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Research Article

Evaluation of environmental education effects on urban environmental justice (Case study: Amol city)

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Abstract

This study examines the role of urban environmental education in achieving environmental justice in the city of Amol. Environmental education, as a key tool, can raise public awareness and empower citizens to address challenges such as air pollution, the reduction of green spaces, and waste management. Enhancing citizens' knowledge and participation in environmental issues leads to more informed decision-making and makes it possible to realize environmental justice, which means equal access for all people to a healthy environment.This applied research collected data through library and field methods. The statistical population included the residents of Amol (271,269 people), and sampling was conducted randomly using the Cochran formula with a sample size of 384 individuals. Information was analyzed using questionnaires and statistical tests (Pearson correlation and stepwise regression) in SPSS software. The variable of environmental education was categorized into four main dimensions (socio-cultural, environmental, institutional, and economic) and 36 indicators.The results showed that the relationship between these variables and environmental justice is significant and positive; in other words, the more attention is paid to these variables, the better the status of environmental education and environmental justice becomes. In the regression analysis, the socio-cultural dimension had the greatest impact, while the institutional dimension had the least effect in explaining changes. Altogether, the combination of these variables accounted for the entire variance of the dependent variable (environmental justice). These findings can serve as a scientific basis for urban planning, environmental education, and the development of policies aligned with sustainable development. Moreover, the model proposed in this study can be applied in other cities and help increase public participation in environmental protection and the promotion of environmental justice.

Keywords: Environment, Urban environmental education, Amol city, Environmental justice, Pearson correlation.

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Introduction

In recent years, human activities have raised serious concerns and attracted the attention of many researchers. Urban development and growth have been accompanied by significant environmental costs and consequences, leading to further environmental degradation (Agboola, 2019). Policies related to solving environmental problems have become one of the main priorities of political systems worldwide. Each country, based on its goals and understanding of these challenges, has developed principles and frameworks for environmental protection and achieving environmental justice. The importance of environmental issues has also become a prominent topic in international courts (Harrison, 2016). World Bank data shows that the human population continues to increase in the 21st century, exacerbating global environmental problems (Yalmanci and Gozum, 2019). Population growth and environmental damage are threats that endanger the balance of nature and the life of living organisms (Alagoz and Akman, 2016). The world has long been striving to address these challenges (Ergin, 2019). Rapid population growth, industrialization, increased demand, and globalization should be part of the solution rather than the causes of problems (Negev et al, 2009). Biodiversity loss, deforestation, food supply issues, air pollution, and global climate change are issues directly or indirectly related to the environment and are rapidly expanding (Ergin, 2019). Addressing these issues is essential as they have negative effects on the health of living beings (Haines et al, 2006). International environmental laws aimed at preventing excessive exploitation of natural resources hold special importance (Stallworthy, 2013). In today's world, literacy is considered one of the essential life skills. The level of literacy affects individuals' ways of living and their social, economic, and political participation. Today literacy does not merely mean having a lot of information; rather it is more important to have the ability to find necessary information (Mashahiri, 2014). Environmental education is a process that enables individuals to identify environmental issues and take action to solve them. This education fosters a deeper understanding of environmental issues and provides necessary skills for informed decision-making (Nouri, 2017). Given that some people in society are unaware of their rights, it is necessary to raise awareness so they become informed about their rights. Environmental education holds that humans can live in harmony with nature by making informed decisions that consider future generations a goal that should be emphasized in environmental education (Mir Sanjari, 2011). Environmental education makes it possible for people to connect with nature even in urban areas and enhances their ability to reduce environmental problems. By participating in environmental education programs citizens will be able to create positive changes and play a more effective role in implementing future programs for improving the environment (Fanni, 2019). One of the crucial factors for taking informed action against environmental changes is acquiring sufficient knowledge about this phenomenon. Educating citizens and involving them in addressing environmental changes should aim to create a proactive society that responds appropriately to clarify related issues. This effort can help increase public awareness and inform individuals about the importance of preserving the environment. (Babaei et al, 2015). The environment significantly impacts relationships among people. To address global environmental challenges, UNESCO has proposed that by 2025, environmental education should be included as a core component in the curricula of all countries (UNESCO, 2021). This type of education can serve as an effective tool for improving individual and professional behaviors and play an important role in this regard (Earle and Leyva-de la Hiz, 2020). The goal of environmental education is to create an atmosphere that develops the attitudes, values, knowledge, and skills necessary for professional environmental actions, thereby increasing the sustainability of human interactions with nature over time (Mastrangelo et al, 2019). Human attitudes and behaviors towards nature are exacerbated by population growth in metropolitan areas and increasing demand for goods, leading to environmental degradation (Nasrnia et al, 2022). Environmental awareness affects various aspects of the environmental situation and requires scientific examination (Azadkhani and Pakzad, 2020). Environmental crises in Iran are considered one of the serious global challenges resulting from a lack of awareness and cultural

