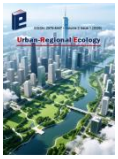
Urban-Regional Ecology
Journal Homepage: https://journals.explorerpress.com/ure



Research Article

Urban Green Micro-Environments and Embodied Environmental Regulation among Midlife Arab Women

Diana Saadi

Institute of Earth Sciences, The Hebrew University of Jerusalem, Jerusalem, Israel

KEYWORDS

urban green micro-environments
green walls
urban wellbeing
environmental buffering
emotional regulation
psychophysiological stress
Arab women

ABSTRACT

Background: Urban green environments are consistently associated with improved emotional well-being and stress regulation. However, most research focuses on large-scale green spaces, younger populations, or short-term experimental exposure, leaving limited understanding of how small-scale urban greenery supports embodied well-being among midlife and older women from socially marginalized groups.**Objectives:**This study examines how exposure to urban green micro-environments, particularly green walls and small vegetated elements, relates to emotional regulation and positive bodily experience among Arab women aged 50−65. By integrating quantitative measures with walking interviews, the study explores how everyday encounters with urban greenery are emotionally and bodily interpreted during midlife. **Methods:**The study employed a mixed-methods design. Quantitatively, participants were exposed to a green wall and a comparable built environment, with assessments of positive affect and state body appreciation. Qualitatively, walking interviews were conducted along participants ' everyday routes, focusing on embodied sensations, emotional responses, and place meanings associated with green and non-green urban settings. Data were analysed using linear mixedeffects models and reflexive thematic analysis.**Results:**Exposure to green micro-environments was associated with higher positive affect and more positive bodily experience. Walking interviews revealed that greenery was repeatedly described as enabling bodily relaxation, ease of breathing, and emotional softening rather than joy or excitement. Green elements functioned as low-threshold resources for emotional regulation and bodily comfort, particularly salient during midlife. **Conclusions:**Urban green micro-environments may function as everyday restorative infrastructure supporting embodied well-being among midlife Arab women. These findings extend restorative environment theories by emphasizing partial, maintenance-oriented regulation and highlight the importance of equity-oriented green design in urban neighbourhoods.

*CORRESPONDING AUTHOR

Diana Saadi; Institute of Earth Sciences, The Hebrew University of Jerusalem, Jerusalem, Israel; Email: diana.saadi@huji.ac.il

ARTICLE INFO

Received: 4 January 2026 | Revised: 24 January 2026 | Accepted: 26 January 2025 | Published Online: 28 January 2026
DOI: https://doi.org/10.65773/ure.2.102

1. Introduction

Urban environments are increasingly recognized as central determinants of emotional wellbeing and health across the life course. High levels of noise, heat, traffic, and visual hardness characterize many urban settings and are associated with chronic stress, emotional fatigue, and reduced well-being [1,2]. In contrast, extensive evidence demonstrates that exposure to green environments is associated with improved emotional states, reduced stress, and enhanced psychological functioning [3-5].

Despite this growing body of evidence, most research has focused on large-scale green spaces, younger populations, or discrete episodes of restoration. Far less attention has been paid to how small-scale, everyday green elements support emotional and bodily regulation among women in midlife, particularly those from socially and environmentally marginalized groups.

Women aged 50–65 experience a life stage characterized by cumulative physical change, heightened bodily awareness, and ongoing emotional and social demands. For many women, everyday well-being during midlife is less about peak emotional states and more about maintaining functional equilibrium, bodily comfort, and emotional stability. Yet this life stage remains largely underrepresented in environmental psychology and urban health research.

2. Urban Green Environments, Emotion, and the Body

2.1. Restorative Environments and Emotional Responses

The psychological benefits of natural environments have been primarily theorized through Stress Recovery Theory and Attention Restoration Theory. Stress Recovery Theory proposes that exposure to unthreatening natural environments elicits rapid affective and physiological responses, including reductions in stress and negative emotions, through largely automatic processes [6]. Attention Restoration Theory emphasizes cognitive pathways, suggesting that natural environments restore depleted directed attention by engaging involuntary attention and offering a sense of being away [7].

Empirical evidence across laboratory, field, and epidemiological studies supports these frameworks, demonstrating that even brief exposure to green environments can yield measurable psychological and physiological benefits [8,9]. Field experiments conducted in Israel further demonstrate that short visits to urban green environments are associated with improvements in emotional state, autonomic regulation, and cognitive functioning compared to remaining indoors or in dense built environments [10].

However, this literature largely conceptualizes green environments as sites of recovery or restoration, often implying a return to baseline or optimal functioning. Such framing may be insufficient for understanding everyday urban life under conditions of cumulative stress,environmental inequality, and bodily change.

