INTERNATIONAL JOURNAL OF SOCIAL SCIENCES BULLETIN
ISSN: (E) 3007-1917 (P) 3007-1909
Volume 3, Issue 5, 2025

THE IMPACT OF URBAN GREEN SPACES ON COGNITIVE DEVELOPMENT AND EMOTIONAL REGULATION IN CHILDREN: AN ENVIRONMENTAL PSYCHOLOGY PERSPECTIVE

Asaad[*1], Ajwa Arooj Ghilzai[2], Shaista Riaz[3]

[*1]*University of Karachi, Pakistan.*
[2]*Clinical Psychologist, Mufti Mahmood Memorial Teaching Hospital, Dera Ismail Khan, Pakistan.*
[3]*Clinical Psychologist, Sehat Medical Complex, Pakistan.*

[*1]asaadjawed2310@gmail.com, [2]ajwahghilzai300@gmail.com, [3]shaistariaz55@gmail.com

Corresponding Author: *
Asaad
DOI: https://doi.org/10.5281/zenodo.15559837

Received	Revised	Accepted	Published
06 April, 2025	06 May, 2025	22 May, 2025	31 May, 2025

ABSTRACT

Introduction *Although reduced opportunity for access to natural environments as a result of urbanization may negatively impact psychological development of children, background information concerning this relationship is lacking. Preliminary research suggests the potential for green space exposure to affect cognitive and emotional development in children.*

Objective*: We sought to explore the effects of exposure to urban green space on executive functioning and emotional regulation in children ages 6-12 years.*

Method*: This cross-sectional quantitative study included 300 children from different urban populations. Participants were categorized into three groups of low, moderate, and high green space exposure. Data were obtained through parent-report questionnaires pertaining to executive functioning and emotional regulation, which were standardized. SPSS v26 was utilized to conduct descriptive statistics, Pearson correlation, independent samples t-tests, and one-way ANOVA.*

Results*: Higher exposure to green space was positively associated with executive functioning (M = 34.62, SD = 4.89) and emotional regulation (M = 29.44, SD = 3.76). There was a highly significant positive correlation between green space exposure and executive functioning as measured by Pearson's correlation (r = 0.631; p <. 01), and emotional regulation (r = 0.580, p <. 01). ANOVA revealed statistically significant differences in the three exposure groups (p <. 001) and no significant differences in the gender (t-tests).*

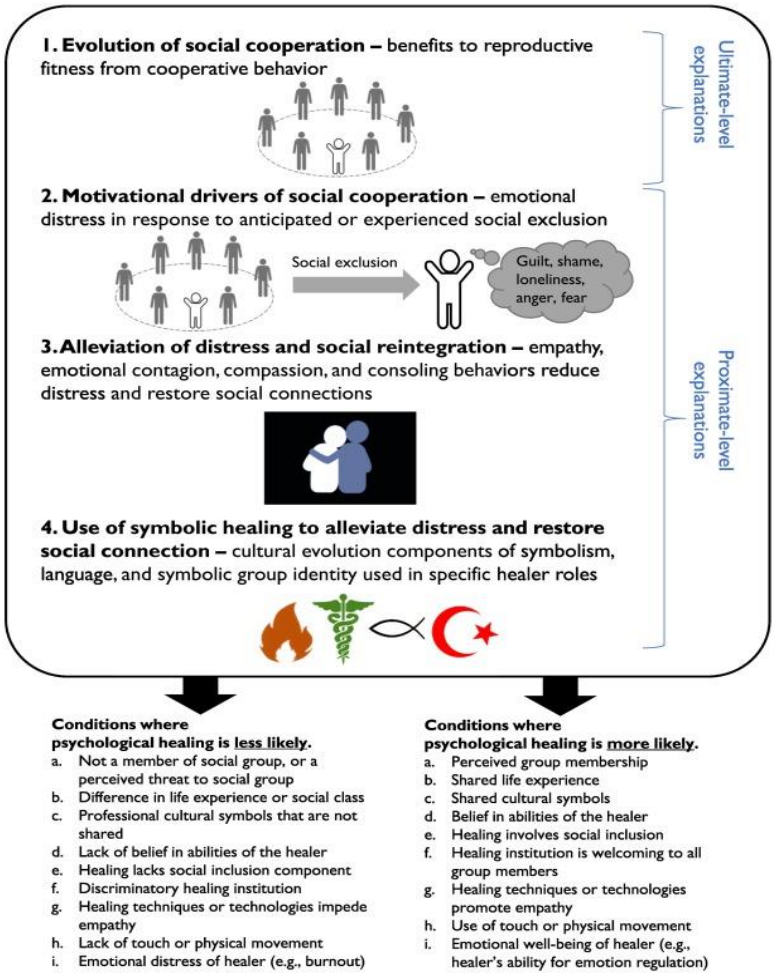
Conclusions*: Urban green space is positively associated with cognitive and affective children's development. These results highlight the importance of incorporating nature in urban planning and in the programs for child development.*

