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Economic Valuation of Urban Green Spaces across a Socioeconomic Gradient: A South African Case Study

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Abstract: Urban green spaces (UGSs) may present economic contributions through increases in proximate property values, encapsulated in the proximity principle (PP). More data on the PP is required from the Global South, where the quality and equitable distribution of UGSs are important considerations. This paper investigates the PP in Potchefstroom, South Africa following a quantitative approach, by statistically analyzing municipal property valuations in three districts differentiated according to their socioeconomic status (SES). Districts are divided into sample areas where three zones are demarcated according to their proximity to a UGS. The results show that property valuations are generally higher for properties in closer proximity to UGSs in lower- and higher-income samples, but are lower in middle-income areas. Neighborhood characteristics and SES, UGS amenity and maintenance, ecosystem services and disservices, domestic garden area and residential property size may be connected to the confirmation or rejection of the PP. The rejection of the PP in middle-income areas indicates a need to improve public UGSs as amenity destinations. The results confirming the PP in low-income areas could incentivize expenditures to improve UGS area and quality to increase the willingness to pay for proximity to such spaces and, reciprocally, increase revenue from municipal property taxes.

Keywords: green infrastructure; environmental justice; property values; proximity principle; socioeconomic status; Global South

Citation: Lategan, L.G.; Steynberg, Z.; Cilliers, E.J.; Cilliers, S.S. Economic Valuation of Urban Green Spaces across a Socioeconomic Gradient: A South African Case Study. *Land* **2022**, *11*, 413. https://doi.org/10.3390/land11030413

Academic Editors: Zhonghua Gou and Thomas Panagopoulos

Received: 4 January 2022
Accepted: 9 March 2022
Published: 11 March 2022

1. Introduction

Research under the broad umbrella of green urban environments is well established, following almost forty years of intensifying scholarship. The bulk of academic investigation has historically focused on the Global North, but interest has also increasingly turned to the Global South, highlighting the need to consider local scale, context and dynamics when developing principles and frameworks to understand the role green uses fulfil in the urban environment [1]. Such themes, once rooted in the biological sciences, have now permeated multiple fields, including disciplines such as urban planning and design and urban ecology [2,3]. Multiple research themes have emerged, initially focused on issues related to environmental degradation and protection, but also increasingly investigating social and economic considerations, often framed by the concept of environmental justice. Conceptualizations around environmental justice traditionally focused more on who receives the benefits of urban green spaces (UGSs) and who bears the brunt of potential disadvantages [4,5]. More recently, the emphasis has fallen on issues of distributive justice concerning environmental quality and equitable UGS distribution and access [5–8]. Whilst there have been exceptions [9], the bulk of international studies on the equitable distribution of UGSs have found that these spaces are frequently unevenly distributed [10–12], with lower-income residents often served by lower levels of access and reduced proximity to lower-quality public and private UGSs in comparison with higher income cohorts [13–18], often overlapping with their racial and ethnic minority status [19–24]. Differences in socioeconomic status have been directly and indirectly linked to the provision, access and use of public and private UGS at multiple levels. Spatiotemporal variations in socioeconomic factors and power relations within national and local structures can lead to significant variability in UGS supply and demand [25,26]. Socioeconomic status (SES) and associated political leverage may exert substantial influence on the planning, development and management of UGSs across the urban landscape [18,27,28]. UGSs are also perceived, visited and utilized in different ways by different socioeconomic groups [29,30] depending on the context, and influenced by, for example, socio-cultural conventions, amenity value, opportunities for social interaction, access and perceptions about inclusivity and safety [31–34]. Issues linked to safety have been cited specifically as concerns for the vulnerable, including socioeconomically disadvantaged factions, the elderly, women and certain ethnic groups internationally [10,29,35]. Such concerns are also often related to physical characteristics and facilities, for example, lush vegetation or a lack of lighting that may conceal criminal activity and limit surveillance [36–38].

The majority of research, and most case studies on UGS equality, quality and its associated positive and negative impacts, have been focused on the Global North and its highly urbanized contexts, which generally present higher incomes per capita and lower population growth figures than most of the Global South [10,13]. The Global South is forecasted to accommodate the largest share of future urbanization [17], establishing what Myers [39] calls a "southern urban world". The resulting appetite for land in contexts presenting more limited resources and capacities may jeopardize UGSs, compromising environmental quality [6] and raising concerns for environmental justice related to environmental degradation, loss of valuable ecosystems [10,17,34,40,41] and the further entrenchment of inequality in access to quality UGSs amongst the disenfranchised. The relationship between SES and planning for UGSs has also received limited attention to date [18,42]. There is a need for urban planners and authorities, who have often been shown to acknowledge the importance of UGSs to some extent [2,34,43], to be further sensitized to the value of these spaces based on research from and focused on the Global South related to the improved planning, development and management of UGSs across the socioeconomic gradient [3,33]. Evidence of the economic savings and contributions related to UGSs may prove fundamental to help justify the human and financial capital required to prioritize the equitable development and maintenance of UGSs to realize more sustainable human settlements [44].

As highlighted in Section 2.3, several studies have attempted to measure the economic benefits of UGSs internationally. Investigations have often employed hedonic price analyses to determine the value of residential property relative to their proximity to UGSs, thereby testing the proximity principle, which assumes increases in residential property prices as distance to UGSs decrease [45]. The principle has generally been confirmed in much of the Global North (for example Immergluck and Balan [46]; Daams et al. [47]), demonstrating that the market may value adjacency to UGSs, translating directly to increased municipal tax revenue. Conversely, South African cases (focused mainly on middle-income suburbs to date) have rejected the premise [48–50], indicating a reluctance to pay more for properties in proximity to UGSs. The limited research conducted in South Africa, providing contrasting results in comparison to international findings, in conjunction with the country's severe socioeconomic and UGS inequality (see Section 1.1), provide opportunities for further investigation.

In consideration of the points raised, this paper aims to test the proximity principle in the South African case study of Potchefstroom along a socioeconomic gradient, including neighborhoods in low-income townships, middle-income suburbs and an exclusive high-income gated community. This paper is the first, to the knowledge of the authors, to apply the proximity principle along a socioeconomic gradient in the Global South with the aim of delivering preliminary findings on the economic value attached to UGSs within differentiated socioeconomic contexts. This study employs hedonic price analysis and the proximity principle (see Section 3) to test the hypothesis that the economic value of UGSs may vary amongst low-income, middle-income and high-income areas in a South African case study. Results may help justify increased resource allocation and prioritization to inform tailored approaches to UGS development and management appropriate to each socioeconomic level.

1.1. Turning to the Global South: South Africa in Focus

Within the Global South, South Africa presents particularly fertile research potential owing to three features. Firstly, although research on multiple facets related to UGSs has predominantly focused on the Global North [51], neglecting sub-Saharan Africa in particular [34], South Africa has been especially well represented in scholarship [52], and the country provides a relatively rich literature base on urban ecology to inform future research. Secondly, South Africa provides an obverse case to conventions in the Global North, with racial minorities (of European descent) generally presenting as the wealthiest group in the country in contrast with the poorer Black majority, as a result of past institutionalized racial discrimination under colonialism and apartheid [8]. Thirdly, apartheid and its restrictions on Black urbanization resulted in suppressed levels of internal migration to urban centers by the majority of citizens for many decades. The fall of apartheid led to rapid urbanization, as those previously restricted then migrated to cities [10], resulting in immense service delivery challenges, while also often stressing existing UGSs. South Africa has continued to struggle with the legacies of its racially segregated development history [53] and remains one of the most unequal societies in the world [54], with disparities between groups of varying SES perhaps being more pronounced than anywhere else in the world.

