The impact of Urban Green Space Renewal on Social Justice:

A Case Study of Bessemoerpark, Groningen

Bachelor Thesis

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Date: 16-06-2023
Word count: 6591

(Sánchez, D., 2021)

Abstract

Urban Green Spaces (UGS) are of great importance in sustainable urban development to integrate the social and environmental sustainability, due to its beneficiary factors related to public health and the environment. However, the access to UGS and UGS of quality is not distributed equally, to resolve these inequalities UGS renewal programs are implemented, in particular in historically disinvested neighborhoods. These programs can have unintended consequences, as the renewal of UGS can result in green gentrification, displacing the residents for which the UGS was intended. This research investigates the renewal of Bessemoerpark in Groningen, and aims to examine the consequences of the revitalization project and its effect on social justice in the period of 2013-2020. Four indicators are investigated by means of spatial analyses conducted in ArcGIS Pro, additionally Multiscale Geographically Weighted Regressions are executed to provide valuable insights into the relationship between UGS renewal and social justice outcomes. The findings indicate that the renewal of Bessemoerpark mainly impacted social justice negatively. To illustrate, in the periods of 2013-2016, 2015-2016, and 2017-2020 the process of green gentrification is identified. Additionally, in the period of 2013-2020, significant results were found regarding the displacement of residents with non-western migration backgrounds as a consequence of the renewal of Bessemoerpark. Moreover, the property values increased due to the renewal, contributing to the displacement and exclusion of households with lower socio-economic status. Contradicting results were found regarding the displacement or preservation of diversity in residents receiving social assistance and the number of properties owned by housing corporations. However, a connection between these indicators is found in the research area. The results of this thesis form a base for indicating if programs, similar to the renewal of Bessemoerpark, can enhance social injustice.

Key words:
Sustainable urban development, Urban Green Spaces (UGS), social justice, green gentrification

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1. Introduction

1.1 Research background

Currently, more than a half of the world's population is living in cities and this trend of urbanization is expected to increasingly continue (Kabisch & Haase, 2014). As a response to the growing pressure on the climate and living conditions, the United Nations (UN) implemented Sustainable Development Goals (SDGs) in 2015 to ensure a sustainable living environment for now and in the future (UN, n.d.) (Fig. 1). Sustainable development aims at reconciling ecological, social, and economic imperatives to develop sustainable societies (Trudeau, 2018).

Fig. 1 *Sustainable Development Goals (UNICEF, n.d.)*

Urban Green Spaces (UGS) are a necessity in sustainable development, due to their beneficiary factors related to public health and the environment (WHO, 2022). UGS include "public green areas for predominantly recreational use" (Wüstemann et al., 2017, p. 125). UGS are of importance in reaching the SDGs, since they can promote good health and wellbeing (SDG 3), create sustainable cities and communities (SDG 11), and combat climate change and its impact (SDG 13) (UN, n.d.).

However, UGS are distributed unequally as low-income groups and minorities are often residing in areas where UGS are either scarce or poorly maintained (Anguelovski et al., 2018). This correlation originates in the history of land development, and racial inequalities (Wolch et al., 2014). A similar pattern can be observed in the Netherlands, as neighborhoods with low socio-economic status have less access to UGS, especially UGS of quality, compared to neighborhoods with high socio-economic status (De Vries et al., 2020). In response to distributional inequalities related to UGS, new strategies regarding restoring green amenities in low-income areas are developed (Anguelovski et al., 2018). However, these strategies can have unintended consequences, as the renewal of UGS can increase the desirability of neighborhoods, resulting in new investments, consequently pricing out the residents for which the UGS was intended (Rigolon & Németh, 2019). This pattern of displacement, called green gentrification, can negatively affect social justice, as these UGS are not equally accessible to all people, especially affecting, for example, people belonging to minority groups and people with lower socio-economic status. (Bhugra, 2016) (Wolch et al., 2014).To understand the effect of the renewal of UGS on a neighborhood scale, this research studies the in 2014 renewed Bessemoerpark in Groningen.

1.2 Relevance

Understanding the effect of the renewal of UGS on social justice is of significance to improve social sustainability (Trudeau, 2018). Currently, numerous new revitalization programs are executed in Groningen, mainly focussing on historically disinvested neighborhoods. For example, the program "Mooie Wijken 2023" (Beautiful Neighborhoods 2023) was launched, which aims at increasing social safety and social cohesion in low-income neighborhoods by, for example, revitalizing UGS (Gemeente Groningen, 2023). As the goal of these new revitalization programs correspond to the aim of the

renewal of Bessemoerpark in 2014, this thesis can form a base for indicating if these similar renewal programs, can enhance social injustice.

1.3 Research objective and questions

Green gentrification is increasingly discussed in sustainable development. This research focuses on the renewal of Bessemoerpark and aims to investigate the impact of the revitalization project on social justice. By examining the extent to which indicators of green gentrification changed, this research can provide valuable insights into the relationship between UGS renewal and social justice outcomes. Consequently, the following research question is proposed:

> *"To what extent did the renewal of Bessemoerpark result in social injustice with respect to green gentrification?".*

The answer to this question is derived through secondary questions:

1. *What specific changes in the socio-demographic profiles are associated with green gentrification?,*
2. *To what extent is the process of green gentrification identifiable at Bessemoerpark comparing the situation 2013- 2020?*
3. *To what extent did the renewal of Bessemoerpark result in social injustice?*

The first secondary research question identifies indicators associated with green gentrification. The second sub-question utilizes these characteristics to identify the process of green gentrification. The final sub-question connects the results to the concepts of green gentrification and social justice.

1.4 Reading guide

This thesis is structured systematically in six chapters.
Chapter one serves as an introduction and consists of the research background, societal relevance, and research objective and questions.
Chapter two demonstrates the theoretical framework, and introduces the concepts of Urban Green Space, social justice, gentrification, and green gentrification. Furthermore, a conceptual model visualizing relationships between concepts, and a hypothesis regarding the research are presented.
Chapter three outlines the methodology employed in this research, including a case description, case study selection process, secondary data collection, and data analysis.
Chapter four presents the results of the spatial analysis conducted in ArcGIS pro.
Chapter five discusses the effect of the renewal of Bessemoerpark on green gentrification and social justice.
Chapter six includes the conclusion and the reflection regarding this research. Additionally, future research is discussed.

2. Theoretical Framework

This chapter introduces the concepts of Urban Green Spaces, social justice, gentrification. and green gentrification. Additionally the conceptual model is visualized.

2.1 Urban Green Spaces (UGS)

Due to urbanization, the pressure on urban areas is increasing, UGS are of particular importance in sustainable renewal, since they provide social and ecological benefits (Taylor & Hochuli, 2017). UGS contribute to, for example, reducing air pollution, mitigating the heat island effects, and increasing biodiversity (Kabisch & Haase, 2014). Additionally, UGS also provides physiological and psychological health benefits. Access to UGS is related to a minimized prevalence of, for example, Obesity, Cardiovascular Disease, and Type 2 Diabetes, as well as reducing anxiety, and depression (Javadi & Nasrollahi, 2021). In this research this definition is used for UGS: "Urban vegetation, including parks, gardens, yards, urban forests and urban farms – usually relating to a vegetated variant of open space." (Taylor & Hochuli, 2017, p. 29).

2.2 Social justice

As discussed earlier, UGS are not equally accessible to everyone. These inequalities in accessibility to green infrastructure and green spaces have been linked to a historical and social context related to segregation, and unequal urban development (Anguelovski et al., 2022). In the Netherlands, a pattern of inequality can be deduced as neighborhoods with low socio-economic status have less access to UGS, and UGS of quality, in comparison to neighborhoods with a high socio-economic status (De Vries et al., 2020). Additionally, over 25% of the households with their main income provider having a non-western migration background were considered low-income households in 2019 (CBS, 2019). Therefore, social injustices are uncovered in accessibility to UGS and the quality of UGS. Urban planning is an important tool in reconnecting social and environmental imperatives, as it can address complex social justice issues (Trudeau, 2018).

Social justice relates to equal opportunities to all people in human society regardless of, for example, their disabilities, ethnicities, age, genders, sexual orientation, or religion. Further, social justice also encompasses the fair allocation of resources and the equal distribution of burdens and benefits of the environment (Bhugra, 2016). These resources are related to, for example, affordable housing, income, the preservation of heritage, wealth distribution, and environmental goods (Siders, 2021). The concept of social justice encompasses not only matters of land-use, but also issues, such as racism, unequal exposure to pollution, exclusionary development patterns, and gentrification (Siders, 2021).

2.3 Gentrification and green gentrification

Gentrification is mentioned as a relatively new debate in social justice. The term of gentrification was first used by Ruth Glass in 1964 in London. Glass defined gentrification as the "complex process involving physical improvement of the housing stock, housing tenure changes from renting to owning, price rises, and the displacement or replacement of the working-class population by the new middle class" (Hamnett, 2003, p. 2401). The phenomenon of gentrification can be explained by the rent-gap theory, which is based on potential land values and capitalized land values. The potential land value is defined as: "the land value that can be capitalized on when land is best utilized" (Yoon & Park, 2018, p. 2441). The capitalized land value depends on the current land use value. To illustrate, in existing neighborhoods, the capitalized value is low, however the potential land value increases if redevelopment is expected. As a result, the gap between these two values increases (Yoon & Park, 2018).

Hedin et al. (2012) published a paper relating to the neoliberalization of housing in Sweden, which focused on gentrification. This article formed the base for this thesis, by determining an increase or decrease in housing value of 13% as a significant change related to gentrification and degentrification. In this thesis, displacement was considered to have occurred if socio-demographic indicators decreased by 13% or more, or if property values and housing prices increased by over 13%. Conversely, if the opposite changes were observed, the indicators were considered to support the preservation of diversity.

