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Explaining the Attitude-Behavior Gap in Urban Renaturation: Landscape Appropriation in Batna, Algeria

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Abstract

Algerian cities face a well-documented decline in urban green space, rising pollution, and weak integration of ecological principles into planning. Renaturation — understood as the intentional restoration of human-nature relationships rather than mere greening — is increasingly proposed as a response, yet its uptake depends on a factor rarely measured directly: whether city dwellers actually know, want, and practice it. Most existing evidence on this question comes from European, North American, or East Asian cities and relies on declarative data alone, leaving open whether the same pattern holds in a Maghrebi urban context, and whether stated support for renaturation is actually reflected in everyday behavior. This study examines that gap in Batna, a mid-sized Algerian city, through a mixed-methods design combining a quota-sample questionnaire (N = 202) with a year-long structured observation of user-nature interactions at a representative public site. Results show near-unanimous recognition of nature's benefits and strong dissatisfaction with current green-space provision, but limited awareness of the renaturation concept itself, an uneven capacity to translate favorable attitudes into engagement, and a distinctly gendered pattern of access and use. Observed behavior corroborates declared attitudes: acceptance outweighs rejection in the great majority of recorded interactions, with informal stewardship practices already visible on site. These findings are read alongside two national mobilizations of late 2025, treated as convergent contextual signals rather than statistical proof of generalization. The study argues that renaturation's uptake in Batna is best understood through an attitude-behavior gap unevenly structured by education and gender, with direct implications for environmental education and participatory governance strategies in Algerian cities.

Keywords: *urban renaturation; socio-spatial appropriation; attitude-behavior gap; participatory governance*

1. Introduction

In a world where urban green space is declining, environmental degradation is increasing and pollution is mounting, the importance of good governance of green space and the incorporation of biodiversity in planning cannot be underestimated. Algeria, like much of the world, is under growing pressure from population growth, industrial expansion and unregulated urban development, leading to loss of green space, degradation of biodiversity and amplification of urban heat-island effects. Batna illustrates these pressures with unusual clarity. Among the city's principal sources of pollution are ceramic factories located roughly ten kilometers from the urban center; although distant, their emissions reach the city directly because of its particular topography Batna is in a natural basin surrounded by mountains which traps the air above it. Thermal inversion causes industrial fumes on the outskirts to be drawn back down into the basin instead of dispersing, settling over the city as a haze that prevailing winds struggle to clear.These ecological pressures are exacerbated by the still limited integration of ecological principles in urban planning and by the sub-use of participatory governance for the shaping of public space. At the national level, the Algerian environmental policy has become more and more involved in the preservation of Green space, as a key element of sustainable urban development. It is supported by a network of environmental and forestry services and formalized by Law 07-06 (2007) and Executive Decree 09-147 (2009) which form the legal and operational framework for the management and protection of green areas. Studies from throughout the world have demonstrated that bringing wildlife into cities can deliver measurable benefits such as cleaner air, increased thermal comfort, stormwater management and social cohesiveness [1, 2, 3]. But it also cautions against simply transplanting these principles elsewhere. They must be modified to local cultural, historical and climatic conditions [4, 5]. This literature has created a sustainable urban landscape strategy by combining ecological, social and cultural factors for multifunctionality, resource efficiency and protection of local identity [6, 7]. It is based on planning techniques such as landscape ecology [8] and green infrastructure strategy [9] and participatory governance is considered as increasingly crucial in fostering ownership and long-term stewardship [10].

Within this literature, renaturation has emerged as a specific and increasingly influential paradigm for reconnecting cities with nature. It is generally distinguished from rewilding, a term that has drawn criticism for evoking a form of "wild" nature long perceived by many communities as foreign to human presence, even threatening [11, 12]. Renaturation, by contrast, is defined by Casagrande and Vasquez [13] as an intentional, reflective attempt to restore human relationships with the natural processes of ecosystems, going beyond the more common focus on restoring their biophysical health alone. Sarabi et al. [14] extend this distinction by describing renaturing as actively restoring human-nature relationships, not just repairing ecological relationships, but also social, cultural, and cognitive relationships between people and ecosystems. This is the intentional integration of nature into everyday urban life through education, cultural inclusion, and adaptive governance, rather than the more passive withdrawal of human intervention in rewilding. Lehmann [15] framed both renaturalization and rewilding as strategies for increasing urban resilience to climate change, biodiversity loss, and public-health crises, demonstrating how nature-based solutions like green roofs, urban forests, and rewilded parks offer benefits such as heat mitigation, mental health, and social cohesion. Russo [16] provides empirical heft to the psychosocial dimension of this argument: a systematic review that characterizes urban green spaces as de facto 'natural therapy hubs' that reduce stress and anxiety, while facilitating cognitive restoration and social interaction, as long as they are accessible and designed inclusively. Read together, these accounts converge on a single claim: renaturing a city is not simply a matter of adding vegetation, but of reshaping how residents understand, value, and live with nature [14], a shift operationalized in practice through the strategic uptake of nature-based solutions [17].

Despite this expanding literature, most empirical work on renaturation's social reception draws on European, North American, or East Asian settings, and typically relies on declarative data alone — surveys of stated attitudes and preferences, rarely checked against how people actually use and treat urban nature day to day. Studies grounded in North African or Maghrebi cities remain scarce, and none, to our knowledge, has combined a structured questionnaire with a systematic, year-long observation of the same population in the same city to examine whether declared support for renaturation is reflected in daily spatial practice. This leaves open a question with direct relevance for planning : does the

ecological consensus often visible in survey data in Algerian cities translate into observable behavior, or does it remain, as documented elsewhere, a matter of stated preference detached from everyday practice [18]? This gap is not Algerian only. Similar work elsewhere in rapidly urbanizing Global South contexts has also shown that the expression of environmental concern is compatible with constrained everyday practice, often for infrastructural, trust in governance, or social norm reasons rather than values per se [19]. What is missing from this broader comparative picture is not the general pattern — which is by now reasonably well established — but grounded, method-triangulated evidence from the Maghreb specifically, where urban sociology has long documented distinctive modes of appropriating public space (the houma as a unit of neighborhood solidarity, informal self-organization or "système D" in the management of everyday constraints) that plausibly shape how an attitude-behavior gap of this kind would locally manifest, without having yet been connected empirically to the renaturation literature.

Mid-sized cities such as Batna are a particularly telling setting in which to ask this question. Unlike Algiers or Oran, whose scale and international visibility have attracted comparatively more research attention, mid-sized regional capitals house a large and growing share of Algeria's urban population while remaining under-documented in the renaturation literature, despite facing the same pressures — heat-island intensification, industrial pollution, rapid peri-urban growth — in a more constrained institutional and budgetary context. What is learned from Batna is therefore unlikely to be an isolated curiosity: it plausibly speaks to a wider category of Algerian cities for which comparative evidence is still largely missing.

This study addresses that question in Batna, asking three more specific questions: (1) how familiar are residents with the concept and practice of renaturation, and how do they evaluate its relevance to their city; (2) how do they perceive their current urban landscape and envision its ecological future; and (3) does declared support for renaturation translate into observable behavior toward existing urban nature. By combining a structured questionnaire with a year-long in situ observation at a representative public site, the study offers a doubly-validated, empirically grounded account of renaturation's social reception in a mid-sized Algerian city — one intended to inform, rather than assume, the design of future renaturation strategies in Batna and, cautiously, in comparable Algerian urban contexts.

2. Methodology

This research rests on two complementary empirical pillars. The first is a sociological questionnaire designed to assess and characterize public acceptance of both spontaneous and planned nature in the city, and to identify the thought patterns, expectations, and obstacles — fear of "disorder," perceived nuisances, and the like — that shape how renaturation initiatives are received. The second is an in situ observation, an essential complement that allows the research to examine actual interactions between users and natural elements, capturing the more sensitive, embodied aspects of space use and identifying which spatial features encourage, or conversely hinder, everyday reconciliation between residents and their environment. Combining the two allows the study to establish a diagnosis broad enough to inform the criteria for successful nature integration in an Algerian urban setting, and to compare directly what residents say with what they do.