The scars of the past are represented spatially and environmentally across the cityscape. Older leafy suburbs with low population densities, many modelled around the ideals of the "Garden City" [55], and new gated communities that increasingly boast eco-development credentials [56], are mostly inhabited by White residents and, increasingly, Black higher income earners as well [10]. These green enclaves contrast starkly against the apartheid era townships and new subsidized mega housing projects developed for lower-income beneficiaries [57,58] that have higher population densities and limited, underdeveloped and poorly maintained UGSs [10]. Within the context of socioeconomic inequality, a significant housing backlog, blooming informal settlement sectors and the failure to deliver basic services, UGSs have been considered luxury amenities [8,38,59]. As such, the quantity and quality of UGSs vary significantly along the socioeconomic gradient [49,57], in keeping with international precedents. For example, in a case study of nine South African towns in the Eastern Cape province, McConnachie and Shackleton [10] found that newer subsidized housing projects delivered five times less green area per capita than apartheid-era townships, and up to 15 times less than more affluent, older suburbs. These results were significant considering that, proportionally speaking, higher-income suburbs presented public UGS provisions comparable in size to more densely populated apartheid-era townships. Despite the subsidized housing projects being more recently developed, and in contradiction of the state's policy support for more sustainable and just outcomes and prescriptions on UGS standards [8], these developments have continued to deliver relatively poor public UGS provisions. In addition, the wealth and racial disparities between older townships and new subsidized housing projects were proven to be negligible in comparison with the vast differences these areas presented in comparison to more affluent suburbs [10]. Results were corroborated by Venter et al. at the national scale, presenting that public and private UGSs were "abundant, accessible, greener and more treed in high-income areas with predominantly White residents relative to low-income areas" [8]. More affluent suburbs presented incomes six times higher on average, with 11.7% more tree cover and 8.9% higher vegetation cover compared to areas accommodating predominantly Black, Indian and Colored citizens (an accepted term in South Africa) [8].

Despite inequities in the provision of and access to UGS along the socioeconomic gradient, international [60,61], African [34] and South African studies [33,62] have continuously shown local communities to appreciate and acknowledge the benefits and value of UGSs.

As discussed in Section 2.1 below, UGSs may constitute critical components of the urban fabric that deliver vital services and environmental, social and economic benefits. It is often much simpler to identify environmental and social benefits [44] in contrast with more obscure economic compensations [63] that may remain unclear and underestimated [64] amongst UGS users and even decision makers. Ignorance, misconceptions and pressures exerted by the challenges highlighted above often result in those in power prioritizing land uses with a more explicit monetary value or political cachet over UGSs [48]. Prescriptive targets on UGS quantity and spacing, often aimed at promoting equal access, may in fact further undermine [19] the actions needed to institute more equitable provisions while considering varying socioeconomic contexts [18].

In keeping with the aim of this paper, the next section discusses core concepts, starting with UGS framed within the paradigms of green infrastructure and ecosystem services and disservices. This is followed by Section 2.3, presenting a more detailed exploration of economic valuation methods, focusing on hedonic price analysis and the proximity principle, with an emphasis on South African examples. Section 3 explains the methodology followed in testing the proximity principle in the case study of Potchefstroom, followed by the presentation and discussion of the results. Concluding remarks and recommendations close the paper.

2. Literature Review

2.1. Urban Green Spaces and Green Infrastructure

UGS is a widely applied and interpreted concept used in reference to a variety of green spaces of varying scales and functions in the urban environment. These may include both natural or anthropogenically developed, formal or informal green spaces that accommodate or compliment a variety of land uses and services [65,66]. It falls beyond the scope of this paper to provide a detailed discussion of the various UGS typologies and examples presented in the literature, but van Zyl et al. [67] provide an apt synopsis tailored to the South African context.

UGSs are increasingly framed as elements of green infrastructure, especially when these spaces accommodate grey-green elements that combine vegetation with engineered technical structures or grey infrastructure [68]. The green infrastructure approach provides a useful lens for this discussion of UGSs, owing to its recognition of several services, benefits and disadvantages potentially levied by such spaces [65]. Green infrastructure, included under the broader banner of "nature-based solutions" [69], is not yet served by an all-encompassing and broadly agreed-upon definition [8,70,71]. The concept is often also supplemented by the term blue-green infrastructure, in recognition of the services provided by water bodies and wetlands when part of a network of UGSs [72]. This paper draws on various established definitions, incorporating elements of blue-green infrastructure, to describe green infrastructure as an interconnected, multifunctional network comprised of links and nodes constituted by natural, semi-natural and artificial blue and green spaces and systems that deliver benefits known as ecosystem services [51,67,73]. The term ecosystem services has evaded a general definition [74], but is defined in this paper as the benefits all living species (humans in particular) derive, directly or indirectly, from the capacity of ecosystems to deliver goods and services that satisfy their needs [75,76]. Ecosystem services may be classified as provisioning, regulating, cultural and habitat or supporting services [77,78], which are regarded as direct benefits. This is captured in Table 1, which also presents examples mainly from sub-Saharan Africa.

Table 1. Main classes of ecosystem services provided by urban green infrastructure, their definitions and some examples from sub-Saharan Africa.

Ecosystem Service Category	Definition	Examples
Provisioning ecosystem services	The capability of natural or semi-natural UGSs to contribute physical products, materials or goods consumed directly by humans.	Cultivated and wild food, water, raw materials such as wood and fuel or those for construction work and arts, crafts and tools, as well as for medicinal uses [79–82].
Regulating ecosystem services	The regulation and mitigation of various processes.	Regulating the climate; the removal of pollutants by air and water filtration; water storage, filtration, and drainage; protection from disasters such as landslides and storms; seed dispersal and pollination; and providing pest and human disease regulation [83–88].
Cultural ecosystem services	The non-material benefits humans obtain from ecosystems that meet cultural or spiritual needs.	Recreation; aesthetic appreciation and reflection; physical and psychological health, educational values, social interaction and social cohesion; spiritual and religious experiences; and sense of place [89–92].
Habitat/supporting ecosystem services	Necessary to facilitate the fulfilment of all other ecosystem services.	Providing habitats to encourage biodiversity and maintenance of genetic diversity [93,94].

Other literature sources used for all the categories: Cilliers et al. [57,95]; du Toit et al. [52]; and TEEB [96].

Economic contributions are regarded as indirect benefits owing to the potential income and savings generated in relation to the four categories of ecosystem services discussed above [63]. An important additional economic benefit relates to the potential for increased property values as a result of proximity or access to UGSs [49] (see Section 2.3 below), reflecting a demand for UGSs and their associated ecosystem services [57]. SES may influence demand for ecosystem services by dictating human needs and activities, and thus influence how UGSs are used and what is expected of them, as well as how the provision of an ecosystem service affects wellbeing, for example, through physical or psychological health [18]. It follows that a holistic view of ecosystem services is required that also considers less-positive impacts, or ecosystem disservices.

2.2. Considering Ecosystem Disservices

The direct benefits derived from ecosystem services are countered by “functions of ecosystems that are perceived as negative for human wellbeing” [35], termed ecosystem disservices [97]. Although no universal definition or typology has been devised, several categories of ecosystem disservices have been identified. Four general classifications that are globally applicable are captured in Table 2, as there have been limited studies focusing on ecosystem disservices in sub-Saharan Africa.

Table 2. Different categories of ecosystem disservices provided by green infrastructure, their origin and some examples.