weakness in human-nature relationships; therefore, national and international efforts to strengthen the culture of environmental protection are essential (Arameshnia et al, 2021). Environmental education can significantly impact strengthening environmental culture and achieving sustainable development goals. Additionally, familiarity with the environment leads to personal growth and better adaptation to life. The right to a healthy environment is vital, highlighting the role of education in achieving human development (Zarabi et al, 2022). People's unawareness of their conditions and rights regarding the environment and health has led to environmental injustices in urban areas like Amol. Meanwhile, environmental education is considered one of the most important methods for raising awareness about climate change. The study area has unique natural, economic, and social conditions that pose challenges for planners. This city has a water-rich river called Haraz that shapes forested areas providing animal and plant diversity. Its proximity to the Caspian Sea and humid climate also offer advantages; however, people's close relationship with their surrounding nature often relies on traditional teachings that challenge environmental conservation efforts. By reviewing the existing literature, it becomes clear that environmental education and environmental justicehave mostly been studied separately, and so far, the impact of education on environmental justice has not been assessed. Most of the research on environmental education has focused on student populations and has concluded that if environmental education is properly implemented in schools, it can be effective. Therefore, in this study, innovation has been achieved by selecting a statistical population that includes all residents of the city and by emphasizing environmental justice. Moreover, examining the impact of urban environmental education on environmental justice for the citizens of Amol also constitutes a novel contribution.

Materials and Methods

Study Area

Amol is one of the central cities in Mazandaran Province, bordered to the north by Mahmoudabad, to the east by Babol, to the south by Damavand and Tehran, and to the west by Noor. The center of this county is the city of Amol. Its area is 3,074.4 square kilometers, accounting for approximately 12.40% of the total area of the province. The population of this county is 370,774 people (with Amol city having a population of 271,269) and it comprises six cities: Amol, Rineh, Gozank, Daboudasht, Babakan, and Imamzadeh Abdullah; as well as five districts: Central, Larijan, Daboudasht, Dashtsar, and Imamzadeh Abdullah. The city of Amol is located in the Mazandaran plain next to the Haraz River at an elevation of 13 meters above sea level. It is approximately 14 kilometers west of Sari (the provincial capital), 78 kilometers south of the Caspian Sea, six kilometers north of the Alborz mountain range foothills, and about 784 kilometers northeast of Tehran.