2.1 Questionnaire

The choice of a questionnaire as the primary data-collection tool reflects an effort to objectify the otherwise largely emotional relationship between city dwellers and their environment, cross-referencing social representations of the landscape with respondents' sociodemographic characteristics. The instrument is a cross-sectional descriptive correlational survey. The instrument contains quantitative items (Likert scales, multiple choice questions) and open-ended qualitative questions to get the maximal information and to avoid the fatigue of the respondents.

The 25-item questionnaire was organized in a funnel logic, from general to specific, in order to gradually guide respondents toward the key concepts of the study without generating social-desirability bias. It was divided into five sections: sociodemographic profile (age, gender, socioeconomic status, education, place of residence); awareness and knowledge of urban biodiversity; perception of the urban landscape, introduced gradually to take into account possible unfamiliarity with technical vocabulary; vision of the city of tomorrow; and the human-nature relationship, including acceptance of spontaneous nature and daily interactions with wildlife .

Content validity was established through a pilot pre-test with a small group, verifying the semantic clarity of items, the neutrality of their wording, and the logical flow of the response process.

In the absence of an exhaustive sampling frame permitting random selection, the study used non-probability quota sampling to replicate the sociodemographic structure of the parent population, yielding a final sample of N = 202 residents and frequent users of Batna. The questionnaire (Google Forms) was distributed through a multi-channel digital strategy: local social-media pages to reach a broad audience, and QR codes placed at key public locations to capture users directly on site. This self-administered approach reduced interviewer bias and facilitated the processing of mixed quantitative-qualitative data, at the cost of somewhat skewing the sample toward digitally active residents — a limitation discussed further in section 5. Data collection ran over several weeks, with response completeness monitored throughout to ensure no section of the instrument was systematically under-answered before closing the survey.

2.2 In situ observation: from declarative to performative

Where the questionnaire captures what residents say they think, feel, or would do — the declarative dimension — observation captures what they actually do in public space, the performative dimension. The potential gap between the two is itself a central object of analysis: introducing an on-site observation phase allows the study to triangulate its data, strengthening internal validity and enabling a more holistic reading of renaturation's social acceptance than either method could provide alone. The research therefore employed a structured, non-participant observation protocol designed to minimize observer bias and to focus specifically on biophilic interactions.

Data were organized through an observation grid (See Apendix A). combining two components. A static inventory assessed the state of the site in terms of flora (structure, diversity, indicators such as spontaneous wildflowers, overall health), fauna (birds, insects, domestic and synanthropic species, presence of nesting or shelter installations) and space management (cleanliness, watering, lighting, street furniture). Through dynamic observation, the interactions of users with these elements were classified as acceptance (rest, contemplation, informal maintenance, tolerance towards wildlife) or rejection

(trampling, littering, avoidance, hostility towards animals), thus allowing the study to move from a static description of the site to an active reading of how it is actually appropriated.

To ensure representativeness, observation was conducted over a complete annual cycle (March 2025–March 2026) across ten one-hour sessions distributed across weekdays, weekends, and different times of day, capturing seasonal and temporal variation in use. The observation site itself was selected purposively rather than exhaustively: eleven candidate sites in Batna (six central, five peri-central) were scored against six literature-derived criteria — accessibility and spatial integration, ecological richness, biophilic potential, intensity of social use, and environmental comfort, among others — using a comparative multi-criteria matrix (Table 1; Figure 1). " BenBoulaid Walkways," a central pedestrianized avenue inherited from the colonial urban grid and combining commercial, residential, and institutional frontages, scored highest (52/60) and was retained as the representative case for observation. No personal or identifying data were recorded at any stage of either instrument, consistent with standard practice for non-invasive research in public settings.

Table 1. *Summary of the results of the multi-criteria matrix applied to the 11 sites.*

Public Green Spaces	Accessibility	Spatial Integration	Ecologiqual richness	Intensity of social use	environmental comfort	Quality of use
"La Verdure" Garden	3	5	9	5	7	5
"Abbatoire" Garden	5	6	2	1	3	7
"1er Mai" Square	9	9	1	7	4	5
"La liberté" Square	7	7	3	6	4	4
Benboulaid walkways	10	10	8	10	8	8
"1 Novembre" Square	8	7	2	4	5	3
"Kechida" Garden	3	3	5	3	2	1
Salah eddine Garden	5	4	5	5	6	5
" La Rue H" Square	5	3	2	5	2	4
"Abdessmad" Square	4	4	1	3	7	8
"Chelia" Garden	1	1	8	0	3	0

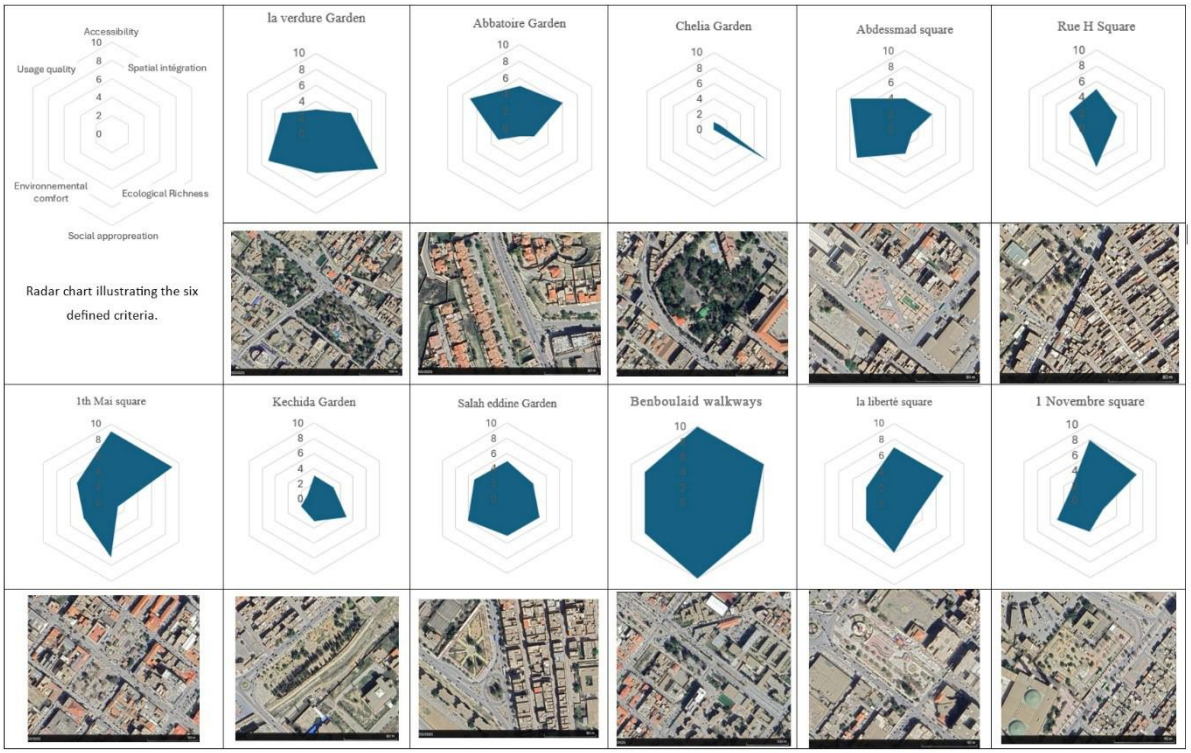


Figure 1. Comparative radar-chart assessment of the 11 candidate sites across the six selection criteria

2.3 Data analysis

The data from the questionnaires were analyzed in SPSS using descriptive statistics (frequencies, means and standard deviations) and bivariate analysis was performed to test for associations between sociodemographic variables and the main indicators of the study. Pearson's chi-square test was used to test categorical associations. Statistical significance was set at $p < .05$ throughout. Where applicable, degrees of freedom and exact p-values are reported in addition to the test statistic rather than significance alone. Internal consistency of multi-item ranking scales was assessed using Cronbach's alpha. Observation data were analyzed descriptively, coding each recorded interaction as a discrete acceptance or rejection sign and aggregating results by session, site component, and age category to construct the generational typology presented in section 3.2.