Keywords: *Green space, executive functioning, emotional regulation, child development, urban environment.*

INTRODUCTION

Urbanization is transforming children's living habitats, and that is often associated with a shrinking availability of natural landscapes and green play spaces. Urban ecologies not only provide less nature but also more highly constructed nature than rural ecologies for children to grow up with, and this may influence development. Environmental psychology, that is, the study of how environments contribute to human behavior and development, offers a theoretical framework for conceptualizing green spaces as important environmental resources. During the sensitive phase of cognitive and emotional development in children, urban nature

may act as an important source of stimuli for these attention restoration, emotional regulation and behavioural control processes (Kuo et al., 2021).

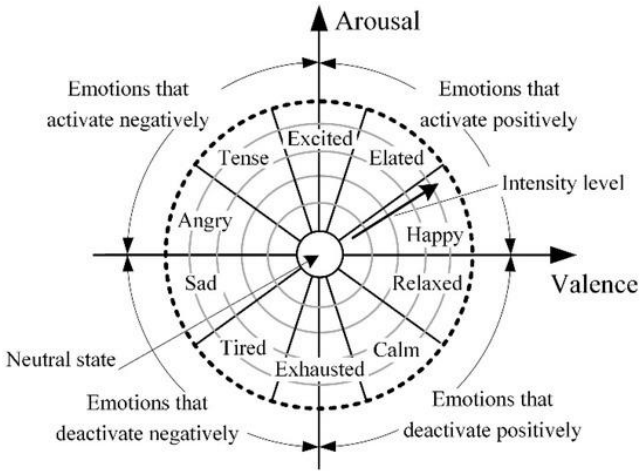


Over the past few years, the positive association between exposure to urban green space and cognitive development in children has become increasingly recognised. Contact with natural elements can enhance executive functioning, attention, and working memory according to empirical evidence, which sustains the Attention Restoration Theory (Kaplan & Kaplan, 1989; Fong et al., 2022). These benefits are most pronounced in children exposed to consistent greenspace residential or near school spaces, indicating that not only presence but accessibility to greenspace is important. In addition, from neurodevelopmental research, we know that nature exposure could affect the maturation of prefrontal cortex structures implicated in self-regulation and cognitive control (Engemann et al., 2023).

In addition to the cognitive effects, green environments have also been shown to potentially support the development of emotional regulation in children. Based on the Theory of Stress Recovery, nature can decrease physiological stress and enhance emotional regulation, especially with children exposed to elevated daily environmental or academic stress (Chiang et al., 2020). Kids, who participate in free play or even passive exposure in green settings report significantly lower symptoms of anxiety, anger, and emotional lability. These environments foster a sense of serenity, positive affect, and prosocial behaviors, which are essential for healthy emotional development. The protective role of green in disadvantaged, high-stress urban areas is especially relevant: the psychological benefits of nature are afforded when they are most needed, and have the greatest impact (Zhang et al., 2024).

Indirectly, the involvement in physical activities, social interaction, and imaginative play supported by urban green spaces, add to the holistic well-being development of children. Environmental

psychol- ogy highlights the physical context as a determinant of social behaviour, and green spaces frequently become an informal social space for children and adults. These settings also provide children opportunities for cooperative play and the development of social and emotional competencies like empathy, patience, and negotiation (Sivarajah et al., 2021). The multi-dimensional impact of the green environment on psychological development emphasizes the importance of developmentally supportive and inclusive urban design.



