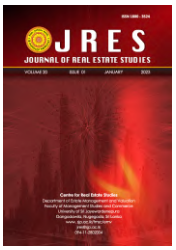

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Effects of Public Open Space on Residential Land Values Using GIS-based Geostatistical Analysis Reference to Bellanwila - Attidiya Weras Ganga Public Open Space

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ABSTRACT

Newly developed public open spaces on surrounding land value changes are important for urban planning and development. Bellanwila-Atthidiya Waras Ganga open space is one of the most attracted open space in the Colombo suburbs and significantly surrounding land values are changed after the project. This research aims to examine the effect on land values in surrounding area due to this project and research devotes a quantitative approach, using GIS-based geostatistical analysis. Land value data, including sales transactions and property assessments, will be collected from relevant government agencies and real estate databases. The collected land value data was used to create geospatial maps using ArcGIS 10.8 spatial interpolation. Various proximity factors and demographic characteristics affected to change land values in this area, also considered for this analysis. Study results indicate that there is a significant relationship between residential land value changes in the lands surrounding public open space and it is 7.2% impact on land value changes. The results are useful for urban planners, policymakers, and real estate developers about the potential economic benefits associated with public open spaces.

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1. INTRODUCTION

Public open space is predominantly associated with parks and green areas in studies focused on active living, while other types of public open spaces such as public plazas, nature reserves, and greenways receive less attention. The existing research studies on the built environment lack consistent definitions of public open space. Urban planning research, for instance, describes public

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open space as "managed open space, often green and accessible to everyone, even if temporarily regulated" (Carmona, 2019, p.47-59). Parks and green spaces, which fall under the umbrella of public open spaces, indeed play a significant role in the built environment by providing opportunities for various physical activities like leisurely walking and sports. Additionally, Lenzholzer's study (2015) highlights the importance of open spaces in shaping the landscape character of cities and addressing pressing urban planning issues such as flooding and the urban heat island effect.

The establishment of new public open spaces contributes to the appreciation of surrounding land values. Research by Biao et al. (2012) reveals that homes located near neighborhood open spaces may experience a price increase of 16.88%, with availability and scenic views contributing 14.93% and 1.95%, respectively. Public open spaces not only provide pleasant and natural environments but also enhance the quality of life in cities while fulfilling important environmental functions (Zhang et al., 2021). Numerous publications have highlighted the significant impact of public open spaces on the values of nearby residential properties (Jim and Chen, 2010). The Internal Revenue Service (IRS) classifies land as a fixed asset rather than a current asset because it does not depreciate. Land serves various primary purposes, including transportation, residential housing, commercial activities, industrial production, agriculture, and recreational use (Chen, 2022). Changes in land status result in capital gains or losses.

The development of new public open spaces plays a crucial role in enhancing the value of the surrounding land. The importance of urban green spaces is often underestimated or undervalued though the parks have the potential to significantly enhance property values. For instance, urban properties close to public parks, gardens, and playing fields are more expensive than those that are not (Natural Capital Team, 2019). However, many people fail to grasp the connection between urban green space and property value, overlooking the additional revenue streams that parks can generate for property owners such as increased rental rates, increased occupancy rates etc. (Czembrowski, Łaszkiewicz, Kronenberg, Engström, & Andersson, 2019).

In recent years, Sri Lanka has witnessed the development of numerous public open spaces, particularly in Colombo and its suburban areas. Notable examples in Colombo include the establishment of Diyatha open space, Nawala open space, and Bellanwila Attidiya public open space. Accordingly, it has been conducted numerous studies on these public open spaces under different aspects, in both local and foreign contexts focusing on the impact of public open spaces on the urban economy (UN-Habitat, 2018), identification of sustainable urban green spaces using a GIS-based multi-criteria analysis (Gelan, 2021) and the historical value of public spaces and determines their contemporary role as spaces for representing cities (Sochacka, Rzeszotarska-Pałka, & Nowak, 2022). However, Despite the extensive establishment of public open areas in Sri Lanka, there has been a lack of research analyzing the impact of new public open space developments on land values in the region. Thus, the research study was conducted to fill the identified gap. Existing research has yet to delve into the impact of public open spaces on surrounding land values, despite the considerable number of such developments in the country. This knowledge gap serves as the motivation for conducting this study, as it aims to fill this void and delve into the relationship between the development of public open spaces and the corresponding changes in land values.

2. LITERATURE REVIEW

2.1 Public open spaces

According to Jacobs (1961) and Madanipour (1999), public open space is an outside area that is freely accessible to the public. Public open space is successful because it facilitates social interaction (Whyte, 1985) and attracts many visitors who engage in various activities accessible to all groups of people (Gehl, 2002). It is also a fundamental element of the city's fabric that supports the urban public's daily life (Salih & Ismail, 2017). Indeed, public open spaces, such as parks and green spaces, appear to be essentially built environment settings that offer opportunities for a variety of physical activity behaviors (Bedimo-Rung et al., 2005; Kaczynski and Henderson, 2007).