3. Results

3.1 Questionnaire results

Sample profile

The sample (N = 202) shows near gender parity (51% women, 49% men), a young profile (55% aged 18–35), and a high education level (82.7% university-educated), with employed (37.1%) and student (24.8%) respondents predominating. Respondents are distributed across both central and peripheral neighborhoods of Batna in proportions broadly consistent with the city's actual residential geography, supporting the sample's adequacy for cross-neighborhood comparisons reported later in this section.

Awareness and knowledge

Awareness of the specific concept of "renaturation" is low: 65.4% of respondents report no familiarity with the term, against 24.2% who claim familiarity. Awareness of nature's general benefits is considerably higher: 70.3% recognize its contribution to public health and climate, while general awareness of natural factors in the urban environment is rated insufficient by 72.3% of respondents. Both indicators are significantly associated with education ($\chi^2 = 9.507$, df = 4, $p = .050$ for concept familiarity; $\chi^2 = 32.180$, df = 4, $p < .001$ for benefit awareness) and with age ($\chi^2 = 45.014$, df = 6, $p < .001$), with 18–35-year-olds the most exposed to the concept (67 of the 89 respondents aware of it belong to this age group). Notably, the two indicators do not move in lockstep: several respondents who report no familiarity with the term "renaturation" nonetheless recognize, when the underlying idea is described to them in the benefits-awareness items, that integrating nature into the city carries real advantages. This suggests that the deficit identified here is more terminological and conceptual than attitudinal — residents are not rejecting the idea so much as lacking a name and a clear mental model for it, a distinction taken up further in section 4.2.

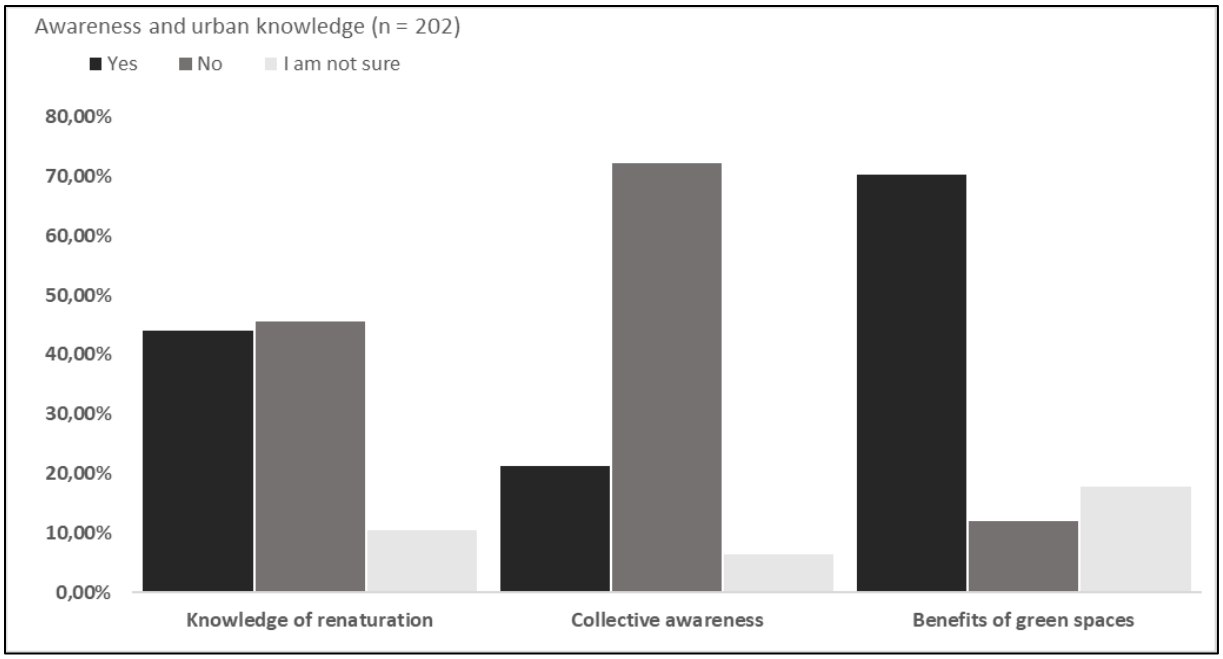


Figure 2. Graph showing participants' knowledge, awareness, and perceived benefits of renaturation and green spaces.

Perception of, and satisfaction with, the urban landscape

Perception of Batna's current urban landscape is markedly negative (72.3% unfavorable), with responsibility attributed jointly to authorities and citizens by 91.6% of respondents. Dissatisfaction with green-space quality (87.1%) and quantity (93.6%) is near-universal and shared across neighborhoods, though gender structures both the evaluative and behavioral dimensions of this dissatisfaction : women report significantly higher dissatisfaction ($\chi^2 = 16.138$, df = 4, p = .003) and significantly lower use frequency ($\chi^2 = 15.173$, df = 4, p = .004) than men. Only 33.6% of respondents use green spaces regularly, despite near-unanimous recognition that nature improves well-being (97%) and urban aesthetics (98.5%) — a gap explained primarily by degradation factors — chiefly pollution (71.8% of responses), well ahead of insecurity (10.4%) and user-related incivility (7.4%) — rather than by indifference, and this ranking holds consistently across neighborhoods. Peace and relaxation are named the primary expected benefit of green space by 75.2% of respondents, and perceived access to green space is seen as inequitable across neighborhoods by 87.6%

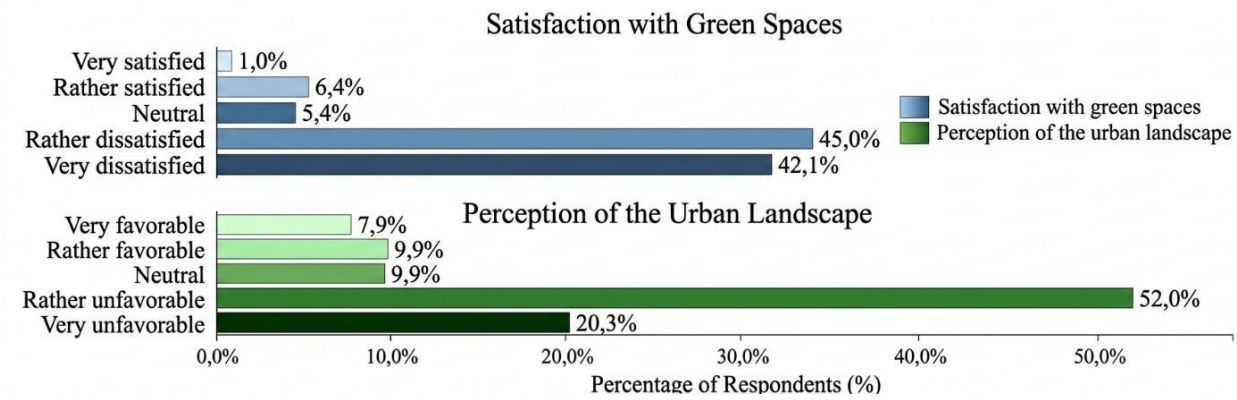


Figure 3. Graph showing respondents' satisfaction with the quality of green spaces and perception of the urban landscape.

