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STUDY OF THE PHENOMENON OF PLANT BLINDNESS USING AN ONLINE SURVEY OF RESIDENTS IN ST. PETERSBURG

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Abstract. The phenomenon of "plant blindness", the inability of people to perceive and appreciate plants in the environment, remains a serious problem for biosphere education and biodiversity conservation. As part of the study, an online survey was conducted among 253 respondents in St. Petersburg to determine the level of knowledge and attitudes towards plants. Overall, we found that people do notice plants less than animals, and also notice and distinguish brighter plants, which is in line with the results of international studies. For all respondents, the aesthetic and ecological significance of the plant world is important, but interest in it does not increase the likelihood of interest in and the ability to distinguish plants, thus there is a gap between awareness of environmental issues and willingness to act. Key findings showed that a significant proportion of respondents only visit city parks, avoiding protected natural areas, which limits contact with rare and endemic plants, which, in turn, reduces the likelihood of distinguishing plants in the wild. Awareness of rare plants remains low overall. Plant blindness may depend on the educational profile, interest in nature (thus, professions closer to interaction with nature demonstrated greater awareness of plant problems and attention to them). Respondents wanted to know more about plants from all possible sources. The study emphasizes the need to strengthen the role of botanical gardens in educational programs, as well as the importance of early interaction with nature in the formation of environmental awareness. The authors propose a comprehensive approach, including popularization of knowledge through the media, structured educational programs and active involvement of the public in the conservation of biodiversity.

Keywords: environmental knowledge, cognitive errors, environmental sociology, sustainable development

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Научная статья

ИЗУЧЕНИЕ ФЕНОМЕНА СЛЕПОТЫ К РАСТЕНИЯМ НА ПРИМЕРЕ ОН-ЛАЙН-ОПРОСА ЖИТЕЛЕЙ В САНКТ-ПЕТЕРБУРГЕ

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Аннотация. В рамках исследования был проведен он-лайн опрос 253 респондентов в Санкт-Петербурге, чтобы выявить уровень знаний и отношение к растениям. В целом мы зафиксировали, что люди действительно замечают растения меньше чем животных, а также отмечают и различают более яркие растения, что соответствует результатам международных исследований. Ключевые результаты показали, что значительная часть респондентов посещает только городские парки, избегая охраняемых природных территорий, что ограничивает контакт с редкими и эндемичными растениями и снижает вероятность различать растения в природе. Авторы предлагают комплексный подход, включающий популяризацию знаний через медиа, структурированные программы просвещения и активное вовлечение общественности в сохранение биоразнообразия.

Ключевые слова: экологические знания, когнитивные ошибки, экологическая социология, устойчивое развитие

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Introduction

About 20% of plant species in the world are currently under the threat of extinction [1]. Inadequate attention to plants is described as the phenomenon of “plant blindness” [2]. In the last twenty years, there has been a growing interest among researchers in the phenomenon of plant blindness–the cognitive bias that leads individuals to overlook or undervalue plant life in comparison to animals [3]. This increased attention can be attributed to several factors (the alarming rate of plant species extinction will also determine the level of food production, climate regulation, and water purification [4]) and has heightened awareness about the need to conserve plant biodiversity through an interdisciplinary view. The growing body of literature on the topic highlights the need to address these cognitive biases to improve ecological education [5], push for effective communication strategies that engage the public in discussions around biodiversity and enhance educational approaches, helping educators to cultivate a more inclusive perception of the natural world. Recognizing the critical role that plants play in ecosystem services

and human well-being is necessary for sustainable policy-making. Addressing plant blindness can influence how societies allocate resources for conservation and education, ultimately promoting more sustainable interactions with natural ecosystems. In this article, we will study the cognitive bias forming in Russian case on the basis of an online survey in St. Petersburg. In Russian practice, such studies have not yet been published. The novelty of the study also lies in the fact that in open questions we tried to trace the logic of plant blindness emergence.

Theory

Cognitive sciences investigating plant blindness offer insights into the cognitive processes governing human perception and attention. By examining how and why people tend to overlook plants, researchers can better understand cognitive biases that influence decision-making and human behaviors. This understanding can lead to the development of interventions aimed at reshaping perceptions, thereby fostering more inclusive and accurate views of biodiversity. When processing the immense amount of visual information in the surrounding world, the brain tends to generalize only a portion of it. If objects do not sufficiently stand out from their background, they blend into their surroundings [6]. The effect of selective perception during nature observation leads people to identify the “background” and generalize frequently occurring and typical objects (such as vegetation), while items that stand out are more likely to be recognized. As a result, non-flowering plants or plants with inconspicuous flowers are less likely to be perceived as worthy of attention [7]. Due to cognitive traits and innate cognitive programs, people tend to first react to faces, which is why animals and humans take priority in attention [8]. Heuristic (generalization) makes information processing and decision-making rapid and efficient, but sacrifices information quality.

– A group of cognitive errors related to the inability to assess data (fundamental attribution error, selective perception), as well as the lack of environmental knowledge, leads to the fact that people usually know less about plants than animals, and also to the inability to assess the necessity of plants within the biosphere and human life, insensitivity to the aesthetics of plants, incorrect belief that plants are inferior to animals in the hierarchy, and underestimation of the importance of plants in everyday life. Time devoted to environmental education, systematic and critical thinking, "cognitive restructuring", and reframing to correct cognitive distortions, in most cases, allowed these cognitive errors to be addressed [9].

