Relationship between GIS-based indexes for landscape aesthetics and older people's perception of beautiful landscape being a motivator for outdoor mobility

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Abstract

This study investigates the relationship between GIS-based indexes for landscape aesthetics and older people's perception of beautiful landscape being a motivator for outdoor mobility. In this study we compared three indexes for neighbourhood landscape aesthetics - patch density, number of land types, and diversity of land use - and their relationship with perceived beautiful landscape as a motivator among 848 community-dwelling older people aged 75-90 living in Central Finland. The analysis of variance showed, that only for participants without difficulties in walking 500 meters, the number of different land types and diversity in land use were higher among those perceiving beautiful landscape as a motivator compared to those not perceiving the motivator. For participants with walking difficulties all indexes were similar regardless of landscape perception.

Keywords: landscape aesthetics older people outdoor mobility

1 Aim of the study

Landscape aesthetics is an important motivating factor for outdoor mobility among older people [5]. Regular physical activity is important to maintain health in old age [6]. Earlier studies have shown that number of land types [2], patch density [3, 2], and diversity of land use (Shannon diversity index, SHDI) [3, 2], defined with GIS, correlate with subjective perceptions of landscape aesthetics. The aim was to study whether older people who perceived beautiful landscape as a motivator for outdoor mobility and those who did not, live in different environments based on objective indices.

2 Materials and methods

2.1 Participant data and perceived landscapce aesthetics

Participant data are from a cohort of community-dwelling older people aged 75-90 years living in Central Finland [4]. The participants (n=848, mean age 81 years, 62% women) were randomly selected from the population register (no spatial sampling). Data on personal characteristics and difficulties in walking 500m (no difficulty -vs. some difficulty to unable) were obtained in interviews. Participants were asked to choose from a checklist factors in their neighbourhood that motivated them for outdoor mobility. We analyzed the responses for beautiful landscape as a motivator.

2.2 Objective landscape aesthetics

Three indexes - patch density, number of land types, and diversity of land use - were selected to operationalize the landscape aesthetics based on objective measures. The index values were defined with ArcMap 10.3 in each participant's neighbourhood using Corine Land Cover (CLC) year 2012 raster data enhanced by the Finnish Environment Institute (SYKE) to a resolution of 20m*20m [1]. A circular buffer with a 500m radius around home was defined as the neighbourhood.

The CLC data included originally 49 different land type classes (Level4, most detailed level) and was reclassified into 13 classes to reflect differences in built and natural environment, object height, and density/colour of vegetation/other land cover substance. Figure 1 shows a portion of the map with reclassified CLC data and, as an example, a home location with neighbourhood buffer.

The reclassified CLC data was used to calculate the three index values in each participant neighbourhood: 1) Patch density: number of separate patches, located partially or completely inside the buffer, divided by the buffer area (in km^2). 2) Number of land types: number of different CLC classes inside the buffer. 3) Diversity of land use (range 0 to 1) was calculated using the equation 1 for normalized SHDI

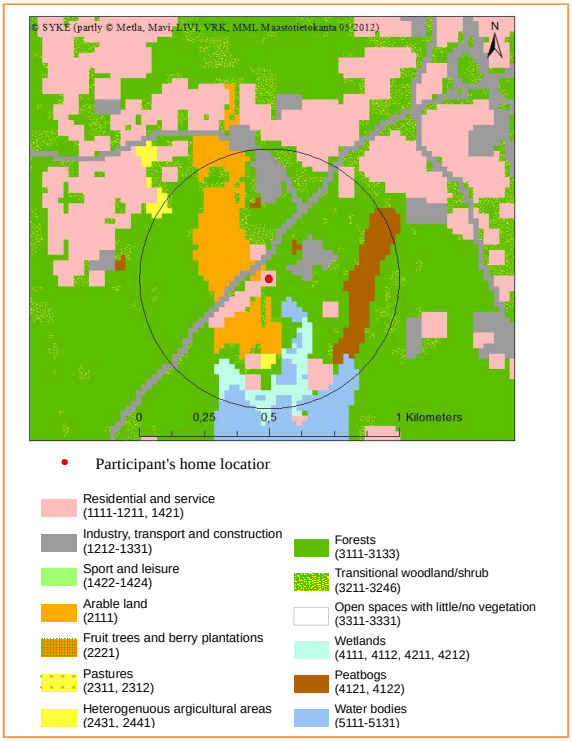
$$SHDI = [-\sum_{i=0}^{R} p_i \ln p_i] * 1/\ln R \qquad (1)$$

in which p_i= the proportion of i:th CLC class's area of the total area within the buffer, and R= the number of all CLC classes, in this case 13.

2.3 Statistical tests

IBM SPSS Statistics 22 was used for statistical testing. Mean index values were compared between participant groups using analysis of variance, accounting for age and sex. Statistical significance level was set to 0.05.

Figure 1: Map with reclassified CLC data (Level4 classes in legend) and a neighbourhood buffer as an example.



Source: CLC 2012 National datasets (20m) [1].

3 Results

Indexes of patch density, number of land types, and diversity of land use showed relatively large variation (table 1).

Table 1: Characteristics of the landscape aesthetics indexes in the neighborhoods of participants.

Variable	Min	Max	Mean	Std
Patch density	26	228	129	39
Number of land types	3	10	6.17	1.18
Diversity of land use	0.16	0.77	0.51	0.08

Of the participants 68% (574) perceived beautiful landscape as a motivator for outdoor mobility and 26% (217) reported walking difficulties. Environments in which participants lived were similar regardless of their perception of beautiful landscape as a motivator or difficulties in walking 500m.

In stratified analyses, only older people without walking difficulties lived in environments, in which the number of land types and diversity of land use indexes were higher for those who perceived beautiful landscape as a motivator compared to those who did not. For participants with walking difficulties all indexes were similar regardless of landscape perception (table 2).

4 Conclusions

These results suggest that indexes for landscape aesthetics could be useful in planning environments which facilitate outdoor mobility of older people without walking difficulties.

Table 2. Mean index values for participants who perceived beautiful landscape as a motivator (Yes) and those who did not (No).

	All			Without walking difficulties			With walking difficulties		
	No (n=274)	Yes (n=574)	P*	No (n=178)	Yes (n=453)	P*	No (n=96)	Yes (n=121)	P*
Patch density	128	130	.54	126	130	.30	131	129	.75
Number of land types	6.08	6.22	.09	5.99	6.23	< .05	6.25	6.16	.57
Diversity of land use	0.51	0.52	.12	0.50	0.52	< .05	0.51	0.51	.55

*Analysis of variance

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