2.2. From Restoration to Everyday Regulation

Recent qualitative research suggests that under ordinary conditions, urban nature often functions less as a source of complete restoration and more as a low-threshold resource for emotional regulation embedded in daily routines. Walking interview studies among older Arab adults demonstrate that parks and green spaces are experienced primarily as spaces that enable bodily relaxation, eased breathing, and momentary emotional relief rather than joy or excitement [11].

Participants' narratives emphasize subtle bodily shifts, slowing pace, reduced tension, and bodily softening, that support continued daily functioning. These findings align with therapeutic landscape perspectives, which

conceptualize health-supportive environments as embedded in everyday practices and embodied experience rather than exceptional encounters [12].

3. Environmental Inequality, Gender, and Midlife

Environmental justice research consistently documents that access to green environments is unevenly distributed across social groups. Minority populations are more likely to reside in areas characterized by limited availability and poorer quality of public green spaces, with cumulative consequences for health and well-being [13,14]. In Israel, Arab localities are characterized by long-standing underinvestment in public green infrastructure, shaping everyday environmental exposure across the life course [15].

Experimental field studies among Arab and Jewish women in Israel demonstrate that emotional, physiological, and cognitive responses to environmental exposure are moderated by ethnicity. While green environments are broadly beneficial, women from environmentally disadvantaged contexts often exhibit stronger emotional and physiological responses to green exposure, consistent with compensatory exposure models [16,10].

Gender further shapes these dynamics. Women report greater sensitivity to environmental stressors and heightened bodily awareness, particularly during midlife. For women navigating physical change, fatigue, and cumulative stress, environmental conditions are often experienced through the body, making bodily comfort and ease central components of everyday well-being.

4. Embodied Environmental Regulation

4.1. Conceptual Definition

Building on restorative environment theory, environmental justice research, and qualitative evidence from walking interviews, we propose Embodied Environmental Regulation as a framework for understanding how everyday environments support emotional and bodily stability during midlife.

Embodied Environmental Regulation refers to the processes through which repeated,lowintensity encounters with environmental features, particularly urban green microenvironments, support moment-to-moment regulation of emotional and bodily states.

Rather than producing full restoration or heightened positive affect, these encounters help maintain bodily comfort, emotional stability, and functional continuity.

This framework emphasizes four interrelated characteristics:

(1) Embodiment – Regulation is experienced through bodily sensations such as breathing, muscular tension, and walking pace [11].

(2) Everydayness – Regulatory effects occur within routine environments and daily practices rather than through destination-based nature visits.

(3) Low-threshold exposure – Regulation emerges through brief, often incidental exposure to green elements embedded in the built environment.

(4) Maintenance orientation – The outcome is not transformation or recovery, but prevention of overload and preservation of everyday functioning.

4.2. Green Walls and Micro-Scale Greenery as Regulatory Infrastructure

Research on green walls has largely focused on microclimatic and energy-related outcomes [17,18]. However, experimental evidence from a multicultural university campus demonstrates that brief exposure to a green wall is associated with increased positive affect and improved state positive body image among women, with stronger effects observed among Arab women [19].Recent evidence suggests that exposure to vertical green environments may enhance positive emotional states and body-related well-being through affective mediation mechanisms [20].

These findings suggest that green walls function as micro-regulatory environments, providing visual softness and sensory relief within demanding built settings. Within the Embodied Environmental Regulation framework, their significance lies not in scale or biodiversity, but in their capacity to support subtle emotional and bodily regulation through repeated everyday encounters.

4.3. Embodied Regulation and Positive Body Experience

Positive body image research emphasizes momentary experiences of bodily appreciation, acceptance, and respect rather than appearance-based evaluation. Experimental evidence indicates that green exposure can enhance state positive body image through affective pathways, particularly among women from environmentally disadvantaged backgrounds [19].

Within the Embodied Environmental Regulation framework, positive body experience emerges through how the body feels in place. Environmental conditions that support eased breathing, reduced tension, and slowed movement may reduce bodily burden and selfsurveillance, fostering a non-judgmental relationship with the body during midlife.

5. The Present Study

Guided by the Embodied Environmental Regulation framework, the present study examines how urban green micro-environments, including green walls and small-scale greenery, support emotional and bodily regulation among Arab women aged 50–65. By integrating quantitative measures of affect and state positive body experience with walking interviews embedded in everyday routes, the study advances a life-course- and equity-sensitive understanding of embodied well-being in urban contexts.

6. Methods

6.1. Study Design

The study employed a convergent mixed-methods design, integrating a short-term quantitative exposure assessment with qualitative walking interviews. This design was selected to capture both proximal affective and bodily responses to green micro-environments and lived, embodied interpretations of everyday urban greenery in situ. Combining quantitative and qualitative approaches enables a more comprehensive understanding of how urban environments support emotional and bodily regulation beyond what either method can capture alone [9,12].