Green gentrification is a specification of gentrification and refers to the process of gentrification that can begin when green amenities are renewed or implemented, leading to an increase in desirability, higher demand, and subsequently higher property values, attracting new and wealthier residents. (BCNUEJ, n.d.). This pattern can contribute to the exclusion and displacement of minorities and households with low socio-economic status to areas with, possibly, an unequal access to UGS. Anguelovski et al. (2020) summarized several factors related to gentrification while comparing several quantitative studies related to gentrification. These characteristics of social change are the composition of race and ethnicities, property values, housing prices, median income, level of education attainment, poverty rate, professional status, home-ownership rate, and executions of other urban revitalization initiatives. Additionally, less common indicators of gentrification include changes in housing construction, home mortgage lending, social media usage, and number of new businesses (Anguelovski et al., 2018).

2.4 Conceptual model

The conceptual model visualizes the relationships between low-income neighborhoods, UGS, and sustainable urban renewal (Fig. 2). Low-income groups and minorities often occupy areas where UGS are either scarce or poorly maintained, they have less access to the benefits related to UGS (Anguelovski et al., 2018). To reduce these inequalities, municipalities implement strategies to revitalize UGS. However, this response can trigger green gentrification, where improving the attractiveness of the area by renewing UGS results in unintended effects of increasing property values and displacement of residents (Wolch et al., 2014). This process of green gentrification can exacerbate social injustices (Anguelovski et al., 2018).
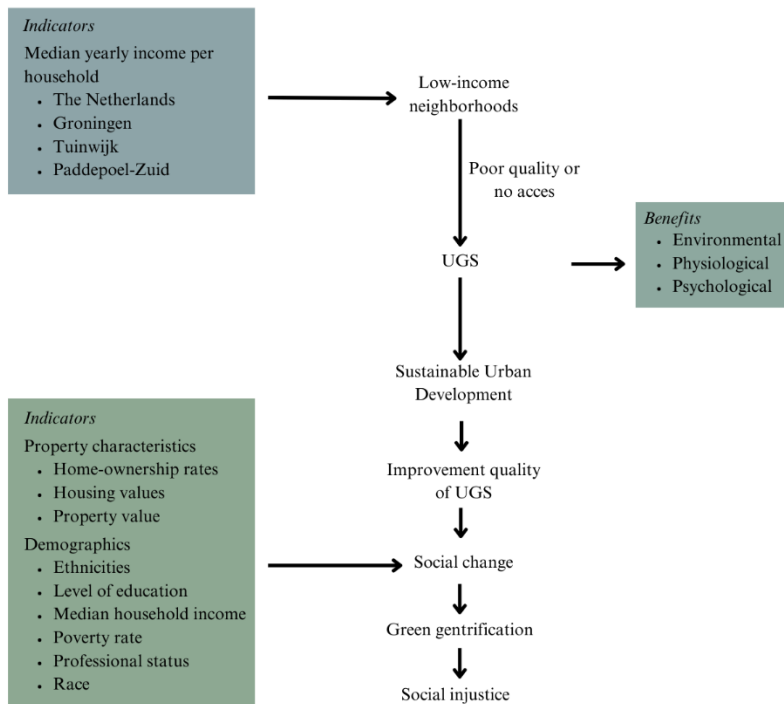

Fig. 2 *Conceptual model (Author, 2023)*

2.5 Hypothesis

As a result of a preliminary literature research it is expected that the investments in Bessemoerpark will result in an negative significant change in the indicators of social change (Fig. 2). Therefore, the conclusion will, with a degree of certainty, be that the revitalization of Bessemoerpark resulted in social injustice as an effect of green gentrification.

3. Methodology

3.1 Case study method

3.1.1   Case description

The focus of this thesis Bessemoerpark, which is located between the neighborhoods of Paddepoel-Zuid and Tuinwijk (Fig. 3). The renewal of Bessemoerpark was part of the neighborhood renewal of Paddepoel-Zuid, which commenced in 2012. The revitalization of Paddepoel-Zuid intended to increase the housing density. The Bessemoerpark was appointed to add more green space in the renewal program (Gemeente Groningen, 2012).

Fig. 3 Location Bessemoerpark in Groningen (Author, 2023)

Before the revitalization of Bessemoerpark, several neighborhood facilities were located within the park, such as schools and a community center (Fig. 6) The goal of the revitalization of Bessemoerpark was to strengthen the area as a green buffer zone, and improve the social safety. The revitalization of Bessemoerpark consisted of the demolition of two elderly blocks, and the school in the south of the park. Also, social housing was constructed to contribute to a diverse population in the surrounding of Bessemoerpark (Gemeente Groningen, 2012). Additionally, the remaining plots were transformed into green spaces. Moreover, the old community center was rebuilt and recreational facilities were implemented, such as a soccer field, and a playground (Fig. 7 & 8). The renewal was finalized in 2014.

Fig. 4 Plan Area Bessemoerpark before the renewal (Gemeente Groningen, 2012)

Fig. 5 *Design of the renewal of Bessemoerpark (Gemeente Groningen, 2012)*

Fig. 6 *Old community center at Bessemoerpark (Gemeente Groningen, 2012)*

Fig. 7 *New community center at Bessemoerpark (Author, 2023)*

Fig. 8 *New entertainment facilities at Bessemoerpark (Author, 2023)*

In 2012, over 60% of households in the Parkwijk and Paddepoel-Zuid, surrounding Bessemoerpark, were considered low-income. Additionally, over 75% of the residences were in 2012 owned by housing corporations in these neighborhoods. To compare, in the municipality of Groningen 54% of the households were considered low-income and only 41% of the residences were owned by housing corporations (StatLine, 2014). Furthermore, these neighborhoods had a percentage of inhabitants with a non-western migration background of approximately 25%, compared to the municipal average of approximately 10% (Statline, 2014).

3.1.2 Case selection

The municipality of Groningen developed numerous revitalization programs to improve the living standards, especially in historically disinvested neighborhoods. In the Netherlands, low-income household are households earning less than €23,520 a year (based on a couple with two children) (CBS, 2019).Households exposed to the greatest risks of becoming low-income households consist of, for example, welfare recipients, and households with migration backgrounds, especially non-Western migration backgrounds (CBS, 2019). To illustrate, almost 75% of the households with welfare recipients are low-income households. Additionally, more than 25% of the households with their main income provider having a non-Western migration background in 2017, were considered a low-income household. The long-term poverty risk varies significantly between the country of origin (Fig. 9).

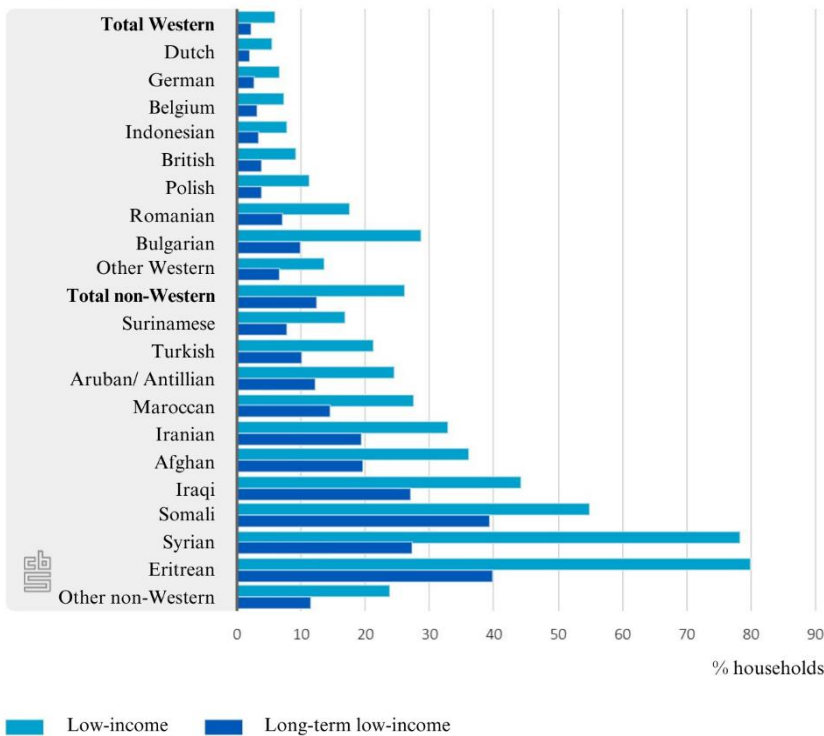**Long-term poverty risk based on migration background, 2017**

Fig. 9 Distribution low-income based on migration background (CBS, 2019, p. 84)

To select the case study, multiple criteria were considered. For instance, the renewal must be finalized, otherwise a comparison could not be conducted. Also, the renewal was finalized later than 2010 and before 2018, to ensure extensive data sets prior and post renewal. The status of these projects were obtained from the website of Ruimtelijkeplannen.nl, which is a national portal for spatial plans. Furthermore, the encompassing neighborhoods of the renewed UGS, should be low-income and with a high diversity in migration backgrounds before the renewal. Neighborhoods in the municipality of Groningen in 2012 are studied with statistical data accessible on the website of CBS, to identify the locations of these neighborhoods of low-economic status. These criteria determined that Bessemoerpark was the most suitable research area.

3.2 Secondary data collection

To answer the first secondary research question, literature research was conducted. The indicators selected for this research are property values, home-ownership rates, poverty rates, and ethnicities. These characteristics were suitable as they strongly connect to the research objective and create an encompassing overview of changes in the housing market, the socio-economic status of the residents occupying the neighborhoods, and the socio-demographic profile of these residents. These changes can be explained by the rent-gap theory and the exposed risk of residents to long-term poverty and displacement (Yoon & Park, 2018) (De Vries et al., 2020).

The answers to the last two secondary research questions were derived through spatial analyses in ArcGIS Pro. Relevant datasets were collected for the spatial analyses from the public catalog available in ArcGIS Pro. The collected datasets consisted of the CBS Gemeenten and CBS Vierkantstatistieken 100 x 100 meter (square statistics) for the years 2013, 2015, 2016, 2017, and 2020. To make these datasets suitable for the research, the CBS Vierkantstatistieken were clipped with boundaries of the municipality of Groningen for each corresponding year. This process was necessary due to the expansion of the municipality of Groningen in 2019. The data used from CBS are related to the indicators of social change, which include: property values, rental properties owned by housing corporations, citizens receiving social assistance, and percentages of residents with non-western migration backgrounds.