Vision of the city of tomorrow

A "green and sustainable city" is the dominant model of the urban future (76.7%), far ahead of smart-city (6.9%), resilient-city (5.4%), and multifunctional or solidarity-based models (4.5% each), with no significant variation by profession ($p = .547$). Ranked priorities (Cronbach's $\alpha = .748$, indicating satisfactory internal consistency across the five ranked items) place multifunctional green spaces ($M = 4.18$) and citizen participation in green-space management ($M = 4.17$) highest, both also drawing the largest share of "absolute priority" ratings; biodiversity integration ($M = 3.87$) and equitable access ($M = 3.85$) occupy an intermediate position, while urban agriculture ranks lowest and most variably ($M = 3.40$, $\sigma = 1.32$). Preferences for specific interventions confirm this pattern: ecological corridors and green streets are favored by 77.2% of respondents, with conventional urban parks a distant second (16.8%) and green roofs, green walls, urban micro-forests, and "smart" green technologies each attracting under 2%. Preferred landscape type follows a comparable logic: 56.4% favor a balanced mix of mineral and plant elements, 41.6% a more vegetated landscape, and only 2.0% a predominantly mineral one, with retirees and respondents under 18 or over 50 more inclined toward the vegetated option and other occupational groups favoring balance. Younger respondents (18–35) are markedly overrepresented among corridor supporters (88/111; $\chi^2 = 34.676$, $p = .010$), while landscape-type preference also varies significantly by occupation ($\chi^2 = 20.033$, $df = 10$, $p = .029$).

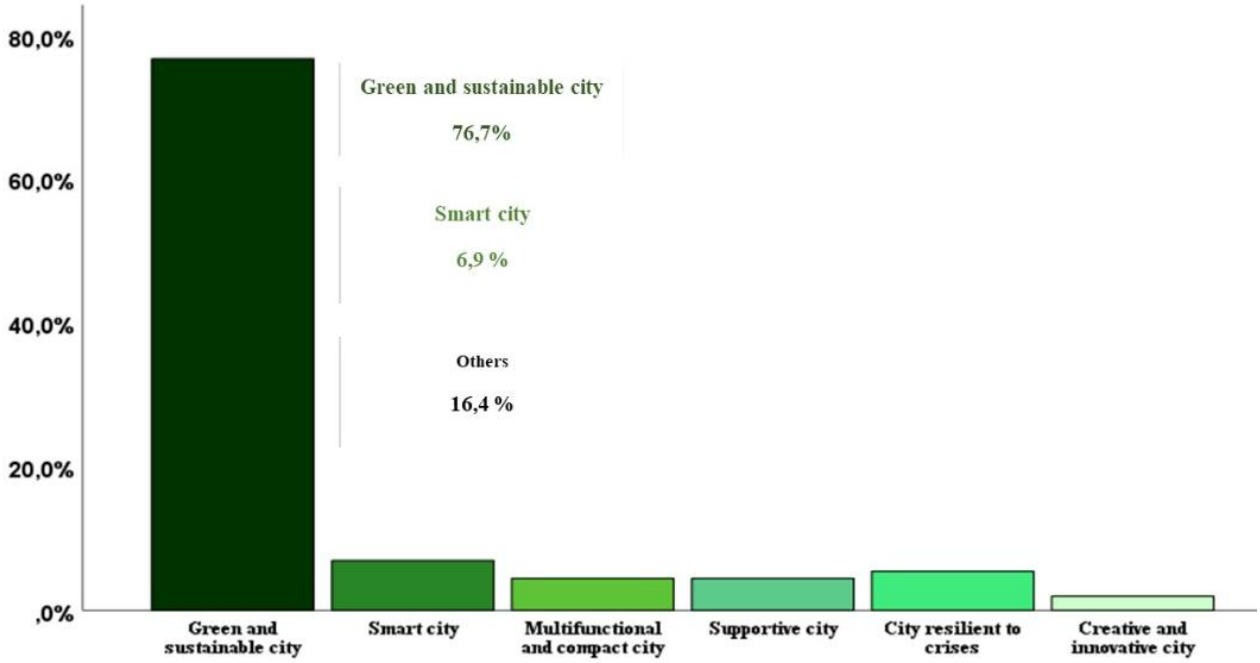


Figure 4. Graph showing citizens' definitions of the city of tomorrow.

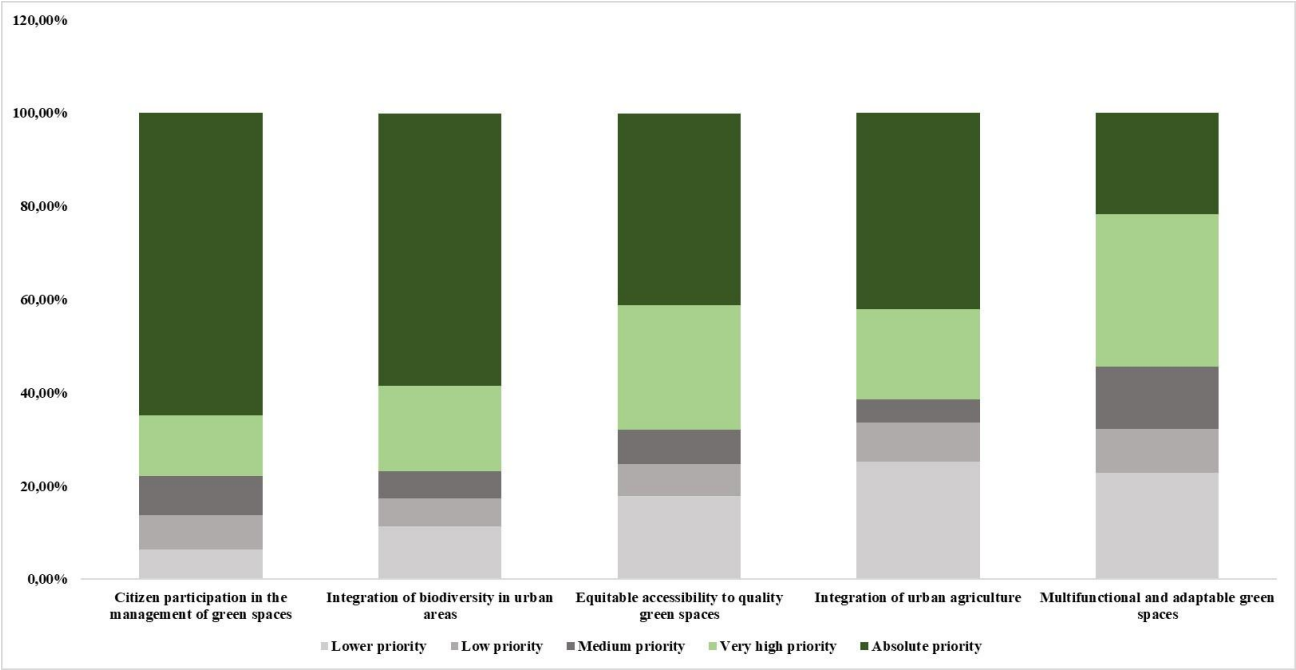


Figure 5. Graph showing the main advantages the city should offer its future residents.

Human-nature relationship and civic engagement

The evaluation of the acceptance of animals in urban areas shows a general positive consensus among the participants. But the good opinions (26.7% somewhat positive and 22.8% very positive) far eclipsed the negative (22.2%). But a large minority were neutral (28.2%). This positive attitude towards urban fauna is also in agreement with the general opinion on spontaneous flora, which is also widely approved

(72.8% in favour of sharing urban space with spontaneous flora). Moreover, the general appreciation of urban biodiversity does not differ significantly with education level, which confirms the demographic homogeneity found earlier with regard to the bioclimatic paradigm. Actual willingness to engage in renaturation initiatives, by contrast, is strongly structured by educational capital ($\chi^2 = 23.890$, df = 6, p = .001), and civic engagement overall favors institutionally supported action (46%) over autonomous initiative (39.6%), with only a small residual minority expressing no willingness to engage at all. The main barriers cited are fear of pests (42.6%), insufficient political will (25.2%), and security concerns (17.8%) — a ranking that itself suggests residents locate the main obstacle in daily nuisance and institutional follow-through rather than in principled opposition to renaturation. A large majority (77.7%) consider renaturation feasible in Algeria, though optimism decreases with education level — a pattern consistent with more critically-informed respondents being more attuned to implementation obstacles rather than less supportive in principle. Open-ended responses converge on four priorities: expanding the green network (38.1%), environmental education (33.7%), improved governance and maintenance (20.8%), and technical/innovative expertise (7.4%).