– The absence or inadequacy of practical experience in interacting with nature serves as not only a barrier to acquiring knowledge but also a lack of practical experience in dealing with plants [10]. If a person lacks practical experience in cultivation, observation, and identification of plants in their geographic region, they ignore both potential usefulness and underestimate the risk of certain plants that may harm them [11, 12]. Here we can observe the consequence of the previous group of cognitive errors. A low level of ecological knowledge prevents individuals from objectively assessing the ecological impact of their actions and their consequences, as they are unable to compare situations and conduct calculations [13, 14].

The cognitive sciences of plant perception are closely interconnected with the theme of investigation of well-being in cities in terms of landscaping and greenery. Residents of many cities with low levels of greenery are more susceptible to stress, exhibit lower activity levels, and face greater risks to their physical health. Conversely, a high level of greenery and frequent interaction with nature contribute to physical and mental well-being [15]. The effect of interacting with nature in shaping pro-environmental behaviour at different stages of life varied; early experiences increased the likelihood of understanding the importance of plants in ecosystem preservation, as well as pro-environmental behaviour [16]. Also, all over the world botanical gardens play a fundamental role of linking public's direct experience to the perception of the importance of natural systems [17]. Botanical gardens realize outreach activities, which are closely connected with the ecological education of the population and are based on the scientific potential of employees, collections of living plants, and understanding the need to preserve biodiversity [18, 19]. However, it turned out that the quality of the experiences and their interpretation was more important, contributing to the formation of ecological identity and commitment to socio-ecological practices. From the perspective of social sciences, studying plant blindness can unveil deeper insights into human attitudes towards nature. Understanding the reasons behind this bias can help psychologists develop strategies to enhance environmental awareness and foster pro-environmental behaviours. Furthermore, insights gained from studying plant blindness can be applied in therapeutic contexts, such as horticultural therapy.

Educational programs that address this bias can empower individuals to recognize the value of plants, promoting greater engagement in biodiversity conservation. This is particularly important for younger generations, who will play critical roles in shaping future environmental policies and practices. Popularizing scientific knowledge about the plant world contributes significantly to environmental education and human understanding of its place in the biosphere. Some studies evaluate the impact of a conservation education program on middle school students' broadened attitudes and knowledge. The results show a positive influence of such programs on knowledge about plants and biodiversity [20, 21]. Some studies investigate the effects of an environmental education program on students' knowledge of and attitudes toward plants. The results demonstrate significant improvement in knowledge about plants and positive changes in attitudes toward them [22], students' knowledge of plant biology and the effectiveness of educational programs. The results show that focusing on ecological education contributes to improved knowledge about plants [23].

The scientific problem addressed in this study is the phenomenon of plant blindness in Russia, which refers to the cognitive bias that leads both the general public and educational professionals to prioritize animals over plants in ecological awareness and education. This bias not only contributes to the insufficient understanding of plant biodiversity but also results in a lack of adequate conservation efforts for endangered plant species. The primary goal of this research is to investigate the cognitive, educational, and societal factors contributing to plant blindness in Russia, with the aim of developing effective strategies to enhance public awareness and appreciation of plant diversity.

This research holds significant practical implications for both conservation efforts and public education in Russia. By identifying the specific cognitive biases

and educational gaps that lead to plant blindness, the study aims to inform tailored outreach programs and educational curricula that engage the public and educators alike. The findings could promote a more balanced view of biodiversity, highlighting the importance of plants alongside animals in ecological discussions.

Methodology and Methods

Concept and description of the project

A scientific and artistic educational project "Botanical World of St. Petersburg" was conducted in order to spread knowledge about the diverse threatened, extinct, invasive and native species of plants in St. Petersburg. The project included an exhibition in the St. Petersburg Botanical Garden and outreach events: six open educational lectures and two workshops. The exhibition presented the role of plants in maintaining urban sustainability and their value for the conservation of terrestrial ecosystems, and spurred a conversation on anthropogenic influence. Also the project demonstrated the importance of scientific botanical research.

Plants selected for the exhibition as models for art objects were diverse in taxa, size and structure: mosses species, herbs, dwarf-shrubs, and trees. The development of scientific and artistic materials included preparation of artistic bas-reliefs of rare plant species and popular science descriptions marking out the features of these species, their significance for environmental sustainability; causes of extinction and listing measures for conservation. More than 1000 visitors visited the exhibition in total. The project was mentioned in Internet media 6 times and in 43 posts on the VK.ru network. The pages noted the project was viewed more than 130,000 times. Both types of publications were accompanied by a link to the sociological survey (a Google Sheet), and the data obtained became the basis of our research. Visitors of outreach events of the project were proposed to fill in the survey form before the start.

One part of the project was the investigation about the knowledge of rare plants and the phenomenon of plant blindness.

In our interaction with nature, we assume spending time directly in natural settings, how individuals perceive the plant world, their level of knowledge about plants (compared to knowledge about the animal world), and how individuals themselves impact nature (study of pro-environmental behaviors). The hypotheses of the investigation are the following:

1. In people's consciousness, there is a phenomenon of "plant blindness" – the inability to see, distinguish, or notice plants in their environment.
2. Modern urban dwellers exhibit a "nature deficit syndrome" – they infrequently visit parks or natural settings, are less sensitive to the natural world, which acts as a barrier to the foundation of ecological knowledge.
3. People are not sufficiently knowledgeable about plant names and rare plants.
4. Plants are perceived by people in terms of their benefit to humans, being categorized as, for example: (1) food plants, (2) medicinal plants, (3) plants with aesthetic value, and (4) components of the landscape.