3.3 Data analysis

The CBS Vierkantstatistieken dataset included percentage data on residents with non-western migration backgrounds and data on property values, home-ownership status, and citizens receiving social assistance. The data was available for both the number of dwellings and the number of citizens within squares, this data was recalculated to percentages to enable comparison. The dataset on migration backgrounds of 2013 was adjusted to match later datasets by taking the average of cohorts as new single percentages. Furthermore, the CBS does not publish data if there are less than five cases or if the amount is less than 5% in a square of 100 x 100 meter (Van Leeuwen & Venema, 2023). Therefore, null values were replaced by two, since the data can range from zero to four, to ensure the usability of the data. The spatial analysis consisting of data of 2013-2020, was split into three analyses. The periods selected were 2013-2016, 2017-2020, and 2013-2020, this division enabled a comprehensive understanding of the extent to which the indicators were affected by the renewal. Since there is no data available regarding residents receiving social assistance and the number of properties owned by housing corporations in 2013, the data of 2015 is used instead.

The research area included Bessemoerpark and surrounding squares within a 500-meter radius. This radius was chosen based on the average distance to green space from peoples residences (500 meter) in the Netherlands (CBS, 2021) Therefore, the impact of the renewal of Bessemoerpark was expected to be limited to a 500-meter radius. The changes in indicators were significant if they either increased or decreased with 13% or more. An increase in property value, or a decrease in the amount of properties owned by housing corporations, residents receiving social assistance, or residents with non-western migration backgrounds supported the theory of displacement. An identification of opposing changes supported the determination of preservation of diversity.

Multiscale Geographically Weighted Regressions (MGWR) were conducted using these significant results to analyze the spatial variability of the relationships between variables (ESRI, nd). MGWR were utilized to determine if there is a significant change in indicators concerning distance to the park, ensuring that changes are related to the renewal. This analysis forms the foundation for understanding spatial changes related to green gentrification and its influence on social groups justice.

4. Results

A spatial analysis was conducted in ArcGIS Pro to determine the pattern of displacement or preservation related to the indicators.

4.1 The effect of the renewal on residents with non-western migration backgrounds

4.1.1   The situation in 2013-2016

Between 2013 and 2016, significant changes were observed in the percentages of residents with non-western migration backgrounds (Fig. 10). Over 12% of the squares within the research area showed a significant change, of which almost 5% accounted for an increase, and over 7% for a decrease (Appendix I). Notably, two squares in the vicinity of Bessemoerpark exhibited a significant change in the percentage of residents with non-western migration backgrounds.

However, no significant correlation was found in the direct vicinity of Bessemoerpark between these changes and distance to the park (Fig. 11). In contrast, a significant perfect positive correlation was detected in the southeastern part of the area, suggesting an increase in residents with non-western migration backgrounds with increasing distance from the park.

Fig. 10 Change in percentage of residents with non-western migration backgrounds, 2013-2016 (Author, 2023)
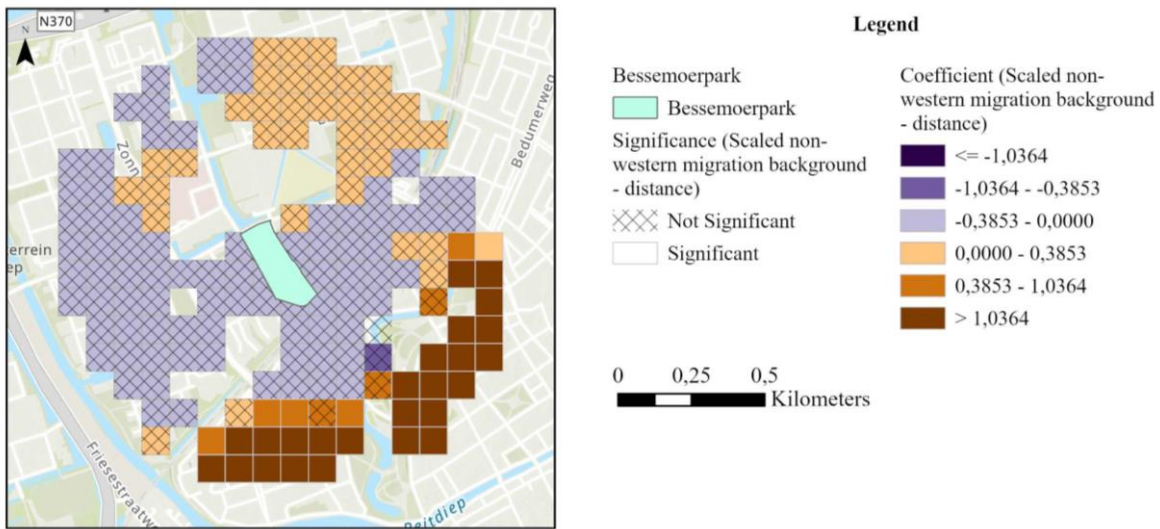

Fig. 11 Correlation: change in residents with non-western migration backgrounds and distance to Bessemoerpark, 2013-2016 (Author, 2023)

4.1.2   The situation in 2017-2020

Despite the significant changes observed between 2013 and 2016, the situation in the following years showed greater stability. From 2017 to 2020, over 60% of the squares in the research area showed no change in the percentage of residents with non-western migration backgrounds (Fig. 12). Only 1.75% of the squares experienced significant changes (Appendix I). To specify, one square connecting to the southern side of Bessemoerpark showed a significant decrease in residents with non-western migration backgrounds.
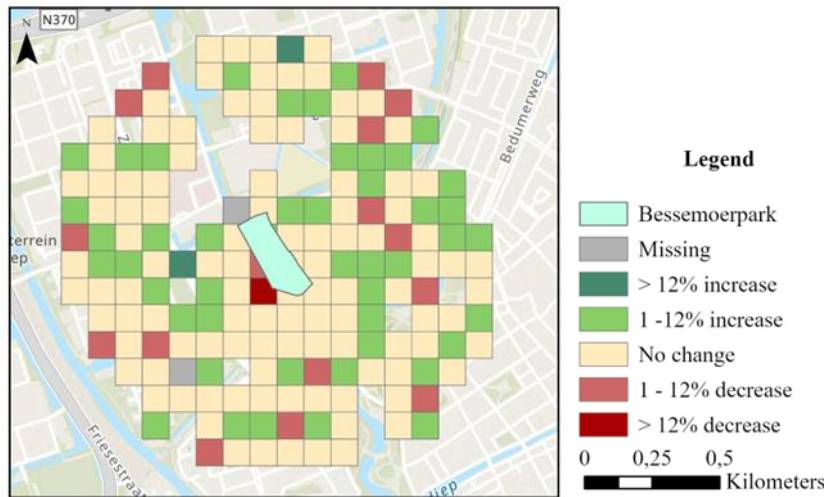
Fig. 12 *Change in percentage of residents with non-western migration backgrounds, 2017-2020 (Author, 2023)*

Similar to the period of 2013 to 2016, a significant perfect positive correlation was found between distance to Bessemoerpark and changes in residents with non-western migration backgrounds in the southeastern and western part of the study area (Fig. 13). These correlations suggest increasing percentages of residents with non-western migration backgrounds with increasing distance from the park. In the direct vicinity of the park, no significant correlations were found.
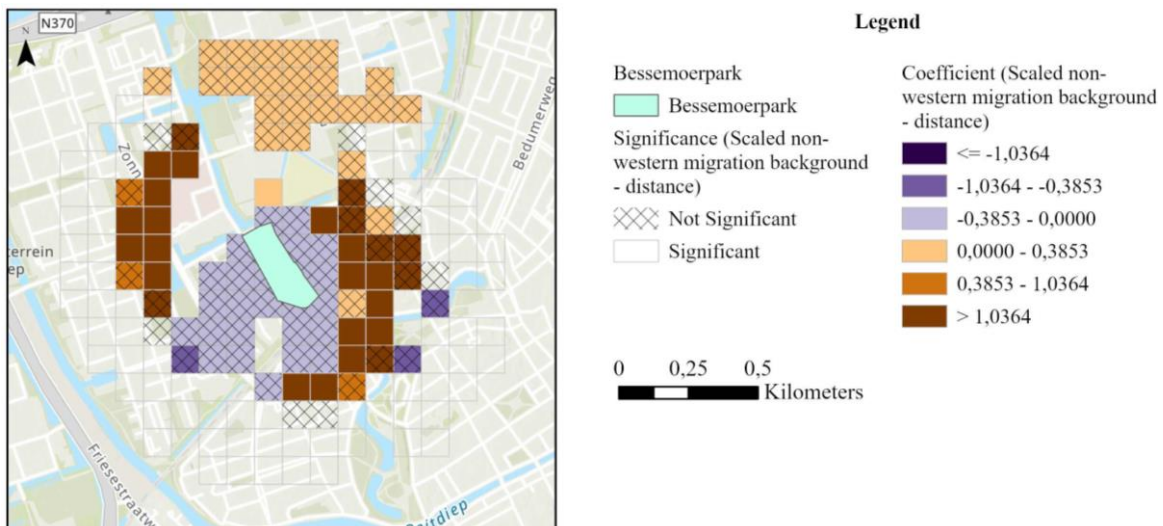

Fig. 13 *Correlation: change in residents with non-western migration backgrounds and distance to Bessemoerpark, 2017-2020 (Author, 2023)*

