Ecological Education of Local Communities through Community Ecological Projects
Case Study Differences between the Stated Purpose and the Pseudo-Ecological Solutions in Riverbank Development

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Abstract

Ecological education is an imperative of contemporary times for all age groups. Ecological development projects implemented within human communities aim to exploit urban spaces in an ecological manner. The urban community is generally divided into two currents: the utilitarian and the aesthetic, whose supporters focus on criteria that strictly serve human activities, respectively, the criterion of supporting biodiversity, promoted by a minority concerned with the welfare of the creatures with which they share the urban ecosystem. The case study presented in the present article refers to the project "Rehabilitation of degraded green spaces and the creation of recreational infrastructure in the Săsar River area," between aspiration and ecological reality. In theory, the central point of the project is ecological in nature and claims "coherent planning, highlighting the importance of the river - the structuring axis of the municipality - through quality public spaces that connect urban and natural environments." Words such as: coherent planning, the river as a structuring axis, the connection between the urban and natural environments, emphasize and point to a heightened interest in the river as an ecological support. In reality, when looking at the project activities descriptions and their implementation, there are no actual efforts to create urban ecosystems that fulfill the dual role of serving human interests and supporting urban biodiversity. Since we suspect a false understanding of the ecological issues, both by the project managers and the general public, and a deficit of education in this niche, the present study investigates the causes of the discrepancies between the declaratively ecological principles and the reality that ignores them. By interviewing a sample of 200 residents, we assessed the level of perception regarding the ecological correctness of the adopted solutions. The present study aims to understand the current level of ecological knowledge of the citizens and identify the limits and gaps that could be improved through a better ecological education.

Keywords: *River as an ecological axis, adult education, ecological projects, educational perception*

Introduction

Currently, urban areas host more than half (54% in 2015) of the world's population, and this percentage is expected to grow rapidly (66% by 2050)[8]. Urbanization induces psychological and physical stress due to reduced contact with nature, lack of social interaction spaces or personal reflection areas, and pollution (noise, air, and water) [3,5]. The negative ecological consequences of urbanization include habitat loss and the degradation of ecosystems that support biodiversity[35]. Urban green spaces (UGS) bring social and ecological benefits and reduce the negative impact of pollution [25,38], even if they are not always designed, planned, and managed to perform all functions simultaneously[4,11,35]. Exposure to nature in urban green spaces is associated with various health and well-being benefits [13], such as stress reduction, increased physical activity, improved air quality, and enhanced social interaction [14,32,40,41,38]. Urban and peri-urban ecosystems contribute to biodiversity and the provision of ecosystem services (ES) and are considered important for sustainable urban development [8,13]. The success of establishing and restoring urban green spaces is multifactorial, being dependent on the reference point and its priorities, international and European policies, as well as local involvement. Policy is a key institutional driver for combining social and ecological functions. To counteract the negative effects of urbanization, cities worldwide are concerned with green space governance policies to include or integrate nature-related considerations into urban planning. Due to its potential to mitigate current societal challenges and provide ecological, social, and economic benefits, urban green infrastructure (UGI) is an important investment for cities. It should be seen as a strategically planned multifunctional network of natural and semi-natural ecosystems (e.g., forests, meadows, rivers, lakes, wetlands) [33,28] and human-made features (e.g.,

