

## Article

# Improving Psychological Well-Being in Urban University Districts through Biophilic Design: Two Cases in Mexico

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**Abstract:** Since 2007, more than half of the population has lived in cities, and an increase of 60 percent is expected by 2030. The city can bring many benefits to citizens, but it also brings a series of problems, such as a loss of psychological well-being and the breakdown of social cohesion and several aspects of mental health. University districts, usually concentrated in specific parts of cities, suffer particularly from these negative effects. Nature can be used to alleviate these problems and provide the benefits of a connected urban life. The university community's well-being depends on contact with nature. In this sense, biophilic design improves the built environment. The purpose of this article is to analyze the relationship between connectedness to nature and psychological well-being in university communities to contrast the effect that nature has on people's psychological well-being and to identify possible biophilic design patterns that could improve connectedness to nature, validating the urgent need to design and implement biophilic design in current cities and university urban districts.

**Keywords:** biophilia; biophilic design; connectedness to nature; nature; psychological well-being; university districts



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**Citation:** Cobreros, C.; Medoza-Ruvalcaba, N.; Flores-García, M.; Roggema, R. Improving Psychological Well-Being in Urban University Districts through Biophilic Design: Two Cases in Mexico. *Sustainability* **2023**, *15*, 5703. <https://doi.org/10.3390/su15075703>

Academic Editor: Miguel Amado

Received: 26 January 2023

Revised: 14 March 2023

Accepted: 17 March 2023

Published: 24 March 2023



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## 1. Introduction

Absence of nature and green spaces in the direct vicinity of urban dweller's surrounds has arguably negative impacts on their general, mental, and physical health. In this article, biophilic design interventions are identified to provide positive health impacts in university districts.

With more than half of the global population living in cities since 2007, a percentage that is expected to increase to 60% in 2030, adding 2.4 billion people by 2050 [1], and occupying a mere 3% of the territory [2], health concerns of the urban population are on the rise, as is the role that nature can play in improving urban living conditions. Cities may be seen as centers that promote mental health [3], urban interactions also entail a loss of psychological well-being and a breakdown of social cohesion [4], leading to suboptimal mental health conditions such as depression [5] in cities, in comparison with rural areas [6–8].

“The modern city represents a regressive encroachment of the synthetic on the natural, of the inorganic (concrete, metals, and glass) on the organic, or crude, elemental stimuli on variegated wide-ranging ones” [9] (p. 26). The city is posited here as the antithesis of nature; the organic is pitted against the artificial. Cities are not explicitly “designed for nature” [10], threatening biodiversity and people's opportunities to interact with nature [11], especially for individuals living within economically deprived urban areas [12], or mental barriers [13].

The lack of outdoor experiences, contact with, and visualization of natural beauty, denies personal physiological nature [14–16], restricting physical and mental [17], spiritual [18], and social [19] benefits. This progressive disconnection with nature is associated with increases in stress-related illnesses [20] and affects human health, well-being, attitudes, and behaviors towards nature [21]. There is broad consensus that limited views of the outdoors or access to exterior landscapes [22–24], no natural light [25], no contact with nature patterns, biomimicry, space diversity, native elements, plants, plant patterns, simulation of natural features or water [24], limits restorative healthy environments [25].

Opportunities for nature experiences are decreasing for many people around the globe, despite their being associated with increased psychological well-being [11]. “Ecological conditions and processes do not operate separately from social processes, and existing socio-natural conditions are always the result of intricate transformations of pre-existing configurations that are themselves inherently natural and social” [26] (p. 445). The urbanization process is “an ecological transformation, which requires the reproduction of those relations in order to sustain it” [27].

The question, therefore, is how to design a city, so it can facilitate the accessibility, the quality, and the quantity of nature. This design is determined by [11]:

- a. The type of natural features: better quality and quantity of nature characterize and define “natural features” (including size, type, composition, spatial configuration, biodiversity, and other attributes of land covers/uses);
- b. The exposure to these features: easier access to nature characterizes “exposure” of people to nature (and/or type of “use”) through an accounting/estimation of the proximity, likelihood, and duration of nature contact of this nature to people;
- c. The experience with these features: the intensity of the interaction with nature illustrates some of the crucial characteristics of nature exposure (i.e., nature experience) types, forms, and the intensity of the experience that exposure instantiates through the approaches captured in the notions of “interaction pattern” and “dose”.

### *Biophilic Design*

The interaction with nature is called Biophilia [28], the “innate emotional affiliation [29] of human beings with other living organisms”, which describes the deep feelings of connection with nature [30]. This emotional affiliation is deemed “essential for human mental health and in that attachment, we find what is vital” [31]. This theory connects with many others that seek restoration and awareness of the environment, and revealing, reviving, or regenerating this loving relationship with nature [32–34], gradually helping the individual towards an “inner transformation” [35], overcoming the current deficit of direct contact or the fragmentation of our perception of the living world [36]. Contact with the natural generates emotion, meaning, compassion, and beauty [37], leading to a stage of “revival” [33].