Using the online survey conducted among visitors to the exhibition ($N = 253$), it was possible to test the main hypotheses. The survey involved semi-structured

and structured questions. The primary limitation of the online survey remains the inability to reflect the entire general population among the residents of St. Petersburg. It is also presumed that exhibition participants may be individuals initially more interested in the plant world. In the future, a comprehensive sample excluding these limitations of the study is planned to be used.

The portrait of the respondents

Seventy-five percent of all the respondents live in St. Petersburg and the Leningrad Region, while 13% are from Moscow and the Moscow Region; the remaining respondents are approximately evenly distributed across other regions. The vast majority of the survey participants were women (84%). It is important to note that the objectives of our study did not include a structured quota sample, as the primary aim at this stage was to explore the existing body of knowledge and the phenomenon of plant blindness. Sixty percent of the respondents indicated that their profession was related to biology;twenty were from the field of education, while the remaining specialists were evenly distributed across sectors such as IT, science, civil service, medicine, design, construction, agriculture, culture, and engineering. Seventy-two percent of the respondents had higher education, ten held an academic degree, and the rest had either incomplete higher or secondary education. Different age categories participated in the survey (see Table 1).

Table 1. **Age of respondents**

Age, years	Age, %
10–15	5
16–20	3
21–35	30
36–45	34
46–60	20
60–80	8

Additionally, 53% of the respondents were married, 43% had no children, 30% had one child, 19% had two children, and the remaining respondents had three or more children.

Results and Discussion

Study of plant blindness bias

Interactions with nature, especially from childhood, can influence the life trajectories of an individual's relationship with the natural environment. For example, participation in activities and natural experiences during childhood is associated with pro-environmental behavior in adulthood [24], a strong environmental identity, and biocentric values. A meta-analysis of 23 life course studies measuring the impact of nature exposure on children and adolescents found that some exposure began as early as birth [25]. Therefore, we initiated a study to understand how much time individuals prefer to spend in natural settings [26, 27]. Out of 253 responses, 49% of the respondents indicated that they prefer to spend time in urban natural spaces and frequently visit city parks (see Table 2). Additionally, 44% visit parks occasionally, while only 5% do so rarely, and 1% reported that they never visit parks. Furthermore, we investigated how often people

spend time in protected natural areas, as these parks provide opportunities to become acquainted with unique fauna, flora, and specific endemic species.

Table 2. **Do you visit protected natural areas (reserves, protected national parks, natural monuments, etc.) in Russia? (253 answered)**

	Quantity	%
Yes, protected areas are a must for my tourism program	116	45.8
If there is a protected area at sights that I found interesting	60	23.7
Optional	28	11.1
I do not visit natural protected areas	49	19.4

As shown in the results, almost half of the respondents try to visit specially protected natural areas consistently, while nearly a quarter do not do so. The survey conducted at the St. Petersburg Botanical Garden indicates that a minority of visitors (3.5%) associate botanical gardens with conservation, compared to 80% who associate the garden with beauty. The conservation of plant species is partially influenced by popularity and aesthetics rather than by extinction risk [28]. Visitors to events that focus not on rare plants but rather on charismatic species with colorful flowers or leaves, such as Maple Day, Sakura Blossom Fest, and Azalea Flowering, constitute the largest groups at the St. Petersburg Botanical Garden. Outreach activities in botanical gardens aimed at popularizing knowledge about the conservation issues surrounding rare plants are relatively few. The event most mentioned in the media in Russia is the annual Rhododendron Day, conducted by the Botanical Garden Institute of the Russian Academy of Sciences in Vladivostok (Primorye Territory). The Rhododendron Day is one of the few events with numerous visitors that promotes knowledge and stimulates research on endemic, rare, yet charismatic, rhododendrons species in the region.

We would like to note that while people spend a lot of time in nature, it does not logically follow that they have sufficient knowledge about the life of nature.

To understand how they perceive the natural world and what they primarily pay attention to, we asked an open-ended question: “When I spend time in nature in parks/protected areas, the first thing I pay attention to is… (continue the sentence)”.

The respondents preferred an aesthetic perception of the landscape, analyzing the picture as a whole (“nature”, “changes in the landscape” and highlighting individual objects that are attractive to their perception (plants, mushrooms, birds, flowers, trees, water objects). They especially pay attention to moving or brightly colored objects, stating “I see the beauty of nature, photogenic angles, butterflies, birds, dragonflies” or a spectacular combination of different environments (aquatic, plant, animal – “harmony of nature”, “landscape”). This universal phenomenon of perception is consistent with research by neuroscientists, who described the phenomenon of “plant blindness”, according to which the background and bright objects, combined with a lack of special knowledge about plants, prevent individuals from deeply analyzing the plant world.

Much attention is given to the quality of the natural environment and the presence of unwanted objects; in a quarter of cases, the respondents mentioned “cleanliness”, “trash”, “absence or presence of garbage”. Within urban green areas, people pay attention to “improvement”, “convenient paths, trees, the presence of ponds and lakes”, “cleanliness and improvement”. Ecologists and biologists, as well as people more interested in the plant world, are more in-depth in the topic of plants: “plant care: diseased plants, tourist information board with with routes and

species living in the area", "state of vegetation, the presence of unusual manifestations", "interesting plant specimens".

To the question "What is the main value for you when you spend time in nature?", the respondents' answers were divided into aesthetics – beauty, enjoyment of nature; rest, comfort, absence of people, silence, solitude, rest from the hustle and bustle; cleanliness, improvement and landscaping. These values were observed in approximately three-quarters of the cases and often complemented each other. There were few intentions to explore or experience nature. "To get to know the world more closely, which existed long before me and will remain when I am gone", "The opportunity to get closer without spoiling anything, and without haste to inspect/touch/smell everything", "biodiversity", which is mainly characteristic of highly specialized professions).

