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Understanding environmental quality of Samylai Eldership in Kaunas District using biophilic design principles

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Biophilia was explained by E.O. Wilson as an innate human need to connect to nature and natural processes that is an expression of a deep-seated evolutionary dependence on nature for survival and personal fulfillment. Biophilic principles is a collective of all those environmental features that play an integral part of the human psyche. Apart from food and resources, the effect of nature on our physical and mental health can be understood. Every summer the edge of the Kauno Marios turns green and slippery accompanied by the mouldy smell of algae and water weeds. Although the Kauno Marios Regional Park works as the natural buffer for the Marios, the green hue is seen every year. This paper aims to enunciate the positive psychological effects created by the natural environment that defines the surrounding of the Marios on the people living closest to it as the additional incentive for environmental protection and sustainable development. The Samylai Eldership was selected as a case to understand and analyse the effects and intercommunication of these biophilic principles. While these settlements were formed as a result of people looking to stay away from the buzz and din of the city, the effects of human activities in these seemingly close to nature, quiet settlements, can be quite overpowering.

Biophilia, biophilic design, environmental quality, Samylai Eldership, Kaunas District

Introduction

This paper presents the environmental health analysis of the settlements in the Samylai Eldership community based on the presence or absence of biophilic patterns and attributes. Other supporting analysis which can be further used to determine any type of project intervention required in the region was done using data collected from sociological workshops and photos collected from site visitation and physical observation. Biophilic patterns are used according to the definition provided by E. O. Wilson in his 1984 book called, Biophilia. The term "Biophilia" was first coined in this book; he describes biophilia as the innate need of humans to connect to nature and natural process for healthy growth and development. S. Kellert has used these core values to further describe the intricacies that need to be observed in Biophilic design. In the book "Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life" he divides biophilic design into 2 dimensions (organic and place-based), 6 elements (environmental features, natural shapes and patterns, natural patterns and processes, light and space, place-based relationships and human-nature relationships), and 72 attributes. Furthermore, multiple space-based research such as the one done be Oliver Heath (Jackson and Goode, 2018) have shown that environmental quality has a direct impact on the psyche and performance of population. Therefore, it is important to have a numerical point of reference to understand environmental health.

Methods

Biophilia is defined by E.O. Wilson (Wilson, 1984) as the innate need of humans to connect to nature and natural process for healthy growth and development. 14 patterns of biophilic design serve as the most popular framework using which the measurements of the implementation of the concept are performed (Browning et al., 2014). Moreover, S. Kellert proposed features and attributes of biophilic design, which can be seen, examined or applied in a biophilic space (Kellert, 2008).

While the concept of biophilia is the means to describe the presence or absence of environmental qualities for sustenance, analysis using the patterns of biophilic design serves as a measure of the interaction that humans in these territories have with the environment.

14 patterns of biophilic design are broadly classified into three main categories. Nature in space patterns encompass all those elements that are linked with the direct presence of nature and the multi-sensory perceptions of sound, smell, humidity, airflow, offered by it. Analogous to nature patterns encompass all those elements, which are the indirect representations of natural features. These are formed by organic or non-organic non-living forms and include the interpretations of colour, texture, shapes, materials and patterns. Nature of space patterns encompass the psychological perceptions that a natural space gives the person experiencing it. Awe, mystery, risk and peril are some of the psychological sensations that we are wired to detect through the natural space around us (Wilson, 1984, Browning et al., 2014).