4.1.3   The situation in 2013-2020

Analysis of changes during the period of 2013-2020 revealed significant changes in the percentage of residents with non-western migration backgrounds within the research area (Fig. 14). To specify, 21.1% of squares experienced significant changes (Appendix I). Several squares in the southern part of Bessemoerpark indicated a significant decrease in residents with non-western migration backgrounds. However, especially in the northern, and western side of the park, significant increases were found.
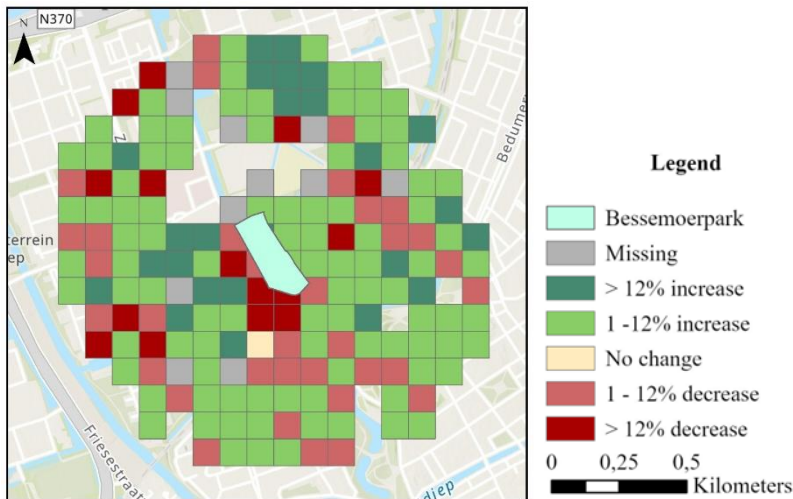
Fig. 14 *Change in percentage of residents with non-western migration backgrounds, 2013-2020 (Author, 2023)*

However, the MGWR identified fewer areas with significant correlations between distance to the park and changes of residents with non-western migration backgrounds compared to previous regressions (Fig. 15). In contrast to the other periods, the southern part of the research area showed a significant perfect negative correlation, suggesting a decrease in residents with non-western migration backgrounds with decreasing distance from the park. These correlations contradict the results of the regressions for 2013-2016 and 2017-2020.
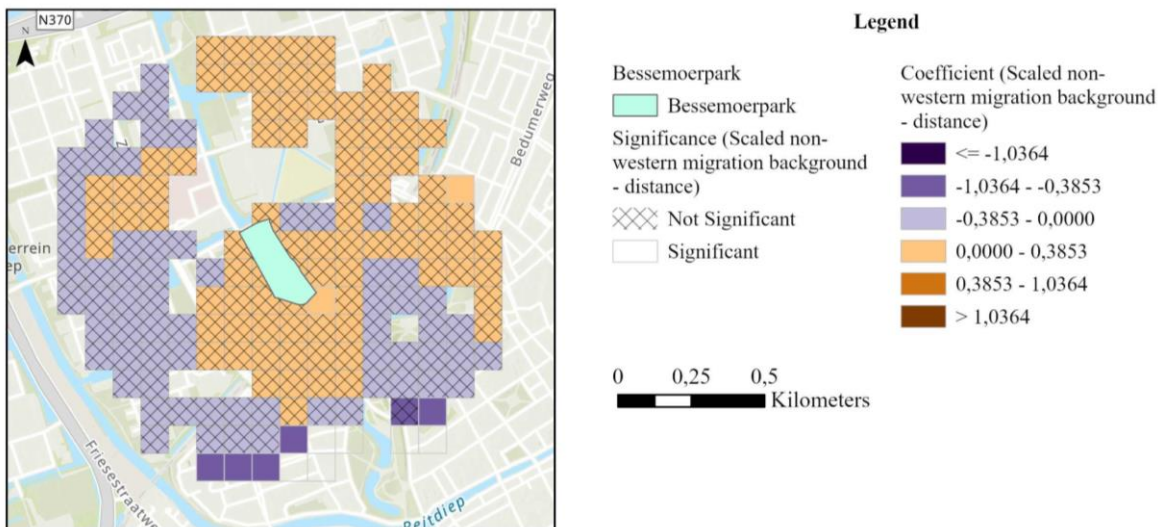

Fig. 15 *Correlation: change in residents with non-western migration backgrounds and distance to Bessemoerpark, 2013-2020 (Author, 2023)*

4.2 The effect of the renewal on residents receiving social assistance

4.2.1 The situation in 2015-2016

The analysis of changes in the percentages of residents receiving social assistance between 2015 and 2016 revealed significant changes in numerous squares within the research area (Fig. 16). Over 30% of squares showed a significant change and over 60% displayed no changes (Appendix II). Various squares near Bessemoerpark showed a significant decrease, while areas located further from the park indicated more significant increases.
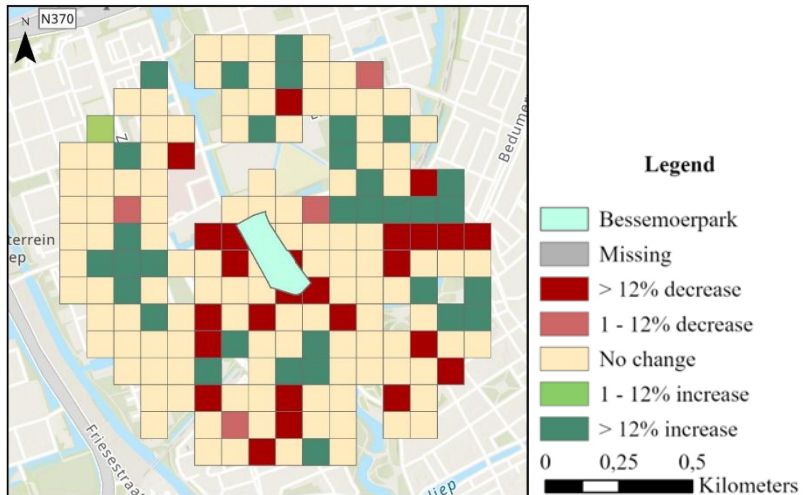
Fig. 16 Change in percentage of residents receiving social assistance, 2015-2016 (Author, 2023)
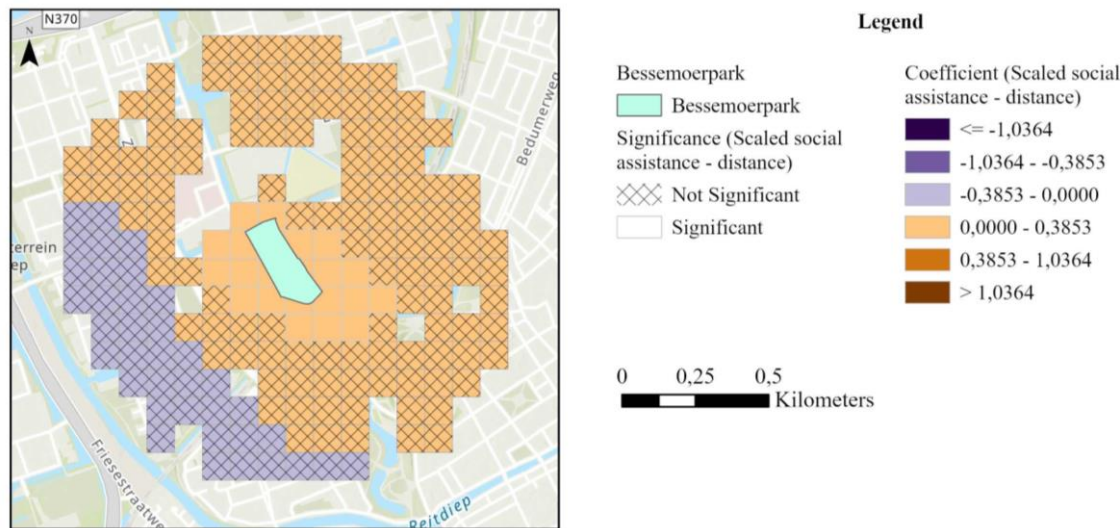

Fig. 17 Correlation: change in residents receiving social assistance and distance to Bessemoerpark, 2015-2016 (Author, 2023)

The conducted regression, significant weak positive correlations were found in the immediate vicinity of the park, suggesting an increase in residents receiving social assistance with increasing distance from the park (Fig. 17). The pattern of significant correlations corresponds to the observed changes in the percentage of residents receiving social assistance.

4.2.2   The situation in 2017-2020

Further analysis of the changes in residents receiving social assistance between 2017 and 2020 revealed an increase in the number of squares experiencing a decrease in comparison to the situation between 2015 and 2016 (Fig. 18). In particular, only 15.5% of squares showed a significant decrease in the period of 2015-2016, this figure rose to 38.2% between 2017 and 2020 (Appendix II).

However, these changes were not found to be correlated to distance to the park, as no significant results were produced by the MGWR (Fig. 19).