constructed parks, private gardens, street trees, reservoirs, ponds, canals) [17,16,18,33,7]. The UGI concept aims to systematize the multiple features of urban and peri-urban ecosystems into an integrated socio-ecological system [26], increasing its capacity to provide services such as climate mitigation and adaptation, water management, biodiversity protection, enhanced social cohesion, food provision, and increased recreational opportunities [34,17,31,1]. Although many cities have plans and policies to safeguard the services provided by UGI, planning the green network is challenging in practice, as it must support the integration of connectivity principles (ecological and socio-cultural), multifunctionality (ecological, social, economic, and cultural functions), green and grey integration, and multi-scale characteristics, based on cross-sectoral, vertical, and horizontal collaboration between stakeholders [29]. Therefore, political decisions should include collaborative planning, such as co-creation, co-production, joint decision-making, or co-management, to support and enhance successful public participation [20]. Societal values, positive attitudes, and behaviors towards urban green spaces [30,15], as well as local initiatives to promote green space sustainability and urban sustainability transformations, can be key levers for designing and implementing UGI [24]. Clearly established objectives accompanied by recommendations for the planning, design, management, and maintenance of green spaces [19,37,17] generate positive outcomes in achieving social and ecological functions. Research on UGS has found that the lack of supportive policies can be a barrier to implementing quality green spaces and, therefore, could also be a barrier to combining social and ecological functions[10,11,27,35]. International policies promote green priorities, such as the UN Decade on Ecosystem Restoration 2021–2030, which includes urban areas as an area of action where urban greening, ecosystem restoration, and wasteland rehabilitation should be promoted for quality of life and biodiversity protection. Additionally, new academic approaches to urban rewilding and human-animal cohabitation bring increased attention to urban biodiversity [2,6]. All these issues can be easily linked to green infrastructure planning, when understood as a comprehensive and integrative concept, raising the question of how to respond to observed changes in attention and priorities [12]. In many cities and regions, various solutions are applied [9,12, 23, 36], and planning concepts are continuously revised in correlation with the evolution of socio-political priorities and citizen understanding. In EU environmental policy, for example, the concept of nature-based solutions has recently gained more attention. Furthermore, the EU Biodiversity Strategy for 2030 calls for "urban greening plans" from EU cities, which should be ambitious efforts to protect and enhance urban nature, both to improve biodiversity and human well-being and climate protection. In recent EU policies, the term "green infrastructure" becomes a pivot. The success of UGI implementation largely depends on local authorities and citizens. Environmental management in urban spaces involves creative problem-solving regarding public communication, economy, and socio-political dynamics [22]. Combining social and ecological functions often depends on socio-cultural differences and user preferences [10,21]. Users' knowledge and previous experience with natural environments shape their preferences and perceptions [19]. Those who have knowledge and positive experiences about the importance of natural areas have affinities for such environments. Furthermore, user perceptions can also be influenced by their expectations of UGS and can thus act as an obstacle/support for their implementation. Negative expectations of green spaces include concerns about safety and accessibility, while positive expectations include mental restoration. On the other hand, like in many management sectors, critical thinking and creative problem-solving are needed. The green infrastructure concept has the potential to promote the planning and implementation of multifunctional green and blue spaces that address multiple urban sustainability issues. Therefore, biodiversity can be defined as a cross-cutting issue that creates synergies with other urban sustainability goals, such as climate adaptation or social cohesion. About ten years ago, the introduction of the EU Green Infrastructure Strategy was crucial for promoting the green infrastructure concept in the European Union [12]. Although globally, biodiversity offsetting is used to balance the negative impacts on biodiversity and ecosystem services caused by exploitation, in the municipal context, there is limited understanding of the concept's use [13]. The present article highlights this limited understanding, which needs to be compensated for through better integration of policies, understanding of concepts, communication, planning, and project implementation.

Site Description

Baia Mare, located in northwestern Transylvania, Romania, is surrounded by the volcanic Gutâi Mountains. The city sits in a depression and is traversed by the Săsar River, which has a mountainous character and is part of the Tisza River basin. Baia Mare is known for its history of extreme pollution

during the communist era due to its mining and ore processing industries. From 1960 to 1989, the initiation and development of these industries led to the intense pollution of air, soil, and water with heavy metal salts, sulfides, and other pollutants. Both local and national populations, as well as the broader European community, expressed disapproval of the high pollution levels and were concerned with addressing these issues. In the post-communist period, significant efforts were made to address environmental pollution. These efforts included attempts to modernize industrial technology, ultimately culminating in the closure of polluting industrial sites. Despite these measures, there remains a high level of historical soil pollution. Against this backdrop, the interest of the population in a pollution-free environment has been particularly strong. This environmental concern has manifested in the establishment of ecological associations and the inclusion of environmental issues in the development strategies of both the Baia Mare municipality and the Maramureș county. However, despite the declared aim of supporting biodiversity and improving environmental quality, the concrete actions taken in Baia Mare through ecological projects often do not align with these objectives.

The study aims to identify:

- The causes that, despite good intentions to develop a green city, lead to green spaces that do not support biodiversity.
- The attitudes of decision-makers regarding biodiversity support.
- Citizens' attitudes towards the functionality of green spaces.
- The knowledge gap regarding biodiversity in order to propose targeted educational interventions for decision-makers and intervention actors.