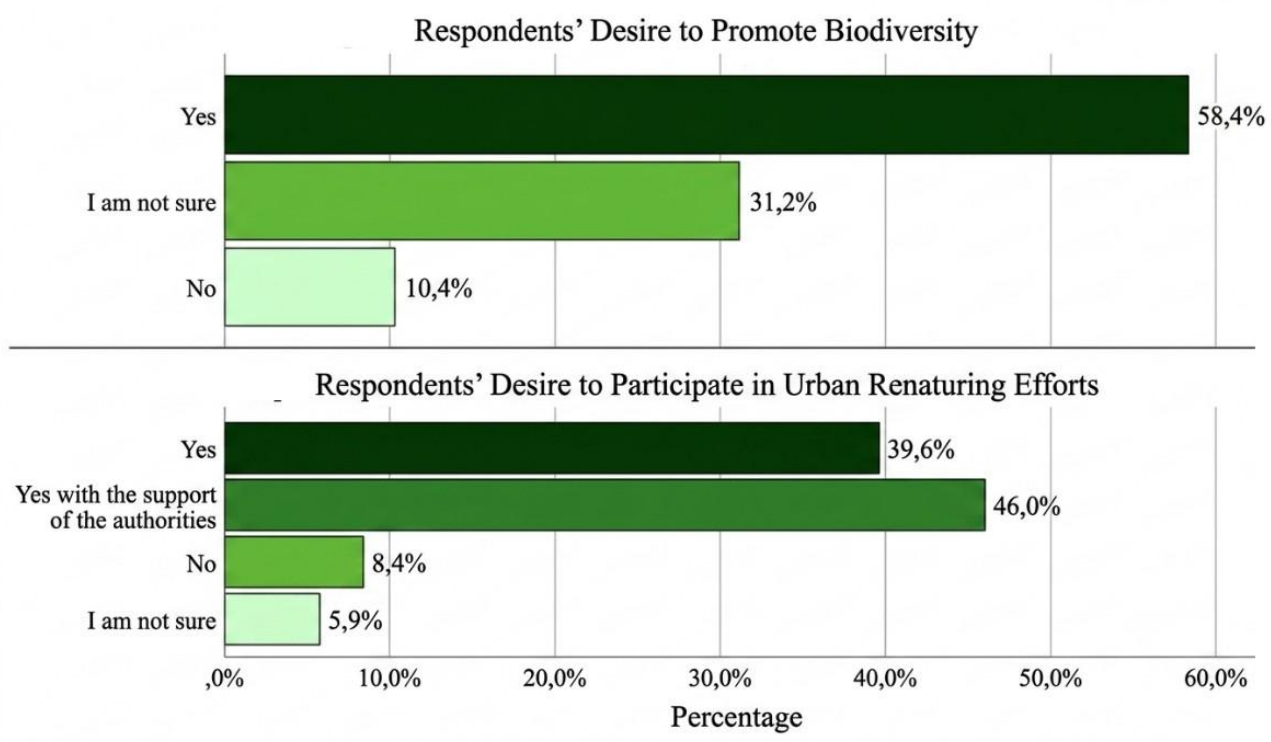


Figure 6. Human-nature relationship and civic engagement: acceptance and priorities for action

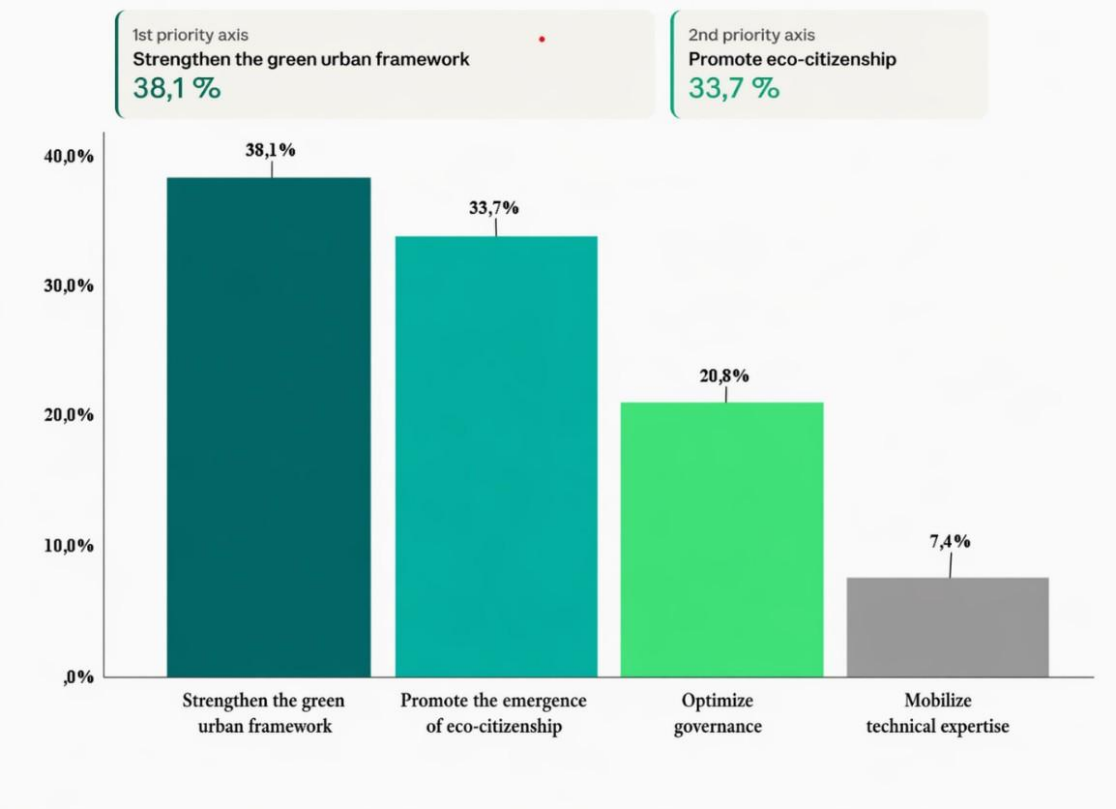


Figure 7. Graph showing participants' expectations for improving urban green spaces

Table 2. Summary of key questionnaire indicators (N = 202)

Indicator	Value
Familiar with the concept of "renaturation"	24.2%
Recognize nature's contribution to public health/climate	70.3%
Unfavorable perception of the current urban landscape	72.3%
Dissatisfied with green-space quality	87.1%
Report insufficient green-space quantity	93.6%
Regular green-space use (≥ once a week)	33.6%
Cite pollution as the main reason for avoiding green spaces	71.8%
Perceive unequal access to green space across neighborhoods	87.6%
Recognize nature's contribution to well-being	97.0%
Recognize nature's contribution to urban aesthetics	98.5%
Value peace/relaxation as the primary expected benefit	75.2%
Prefer a "green and sustainable city" as the future model	76.7%

Favor ecological corridors / green streets	77.2%
Support sharing space with spontaneous vegetation	72.8%
Support biodiversity promotion despite lawn trade-offs	58.4%
Willing to engage in renaturation (directly or with institutional support)	85.6%*
Consider urban renaturation feasible in Algeria	77.7%

** Sum of two mutually exclusive response categories (direct engagement, 39.6%; engagement conditional on institutional support, 46%).*

3.2 Observation results

Static site assessment

Over ten sessions, overall site condition was rated positive in 63.8% of observations. Trees (70%) and shrubs (80%) were consistently rated in good condition, while the herbaceous layer and wild flora proved more vulnerable, rated "average" or "poor" in close to half of observations. Wildlife — birds, insects, and domestic animals — was present in 80% of sessions, supported by nesting boxes and shelters functional in 70% of cases. Street furniture and public lighting were maintained to a high standard (90% positive), whereas watering management and overall cleanliness received more mixed ratings (30–40%), pointing to maintenance rather than design as the site's principal weakness (Table 3). This distinction matters for interpretation: the elements most directly dependent on recurring upkeep — watering, cleanliness — are also the ones rated least favorably, while elements reflecting the site's original design and planted structure remain comparatively well preserved, suggesting that the avenue's ecological potential is not being eroded by its layout but by the intensity and consistency of its day-to-day management.