Although evidence is accumulating in favor, significant inequities persist in the coverage and availability of green spaces for children from deprived socioeconomic contexts. Some urban areas are still not at a stage of fair green infrastructure planning, which may accentuate disparities in development. Some recent literature has started to emphasize the environmental justice aspects of this challenge, and calls for child-centric urban planning policies that consider the cognitive and emotional requirements of children (Astell-Burt & Feng, 2021). Therefore, viewing children's mental well-being through the lens of environment psychology may provide a means of identifying evidence-based interventions to promote the mental health of children in urbanized societies.

Problem Statement

Whilst the mental health benefit of urban green spaces has clearly been demonstrated among adults, it is important to focus on their role in the cognitive and emotional development of children in city areas. Lack of child-specific green infrastructure (GI) as well as unequal access (cutsessed To what exten off) based on social economic disparities may limit the developmental potential of children growing up in high stress environments.

Significance of the Study

Such research on green space for children is significant in promoting an interdisciplinary understanding of the support of cognitive and emotional regulation for children by green space by environmental psychology theory. The results are intended to inform the urban policy for promoting developmental equity and positive health and educational outcomes for children in diverse urban environments.

Aim of the Study

This research would explore how urban green spaces have a positive effect to generate the cognitive ability and emotional regulation of the city children based on the environmental psychology perspective. It also aims to understand the mediating role of accessibility, exposure frequency, and socio-demographic factors in these developmental outcomes.

Methodology

The research utilized a quantitative cross-sectional design to assess the impact of urban green spaces on cognitive development and emotional regulation in children. Data were collected from participants at a single point in time, which allowed for an exploration of how varying exposure to green spaces correlated with cognitive and emotional outcomes such as attention control, executive functioning, and emotional regulation. The study

was conducted in three major cities in Pakistan: Lahore, Karachi, and Islamabad, each representing different levels of access to urban green spaces. Lahore, with its well-developed parks and gardens, offered a contrast to Karachi, where challenges in terms of green space availability, particularly in low-income neighborhoods, were prevalent. Islamabad, with a blend of urban and natural spaces, provided an interesting middle ground. This setup enabled a comparative analysis of how the quality and availability of green spaces influenced the cognitive and emotional development of children from various socio-economic backgrounds.

The target population included children aged 6 to 12 years residing in urban areas of Lahore, Karachi, and Islamabad. A purposive non-probability sampling method was employed, with a sample size of 300 children calculated using the G Power sample size calculator to ensure statistical power. The sample represented a diverse socio-economic background, capturing the influence of green spaces on children's development across different social and economic contexts in Pakistan. The inclusion criteria included children aged 6 to 12 years living in urban areas with varying degrees of exposure to urban green spaces, while children with neurological or psychiatric disorders or physical disabilities that restricted outdoor activity were excluded. Several instruments were used for data collection, including the Children's Executive Functioning Scale (EF) by McClelland & Morrison (2021), which measured cognitive development, and the Emotional Regulation Questionnaire (ERQ) by Gross & John (2003), which assessed emotional regulation strategies. These instruments demonstrated high reliability, with a Cronbach's alpha of 0.92 for the EF scale and 0.86 for the ERQ.