The general benefits of biophilic design are related to the role nature plays in allowing humanity to have all the benefits of a connected urban life while alleviating the urban environment penalty [1]. Being in contact with nature and its processes, having access to open natural spaces such as parks, gardens, or rivers, and the interaction with animals and plants improves our general wellbeing [38], our health [39,40], and has environmental, social, cultural, and economic benefits [21,41]. The magnitude of the impact of nature on physical and mental health depends on the complex interactions between urban form, human society, and natural features [37,42]. Pathways to enhance nature relatedness involve sustained contact, emotion, and compassion toward nature, as well as appreciation of beauty [43]. However, the relationship with nature and environmental knowledge develops throughout an individual’s life and not only during childhood [21]. Biophilic design incorporates natural components into built environments [44]. There are successful examples of biophilic urban acupuncture, with a positive impact on emotional health, promoting physical activity, accessible and inclusive, promoting sensory stimuli [45]. Biophilic design contributes to improved wellbeing [46]. Biophilic cities are resilient and sustainable cities,

providing numerous ecological and adaptive services at the same time, while providing essential benefits in the form of mental and physical health [47].

Schools and educational institutions play an important role in promoting connections with nature [48]. A natural environment therefore ensures that the benefits reach young people, favor the use of nature, promote attention, cognitive performance, and mood [49], and improves concentration, self-discipline, and reduce physiological stress [50]. Contact and visualization of natural beauty stimulate prosocial behavior and empathy, generosity, trust, and collaboration [16,19,51]; this can be accomplished, for instance, by the mere existence of nearby green spaces [47,52]. People have greater social contact with each other [53] and expose to nature inspires them to acquire human senses, develop social behaviors, and even create ethical structures that are intimately derived from our relationships with other living beings [38].

There are also substantial benefits for physical health [54,55], resulting from both qualitative and quantitative increase of natural elements [56–59]. Spending more time outdoors reduces heart rate and blood pressure and increases the immune system function [60] and mindfulness [61].

Being in contact or interacting with natural environments improves general mental wellbeing [62,63], especially for children and adolescents [47,64,65]. There is a multitude of benefits of natural environments for mental health: It can reduce stress, increase creativity, and improve mental clarity [45,66,67]; it constitutes a healthy restorative environment [24,25] and restorative functions [68]. It can reduce incidences of depression and stress [41,60], anxiety [51], and schizophrenia [69], and can improve self-reported mental health [70] and one's sense of emotional well-being, particularly among those susceptible to mental health problems [71]. Adults improve in mood [42,72]. Brain activity is forged in the connection with nature and urban nature is necessary for good psychological functioning [41]. Nature relatedness is related to general psychological well-being and subjective well-being [73,74]. It is important that populations vulnerable to mental health problems, have easy access to parks and feel safe using it [47]. Three main pathways are provided by the natural environment that contribute to benefits for mental health and psychological well-being [67]:

- Directly through the restorative effect of nature;
- Providing opportunities for positive social contact;
- Providing opportunities for physical activity.

The purpose of this article is to analyze the relationship between connectedness to nature and psychological well-being in university communities, to contrast the effect that nature has on people's psychological well-being, and to identify possible biophilic design patterns that could improve connectedness to nature, validating the urgent need to design and implement biophilic design in current cities and university urban districts.

## 2. Materials and Methods

The research is based on the study of the relationship between connectedness to nature and psychological well-being, conducted by a multicenter study and supported, as a main method, by a cross-sectional survey. The research is complemented by the identification of possible biophilic design patterns that could suit the improved psychological well-being through better connectedness to nature.

The relationship between connectedness to nature and psychological well-being is conducted by a multicenter study in Guadalajara and Querétaro, located in the west and center of Mexico. The analytical cross-sectional design, based on the perception of users regarding their environment, has a double purpose, from the descriptive to the analytical [75]. Participating individuals in the survey were eligible when they were 18 years or older, consented to participating, and completed the designed research-form. Incomplete submissions were excluded. Totally,  $n = 276$  people participated, of whom 63% ( $n = 174$ ) were women, 35.1% ( $n = 97$ ) men, and 1.8% preferred not to specify ( $n = 5$ ). The average age was 27.3 years (S.D. = 10.8), ranging between 18 and 75 years, and 65% were between