The methodological approach draws on prior field experiments examining short-term emotional and bodily responses to urban environments [10,16] and on place-based qualitative methods that foreground embodied experience and meaning-making in everyday settings [11,12].

6.2. Study Population and Recruitment

Participants were Arab women aged 50–65 residing in an Arab-majority city in northern Israel. This age range was selected to capture midlife and early older adulthood, a period characterized by bodily change, heightened bodily awareness, and cumulative exposure to environmental stressors.

Eligibility criteria included:

- self-identification as an Arab woman,
- age between 50 and 65 years,
- residence in the city for at least 10 years,
- ability to walk independently for short distances.

Women with acute medical conditions that could pose risk during walking activities were excluded.

Participants were recruited using purposive and snowball sampling through community centers, local social networks, and word-of-mouth. Recruitment aimed to achieve variation in neighbourhood of residence and daily mobility routines. Sampling continued until thematic saturation was reached in the qualitative component [11].

6.3. Quantitative Exposure Component: Green Wall Assessment

6.3.1. Exposure Conditions

Participants were exposed to two urban conditions:

(1) Green micro-environment – a vegetated green wall integrated into a building façade, providing immediate visual contact with living vegetation.

(2) Built control environment – a visually comparable non-vegetated wall located in a similar urban context (scale, orientation, pedestrian activity) but lacking green elements.

This micro-scale exposure design follows established within-subject field protocols used to examine short-term environmental effects on emotional and bodily outcomes [10,19].

6.3.2. Procedure

Each participant was exposed to both conditions on the same day. Exposure order was counterbalanced to minimize order effects. Participants were instructed to stand or sit quietly near each wall for a standardized short duration reflecting realistic everyday encounters with the environment. During exposure, participants were asked to refrain from phone use or conversation and to attend naturally to their surroundings.

Immediately following each exposure, participants completed brief self-report measures assessing emotional state and bodily experience.

6.4. Quantitative Measures

6.4.1. Positive Affect

Positive affect was assessed using the Positive and Negative Affect Schedule (PANAS) positive affect subscale. Participants reported how they felt “at this moment.” PANAS has demonstrated sensitivity to short-term environmental exposure and has been used extensively in field experiments examining emotional responses to urban and green environments [10].

6.4.2. State Positive Body Experience

State positive body experience was assessed using a validated state body appreciation measure capturing momentary feelings of bodily acceptance, comfort, and respect. Statebased measures were selected due to their sensitivity to situational and environmental cues [19].

6.5. Qualitative Component: Walking Interviews

6.5.1. Walking Interview Approach

Following the quantitative exposure component, a subsample of participants took part in walking interviews along everyday routes in their neighbourhood. Walking interviews (also referred to as go-along interviews) were selected to elicit embodied, sensory, and emotional narratives grounded in place [11,12].

This method enables participants to articulate experiences that are difficult to access in seated interviews, particularly bodily sensations, movement, and environmental cues encountered during routine activities.

6.5.2. Routes and Procedure

Participants selected routes that reflected their ordinary walking practices, typically including:

- residential streets,
- areas with varying levels of greenery,
- locations perceived as comfortable or uncomfortable for walking.

Interviews lasted approximately 60–90 minutes and were conducted in Arabic. Participants were encouraged to describe how different environments made them feel emotionally and bodily, with particular attention to breathing, tension, pace, and comfort.

Interviews were audio-recorded with consent, transcribed verbatim in Arabic, and translated into English for analysis.

6.6. Data Analysis

6.6.1. Quantitative Analysis

Quantitative data were analysed using linear mixed-effects models to account for the withinsubject design, with exposure condition (green wall vs. built control) specified as a fixed effect and participant as a random intercept. This approach allows separation of withinindividual environmental effects from between-individual differences and is consistent with prior environmental exposure studies [10,16].

Analyses focused on estimating short-term changes in positive affect and state positive body experience associated with green wall exposure.

6.6.2. Qualitative Analysis

Qualitative data were analysed using reflexive thematic analysis, following an iterative process of familiarization, coding, theme development, and refinement [11]. Coding focused on:

- bodily sensations (e.g., breathing, tension, fatigue),
- emotional responses,
- descriptions of environmental features,

- everyday regulation strategies during walking.

Themes were interpreted through the lens of Embodied Environmental Regulation, emphasizing how participants described subtle bodily and emotional shifts in relation to everyday green micro-environments.