The hypothesis was partially confirmed. Firstly, we identified a perception characteristic consistent with previous studies: people distinguish between a background and certain natural objects to which they primarily pay attention. The natural landscape is associated with relaxation and the pursuit of aesthetic satisfaction. We asked the respondents to evaluate statements regarding their well-being in nature by rating each statement on a scale from 1 to 5, where "1" indicates "does not apply to you at all" (do not agree) and "5" indicates "absolutely agree" (see Table 3). In total, we collected 253 responses.

Table 3. **Distribution of respondents' responses associated with being in nature (number, percentage)**

Statement	5 absolutely agree	4	3	2	1 absolutely disagree
I would definitely like to spend more time in nature/parks if it were possible	194 (76.7%)	29 (11.5%)	17 (6.7%)	12 (4.7%)	1 (0.4%)
I feel better physically and mentally when I am surrounded by greenery – trees, flowers, plants	204 (80.6%)	20 (7.9%)	12 (4.7%)	13 (5.1%)	4 (1.6%)
We are absolutely dependent on plants for life and health	173 (68.4%)	41 (16.2%)	22 (8.7%)	11 (4.3%)	6 (2.4%)

The vast majority of the respondents expressed a desire to spend more time in nature, noting that they feel better there and agreeing (or strongly agreeing) that plant life is essential for survival and health. We can confirm that Hypothesis 2 – "Modern urban dwellers exhibit a 'nature deficit syndrome" – they infrequently visit parks or natural areas and are less sensitive to the natural world, which acts as a barrier to the establishment of ecological knowledge" – is supported by our findings.

Conversely, when examining the responses of biologists and individuals involved in environmental activities, we observe a much greater variation in what nature means to them. In addition to relaxation and beauty, participants also noted environmental and biodiversity issues, as well as specific species as important. From this, we can conclude that observation and an improvement in the quality of knowledge about natural objects may reduce the severity of the cognitive error associated with "plant blindness", which refers to the inability to see, distinguish, or notice plants in their environment.

We also examined whether the respondents engaged in any environmental activities. Only 5% of the respondents regularly participate in volunteer environmental activities, 30% do so occasionally, 39% very rarely, and 26% never. Among those who engage in volunteer activities, the most popular practices include garbage collection, cleaning and beautifying areas, including tree planting (63%); educational initiatives (30%); work in protected areas (5%); and extinguishing and preventing fires (3,5%). Given the high percentage of the respondents involved in landscaping, it is anticipated that experiencing nature may make respondents more receptive to the plant world and strengthen their knowledge about nature. We aim to investigate this further in the part on the respondents' awareness of the natural world.

Awareness of rare plants and animals

Understanding the factors influencing knowledge about rare plants is necessary for effective conservation efforts and socio-environmental behavior. Factors influencing knowledge about rare plants include their endemism, narrow distribution, demographic [29] and genetic effects in small populations, and the impact of habitat destruction and management practices.

According to the order of the Ministry of Natural Resources and Environment of the Russian Federation No. 320 of 23 May 2023, On Approval of the List of Flora Objects Listed in the Red Data Book (RB) of the Russian Federation, the objects are divided into 7 sections with the majority angiosperms plants (64.5%), fungi and lichens (15.8%), spore plants (bryophytes, pteridophytes) (13.1%), algae (4.7%), and gymnosperms (1.9%). We asked the respondents an open question: "Please, list any plant species included in the RB". We got 251 responses. Most of the survey participants live in the European part of Russia (237 responses), 200 responses were received from residents of St. Petersburg and the Leningrad Region. Out of all the responds 13% were not able to name any rare plant name. An algae species was noted just by one respondent; 1.1% of the answers mentioned spore plants; 2.0% gymnosperms; 2.3% fungi and lichens, 88.7% angiosperms. There were comments noting the importance of rare plant species in addition to some answers: "I do not know any species, but after the question, I am going to read the RB with my child", "Rare are all beautiful flowering plants" or "medicinal and honey plants".

In their responses, 213 respondents (84.5%) named at least one floral object, an average response containing 2–3 mentions. So, in total, we got 523 mentions of floral objects. However, only 98 people (38.9% of respondents) named at least one plant species listed in the RB of the region of residence or of the Russian Federation, which supports our Hypothesis 3 that people are not sufficiently knowledgeable about plant names and rare plants.

Among the rare angiosperm plants the respondents predominantly named noticeable attractive flowers: most frequent was the lily-of-the-valley (*Convallaria majalis*) (114 times, 45.2% of the 252 questionnaires). The lily of the valley is an incorrect answer as it is not listed in the RB of the Russian Federation and in most regional RBs. The species is recognized as a rare plant in the Moscow, Murmansk, and Astrakhan Regions, while most of the responses were received from residents of St. Petersburg, where the species is not a rare one. Perhaps this result is related to the fact that the lily of the valley is an early flowering plant, which is difficult to

recognize when it is not blooming. Second frequent (110 times, 43.7%) was the orchid, of which lady's slipper orchids (*Cypripedium sp.*) was mentioned 54 times (21.4%), and "orchid" without specifying as well as orchis (*Orchis sp.*), butterfly orchids (*Platanthera sp.*), calypso orchid (*Calypso sp.*) 56 times (22.2%). Seasonal flowering plants, such as snowdrops (*Galanthus sp.*), anemone (*Anemonoides sp.*), pasque flower (*Pulsatilla sp.*), and crocus (*Crocus sp.*), were mentioned 80 times (see Table 4).