20 and 29 years old. Of the total population, 47.83% corresponded to Querétaro and 52.27% to Guadalajara. To measure the impact of nature on psychological well-being, several scales have been applied (See Table 1). The Connectedness with Nature Scale [76] was used to measure the level of affective and experiential connection of individuals with nature. The scale has a Cronbach's alpha  $\alpha = 0.84$ . Psychological well-being was operationalized through different affective dimensions experienced by people during life. The Mood Rating Scale was used [77] to assesses four emotional states: depression, anxiety, hostility or anger, and joy. The scale has a Cronbach's alpha  $\alpha = 0.81$ . The Satisfaction with Life scale [78] measures individuals' global cognitive judgments of satisfaction with their life. The scale has a Cronbach's alpha  $\alpha = 0.87$ . The Perceived Stress Scale was used [79] to assess the level of stress involved in different life situations. The scale has a Cronbach's alpha  $\alpha = 0.87$ . Finally, to assess the quality of life, the World Health Organization's Quality of Life Scale WHOQOL-BREF [80] was used. It has a Cronbach's alpha  $\alpha = 0.90$ . To explore the impact of connectivity with nature on psychological well-being, multivariate analysis of variance (MANOVA) was conducted. The dependent variables referred to mood (sadness/depression, anxiety, anger/hostility, joy), life satisfaction, perceived stress, and quality of life (general, perceived, physical, psychological, social relationships, environment), all of which were integrated as the psychological well-being variable. The Bonferroni adjusted alpha of 0.017 was used and partial eta squared ( $\eta^2$ ) values were calculated to estimate effect size. Values greater than 0.14 (or 14%) were considered large effects [81].

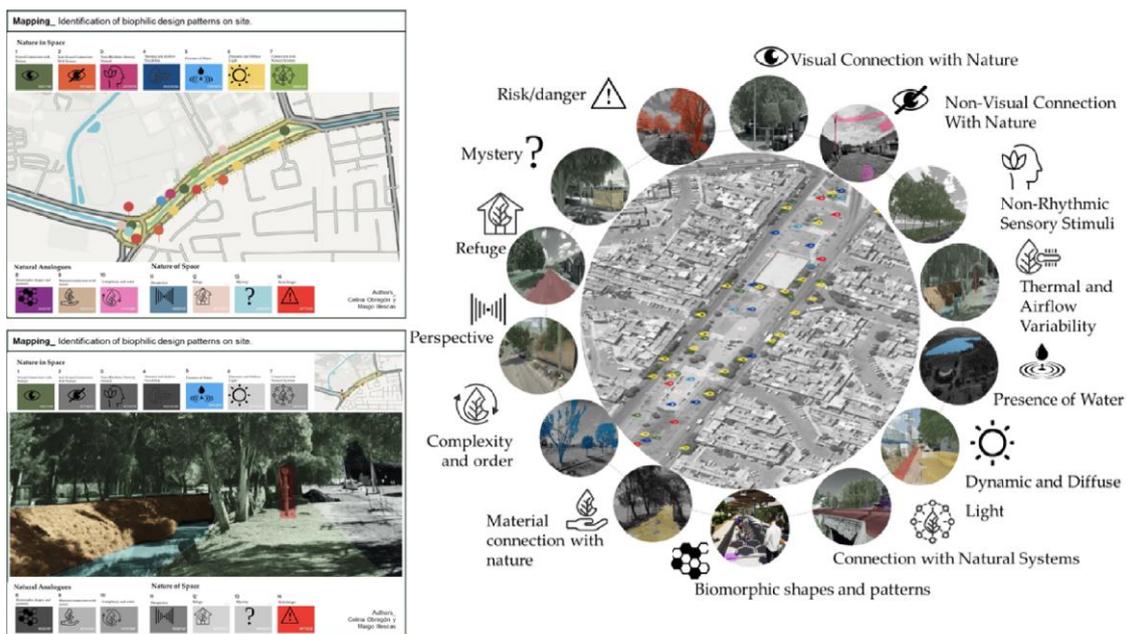
**Table 1.** Measurement scales for the design of the instrument.

Measurement Scales	Specific Objectives
The Connectedness with Nature Scale [76]	To measure the level of affective and experiential connection of individuals with nature.
Mood Rating Scale [77]	To assess four emotional states: depression, anxiety, hostility or anger, and joy.
The Satisfaction with Life scale [78]	Measures individuals' global cognitive judgments of satisfaction with their life.
The Perceived Stress Scale [79]	To assess the level of stress involved in different life situations.
World Health Organization's Quality of Life Scale WHOQOL-BREF [80]	To assess the quality of life in general and four domains: physical health, psychological health, social relationships, and environmental health.

Complementarily, possible biophilic design patterns have been identified that could suit the improved connectedness to nature and consequently, as a hypothesis, psychological well-being. Therefore, 14 biophilic design patterns [45], subdivided in 3 conceptual categories (nature in space, natural analogues, nature of space) [82], have been selected, which relate human biological science and nature to the design of the built environment (Table 2). Direct observation techniques and methods through pedestrian-scale photographs were employed, wherefrom biophilic design patterns were categorized. Each image was broken down and analyzed to highlight the coincidences of each "pattern-element" with its environment, which resulted in an image translated into a diagram (Figure 1) where the patterns were highlighted based on their physical characteristics, such as size, proportion, structure, among others, identifying, punctually, its location, and associating the experience and feelings derived from it.