2.2 The role of open spaces in a city

Public open spaces play a significant role in urban environments, providing recreational opportunities, enhancing the quality of life, and contributing to the overall attractiveness of a neighborhood. Several studies have emphasized the multifaceted benefits of public open spaces. Open spaces offer opportunities for recreation, physical activity, and social interaction, leading to improved public health and well-being (Bedimo-Rung et al., 2005; Kaczynski et al., 2008). They also contribute to the conservation of biodiversity, urban cooling, and stormwater management, enhancing the environmental sustainability of cities (Tzoulas et al., 2007; Wolch et al., 2014). Additionally, public open spaces foster a sense of community, promote cultural activities, and provide platforms for public events and gatherings (Hou, 2004; Madanipour et al., 2012). These include incorporating diverse vegetation and landscaping features (Kaplan and Kaplan, 1989), providing adequate seating and shade (Carr et al., 1992), ensuring accessibility for all individuals (Crawford et al., 2003), and integrating amenities such as playgrounds, sports facilities, and walking trails (Cohen et al., 2017). Moreover, open spaces contribute to the overall landscape character of cities and help address crucial urban planning issues such as flooding and the urban heat island effect, as highlighted in a study by Lenzholzer (2015).

2.3 Socio-economic benefits of open spaces: towards sustainable housing

Beyond the evident health and environmental benefits, residents of areas with open spaces experience psychological well-being. Residential townships that incorporate open areas exhibit higher market values, with apartments selling quickly and being in high demand compared to traditional structures. This not only increases the value of their houses but also enhances their overall quality of life (Kakkar & Supriya, 2014). Public areas provide tremendous cultural, economic, and social benefits that revitalize cities' identities and improve residents' quality of life by presenting them with opportunities for novel experiences (Kishore,2015). In addition, a study based on the urban area of Enugu, Nigeria revealed that open spaces significantly improve the quality of life in Enugu State by creating recreation opportunities, preserving natural processes, and providing aesthetic value to the community (Emeasoba, Uchegbu, Eneh, Asiwa, and Ogbuefi, 2017). Along with that, it was determined that the advantages of open spaces include improved quality of life, property values, user utility, health, education, public benefit, and tourist attraction. Urban residents in Enugu and developers have a positive view of the development of open spaces, and there is a significant relationship between open spaces and the impact of the conversion on the socioeconomic development of Enugu urban (Emeasoba, Uchegbu, Eneh, Asogwa, and Ogbuefi, 2017).

There is a substantial and growing body of research that estimates the effect of public open spaces on residential property values (Smith, Poulos & Kim 2002). According to research by Bolitzer and Netusil (2000) to ascertain the magnitude of the favorable influence, properties that are situated within 457 meters of a public space advertise for more wealth than those that are further away. Tyrväinen and Miettinen (2000) found that distance up to 600 meters had a positive significant amenities impact on the property price, with the research findings becoming positive but insignificant beyond this path length. The amenity impacts of natural open spaces greatly raised the value of nearby properties according to Lutzenhiser and Netusil (2001). They discovered that residences within 457 meters of a recreational park saw significant statistical property premiums, whereas houses between 121 and 180 meters from natural area parks experienced a 19.1% premium. They also mentioned that when talking about urban open spaces, the highest premium for urban parks was between 61 and 120 meters.

In addition, a quantitative analysis conducted by Lei (2020) demonstrates that surrounding parks and open spaces have a statistically significant impact on residential property values and that different sizes and distances from residential properties have varying, albeit small, effects in New York City. Consequently, it was determined that larger parks and open spaces have a greater effect on the change in the value of houses than smaller parks. The residential property valuation will increase proportionally to the size of the neighboring park or open space (Lei, 2020).

In addition to case studies, a growing body of quantitative research examines the causal connection between open spaces and property values (Lei, 2020). The development of public parks and the improvement of the properties' surroundings have a positive effect on property values, particularly in residential areas (Ibrahim, 2020). Apartments with a greater view and better air were in high demand and were willing to cost extra. However, the price of homes was not significantly influenced by the green belt. Using GIS techniques and landscape measurements in hedonic price modeling, the facility value of open space was determined (Kong, Yin, and Nakagoshi, 2007). The findings supported the hypothesis that neighboring open spaces had a favorable amenity impact on home prices. Jim and Chen (2010) looked at how local green space affected the cost of high-rise real estate in Hong Kong. The data suggest that neighboring open space might raise property prices by 16.88%, with availability increasing by 14.93% and view increasing by 1.95%. (Biao et al., 2012).

Numerous recent studies have demonstrated that proximity to open spaces has a positive impact on residential property values. Accordingly, a study conducted by Trojanek et al., (2017) identified in the average presence of an urban green area within 100 meters of an apartment increases the price of the dwelling by 2.8% to 3.1%. Song and Knaap (2004) used quantitative results of mixed land uses and found that the cost of housing increased in significant proportion to the distance from private and/or public parks. Morancho (2003) discovered a comparable pattern, citing a 1% drop in sales prices in Spain for every 100 meters away from an urban green area. In their thorough analysis of 193 public parks, Bolitzer and Netusil (2000) found that homes within 457 meters of a recreational area had an increase in sale price of $2,262 using a model of linear regression and $845 using a semi-log form. More specifically, they discovered that there was an influence on property values within 30 meters of open space that was

positive but not statistically significant. The findings revealed that properties sold for a statistically significantly higher price at distances more than 30 meters and up to 450 meters from an open space than those farther than that.