Table 4. **Distribution of survey responses by regions, %**

Answer as	Species	Region of residence	
		St. Petersburg	Other regions
Plants of the Black List	Japanese rose (*Rosa rugosa*)	2.5	0.0
	Common ragweed (*Ambrosia artemisiifolia*)	5.0	7.7
	Sosnowsky's hogweed (*Heracleum sosnowskyi*)	71.5	67.3
	Canadian waterweed (*Elodea canadensis*)	4.0	0.0
	Box elder (*Acer negundo*)	12.5	23.1
	Wild cucumber (*Echinocystis lobata*)	0.0	5.8
	Canadian horseweed (*Erigeron canadensis*)	0.5	1.9
	Large-leaved lupine (*Lupinus polyphyllus*)	5.5	7.7
	Himalayan balsam (*Impatiens glandulifera*)	0.5	1.9
	Giant knotweed (*Reynoutria sachalinensis*)	2.0	0.0
	Guasca (*Galinsoga parviflora*)	1.0	0.0
	Canada goldenrod (*Solidago canadensis*)	9.5	5.8
Rare floral object	Fungi, lichen	4.0	3.8
	Spore plants	1.5	1.9
	Lily of the valley (*Convallaria majalis*)	43.0	40.4
	Orchid (*Orchidaceae*)	33.5	19.2
	Snowdrop (*Galanthus sp.*), Anemone (*Anemonoides sp.*)	19.5	19.2
	Water lilies (*Nymphaeaceae*), irises (*Iris sp.*), lotus (*Nelumbo nucifera*)	10.5	21.2
	Tulip (*Tulipa sp.*)	1.5	1.9
	Pasque-flower (*Pulsatilla sp.*)	7.5	7.7

In the survey, the respondents attempted to identify rare plant species, often naming common ones, for instance, coltsfoot (*Tussilago farfara*), honesty (*Lunaria sp.*), goldenrods (*Solidago sp.*).

Thus, we can infer that the most common depiction of a protected plant is an herbaceous plant with a beautiful flower or inflorescence.

Having analyzed the answers of St. Petersburg and the Leningrad Region residents, we found that only they mention such rare species endemic to the region and included in the RB of Russia as a deciduous shrub bog-myrtle (*Myrica gale*) (11 times), pasque flowers species (*Pulsatilla sp.*) (15 times). Only St. Petersburg residents named insectivorous plants (*Drosera sp.*, *Aldrovanda sp.*), which are common due to the abundance of bog vegetation in the region.

We asked the respondents an open question "Please, list any plant species included in the Black List (list of invasive plants)". The information regarding plant species mentioned in the Black Book (invasive plants) was analyzed during the study. In 62 instances, respondents provided no answers. The most frequently cited species was Sosnowsky's hogweed (*Heracleum sosnowskyi*), which was mentioned 174 times, sometimes without specifying the species. In 37 cases, the respondents referenced the ash-leaved maple (*Acer negundo*), often confusing it with other closely related species. Canada goldenrod (*Solidago canadensis*) was mentioned by 22 participants, frequently without specifying the species (see

Table 4). Respondents from other regions mentioned the box elder as an invasive plant twice as often, which probably reflects that the species is not very common in natural habitats in St.Petersburg and the Leningrad Region. Unlike residents of other regions, residents of St. Petersburg never mentioned the wild cucumber (*Echinocystis lobata*), which has a more southern secondary range.

We used one-way analysis of variance (ANOVA) to compare the respondents' answers on the species most frequently noted as invasive plants: Sosnowsky's hogweed, box elder, and Canada goldenrod. There are no significant differences in the frequency of mentioning these species by residents of different regions since the P value of the F-test is smaller than 0.05. Regarding animals, large predatory felids (such as the Amur tiger (*Panthera tigris tigris*), leopard (*Panthera pardus orientalis*), and snow leopard (*Panthera uncia*)) were mentioned 236 times. It is important to emphasize that as a result of the mention of one of the species all the answers for "Name an animal included in the RB" were correct. Awareness of animal species is presumed to be higher, although still insufficient regarding various species, likely due to media coverage. Specifically, the Amur tiger was referenced 122 times. Seventy respondents mentioned the snow leopard and leopard (the participants did not specify, or confused, several species, including the Caucasian leopard, the Far Eastern leopard, and the snow leopard). Diurnal and nocturnal raptors (such as the Eurasian eagle-owl and owl) were also frequently mentioned. The polar bear and seals were noted, possibly due to the popularity of these animals in St. Petersburg. The polar bear is the logo of the Leningrad Zoo – one of the oldest zoos in Europe, and the ringed seal (*Pusa hispida*) was mentioned 25 times supposedly as a result of it popularization as an endemic species by the Baltic Seal Friends Foundation.

The depiction of protected animals primarily includes vertebrates, predominantly mammals (in terms of significance to humans), followed by birds, reptiles, insects, and fish (notably, only sturgeon species were mentioned). The responses did not include mollusks, jellyfish, or other marine inhabitants.

When completing the questionnaire, we asked the respondents to indicate whether their education or profession related to biology. We used one-way ANOVA to compare responses from individuals with biology-related and non-biology-related occupations. Since the P value of the F-test is smaller than 0.05 people whose professions are related to biology statistically more often name correctly rare plant species from the regional and national RBs, species listed in black books and black lists. At the same time, there is no statistically significant difference in naming more taxa of rare animals species (see Table 5).