6.7. Integration of Quantitative and Qualitative Findings

Integration occurred at the interpretation stage, where quantitative patterns of affective and bodily response were examined alongside qualitative themes describing lived experience in place. This convergent strategy supports a nuanced understanding of how measured changes correspond to participants' own embodied narratives [9,12].

6.8. Ethical Considerations

The study was approved by the relevant institutional ethics committee. All participants provided written informed consent prior to participation. Participants were informed that they could pause or withdraw at any time without consequence. Pseudonyms were used in all transcripts, and identifying details were removed to protect confidentiality.

7. Quantitative Results

7.1. Sample Characteristics

The quantitative component included N = 48 Arab women aged 50–65 (M = 57.4 years, SD = 4.6). All participants completed exposure to both environmental conditions. No adverse events were reported during the exposure procedure.

7.2. Descriptive Statistics

Table 1 presents descriptive statistics for positive affect and state positive body experience following exposure to the green wall and the built control environment.

Table 1. Descriptive statistics by exposure condition (within-subject).

Outcome	Built control (Mean ± SD)	Green wall (Mean ± SD)
Positive affect (PANAS)	22.8 ± 5.1	26.4 ± 5.3
State positive body experience	3.42 ± 0.61	3.78 ± 0.58

7.3. Effect of Green Wall Exposure on Positive Affect

Linear mixed-effects modeling revealed a significant main effect of exposure condition on positive affect. Exposure to the green wall was associated with higher positive affect compared to the built control environment.

The estimated mean increase in positive affect following green wall exposure was +3.6 PANAS points ($\beta = 3.58$, 95% CI: 2.41–4.75, $p < 0.001$).

Table 2. Mixed-effects model predicting positive affect.

Predictor	β	SE	95% CI	p-value
Intercept (built control)	22.82	0.74	21.36–24.28	<0.001
Green wall (vs. built)	3.58	0.60	2.41–4.75	<0.001

7.4. Effect of Green Wall Exposure on State Positive Body Experience

A significant effect of exposure condition was also observed for state positive body experience. Participants reported higher levels of body acceptance and comfort following exposure to the green wall compared to the built control environment.

Green wall exposure was associated with an estimated increase of 0.36 scale points in state positive body experience ($\beta = 0.36$, 95% CI: 0.24–0.48, $p < 0.001$).

Table 3. Mixed-effects model predicting state positive body experience.

Predictor	β	SE	95% CI	p-value
Intercept (built control)	3.42	0.09	3.24–3.60	<0.001
Green wall (vs. built)	0.36	0.06	0.24–0.48	<0.001

7.5. Association Between Positive Affect and State Positive Body Experience

To examine whether affective responses were associated with bodily experience, positive affect was entered as a predictor of state positive body experience in a mixed-effects model.

Positive affect was significantly associated with higher state positive body experience ($\beta = 0.05$ per PANAS point, 95% CI: 0.03–0.07, $p < 0.001$).

Table 4. Mixed-effects model predicting state positive body experience from positive affect.

Predictor	β	SE	95% CI	p-value
Intercept	2.31	0.28	1.76–2.86	<0.001
Positive affect	0.05	0.01	0.03–0.07	<0.001

7.6. Mediation Analysis: Positive Affect as a Proximal Pathway

When positive affect was included in the exposure model predicting state positive body experience, the coefficient for green wall exposure was attenuated but remained statistically significant ($\beta = 0.19$, 95% CI: 0.08–0.30, $p = 0.001$), indicating partial mediation.

The indirect effect of green wall exposure on state positive body experience via positive affect was 0.17 (bootstrapped 95% CI: 0.10–0.26), accounting for approximately 47% of the total effect.

Table 5. Mediation summary.

Effect	Estimate	95% CI
Total effect (green → body)	0.36	0.24–0.48
Direct effect	0.19	0.08–0.30
Indirect effect (via affect)	0.17	0.10–0.26
% mediated	47%	,

7.7. Summary of Quantitative Findings

In summary, exposure to a green wall was associated with:

(1) significantly higher positive affect,
(2) significantly higher state positive body experience,
(3) a strong positive association between affective and bodily responses, and
(4) partial mediation of the green wall–body experience relationship by positive affect.

These findings indicate that even brief exposure to urban green micro-environments is associated with measurable affective and embodied responses among midlife Arab women.

8. Qualitative Results: Embodied Environmental Regulation in Everyday Urban Experience

Analysis of the walking interviews revealed four interrelated themes corresponding to the core dimensions of Embodied Environmental Regulation. Across interviews, participants described green micro-environments not as sites of joy or escape, but as everyday resources that supported bodily ease, emotional softening, and continuity of daily functioning. These themes align closely with the quantitative patterns observed for positive affect and state positive body experience.