In Jinan City, China, Kong et al. (2007) investigated the amenity value of urban green space and discovered that it had a positive proximal impact on the cost of real estate. Its results indicated that nearby parks could raise prices by around 17%. In a more recent survey, Zhang et al. (2012) investigated the relationship between Beijing's 14 parks and the average home prices in 76 residential neighborhoods. They discovered that the sales price of residential properties located 850 to 1604 meters from open spaces increased from 0.5% to 14.1%. Additionally, research has shown that being close to a neighborhood's public open space has a mixed or adverse pricing impact. In this regard, Hendon's (1972) study of three open spaces in Fort Worth found that the mean values of houses within 153 meters of two of the parks were substantially higher in value than those farther away. This study did not entirely support the proximal basic concept because the results from one park revealed that the orientation of the significant link was the opposite of what was expected. In a ground-breaking study, Weicher and Zerbst (1973) compared homes with parks on their front and back lawns, as well as those next to parks with varied densities of recreation use and development. They found that while houses near to parks but isolated from them by a roadway fetched higher premiums in their valuations, those fronting or backing on parks either retained value or saw a drop in value.

They claimed that this was brought on by the inconveniences and disruptions that come with residing close to a public open space, particularly when that space served as a gathering place, particularly for undesirable purposes. Hammer, Coughlin, and Horn (1974) evaluated the effect of a single, larger park on the sales prices of 336 properties in Philadelphia and confirmed these results. As a result of disturbances and a loss of privacy, homes near to each other were shown to have a negative coefficient. They observed that homes on corner lots or those facing parks had higher values. Although improvements in security and upkeep, as well as public acceptance of public areas, have generally improved over the years, these studies continue to be relevant due to persistent concerns about teenage criminality and anti-social conduct. A park's reputation may affect housing prices negatively if the general public holds it in low regard. This is supported by a wide range of research that demonstrates that negative externalities like the perception of danger and fear from antisocial behavior (Jorgensen et al., 2007; Van den Berg and Ter Heijne, 2005), crowding effects (Arnberger and Haider, 2005; Price and Chambers, 2000), conflicts between distinctive user groups (Arnberger, 2006), poor maintenance (Fox, 1990), human destruction of vegetation (Kissling et al., 2009). Research on the proximity impacts of urban public open space like parks is therefore inconsistent, albeit in some cases this may be due to methodological issues (Crompton, 2001).

According to empirical results, the proximity to and views from traditional urban public spaces may not have the same as those from bigger natural public open spaces. The effect appears to rely on the park's status, accessibility, level of use and/or development, and physical relationship to the land. The overwhelming collection of data indicates that residential property priced at a premium is often placed between 90 and 610 meters from urban public space. Additionally, it demonstrates that having access to urban public open spaces has a positive effect on real estate prices. According to Zhang et al. (2012)'s study of recent Euro-American research, urban

green space increased neighboring property values by an average of 5% to 20%, which is familiar with Crompton's findings (2001; 2005).

Despite the wealth of knowledge from other countries, the evidence is primarily based on empirical findings from countries other than the UK (Dunse et al, 2007). According to the few large research studies that have been conducted in the UK context, people value open green spaces marginally more than other things, and this value premium is priced accordingly they are ready to pay.

2.4 Previous studies on the relationship between public open spaces and land values

The relationship between public open spaces and land values has been a topic of interest in urban economics. Several studies have investigated the influence of proximity to public open spaces on property values. Findings indicate that properties located near well-designed and well-maintained public open spaces often experience increased land values (Gehl et al., 2006; Zhang et al., 2018). These spaces are seen as attractive amenities that enhance the desirability and livability of neighborhoods. However, the relationship between public open spaces and land values can be complex, influenced by factors such as park size, accessibility, maintenance, and the characteristics of surrounding areas (Bolitzer and Netusil, 2000; Crompton et al., 2004). Historically, A study conducted in Portland revealed that the presence of the city's 193 public open spaces had a significant positive effect on the value of houses within a 1,500-foot radius of these areas (Bolitzer & Netusil, 2000). These parks ranged in size from 0.2 to 567.8 acres, and the proximity to parks was found to account for 1% to 3% of the overall value of these houses. Further research on 115 of these urban parks, with sizes ranging from 0.4 to 195.7 acres, revealed that homes within 800 feet of parks saw the biggest premiums (of 2 to 3 percent of value), whereas properties farther away had no discernible effects on property values. A study conducted by Pathmasiri & Perera (2021) considering Diyawannawa Lake, Sri Lanka as a case study shows that a 'quality' water body as an open space provided social, economic, physical, psychological, and aesthetic utilities to the surrounding residential area and consequently the residential properties with a scenic view of 600or more towards Diyawannawa Lake recorded a premium market value of Rs. 803,433.05 between the period of the year 2019 -2020. Biao et al. (2012) indicate that neighborhood open spaces can potentially elevate surrounding house prices by 16.88%, with 14.93% attributed to the availability of such spaces and an additional 1.95% linked to the view they offer. A study by Kong et al. (2007) examined the amenity value of urban green spaces in Jinan City, China, revealing a positive and immediate effect on real estate prices.

2.5 Factors affecting land values

The value of urban land is primarily determined by its location, which is shaped by various factors such as the characteristics of the surrounding area and the amenities available nearby. Accessibility, centrality, and physical attributes of a place all contribute to the worth of a property, while socioeconomic conditions and neighborhood amenities also play a significant role in the spatial variation of land value. In addition to distance metrics, time can be considered as an alternative factor affecting land value. Environmental and ecological elements, as well as unfavorable externalities and natural disasters, further impact land prices. The regulation of zoning and density control also influences land values by restricting development, regulating floor area ratio (FAR), and imposing height restrictions.