Non-existent species mentioned in movies or literature were also named: the silver lily of the valley (self-titled movie) twice; the Mexican jerboa (mentioned in *The Twelve Chairs* novel), once.

We can describe the image of a species of flora – a beautifully flowering herbaceous plant, the image of an invasive plant species – Sosnowsky's hogweed, the image of a rare animal species – large predatory mammals, preferably felids.

Hypothesis 3 about the proposition of the low level of knowledge was confirmed. The media, such as television programs, documentaries, and social media platforms often highlight unique plant species, contributing to their recognition among the general public, in Russian experience, too; and most of

them are more highlighted than others, which depends on the rare conservational status [30].

Table 5. **Dependence between respondents' answers and their profession**

Dependent variable	Profession is not related to biology (average per respondent)	Standard deviation	Profession is related to biology (average per respondent)	Standard deviation	F-ratio	P-value
Average number of plant species named as rare	2.201	1.210	2.333	1.228	0.620	0.431
Named groups of floral objects, average (question about rare plants)	0.927	0.573	0.989	0.404	0.790	0.375
Not able to name any rare floral objects	0.177	0.384	0.086	0.282	3.760	0.054
Rare floral objects included in the regional RB named correctly	0.548	1.030	0.925	1.080	6.770	0.010
Rare floral objects included in the RB of Russian Federation named correctly	0.605	1.132	0.936	1.111	4.610	0.033
Number of named invasive plant species	1.242	1.023	1.516	1.256	3.140	0.071
Number of invasive plant species included in the Black List of a region or Russia named correctly	1.105	0.986	1.409	1.182	4.250	0.041
Number of rare animals species named correctly	2.870	2.024	2.925	2.097	0.04	0.849

The role of local communities, botanical gardens and plant clubs significantly increased members' knowledge about native and rare plants [31].

The rare plants' popularity also depends on their aesthetic value [32]. Certain rare plants may hold cultural or historical significance that captures the public's interest. For example, plants that are connected with local folklore or traditional medicine can become popular due to their perceived value within specific communities [33]. The same as in the Russian perspective, some plants that are both medicinal and rare are more popular, especially in some regions, such as golden root (*Rhodiola rosea*) in the Altai Republic and the Murmansk Region. Some rare plants are easier to cultivate or maintain than others, which makes them more desirable among gardening enthusiasts.

We offered to evaluate statements on the need to gain knowledge about the natural world, asking the respondents to rate them from 1 to 5, where "1" indicates "does not apply to you at all" (do not agree) and "5" indicates "absolutely agree" (253 answers) (Table 6).

Table 6. **Knowledge about nature issues**

Answer option	5	4	3	2	1
I would like to know more about the life and benefits of plants	148 (58%)	48 (19%)	37 (14%)	17 (8%)	3 (1%)
I would like to know more about the animal world	144 (57%)	53 (21%)	33 (13%)	17(7%)	6 (2%)
I would like to know more about current environmental issues	102 (40%)	65 (25%)	48 (19%)	22 (9%)	16 (7%)
More attention shoud be paid to animal issues in the media and educational institutions	141 (55%)	59 (24%)	25 (10%)	20 (8%)	8 (3%)
The media and education should pay more attention to the problems of the plant world	153 (60%)	55 (22%)	23 (10%)	17 (7%)	5 (1%)

Next, we asked people to respond to some statements (assuming the correct answer) to assess how well people know about the life and place of plants in the natural world (Table 7). Also, we offered to compare the functional characteristics of plants and animals, also offering to mark statements that seem correct (there is a correct answer too) (see Table 8).

Table 7. **Evaluation of statements abouts plants and animals**

Statements	Totally agree	Partially agree	Don't agree
Plants are more demanding of their life form compared to animals (Correct answer: no, because all subjects are interconnected in the ecosystem)	24 (9%)	109 (43%)	123 (48%)
Rare biological species are key for biodiversity (Correct answer: yes, because they are important for biodiversity)	73 (28%)	137 (54%)	46 (18%)

Table 8. **Distribution of answers to the question: "Please name what plants and animals can and cannot do, in your opinion (two answers possible)"**

Statements	Correct for plants	Correct for animals
Producing oxygen (correct for plants)	245 (96%)	12 (5%)
Consuming carbon dioxide (correct for plants	245 (96%)	43 (17%)
Consuming oxygen (correct for plants and animals)	141 (55%)	246 (96%)
Can interact with each other (correct for plants and animals)	239 (93%)	239 (93%)

Here we need to explain the significance of the statements. Unlike plants, animals are not capable of photosynthesis, that is, they are unable to produce oxygen. Plants, like other living organisms, respire by absorbing oxygen through the pores (stomata) of leaves and stems and releasing carbon dioxide. Plants need oxygen in order to oxidize organic substances and obtain energy necessary for life. They breathe more at night (the shadow phase of photosynthesis) and consume very little oxygen, but during the day they absorb carbon dioxide and release oxygen. Animals (some species are still more adaptive to carbon dioxide due to the characteristics of life in a certain environment) are generally not adapted to consuming carbon dioxide (including humans); when inhaling carbon dioxide concentrations above 0.1% (1000 ppm), they feel stuffiness: general discomfort, weakness, headache, decreased concentration.

The interactions of plants and animals with each other and with other organisms can be different. Ecology describes the nature of interspecific relationships in an ecosystem: competition, symbiosis, predation, parasitism. Also they can be both intra- and interspecific, positive, negative, neutral for different kinds of beings. An important tool for studying interactions is the analysis of symbiosis; such can be obligate (one cannot exist without the other) or facultative (not obligatory). Interactions arise as a result of different types of influences on plants and can be one-sided or two-sided. Here we can see absolutely right answers; observation of nature helps to grasp the different nature of interactions at the level of common sense.