**Table 2.** Fourteen biophilic patterns.

Nature in Space	Natural Analogues	Nature of Space
Visual Connection with Nature	Biomorphic shapes and patterns	Perspective
Non-Visual Connection with Nature	Material connection with nature	Refuge
Non-Rhythmic Sensory Stimuli	Complexity and order	Mystery
Thermal and Airflow Variability		Risk/danger
Presence of Water		
Dynamic and Diffuse Light		
Connection with Natural Systems		



**Figure 1.** Example of identification of biophilic design patterns on site.

For the identification of biophilic design patterns, variables have been determined that allow characterizing each of the elements of the study area. The characterization matrix shown in Table 3 indicated a code that was obtained for the analysis and graphing in percentage of presence of each of the patterns in the place.

For the identification of biophilic patterns, Figure 2 shows the eight analytical cases from eight reference, representative, and characteristics locations of the studied urban university districts were defined with different characteristics and scales to allow the validation of the biophilic pattern identification instrument. For this, the weighting was 100% when identifying all 14 patterns, which gave a value of 7.14% to each pattern with the intention of initially identifying a significant presence of biophilic patterns at the diagnostic level (%). For this, work sheets were made which integrated references in the analyzed path, as well as images and their categorization.



**Figure 2.** Variability in intervention scales for the identification of biophilic design patterns in sites at the initial diagnostic level.

**Table 3.** Characterization of biophilic patterns and codes for identification of elements on site.

Biophilic Patterns and Code	Characterization of Elements
1. Visual Connection With Nature (VCWN)	Views, natural elements, natural processes.
2. Non-Visual Connection With Nature (N-VCWN)	Noise, Touch, Smell, taste, Sight. Positive perception regarding nature.
3. Non-Rhythmic Sensory Stimuli (N-RSS)	Random, ephemeral behavior regarding the connection with nature.
4. Thermal Variability and Airflow (TVA)	Air temperature, relative humidity, airflow across the skin, and surface temperatures that mimic natural environments.
5. Presence of Water (PW)	Hear and touch Water, experience improvement.
6. Dynamic And Diffused Light (DDL)	Light and shadow, experience of the natural.
7. Connection With Natural Systems (CWNS)	Seasonal changes, healthy ecosystems.
8. Biomorphic Forms and Patterns (BFAP)	Symbolic: natural form, texture, rhythm, order.
9. Material Connection With Nature (MCWN)	Materials and elements of nature that local ecology or geology. Distinctive sense of place.
10. Complexity And Order (CAO)	Rich sensory information and hierarchy, spatial.
11. Perspective (PER)	Free view, monitoring and planning.
12. Refuge (REF)	Place of Protection, to minimize risk, security.
13. Mystery (MY)	Attraction, Curiosity, Surprise.
14. Danger/Risk (D/R)	A threat, trust level.

### 3. Results

#### 3.1. Connectedness to Nature and Psychological Well-Being

The results of the study of the relationship between connectedness to nature and psychological well-being are depicted in Table 4. No differences were found according to gender or age.

The relationship between connectedness to nature and the variables of psychological well-being is shown in Table 5. Referring to mood, a positive significant relationship was found between connectedness with nature and feelings of joy ( $r = 0.159, p = 0.009$ ), no correlation was found with sadness/depression, anxiety, and anger/hostility. A positive significant relationship was also observed between connectivity with nature and life satisfaction ( $r = 0.302, p = 0.000$ ), quality of life in general ( $r = 0.203, p = 0.001$ ), as well as in its specific dimensions of physical health ( $r = 0.154, p = 0.011$ ), psychological health ( $r = 0.282, p = 0.000$ ), and social relationships ( $r = 0.133, p = 0.027$ ). Additionally, a significant negative correlation was found between connectivity with nature and perceived stress ( $r = -0.175, p = 0.004$ ). Most representative correlations are shown in Figure 3, which shows a trend of

major connectedness to nature being associated with major life satisfaction, general quality of life, health, and psychological quality of life, as well as less perceived stress.

**Table 4.** Connectedness to nature and variables of psychological wellbeing.

Variable	Mean	SD	Minimum	Maximum	
Connectedness to Nature	54.09	9.36	24.00	70.00	
Psychological Well-Being	Depression	9.20	4.24	4.00	20.00
	Anxiety	10.20	4.41	4.00	20.00
	Hostility	7.75	4.11	4.00	20.00
	Happiness	13.25	3.66	4.00	20.00
	Life Satisfaction	25.26	6.26	6.00	35.00
	Perceived Stress	40.94	9.37	17.00	62.00
	QOL Perceived	4.20	0.80	1.00	5.00
	Subjective Health	4.01	0.92	1.00	5.00
	QOL Physical Health	27.93	4.86	13.00	35.00
	QOL Psychological	22.41	4.43	8.00	30.00
	QOL Social Relationships	11.42	2.61	3.00	15.00
	QOL Environmental	31.61	5.05	17.00	40.00
CV General	101.61	14.65	60.00	128.00	

