Article

"Passive" Ecological Gentrification Triggered by the Covid-19 Pandemic

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Abstract

Urban areas can be conceptualized as large and ever-changing playgrounds in which many diverse agents (households, businesses, developers, municipalities, etc.) are active. The interactions between the playground qualities and the players' preferences are not unidirectional. However, sometimes, external events may change the perception of the playground qualities in the player's eyes. The recent Covid-19 pandemic and its associated precautionary measures are a clear example. During the pandemic, the value of existing urban green infrastructures has increased, as lockdowns were imposed, and distance working became widespread. The concept of "passive" ecological gentrification is developed in order to characterize this type of process. In contrast with "active" ecological gentrification, caused by purposeful intervention in the urban arena, "passive" ecological gentrification is triggered by a change of context, such as the pandemic impacts. This article focuses on the appreciation of green urban infrastructures by urbanites during the pandemic, showing that the willingness to pay to live near green and open spaces has increased in general, but with significant spatial differences. The main research questions are: (a) How does the player's perception of the playground's value change in times of pandemic? (b) Do these changes support the emergence of "passive" ecological gentrification? The methodology is based on the analysis of changes in property values over time as an indirect measure of a location's appeal, looking specifically at areas near green urban infrastructures, both in the inner city and in the peripheral areas. Relatively large changes in property value over time are a possible indicator of ongoing gentrification processes: When they are observed near existing green infrastructures, and not related to redevelopment initiatives, "passive" ecological gentrification may be the result. Using detailed spatial data on land use and property prices from the Netherlands, we find evidence that supports the hypothesis of a "passive" ecological gentrification drift towards areas around urban parks and green infrastructures in general.

1. Introduction

The pandemic outbreak seems to have triggered changes in the spatial structure and morphology of urban areas. It is perhaps too early to discern whether these changes are short-term and reversible, or long-lasting (Florida et al., 2021). There is evidence of a shift from dense city centers to the suburbs in US cities (Ramani & Bloom, 2021), albeit a moderate one compared with some initial predictions concerning the massive migration out of urban cores (Gallent, 2020; Nathan & Overman, 2020). Others argue that in the long term the agglomeration forces that had shaped cities since their beginning will ultimately prevail (Reades & Crookston, 2021). In any case, crowd-avoiding behaviors, the possibility of teleworking, and the search for nearby amenities, seem to have impacted the locational choices of certain population segments (Florida et al., 2021). Thoughts and reconsiderations about the most appropriate residential area seem to have been widespread during the successive Covid-19 waves (Kang et al., 2021). For example, the locational preferences of graduate students shifted, after the first year of the pandemic, to the neighborhoods located further away from city centers in US cities (Ferreira & Wong, 2022). Besides these first and limited empirical case studies, theoretical urban growth models predict

significant changes in the future spatial structure if the impact of the pandemic turns out to be long-lasting (Buda et al., 2022).

The importance of available and nearby green and open areas in times of restricted mobility cannot be underestimated (Bherwani et al., 2021; Day, 2020). This is true for physical (Fagerholm et al., 2021), as good for mental health (Maury-Mora et al., 2022). Health decision-makers were aware of the beneficial influence when entire populations of many countries were summoned to implement social distancing measures for preventive purposes during the Covid-19 virus outbreak (Slater et al., 2020). Indeed, in some places, physical exercise in these areas was explicitly encouraged, even during lockdowns (Spencer et al., 2020), despite potential infection risks (Pan & Bardhan, 2022).

More importantly, the perceptions of green areas near places of residence changed markedly during the pandemic. Evidence shows that the interest and the value assigned to them increased among the population, particularly during periods of compulsive social distancing in several parts of the world (Larcher et al., 2021; Uchiyama & Kohsaka, 2020). Even in the aftermath of the pandemic, there are good reasons to believe that the attraction to green areas will continue to increase consistently (Venter et al., 2021). In parallel, inequality, both regarding the accessibility to green areas and their use, was more evident during the Covid-19 pandemic than beforehand (Spotswood et al., 2021; Uchiyama & Kohsaka, 2020). Both trends suggest that a new type of ecological gentrification, which can be denominated "passive," is arising in urban areas, triggered by the recent experience of the Covid-19 pandemic.