Ecosystem Disservice Category	Ecosystem Origin	Examples
Environmental/Ecological	Biotic	Invasive species outcompete indigenous species; Changes in species interactions and species populations.
	Abiotic	Changes in environmental variables of species in terms of soil and climate; Maintenance and management expenditure;
Economic/Financial	Biotic	Damage to infrastructure (property, cables, sidewalks, roads) caused by vegetation and tree roots; Pest-disease control.
	Abiotic	Drought; Wildfires; Siltation; Leaching of nutrients; Pruning and planting (maintenance costs); Foregone land-use opportunities; Decreased property values.

Table 2. *Cont.*

Ecosystem Disservice Category	Ecosystem Origin	Examples
Health (Physical, Mental, Safety)	Biotic	Human diseases from pathogens; Negative health impacts due to volatile organic compounds (VOC's) and pollen; Poisonous plants and pests/venomous animals; Allergens; Disease vectors; Safety hazards due to tree falls and lack of maintenance.
	Abiotic	Security concerns (crime); Anxiety; Discomfort; Floods; Storms; Landslides; Changes in air quality due to the production of VOC's; Decreased property values.
Cultural (Aesthetic and Cultural)	Biotic	Bird excrement on stonework and sculptures; Damage to infrastructure (sidewalks/paving); Littering and dumping of waste; Unpleasant odors from rotting organic matter; Aesthetically unpleasing; High noise levels; Decreased property values.
	Abiotic	Soil erosion; Landslides; Exposure to the elements (winds) makes it an unpleasant experience; Blocked views; Obstruction of traffic infrastructure.

Source: Own composition, based on Lategan and Cilliers [62]; Cilliers et al. [57]; Lyytimäki and Sipilä [35]; Lyytimäki [98]; Gómez-Baggethun et al. [99]; von Dohren and Haas [100]; Shackleton et al. [101]; Davoren and Shackleton [97].

Ecosystem disservices may (i) occur at different spatial and temporal scales and (ii) require certain threshold conditions to be met, often interacting with other disservices, leading to cumulative negative effects [101]. These may be context-specific and vary from one socioeconomic group to another, with the poor and more vulnerable often being disproportionately affected [101]. It is critical that a balanced approach is followed and that ecosystem disservices are thoroughly considered when attempting to plan for UGSs [18]. It must be noted that whilst certain scholars, for example, Shackleton et al. [101], explicitly exclude impacts such as littering and crime from ecosystem disserves as they are not the direct outcome of an ecosystem process, these are included in Table 2, in recognition of the broad perspective required when evaluating and valuing UGSs and their associated effects. Such impacts have also been recognized by others, for example, Lyytimäki and Sipilä [35] and von Dohren and Haas [100]. Negative impacts related to the lack of a dedicated function or amenities, poor maintenance, nuisance and crime, as is often exhibited by public UGSs in South Africa [50], may sway public sentiment and affect the willingness of the market to pay for close proximity to certain UGSs [99]. Such impacts, together with the availability and size of private UGSs such as domestic gardens, may also result in a preference for green views and not necessarily for immediate proximity or access to public UGSs [102,103].

Accounting for both ecosystem services and disservices is crucial if the net benefits UGSs deliver in cities are to be demonstrated [104]. In light of the importance of demonstrating the obscure economic value of UGSs and the complex interrelationship between ecosystem services and disservices, several economic valuation methods have been applied. These include the stated preference approach, revealed preference approach, avoided cost, replacement cost, travel cost, contingent valuation and hedonic price analysis [57,99,105,106]. Hedonic price analysis is highlighted for its broad application internationally and in South Africa [50].

2.3. Hedonic Price Analysis and the Proximity Principle

Hedonic price analysis generally breaks down the price of an observed good into discrete marginal prices linked to separate characteristics, whilst also considering consumer choice [107,108]. Hedonic price analysis has been employed in the valuation of UGSs by investigating residential property prices to identify and quantify various factors that may exert an influence on property values, without considering the interactions between these factors [47,48,107,109]. The relative distance to UGSs has been particularly widely employed as a factor, translated via the proximity principle. As stated in the introduction, the proximity principle posits that property prices will increase as distance to UGSs decreases, thereby determining the value of amenities such as UGSs via the value of surrounding residential properties, taken as representative of consumers' willingness to pay for proximity to UGSs and their associated benefits [47,49]. Increased residential property values translate to increased residential property taxes for municipalities, which may present economic returns to account for public expenditures on the development and maintenance of these spaces [48,110].

Several studies have attempted to investigate the impacts of UGSs on residential property values, with the most focused-on case studies being located in the Global North. In general, the results have supported the proximity principle to varying degrees [50]. General trends seem to confirm the proximity principle where certain conditions are satisfied, for example, when residential properties have fairly direct access to a UGS or enjoy views of it; certain active or passive uses are accommodated; UGSs are perceived as safe and well-maintained public spaces; and surrounding residential properties are smaller in area, for example, by accommodating higher-density dwelling units or where socioeconomic conditions result in smaller or less developed domestic gardens [110–112].

In consideration of the literature reviewed above, the next section discusses the methodology employed in this research, before results are disclosed and discussed.

3. Materials and Methods

This paper relied on a quantitative research approach, based on an investigation of a South African case study in Potchefstroom, to analyze residential property values in relation to UGS proximity (relative distance from a UGS) within three areas reflecting characteristics of varying SESs. The following section discusses the choice of Potchefstroom as the case study area and elaborates on the steps followed in analyzing property values in the three areas of differentiated SES.

3.1. Study Area

Potchefstroom (26°42′3″ S 27°05′49″ E), located in South Africa's North West province and within the JB Marks Local Municipality (see Figure 1), was selected as the case study area, as the town has previously been the focus of preliminary research on the proximity principle and UGSs [48–50], offering established methods and data for longitudinal comparison. This paper drew primarily on the research conducted by Cilliers and Cillliers [48], returning to the areas investigated, refining the methodology employed with updated data and expanding on the approach through a broader geographic and socioeconomic focus.

Cilliers and Cilliers [48] employed hedonic price analysis and investigated the proximity principle in relation to a local UGS in five middle-income neighborhoods in Potchefstroom, using as variables municipal valuations of properties surrounding a UGS in Grimbeek Park, van der Hoff Park, Potchefstroom Dam, Heilige Akker and Oewersig (for more detail on neighborhood characteristics and the UGS included in each sample, see Section 3.2). Cilliers and Cilliers [48] identified sample properties in each neighborhood depending on their relative distance to a specific UGS, and classified these into three zones depending on their proximity to the UGS in question. Properties in zone 1 bordered the UGS; those in zone 2 were further away from the UGS, mostly located across the street or one property away from those in zone 1; and those in zone 3 were further away from the UGS than those in zone 2. Figure 2 illustrates an example of a UGS and the properties included in each zone, selected based on their relative distance from the UGS as determined by Cilliers and Cilliers [48].