Fig. 18 *Change in percentage of residents receiving social assistance, 2017-2020 (Author, 2023)*
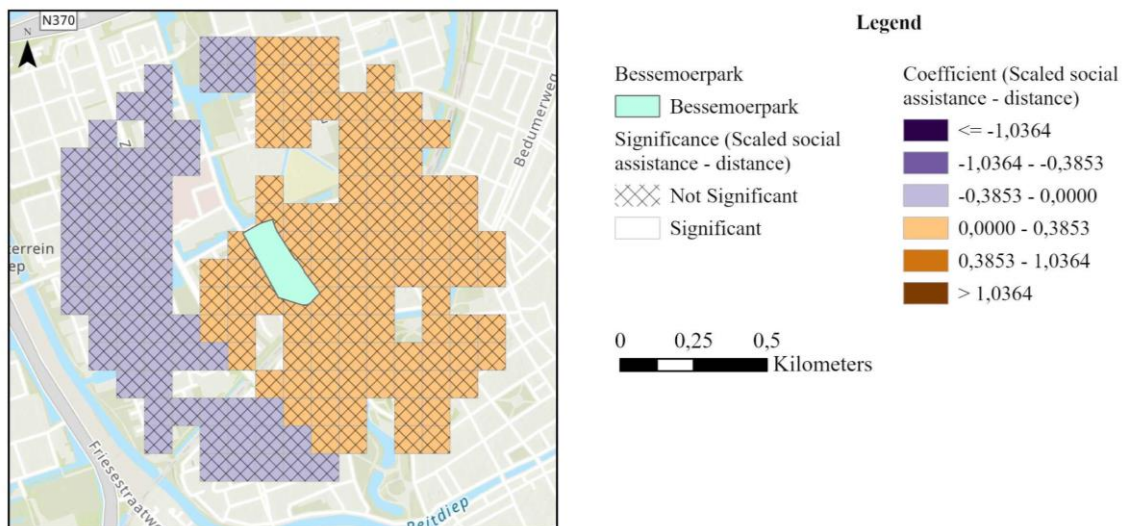

Fig. 19 *Correlation: change in residents receiving social assistance and distance to Bessemoerpark, 2017-2020 (Author, 2023)*

4.2.3 The situation in 2015-2020

Analysis of changes in residents receiving social assistance between 2015 and 2020 revealed similarities to the results obtained for the period of 2017-2020 (Fig. 20). Approximately 64% of squares showed significant changes and 45% showed no changes (Appendix II).
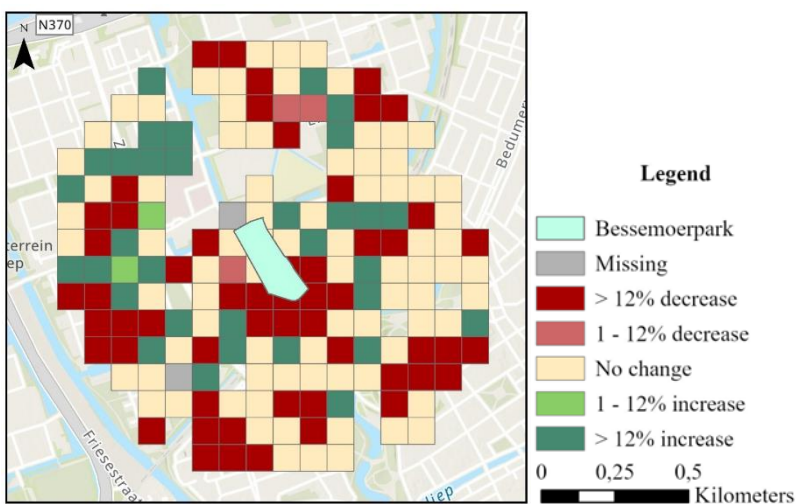
In contrast to previous regression analyses regarding social assistance, significant correlations were identified. Strong significant negative correlations were found in the southeastern area near Bessemoerpark, suggesting an increase in residents receiving social assistance with decreasing distance from the park (Fig. 21). Squares along the border of the research area showed significant perfect positive correlations, indicating an increase of residents receiving social assistance with increasing distance from the park.
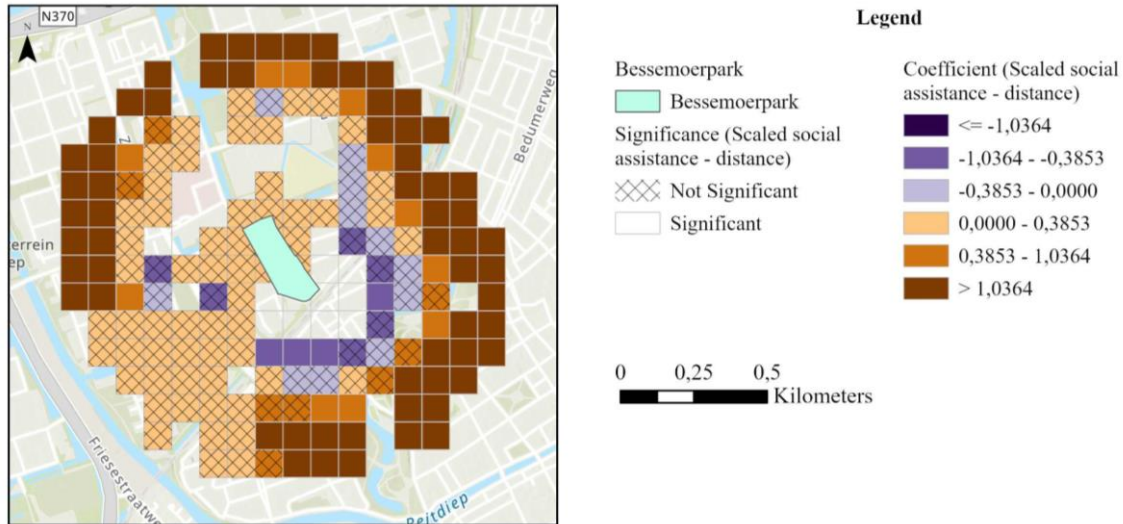

Fig. 21 Correlation: change in residents receiving social assistance and distance to Bessemoerpark, 2015-2020 (Author, 2023)

4.3 The effect of the renewal on properties owned by housing corporations

4.3.1   The situation in 2015-2016

During the period of 2015-2016, over 90% of squares in the research area experienced no change in the properties owned by housing corporations (Table 3). However, all identified squares with significant changes showed a decrease in properties owned by housing corporations (Fig. 22). This significant decrease accounted for approximately 5% of the squares in the study area.
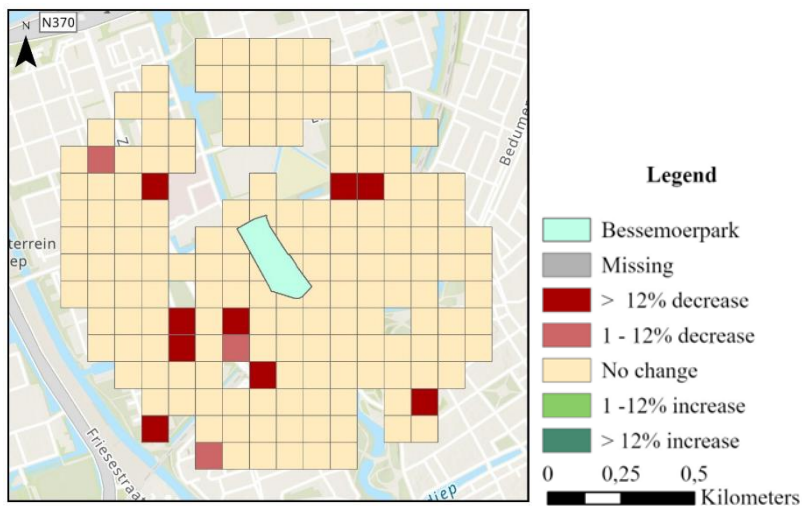
Fig. 22 Change in percentage of property owned by housing corporations, 2015-2016 (Author, 2023)

Significant correlations were found between distance to the park and changes in properties owned by housing corporations (Fig. 23). Near Bessemoerpark, significant strong correlations were found, suggesting an increase of properties owned by housing corporations with decreasing distance from the park. In contrast, significant strong and perfect positive correlations were found in the border area of

the buffer, indicating an increase of properties owned by housing corporations with increasing distance from the park.

Fig. 23 *Correlation: change in properties owned by housing corporations and distance to Bessemoerpark, 2015-2016 (Author, 2023)*

4.3.2 The situation in 2017-2020

Compared to the period of 2015-2016, squares with significant changes in properties owned by housing corporations increased in diversity during the period of 2017-2020 (Fig. 24). However, over 80% of squares showed no changes in both periods (Table 3) Additionally, a square connected to the southern part of Bessemoerpark showed a significant increase.
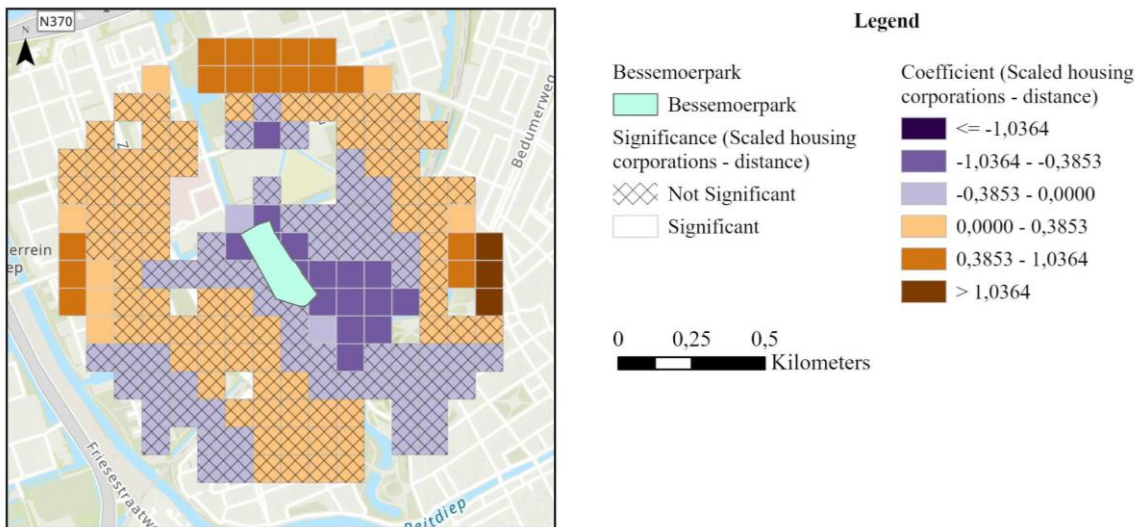

Fig. 24 *Change in percentage of property owned by housing corporations, 2017-2020 (Author, 2023)*

The MGWR revealed various areas with significant correlations (Fig. 25). A significant weak positive correlation was observed near Bessemoerpark, increasing in strength as the distance to the park increases. Strong and perfect positive correlations were identified in the northern, western, and eastern parts of the area, indicating increasing properties owned by housing corporations with increasing distance from the park. However, along the border on the northern and southern side of the buffer, significant strong negative correlations were observed, suggesting that as the distance to the park decreases the percentage of properties owned by housing corporations increases.