The role of knowledge in biology – what we want to know

We also asked, "What topics related to ecology, botany, or the world of animals and plants are you interested in and would like to learn more about, and why?"

The respondents expressed equal interest in both flora and fauna. Specific topics of interest included rare species, microbiology, genetics, individual or favorite species, ecology, evolution (particularly among ecologists), and ecological biocenoses: “Environmental protection, harmonious cohabitation with nature and animals. Man is a part of nature; he cannot survive without other elements of living and inanimate nature. To keep nature in excellent condition and prolong life on our planet.”

The respondents expressed interest in aesthetics, particularly regarding plants and landscape design, as well as the medicinal effects of plants when consumed and their impact on health. From an ecological perspective, the respondents also showed a desire to learn more about mycology and fungi, as mushrooms are receiving increasing attention in the scientific community.

Additionally, urban dwellers show interest in learning about the natural world within the urban environment, including animals, birds, and fish, and how these organisms adapt to city conditions: “How to organically fit plant communities into the urban environment and make them resistant to anthropogenic impact, what species take root well in the urban environment. How to minimize and recycle waste on the scale of our city so that this is a successful model”, “Human influence on the world around us and the possibilities of minimizing it”.

Most respondents preferred interactive engagement with the natural environment, such as parks, botanical gardens with guided tours, and museums. However, the Internet emerged as the primary source of information (Table 9). Popular lectures, literature, and exhibitions were considered less preferable, while specialized scientific literature, podcasts, and games were deemed even less interesting. Sources such as television and newspapers were predominantly disregarded as viable options for obtaining the desired information.

Table 9. **Distribution of answers to the question: “Where would you like to receive more information about nature? (select all that apply)”**

Source	%
Nature excursions	78.5
Zoos, botanical gardens, etc.	77
Internet	70
Science and nature museums	64.5
Popular science lectures	53
Art museums and exhibitions	46.5
Popular science literature	46.5
Festivals and conferences	38
Podcasts	37
Intellectual games	31
Scientific articles and literature	30
TV	28
Radio	11
Newspapers	7

Conclusion

The respondents express a desire for increased immersion in nature and recognize the importance of plant life for physical and mental well-being, as well as for survival and health. The phenomenon of “plant blindness” is noted, indicating a need for greater awareness and knowledge about the natural world, but education and profession related to biology reduce “plant blindness”. It is evident

that there is a significant demand for comprehensive information about the natural world and the need for greater access to interactive experiences and knowledge dissemination. Meeting this demand through various avenues, such as nature excursions, internet resources, and scientific museums, can effectively bridge the gap between urban dwellers and the natural environment, contributing to enhanced ecological awareness and a deeper understanding of the importance of biodiversity.

References

1. *The IUCN Red List of Threatened Species*. [Online] Available from: https://www.iucnredlist.org/en (Accessed: 3rd October 2024).

2. Allen, W. (2003) Plant Blindness. *BioScience*. 53(10). pp. 926–926. DOI: 10.1641/0006-3568(2003)053[0926:PB]2.0.CO;2

3. Stagg, B.C., Hetherington, L. & Dillon, J. (2024) Towards a model of plant awareness in education: a literature review and framework proposal. *International Journal of Science Education*. 47(4). pp. 539–559. DOI: 10.1080/09500693.2024.2342575

4. Blue, S., Hargiss, C.L.M., Norland, J.E., DeKeyser, E.S. & Comeau, P. (2023) Plant blindness represents the loss of generational knowledge and cultural identity. *Natural Sciences Education.* 51(1). e20106. DOI: 10.1002/nse2.20106

5. Bobo-Pinilla, J., Marcos-Walias, J., Iglesias, J.D. & Tapia, R.R. (2023) Overcoming plant blindness: are the future teachers ready? *Journal of Biological Education*. 58(11). pp. 1–15. DOI: 10.1080/00219266.2023.2255197

6. Norretranders, T. (1998) *The User Illusion: Cutting Consciousness Down to Size*. Viking.

7. Thomas, H., Ougham, H. & Sanders, D.L. (2021) Plant blindness and sustainability. *International Journal of Sustainability in Higher Education*. 23(1). pp. 41–57. DOI: 10.1108/IJSHE-09-2020-0335

8. Parsley, K.M. (2020) Plant awareness disparity: A case for renaming plant blindness. *PLANTS, PEOPLE, PLANET*. 2(6). pp. 598-601. DOI: 10.1002/ppp3.10153

9. Kubiatko, M., Fančovičová, J. & Prokop, P. (2021) Factual knowledge of students about plants is associated with attitudes and interest in botany. *International Journal of Science Education*. 43(9). pp. 1426–1440. DOI: 10.1080/09500693.2021.1917790

10. Wandersee, J.H. & Schussler, E.E. (1999) Preventing Plant Blindness. *The American Biology Teacher*. 61(2). pp. 82–86. DOI: 10.2307/4450624

11. Achurra, A. (2022) Plant blindness: A focus on its biological basis. *Frontiers in Education*. 7. 963448. DOI: 10.3389/feduc.2022.963448

12. Margulies, J.D., Bullough, L.-A., Hinsley, A., Ingram, D.J., Cowell, C.R., Goettsch, B., Klitgård, B.B., Lavorgna, A., Sinovas, P. & Phelps, J. (2019) Illegal wildlife trade and the persistence of "plant blindness." *Plants, People, Planet*. 1(3). pp. 173–182. DOI: 10.1002/ppp3.10053