Ecological gentrification is the process by which the benefits of the transition to more sustainable cities are appropriated by affluent social sectors at the expense of low-income residents (Checker, 2011). As such, ecological gentrification is a consequence of "active" interventions performed in the urban arena, such as brownfield redevelopment (Bryson, 2013) or urban greening initiatives (Anguelovski, Connolly, Garcia-Lamarca, et al., 2019). In contrast with "active" ecological gentrification, a "passive" version of it can arise if the urban context changes, without any purposeful interventions.

This article suggests that the perception of the urban green infrastructures during the Covid-19 pandemic was a change of context strong enough to trigger a "passive" ecological gentrification process in cities. The main goal of this study is to demonstrate this hypothesis, showing that residential values in the surroundings of sensitive green infrastructures have increased during the pandemic, both compared with residences located elsewhere, and with pre-pandemic values.

2. Literature Review

This article is part of a research framework aimed at developing a set of methodologies able to describe and explain the spatiotemporal dynamics of neighborhoods and households. This framework conceptualizes the neighborhoods that compose an urban system as an ever-changing playground: Although neighborhoods are fixed in space, their characteristics change over time (Buda et al., 2021). The households living in the urban system are mobile players in the playground: Their behavior, either modifying their preferences over time or perhaps moving to another neighborhood, continuously modifies the playground itself (Buda et al., 2022). This is an inherently out-of-equilibrium setting.

On one hand, households sort themselves in the urban area, considering the differences in spatial amenities. This approach is applicable to unique amenities like proximity to the city center (Ahlfeldt, 2011; Chen & Hao, 2008) as well as to diverse amenities spread throughout the cityscape (Glaesener & Caruso, 2015). On the other hand, changes in households' preferences are among the most powerful drivers of the socioeconomic changes observed in neighborhoods. For example, changes in the preferences of wealthy households in the urban arena are at the heart of the burgeoning literature on gentrification (Butler, 2007; Lees, 2000). An influential variable related to these preferences' dynamics is the distance from desirable amenities such as coasts, parks, and open spaces in general (Gibbons et al., 2014).

The term "ecological gentrification" was coined to describe the process by which, appealing to environmental values and ethics, the development of green infrastructures leads to a more ecologically sustainable city but also triggers social displacement and the exclusion of vulnerable local populations (Dooling, 2009). One of the arguments is that discourses related to urban ecology and environmental awareness are additional tools in the profit-making toolbox of planners and real-estate developers, provoking inequalities and ending ultimately in gentrification processes (Quastel, 2009). The great paradox of ecological gentrification is that, although environmentally friendly planning can provide many benefits for the general population of an area, it may also create novel vulnerabilities for some specific groups (Anguelovski et al., 2018). However, there are several open research avenues on ecological gentrification and its related social, economic, and spatial dynamics. Although the development of green infrastructure projects in cities seems to raise spatial inequities (Anguelovski, Connolly, Pearsall, et al., 2019), it is argued that this is not a necessary corollary of these interventions. Therefore, it is important to understand where ecological gentrification is likely to emerge and in which situations it can be prevented (Anguelovski, Connolly, Garcia-Lamarca, et al., 2019).

Several seemingly related concepts were developed in this field over the last few years, such as ecological, environmental, and green gentrification. Some scholars refer to these concepts interchangeably, treating them almost as synonyms (Anguelovski, 2016; Pearsall, 2018). In other studies, there is an effort to stress the specific

particularities of each concept, whether based on contextual grounds (Cucca, 2019) or their evolution over time (Yu & Sun, 2021). There is a wide range of cases regarding the severity of the situations addressed using the ecological gentrification concept. There are places with blatant inequalities in access to urban green infrastructures closely related to the ethnicity of the dwellers (Connolly & Anguelovski, 2021; Venter et al., 2020), and others in which the quest for environmental justice leads to social struggles (Baumgartner, 2021; Gould & Lewis, 2016).

Within the broad scope of ecological gentrification case studies, this analysis is positioned in the mild range for two reasons. First, in the chosen test case (the Netherlands), the availability and accessibility of urban green infrastructures are high and relatively well distributed. Second, the present study focuses on "passive" ecological gentrification, caused by a change of perception concerning already existing green assets, instead of by the redevelopment of environmentally degraded places. Both aspects are discussed in this section.