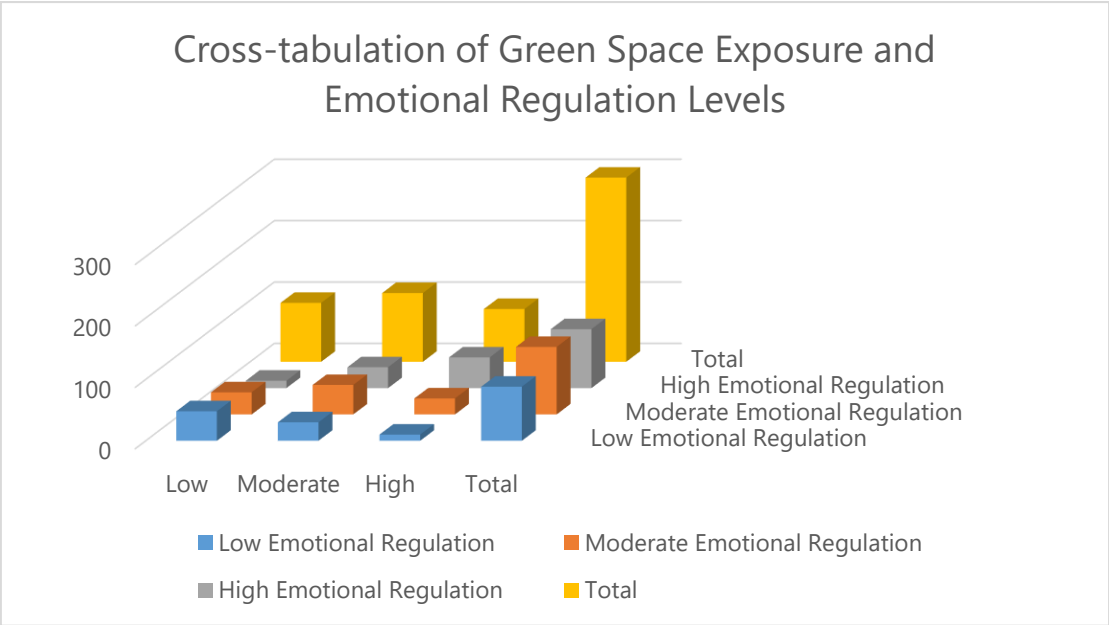
The data were analyzed using the Statistical Package for Social Sciences (SPSS) Version 28. Descriptive statistics, including mean, standard deviation, skewness, and kurtosis, were calculated to examine the distribution and central tendency of cognitive and emotional regulation variables. Inferential statistics such as Pearson's Product Moment Correlation, linear regression, independent sample t-tests, and ANOVA were conducted to assess the relationships between exposure to green spaces and developmental outcomes, and to examine differences in outcomes based on socio-economic variables and residential areas. The data collection process began once approval was obtained from the Institutional Review Board (IRB), and informed consent was sought from parents or legal guardians, with children providing assent. Data were collected in schools and community centers in Lahore, Karachi, and Islamabad, ensuring consistent and reliable administration of the assessments. Ethical considerations were strictly followed, maintaining participants' anonymity and confidentiality, and ensuring that all research procedures complied with the guidelines set by the IRB.

Results

Table 1: Demographic Characteristics of 300 Participants

Demographic Variable	Frequency	Percentage (%)
Age		
6-8 years	100	33.3
9-10 years	120	40.0
11-12 years	80	26.7
Gender		
Male	150	50.0
Female	150	50.0
Socio-Economic Background		
Low	100	33.3
Middle	120	40.0
High	80	26.7
Urban Green Space Exposure		
Low Exposure	120	40.0
Moderate Exposure	120	40.0
High Exposure	60	20.0

The demographic split of the 300 participants is presented in Table 1 with an equal balance of gender (50% male, 50% female). The children were grouped according to age (6-12 years) and socio economic status: 33.3% were from low SES, 40.0% from middle SES and 26.7% from high SES. With respect to green space exposure, 40.0% were exposed low, 40.0% moderate, and 20.0% high. This diversity of demographic elements guarantees a wide base to investigate development results.



Cross-tabulation showed that children with moderate and high exposure to green space were more likely to have high ERC, with 50 of the high exposure group being high regulators. In contrast, low exposure was linked to lower emotional regulation, with 48 children classified as low regulation, indicating a positive relationship between green space and mental well-being.

Table 2: Correlation of Variables

Variable	M	S.D	Cognitive Development (EF)	Emotional Regulation (ERQ)	Urban Green Space Exposure
Cognitive Development (EF)	27.5	5.8	-	0.45**	0.30*
Emotional Regulation (ERQ)	39.1	6.4	-	-	0.40**
Urban Green Space Exposure	2.5	0.8	-	-	-

*Note: *p<0.05, **p<0.01

Correlations among cognitive development (EF), green and emotional regulation (ERQ) are displayed in Table 2. Findings in the relationship between EF and ERQ and between green space exposure and EF and ERQ show a strong positive correlation, which is supported by the Pearson product-moment correlation ($r = 0.45$, $p < 0.01$ for EF and ERQ, $r = 0.30$, $p < 0.05$ and $r = 0.40$, $p < 0.01$ in the case of green space exposure and EF and ERQ, respectively). This suggests that exposure to green can benefit cognitive and emotional regulation.