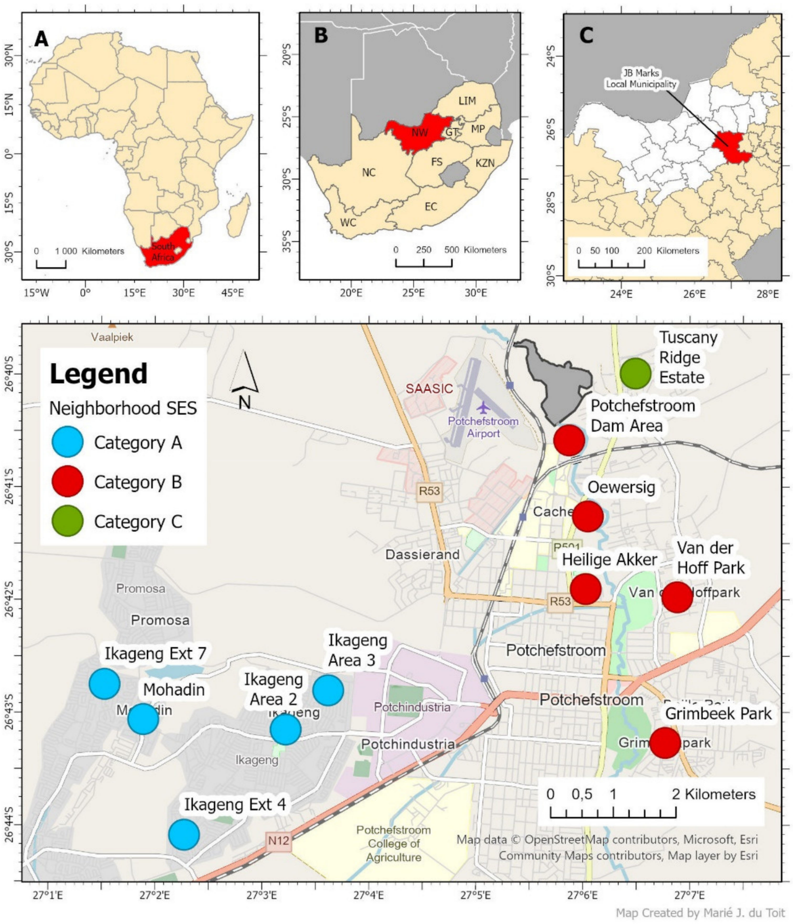

Figure 1. Maps of the study area showing South Africa (**A**); The North-West province (NW) (**B**); and the JB marks Local Municipliaty (**C**) within which Potchefstroom is located, as well as the location of neighborhoods within each SES Category in Potchefstroom. Blue: Category A sample (SES 1); Red: Category B (SES 4) sample; Green: Category C (SES 5) sample. Source: Own construction (2022) by M.J. du Toit.

Figure 2. The Heilige Akker neighborhood as an example of Category B (SES 4), with sample properties in three zones of relative distance from a specific UGS. Source: Own construction (2022) based on Cilliers and Cilliers [48] by M.J. du Toit (2022).

Cilliers and Cilliers [48] employed 2013 municipal valuations to arrive at a mean South African rand price per square meter value (R/m^2) for each property included in the sample. Each zone in each neighborhood was then assigned a mean R/m^2, employed as a variable in statistical analyses to compare zones. In general terms, the findings indicated that properties in zone 1 presented lower average valuations than those further away from a UGS, leading Cilliers and Cilliers [48] to reject the proximity principle in the case of middle-income neighborhoods in Potchefstroom. In 2020, Combrinck et al. [49] returned to the Potchefstroom case study to replicate the study in the same middle-income sample using the latest municipal valuations released in 2019. Again, the results presented by Combrinck et al. [49] rejected the proximity principle. The validation of previous results led to two main questions: firstly, whether the rejection of the proximity principle in the Potchefstroom case study, in comparison with most international findings (see Section 2.3), could be explained by the use of municipal valuations as variables, in contrast with most other studies that have employed market values? Lategan et al. [50] addressed this issue, returning to Cilliers and Cilliers' [48] case study, but employing estimated market values as variables in their analysis. Again, the results generally rejected the proximity principle. The second question related to the impact of a socioeconomic gradient on the confirmation or rejection of the proximity principle, or in other words, whether the proximity principle would also be rejected in low- and high-income samples in Potchefstroom. This question is considered particularly important given the spatial legacy of South Africa's colonial and apartheid history and the inequitable distribution and quality of UGSs discussed previously (see Section 1.1).

Potchefstroom is characterized by an unequal and typically fragmented apartheid-city layout, presenting a steep socioeconomic gradient [57]. The wealthy are located in green suburbs and gated communities, and the previously disadvantaged are still accommodated in peripheral townships that often provide lower-quality housing and access to services and amenities, including UGSs [113]. Lubbe [113] examined the distribution of domestic garden flora across a socioeconomic gradient in Potchefstroom, demarcated according to five SES categories based on employment, household size, access to basic services, number of rooms in dwellings and schooling. These included SES levels 1 to 3 (low-income), SES level 4 (middle income), and SES level 5 (high-income). The results showed that the higher the SES level, the greater the access to higher-quality public and private UGSs, the more species rich the environment and the higher the vegetation and tree cover [57,113], in keeping with international precedents (also see Figure 3).

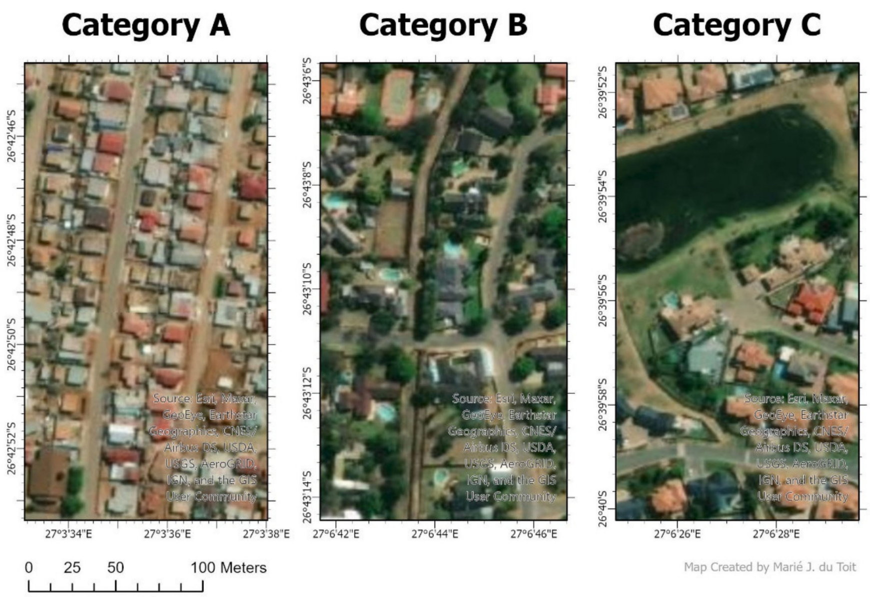

Figure 3. Aerial views of sections of Category A (SES 1), B (SES 4) and C (SES 5) neighborhoods. Source: Own construction (2022) by M.J. du Toit.

3.2. Identification of Samples

This paper replicated the approach followed by Cilliers and Cilliers [48], but like Combrinck et al. [49], employed 2019 municipal valuations to investigate the proximity principle using three zones of proximity to a UGS in three distinct areas of Potchefstroom differentiated by level of SES. This included properties surrounding a single UGS in five lower-income neighborhoods (SES 1), from here on referred to as the Category A sample (Ikageng Extension 7; Mohadin; Ikageng Extension 4; Ikageng Area 2; and Ikageng Area 3); the same five middle-income neighborhoods (SES 4) examined by Cilliers and Cilliers [48], from here on referred to as the Category B sample (Grimbeek Park; van der Hoff Park; Potchefstroom Dam; Heilige Akker; and Oewersig); and a higher-income sample (SES 5), from here on referred to as the Category C sample (Tuscany Ridge Estate) (see Figure 1). As noted in Table 3, the number of properties included in each sample varied as a result of neighborhood layout and size or the availability of municipal valuation data.

Table 3. SES Category neighborhoods and descriptive details.