The recent Covid-19 pandemic boosted a renewed interest in the role of green infrastructures in the environmental and social sustainability of cities (Ferrini & Gori, 2021). This interest is evident not only in professional and academic circles but also regarding the perceptions of urban green spaces in the eyes of the general public. There are good reasons to believe that the relationship of urbanites with green spaces (whether emotional or physical) is undergoing a fundamental change following the recent pandemic (Honey-Rosés et al., 2020). However, the inequalities described previously are also observed in the accessibility to green areas during the pandemic period (Pallathadka et al., 2021).

Despite the relatively short time that elapsed since urban areas returned to seemingly normal functioning in the aftermath of Covid-19 (Florida et al., 2021), there are already first visible signals of changes in perceptions regarding the quality of urban areas. A metropolitan-level view of urban real estate prices indicates that, at least during the pandemic, real estate prices declined in urban centers and increased towards the suburbs (Gupta et al., 2021). Some authors argue that these trends, partially influenced by changes in working and commuting patterns, have the potential to hollow out dense city cores (Ramani & Bloom, 2021). These ongoing trends may cause fundamental shifts in the way local services and transportation are approached (Nathan, 2021). More focused analyses that are relevant to the topic

of this article indicate that preference for residences in low-population-density areas with outdoor facilities seems to be on the rise (Guglielminetti et al., 2021). These observations are in line with increasing preference for locations away from dense urban centers (Ferreira & Wong, 2022). In particular, there is evidence of a willingness to pay premium prices for locations adjacent to open spaces and beaches, and also a drift toward places further away from the city center, compared with pre-Covid-19 observations (Cheung & Fernandez, 2021).

The first assumption of this article is that the Covid-19 outbreak and the implemented preventive measures during the pandemic have suddenly changed the perception of urban spaces, location, and particularly the value of urban green infrastructures. In other words, and following the playground and player analogy, the main hypothesis is that, although the physical and real playground has not changed significantly since the Covid-19 outbreak, the emerging perception of the players modified the urban landscape. The immediate effect of these changing perceptions is not visible from the outside and belongs to the mental and psychological realm of urban dwellers. But three years after the outbreak, and despite the relatively slow reaction of the real estate markets, there are already observable traces of "passive" ecological gentrification. The emphasis on the passive nature of the phenomenon aims to stress that it is caused by changing perceptions of existing physical infrastructures, instead of the development of new ones, as in the case of traditional ("active") ecological gentrification. The first aim of this article is to prove that the changing perceptions of the players regarding urban green infrastructures are evident in the spatial distribution of residential prices. The second aim is to show that the observed spatial and temporal patterns of residential prices support the hypothesis of an emergent process of "passive" ecological gentrification.

Before Covid-19, urban centers were among the most appealing locations, while urban areas near green infrastructures were also appreciated. In comparison, peripheral areas, regardless of their location relative to green infrastructures, were less appealing. The changing perception caused a preferential shift in the post-Covid-19 period: While the preference for urban cores declined, the preference for urban locations near open and green spaces is rising. In this context, urban places near urban green infrastructures, such as parks, are particularly appealing. Figure 1 summarizes the research hypotheses.
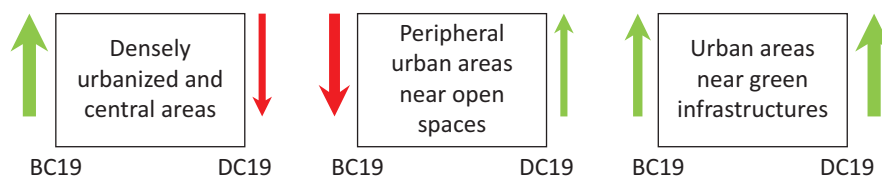

Figure 1. Hypothesized changes in the attractiveness of different types of urban areas before Covid-19 (BC19) and during Covid-19 (DC19). Note: Green arrows symbolize appreciation, red arrows depreciation, and the thickness of the arrows is their expected strength.

The Netherlands makes an interesting case study to analyze "passive" ecological gentrification during the Covid-19 period because of several reasons. First, it has a long tradition of successful urban planning that managed to allow residential development while protecting open areas (Alterman, 1997; Faludi & van der Valk, 1994). Parts of these open areas are located within the urban fabric and constitute lively and popular urban parks that contribute to the well-being of city dwellers (Chiesura, 2004). Finally, the Netherlands is blessed with time series of very detailed spatial data, including residential values at small scales that allow for the tracking of changing dwelling prices over more than a decade. In the next section, we set up the scene by describing the data sources on which this research is built.