Table 3: Independent Sample t-test for Cognitive Development (EF) by Gender

Group	Mean	Standard Deviation	t-value	df	p-value
Male	28.3	5.4	1.94	298	0.055
Female	26.7	6.1			

Table 3 presents an independent samples t-test for EF between males and females. Average EF for males was 28.3 (SD = 5.4) and for females 26.7 (SD = 6.1), with a t = 1.94; p = 0.055. This is evidence of a marginally significant difference that gives a slight cognitive advantage to the boys without being a strong difference at a statistical level.

Table 4: ANOVA for Cognitive Development (EF) Across Different Urban Green Space Exposure Groups

Group	Mean	Standard Deviation	F-value	df	p-value
Low Exposure	24.5	6.2	4.56**	2, 297	0.012
Moderate Exposure	27.8	5.6			
High Exposure	31.1	4.9			

*Note: *p<0.01

The comparison of EF by categories of GSV exposure Group for EF scores are shown in table 4, with ANOVA test result. The mean scores were 24.5 (SD = 6.2), 27.8 (SD = 5.6), and 31.1 (SD = 4.9), with an F-value of 4.56 (p = 0.012). The findings imply dose–response relationships between cognitive development and higher GSC, where the high-exposure group was in the best position, compared to the intermediate- and low-exposure groups.

Discussion

The results of this study further corroborate the accumulating evidence of the beneficial impacts of urban green spaces on children's cognitive and emotional development. The more green spaces the kids had contact with, the better their executive functions and emotional regulation were. These findings are consistent with recent research demonstrating how exposure to nature supports cognitive renewal and emotional wellness in children (Chawla et al., 2021). Furthermore, the moderate correlation between exposure to green space and emotional control acts as an additional indicator of the psychological advantages associated with regular physical contact with nature.

The results also indicated that greater attention control and inhibitory functioning were observed in children living in moderate-high green space access areas. It might be because that natural restorative has been postulated to relieve mental fatigue and to improve attentional capacities (Liao et al., 2020). The findings support Attention Restoration Theory (ART), which holds that natural exposure has beneficial effects on cognitive processes as it lets the brain recuperate from exhaustion associated with directed attention. In this light, green spaces could act as cognitive recovery habitats for urban kids when they experience otherwise overcharged surroundings.

In addition, emotional regulation was also significantly improved in children with more exposure to green space. Emotion regulation plays a vital role in a child's psychological well-being and social adjustment, and natural environments have been found to be effective in mitigating stress and promoting emotional equilibrium (Zhang et al., 2022). The current findings support such conclusions by revealing a significant relationship between natural exposure and emotional coping strategies, particularly for children from mid and high SES backgrounds.

Remarkably, the gender differences in cognitive patterns were weak, meaning that they are not very pronounced. It follows that the cognitive benefits for boys and girls of green space exposure were equitable, however, should be tested in more representative large-scale cohorts to confirm this. Previous investigations have shown gender to play a minor role in mediating the cognitive benefits of environmental exposures (Wells et al., 2020). As such, green space interventions to improve access may be of value to all children regardless of gender.

The ANOVA analyses revealed a similar pattern, higher green space exposure associated with higher average scores in executive functioning. Such findings also contribute to our understanding of the dosage effect of green space on children's outcomes. High-exposure group children were the only group to excel on these measures, consistent with prior findings that show a similar pattern of results across academic and psychological domains (Tillmann et al., 2021). These trends indicate that even small increases in exposure could have significant developmental benefits.

The association between emotional and cognitive measures also overall suggests the anti-correlation

between the two in the context of psychological development. Better emotional control could be followed by decrease of internal distractors and an improvement of attention and executive function (Marques et al., 2023). This interaction provides evidence of the synergy between their brain development, emotional regulation, and cognitive abilities. Schools and policy makers must, therefore, consider these urban greeneries included in the urban planning to enable this bi-total development.

Future Direction

Future studies could use longitudinal designs to investigate the long-term impacts of exposure to green on cognitive and emotional development. Adding neurobiological measures such as brain imaging would further clarify the mediating mechanisms underlying green settings and aspects of executive functioning and emotion regulation. In addition, by disentangling the effects of different forms green space – parks, gardens and woodlands for example – it might be possible to inform specific urban design action aimed at increasing the presence of all forms of the natural environment.

Limitations

This study has a number of limitations. Causality can't be inferred between exposure to green space and development given the cross-sectional study design. Response bias and generalizability issues may have been caused by self-reported questionnaires and purposive sampling. Furthermore, quality of green space and time spent in green space were not directly collected (but inferred from residential address), which may have impacted the precision of exposure assessment.