8.1. "My Body Calms down Here": Bodily Softening and Reduced Tension

Across interviews, participants repeatedly described green elements as producing immediate bodily effects, particularly reductions in muscular tension and bodily heaviness. These sensations were often articulated without explicit emotional labeling, emphasizing bodily change rather than mood.

"When I reach a place with plants, my shoulders drop without me thinking about it."
(Woman, 58)
"Here my body feels lighter. I don't know how to explain it, but it's easier to stand."
(Woman, 61)

Participants contrasted these sensations with nearby built environments, which were described as physically demanding or constricting.

"On the street with concrete, my body feels tight. Near the green wall, it loosens."
(Woman,55）

These accounts correspond with the quantitative finding of higher state positive body experience following green wall exposure, suggesting that bodily comfort is a central component of the observed effects.

8.2. Breathing as a Marker of Regulation

Breathing emerged as a dominant embodied metaphor across interviews. Participants described changes in breathing as a primary indicator of environmental comfort and regulation, often preceding conscious emotional appraisal.

"Here I breathe better. It's not about air, it's about feeling."
(Woman, 62)
"I don't stop and say I'm calm. I just notice I'm breathing normally again."
(Woman, 57)

Breathing was frequently described as shallow or constrained in dense built settings and deeper or freer near green elements.

"In places like this [green wall], my chest opens."

(Woman, 60)

These embodied descriptions align with the increase in positive affect observed quantitatively and help explain why affect functioned as a proximal pathway linking green exposure to bodily experience.

8.3. Slowing Down: Pace, Posture, and Everyday Self-Regulation

A third theme concerned changes in walking pace and posture. Participants described slowing down, pausing, or standing more comfortably near green micro-environments, often without deliberate intention.

"Here I don't rush. My legs slow down by themselves."

(Woman, 59)

"I stop for a moment without planning to." (Woman, 63)

In contrast, built environments were associated with hurried movement and bodily vigilance.

"On other streets I walk fast, like I want to finish."

(Woman, 54)

These changes in pace and posture reflect everyday regulatory strategies embedded in routine movement, reinforcing the interpretation of green micro-environments as supporting maintenance-oriented regulation rather than episodic restoration.

8.4. Feeling Comfortable in the Body: Reduced Bodily Burden and Self-Surveillance

Participants frequently linked green environments to a sense of being more at ease with their bodies, particularly during midlife. Rather than referencing appearance, women described feeling less burdened by their bodies and less preoccupied with discomfort or strain.

"Here I don't think about my body so much. It's just okay."

(Woman, 56)

"I feel less tired of myself."

(Woman, 64)

Some participants explicitly contrasted these experiences with other urban settings where bodily discomfort was more salient.

"In busy places I feel my body all the time. Here I forget it."

(Woman, 58)

These narratives correspond directly with the quantitative increase in state positive body experience and support the mediation finding, whereby affective softening facilitated more positive bodily experience.

8.5.Everydayness and Repetition: Green Micro-Environments as Low-Threshold Resources

Importantly, participants emphasized that the regulatory effects of green elements did not depend on special visits or extended time. Instead, repeated, brief encounters were described as sufficient.

"I pass here every day. Even one minute is enough."

(Woman, 60)

"It's not a place I go to. It's just on my way."

(Woman, 55)

This everydayness distinguishes green micro-environments from parks or destination-based nature and reinforces their role as low-threshold regulatory infrastructure embedded in daily life.

8.6. Summary of Qualitative Findings

Together, the qualitative findings demonstrate that green micro-environments support embodied environmental regulation through:

(1) bodily softening and reduced tension,

(2) eased breathing as a marker of emotional regulation,

(3) slowed pace and relaxed posture during routine walking, and

(4) reduced bodily burden and enhanced bodily comfort.

These themes closely align with the quantitative results, providing experiential grounding for the observed increases in positive affect and state positive body experience following green wall exposure.

9. Discussion

This study examined how urban green micro-environments, particularly green walls, support emotional and bodily regulation among Arab women aged 50–65. By integrating short-term quantitative exposure data with walking interviews grounded in everyday routes, the study advances understanding of how small-scale urban greenery contributes to embodied wellbeing during midlife.

Three central insights emerge from the findings. First, brief exposure to a green wall was associated with measurable increases in positive affect and state positive body experience. Second, qualitative walking interviews revealed that these effects were experienced primarily through bodily sensations, such as eased breathing, reduced tension, and slowed pace, rather than through explicit emotional appraisal. Third, affective softening partially mediated the association between green exposure and bodily experience, suggesting that emotional regulation operates as a proximal pathway linking environment and embodiment.

Together, these findings support a shift from restoration-oriented interpretations of nature toward a framework of Embodied Environmental Regulation.