Fig. 25 Correlation: change in properties owned by housing corporations and distance to Bessemoerpark, 2017-2020 (Author, 2023)

4.3.3   The situation in 2015-2020

The changes in properties owned by housing corporations during the period of 2015-2020 were relatively more significant compared to the periods of 2015-2016, and 2017-2020 (Fig. 26). Over the total period, more than 15% of squares were exposed to significant changes (Table 4). In the southern part of Bessemoerpark, two squares showed a significant decrease and one square showed a significant increase.
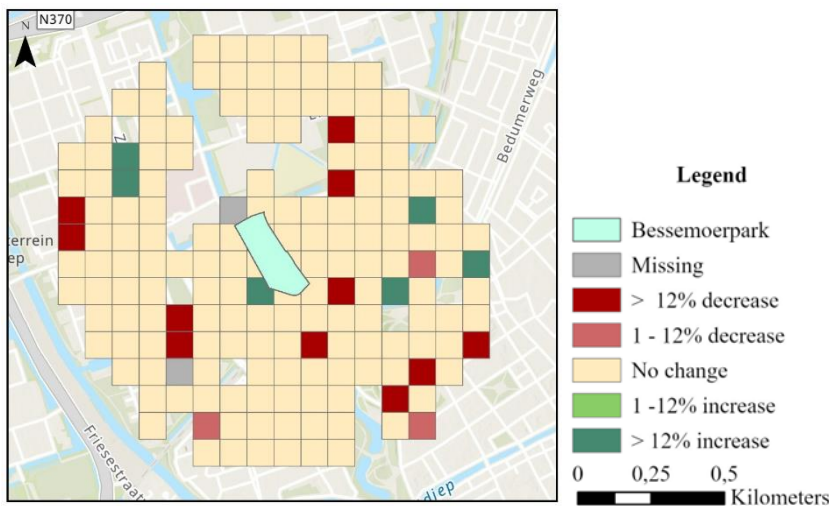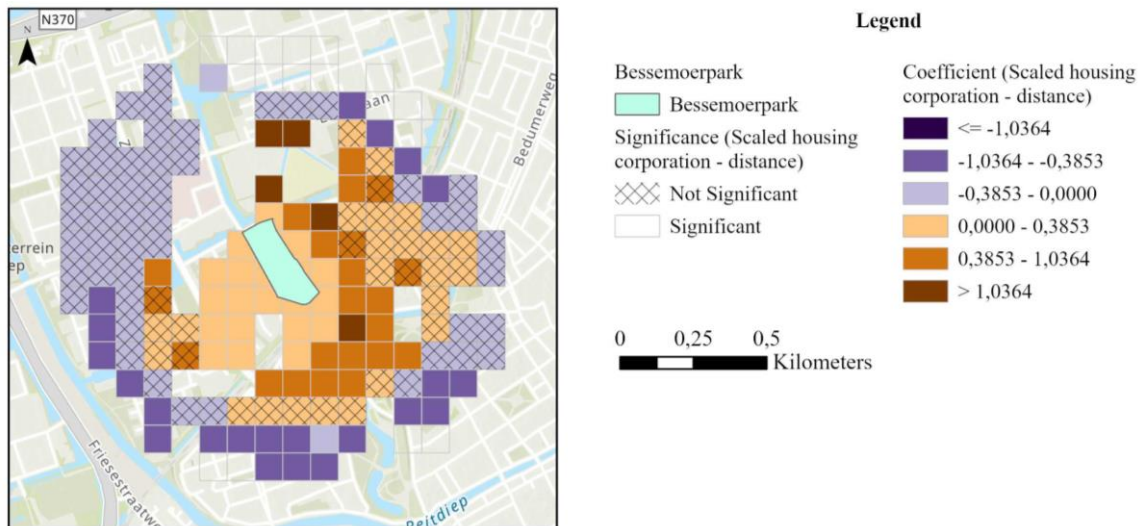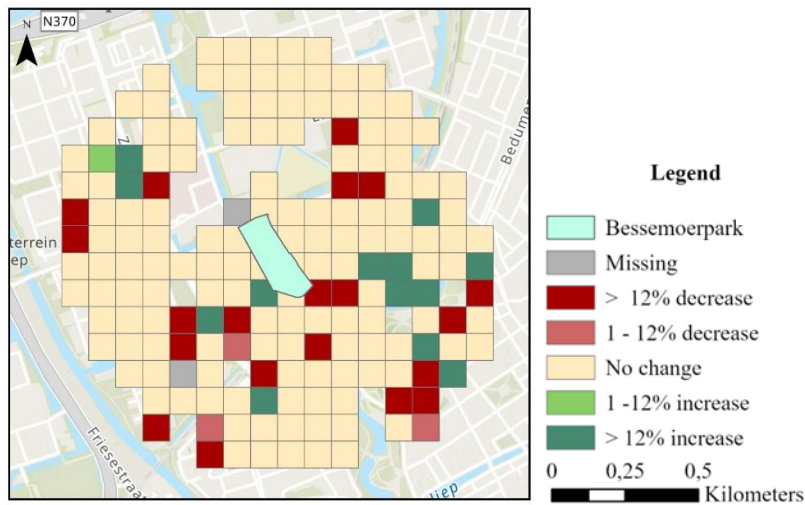

Fig. 26 Change in percentage of property owned by housing corporations, 2015-2020 (Author, 2023)

The regression analysis revealed a significant correlation in the vicinity of Bessemoerpark (Fig. 27). Strong negative correlations were found in the southern part, indicating an increase of properties owned by housing corporations with decreasing distance to the park. In contrast, along the eastern border of the research area, significant strong positive correlations were observed, suggesting increasing amounts of properties owned by housing corporations with increasing distance to the park. No significant correlation was found on the western side of the area.
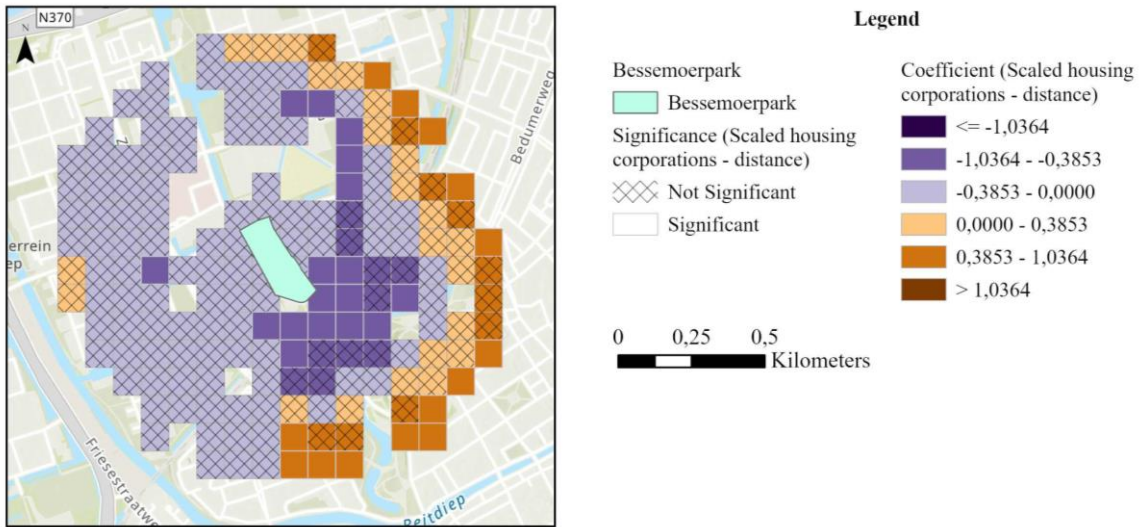
Fig. 27 Correlation: change in properties owned by housing corporations and distance to Bessemoerpark, 2015-2020 *(Author, 2023)*

4.4 The effect of the renewal on the property value

4.4.1   The situation in 2013-2016

During the period of 2013-2016, almost 70% of squares experienced an insignificant decrease in property values, compared to approximately 11% with significant changes (Table 4). In the southern part of Bessemoerpark, a square with a significant increase in property value was observed (Fig.28). Approximately 10% of squares experienced a significant decrease in property value.

The results of the regression indicated a significant weak negative correlation in the direct vicinity of Bessemoerpark, suggesting an increase in property values with decreased distance from the park (Fig. 29). This pattern extends to the northeastern border of the research area.

Fig. 28 Change in percentage of property value, 2013-2016 *(Author, 2023)*

Fig. 29 Correlation: change in property value and distance to Bessemoerpark, 2013-2016 (Author, 2023)

4.4.2   The situation in 2017-2020

Compared to the period of 2013-2016, a noticeable change in squares exposed to significant changes in property values was observed (Fig. 30). Over 90% of squares exhibited significant increases in property values and no squares indicated a significant decrease (Table 4).

The regression analysis revealed significant weak negative correlations throughout almost the entire research area, indicating an increase in property values with decreasing distance from the park (Fig. 31).