Sample	Neighborhoods	Zoning and Size for Each UGS	Characteristics/Land Use for Each UGS	Number of Residential Properties Included	Property Size Range (m^2)
Category A	Mohadin	Public open space	Bordering a communal urban park	40	500–800
	Ikageng Extension 7	Public open space	Bordering vacant land connected to the Poortjies Dam.	72	200–500
	Ikageng Extension 4	Public open space	Bordering vacant land with informal squatters.	37	200–500
	Ikageng Area 2	Private open space	Located opposite a sporting field.	36	200–500
	Ikageng Area 3	Private open space	Bordering vacant land.	36	200–500
Category B	Grimbeek Park	Public and private open space	Golf course and areas used for birdwatching and horseback riding.	41	1000–2000
	Van der Hoff Park	Public open space	Wetland with limited tree cover.	43	1000–2000
	Potchefstroom Dam	Public open space	Potchefstroom Dam and Mooirivier with dense vegetation.	27	1000–2000
	Heilige Akker	Educational	UGS with limited vegetation and tree cover.	36	1000–2000
	Oewersig	Public open space	Mooirivier with dense vegetation and tree cover.	41	1000–2000
Category C	Tuscany Ridge	Private open space	UGS with moderate tree and vegetation cover, with well-maintained lawns and water bodies.	72	700–2000

Table 3 provides details regarding each neighborhood included under each SES category, presenting zoning, each UGS's characteristics and uses, the number of properties included in each sample and average property size ranges to inform the discussion.

In further support of Figures 1 and 2 and Table 3, Figure 3 provides an overview of general neighborhood characteristics for each included category area. Note the stark contrasts in density and vegetation cover between Category A and Categories B and C.

Whereas the Category A and Category B areas contained five neighborhood samples each, certain limitations in the context of Potchefstroom, and its high-income gated communities specifically, limited the number of feasible samples within the Category C classification. These included the limited number of high-income gated communities in the town; the lack of large communal green spaces in other options, in favor of large private gardens; the relatively young age of other options in comparison with Tuscany Ridge and its mature public green spaces; challenges related to the layout of other options, complicating the selection of residential properties surrounding communal greens in zones of comparable distance; and the proliferation of townhouses and clusters rather than detached dwellings in other options. Single-case studies are commonly applied and are regarded as particularly useful experimental designs in a variety of situations, for example, when researchers have limited resources, conditions present low incidences or when examining the effects of novel or expensive interventions [114]. However, the inclusion of only one sample in Category C is still acknowledged as a limitation of this research, providing limited representation of high-income demographics and their associated UGSs in Potchefstroom. Results obtained from Category C are thus only interpreted in an exploratory manner.

Following the identification of sample properties and the calculation of mean R/m^2 values, statistical tests were conducted. This paper employed two-way analysis of variance (ANOVA) using Categories A, B and C and the three zones of relative distance to a UGS as factors. For the two-way ANOVA, an effect size of ≈0.2 indicates a small, not practically significant difference; an effect size of ≈0.5, a medium, practically visible difference; and an effect size of ≈0.8, a large, practically significant difference. Post-hoc tests based on Tukey's B were conducted to make pairwise comparisons between groups (category and zone). As a convenience sample was used, *p*-values were included for the sake of completeness and to add further credence, but were not interpreted. The following section reports and discusses the results obtained from the analysis of municipal valuations in relation to UGS proximity in each SES category.

4. Results and Discussion

The results of the quantitative analysis are provided below, summarizing the data and outcomes of the statistical tests, followed by a discussion that highlights certain findings regarding the proximity principle in the context of each UGS, aided by anecdotal evidence from observations and spatial analyses. Table 4 below provides an overview of each neighborhood included in each category area, the number of properties included, the mean R/m^2 municipal valuations retrieved for each zone and which zone presented the highest, middle and lowest mean R/m^2 in each neighborhood.

Table 4. Summary of individual neighborhoods and three zones of relative distance from a UGS per category area.

Sample	Neighborhoods	Zone	N	Mean R/m^2	Highest, Middle or Lowest Zone (Mean R/m^2)
Category A	Ikageng Extension 7	1	24	526.52	Lowest
		2	24	635.96	Highest
		3	24	588.89	Middle
	Mohadin	1	13	969.21	Highest
		2	15	815.99	Middle
		3	13	765.87	Lowest
	Ikageng Extension 4	1	12	1099.52	Highest
		2	12	824.62	Middle
		3	13	599.57	Lowest
	Ikageng Area 2	1	12	973.41	Highest
		2	12	833.98	Middle
		3	12	758.63	Lowest
	Ikageng Area 3	1	12	898.65	Lowest
		2	12	1083.30	Highest
		3	12	1080.96	Middle

Table 4. *Cont.*

Sample	Neighborhoods	Zone	N	Mean R/m^2	Highest, Middle or Lowest Zone (Mean R/m^2)
Category B	Grimbeek Park	1	14	1260.70	Lowest
		2	14	1611.67	Middle
		3	13	1699.25	Highest
	Van der Hoff Park	1	15	1290.59	Lowest
		2	15	1472.43	Middle
		3	13	1624.30	Highest
	Potchefstroom Dam	1	9	1116.44	Lowest
		2	9	1303.45	Middle
		3	9	1448.64	Highest
	Heilige Akker	1	10	1751.96	Lowest
		2	12	1904.15	Highest
		3	14	1850.28	Middle
	Oewersig	1	14	1668.44	Middle
		2	14	1852.15	Highest
		3	13	1549.20	Lowest
Category C	Tuscany Ridge Estate	1	24	3915.46	Highest
		2	24	3612.63	Middle
		3	24	3058.63	Lowest

Table 5 follows from Table 4, and presents the mean R/m^2 values for each zone per category area, used as the dependent variable in two-way ANOVA testing to determine the relationship between different zones in each category area.

Table 5. Two-way ANOVA based on mean R/m^2 identified for each zone in each category sample using three zones in each category area as factors.

Dependent Variable	R/m^2				Effect Sizes	
Category	**Zone**	**Mean**	**Std. Deviation**	**N**	**1 with**	**2 with**
A	1	834.1791	519.47186	73		
	2	805.4081	411.62278	75	0.06	
	3	729.1787	378.35255	74	0.20	0.19
	Total	789.4590	440.33770	222		
B	1	1418.2978	389.71718	62		
	2	1643.1354	382.48991	64	0.58	
	3	1649.7992	424.23869	62	0.55	0.02
	Total	1571.1845	411.23169	188		
C	1	3915.4593	1018.23754	24		
	2	3612.6349	444.37633	24	0.30	
	3	3058.6274	610.12136	24	0.84	0.91
	Total	3528.9072	805.02298	72		
Total	1	1527.0475	1193.93740	159		
	2	1547.6657	1026.01751	163		
	3	1435.3364	914.53858	160		
	Total	1503.5766	1049.60171	482		

In Table 6, the *p*-values (significance) indicate that the interaction effect between category and zone is statistically significant, seeing that the reported value of <0.000 is below the guideline value of <0.05.

Table 6. Test of between-subject effects.

Dependent Variable Source	R/m² Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	421,072,689.835 [a]	8	52,634,086.229	228.765	0.000
Intercept	1,462,376,992.023	1	1,462,376,992.023	6355.965	0.000
Category	409,338,084.457	2	204,669,042.228	889.558	0.000
Zone	4,365,404,467	2	2,182,702,234	9487	0.000
Category * Zone	10,487,761,981	4	2,621,940,495	11.396	0.000
Error	108,827,577,814	473	230,079,446		
Total	1,619,578,126,813	482			
Corrected Total	529,900,267,649	481			

[a] R Squared = 0.795 (Adjusted R Squared = 0.791).

The results of post-hoc testing using Tukey's B are reported below, first by category (Table 7) and then by zone (Table 8).

Table 7. Tukey's B with homogenous subsets: category.

R/m²				
Tukey's B [a,b,c]				
Category	N	Subset		
		1	2	3
A	222	789.4590		
B	188		1571.1845	
C	72			3528.9072

Means for groups in homogeneous subsets are displayed. Based on observed means. The error term is Mean Square(Error) = 230,079.446. [a.] Uses Harmonic Mean Sample Size = 126.515. [b.] The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed. [c.] Alpha = 0.05.