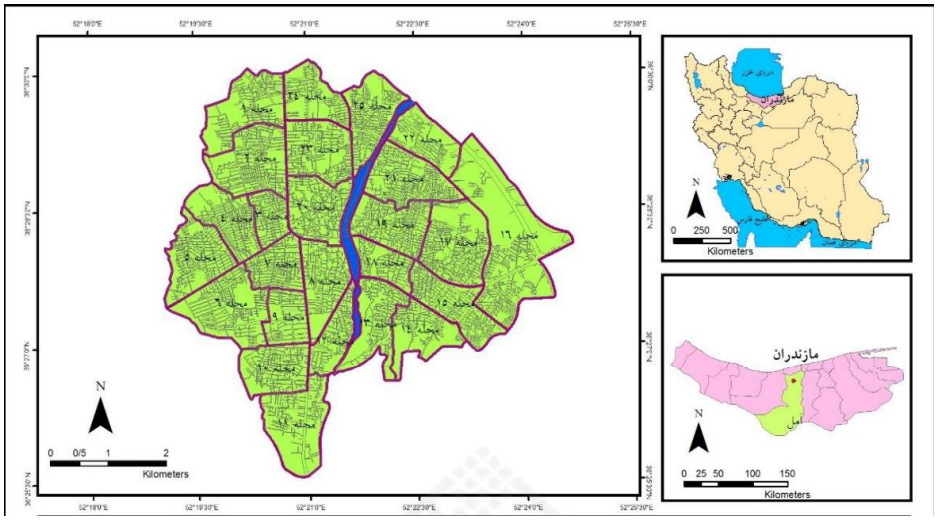

Fig. 1: Geographical location map of Amol city

Methods

This study is applied and practical in nature. It employs a descriptive-analytical research method. Data collection was conducted through library and documentary studies, while the findings were obtained through field investigations and questionnaires.The statistical population consists of the residents of the various districts of Amol city, which also constitutes the geographical scope of the study. According to the most recent census, the population of the city is reported to be 271,269. The sample size was determined using Cochran's sampling method with a 5% margin of error, resulting in a sample of 384 individuals.Given the nature of the research topic, an analytical and correlational approach was used to investigate, assess, and analyze the data, indicators, and research components. The data were gathered through statistical analysis of the questionnaire responses, and sampling was carried out using a random sampling method.To ensure the content validity of the questionnaire, after its design and formulation, feedback was solicited from professors, experts, and qualified urban specialists. The majority confirmed the appropriateness and clarity of the questionnaire items. To evaluate the reliability of the instrument, Cronbach's alpha was calculated, yielding a value of 0.919, indicating excellent internal consistency. This suggests that the questions are well-aligned with the research objectives and are capable of accurately measuring and addressing the research questions.For data analysis, stepwise regression analysis and the Pearson correlation coefficient were used within the SPSS software environment. The correlation coefficient is a statistical measure used to determine the type and strength of the relationship between two quantitative variables. The coefficient, which ranges from -1 to +1, indicates both the direction (positive or negative) and intensity of the relationship.From a statistical perspective, the term regression refers to the concept of a variable returning to an average value over time, meaning certain phenomena tend to stabilize around a mean. Regression analysis, therefore, is a statistical technique used to examine and model the relationships between variables.To operationalize the research, all relevant components were synthesized and categorized into four Variables**,** comprising a total of 36 indicators.

Table 1: Indicators of the impact of education on environmental justice

Index	Variables
1. The impact of education on attention to environmental culture at community levels.	
2. The effect of education on public support for renewable energy.	
3. The extent to which education influences citizens' awareness for achieving environmental justice.	
4. The impact of education on consideration for future generations' rights.	
5. The effect of education in strengthening private institutions related to environmental issues.	**Cultural and social**
6. The influence of education on sustainable use of environmental resources.	
7. Attention to equal participation rights in utilizing environmental facilities.	
8. The impact of education on cultural interaction between humans and living beings.	
9. The effect of education on conscious decision-making aimed at reducing waste production.	
1. Training on the use of green technology.	
2. Training on design and innovation in various environmentally friendly technologies.	
3. Training for optimal use aimed at producing less carbon.	
4. Training to attract financial and human investment in the environment.	
5. Training to prioritize ecological benefits over personal interests.	**Economic**
6. Attention to creating infrastructure related to environmental education in the city.	
7. The impact of environmental education on waste recycling for income generation.	
8. The impact of environmental education on the use of personal vehicles.	
9. Investment in environmental education events.	

1. The extent of the impact of educational strategies and solutions in the field of environment. 2. The impact of education on the level of biodiversity protection in the city. 3. The impact of education on reducing the use of materials that harm the environment. 4. The extent of education's impact on reducing air pollution creation. 5. The impact of education on reducing thermal pollution in the city. 6. The impact of education on reducing noise pollution in the city. 7. The impact of education on reducing water pollution in the city. 8. The impact of education on reducing soil pollution in the city. 9. The impact of education on urban waste production levels.	**Environmental**
1. The impact of education on making laws and regulations understandable for everyone. 2. The extent to which education affects the feasibility and implementation level of laws at the city level. 3. The extent to which sectors related to urban environmental education influence environmental protection. 4. The effect of practical training on people's attention to environmental protection. 5. The extent to which training influences community organizations' participation in decision-making processes. 6. Attention to all groups' and citizens' opinions regarding environmental justice. 7. To what extent does training create a right to peaceful protest for everyone 8. The effect of training on policy-making in urban planning. 9. Education fosters fair behavior and access to educational rights regardless of nationality or race.	**Institutional**