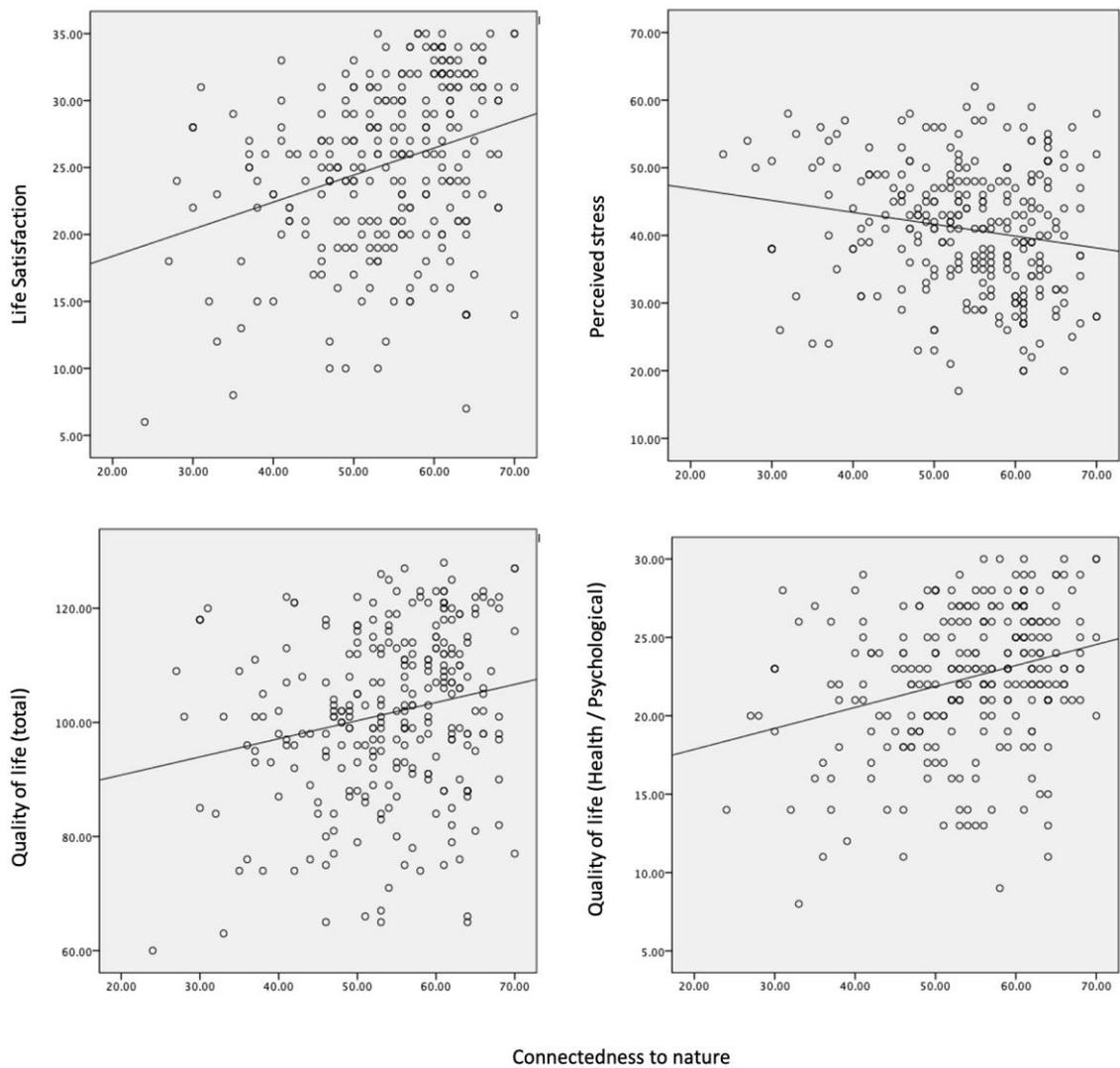
Notes: QOL = Quality of life, SD = Standard deviation.

**Table 5.** Correlation between connectedness to nature and variables of psychological wellbeing.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Connectedness to nature	1													
2. Depression	-0.041	1												
3. Anxiety	-0.054	0.668 **	1											
4. Hostility	-0.069	0.663 **	0.651 **	1										
5. Happiness	0.159 **	-0.434 **	-0.363 **	-0.320 **	1									
6. Life satisfaction	0.302 ***	-0.269 **	-0.288 **	-0.378 **	0.445 **	1								
7. Perceived stress	-0.175 **	0.494 **	0.596 **	0.414 **	-0.389 **	-0.540 **	1							
8. QOL perceived	0.056	-0.103	-0.122 *	-0.236 **	0.265 **	0.538 **	-0.193 **	1						
9. Subjetive health	0.018	-0.206 **	-0.248 **	-0.278 **	0.287 **	0.405 **	-0.255 **	0.470 **	1					
10. QOL Physical health	0.154 *	-0.447 **	-0.475 **	-0.463 **	0.447 **	0.549 **	-0.472 **	0.432 **	0.523 **	1				
11. QOL Psychological	0.282 ***	-0.527 **	-0.552 **	-0.445 **	0.526 **	0.652 **	-0.679 **	0.289 **	0.403 **	0.674 **	1			
12. QOL Social relationships	0.133 *	-0.338 **	-0.330 **	-0.273 **	0.338 **	0.512 **	-0.385 **	0.398 **	0.298 **	0.479 **	0.547 **	1		
13. QOL Enviromental	0.112	-0.226 **	-0.229 **	-0.315 **	0.319 **	0.571 **	-0.298 **	0.629 **	0.450 **	0.543 **	0.434 **	0.409 **	1	
14. QOL General	0.203 ***	-0.466 **	-0.485 **	-0.477 **	0.511 **	0.725 **	-0.560 **	0.603 **	0.593 **	0.866 **	0.815 **	0.685 **	0.792 **	1