3. Data and Methods

The data sources used for this research were provided by the Dutch Central Bureau of Statistics. The spatial data covering the whole territory of the Netherlands using a grid of cells of 100 m² is consistently available for several years. The first type of data is the predominant land use at each cell: This was calculated using spatially explicit vectorial data (Central Bureau of Statistics, 2015), converted to raster, and aggregated into 38 predominant land use types. We restricted the classified land uses to four different and mutually exclusive categories: residential, parks, agricultural and natural. All other land uses were excluded from this research. Only open-field agriculture is considered agricultural land use, excluding greenhouses or other built agricultural infrastructures. Wetlands and forests are considered collectively as natural land uses. Parks are green and open lots, squares, playgrounds, and recreational

areas in general within the urban fabric. The second type of data is the property valuation, calculated by the Central Bureau of Statistics as the average of the property value of all the residences included in the cell (Central Bureau of Statistics, 2017, 2022a, 2022b). The data is derived from the statistics of real-estate valuation and includes exclusively residential properties. From these datasets, we retrieve the residential values of 2011, 2019, and 2021. The data is expressed in units of €1,000. Figure 2 shows part of the spatial data in Amsterdam and its surroundings, along with a histogram that describes the residential property data collected in the country.

From Figure 2 (right), the distribution of the average residential values per cell is skewed to the right, with a long tail of high values. Therefore, to constrain the distribution around each year's average value, we selected a range from one standard deviation from the left of the distribution's mean to three standard deviations to its right. These values were defined as the minimum and maximum of the modified distribution, respectively, summarized in Table 1.

The main goal of this study is to test whether residential values in certain places, such as near urban parks, had changed their relative values compared with residences located elsewhere, in each of the tested years. In other words, a snapshot of the relative residential values in 2011, 2019, and 2021 is required. Therefore, the distribution of the average residential values in each one of the studied years can be normalized. This was performed by adjusting each one of the distributions to a 0–100 scale, creating an annual rank for each residential cell. As a result, the relative price position of a residential cell compared with all the others in 2011, 2019, and 2021 is calculated.
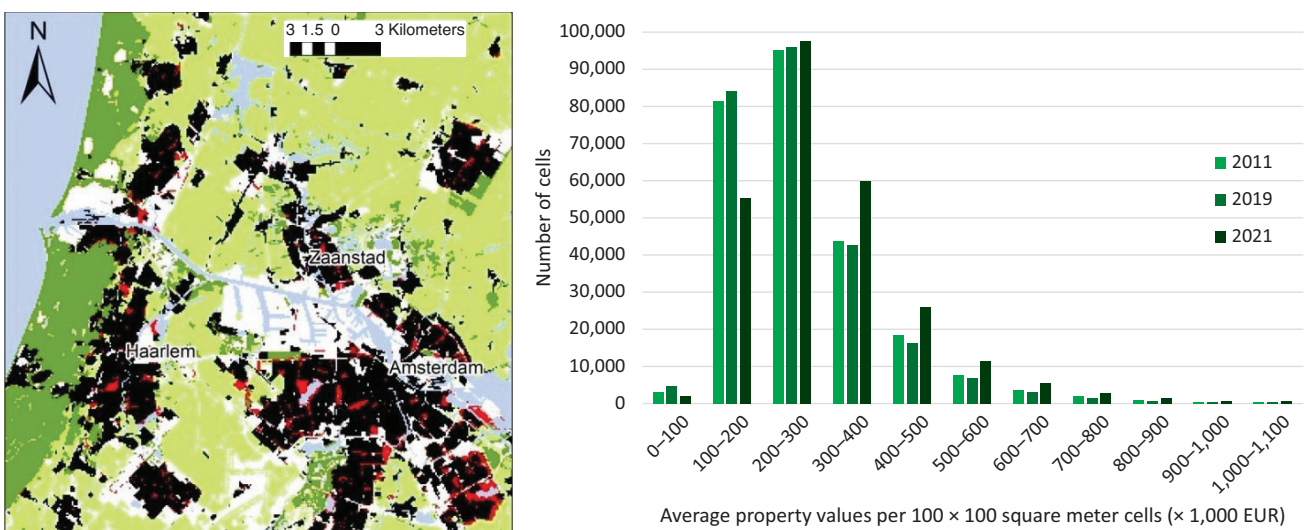

Figure 2. On the left are the main categories of land use in the Amsterdam area (residential areas in black, urban parks in red, nature in dark green, and agriculture in light green); on the right is a histogram with the distribution of the residential values per cell in the country. Note: The graph is trimmed to the right since the distribution has a long tail, with few cells that have extremely high residential values, beyond €1,100,000.