Figure 8. aerial view of part of our observation site

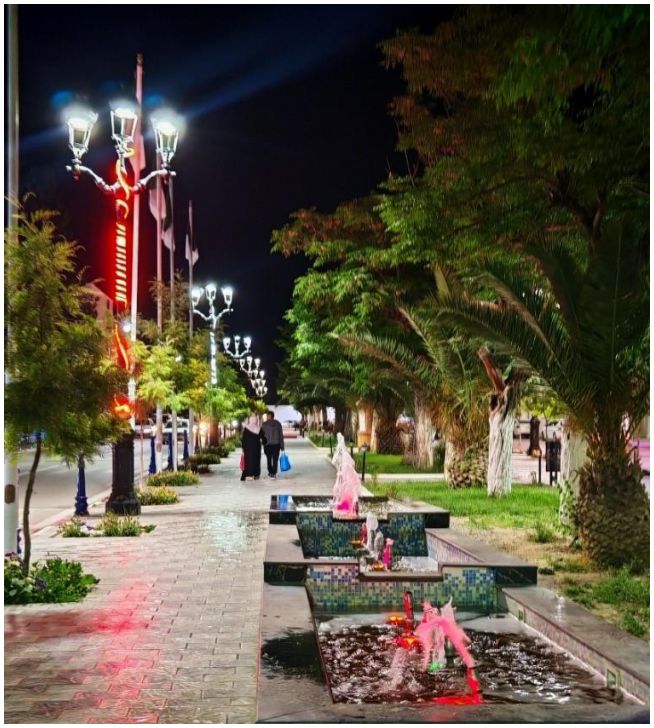


Figure 9. Assessment of site maintenance, including street elements, public lighting, watering management, and cleanliness.

Table 3. Static site-assessment summary (10 observation sessions)

Component assessed	Result
Overall site condition	63.8% positive
Trees (condition)	70% rated “good”
Shrubs (condition)	80% rated “good”
Herbaceous layer / wild flora (condition)	≈50% rated “average”/“poor”
Wildlife presence (birds, insects, domestic animals)	80% of sessions
Nesting boxes / shelters functional	70% of cases
Street furniture and public lighting maintenance	90% positive
Watering management	30–40% mixed ratings
Overall cleanliness	30–40% mixed ratings

Dynamic user-nature interactions

Analysis of interactions between users and natural elements (flora and fauna) shows a predominance of signs of acceptance of nature in the city. Out of a total of 386 interactions recorded, 76.1% demonstrate a positive attitude compared to 23.9% of rejection behaviors.

Manifestations of acceptance (294 signs):

Positive interactions are essentially reflected in a functional and contemplative use of green space: Use and physical contact (118 signs): Use of lawns for rest or picnics (60 signs), seeking gentle tactile contact with plants (41 signs), and informal maintenance by citizens (17 signs)

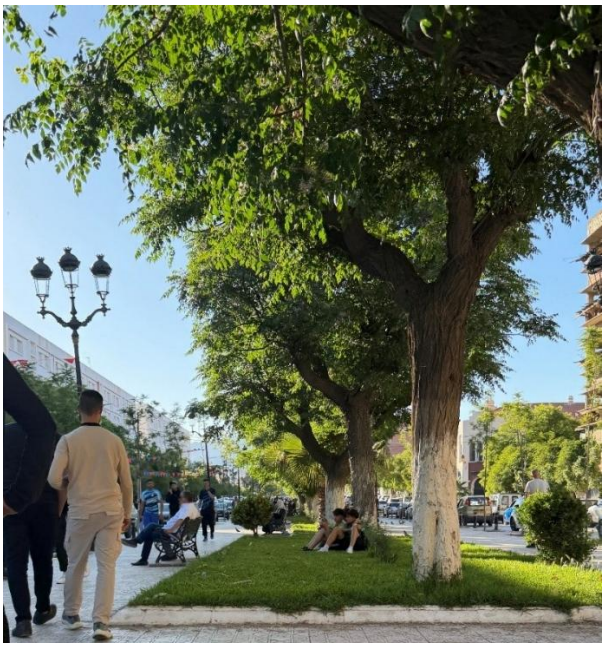


Figure 10. Functional use of green spaces, including resting and picnicking on lawns



Figure 11. Informal maintenance activities carried by citizens in green spaces.

Aesthetic dimension and observation (79 signs): Contemplation is translated by taking photographs of plants (45 signs) or animals (34 signs).

Cohabitation with wildlife (97 signs): Feeding animals (45 signs) and protective/play behaviors (52 signs) confirm a strong tolerance towards urban animals like dogs and pigeons



Figure 12. Feeding of urban animals in green spaces



Figure 13. Protective and playful interactions with urban wildlife

Manifestations of rejection and degradation (92 signs):

Although in the minority, instances of nature degradation have been recorded:

Damage to flora (49 signs): Trampling of planted areas (18 signs), throwing of waste (17 signs), uprooting of flowers and leaves (12 signs), and, marginally, engraving on trunks (2 signs).

Conflictual relationship with wildlife (43 signs): Avoidance due to fear (24 signs) is the main negative sign, followed by intolerance of animal noises (10 signs) and rare acts of cruelty or hunting (9 signs).



Figure 14. A child pulling leaves and flowers from a plant

Differentiated analysis of behaviors by age category

Cross-analysis of the data shows that interaction patterns differ according to user age groups, highlighting distinct relationships with nature between children, adults, and the elderly.

Among children (n=50), signs of acceptance (58 occurrences) are primarily marked by active coexistence with wildlife: play and tolerance towards animals (16 signs), as well as feeding (14 signs), are the most frequent interactions. Tactile contact with plants is also significant (11 signs). However, this group shows a relatively higher proportion of rejection (32 signs). Pulling flowers and leaves (8 signs) and trampling (7 signs) constitute the main forms of harm, while aesthetic contemplation (photography) is almost non-existent, confirming a relationship with nature based on action rather than passive observation.

The adult group (n=112) demonstrates the greatest diversity of interactions, where acceptance clearly predominates (162 signs). This category is distinguished by an aesthetic and contemplative appreciation of nature, illustrated by the practice of photography (39 cumulative signs of fauna/flora). A salient feature is the emergence of a sense of civic responsibility, with 16 signs of informal maintenance (watering). Their rejection behaviors (40 signs) are more linked to logistical uses or urban neglect: littering in green spaces (12 signs) and trampling planted areas to save time (11 signs) prevail over acts of deliberate damage.

The elderly (n=38) have a primarily contemplative relationship with nature, respecting the integrity of the site. No signs of uprooting, trampling, or engraving were recorded in this category. Positive use is centered on resting in the shade and picnicking (16 signs), as well as observation. Nevertheless, this category expresses the most distant relationship with urban wildlife. Although animal protection is present (9 signs), there is a marked prevalence of avoidance due to fear (11 signs) and intolerance to animal calls (8 signs), proportionally much higher than in the other groups. This rejection among seniors is not manifested as aggression towards nature, but rather as a search for distance and quiet.