9.1. From Restoration to Embodied Regulation

The quantitative results demonstrate that even brief exposure to a green wall was associated with higher positive affect and improved state positive body experience. These findings are consistent with established evidence showing that short encounters with green environments yield psychological benefits [3-5,10,20]. However, the qualitative findings nuance this interpretation by showing that participants rarely described their experiences in terms of recovery, pleasure, or improved mood.

Instead, women emphasized bodily processes, breathing, muscular relaxation, posture, and pace, as primary indicators of environmental comfort. This suggests that the benefits observed quantitatively reflect regulatory processes rather than discrete restorative episodes. In this sense, green micro-environments appear to support maintenance of bodily and emotional equilibrium rather than full recovery, extending classic formulations of Stress Recovery Theory and Attention Restoration Theory [6,7].

This interpretation aligns with emerging perspectives emphasizing everyday, repeated, and low-intensity interactions with nature as central to well-being in urban contexts [9,12].

9.2. Embodied Environmental Regulation as a Linking Framework

By integrating quantitative and qualitative findings, this study proposes Embodied Environmental Regulation as a conceptual framework capturing how environments support well-being through bodily processes embedded in

daily routines. Within this framework, regulation is experienced not as conscious emotion regulation or cognitive appraisal, but as subtle bodily shifts that reduce strain and support functional continuity.

The qualitative themes, bodily softening, eased breathing, slowed pace, and reduced bodily burden, map directly onto the quantitative increases in positive affect and state positive body experience. The mediation analysis further supports this interpretation, indicating that affective softening accounts for a substantial portion of the relationship between green exposure and bodily experience.

This finding resonates with evidence that affective responses to environments are rapid and often pre-cognitive [3,6], and that bodily experience plays a central role in shaping momentary self-related perceptions, including body appreciation [19].

9.3. Green Micro-Environments as Everyday Regulatory Infrastructure

A key contribution of this study is its focus on green micro-environments, particularly green walls. While prior research on green walls has emphasized microclimatic, energy, and aesthetic outcomes [17,18], the present findings demonstrate their relevance for everyday emotional and bodily regulation.

Participants described green walls and small vegetated elements as effective despite their limited scale and brief exposure. Importantly, these environments were encountered repeatedly and incidentally as part of routine movement, distinguishing them from destination-based green spaces such as parks.

Within an environmental justice perspective, this everydayness is particularly significant. In contexts characterized by long-standing underinvestment in public green infrastructure [13-15], micro-scale green interventions may offer accessible and equitable opportunities for regulation embedded within daily life.

9.4. Green Micro-Environments Within Urban Social–ecological Systems

From an urban ecological perspective, green micro-environments such as green walls can be understood as functional components of urban social–ecological systems rather than isolated aesthetic interventions. Although limited in spatial extent, such elements contribute to microclimate moderation, sensory buffering, and experiential softening within dense built environments.

These functions align with urban ecology frameworks that emphasize the cumulative importance of small-scale ecological features embedded within everyday urban morphology. Repeated exposure to micro-scale greenery may reduce thermal stress, attenuate noise and visual hardness, and support moment-to-moment regulation of human–environment interactions, particularly along routine mobility corridors.

Within this framing, green walls operate as distributed ecological infrastructure nodes that complement larger green spaces by providing low-threshold, proximate regulatory benefits. Their contribution is therefore not primarily ecological productivity or biodiversity, but the provision of cultural ecosystem services that support embodied well-being, especially for populations with limited access to destination-based green spaces.

9.5. Midlife, Gender, and Bodily Experience

Focusing on women aged 50–65 highlights the importance of life-course perspectives in environmental health research. Midlife is characterized by bodily change, increased bodily awareness, and cumulative exposure to environmental stressors. The findings suggest that for women in this life stage, environmental benefits may manifest primarily through bodily comfort and ease rather than through enhanced mood or excitement.

The observed improvements in state positive body experience were not framed in terms of appearance or evaluation, but rather as a reduced sense of bodily burden and selfsurveillance. This supports conceptualizations of positive body image as grounded in embodied experience rather than cognitive judgment [19].

By situating body experience within environmental context, the study contributes to emerging efforts to integrate body image research with environmental psychology and health geography.

9.6. Methodological Implications

Methodologically, the study demonstrates the value of combining short-term quantitative exposure assessment with walking interviews to capture both measurable effects and lived experience. The convergence between quantitative and qualitative findings strengthens confidence in the interpretation of green micro-environments as regulatory rather than merely restorative.

Walking interviews were particularly effective in eliciting embodied descriptions of regulation that may not emerge in seated interviews[11,12]. This approach supports calls for more place-based, embodied methods in urban health research.