Table 1. Modified distributions of average residential values per cell (× €1,000).

	2011	2019	2021
Average	276	268	310
Standard deviation	153	146	164
Minimum	123	122	147
Maximum	736	707	801

Distance is the main aspect that defines the accessibility of open areas to urban residents since beyond a certain threshold, their use declines sharply (Ekkel & de Vries, 2017). Therefore, accessibility to open areas (whether to parks, nature, or agriculture) is operationalized using the effective distance of 300 m (Nielsen & Hansen, 2007). Figure 3 below shows an example of the calculated buffer areas around each of the green areas' typologies.

Based on the defined buffers, the residential cells were categorized according to the open areas that are located nearby. For example, residential cells located within the 300-m buffers around parks are considered influenced by them. The same definition applies to the other green areas (agriculture and nature). The influence of green areas on a residential cell is not mutually exclusive: There are residential cells that are influenced by any possible combination of green areas (for example, agriculture, nature, and parks, or two of these uses). But there are also residential cells that are influenced exclusively by one type of green area. Finally, there are also residential cells not influenced by green areas at all. For the residents in these cells, the distance from any type of green area is more than 300 m.

4. Results

There are 223,014 residential cells in the country for which the annual ranking of residential prices for 2011, 2019, and 2021 is available. These cells are distributed according to their location relative to green areas as described in Figure 4.

From Figure 4, we see that there are 43,703 residential cells from which green areas are not accessible according to the considered distance. The dwellers of these cells need to walk or travel more than 300 m to reach a green area of any type. In contrast, 176,011 residential cells have at least one type of green area at less than 300 m distance. Among these, the dwellers of 7,129 cells can access natural areas, agricultural fields, or parks that are located within walking distance.

The dissection of resident cells, according to the type of green area that may influence their residential price rank over time is the key feature of this study. By analyzing and comparing the ranking of each subset of the residential cells during each one of the studied years, it is possible to track the attractiveness of these subsets over time. Concretely, for each residential cell, the difference between its price rank in 2011 and 2019, and between 2019 and 2021, is calculated. Then, the average differences of all the residential cells that belong to each of the subsets shown in Figure 4 are computed. Table 2 summarizes the results.

The results shown in Table 2 summarize the findings of this study. The average residential rank of cells located near agricultural areas only decreased steadily during both periods. For cells located near natural areas exclusively, the average residential rank rose during the first period but decreased during the second. In contrast,
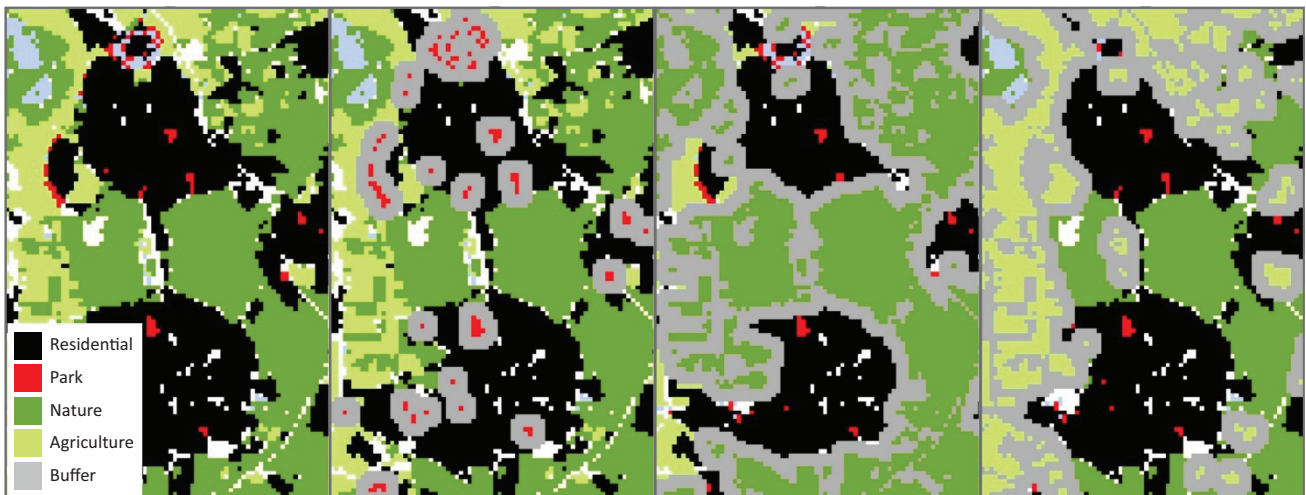