Table 8. Tukey's B with homogenous subsets: zone.

R/m²		
Tukey B [a,b,c]		
Zone	N	Subset
		1
3	160	1435,3364
1	159	1527,0475
2	163	1547,6657

Means for groups in homogeneous subsets are displayed. Based on observed means. The error term is Mean Square(Error) = 230,079.446. [a.] Uses Harmonic Mean Sample Size = 160.649. [b.] The group sizes are unequal. The harmonic mean of the group sizes is used. Type I error levels are not guaranteed. [c.] Alpha = 0.05.

Whilst the two-way ANOVA (Tables 5 and 6) showed significant differences between the zones in each category, from Tables 7 and 8 it is apparent that differences were found between all categories, whilst zones presented no differences from one to another.

In illustrating the interaction between categories and zones, Chart 1 below provides a graphic representation of the results for ease of reference.

The results captured in Chart 1 present a simplified view of the data, illustrating that in Category A, mean R/m^2 values decreased further away from a UGS; in Category B, mean R/m^2 values increased further away from a UGS; whilst in Category C, mean R/m^2 values decreased as distance from a UGS increased. These observations facilitate deliberation for a verdict on the proximity principle in each category area, as discussed in more detail below.

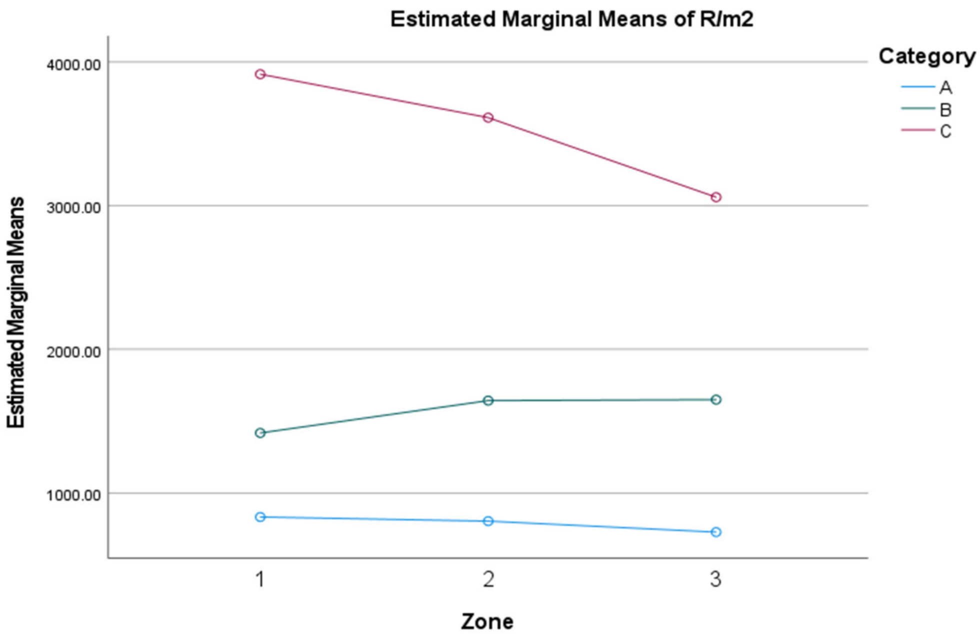

Chart 1. Graphical representation of findings.

4.1. Findings on the Confirmation or Rejection of the Proximity Principle in Category A (Low SES)

As shown in Table 4, the results for Category A indicated that zone 1 (closest to a UGS) presented the highest mean R/m^2 value in three of the five residential areas (Mohadin, Ikageng Extension 4 and Ikageng Area 2) compared to zones 2 and 3 (further away from a UGS). The Mohadin sample presented a mean value of R969.21/m^2 in zone 1, compared to R815.99/m^2 (18,8%) in zone 2 and R765,87/m^2 (12.6%) in zone 3. Likewise, Ikageng Extension 4 presented a mean value of R1099.52/m^2 in zone 1, compared to R824.62/m^2 in zone 2 (33.35%) and R599.57/m^2 in zone 3 (83.52%). Ikageng Area 2 reflected the same trends with a mean value of R973.41/m^2 in zone 1, compared to R833.98/m^2 in zone 2 (16.7%) and R758.63/m^2 in zone 3 (28.3%), confirming the proximity principle. Zone 1 presented the lowest R/m^2 value in two of the five residential areas (Ikageng Extension 7 and Ikageng Area 3), contradicting the premise of the proximity principle. In Ikageng Extension 7, zone 1 presented a mean value of R526.52/m^2, compared to R635.95/m^2 (20.8%) and R588.89/m^2 in zone 3 (11.8%). In Ikageng Area 3, zone 1 delivered a mean value of R898.65/m^2, in comparison with R1083.30/m^2 in zone 2 (20.5%) and R1080.96 in zone 3 (20.3%). The result of the two-way ANOVA test indicated small effect sizes ($d \leq 0.20$) or practically insignificant differences between the mean R/m^2 values for zone 1, zone 2 and zone 3 in Category A, confirming small differences between the mean R/m^2 values presented (Table 5). The results translated to a general confirmation of the proximity principle in the Category A sample (Chart 1).

As shown in Table 4, the proximity principle was confirmed in samples in Mohadin, Ikageng Extension 4 and Ikageng Area 2. The UGS in Mohadin was constituted by a vacant and relatively barren land parcel with a low vegetation cover and no trees, providing limited regulating and supporting ecosystem services, but no provisioning services. The space did present ample room for the realization of cultural ecosystem services, facilitating recreation and social interaction in a quiet environment. These benefits could overshadow other, more negative considerations such as ecosystem disservices, including diminished aesthetic appeal, translating to a willingness to pay for proximity to the UGS. In Ikageng Extension 4, the confirmation of the proximity principle could be attributed to a relatively visually attractive UGS that provided good access to a more park-like setting populated by a number of trees, whilst still providing some open space for recreation and play (cultural ecosystem services). However, a site visit revealed the presence of newly erected informal dwellings, which feasibly produce ecosystem disservices in terms of the loss of aesthetic appeal and the emergence of additional security issues, with the potential to negatively affect more up-to-date property valuations. In comparison with the other neighborhoods included under the Category A sample, the UGS in Ikageng Area 2 seemingly delivered the highest amenity value, specifically in terms of various cultural ecosystem services. The space provided a link to a sporting facility located close by and delivered opportunities for recreation and social gatherings in a quiet and relatively well-maintained, aesthetically pleasing environment, in comparison with the surrounding area. This was reflected in the higher municipal valuations for residential properties located closer to it. The results in Ikageng Extension 7 rejected the proximity principle; however, the highest mean R/m^2 value was identified in zone 2, indicating that closer proximity, but not adjacency, to the UGS was still preferred by the market. On closer inspection, the UGS in question, comprised of vacant land, appeared to provide a quiet environment with adequate open space for recreation and social gatherings, as well as a relative aesthetic appeal contributed by moderate vegetation cover. Vegetation also provided regulating and supporting ecosystem services. However, the UGS's location, linking it to a densely vegetated area with high tree cover surrounding the Poortjies Dam and the potential to harbor criminal activity and vagrants on its periphery (as reported elsewhere by Davoren and Shackleton [97] and Lategan et al. [50]), in conjunction with the potential for disturbances from social gatherings and children at play (ecosystem disservices), could be cited to explain the proximity principle's rejection. Although this area offered regulating services in terms of climate regulation and the removal of pollutants, and supporting services such as high native biodiversity, these benefits are potentially not recognized by all residents.