Results and Discussion

Regarding the relationship between the current status of Amol city and the mentioned indicators, as displayed in the table below, results from Pearson correlation tests indicate that since Sig = 0 (significance level), it shows that their relationship is significant, with a positive Pearson correlation coefficient indicating a direct relationship between them; meaning that as values for these indicators and components increase, so does the current condition of Amol city improve, and conversely, as these values decrease, so does Amol city's current condition. To better identify indicators related to environmental education with an emphasis on environmental justice, stepwise regression was used as a method for analysis; all components were computed, followed by multivariate stepwise regression analysis to examine relationships and impacts among these variables. In this multivariate stepwise regression method, four dimensions were entered into the equation as influencing factors: The first independent variable entered into the model was cultural and social dimension with a correlation coefficient value of 0.896.In stage two, when entering environmental dimension into model, its correlation coefficient increased by 0.956. In stage three, with institutional dimension entering into previous dimensions, its correlation coefficient increased by 0.981.In stage four, when economic dimension was added to previous dimensions, its correlation coefficient reached 1.000 indicating that these four criteria explain variance related to dependent variable. To analyze the study area, a question was designed for each indicator. Responses were based on a five-point Likert scale, including options such as very low, low, medium, high, and very high. Citizens answered the questionnaire accordingly, and the mean and standard deviation of the responses are presented in the table below.

Table 2: Pearson correlation of the effect of environmental education on environmental justice

The impact of environmental education on environmental justice		The impact of environmental education on environmental justice	Environmental dimension	Institutional dimension	Social and cultural dimension	Economic dimension
	Pearson correlation	1	0/613	0/593	0/896	0/880
	Sig. (2-tailed)		0/000	0/000	0/000	0/000
	Abundance	384	384	384	384	384

Table 3: Table of mean and standard deviation of data

Standard deviation	Average	Index	Dimensions	Standard deviation	Average	Index	Dimensions
1/158	3/82	The impact of education on making laws and regulations understandable for everyone.	Institutional	1/010	3/81	Training on the use of green technology.	Economic
1/143	3/74	The extent to which education affects the feasibility and implementation level of laws at the city level.		1/049	3/74	Training on design and innovation in various environmentally friendly technologies.	
0/978	4/04	The extent to which sectors related to urban environmental education influence environmental protection.		1/211	3/58	Training for optimal use aimed at producing less carbon.	
1/060	3/66	The effect of practical training on people's attention to environmental protection.		1/224	3/47	Training to prioritize ecological benefits over personal interests.	
1/136	3/57	The extent to which training influences community organizations' participation in decision-making processes.		0/999	3/63	Attention to creating infrastructure related to environmental education in the city.	
1/009	3/69	Attention to all groups' and citizens' opinions regarding environmental justice.		1/251	3/55	The impact of environmental education on the use of personal vehicles.	
1/070	3/64	Education creates the right to peaceful protest for everyone		1/086	3/72	Investment in environmental education events.	
1/121	3/47	The effect of training on policy-making in urban planning.		1/110	3/48	Training to attract financial and human investment in the environment	
1/272	3/48	Education fosters fair behavior and access to educational rights regardless of nationality or race.		1/232	3/48	The impact of education on reducing water pollution in the city.	

1/121	3/61	The impact of education on attention to environmental culture at community levels.		0/898	4/00	The extent of the impact of educational strategies and solutions in the field of environment.	
0/934	3/83	The effect of education on public support for renewable energy.		0/982	4/05	The impact of education on the level of biodiversity protection in the city.	
1/020	3/67	The extent to which education influences citizens' awareness for achieving environmental justice.		1/065	3/97	The impact of education on reducing the use of materials that harm the environment.	
1/141	3/73	The impact of education on consideration for future generations' rights.		1/112	3/54	The extent of education's impact on reducing air pollution creation.	
1/101	3/53	The effect of education in strengthening private institutions related to environmental issues.		1/222	3/31	The impact of education on reducing thermal pollution in the city.	
1/109	3/68	Attention to equal participation rights in utilizing environmental facilities.	Social and cultural	1/070	3/66	The impact of education on reducing noise pollution in the city.	Environmental
1/066	3/54	The influence of education on sustainable use of environmental resources		1/160	3/55	The impact of education on reducing water pollution in the city.	
1/112	3/82	The impact of education on cultural interaction between humans and living beings.		1/145	3/75	The impact of education on reducing soil pollution in the city.	
1/126	3/76	The effect of education on conscious decision-making aimed at reducing waste production.		1/128	3/77	The impact of education on urban waste .production levels.	