To assess property values, remote sensing, and GIS techniques are employed to combine environmental and accessibility factors. The price of land is ultimately determined by the land market, which is influenced by the interplay of supply and demand (Beekmans et al., 2014).

Table 1: Factors affecting land value formation.

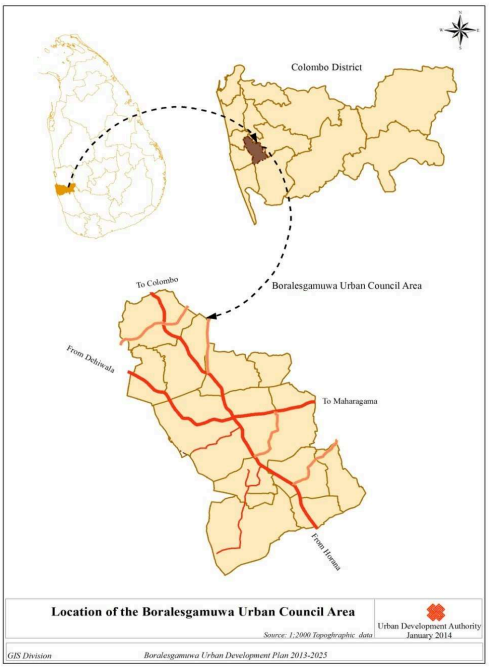
Factors	References
Proximity factors	
Distance to the city center	(Ferlan, Bastic, & Psunder, 2017)
Distance to the police station	(Chinh, et al., 2020)
Distance to schools	(Chinh, et al., 2020)
Distance to health facilities	(Thiwanka & Wickramaarachchi, 2022)
Size of the tract	(Ferlan, Bastic, & Psunder, 2017)
Socio-economic factors	
Ability to provide clean water	(Chinh, et al., 2020)
Static traffic density	(Chinh, et al., 2020)
Population density	(Gwamna, Wan Yusoff, & Ismail, 2015)
New Urban areas	(Razali, Menan, & Ten, 2020)
Security control	(Thiwanka & Wickramaarachchi, 2022)
Environmental Factors	
Air quality	(Chinh, et al., 2020)
Water quality	(Chinh, et al., 2020)
Soil	(Thiwanka & Wickramaarachchi, 2022)

Source: Survey data (2019)

3. METHODOLOGY

3.1 Study area

Figure 1: Study area



Source: Urban Development Authority (2014)

Boralesgamuwa is a residential suburb located in the Colombo district. It is accessed through Horana Colombo main road and Dehiwala Maharagama main road and is located about 14 km southeast of the commercial capital Colombo.

The average population density of the area contains 52 persons per ha. and some GND divisions show more than 80 persons per ha.

The total built-up area is 69.22% of the total land and 57.09% of the built-up area consists of residential use. The other significant feature of land use is 28.15% of land consists of Marshy Paddy and lowlands. Also, 2% of land consists of water. Then Boralasgamuwa is an area with natural beauty, and one side of the area is boarded of Boralasgauwa-

Aththidiya bird sanctuary consisting of adjacent Bolgoda lake.

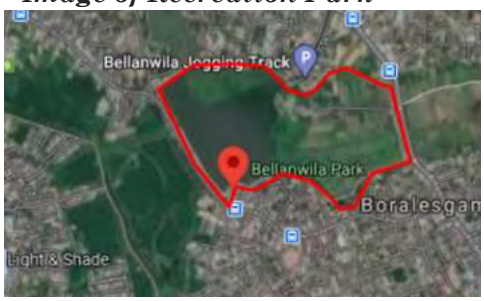
The public open space named Weras Ganga Bellanwila Recreation Park, is situated close to the Bellanwila Rajamaha Viharaya in the Boralasgamuwa.

3.2 Weras Ganga Bellanwila Recreation Park

The Weras Ganga open space is located between Boralesgamuwa and Bellanwila area and there are entrances to the park from both areas. The development of this park was completed in 2014. This park serves the visitors and neighborhood with outdoor food court offering a traditional and fast food variety of food and beverages, offers a scenic view with a walking and cycling track that runs for about 3km in distance. The following figures show the previous and existing situation of the Weras Ganga Bellanwila Recreation Park and its surrounding.

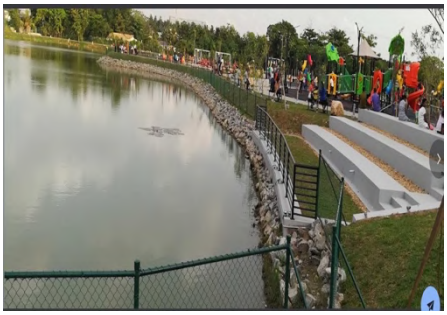
Figure 2: Weras Ganga Bellanwila Recreation Park

Image of Recreation Park



Area Before the Project

Area after the Project



There is a residential neighborhood existed around the recreational park and land values are increased after the project and this study focuses to identify the relationship of those changes.

3.2 Data and method

In this research, a 1km buffer zone from the recreational park was selected as the case study area, and land value data within it was acquired as the major data source. For that, it has been adapted several data collection methods to collect land value data through observations, interviews, and other secondary data collection methods.