Notes: QOL = Quality of life, \*\*\*, Correlation is significant at the 0.001 level (2-tailed), \*\*, Correlation is significant at the 0.01 level (2-tailed), \*. Correlation is significant at the 0.05 level (2-tailed).

The effect of connectedness to nature on the psychological well-being variable is shown in Table 6. Connectedness with nature had a significant effect on the combined dependent variable of psychological well-being, explaining 17% of the variance ( $F = 1.13$ ;  $p = 0.001$ ; Wilkes Lambda = 0.10). Specifically, connectivity with nature had a large significant effect explaining 29% of the variance in life satisfaction ( $F = 2.3$ ;  $p = 0.000$ ); 27% of the variance in psychological health ( $F = 2.1$ ;  $p = 0.000$ ); 25% of the variance in perceived stress ( $F = 1.9$ ;  $p = 0.001$ ); 23% of the variance in general quality of life ( $F = 1.7$ ;  $p = 0.008$ ); and 21% of the variance in quality of life in the dimension of social relationships ( $F = 1.5$ ;  $p = 0.002$ ).



**Figure 3.** Correlation of connectedness to nature and life satisfaction, perceived stress, total quality of life, and health-related/psychological quality of life.

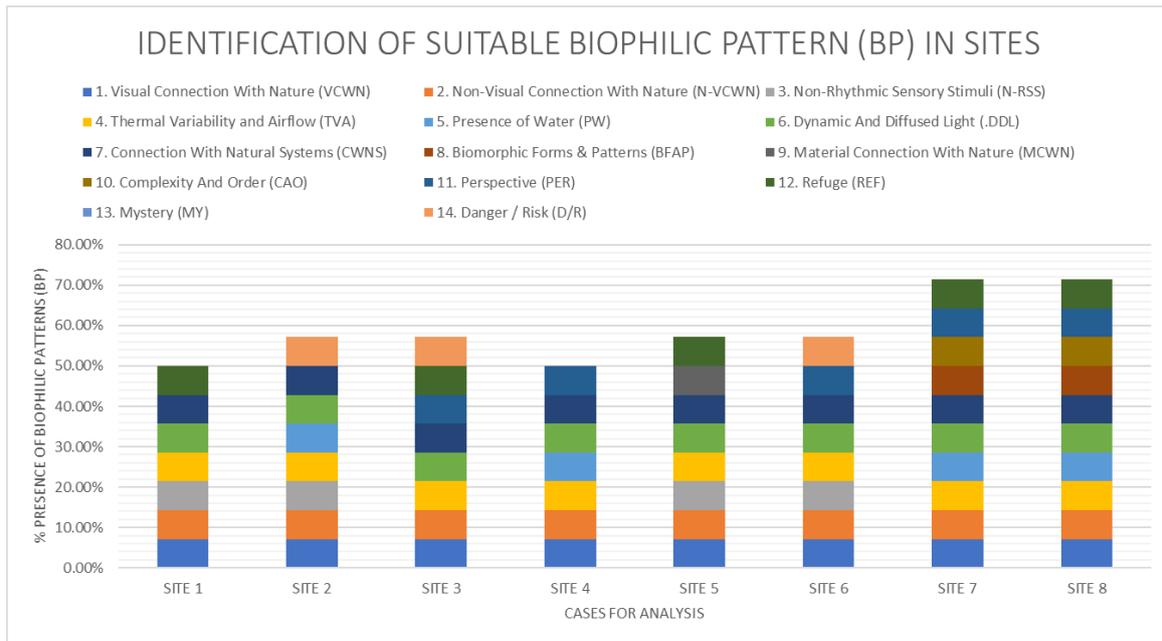
**Table 6.** Effect size of connectedness to nature on psychological well-being variables: mood states, perceived stress, life satisfaction and quality of life.

