petersburg Botanic Garden?".

Age	As a place for education (A)	%	As a place for rest (B)	%	As a place for entertainment (C)	%	A+B	%	A+C	%	B+C	%	All options	%	Total	%
under 30	--		--		--		1	1	--		--		--		1	1
30--34	3	4	--		--		8	10	2	2	--		2	3	15	20
35--45	9	12	--		--		15	20	12	16	--		4	5	40	52
above 45	4	5	--		--		7	9	--		--		0	13	21	27
Total	16	1	--		--		1	40	4	18	--		6	1	7	00

What do you associate Saint Petersburg Botanic Garden with?
 Botanic Garden of Komarov Botanic Institute
 of the Russian Academy of Sciences

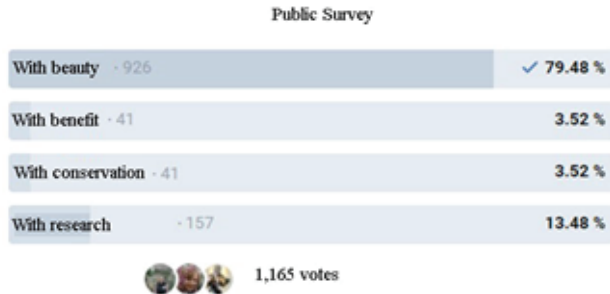


Figure 3: Screenshot of VKontakte group with survey results "What do you associate Botanic gardens with?".

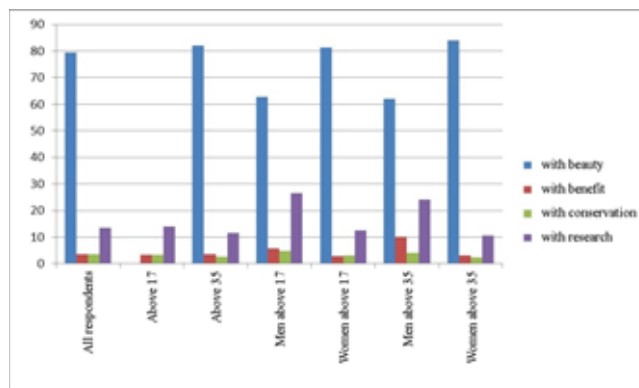


Figure 4: Results of the survey of visitors in VKontakte group in March, 2019.

3. Results

The survey showed that the majority of respondents -- 40 % -- consider a Botanic garden "a place for education and relaxation", 21 % -- only "as a place for education", none of respondents consider a garden "as a place for entertainment", nevertheless 21 % of respondents voted for all three options ("a place for education", "a place for relaxation" and "a place for entertainment").

The associations with the Botanic garden were distributed as follows. Among people above 35 years old 82.14 % of respondents answered "with beauty" and 11.64 % -- "with research". The study among people above 17 years old showed slightly more votes for "with research" -- 13.95 % and 79.43 % -- "with beauty". It is interesting that 24 % of men above 35 years old and 26.47 % of men above 17 years old associate a garden "with research". 10 % of men above 35 years and only 3.12 % of women get "benefit" from visiting a garden (i.e. they gain knowledge) (Fig. 3-4).

4. Conclusion

1. The direct survey in Saint Petersburg Botanic Garden conducted in November, 2018 showed that the majority of respondents (40 %) consider a garden as "a place for education and relaxation".

2. The mediated sociological survey of the VKontakte group demonstrates that the majority of respondents (79.48 %) associates the garden "with beauty", 13.48 % – "with research" and only 3.52 % – "with conservation" and "with research" respectively.

3. The analysis of attendance revealed that the interest in the open ground collections is growing. In April, 2018, on the Day of Snowdrop, twice more visitors than in 2017 got acquainted with the collection. Besides, the family quests as an opportunity to spend time with the family are becoming more popular. In 2018 three times more visitors than in 2017 participated in a quest on the Maple Holiday.

4. There is a need to develop and enrich the "botanic garden -- person" interaction system in order to expand the knowledge on biodiversity of plants thus embodying the ideas of the Global Strategy for Plant Conservation.

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