Figure 3. An example of a residential area surrounded by agricultural and natural open spaces and parks. Notes: On the left, are the main categories of land use; the three figures to the right show the 300-m buffers around parks, nature, and agriculture, respectively.
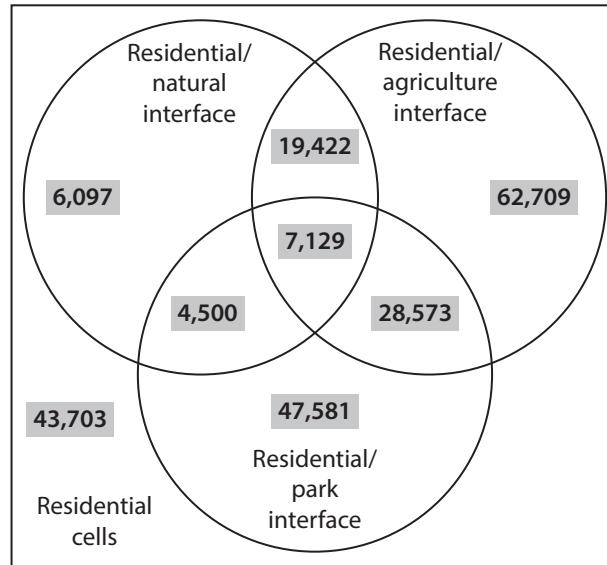
Figure 4. The universe of the residential cells considered in this study, distributed according to their location respective to green areas. Note: The word "interface" means "located within a buffer of 300 m."

residential cells located near parks, on one hand, or far away from any green areas, on the other, experienced a steady increase in their average residential rank during both periods. However, the rate of the rank's increase, in both periods, is much higher for residential cells located near parks exclusively.

5. Discussion

The relatively large increase of residential rank in cells located near urban parks, compared with all the others, demonstrates the main hypothesis of this work: In times of pandemic, the playground is valued differently by the players living in it. More specifically, residential values near urban parks increased enough to raise the rank of the cells where they are located. This measurement shows that open green areas within cities are more highly valuated than other types of land use in cities during the pandemic. In other words, these results support the hypothesis of a "passive" ecological gentrification emergence. On one hand, there are no traces of significant urban green infrastructure improvements during the analyzed period. Therefore, the observed higher residential values near those green infrastructures were caused by their increasing appeal in the context of the Covid-19 pandemic. On the other hand, higher residential values increase the risk of social and physical displace-

ment of low-income residents. This outcome is similar to the risk caused by "active" ecological gentrification in which redevelopment initiatives, instead of changes of context, are the triggers of the process.

Locations near parks steadily increased their ranking also in the period before the Covid-19 outbreak, as shown in the first column of Table 2. However, there are several significant differences between both periods. First, closeness to agricultural areas seems to be more of a disadvantage than an asset, as evidenced by the negative figures in both periods (Table 2, first row). One possible explanation is that, despite the beneficial effects that agricultural areas may have as open and green spaces, there are potential negative impacts through exposure to chemical substances (Farenhorst et al., 2015), supposed to be linked to detrimental effects on health (Brouwer et al., 2018). The differences between both periods regarding residential locations near natural areas are more difficult to explain (Table 2, second row). During the first period, the residential rank of these places increased but plummeted during the Covid-19 pandemic. In this case, there also may be some negative influences of nature on nearby dwellers. According to a recent study, reduced human activity triggered an abundance of problematic wildlife, potentially leading to increased risks of injuries for people living in suburban areas (Soga et al., 2021).

Table 2. Average changes in the residential price rank for subsets of residential cells.