In there, interviews were conducted with estate agents, valuers, individuals with plots for sale, and expert opinions from land valuers in the private and public sectors. Additionally, transaction data from large real estate agent datasets were also utilized in the study. Accordingly, land values collect from this buffer zone area before the project and after the project in the same lands. Major land

value changes calculated in the same land plots and other spatial factors affected by land value are also considered independent variables. Then 5 spatial factors were also identified such as proximity to walking paths, population density, land use, and proximity to the main road. Data analysis was done through SPSS software by descriptive, correlation and regression analysis focused on GIS-based spatial analysis using ArcGIS 10.8. Using the above factor maps dependent and independent variables were identified and the following table shows details of that. Data analysis will be done through SPSS software by descriptive, correlation, and regression analysis.

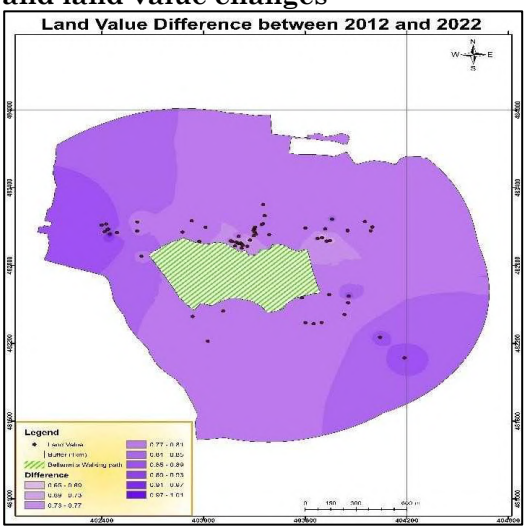
Table 2: Variables used in the study

Variable code	Variable name	Measurement
LV2011	2011 Land value	Interval
LV2012	2012 Land value	Interval
LV2022	2022 Land value	Interval
DLV	Differences in land value 2012 - 2022	Interval
LA_USE	Land use	Nominal
POP_DEN	Population Density	Ordinal
PROX_MR	Proximity to Main Road	Interval
PROX_WP	Proximity to Walking Path	Interval

Source: Author (2023)

The dependent variable here is defined as changes in the land values. A mixed sourcing technique was used to search for market transaction data for the sampled plots in the three different years. This mixed sourcing technique consisted of combining the following data sources: transaction data as obtained from the government valuation department and the valuation division of Kesbewa Municipal Council and Boralesgamuwa Urban Council; transaction data as obtained from data sets of large real estate agents; interviews with individuals with plots for sale and expert opinion from land valuers from both private and public sectors. Newspaper advertisements and prime land group advertisements from the website were also used as a reference in discussions with these experts. The data obtained from each category was used in two ways: as primary information, and as a gauge from which to check the accuracy of other data sources. For parcels where actual sales were not found, land values were estimated using the data from the above sources and in discussion with valuers and estate agents. Data on land value was collected and entered as the value per perch in the local currency (Sri Lankan Rupees per perch).

Figure 3: The sample residential plots and land value changes



Source: Author (2023)

4. ANALYSIS

4.1 Measurement of the independent variables

Both spatial and non-spatial factors, which influence land values, were determined using literature and local knowledge by the researcher. Accordingly, 4 spatial variables were identified as follows. Using GIS spatial analysis assign

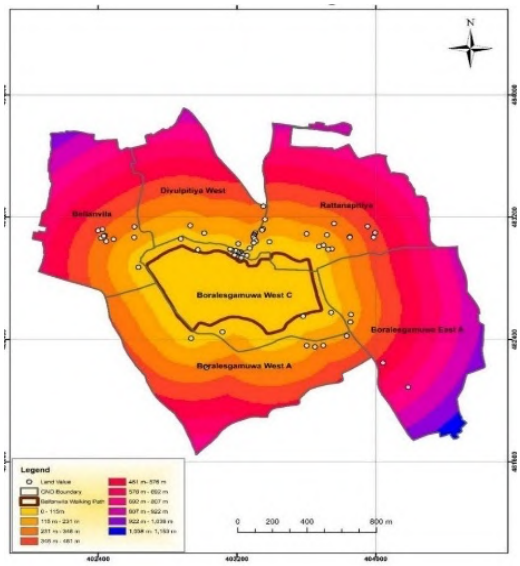
values to different spatial factors as follows.

I. Proximity to the Recreation Park (Anderson,2000)
II. Proximity to the nearest main road (Bolitzer,2000)
III. Population density (Bolitzer,2000)
IV. Land use (Jim,2010)

I. Proximity to the walking path

Accessibility to the walking path is attached to high value by households in locating where to stay. This is mostly where commuter transport is the preferred or the most used mode of transport. Hence, it is assumed that land values increase with nearness to the walking path. This variable was measured as a straight-line distance from the subject parcel to the nearest walking path.