13. Zani, G. & Low, J. (2022) Botanical priming helps overcome plant blindness on a memory task. *Journal of Environmental Psychology*. 81. 101808. DOI: 10.1016/j.jenvp.2022.101808

14. Zhang, H., Zhang, Y., Song, Z. & Lew, A.A. (2019) Assessment bias of environmental quality (AEQ), consideration of future consequences (CFC), and environmentally responsible behavior (ERB) in tourismю *Journal of Sustainable Tourism*. 27. pp. 609–628. DOI: 10.1080/09669582.2019.1597102

15. Amprazis, A. & Papadopoulou, P. (2020) Plant blindness: a faddish research interest or a substantive impediment to achieve sustainable development goals? *Environmental Education Research*. 26. pp. 1065–1087. DOI: 10.1080/13504622.2020.1768225

16. Pedrera, O., Ortega, U., Ruiz-González, A., Díez, J.R. & Barrutia, O. (2021) Branches of plant blindness and their relationship with biodiversity conceptualisation among secondary students. *Journal of Biological Education*. 57. pp. 566–591. DOI: 10.1080/00219266.2021.1933133

17. Waylen, K.A. (2006) Botanic Gardens: Using Biodiversity to improve human well-being. *Medicinal Plant Conservation*. 12. 4-8. Ref. 25.

18. Lavrova, T.V. & Romanova, E.S. (2019) Possibilities of the Botanical Garden of Moscow State University in Support of Ecological and Botanical Education at Schools. *Biology in School*. 6. pp. 47–55.

19. Musinova, L.P., Kalugin, Yu.G. & Mitina, E.G. (2020) Excursion as an Organization Form of Educational Activities in Peter the Great Botanical Garden of Komarov Botanical Institute of Russian Academy of Sciences. *Samara Journal of Science*. 9(1(30). pp. 259–267. DOI: 10.17816/snv202091308

20. Erhabor, N. (2018) Developing Leaders Through Mentoring in Environmental Education. *Electronic Green Journal*. 1(41). DOI: 10.5070/G314134454

21. Kahtz, A.W. (1995) Impact of Environmental Education Classes at Missouri Botanical Garden on Attitude and Knowledge Change of Elementary School Children. HortTechnology Horttech. 5(4). pp. 338–340. DOI: 10.21273/HORTTECH.5.4.338

22. Jose, S., Wu, C. & Kamoun, S. (2019) Overcoming plant blindness in science, education, and society. *Plants, People, Planet*. 1. pp. 169–172. DOI: 10.1002/ppp3.51

23. Balding, M. & William, K.J.H. (2016) Plant blindness and the implications for plant conservation. *Conservation Biology*. 30(6). pp. 1192–1199. DOI: 10.1111/cobi.12738

24. Barrable, A., Friedman, S. & Beloyianni, V. (2024) Nature connection in adulthood: The role of childhood nature experiences. *People and Nature*. 6(4). pp. 1571–1580. DOI: 10.1002/pan3.10657

25. Aota, Y. & Soga, M. (2024) Both frequency and diversity of childhood nature experiences are associated with self-reported pro-biodiversity behaviours in adulthood. *People and Nature*. 6(2). pp. 792–799. DOI: 10.21203/rs.3.rs-3291460/v1

26. Yanniris, C., Gavrilakis, C. & Hoover, M.L. (2023) Direct Experience of Nature as a Predictor of Environmentally Responsible Behaviors. *Forests*. *14*(11), 2233. DOI: 10.20944/preprints202309.1730.v1

27. Stehl, P., White, M. P., Vitale, V., Pahl, S., Elliott, L.R., Fian L. & Bosch M. van den (2024) From childhood blue space exposure to adult environmentalism: The role of nature connectedness and nature contact. *Journal of Environmental Psychology*. 93. 102225. DOI: 10.1016/j.jenvp.2023.102225

28. Adamo, M., Sousa, R., Wipf, S., Correia, R. A., Lumia, A., Mucciarelli, M. & Mammola, S. (2022) Dimension and impact of biases in funding for species and habitat conservation. *Biological Conservation*. 272. 109636. DOI: 10.1016/j.biocon.2022.109636

29. Falk, D.A. (1992) From Conservation Biology to Conservation Practice: Strategies for Protecting Plant Diversity. In: Fiedler, P. L. & Jain, S. K. (eds) *Conservation Biology*. Boston. pp. 397–431. DOI: 10.1007/978-1-4684-6426-9_16

30. Arendt, F. & Matthes, J. (2014) Nature Documentaries, Connectedness to Nature, and Pro-environmental Behavior. *Environmental Communication*. 10. pp. 1–20. DOI: 10.1080/17524032.2014.993415

31. Doyle, G. (2022) In the garden: capacities that contribute to community groups establishing community gardens. *International Journal of Urban Sustainable Development*. 14(1). pp. 15–32. DOI: 10.1080/19463138.2022.2045997

32. Lindemann-Matthies, P., Junge, X. & Matthies, D. (2010) The influence of plant diversity on people's perception and aesthetic appreciation of grassland vegetation. *Biological Conservation*. 143(1). pp. 195–202. DOI: 10.1016/j.biocon.2009.10.003

33. Niigaaniin, M. & MacNeill, T. (2022) Indigenous culture and nature relatedness: Results from a collaborative study. *Environmental Development*. 44. 100753. DOI: 10.1016/j.envdev.2022.100753

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