Examining the Relationship Between Dimensions and the Practical Model

In analyzing the relationship between the economic dimension and the practical model of the research, Pearson's correlation method was used. The results of Pearson's correlation test shown in the table below indicate that there is a positive relationship between the economic criterion and the practical model of research in Amol city. This means that as the correlation between the economic dimension and the practical model of research in Amol increases, it enhances the impact of urban environmental education on environmental justice.

Table 4: Examining the relationship between economic Variable Amol city

	Pearson correlation analysis	
Economic	Pearson Correlation	0/880
	Sig. (2-tailed)	0
	N	384

The results from Pearson's correlation test in analyzing the relationship between institutional dimensions and the practical model of research are shown in the table below. It indicates that there is a positive relationship between institutional dimensions and the practical model of research in Amol city. This relationship is significant and direct, meaning that as the correlation between institutional dimensions and the practical model of research in Amol increases, it enhances urban environmental education's impact on environmental justice.

Table 5: Examining the relationship between the institutional Variable in the city of Amol

	Pearson correlation analysis	
Institutional	Pearson Correlation	0/593
	Sig. (2-tailed)	0
	N	384

The results of the Pearson correlation test in the analysis of the relationship between the ecological environment and the applied model research in the table below show that the relationship between the biological environment and the applied model in the research of Amol city has a positive value. This relationship is significant and direct, in the sense that the higher the correlation between the environmental environment and applied model research in the city of Amol, the greater the impact of urban environmental education on environmental justice.

Table 6: Examining the relationship between the environmental Variable in the city of Amol

	Pearson correlation analysis	
Environmental	Pearson Correlation	0/613
	Sig. (2-tailed)	0
	N	384

The results from Pearson's correlation test analyzing social and cultural dimensions' relationship with the practical model of research are shown in the table below. It indicates that there is a positive relationship between social and cultural dimensions and this model in Amol city. This significant direct relationship means that as this correlation increases, it enhances urban environmental education's impact on environmental justice.

Table 7: Examining the relationship between the social and cultural Variable in the city of Amol

	Pearson correlation analysis	
Social and cultural	Pearson Correlation	0/896
	Sig. (2-tailed)	0
	N	384

To assess the impact of various components in the city of Amol, a stepwise multiple regression method was used. In this approach, dimension indices were combined, and four main dimensions were introduced into the equation as influential factors. In the first step, the social and cultural dimension was added to the model, with a correlation coefficient of 0.896. In the second step, the environmental dimension was added, increasing the

correlation coefficient to 0.956. In the third step, with the inclusion of the institutional dimension, the correlation coefficient rose to 0.981. In the fourth step, by adding the economic dimension to the previous ones, the correlation coefficient reached 1. This indicates that these four criteria fully explain the variance related to the dependent variable and play a key role in analyzing urban environmental education. A correlation coefficient of 1 suggests that combining these dimensions effectively covers all changes and differences in the dependent variable, highlighting their significant impact on improving and enhancing environmental education and justice in Amol city. Emphasizing their importance and influence on environmental education for environmental justice, these results can serve as a scientific basis for effective guidance in future planning and decisio Table 8. Stepwise regressionn-making.

Table 8: Stepwise regression

Later (environmental, institutional, cultural and social, economic)					
Standard error	Adjusted coefficient of determination	Coefficient of determination (R2)	Multiple correlation coefficient (R)	Variable entered at each stage	Next steps
0/25007	0/803	0/803	0/896	Social and cultural	Step one
0/16602	0/913	0/913	0/956	Social and cultural, environmental	Step two
0/11090	0/961	0/961	0/981	Social and cultural, environmental, institutional	Step Three
0/00000	1/000	1/000	1/000	Social and cultural, environmental, institutional, economic	Step Four