4. Discussion

4.1 Cognitive asymmetry between general awareness and knowledge of emerging concepts

The rise of "renaturation" as a scientific paradigm has outpaced its adoption by city dwellers: general ecosystem benefits are well understood, but the technical concept itself remains largely unfamiliar, consistent with evidence that ecological knowledge and public acceptance tend to move together [20]. Batna residents also tend to reduce renaturation to greening alone, a simplification also documented by Russo [16]. in other contexts. This asymmetry is structured by education ($\chi^2 = 9.507$, $p = .050$ for concept familiarity; $\chi^2 = 32.180$, $p < .001$ for benefit awareness), confirming educational capital as a determinant of environmental knowledge [21, 22], and by age ($\chi^2 = 45.014$, $p < .001$), with younger respondents most exposed to the concept — a generational pattern consistent with Soga and Gaston's [23] account of the gradual erosion of everyday human-nature interactions in contemporary urban societies. The practical implication is that outreach efforts in Batna may gain more from naming and explaining renaturation explicitly than from further general environmental messaging, which the data suggest is already reasonably well received. This also suggests a specific role for schools and local media in closing the asymmetry: since the underlying appreciation of nature is already broadly shared, the remaining task is more conceptual and terminological than attitudinal, and arguably more tractable for local institutions to address than a full-scale shift in environmental values would be.

4.2 Beyond aesthetics: the gendered and spatial roots of urban dissatisfaction

Batna's marked landscape dissatisfaction reflects more than an aesthetic judgment: it signals a structural deficit, as existing spaces no longer fulfill their social and ecological functions [24] — a legacy of urban growth that has historically prioritized infrastructure and housing over recreational and ecological space.

This deficit is also gendered. Women report significantly higher dissatisfaction ($\chi^2 = 16.138$, $p = .003$) and use green spaces significantly less ($\chi^2 = 15.173$, $p = .004$) than men — not two separate findings but a single gendered spatial practice, in which lower satisfaction and lower use likely reinforce one another, mediated by perceived safety and prevailing norms of women's presence in public space [25]. Underuse is not indifference: pollution, not lack of interest, is the primary reason cited for avoiding green space

(71.8%), consistent with Ord et al. [26] on the role of maintenance and safety over mere availability. The near-unanimous perception of unequal access across neighborhoods (87.6%) further reframes the deficit as one of environmental justice properly speaking [3]; in the Algerian urban context, where the houma remains a primary unit of socio-spatial identification and solidarity, an uneven distribution of green infrastructure across neighborhoods is not merely a planning failure — it risks reproducing existing hierarchies between historically favored and marginalized quartiers. Against a near-total consensus on nature's benefits (97–98.5%) confirming the biophilia hypothesis [27, 28], the demand for nature in Batna is not in question — its equitable distribution is. This distinction between demand and distribution is worth stating plainly, since the two are easily conflated in planning documents that treat low usage rates as evidence of low demand, when the data here point in the opposite direction: usage is low despite demand, not because of its absence.

4.3 The city of tomorrow: from technocentric fragments to an ecological continuum

Residents' vision of the city of tomorrow converges on a single underlying model rather than a list of separate preferences: nature as continuous infrastructure, not as isolated technical objects. The bioclimatic paradigm dominates without socio-professional cleavage (76.7%, $p = .547$), consistent with Gómez-Baggethun et al.'s [29] account of a shared global grammar of urban ecology that local planning has yet to fully translate into practice. This preference is explicitly directed against isolated, technology-centered devices — green roofs, green walls, and "smart" systems each attract under 2% of respondents — a rejection that echoes current critiques of smart planning's limited responsiveness to residents' everyday comfort [16]. By contrast, ecological corridors and green streets are favored by 77.2% of respondents, a result better read not as a preference for "more parks" but as a demand for connective, continuous nature woven into daily circulation, reinforced by strong support for spontaneous vegetation (72.8%), no longer perceived as neglect but as a marker of a "living" city [30]. Age and occupation modulate the intensity, not the direction, of this continuum model: younger respondents are markedly overrepresented among corridor supporters ($\chi^2 = 34.676$, $p = .010$), while landscape-type preference varies significantly by occupation ($\chi^2 = 20.033$, $p = .029$) — a distinction with direct implications for the multigenerational design approach advocated by Maas et al. [31]. Read as a whole, these results

describe less a "green" city than a connected one, where nature functions as structural tissue rather than ornament — a shift that echoes Beatley's [1]. biophilic city, but which, in the Algerian context, also revives earlier models of tree-lined urban promenades such as Batna's own Allées Benboulaïd. The near-absence of support for discrete technological add-ons is worth dwelling on, since much of the international nature-based-solutions literature is organized precisely around cataloguing such devices — green roofs, living walls, sensor-based irrigation — as the primary unit of intervention. Batna's respondents appear to be asking a different question, closer to spatial continuity and everyday accessibility than to technological sophistication, which suggests that renaturation strategies imported wholesale from contexts where such devices are prominent may be answering a demand that is not, in fact, the one residents are expressing.

4.4 From shared attitudes to unequal capacity to act: an Algerian illustration of the attitude-behavior gap

Batna's results illustrate the attitude-behavior gap well documented in environmental psychology [18]: favorable attitudes toward biodiversity and spontaneous nature show no significant variation by education, yet actual willingness to engage is strongly structured by it ($\chi^2 = 23.890$, $p = .001$). This gap between an evenly shared attitude and an unevenly distributed capacity to act corroborates Pooley and O'Connor [32]: positive environmental attitudes are necessary but not sufficient for action, which also depends on perceived personal efficacy, itself unevenly distributed by educational capital. The gap has an institutional face too: civic engagement favors institutionally supported action (46%) over autonomous initiative (39.6%), suggesting that — unlike the informal self-organization documented elsewhere in Algerian urban life — environmental engagement here is expected to be structured and legitimized by public institutions rather than improvised individually [33]. Finally, the gap is affective as much as institutional: despite majority support for biodiversity trade-offs (58.4%; (58.4%) [34, 35],), the persistence of specific fears — of pests, of insufficient political will, of insecurity — indicates that closing the gap will require institutional guarantees addressing these concrete frictions, not awareness campaigns alone [19]. Taken together, the three faces of this gap — educational, institutional, and affective — suggest that "willingness to engage" is best treated not as a single attitude but as a composite

outcome, each component of which responds to a different kind of intervention: information for the educational component, credible institutional channels for the institutional component, and concrete reassurance — about pests, about maintenance, about safety — for the affective one.

4.5 From "saying" to "doing" : a life-course reading of ecological appropriation

The year-long observation converts the declarative demand for nature captured by the survey into a differentiated map of actual engagement, structured less by isolated individual variation than by a life-course logic : the relationship to nature shifts from tactile exploration in childhood to contemplative caution in old age, with adulthood marking the emergence of a properly civic register. This civic register is most visible in adults' informal maintenance practices — notably the spontaneous watering of trees — which, like the self-organized practices already discussed in relation to environmental engagement, operate outside any formal mandate. This dovetails with Barthel et al.'s [36] work on social-ecological memory, pointing to a latent governance resource: these "micro-stewards" are not so much acting despite the absence of institutional support as filling it — a distinction that matters for any policy seeking to formalize rather than merely tolerate such practices.