Materials and Methods

The objectives were achieved through:

1. Studying documents that include the local strategy regarding the environment and the green areas of the city.
2. Analyzing green spaces in terms of area and quality.
3. Administering a questionnaire to a sample of residents.

The questionnaire specifically refers to the project "Rehabilitation of degraded green spaces and creation of recreational infrastructure in the Săsar River area," considered a relevant example for the protective attitudes of decision-makers and citizens. The questionnaire consists of 10 items regarding citizens' attitudes. It was launched in March-April 2024, in electronic format. All survey questions were answered on a Likert scale from 1-5, where 1 signifies total disagreement with the statement, 2 - disagreement, 3 - neutral position, and 4 and 5 - agreement and total agreement, respectively. The questionnaire is structured into two sets of questions: I1-I5 with specific questions about the project and I6-I9 questions related to the ecological principles applicable in urban ecology, and I10 - assessing the need for improvement in this field. The tested aspects include: the stage of the project activities and the discomfort created by these for citizens and biodiversity; the ability to identify the qualitative results of the project; the attitude of residents regarding the provision of a framework for the development and support of biodiversity, as well as the identification of additional educational requirements to strengthen ecological education in support of biodiversity. In the final part of the questionnaire, questions were asked about education level, age, and gender. The results were analyzed using ANOVA.

The urban development strategy is "Objective 3. Raising the standard of living of citizens by improving the quality of the environment and protecting/sustainably using natural resources." The strategy aims to achieve this objective through: "Reusing the Craica stream area by setting up the 'Phoenix Public Park' and balanced development of the Baia Mare Urban System; Developing the urban eco-network and recreational infrastructure in the Vasile Alecsandri neighborhood (restoring and geometrizing soil quality, lawn, planting trees and ornamental shrubs, pedestrian alleys and urban furniture, playgrounds, street alignments); Restoring the alignments of the eco-network of green spaces by planting about 2000 trees, 6000 meters of hedges, and 3000 shrubs."[42].

Result and Disscusion

The municipality aims to launch and consolidate the "green city" brand, which involves the presence of nature within the city and ensuring the minimum green area per inhabitant required by legal standards. Among the five urban regeneration areas proposed by the development strategy, the priority is "Urban Regeneration Area 1 – Baia Mare Center (Săsar River), specifically the green area and the banks of the Săsar River, which owes its original name to the city of Baia Mare 'Rivulus Dominarum', by

transforming it into a spatial, social, ecological, and economic development axis, both at the local and regional level, which naturally requires an increase in the built-up area along its main course, with a view to shaping an urban section naturally, as spatial limits of the municipality's development in the East-West direction[42]. Additionally, several ecologically-focused projects are highlighted on the city's website. Currently, the area of green spaces in the city is much greater than it was 20 years ago.

However, the analysis of green spaces, as well as other available, unbuilt, and undefined functional areas in the city, conducted by biology students from the Technical University of Cluj-Napoca, highlights that the existing developments are not intended to support biodiversity. Evaluations of green spaces conducted in 2022-2024 based on criteria such as: the ratio of areas with trees/shrubs/hedges to those with lawns/paving; areas with stratified vegetation; connection of green spaces, led to the conclusion that the planning and development of green spaces ignored the presence of biodiversity, and the adopted criteria were solely aesthetic. We consider that neglecting the criteria of ecological functionality, the importance of ecosystem services, and the correlation between population health and increased biodiversity levels is due to: the lack of specialized knowledge of the staff involved in ecological projects; the communication deficit between municipal decision-making departments and the population, ecological organizations and the academic environment; and the insufficient involvement of interested parties.

To support the findings, the most recent green infrastructure project carried out in the city was analyzed:

"Rehabilitation of degraded green spaces and creation of recreational infrastructure in the Săsar River area," Code SMIS: 129615.