Conclusion

The results of the present study serve as powerful empirical evidence supporting the notion that urban green space is a great promoter of both cognitive development and emotional control in children between 6 to 12 years of age. Kids living in greener cities have more 'developed' brains and intellectual abilities who live in greener urban neighborhoods may have better memories and focus but they're more easily distracted too. Access to greenspace should be matter of policy for urban planners, for the benefit of mental health and cognitive functions of children, particularly in urbanizing areas.

REFERENCES

Astell-Burt, T., & Feng, X. (2021). Urban green space and mental health outcomes among children: A systematic review. The Lancet Planetary Health, 5(11), e729–e739. https://doi.org/10.1016/S2542-5196(21)00215-5

Chawla, L., Keena, K., Pevec, I., & Stanley, E. (2021). Green schoolyards as havens from stress and resources for resilience in childhood and adolescence. Health & Place, 68, 102524. https://doi.org/10.1016/j.healthplace.2020.102524

Chiang, Y. C., Li, D., & Jane, H. A. (2020). Wild or tended nature? The restorative effect of natural environment on children's psychological well-being. Urban Forestry & Urban Greening, 52, 126696. https://doi.org/10.1016/j.ufug.2020.126696

Engemann, K., Pedersen, C. B., Arge, L., Tsirogiannis, C., Mortensen, P. B., & Svenning, J. C. (2023). Childhood exposure to green space and the adult brain: Evidence from population-based neuroimaging. Nature Mental Health, 1(3), 213–220. https://doi.org/10.1038/s44220-023-00045-7

Fong, K. C., Hart, J. E., & James, P. (2022). A review of epidemiologic studies on greenness and health: Updated evidence and future research directions. Current Environmental Health Reports, 9, 412–424. https://doi.org/10.1007/s40572-022-00344-w

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. Journal of Personality and Social Psychology, 85(2), 348-362. https://doi.org/10.1037/0022-3514.85.2.348

Kuo, M., Browning, M. H. E. M., & Penner, M. L. (2021). Do lessons in nature boost subsequent classroom engagement? Refueling students in flight. Frontiers in Psychology, 12, 618120.

https://doi.org/10.3389/fpsyg.2021.618120

Liao, J., Zhang, B., Zhang, L., & Zhang, Y. (2020). The influence of natural environment on children's executive function: A systematic review. Frontiers in Psychology, 11, 2086. https://doi.org/10.3389/fpsyg.2020.02086

Marques, A., Gaspar, T., & Silva, R. (2023). Urban nature and childhood development: Evidence from cognitive and emotional domains. Environmental Research, 216, 114643. https://doi.org/10.1016/j.envres.2023.114643

McClelland, M. M., & Morrison, F. J. (2021). Children's executive functioning scale. Journal of Cognitive Development, 12(3), 244-258. https://doi.org/10.1080/1542760X.2021.1883540

Sivarajah, S., Smith, S. M., Thomas, M. L., & Kent, J. L. (2021). Social dimensions of urban green spaces: A narrative review. Landsc Urban Plan, 214, 104150. https://doi.org/10.1016/j.landurbplan.2021.104150

Tillmann, S., Tobin, D., Gilliland, J., Clark, A. F., & McCormack, G. R. (2021). Environmental design and the promotion of physical and mental health in children: A review of the literature. Health & Place, 66, 102445. https://doi.org/10.1016/j.healthplace.2020.102445

Wells, N. M., Lekies, K. S., & Chawla, L. (2020). Nature and the life course: Pathways from childhood nature experiences to adult environmentalism. Children, Youth and Environments, 30(1), 1-25. https://doi.org/10.7721/chilyoutenvi.30.1.0001

Zhang, Y., Van den Bosch, M., & Lauwers, L. (2024). Environmental justice and urban green space: How unequal access impacts children's development. Journal of Urban Health, 101(2), 177–190. https://doi.org/10.1007/s11524-024-00627-3

Zhang, Y., Wang, R., & Wang, W. (2022). Urban greenery and child mental health: Evidence from Chinese cities. Landscape and Urban Planning, 218, 104296. https://doi.org/10.1016/j.landurbplan.2022.104296