The static assessment reveals a further duality, more specific than a simple lack of automatic acceptance : perennial, ornamental elements (trees, street furniture) are broadly respected, while wild flora and grass remain more vulnerable. This asymmetry suggests that the ecological legitimacy of spontaneous vegetation — as opposed to planted, visibly designed nature — is not yet self-evident to users, a gap in ecological legibility rather than a rejection of nature as such [20]. As the observational data make explicit, this generational gradient argues against a one-size-fits-all renaturation design: children require mediating tools that convert exploratory contact into care rather than damage [37]; adults represent an underused lever for participatory governance rather than a population to simply inform [33]; for the elderly, benefit is conditional on a sense of safety and quiet, not merely on proximity to greenery [25] — itself consistent with a longer Algerian tradition of tree-lined avenues as spaces of calm, leisurely appropriation. Finally, the spatial coincidence between neglect behaviors and areas rated poorly for watering and cleanliness suggests, without establishing a direct causal link, that disengagement more often reflects a management shortfall than a deep-seated hostility to nature — reinforcing, alongside

§4.2, participatory governance as a precondition for renaturation's durability rather than a desirable complement to it [38]. Read against the declarative results in section 3.1, this life-course pattern also qualifies what "engagement" should be expected to look like in practice: for a large share of users, especially children and the elderly, the relevant form of engagement is not formal participation in planning processes but everyday, low-visibility interaction with the site — a distinction planners should keep in mind when designing participatory mechanisms that implicitly assume a working-age, civically-available participant.

4.6 The Batna case in national perspective: convergent signals, not statistical proof

Two events from the last quarter of 2025 invite us to read the Batna case within a broader Algerian context, without treating them as a validation of our results at the national scale. On October 25, 2025, a national reforestation campaign led by the Ministry of Agriculture, Rural Development, and Fisheries, together with the "Al-Jazaïr Khadraa" association, mobilized more than 1.39 million trees planted in a single day across all 58 provinces, exceeding its initial target of one million seedlings. Beyond its technical scale, the campaign's reliance on citizens, schools, and volunteers, amplified by the "Khadra bi idhn Allah" social-media campaign [39], illustrates a form of collective appropriation of public space through vegetation that resonates with the participatory aspirations expressed by our respondents. A parallel shift occurred in November 2025 around urban wildlife: the "#StopGaloufa" movement, which denounced the culling of stray animals, led to a ministerial decision replacing indiscriminate slaughter with sterilization and vaccination programs grounded in a One Health approach, echoing the majority preference for coexistence with urban wildlife observed in our own data [40]. Neither event constitutes empirical proof that our findings generalize to Algeria as a whole — the sample and observation site of this study remain specific to Batna — but both suggest that the attitudes and practices identified locally are not an isolated phenomenon, and that the hypothesis of a broader Algerian socio-ecological transition would deserve to be tested through comparative research in other cities. For policymakers, the coincidence is nonetheless useful: it suggests that local renaturation initiatives in Batna would be pushing in the same direction as, rather than against, a wider national momentum, which may ease the political cost of committing municipal resources to them.

4.7 Toward an integrated reading: renaturation as an unevenly distributed capacity

Read across all seven results, a single pattern recurs: Batna's residents do not lack ecological values ; what varies is their capacity, opportunity, and institutional legitimacy to act on those values. Attitudes toward nature — whether spontaneous vegetation, urban wildlife, or the green-city ideal — are remarkably homogeneous across gender, age, and education. What differs sharply across these same variables is engagement : who uses green space, who volunteers to maintain it, who believes their engagement will be institutionally supported. This distinction, familiar from environmental psychology's attitude-behavior gap [18], takes a specific shape in Batna : it is structured less by disagreement over ends than by unequal access to the means of acting — safety for women, confidence and resources for the less educated, institutional trust for residents in general. Framed this way, the local case this study set out to describe becomes something more transferable: an illustration of how a globally-documented gap between environmental attitude and behavior is locally inflected by gender norms, educational stratification, and a preference for institutionally sanctioned rather than autonomous civic action — three variables any renaturation strategy in a comparable Algerian city would need to take seriously, whatever its specific site or sample.

5. Limitations

Three primary limitations qualify these findings. First, the non-probability quota sample, self-administered via social media and QR codes, likely over-represents younger, highly educated, and digitally active residents. In contrast, older residents, those without regular access to the internet, and less digitally engaged neighborhoods are very likely underrepresented relative to their real share of Batna's population. The results of the survey should therefore be seen as representing this particular demographic profile, and not necessarily as fully representative of the city as a whole.

Second, the in situ observation was conducted at a single, purposively selected site. While methodologically justified as the most relevant case among the candidate spaces, the specific mix of uses at Benboulaïd walkways—alongside its central, well-maintained character—may not reflect the

realities of more peripheral or under-resourced sites. Generalization to other public spaces in Batna therefore warrants caution.

Third, as indicated above, the recent national environmental campaigns are seen as convergent contextual signals, not as statistical evidence for the universal applicability of our results in Algeria.

Together, these limitations suggest less a flaw in the research design than the specific scope within which its conclusions should be read: as a grounded, doubly-validated account of socio-ecological dynamics in one Algerian city, not a definitive snapshot of the whole country. Further research combining multi-site spatial observation and probability sampling would be important to assess the external validity of these patterns in other Algerian urban settings.

6. Conclusion

Across all three data sources — questionnaire, observation, and national context — this study converges on a single finding: the residents of Batna accept urban renaturation, flora and fauna combined, as a plausible and desirable future for their city. This acceptance operates on three levels: declarative (near-unanimous recognition of nature's benefits, strong demand for participatory governance and everyday green infrastructure), behavioral (a majority of on-site interactions already reflect acceptance, including emergent informal stewardship), and macro-social (national mobilizations suggesting a similar shift from "saying" to "doing" beyond Batna alone, though this remains a hypothesis rather than a demonstrated fact).

This acceptance is not, however, evenly distributed. It is structured by education, which governs the transition from favorable attitude to actual engagement ($\chi^2 = 23.890$, $p = .001$), and by gender, which shapes both satisfaction and use of existing green space. Renaturation's uptake in Batna therefore depends less on convincing residents of nature's value — already largely accepted — than on addressing the institutional, spatial, and informational conditions that currently prevent that value from translating uniformly into practice.

These patterns translate into fairly concrete priorities for local planning. Because attitudes are already favorable and fairly homogeneous, campaigns aimed at persuading residents that nature belongs in the

city are likely to yield less than campaigns aimed at removing the specific frictions identified here: perceived insecurity and poor lighting for women's use of green space, unclear or absent channels for citizen involvement in maintenance, and a persistent conflation of "renaturation" with simple greening that understates what residents are actually being asked to support. None of these are large-budget interventions ; each is closer to a governance and communication fix than an infrastructure one, which is itself a modestly encouraging finding for a municipal context with limited resources.

More broadly, this study suggests that a mid-sized Algerian city can be a productive rather than a marginal site for testing ideas developed primarily in European and North American urban literatures. Batna's residents engage with the language of the "green and sustainable city" in ways that closely track international debates, while also filtering that language through locally specific practices — informal stewardship, neighborhood solidarity, a preference for institutionally endorsed rather than autonomous action — that are not simply local color but substantive modifiers of how a globally-discussed attitude-behavior gap actually operates on the ground. Taking that filtering seriously, rather than treating Batna as a passive recipient of imported concepts, is what allows a study of one city to speak, cautiously, to a wider conversation about renaturation in the Maghreb.

For Batna, renaturation is therefore neither a luxury nor a utopia: it is the response most coherent with, and most legitimately rooted in, residents' own expectations for the environmental, climatic, and social challenges of the city of tomorrow. Any renaturation strategy should integrate three inseparable dimensions identified by this study: improved infrastructure (cleanliness, safety, accessibility); equitable spatial distribution to avoid an ecological divide between neighborhoods; and renewed environmental education able to transform individual aspirations into a shared, inclusive, and sustainable urban culture of nature. Whether this pattern extends beyond Batna to other Algerian cities remains, as noted in section 5, an open and promising question for future comparative research.

List of Abbreviations

SPSS: Statistical Package for the Social Sciences

QR (code): Quick Response (code)

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