Variables of Psychological Well-Being	F	n2	p
Happiness	1.264	0.184	0.145
Depression	1.451	0.206	0.047
Anxiety	1.065	0.160	0.374
Hostility	1.204	0.177	0.199
Perceived stress	1.937	0.2570	0.001
Life satisfaction	2.311	0.292	0.000
QOL General	1.700	0.233	0.008
QOL Perceived	1.362	0.195	0.082
Subjective Health	1.001	0.151	0.477
QOL Physical Health	1.389	0.198	0.070
QOL Psychological	2.117	0.274	0.000
QOL Social Relationships	1.547	0.216	0.002
QOL Environmental	1.537	0.215	0.026

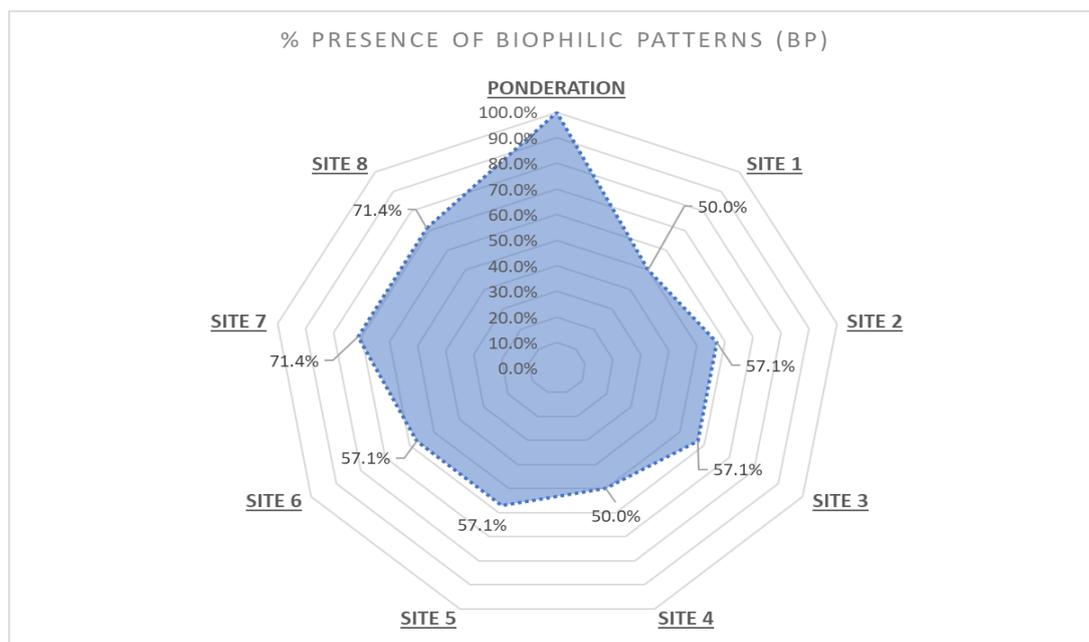
Notes: QOL = Quality of life; n2 = partial eta squared (size effects).

### 3.2. Identification of Suitable Biophilic Patterns

According to the results shown in the Figure 4, the existing elements that show a direct initial contact were clearly identified in all the cases, and those that denoted an experience were not so easily identified. It is also possible to recognize that the average biophilic patterns scored 8 out of 14, with a strong tendency to the presence of nature in the place. Secondly in the Figure 5, the percentage of present biophilic patterns as a global value per case study is observed, identifying those cases with the most potential to develop strategies based on biophilic design.



**Figure 4.** Identification of suitable biophilic patterns in different sites for case studies and % of presence of each one per case.



**Figure 5.** Presence of each pattern per case.

#### 4. Discussion

Connectedness with nature has a large significant effect in relation to life satisfaction. Engaging with the natural environment contributes to various objective and subjective metrics of human wellbeing, and nature provides substantial cultural and social values to humans. Previous studies have confirmed these findings. In this sense, nature's restorative effect explains why happiness is directly related to nature connectedness. Moreover, people with a higher connectedness to nature are more likely to spend time in nature, and they benefit from both the affective and revitalizing effects of natural environments.

In this study, it is found that the connectedness to nature has a large positive impact on stress. This is well documented by previous studies that report that being in nature, frequent exposure to nature, or even viewing scenes of nature reduce negative effects such as anger, fear, and stress. Connectedness to nature is also associated with, and has an important impact on, the quality of life improving an individual's general well-being, including physical, emotional, and psychological aspects. Spending time in nature, engaging with nature directly and indirectly, and a strong sense of nature connectedness (a psychological/emotional connection with nature) positively impact wellbeing. Specifically, nature connectedness and engaging with nature through simple activities (such as smelling flowers) are stronger predictors of wellbeing and mental health, rather than the actual time spent in nature [82].

In this study, the sizes of the effects are, in general, large; these were statistically significant and relevant. Not only does scientific evidence provide support to the intuition of individuals who visit parks and gardens that they personal health and well-being benefits; it also provides the basis for spatial interventions that are based on increasing the exposure to nature in cities as a practical way to enhance public health. In this sense, contact with nature provides an effective population-wide strategy.