9.7. Limitations and Future Research

Several limitations should be noted. First, the study focused on a single city and a specific population, which may limit generalizability. Second, the quantitative component captured short-term responses and cannot address longer-term adaptation or cumulative effects. Third, physiological measures were not included, which could further elucidate regulatory mechanisms.

Future research could examine embodied environmental regulation across different life stages, genders, and urban contexts, and could integrate physiological indicators such as heart rate variability to complement self-report and qualitative data. Longitudinal designs would also help clarify how repeated exposure to green micro-environments contributes to sustained well-being.

9.8. Implications for Urban Design and Health Equity

The findings suggest that urban green micro-environments should be understood as healthsupporting regulatory infrastructure rather than optional aesthetic features. For midlife women living in under-greened urban contexts, small-scale greenery embedded in everyday routes may provide meaningful support for emotional and bodily regulation.

Design and planning strategies that prioritize accessible, visible, and evenly distributed green micro-elements, such as green walls, street greenery, and shaded vegetated edges, may contribute to equity-oriented urban health interventions [13,14].

In the context of urban resilience and climate adaptation, green micro-environments may play a particularly important role for socially marginalized populations. As cities face increasing heat stress and environmental strain, small-scale vegetated elements integrated into existing urban fabric offer flexible and scalable adaptation strategies.

For midlife and older women, whose daily mobility is often localized and routine-based, such interventions may provide meaningful support for embodied regulation without requiring behavioral change or additional time resources. Incorporating green micro-environments into climate-sensitive urban design may therefore enhance both environmental resilience and health equity at the neighborhood scale.

10. Conclusion

This study demonstrates that urban green micro-environments support embodied environmental regulation among Arab women aged 50–65. By showing how brief, everyday encounters with greenery influence affective and bodily experience, the findings extend restorative environment theory toward a life-course- and equity-sensitive understanding of urban well-being.

Theoretical Contribution

This study makes three interrelated theoretical contributions to research on urban nature, health, and embodiment.

First, it extends restorative environment theory by shifting the analytical focus from restoration toward regulation. While Stress Recovery Theory and Attention Restoration

Theory emphasize recovery from stress or attentional fatigue, the present findings demonstrate that everyday encounters with green micro-environments primarily support maintenance-oriented emotional and bodily regulation rather than full restoration. This distinction is particularly salient for midlife populations navigating cumulative stress and bodily change, for whom well-being depends on sustaining functional equilibrium rather than achieving peak emotional states.

Second, the study advances an embodied perspective on environmental effects by introducing the concept of Embodied Environmental Regulation. This framework foregrounds bodily sensations, such as breathing, muscular tension, posture, and pace, as central mechanisms through which environments influence well-being. By integrating quantitative indicators of affect and bodily experience with in-situ walking narratives, the study demonstrates how environmental regulation operates through lived bodily processes embedded in everyday routines, thereby bridging environmental psychology with embodied and place-based approaches in health geography.

Third, the study contributes to environmental justice theory by showing how small-scale urban greenery functions as equity-relevant regulatory infrastructure. Focusing on Arab women aged 50–65, a population largely absent from environmental health research, the findings illustrate how green micro-environments can yield meaningful embodied benefits in contexts shaped by long-standing underinvestment in green infrastructure. This perspective reframes green walls and similar interventions not as aesthetic add-ons, but as low-threshold, everyday resources that support embodied well-being across the life course.

Together, these contributions offer a theoretically grounded and empirically supported framework for understanding how urban environments shape embodied well-being through regulation rather than restoration, with implications for research, design, and health equity.

Ethics Approval and Consent to Participate

This study was approved by the Ethics Committee of Institute of Earth Sciences, The Hebrew University of Jerusalem, Jerusalem, Israel and was conducted in full accordance with institutional and international ethical standards for human-subject research. Before participation, all parents received a detailed explanation of the study aims, procedures, physiological measurements, and data confidentiality. Written informed consent was obtained from all participants.

Funding

This research received support from the following sources:

1. I . Ministry of Science & Technology, Israel
2. Smaller Winikov Scholarship Honors Award, Keren Kayemeth Lelsrael Jewish National Fund (KKL-JNF)

The ftnders were not involved in study design, data collection, analysis, interpretation, or manuscript preparation.

Data Availability

Data supporting the findings of this study are available from the corresponding author upon reasonable request. Environmental exposure data (NDVI) are derived from publicly accessible Landsat 8 satellite imagery. HRV datasets, questionnaire responses, and processed analytic files can be provided in anonymized form in accordance with ethical approval.