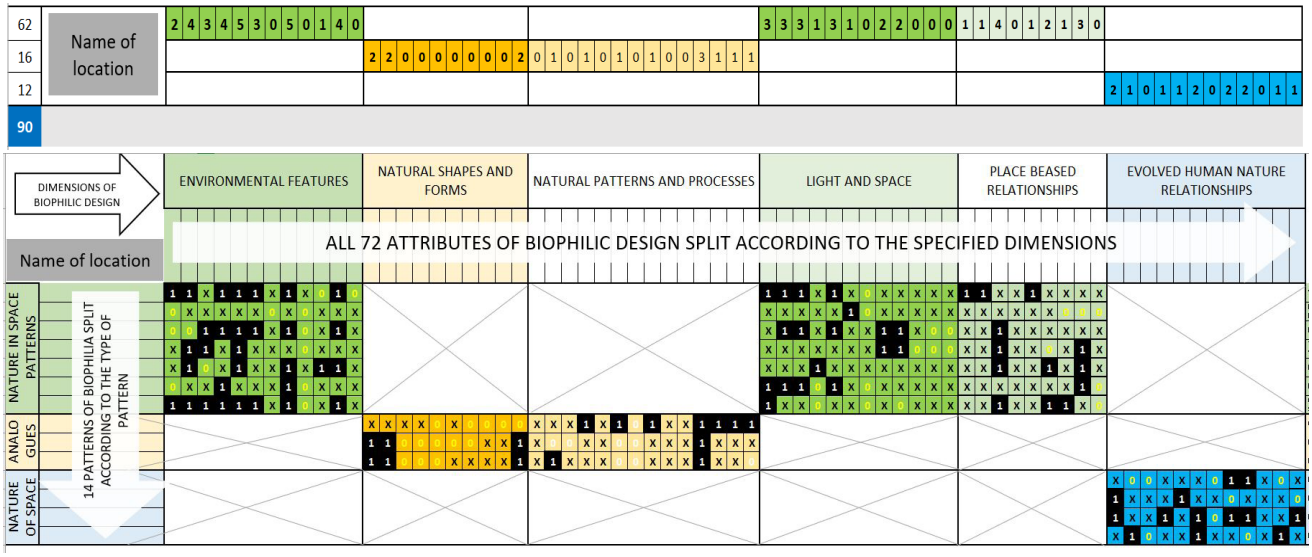
72 attributes defined by S. Kellert are classified into five features, which are further grouped into two dimensions: organic and place-based dimensions (Kellert, 2008). The five features relate to the three broad categories of biophilic patterns based on complete or partial correspondences of definitions. This co-relation can be seen in the table 1 (Khan, 2020).

Table 1. Correlation of biophilic design patterns and biophilic design features (Wilson, 1984; Browning et al., 2014; Kellert, 2008; Khan, 2020)
1 lentelė. *Biofilinio projektavimo principų ir bruožų ryšiai (Wilson, 1984; Browning et al., 2014; Kellert, 2008; Khan, 2020)*

	Environmental features	Natural shapes & patterns	Natural patterns & processes	Light and Space	Place based relationships	Evolved human nature relationship
Nature in space patterns	COMPLETE			COMPLETE	PARTIAL	
Analogous to nature Patterns		COMPLETE	PARTIAL			
Nature of space patterns						COMPLETE

Three broad categories of biophilic patterns (Browning W., 2014) were arranged in the comparative matrix against the five features of S. Kellert (Kellert, 2008) classifications. The patterns were eliminated based on their absolute

Table 2. A sample of the table of the correlations of biophilic design patterns and biophilic design features – biophilic meter (Khan, 2020)
2 lentelė. Biofilinio projektavimo principų ir bruožų ryšių matricos fragmentas - biofilinjos matuoklė (Khan, 2020)



relationship to each other. The subdivisions of each group were further eliminated using the same principle. The rest of the remaining patterns and subdivisions were used in binary context to mark the presence or absence of the biophilic features. A matrix summation resulted in an overall biophilic score of the territory under analysis.

This sample matrix shows the elaborate correlations between the 72 attributes of biophilic design given by Stephen Kellert in the x-axis and the 14 patterns of biophilia given by E.O.Wilson. (Wilson, 1984). The second matrix is a summation of all the binary aspects derived from presence or absence in the first matrix. The summation is made along the y axis since the 14 patterns are the core representation of biophilic properties. A final summation of individual rows yields the overall biophilic score of a region. This tool is therefore the biophilic meter which determines the environmental quality in a numerical sense using intricate properties of biophilia.

The urban infrastructure was analyzed using a similar scale definition derived from Ch. Alexander's patterns (Alexander et al., 1977). However, since the biophilic analysis of environment is the key aspect of this paper, the details of the analysis using Ch. Alexander's neighborhood patterns are not elaborated here. Furthermore, the cultural and social aspects were based on a sociological survey. The survey was conducted in each of the locations by assembling the people