	2019 compared to 2011	2021 compared to 2019
Influenced by agriculture exclusively	−0.502	−0.790
Influenced by nature exclusively	1.941	−0.187
Influenced by parks exclusive	2.999	0.265
Not influenced by green areas	2.760	0.097

The last row of Table 2 shows the changes in the cells that are far away from any type of open and green area. Since this subset of the urban cells excludes most of the peripheral locations (near natural or agricultural areas), it is constituted by cells located in the city centers or central residential areas. The observation that the ranking of this subset also increases consistently during both periods is related to the fact that the Covid-19 pandemic did not change the fundamental urban development trends. In simple words, despite all the observed urban dynamic changes (described extensively in Section 2), the attraction of urban cores is still one of the most influential forces in the city (Broitman & Koomen, 2020).

Despite the relevance of the results for the posited research questions, there are several limitations to this study that are worthy of discussion. The first and most obvious limitation is the short time elapsed since the Covid-19 outbreak. Moreover, although it seems that we have already passed the most acute waves, the pandemic is still here (World Health Organization, 2022). This makes it difficult to discern whether the described processes will be long-lasting or momentary changes caused by an unexpected event that will be corrected once things return to their normal path. The spatial spreading of the described results is a second limitation. The study was performed at the level of all the residential cells in the Netherlands. There are large regional variations, among big cities, smaller towns, and rural areas, but also within each of these subsets, caused by their inherent heterogeneity. However, the results represent the average trends observed during both periods.

A third limitation is related to the data available and used in the study. As explained in Section 3, the residential value data is calculated as the average of the property value of all the residences included in the cell. This may not be the most accurate measurement, since data about the distribution of values within each cell is unknown (for example, we can consider a case of a cell with a mix of small apartments and a few larger and more expensive detached houses). If the relevant data could be obtained in the future, a better option for this type of analysis will be a detailed dataset of real estate transactions, from which both the residents and the land price per square meter could be derived.

Finally, as is clear from Section 3, the present study is not a statistical analysis, but a descriptive approach aimed at providing initial answers to the research questions. Usually, statistical analysis related to changing land use patterns and location choices includes variables such as distances to transport hubs, job locations, and facilities (as examples relevant to the Netherlands, see Broitman & Koomen, 2015; Jacobs-Crisioni et al., 2014). The use of these types of variables in the present case is problematic: A large part of the observed behavioral changes during the pandemic is related to working, shopping, and leisure consumption. Therefore, it is not clear the extent to which these distance-related parameters will continue to be relevant in the post-Covid-19 urban world. This is not to say that they will be meaningless in the future, but probably that their use will need to be recalibrated once new post-Covid-19 normality is achieved.

6. Conclusions

Urban areas can be conceptualized as large and ever-changing playgrounds in which many and diverse agents play. Sometimes, the playground itself changes, as in redevelopment interventions that provoke "active" ecological gentrification. In these cases, diverse players react differently to the new playground features, but it may also be that external events suddenly modify the perception of the playground qualities in the player's eyes, even if the playground remains static. In that case, other processes, such as "passive" ecological gentrification may arise. The recent Covid-19 pandemic and its associated precautionary measures, particularly lockdowns and distance working, is one example. Green urban infrastructures have been more appreciated by urbanites since the outbreak of the pandemic: The willingness to pay to live near green and open spaces has increased in general, but with significant spatial differences. Using detailed Dutch spatial data about land use and property prices, we uncover initial signs of increasing property values in areas around urban parks and green infrastructures in general, even if these infrastructures were not upgraded significantly over the last few years. These residential value increases are an indicator of ongoing "passive" ecological gentrification processes.

The concept of "passive" ecological gentrification, in which a change of context is the triggering event, has the potential to contribute to future analysis of socio-economic location processes around urban green infrastructures. Traditional ("active") ecological gentrification will continue to be the most important conceptual tool for cases where redevelopment initiatives take place. However, ongoing processes such as climate change and urban population growth may cause a sharp appreciation of actual green infrastructure assets, without the need for upgrades or redevelopments, but causing similar socio-economic effects. In these cases, "passive" ecological gentrification can be a useful conceptual analysis tool.

Finally, this study is a potential contribution to the understanding of future post-Covid-19 urban areas. In particular, regarding the changing dwelling preferences (and their associated willingness to pay) triggered by the recent pandemic experience. However, in light of the limited short-term evidence available, it will be necessary to wait until data from a larger period is available. This refers both to real estate data, and to behavioral data, and it is not clear yet how, and to what extent, it will be different from the pre-pandemic period. A solid spatial statistical analysis based on these expected available data will be a natural following step of this study.

Acknowledgments

Conflict of Interests

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