Conflicts of Interest

The author declares that there are no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

Acknowledgments

The author expresses deep gratitude to Ziad Saadi, Roaa Saadi, Jumana Saadi, Tarek Saadi, Retal Saadi, Hazem Hubashy, and Fatma Hubashy for their dedicated assistance throughout data collection and community recruitment.

References

[1] Stansfeld, S. A., & Matheson, M. P. (2003). Noise pollution: Non-auditory effects on health. British Medical Bulletin, 68, 243–257. https://doi.org/10.1093/bmb/ldg033

[2] Nieuwenhuijsen, M. J. (2018). Urban and transport planning, environmental exposures and health. Oxford University Press. https://doi.org/10.1093/oso/9780198819849.001.0001

[3] Ulrich, R. S., Simons, R. F., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. Journal of Environmental Psychology, 11(3), 201–230. https://doi.org/10.1016/S0272-4944(05)80184-7

[4] Kondo, M. C., Fluehr, J. M., McKeon, T., & Branas, C. C. (2018). Urban green space and its impact on human health. International Journal of Environmental Research and Public Health, 15(3), 445. https://doi.org/10.3390/ijerph15030445

[5] Twohig-Bennett, C., & Jones, A. (2018). The health benefits of the great outdoors: A systematic review and meta-analysis of greenspace exposure and health outcomes. Environmental Research, 166, 628–637. https://doi.org/10.1016/j.envres.2018.06.030

[6] Ulrich, R. S. (1984). View through a window may influence recovery from surgery. Science, 224(4647), 420–421. https://doi.org/10.1126/science.6143402

[7] Kaplan, R., & Kaplan, S. (1989). The experience of nature: A psychological perspective. Cambridge University Press. https://doi.org/10.1017/CBO9780511629418

[8] Hartig, T., Mang, M., & Evans, G. W. (1997). Restorative effects of natural environment experiences. Environment and Behavior, 29(1), 3–26. https://doi.org/10.1177/001391659702900301

[9] Markevych, I., Schoierer, J., Hartig, T., et al. (2017). Exploring pathways linking greenspace to health: Theoretical and methodological guidance. Environmental Research, 158, 301–317. https://doi.org/10.1016/j.envres.2017.06.028

[10] Saadi, D., Schnell, I., Tirosh, E., Basagaña, X., & Agay-Shay, K. (2020). There's no place like home? The psychological, physiological, and cognitive effects of short visits to outdoor urban environments compared to staying in the indoor home environment. Environmental Research, 187, 109687. https://doi.org/10.1016/j.envres.2020.109687

[11] Saadi, D. (in press). Urban nature as an informal coping infrastructure: Walking interviews with older Arab adults. Health & Place.

[12] Finlay, J. M., Franke, T., McKay, H., & Sims-Gould, J. (2015). Therapeutic landscapes and the effects of green and blue spaces on older adult health and wellbeing. Health & Place, 34, 97–106. https://doi.org/10.1016/j.healthplace.2015.05.001

[13] Mitchell, R., & Popham, F. (2008). Effect of exposure to natural environment on health inequalities: An observational population study. The Lancet, 372(9650), 1655–1660. https://doi.org/10.1016/S0140-6736(08)61689-X

[14] Rigolon, A. (2016). A complex landscape of inequity in access to urban parks: A literature review. Landscape and Urban Planning, 153, 160–169. https://doi.org/10.1016/j.landurbplan.2016.05.003
[15] Haddad Haj-Yahya, N., Rudnitsky, A., & Malach, G. (2021). The Arab society in Israel: Population, society, economy. Israel Democracy Institute.
[16] Saadi, D., Schnell, I., & Agay-Shay, K. (2019). Ethnic differences in psychophysiological responses to urban environments: A field experiment among Arab and Jewish women in Israel. Journal of Environmental Psychology, 64, 101343. https://doi.org/10.1016/j.jenvp.2019.101343
[17] Perini, K., & Rosasco, P. (2013). Cost–benefit analysis for green façades and living wall systems. Building and Environment, 70, 110–121. https://doi.org/10.1016/j.buildenv.2013.08.014
[18] Manso, M., & Castro-Gomes, J. (2015). Green wall systems: A review of their characteristics. Renewable and Sustainable Energy Reviews, 41, 863–871. https://doi.org/10.1016/j.rser.2014.07.087
[19] Saadi, D. (2026). Green walls, emotional well-being, and women's positive body image: Evidence from a multicultural university campus. Journal of Women's Health and Development, 9(1), 51–69. https://doi.org/10.26502/fjwhd.2644-288400140
[20] Mohsen, Reem and Saadi, Diana and Lensky, Itamar and Agay-Shay, Keren, The Effect of Exposure to Green Walls on State Positive Body Image and Mediation by Feelings. http://dx.doi.org/10.2139/ssrn.4299795