Fig. 30 Change in percentage of property value, 2017-2020 (Author, 2023)
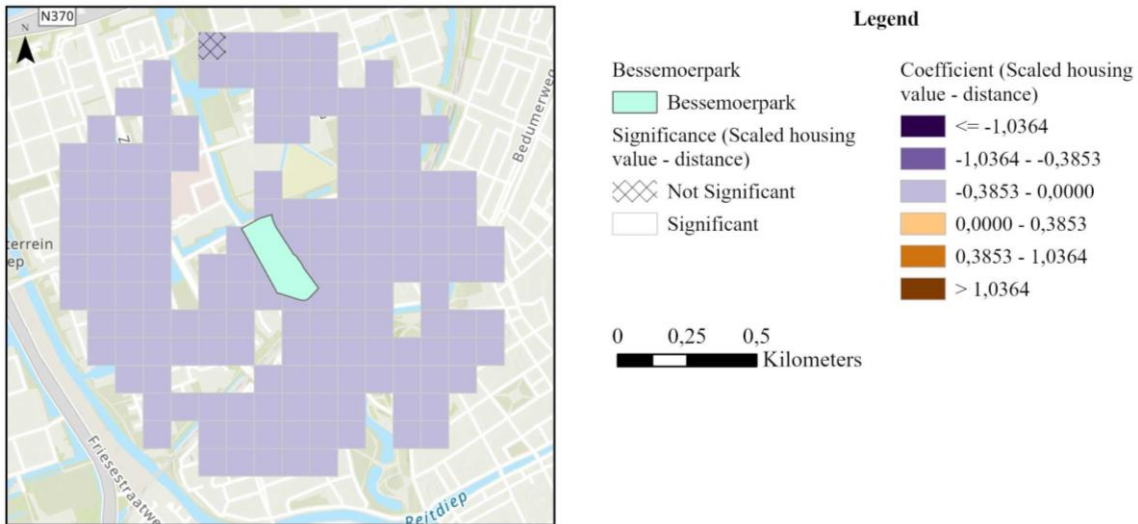
Fig. 31 *Correlation: change in property value and distance to Bessemoerpark, 2017-2020 (Author, 2023)*

4.4.3   The situation in 2013-2020

When comparing the changes during the period of 2017-2020 to the total period of 2013-2020, it was observed that the diversity in property value changes increased (Fig. 32). Most squares showed significant increases in property value, however, some squares on the eastern side showed decreasing values.

A relatively small amount of squares were subject to significant correlations (Fig. 33). In the vicinity of Bessemoerpark, one weak negative significant correlation was identified, suggesting property values increase as the distance to the park decreases. Along the border of the research area, various significant weak positive correlations were observed, implicating that property values increase with increasing distance from the park.
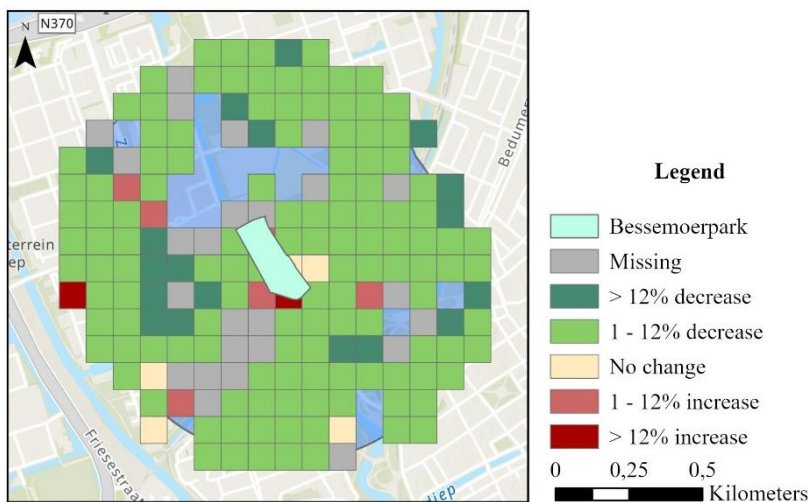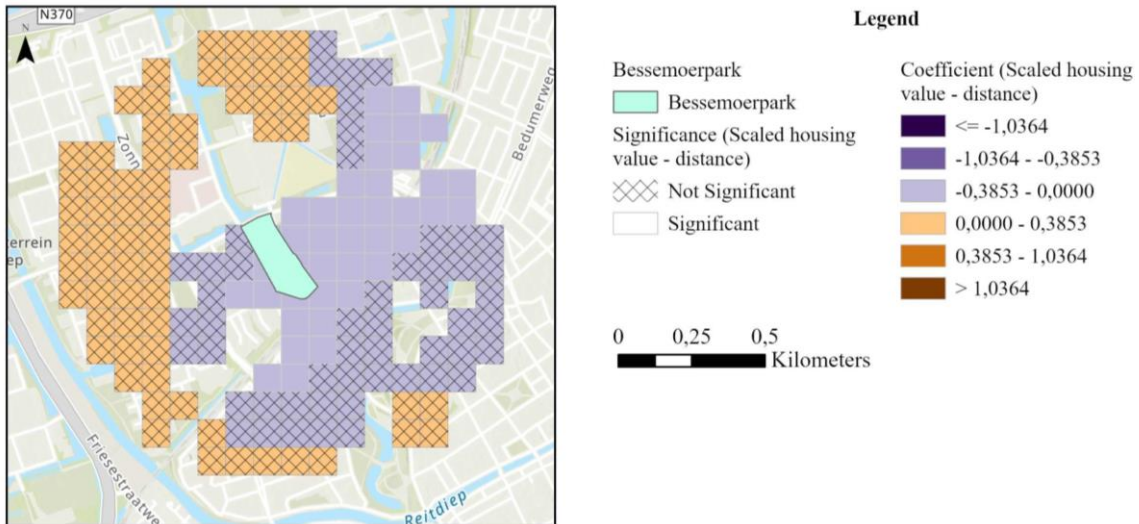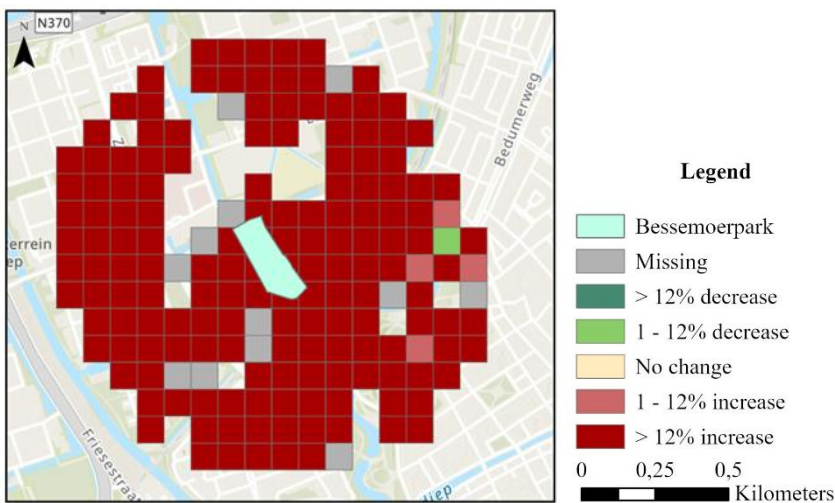

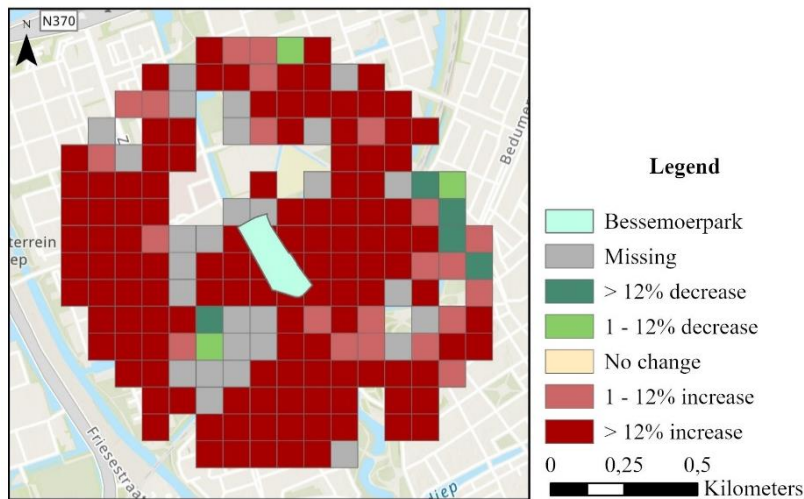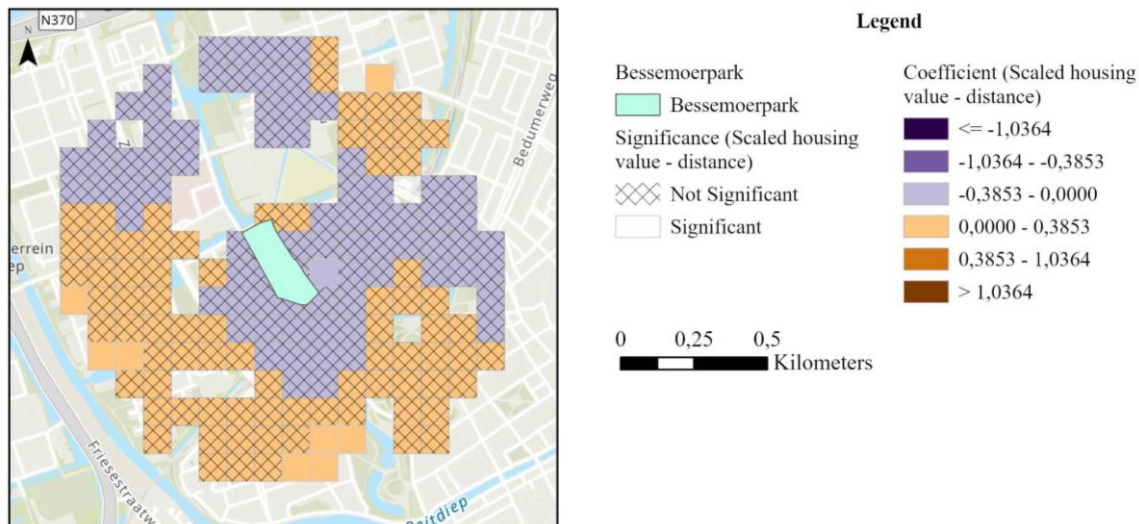***Fig. 32*** *Change in percentage of property value, 2013-2020 (Author, 2023)*

Fig. 33 *Correlation: change in property value and distance to Bessemoerpark, 2013-2020 (Author, 2023)*