Table 1. Differences Between Planned and Actual Activities in the Green Infrastructure Project

Principles and objectives provided in the project	Planned actions	Actions taken	Human benefit	Biodiversity benefit	Common benefits met	Consequence
Coherent layout that emphasizes the importance of the river as the structuring axis of the municipality through quality public spaces that connect the urban and natural environment	Creation of public spaces intended for spending free time	Yes	Yes	No	No	Enriching the functionality of the space
	Placement of multifunctional pavilions to activate the area	Yes	Yes	No	No	Increasing human presence Decrease in the presence of wild species
	The development of some areas of medium vegetation towards the street that will increase the attractiveness of the development	No	Yes	Yes	No	Creating hedges and alignments of shrubs and trees that will act as filters for dust and noise Habitats for insects and birds Increasing the safety of the area for residents Declining habitat for nocturnal insects, birds and mammals
	Placement of light poles	Yes	Yes	No	No	Disturbance of nocturnal biodiversity
	Planting trees where there are none to provide a friendly environment and shade during the	Partial	Yes	Yes	Partial	Specific diversity Dust and noise filters Sources of

	summer The combination of urban and natural through areas of vegetation that merge with the mineral alley and loasir areas	Partial	Yes	No	Partial	improvement in atmospheric composition
		Strong land mobilization	No	No	No	Deterioration of the perennial grass carpet Destruction of microinvertebrate habitats Penetration of invasive plant species
		Deforestation of hedges and trees initially existing	No	No	No	Deterioration of the original habitats of invertebrates, birds; increasing the level of dust and noise pollution.

Table no. 1 highlights a difference between the objectives and the planned actions (columns 1 and 2), their mode of operation in the field (column 3), the benefits for people and for biodiversity. Column 7 emphasizes the consequences, mostly negative, for biodiversity.

3. The questionnaire completed online by a balanced segment of the population highlights that women (67%) are more concerned with the ecological aspects of the city. 44.08% of the participants were between the ages of 20 and 40, 37.63% were over the age of 40 and 10.75% were under the age of 20. 7.4% of the participants did not declare their age. As for the level of education, the respondents fall into the following categories: 22.4% with high school education and 77.6% with university education. The mean of the responses and the standard deviation of the tested groups pointed out that gender, age group and level of education did not influence the knowledge and attitudes regarding green spaces and biodiversity.
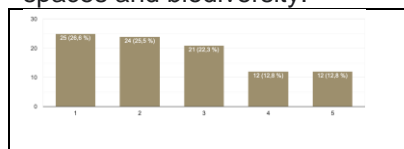

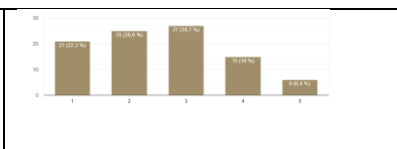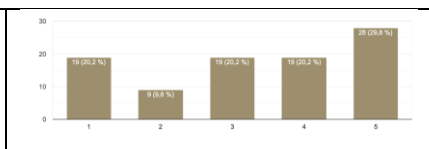| Fig.1. 1. 22.4% believe that at this moment the objectives of the project, completed in 2022, have been achieved, while 48.9% believe that the objectives of the project have not been met, and more than 28% have no opinion in this regard.	Fig.2. 2. 25.6% of the subjects believe that the project responded to a large extent to the requirements of people and living things, and 52.1% that the project did not offer solutions for the problems of people and biodiversity, and 22.3% did not give their opinion on this question.	Fig.3. 3.50% of the participants believe that lawn and paved surfaces are a priority and should be expanded, while 29.8% do not approve of these arrangements of green spaces. 20.2% do not have an opinion for or against paved and lawn surfaces.
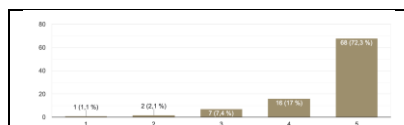
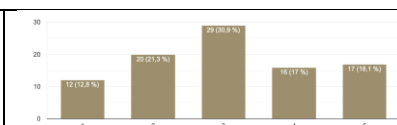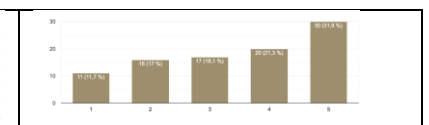| Fig.4. 89.3% of the respondents want the planting of woody vegetation as an element of connectivity, although the objective was not reached, the trees being	Fig. 5. 5. 35.1% of the interviewees believe that the project generated a safe and useful space for citizens as exclusive beneficiaries. Very similar percentages disagree with	Fig. 6. 53.2% of the interviewees believe that the biodiversity present around the river has the same rights as humans as far as usage of space is concerned,

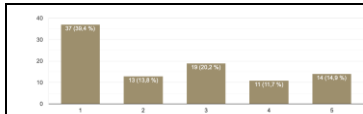| planted in islands. A minority disapproves of this action and a small percentage cannot express an opinion on this.	this statement while about a third do not express their opinion.	28.7% believe that green spaces are intended only for people, and 18.1% are neutral towards the matter.