Although the findings in this and many other studies suggest that connectedness to nature has a positive impact on psychological well-being, some limitations are addressed. An important limitation in this study relates to the fact that the participants were recruited from an email list of a private university, which limits the generalizability to larger populations. Future research involving a wider population is suggested. Another limitation is related to its cross-sectional nature which limits our conception of causal relationships; therefore, longitudinal data are needed to provide stronger evidence. Finally, data collection was developed by an online self-report questionnaire, which represents bias due to the fact that the population to which it was distributed cannot be accurately described, and respondents with biases may select themselves into the sample.

While the implementation of biophilic design at the urban scale can be very purposeful and ambitious, the implementation in cities is not so straightforward, as they have different characteristics in all their dimensions. Although the benefits of resilience are broad, they require considerable biophilic investments, from trees and urban forests to wetland systems. However, it serves the expansion of adaptive capacity in the face of a "storm" of shocks and stressors that global cities will face in the coming decades. This helps people, individuals, families, and communities, to become healthier and more socially connected, with a greater likelihood of successfully adapting to the future.

There is little understanding of the processes that are derived from a biophilic city, which posits adaptations to the functioning of natural systems. It is not clear, for example, what the minimum level of nature, or access to nature, is to live a healthy, happy, and resilient life. Additionally, the cumulative impacts of different green elements and combinations of green elements in urban environments is ill-understood. There is much more research required to better understand the benefits that resilience provides to biophilic cities and even the different basic forms in which urban biophilia manifests (which vary by geography and climate) [83].

This study provided evidence for the identification of a variety of biophilic patterns for new intervention opportunities based on biophilic design with high development potential.

The methodology started with the adaptation of biophilic design patterns, then identified the parameters for the existing infrastructure of the city within the study areas in eight representative locations of the two urban university districts studied. We chose the locations because they are characteristic of both cases, and associated the level of interaction of students with the psychological metrics of well-being and commitment to nature.

This study not only highlights the importance of integrating aspects of biophilic design, but also the need to integrate multidisciplinary approaches in which different types of data, such as environmental, statistical, sociological surveys, geographical information, and design with nature, can be related [84]. As mentioned above, it is of vital importance to recognize the physical environment from everyday experiences with nature, which will allow us to propose biophilic design strategies towards the shaping of a true biophilic city.

## 5. Conclusions

The article illustrates the effect of nature on people's psychological well-being and validates the need to design and implement biophilic design strategies and patterns in cities and university districts. It is not enough simply to mimic nature in the city/urban environments; this should be read as real nature, with all the in-depth features nature has (clean air, take up of particles, carbon, producing oxygen, food, etc.).

It can be concluded that connectedness with nature has a significant positive effect on psychological well-being, showing consistency with former studies carried out which revealed, e.g., that connectivity and access to nature should play an important role in the structure of cities. Biophilic design should therefore play a fundamental role in the development of future cities, thus validating the need to design and implement biophilic design strategies in today's cities.

This study contributes to the theory on the benefits of connectedness with nature in relation to public health and life satisfaction in cities, promoting substantial cultural and social values, with a positive impact on states of mind, and specifically on happiness.

In view of the above, it is suggested that researchers continue to delve into exploratory methodologies for the recognition of biophilic design patterns in the neighborhood and the interaction of the community with each one of them. They will be recognized as strategic components of a healthy environment. It will be important to delve into the variability and adaptability of different environments which converge with the natural processes of permanent transformation, and also to explore other experiences from the perspectives of age and gender, and the perception of other sectors in conjunction with education, including the variable of temporality.

To understand the benefits of being connected to nature, there is also a need for further studies on the biophilic potential of cities and the analysis of specific biophilic strategies, depending on the place and the context of application, to promote quality of life in its psychological dimensions of vitality, happiness, relaxation, and stress relief.

**Author Contributions:** Conceptualization, C.C., N.M.-R., M.F.-G. and R.R.; methodology, C.C., N.M.-R.; software, N.M.-R.; validation, C.C., N.M.-R. and R.R.; formal analysis, C.C., N.M.-R. and R.R.; investigation, C.C., N.M.-R., M.F.-G. and R.R.; resources, N.M.-R., C.C. and M.F.-G.; data curation, N.M.-R., C.C. and M.F.-G.; writing—original draft preparation, C.C., N.M.-R., M.F.-G. and R.R.; writing—review and editing, C.C., N.M.-R., M.F.-G. and R.R.; visualization, N.M.-R. and M.F.-G.; supervision, C.C., N.M.-R., M.F.-G. and R.R.; project administration, C.C.; funding acquisition, C.C. All authors have read and agreed to the published version of the manuscript.

**Funding:** This research received no external funding.

**Institutional Review Board Statement:** Not applicable.

**Informed Consent Statement:** Informed consent was obtained from all subjects involved in the study.

**Data Availability Statement:** Data used in this study are available from the corresponding authors upon reasonable request.

**Conflicts of Interest:** The authors declare no conflict of interest.

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