5. Effect of the renewal of Bessemoerpark

During the period of 2013-2016, three out of four indicators showed significant correlations associated with displacement. The indicators of residents with non-western migration backgrounds and residents receiving social assistance signified correlations corresponding with the determined increased risk of displacement for minorities and households of low socio-economic status, signaling the process of green gentrification. In contrast, in the direct vicinity of Bessemoerpark, negative correlations were detected between properties owned by housing corporations and distance from the park, supporting the process of preservation of diversity. A potential reason for the location and strength of this correlation are the social housing initiatives incorporated in the renewal program, which aimed at constructing social housing on the Bessemoer strip to contribute to a diverse population. Furthermore, in the direct vicinity of the park, negative correlations were found between property values and distance from the park. These correlations suggested that the renewal of Bessemoerpark resulted in increased property values, which could be explained by increasing potential land values. Consequently, this process could result in the displacement of the original residents, suggesting that green gentrification occurred. Since three out of four indicators suggested the process of displacement, it can be stated that the revitalization resulted in social injustice. The social groups affected by the renewal of Bessemoerpark are residents with non-western migration backgrounds, and residents receiving social assistance. Additionally, the increasing property values could also result in the displacement and exclusion of low-income households who are not necessarily receiving social assistance. This pattern corresponds with the increased risk of displacement of minorities and households of lower socio-economic status. However, the increase in properties owned by housing corporations, should in theory, be contributing in persevering the diversity of the neighborhoods involved. An overlap in the location of positive correlations between residents receiving social assistance and distance from Bessemoerpark, and negative correlations of properties owned by housing corporations and distance from Bessemoerpark is assumed. In the case of Bessemoerpark, this overlap indicates that the preservation of the diversity did not occur, as the pattern of displacement of residents receiving social housing has been identified. This finding signifies that the aim of the municipality to construct social housing on the Bessemoer strip to contribute to a diverse population was not met.

Additionally, during the period of 2017-2020, also three out of four indicators showed significant correlations linked to displacement. Specifically, the indicators of residents with non-western migration backgrounds, and properties owned by housing corporations. Furthermore, on the border, positive correlations between the number of properties owned by housing corporations and distance from Bessemoerpark, were found. These correlations increase in strength with increasing distance

from the park, suggesting that the number of properties owned by housing corporations increased closer to the border, signifying displacement. Moreover, negative correlations were identified between property values and distance from the park, indicating that the property values in the research area increased due to the renewal. This process could be explained by the rent-gap theory, and can result in displacement of the original residents. However, in comparison to 2015-2016, no significant correlations were found between changes in residents receiving social assistance and distance from Bessemoerpark. Therefore, during the period 2017-2020, correlations suggest that green gentrification occurred as a result of the revitalization of Bessemoerpark. Considering three out of four indicators in this period signified displacement, it can be stated that the renewal of Bessemoerpark resulted in social injustice. Residents with non-western migration backgrounds and households eligible for social housing have been affected by the renewal in the period of 2017-2020. As a result of the decrease in the number of properties owned by housing corporations, the area of Bessemoerpark became less accessible, especially in the areas located near the park. The areas experiencing positive correlations between the number of properties owned by housing corporations and distance from the park, correspond with the areas signifying positive correlations between residents with non-western migration backgrounds and distance from the park. Moreover, the increasing property values could also result in the displacement or exclusion of households with lower socio-economic status who are not receiving social assistance. As no significant correlations were identified between residents receiving social assistance and distance from Bessemoerpark, no statement can be made regarding the impact of the renewal of the park on this social group.

Last, during the total period of 2013-2020, two out of four indicators showed significant correlations associated with displacement. In particular, in the direct vicinity of Bessemoerpark, a positive correlation was found between residents with non-western migration backgrounds, signifying displacement. Additionally, in the area of this correlation, a negative correlation between property values and distance from Bessemoerpark was identified, implying that the property values increased due to the renewal of the park. This development could also be explained by the rent-gap theory, and can result in displacement of the original residents. In contrast, in the center of the research area, negative correlations were found between the number of properties owned by housing corporations and distance from Bessemoerpark, and residents receiving social assistance. These correlations represent the process of preserving diversity, as this area became more accessible as a result of the renewal. However, on the border of the research area, positive correlations were found between the number of properties owned by housing corporations and distance from the park, and between residents receiving social assistance, indicating a process of displacement. Since two out of four indicators in the vicinity of Bessemoerpark implied a pattern of displacement, no conclusive statement can be made in regards to green gentrification. Although the results of green gentrification are inconclusive, remarks can be made regarding social injustice related to the renewal of Bessemoerpark. The residents receiving social assistance and the numbers of properties owned by housing corporations indicated an overlap. To specify, in the center of the research area, this process proclaims a process of preserving diversity, contributing to social justice. However, on the border of the research area, the overlapping correlations represent a process of displacement resulting in social injustice.

	Change residents with non-western migration backgrounds	Change residents receiving social assistance	Change properties owned by housing corporations	Change property values
2013-2016	Displacement	-	-	Displacement
2015-2016	-	Displacement	Preservation of diversity	-
2017-2020	Displacement	No significant changes	Displacement	Displacement
2013-2020	Displacement	-	-	Displacement
2015-2020	-	Preservation of diversity	Preservation of diversity	-

Table 1 *Interpretation correlations between indicators and distance from Bessemoerpark*

5.1 Strength & Limitations

The quality of this research may have been affected by several challenges. First, the use of the mean of cohorts of percentages for non-western migration backgrounds and the use of "2" in cases where data was described as "<Null>" may have introduced distortion in the results. This could potentially affect the accuracy and reliability of the findings. Secondly, the lack of data on social assistance and housing corporations until 2014 may have limited the scope and depth of the analysis. Without this data, it may be difficult to fully understand and interpret the changes and correlations observed in these indicators. Finally, external factors such as parallel policies affecting the renewal of Bessemoerpark and changes to other UGS, for example, Noorderplantsoen may have influenced the correlations identified in this research. However, the extent to which external factors influenced correlations was limited due to application of MGWR to ensure that the changes are related to Bessemoerpark. It is important to consider the potential impact of these external factors when interpreting the results and drawing conclusions.

6. Conclusion

This research examined the renewal of Bessemoerpark in Groningen, and investigated the consequences of the revitalization project and its effect on social justice in the period of 2013-2020. The following main research question was proposed: *"To what extent did the renewal of Bessemoerpark result in social injustice with respect to green gentrification?"*.

Based on spatial analyses conducted in ArcGIS Pro it can be concluded that the renewal of Bessemoerpark mainly impacted social justice negatively. In the periods of 2013-2016, 2015-2016, and 2017-2020 the process of green gentrification is exposed. In particular, the renewal resulted in the displacement of residents with non-western migration backgrounds. Additionally, the property values increased as a consequence of the revitalization of Bessemoerpark, which could result in the displacement and/ or exclusion of households with lower socio-economic status. Contradicting results were found related to the number of properties owned by housing corporations. In the period of 2015-2016, social housing properties were facilitated to contribute to a diverse population, however the indicators during this period did not signify a process of persevering diversity. During the period of 2017-2020 the number of properties owned by housing corporations decreased and an interdependency with the residents with non-western migration backgrounds was identified. In the period 2015-2020 the number of residents receiving social assistance and the number of properties owned by housing corporations were interconnected, signifying a process of social justice in the surrounding of Bessemoerpark, and a process of social injustice on the border of the research area.

6.1 Reflection and further research

This research focussed on green gentrification and social justice, both of which are topics that I find tremendously interesting. The combination of these concepts is an increasing discussion in spatial planning. Since numerous sustainable renewal programs have to be executed in my future work field,

it is important to understand the potential effects of these projects. Throughout this research, I have come to understand the complex multidimensional nature of green gentrification, which complicates the investigate their individual impacts. Additionally, my limited experience with ArcGIS Pro presented a challenge in conducting this research. Consequently, it is possible that errors were made in the spatial analyses which affected the reliability and validity of the research. Due to my limited knowledge of the program, it took more time than anticipated to derive usable results. I am excited to continue learning about gentrification and exploring ways to balance the improvement of the living environment while persevering social justice.

Recommendations for future research relate to extending this research by investigating the inconsistencies relating to residents receiving social assistance and the number of properties owned by housing corporations. Additionally, it is advised to extend the research by investigating parallel policies that could affect the results related to social injustice as a consequence of the renewal of Bessemoerpark. Furthermore, it is recommended to expand the research to other renewed UGS in Groningen to see if this pattern is reoccurring and if the municipality of Groningen should adjust their policies to avoid social injustice as a result of UGS renewal.

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Appendix I – Percentual change of residents with non-western migration backgrounds

	2013-2016	2017-2020	2013-2020
Missing data	4.42%	1.16%	6.08%
>12 % increase	4.97%	1.16%	13.81%
1-12 % increase	45.30%	27.17%	52.49%
No change	1.66%	60.69%	0.55%
1-12 % decrease	35.91%	9.25%	18.79%
>12 % decrease	7.73%	0.59%	8.29%

Appendix II – Percentual change of residents receiving social assistance

	2015-2016	2017-2020	2015-2020
Missing data	0%	1.16%	1.15%
>12 % increase	18.39%	14.45%	18.39%
1-12 % increase	0.58%	0%	1.15%
No change	64.37%	45.66%	45.98%
1-12 % decrease	2.30%	1.73%	0.59%
>12 % decrease	15.52%	38.15%	31.61%

Appendix III – Percentual change of properties owned by housing corporations

	2015-2016	2017-2020	2015-2020
Missing data	0%	1.16%	1.16%
>12 % increase	0%	3.47%	7.51%
1-12 % increase	0%	0%	0.58%
No change	93.10%	87.28%	77.46%
1-12 % decrease	1.72%	1.73%	1.73%
>12 % decrease	5.17%	6.36%	11.56%

Appendix IV – Percentual change of residents with non-western migration backgrounds

	2013-2016	2017-2020	2013-2020
Missing data	13.81%	6.93%	15.47%
>12 % increase	1.10%	90.17%	12.15%
1-12 % increase	3.31%	2.31%	67.96%
No change	2.76%	0%	0%
1-12 % decrease	69.06%	0.58%	1.66%
>12 % decrease	9.94%	0%	2.76%