The results in Ikageng Area 3 merit closer inspection in that, although the proximity principle was rejected, the difference between zone 2 and zone 3 was marginal (0.22%), thus insinuating that increased distance from the UGS did not result in significant increases in mean R/m^2 values. The UGS in Ikageng Area 3 was of a relatively small size, had sparse vegetation cover (therefore presenting low levels of regulating and supporting ecosystems services) and was poorly maintained, thus decreasing its aesthetic appeal (cultural ecosystem service). It was also located adjacent to a very busy road, further limiting its attraction power and use in terms of other cultural ecosystem services, and feasibly accounting for the negative impact on immediately adjacent property values. Interpretations based on ecosystem services, for example, a lack of aesthetic appeal, to account for the rejection of the proximity principle are highly subjective, and studies of such impacts conducted in the Global South have been limited [97]. Studies in sub-Saharan Africa have indicated that aesthetic values in such contexts may be linked to perceptions regarding urban trees, with more focus often placed on negative features such as thorns, poisons and allergic reactions [115].

4.2. Findings on the Confirmation or Rejection of the Proximity Principle in Category B (Medium SES)

For Category B, the mean R/m^2 in four of the five residential areas (Grimbeek Park, Van der Hoff Park, Potchefstroom Dam and Heilige Akker) indicated that zone 1 presented the lowest value in mean R/m^2 compared to zone 2 and zone 3. As illustrated by Table 4, zone 1 in Grimbeek Park presented a value of R1260.70/m^2, compared to a higher value of R1611.67/m^2 in zone 2 (27.8%) and R1699.25/m^2 in zone 3 (34.8%). In Van der Hoff Park, the same trends were presented, with a value of R1290.59/m^2 in zone 1, R1472.43/m^2 in zone 2 and the highest value, R1624.30/m^2, in zone 3. Zone 1 to zone 2 presented a difference of 14%; zone 2 to zone 3, a difference of 10.3%; and zone 1 to zone 3, a difference of 25.9%. In the Potchefstroom Dam sample, zone 1 presented a value of R1116.44/m^2, compared to R1303.45/m^2 in zone 2 (16.8%) and R1448.64/m^2 in zone 3 (29.8%). In Heilige Akker, zone 1 presented the lowest value of R1751.96/m^2, but zone 2 presented the highest value of R1904.15/m^2, followed by the second-highest value of R1850.28/m^2 in zone 3. Thus, zone 1, located closest to the UGS, presented the lowest mean R/m^2 value, 8.7% lower than zone 2 and 5.6% lower than zone 3, in opposition to the proximity principle. In

Oewersig, zone 1 presented a mean value of R1668.44/m^2, 11% lower than the R1852.15/m^2 in zone 2 and 7.7% lower than the R1549.20/m^2 in zone 3. The results of the two-way ANOVA test presented medium effects or practically visible differences (d = 0.58 and 0.55) between zone 1 and the zones further away from the UGS (Table 5), where zone 1's mean R/m^2 value was lower than that of the other two zones (1418.2978 vs. 1643.1354 and 1649.7992). In totality, these results lead to a general rejection of the proximity principle in Category B, as also presented by Cilliers and Cilliers [48] and Combrinck et al. [49] (also see Chart 1).

Despite a rejection of the proximity principle, the majority of the UGSs included under this SES category were of a much higher quality in terms of vegetation and tree cover, amenities and general maintenance compared to those in Category A. The UGS in Grimbeek Park accommodated a golf course and areas for horseback riding and birdwatching, and thus hosted a range of recreational activities and opportunities for social interaction (cultural ecosystem services) [48]. The space could also be perceived as aesthetically pleasing and well maintained and managed, as well as housing high levels of biodiversity, presenting the highest quality UGS in this sample. A relatively low difference in R/m^2 values was also identified between zone 2 and zone 3 here (5.43%), signifying the strong impact of immediate adjacency compared to proximity. In Van der Hoff Park, the sample UGS bordered the Mooi River and included a biodiverse and species rich wetland [116] worthy of conservation [117], presenting a quiet environment that could accommodate recreation and physical activity. Additionally, the urban wetlands provide various regulating ecosystem services such as water regulation, purification and drainage [118,119] and high biodiversity (supporting ecosystem services) [117]. However, the location along the Mooi River, having dense vegetation cover, also provided a potential movement corridor for vagrants and criminals, creating high security risks for residents living close by [48,97]. Other ecosystem disservices observed for this wetland included decreased aesthetic appeal during the winter months when annual plants have died down, unpleasant odors due to polluted water entering through stormwater drains and standing water during the rainy season, providing breeding ground for mosquitos. The UGS in the Heilige Akker neighborhood also linked to the Mooi River and presented high biodiversity, but with a lower tree cover and larger lawn cover [48]. The space provided some opportunities for recreation and social gathering in a relatively quiet and well-maintained environment [48]. Properties in zone 2 of the sample in Heilige Akker presented peak mean R/m^2 values, demonstrating that immediate adjacency may not have been valued, and that relative proximity was preferred. This was also the case in the Oewersig sample. The UGSs in the Oewersig and Potchefstroom Dam neighborhoods were both densely vegetated and tree covered, accommodating high levels of biodiversity (supporting ecosystems services) and fulfilling several regulating ecosystem services [48]. However, as elsewhere, this also generated ecosystem disservices by obscuring surveillance and providing potential hiding places for intruders. Yet, the Oewersig UGS, in particular, provided important cultural ecosystem services, as it included a large lawn fit for recreational purposes and presented significant educational value, owing to a short trail with information boards on bird, reptile and amphibian biodiversity, which was the outcome of a resident initiative to improve the area. The rejection of the proximity principle in Category B (Chart 1), despite the relatively high-quality UGSs included in the sample, which provided several ecosystem services, could be ascribed to some of the ecosystem disservices noted, in conjunction with the generally large and lush private gardens available to home owners in these neighborhoods which fulfil their basic recreational needs [110,112].

4.3. Preliminary Findings on the Confirmation or Rejection of the Proximity Principle in Category C (High SES)

As seen in Table 4, mean R/m^2 values in the Tuscany Ridge Estate indicated that zone 1 presented the highest value in mean R/m^2 compared to zone 2 and zone 3. Zone 1, featuring properties bordering a UGS, presented the highest value of R3915.46/m^2, zone 2 presented the second-highest value of R3612.63/m^2 and zone 3 presented the lowest value of R3058.63/m^2. Zone 1 to zone 2 presented a difference of 8.4%; zone 2 to zone 3, a difference of 18.1%; and zone 1 to zone 3, a difference of 28%. For category C, large effect sizes or practically significant differences (d = 0.84 and 0.91) were reported between zone 1 and the other two zones' mean R/m^2 values (Table 5). This time around, zone 1's mean R/m^2 value was higher than that of the other two zones (3915.4593 vs. 3612.6349 and 3058.6274). The results in the Tuscany Ridge Estate sample thus showed that properties in closer proximity to public green spaces were valued substantially higher than those located further away.

The well-maintained and aesthetically pleasing UGSs in the high-income Tuscany Ridge Estate presented moderate tree and vegetation cover, but accommodated high levels of biodiversity (supporting ecosystem services), including grassland fragments from the vulnerable Rand Highveld Grassland vegetation type [94]. These spaces also presented social benefits, as the UGSs encouraged social interaction and recreation in a safe environment. The UGSs further provided functions as part of sustainable stormwater management systems. The residential properties included in the sample were larger than those included under Category A, with some also being smaller and equal in size to those in Category B. Tuscany Ridge Estate residents could, however, substitute more limited, private UGSs—in some cases due to smaller stand sizes and, in others, to exceptionally large dwelling footprints—with high quality public UGSs, where many of the ecosystem disservices often associated with such spaces in the South African context could be avoided or effectively managed (see Section 1.1).