Figure 4: Proximity to the walking path



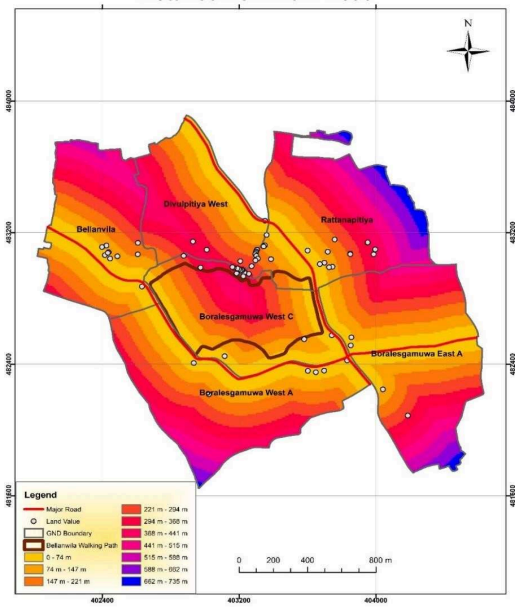
Source: Author (2023)

The proximity of each sample residential land parcel to the walking path is depicted on the above map. ArcGIS extracted this data for data representation. The official village domains, to which the land parcels belong, are shown on the above map. The range of distance as described above has been used to segregate and display how distant each land plot is from the walking path.

II. Proximity to the nearest main road

Accessibility to the main road is attached to high value by households in locating where to stay. This is mostly where commuter transport is the preferred or the most used mode of transport. Hence, it is assumed that land values increase with nearness to the main road. This variable was measured as a straight-line distance from the subject parcel to the nearest main road.

Figure 5: Proximity to the main road



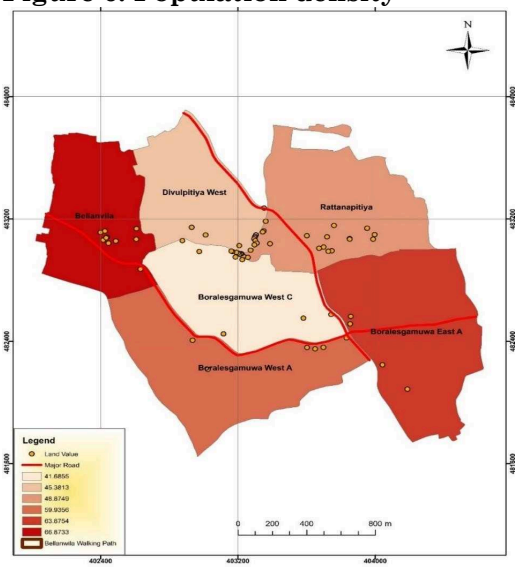
Source: Author (2023)

The proximity of each sample residential land parcel to the main road is depicted on the above map. ArcGIS extracted this data for data representation. The official village domains, to which the land parcels belong, are shown on the above map. The range of distance as described above has been used to segregate and display how distant each land plot is from the main road.

III. Population density

Areas of low population density are expected to be highly valued as opposed to areas of high density. Using census data, population density was grouped into intervals and each interval as- signed a value. Two classes were identified with the lowest density class being assigned a value of 1 and the highest density class being assigned a value of 2.

Figure 6: Population density



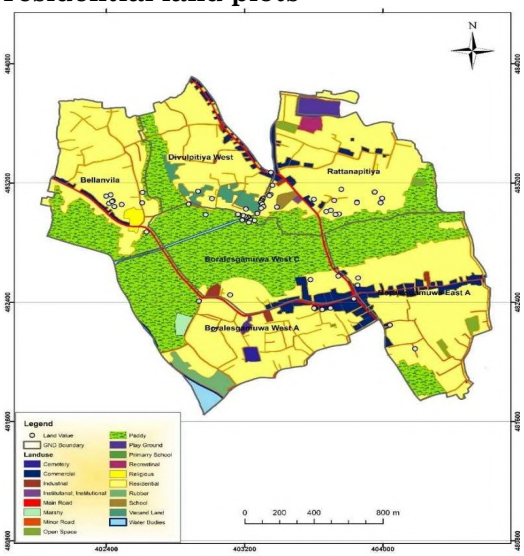
Source: Author (2023)

The population density of each sample residential land parcel is depicted on the above map. ArcGIS extracted this data for data representation. According to the above map, highest land values can be seen within the highly dense areas such as Bellanwila and Boralesgamuwa East while lower land values can be identified within the low dense areas such as Boralesgamuwa West, Divualapitiya West. The range of population density as described above has been used to segregate and display the situation of population density belonging to each land plot.

IV. Land use

Land use is an important land value determinant. Land use was confirmed by the field survey for every sample plot for three different years. Measurement for land use was in a nominal scale. All the samples fell into seven land use categories (residential, commercial, paddy, park and playground, transportation, wetland and institutional) and were assigned a value for them from 1 to 7.

Figure 7: land use with sample residential land plots



Source: Author (2023)

The land use of each sample residential land parcel is depicted on the above map. ArcGIS extracted this data for data representation. The official village domains, to which the land parcels belong, are shown on the above map. Land use as described above has been used to segregate and display the variety of land use belonging to each land plot. This map shows that the highest land values are within the areas with mixed land uses especially in commercial and residential land uses.

4.2 Model setting

Variables and procedures

Land values and land factors affected to land values are considered for the variable of the study. A comprehensive analysis could only be possible if the implicit locational influences on land values are included in the model. The major concern in model estimation is to identify those variables that explain the maximum variance in land prices. These variables will then be regressed on the dependent variable.