Examining the Relationship Between Dimensions and the Practical Model

In analyzing the relationship between the economic dimension and the practical model of the research, Pearson's correlation method was used. The results of Pearson's correlation test shown in the table below indicate that there is a positive relationship between the economic criterion and the practical model of research in Amol city. This means that as the correlation between the economic dimension and the practical model of research in Amol increases, it enhances the impact of urban environmental education on environmental justice. The results from Pearson's correlation test in analyzing the relationship between institutional dimensions and the practical model of research are shown in the table below. It indicates that there is a positive relationship between institutional dimensions and the practical model of research in Amol city. This relationship is significant and direct, meaning that as the correlation between institutional dimensions and the practical model of research in Amol increases, it enhances urban environmental education's impact on environmental justice. The results of the Pearson correlation test in the analysis of the relationship between the ecological environment and the applied model research in the table below show that the relationship between the biological environment and the applied model in the research of Amol city has a positive value. This relationship is significant and direct, in the sense that the higher the correlation between the environmental environment and applied model research in the city of Amol, the greater the impact of urban environmental education on environmental justice. The results from Pearson's correlation test analyzing social and cultural dimensions' relationship with the practical model of research are shown in the table below. It indicates that there is a positive relationship between social and cultural dimensions and this model in Amol city. This significant direct relationship means that as this correlation increases, it enhances urban environmental education's impact on environmental justice. To assess the impact of various components in the city of Amol, a stepwise multiple regression method was used. In this approach, dimension indices were combined, and four main dimensions were introduced into the equation as influential factors. In the first step, the social and cultural dimension was added to the model, with a correlation coefficient of 0.896. In the second step, the environmental dimension was added, increasing the correlation coefficient to 0.956. In the third step, with the inclusion of the institutional dimension, the correlation coefficient rose to 0.981. In the fourth step, by adding the economic dimension to the previous

ones, the correlation coefficient reached 1. This indicates that these four criteria fully explain the variance related to the dependent variable and play a key role in analyzing urban environmental education. A correlation coefficient of 1 suggests that combining these dimensions effectively covers all changes and differences in the dependent variable, highlighting their significant impact on improving and enhancing environmental education and justice in Amol city. Emphasizing their importance and influence on environmental education for environmental justice, these results can serve as a scientific basis for effective guidance in future planning and decision Table 8. Stepwise regressionn-making.

Conclusion

Urban environment refers to quality of life in cities and its positive and negative impacts on nature. This concept includes factors such as pollution, weather conditions, amenities, public health, urban attractions, and green spaces. Urban attractions are recognized as key factors in maintaining environmental quality. Environmental education can significantly enhance environmental culture and achieve sustainable development goals. Additionally, familiarity with nature leads to personal growth and better adaptation to life. The right to a healthy environment is vital and highlights education's role in achieving human development. After reviewing theoretical foundations and research background, it was found that there is no conflict between urban environmental education indicators/components and environmental justice; they are aligned towards improvement with potential for integration/overlap. No specific study has been conducted on this topic within this scope that combines urban environmental education components/indicators with those of an environmental justice approach using this method for enhancement.This study facilitates understanding content/logical connections among theoretical foundations/concepts related to subject/research background information by overlapping/combining all components into four dimensions categorized into 36 indices. Pearson's correlation coefficient/statistical analyses via SPSS software were used to examine relationships between dimensions/application model presented research in Amol city; results show significant relationships exist between economic/environmental/institutional/social-cultural dimensions/application model research Amol city. The correlation coefficient between them is positive and significant, indicating a direct relationship. The higher the correlation between the dimensions and the applied research model in the city of Amol, the more it enhances education and environmental justice. Stepwise regression revealed that among the dimensions affecting the combined and applied model of Amol, the institutional dimension has the least impact, while the social and cultural dimension has the most significant impact on the city. These results can assist policymakers and urban planners in focusing on influential dimensions to achieve substantial improvements in urban environmental education and justice. The findings of this study can also be used as an implementable model in other similar urban areas to aid in developing urban environmental education. Considering the identified dimensions and their impact on environmental justice, this model can serve as a guide for future decision-making in urban management, environment, and environmental education. Attention to these presented dimensions and making adjustments according to each region's specific characteristics can lead to policies aligned with sustainable development goals, natural resource conservation, and creating environmental justice. Moreover, these results can provide a strong scientific and practical basis for educating and promoting environmental concepts and justice in urban communities so that citizens actively participate in improving urban environments.

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