5. Conclusions

This research fits under the ever-expanding framework of environmental justice, with its strong focus on equality in the distribution and quality of environmental resources, such as UGSs, in relation to socioeconomic differentiations. Within this broad focus, this paper attempted to relate an economic value to UGSs based on international conventions on the use of hedonic price analysis and the proximity principle, not with the intention of monetizing nature or viewing it solely through a capitalist lens [120], but to provide preliminary evidence of the manner in which UGSs may be valued by the market along a socioeconomic gradient. This is intended to inform decision making in support of a more just and greener urban agenda. As presented in Sections 1.1 and 2, improved understanding of such values is critical in the underrepresented contexts of the Global South, where rapid urbanization, its accompanying resource depletion and socioeconomic and environmental inequality demand increased scholarship and understanding. South Africa presents an interesting microcosm in which such issues are particularly pronounced.

Through the case study of Potchefstroom, this paper provided a novel investigation of the market's willingness to pay for proximity to UGS based on the average municipal valuation/m^2 in areas of varied SES, including low (Category A), middle (Category B) and high (Category C) income areas. Broadly speaking, the results verified the research hypothesis, demonstrating that the proximity principle was confirmed in low-income neighborhoods where residential properties were smaller and UGSs were of low to moderate quality, and rejected in middle-income neighborhoods where UGSs were of improved quality, but the residential properties were larger than in low-income neighborhoods. The limited sample in the high-income gated community, with its UGSs of outstanding quality and its number of smaller residential properties compared to Category B neighborhoods, also showed higher property valuations in proximity to UGSs (see Tables 3 and 4 and Chart 1). Given the small size of the sample in Category C, a generalized verdict on the confirmation or rejection of the proximity principle in high-income areas cannot be reached. However, useful observations may still be made. The results and subsequent discussion delivered key conclusions and recommendations.

5.1. Socioeconomic Characteristics and Urban Green Space Functions Impact the Value Attributed to Them

Firstly, the diverse results within each SES level reconfirmed the discussions presented in the literature review on the impact of socioeconomic characteristics, as determinants of context, on the use of and value attributed to UGSs and ecosystem services and disservices [25,26,29,30]. Whilst certain common themes emerged across SES categories, context-appropriate planning responses are justified and demand consideration in UGS planning.

The potential impact of residential property size, and therefore the area available for the cultivation and use of domestic green spaces, as well as the probable effects of crowding and a lack of privacy [58], can be regarded as major influences on the economic value placed on public UGSs. This was evidenced in both the Category A and C samples, representing opposite sides of the SES spectrum, where smaller residential property sizes could be linked to higher property prices when in proximity to UGSs. Thus, this potentially calls for increased areas for public UGSs where smaller residential properties and increased population densities are present. Whilst this may be regarded as a foregone and logical conclusion and recommendation, it opposes the standard practice of prescriptive UGS targets, which may limit adaptable responses in diverse socioeconomic contexts [18]. In the South Africa case, this may apply directly to development standards in low-income and subsidized housing projects where small stand sizes, high population densities and the incursion of informal backyard structures often threaten domestic UGS access [62]. Public UGSs also require additional consideration regarding the improvement of UGS area and quality in both completed and new low-income housing developments. In existing areas, the danger of infill development at the cost of valuable UGSs should be carefully considered, and existing UGSs and vacant land protected and renewed.

Such considerations are not restricted to areas occupied by those of lower SES. In Potchefstroom's Category B sample, the rejection of the proximity principle directed attention to the quality and amenity value of existing public UGSs [48]. Whilst we observed these spaces in middle-income neighborhoods to be of improved quality over those in lower-income areas, without dedicated functions or support for social activities, these spaces may not be used or valued sufficiently. To draw the immediate and broader community, many of whom may have substantial access to private UGSs and transport and can afford to travel to other destinations for leisure and recreation, concerted efforts are required. Public–private partnerships, in which local champions often prove critical, may be needed to capitalize on a neighborhood's resources and compensate for the incapacity and lack of resources or political will of the public sector. Such initiatives should also place a firm focus on ecosystem disservices, especially the social ails potentially related to UGSs, as presented in Section 1.1 and emphasized by Davoren and Shackleton [97] as important issues in the Global South. This may include programs to improve the maintenance of vegetation and clear areas for recreation, and to improve surveillance and lighting. It is, however, critical that public UGSs are retained as accessible and welcoming public spaces that contribute to social cohesion and not division, especially in the South African context.

5.2. Urban Green Spaces Need to Be Valued as Green Infrastructure to Enhance Value

Increased municipal property valuations and their associated property taxes may follow when UGSs are valued by homeowners and prospective buyers, but local authorities need to value UGSs as green infrastructure as well. The lack of dedicated green infrastructural systems in public UGSs in the low- and middle-income samples included in this research attests to a lack of application and a failure to realize the potential multifunctional values UGSs can deliver. It is thus recommended that alternatives combining grey and green infrastructure in the development of new and the retrofitting of existing UGSs and infrastructural networks be more ardently pursued as priorities in planning practice. For example, the UGSs included under Category C constituted important components of the development's stormwater management network. Stormwater management through drainage, retention, filtration, etc., is one of the most commonly derived green infrastructure functions, as part of regulating ecosystem services (see Table 1). Whilst regulating, provisioning and habitat/supporting ecosystem services often bear identifiable and even quantifiable benefits, more obscure advantages related to cultural ecosystem services must also be considered in unison to extract optimal value. Whereas the Category C sample and its abundant, well-maintained public UGSs may present an ideal, far removed from the realities of low-income and even middle-income areas, it provides some perspective on the impact of quality UGSs on property value. In the Category C sample, higher property valuations in relation to UGSs between properties in zone 1 and zone 3, by substantial margins in value (28%), highlight the potential significant impact of access to usable UGSs of high quality.

5.3. More Valuation Studies Are Needed across Socioeconomic Gradients

As noted, the consideration of only one sample in Category C is recognized as a limitation of this study. Other limitations include the lack of quantitative and more structured qualitative evidence on the ecosystem services and disservices delivered, as well as the need for more data on resident perceptions pertaining to the UGSs included in this study, to overcome a reliance on anecdotal observations. It is thus recommended that future research be expanded to other case study locations in South Africa and the Global South where an increased number of samples in high-income areas and gated communities can be included for analysis. It is also recommended that this case study be revisited and supplemented by more quantitative and qualitative analyses of the UGSs included to augment the preliminary findings presented here. Despite its limitations, this research provides a firm foundation from which to investigate the impact of SES on the proximity principle to improve UGS planning in South Africa (and the broader context of the Global South) and advance emerging themes such as environmental justice, context sensitivity and greener urban environments [1].

Author Contributions: Conceptualization, S.S.C., E.J.C. and L.G.L.; methodology, S.S.C. and E.J.C.; formal analysis, Z.S. and L.G.L.; investigation, Z.S.; writing—original draft preparation, L.G.L.; writing—review and editing, L.G.L., Z.S., E.J.C. and S.S.C.; visualization, Z.S.; supervision, E.J.C., S.S.C. and L.G.L.; project administration, L.G.L.; funding acquisition, E.J.C. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by National Research Foundation South Africa, grant number 116243.

Data Availability Statement: The data presented in this study are contained in the body of the paper.

Acknowledgments: This research (or parts thereof) was made possible by the financial contributions of the National Research Foundation (NRF), South Africa (Grant No. 116243). Any opinion, findings, conclusions or recommendations expressed in this material are those of the author(s). The NRF does not accept any liability in regard thereto. The authors also thank M.J. du Toit for her assistance in generating maps and figures.

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

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