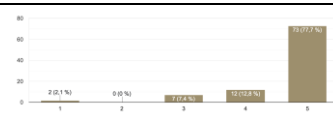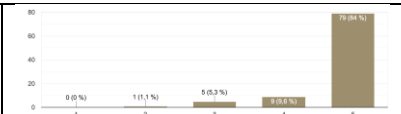|		
Fig.7. The question reiterates the attitude of the citizens towards the presence of biodiversity in the green spaces present on the banks of the river. The same percentage of 53.2% disagree with the statement that people should not be disturbed by living things and that they should not be taken into account when designing green spaces. 26.6% don't like the idea of sharing green space with biodiversity elements, 20.2% express a neutral position on the subject.	**Fig. 8.** The explicit question regarding the role of green spaces in generating balance between biodiversity and the human population gathers favorable responses from 90.5%. 2.1% disagree completely, and 7.4% are neutral.	**Fig. 9.** 93.6% believe that biodiversity generates an increased quality of urban life, while 5.3% have no opinion, and a minority disapprove of the influence of biodiversity on quality of life.
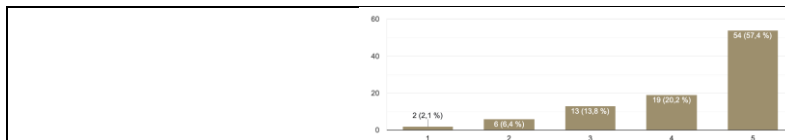
Fig. 10. 77.6% of the interviewed group believe that they would like to learn more about the relationship between humans and urban biodiversity, 1.1% are not interested in the subject, and 5.3% do not express any opinion whatsoever.

The questionnaire tests the ecological attitudes of a group of adults interviewed on ecological concepts such as biodiversity, connectivity of green spaces, lawns/impervious surfaces, and human-biodiversity relationship. We believe that the right attitudes towards the management of green spaces and biodiversity are based on key concepts connected in an articulated system of ecological knowledge. In its absence, people cannot have the correct attitudes towards the role of green spaces, or the support and conservation of biodiversity. One-way anova calculated for the mutual influence of question sets I1-I5 on I6-I10, as well as vice versa, show significant correlations only in a few cases of the item pairs analyzed. This analysis, together with the answers given by the participants, demonstrate that most of the respondents have some notions of ecology/biology, but they are not structured in a coherent system. For example, most appreciate the role of tree alignments that should accompany river banks for connectivity purposes, but they also believe that grass and paved areas should be expanded. A high percentage recognize that there is a correlation between the quality of urban life and biodiversity and believe that green spaces must also take into account other living things. A high percentage of respondents give neutral answers to most questions: they cannot appreciate whether the concrete activities of the project serve the interests of man and biodiversity (28.7%), they do not have an opinion regarding paved/waterproof surfaces and those with grass in the composition of green spaces (20.2%), they cannot appreciate whether green spaces should serve both people and biodiversity (30.9%), and they have a neutral attitude towards the presence of living things in green spaces (18.1 - 20.2%). On the other hand, only a small number of participants are neutral/undecided about the relationship and balance between living things and humans (7.4 - 5.3%). The unequal scores on questions regarding the same range of attitudes demonstrate that behind them, there is fragmented knowledge that cannot generate a coherent value system or firm reactions and citizen involvement in decision-making on green spaces. Training in urban ecology and biodiversity is insufficient at the high school and university level and thus including it in some form (e.g. microcredits) might be something worth considering. Going forward, a better ecological education coupled with a higher degree of involvement from the interested factors and more efficient local authorities might be crucial for the success of "greening" projects in cities.

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