As explained earlier, factors that can potentially explain the structure of land value changes were selected based on a literature review and knowledge of experts. A regression analysis is used to estimate a price equation for land. Land value changes are the result of complex interactions between legal, social, economic, human and neighborhood driving forces or characteristics that act over a wide range of temporal and spatial scales. The regression models land prices as a function of these characteristics. Using the factors already identified above, the function of this study is,

DLVx = f (, PROX_MR, POP_DEN, LA_USE, PROX_WP)

Using these variables, multiple regression equation can be hypothesized to be:

Y = a + b1PROX_WP + b2PROX_MR + b3POP_DEN + b4LA_USE

Where 'a' is the regression constant and b1 to b4 are the value rating for the independent variables.

Table 3: Variables used in the study

Variable code	Variable name	Measurement
LV2011	2011 Land value	Interval
LV2012	2012 Land value	Interval
LV2022	2022 Land value	Interval
DLV	Differences in land value 2012 - 2022	Interval
LA_USE	Land use	Nominal
POP_DEN	Population Density	Ordinal
PROX_MR	Proximity to Main Road	Interval
PROX_WP	Proximity to Walking Path	Interval

Source: Author (2023)

Statistical analyses were done in SPPS 16.0 software to establish land value changes with the above independent variables. To determine whether above mentioned independent variables have significantly affected the land values, the hypothesis was established.

'Statistically significant' means whether an individual variable coefficient depicts it as an important explanatory variable. This is the strength of a multiple regression model because it allows us to account for the strength of an explanatory variable according to its importance in explaining the land value changes.

4.3 Data Exploration

Data exploration involves carrying out descriptive and correlation analysis to get a better understanding of the data.

Descriptive Statistics

Table 4: Descriptive statistics for the dependent variable

	Land Values 2012	Land Values 2022
Mean	1.21	1.67
Median	1.00	2.00
Mode	1	2
Std. Deviation	.412	.475
Variance	.170	.225

Source: Field Data (2023)

The results indicate that land values for each year are close to a normal

distribution as opposed to the other two years. This is because the mean, median, and mode for land values for each year are very close. The variance and the standard deviation increase with time, with 2022 land values showing a positive significance variance.

Descriptive statistics for the independent variables 2022

Table 5: Descriptive statistics for the dependent variable

	Statistics			
	Proximity to the walking path	Proximity to the roads	Population Density	Land Use
Mean	1.32	1.27	1.29	3.45
Median	1.00	1.00	1.00	2.00
Mode	1	1	1	1
Std. Deviation	.498	.475	.458	2.580
Variance	.248	.225	.210	6.657

Source: Author (2023)

The means and standard deviations of each variable were checked. The mean of a binary variable indicates the percentage of parcels possessing that characteristic. For example, the mean of 3.45 for LA_USE means 34.5% of the parcels are either commercial, residential, institutional, paddy, transportation, park and playground or wetland. Descriptive statistics were also done for the independent variables and the completeness of both data sets was confirmed.

Correlation

The table below shows the correlation matrix. This correlation analysis was done to show how the variables are related and how they can explain each other. This is measured by the coefficient of correlation (R). The value of R ranges from –1 to +1 with both extremes indicating a perfect correlation. In such a case (when R = ±1), the variables are 100% correlated and one variable explains 100% of the other. A correlation close to 0 indicates that the two variables are not related at all. A positive R implies that when one variable increases, the other variable increases while a negative R implies that when one variable increases, the other decreases.

Table 6: Correlation matrix

	PROX_WP	PROX_MR	LA_USE	POP_DEN
PROX_WP	1	-.023	.401	-.002
PROX_MR	-.023	1	-.133	-.054
LA_USE	.401	-.133	1	.172
POP_DEN	-.002	-.054	.172	1

Source: Field Data (2023)

Two variables are considered highly correlated if they have correlations more than or equal to 0.70 (Murphy, 1989). This is an indication that there is a strong explanatory interrelationship between the variables, which can lead to multicollinearity. This term is used to describe the combined influence of several independent variables where the influence of each is difficult to isolate. Multicollinearity occurs when the independent variables are highly correlated.

Correlation analyses were also done for independent variables. None of our independent variables are highly correlated; all the variables show moderate or weak correlations with one another. Hence, there is no need to eliminate any at this stage.

4.4 Multiple Regression Analysis & Results

According to the conceptual framework, this paper tests four independent variables with the land value changes around Boralesgamuwa public open space area. The model suggested four hypotheses to test as follows.

H1: There is a relationship between land value changes and Proximity to the walking path.

H2: There is a relationship between land value changes and Proximity to the nearest main road.

H3: There is a relationship between land value changes and land use.

H4: There is a relationship between land value changes and population density

The following tables show the results of the multiple regression analysis.

The dependent variable (land value changes) was regressed on predicting variables of proximity to the walking path, proximity to the nearest roads, population density, and land use.