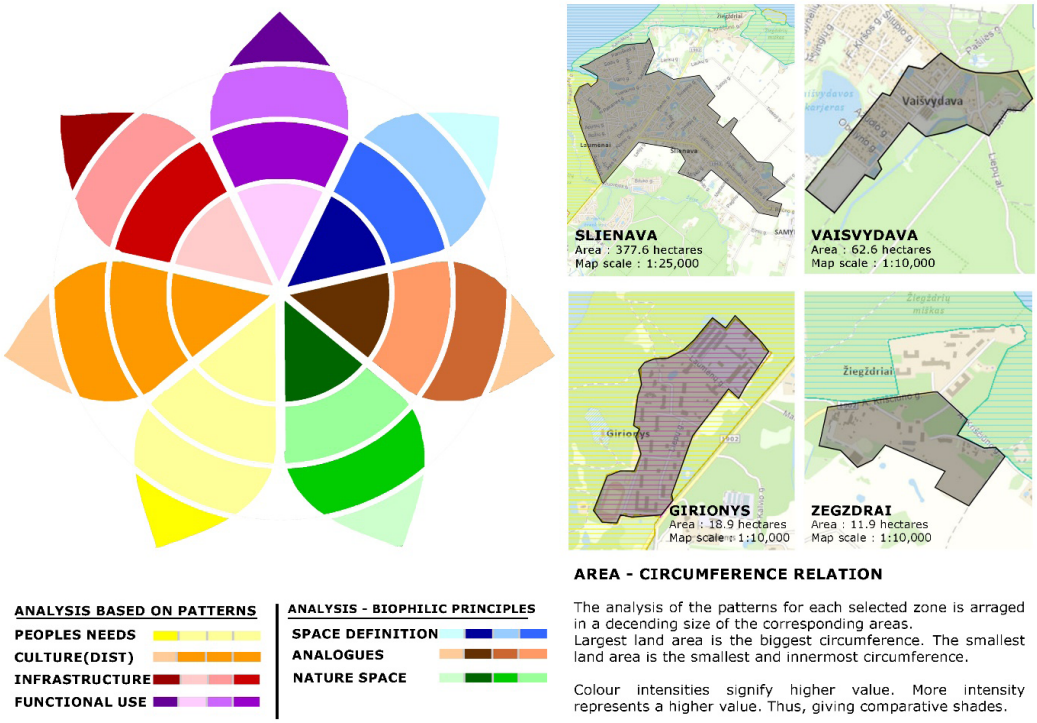


Fig. 1. Overall analysis of biophilic principles and urban influence in the Samylai Eldership settlements (Khan, 2020)
1 pav. *Miesto įtakos ir biofilinių savybių Samylų seniūnijoje esančiose gyvenvietėse tyrimas* (Khan, 2020)

of the community and asking them to create their own understand via mind-mapping their locality. This provided insight into their needs as well as put us in a place to understand the strengths and benefits of their space from their own perspective. These aspects are shown in the conclusion of all settlements in the Samylai community for further co-relation of biophilia and human psyche which is beyond the scope of this paper.

Results and Discussion

The results of this experiment is reflected in this biophilic flower-shaped scheme presented in the figure 1. Each of the four rings of the flower represent the four settlements of the Samylai Eldership. Each ring is a representation of the land area of each settlement. The innermost dense ring represents Žiegždriai since it has the smallest settlement area, it is followed by Girionys, Vaišvydava and Šlienava, which constitutes the largest settlement area (Khan, 2020).

The analysis was done for seven major aspects namely, needs of the people, cultural references, urban intervention (infrastructure and functionality), nature space patterns, natural analogues and nature-space definition. The results show that the settlement of *Šlienava* demonstrates low biophilic qualities as compared to *Žiegždriai*, which shows the densest score. The majority of the biophilic score attributed to the smaller settlements is the result of the Kauno Marios regional park, which aims to form a green barrier between the land and Marios (Khan, 2020).

This analysis shows that the settlements of *Žiegždriai*, Girionys and Vaišvydava have high cultural references and limited needs as expressed by the people. Vaišvydava and Girionys show similar variations in natural and built spaces. This is because the settlement of Vaišvydava is closest to the city limits of Kaunas and the presence of the forestry school in Girionys brings in more sources of communication with the city. Both these settlements have a balanced exposure to the city and the natural environment. Therefore, the needs put forward by the people in the survey are also minimal.

The settlement of *Žiegždriai* shows similar cultural tendencies, however, shows high biophilic value and low intervention of built spaces. A large part of the settlement is occupied by the territory of the mental health institution, where the presence of the natural environment is encouraged, and the built form development is limited. In the remaining zone, the settlement is dotted with individual homes, a horse ranch and a apartment housing complex. The settlement is defined by the activities carried out in the lap of nature: the horse ranches in the summer, mushroom picking, and the general feel and presence of nature and its transitions. This natural forest character of the settlement is coupled to municipal negligence in terms of transit infrastructure and security.

The settlement of *Šlienava* shows low score on the natural biophilic qualities. The distance of the forest from the major expanse of the settlement is increased by the vast agricultural fields. These are considered as the expression of analogous natural patterns because the interactions are forced by economy and its requirements. Most of the natural score of the biophilic properties in *Šlienava* is contributed by the presence of Marios and the popular road leading to it.

Šlienava has the central arterial road which is flanked by residences. The whole settlement lies in the centre of vast expanses of agricultural fields. According to municipal data, these lands are used as arable fallows, meadows, and are left as perennial green lands. Fallows are a healthy practice of land use since it allows for regeneration of natural soil minerals over a period of non-cultivation time. However, if there is no crop rotation, the minerals, even though regenerated may reduce due to only a section of the minerals in continuous use. This leads to farmers adding fertilizers to the soil to ensure a steady quality crop.

The water blooms seen in Marios every summer are the possible result of this. This eutrophication makes the water unsuitable for swimming. Despite the forest barrier, the volume ratio of the forest and agricultural lands is not enough to tackle the algae blooming. Legumes and nitrogen fixing plants are required to increase the absorption and circular use of these chemicals rather than allowing the fallows to remain barren. This way, the algae bloom around *Šlienava* and the Samylai Eldership may be controlled. This also protects the health of the smaller pools of water that serve the agricultural landscape.

Conclusions

1. *Šlienava* has the lowest biophilic index and the highest urban interference. This is because majority of open lands are a force interaction with nature (agriculture). This, although natural, does not fully encompass the properties of the natural features because the interaction is a result of an economic need and not personal or social relaxation.
2. The settlement of *Žiegždriai* shows highest biophilic potential which indicates that the location has the most natural and undisturbed vegetation.
3. The location of Vaišvydava shows the second highest presence of natural and analogous patterns. This is due to the presence of the large reservoir and smaller ponds which are mostly used for recreation and relaxation. The locals feed the ducks and relax on benches by the ponds.
4. Girionys shows the second highest score in the presence of human-nature interactions also called space definition patterns. This is a result of the micro forest clusters formed by the trees planted as part of experimental studies of the forestry school and the nature of surrounding water pools.

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Kauno rajono Samylių seniūnijos aplinkos kokybės tyrimas naudojant biofilinio projektavimo principus

Summary

E. O. Wilson teigimu, biofilija yra įgimtas žmogaus poreikis sietis su gamta ir gamtiniais procesais, kuris yra giliai įsišaknijusios evoliucinės priklausomybės nuo gamtos ir asmeninės realizacijos siekio išraiška. Biofilinio projektavimo principai atspindi tų aplinkos ypatybių, kurios teigimai veikia žmogaus psichiką, visumą. Svarbu suprasti gamtą ne tik kaip išteklių, bet ir jos poveikį mūsų fizinei ir psichinei sveikatai. Kiekvieną vasarą Kauno Marių pakraštys nusidažo žalia spalva ir tampa nepatrauklus dėl dumblių poveikio. Nors Kauno Marių regioninis parkas veikia kaip gamtinis Marių buferis, dumbliai matomi kiekvieną vasarą. Šiuo straipsniu siekiama išskirti teigiamą psichologinį Kauno rajono Samylų seniūnijos gamtinės aplinkos poveikį vietos gyventojams, pateikiant jį kaip papildomą paskatą aplinkos apsaugai ir darniam šios seniūnijos vystymuisi. Samylų seniūnija buvo pasirinkta atvejo studijai, siekiant suprasti biofilinio projektavimo principų tarpusavio ryšius ir potencialą. Šios gyvenvietės susiformavo žmonėms siekiant įsikurti atokiau nuo miesto šurmulio, tačiau net ir šiose iš pažiūros ramiose gyvenvietėse juntamas intensyvus žmogaus poveikis gamtinei aplinkai.

Biofilija, biofilinis projektavimas, aplinkos kokybė, Samylai seniūnija, Kauno rajonas

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