Table 7: Summary of the Model

Summary of the Model

Variable	R	R^2	Adjusted R Square	Std. Error of the Estimate
Proximity to the walking path	.268[a]	.072	.059	.345
Proximity to nearest main road	.325[a]	.106	.093	.339
Land Use	.103[a]	.011	-.003	.357
Population Density	.019[a]	.000	-.013	.359

Table of Summary of the ANOVA

Model		Sum of Squares	df	Mea Square	F	Sig.
Proximity to the walking path	Regression	.676	1	.676	5.668	.020[b]
	Residual	8.710	73	.119		
	Total	9.387	74			
Proximity to the nearest main road	Regression	.992	1	.992	8.629	.004[b]
	Residual	8.394	73	.115		
	Total	9.387	74			
Land use	Regression	.099	1	.099	.779	.380[b]
	Residual	9.288	73	.127		
	Total	9.387	74			
Population Density	Regression	.003	1	.003	.026	.873[b]
	Residual	9.383	73	.129		
	Total	9.387	74			

Dependent variable – Differences of land values

Table of Summary of Coefficient

Model		Unstandard. Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Er	Beta		
1	(Constant)	1.600	.114		14.063	.000
	Proximity to the walking path	.192	.081	.268	2.381	.020
2	(Constant)	2.162	.112		19.262	.000
	Proximity to the roads	-.244	.083	-.325	-2.938	.004
3	(Constant)	1.804	.069		26.108	.000
	Land Use	.014	.016	.103	.883	.380
4	(Constant)	1.834	.125		14.714	.000
5	Population Density	.015	.091	.019	.160	.873

Dependent variable – Differences of land values

Source: Field Survey (2023)

The proximity to the walking path and changes in land value were the variables in the fitted regression model. It was discovered by examining the aforementioned tables that the total regression was statistically significant (P 0.05). The proximity to the walking path affects changes in land value by 7.2%, as shown by the R square value of 0.072.

The closest main road proximity and changes in land value were the variables in the fitted regression model. It was discovered by examining the aforementioned tables that the total regression was statistically significant (P 0.05). The R square value is 0.106, indicating a 10.6% influence of changes in the nearest major road on changes in land value.

The land value changes and land use were represented by the fitted regression model. It was discovered by examining the aforementioned tables that the total regression was statistically insignificant (P> 0.05). Because the total regression was statistically insignificant, even if the R square value of 0.011 indicates that there is a 1.1% impact of land use on changes in land value, it is not much to be taken into consideration.

Land value changes and population density were the variables in the constructed regression model. It was

discovered by examining the aforementioned tables that the total regression was statistically insignificant (P> 0.05). The R square value is 0.000, indicating that there is no relationship between population density and changes in land values and that the overall statistical significance of the regression was not reached.

5. DISCUSSION

The research analyzed land value changes surrounding public open spaces in the Colombo suburbs, focusing on the Bellanwila-Attidiya Weras Ganga Public open space and taking four influential factors into account. The study's findings significantly contribute to both knowledge and practice in this discipline.

The findings revealed a significant correlation between land value changes and the prevalence of public open spaces in the suburbs of Colombo. Specifically, two statistically significant factors were identified as contributors to these alterations. Initially, it was determined that proximity to the pedestrian path had a significant effect, accounting for a 7.2% change in land value. The proximity to the nearest major road also had a significant impact, contributing to a 10.6% change in land value.

These findings have significant ramifications for valuers, urban planners, and policymakers, as they emphasize the importance of public open spaces when assessing changes in suburban land values. The study highlights the role of walking paths and main road accessibility in influencing land value dynamics, which can be used to make more informed decisions regarding future developments and investments.

In addition, the study provides valuable insights by identifying population density and land use as factors that were not statistically significant on land value changes. This knowledge can help designers and evaluators of urban development strategies prioritize influential factors.

Overall, the research findings provide valuable guidance for urban planning and land-use decisions, enhancing our knowledge of the effect of public open spaces on land values in the Colombo suburbs. This knowledge will help create more sustainable and livable environments for residents and investors as cities continue to develop and evolve.

6. CONCLUSION

The primary factors influencing land value were initially identified as proximity to a walking path, land use, population density, and proximity to the nearest major road. The results of the data analysis confirmed a significant relationship between land values and proximity to the walking path, providing hypothetical support for this relationship and indicating a significant positive correlation. Conversely, no significant relationship was found between land values and land use, with the hypothesis not being supported. Similarly, there was no significant relationship between land values and population density, also not supported by the hypothesis. In terms of the temporal variation of land values, it was demonstrated that the development of public open spaces and changes in land value exhibit a positive correlation. Hence as per the research findings, decision-making on the land value changes around public open spaces within Colombo sub-urban area related to the Bellanwila-Attidiya Weras Ganga Public open space can be taken by considering the proximity to a walking path and proximity to the nearest major road.

However, there are some limitations to consider. The research is limited to changes in land value caused by the development of public open spaces, specifically Bellanwili-Attidiya park.

Other types of developments are not considered in this study. The study examines only changes in land value over time and does not investigate any other potential effects of the creation of public open spaces. Because the sample size is restricted to residential properties surrounding Bellanwila Park, the results cannot be generalized to other property types.

The findings of this study have significant applications for land administration. There is a larger demand for sound long-term data analysis about land prices, general land market behavior, and spatial development given the increased interest in better urban land management across the globe. These findings can be positively applied by government organizations concerned with land management, particularly in the area of land taxation. Additionally, by examining the variations in residential land prices through time, it is feasible to determine whether these variations have negatively impacted the ability of low-income people to purchase land for habitation. Land values in various residential land market sectors that are sharply different from one another are likely to influence the level of socioeconomic heterogeneity in any given neighborhood. This will impact the likelihood of population mobility across market segments. This might prompt coordinated state action to address the disparity, which if left unchecked would result in unwelcome, pronounced income segregation.

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