

CONNECTING CITY LIFE THROUGH GREEN AND SUSTAINABLE INTERVENTIONS

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ABSTRACT

Green areas are considered a significant parameter of sustainable and resilient city life. Health and wellbeing are directly affected by urban greening which is fostering social interaction, joy and happiness. Especially in the Mediterranean cities, where climate favors walking and outdoor activities, the quality of open public spaces' is directly affected by the amount and quality of vegetation.

This research examines the evolution of green spaces in the city of Thessaloniki, Greece as a parameter of quality of urban life. The methodology uses urban data such as land use, urban density, population density and their correlation to the spatial distribution of green areas. Urban patterns of green distribution and green areas are investigated and presented. The urban area of Thessaloniki is used as a case study area to examine vegetation patterns and distribution at the urban scale.

The results of the research prove that green infrastructure is a significant parameter of the quality of life in cities. Greek cities present crucial transformation potential when it comes to green patterns and the evolution of urban areas needs a green oriented, planned and targeted strategy to lead at a sustainable and healthy urban future.

KEYWORDS _ *Sustainable city, Urban greening, Microclimate, Citizen's wellbeing*

INTRODUCTION

The role of green spaces in the urban environments is strongly connected to the sustainable development of cities. The evolution of green spaces has always followed the social, cultural, political and economic dimensions of each period.

Until the 19th century green spaces were mostly developed as private gardens to express the style and wealth of their owners, mostly resulting in emblematic garden areas. After the industrial revolution and rapid urbanization, the idea of public gardens started to evolve to promote an *“enhanced quality of life in expanding urban centers”* (Chkird et al. 2024).

The economic and political implications of the post war period did not favor the development of green areas as a primary planning strategy. However, after the war, the progressive improvement of the economy led to the increase of green spaces and of open public spaces. The postwar period was characterized by a growing recognition of the importance of green spaces for the balance and quality of urban life.

The idea of sustainable development during the 00's left a deep imprint on contemporary garden design. The preservation of natural resources and the reduction of environmental impact were considered the base for an ecologically, socially and economically balanced urban development.

The term 'green space' encompasses various small green areas, such as playgrounds, squares and neighbourhood gardens, parks, yards, urban forests and urban farms (Taylor and Hochuli 2017). Although vaster green spaces are often considered to be more important for their ability to provide space for leisure and isolation from the urban life, street trees constitute also an important part of the green space of the city, as they can increase the quantity, quality and distribution of the vegetation at the urban tissue. In another definition cities are shaped *“by parks, forests and green corridors”* (Karanikola et al. 2025).

Besides the improved microclimatic conditions and improved air quality, the evenly distributed green spaces, also encompass the notion of urban equality in terms of the accessibility of the green spaces. In addition, the availability of small green spaces in proximity to residential buildings is considered of crucial importance, especially for less mobile people and young children (Van Herzele and Wiedemann 2003).

Moreover, the improved quality of the urban environment in terms of the aesthetic quality and the microclimatic conditions that can be achieved through vegetation include, lower temperatures during summer periods and shorter periods of exposure to heat stress contributing at the health and wellbeing of citizens.

On the other hand, green areas have been proved to improve mental health, to encourage physical activity and to enhance social interaction and social cohesion. Besides, it has often been stated that a large number of premature deaths in European cities could be prevented by increasing exposure to green space, while contributing to sustainable, livable and healthy cities (Barboza et al. 2021), (Farkas et al. 2023).

According to the fact that the expansion of the urban environments and the intense urbanization of areas has in many cases contributed to both the low quantity and quality of green spaces in the urban environments, this research examines the condition of green spaces in Greek cities as a parameter of quality of urban life. Several parameters of the urban form of the city of Thessaloniki are examined in the context of the contribution of urban vegetation to the formation of the quality of urban environment which promotes also the health and wellbeing of citizens.

THE EVOLUTION OF GREEN SPACES IN THESSALONIKI, GREECE

The evolution of green spaces in Greece has followed different patterns compared to other European cities, as the conditions in the post-war years were radically different *"based on the concession, by the state, of the right to build to private individuals and contractors, with minimal infrastructure, public services, public facilities and landscaping"* (Hastaoglou-Martinidis, Kalogirou, and Papamichos 1993).

Thessaloniki is a Mediterranean city situated in Northern Greece at the Prefecture of Central Macedonia. Built around the Thermaikos Gulf, its climate is characterized as mild and humid. It is the second largest city in Greece. The population of the Municipality of Thessaloniki for the year 2021 was 319.045 while, the population of the Metropolitan area was 1.092.919 (Population and Housing Census- ELSTAT 2021). The urban area of Thessaloniki is divided into 8 Municipalities and Municipal units.

The urban tissue is characterized by its high building density and the inadequate surface of green spaces (Katsavounidou 2021). There has been a lot of research on the ratio of public to private space, or the ratio of built to unbuilt space. The green to built space, or the ratio of green space per capita in Greek cities are also parameters investigated in many cases. Most researchers conclude in the small proportion of open spaces per capita. According to Verani et al., 2015 the green space per capita in the Municipality of Thessaloniki is 2.19 m / person, while, the recommended lowest rate according to the OECD (2014) is 9 m / person (Verani, Pozoukidou, and Sdoukopoulos 2015).

There have been very few urban greening interventions for improving the quantity, quality and distribution of green spaces in the city. An important legislative policy was Law 2745/99 for the development and resettlement of military camps which regulated the terms of ceding disused military camps to local authorities, setting as a prerequisite that at least 50% of their surface will be dedicated to green or public services areas.

Some important interventions of urban regeneration were also targeted at larger parks such as the regeneration of the area of the waterfront park, completed in 2013. The proposed new master plan for Thessaloniki also suggested relocation of the Thessaloniki International Fair from its current position at the city center, to develop a metropolitan park. However, due to economic and political reasons the plan has been postponed (Dionysis Latinopoulos, Mallios, and Latinopoulos 2016).

During the recent economic crisis municipalities faced difficulties in funding the conservation of urban green areas and open public spaces as their budget was significantly cut down. Several municipal initiatives or governmental decisions were adopted to mitigate economic issues for the development of green areas. One of them was the attraction of private sponsorships for the redevelopment and maintenance of existing parks and squares or the privatisation of some of the former military camps (Athanassiou 2017).

The lifestyle of the inhabitants of Greek cities has deteriorated due to all these economic and social problems. The condition of green spaces in cities which used to be retreats and places of escape for residents from their daily problems and recent isolation, often appear deteriorated. The distribution of green spaces remains at low levels and most green spaces are characterized by low quality fragmented vegetated areas. The uneven distribution of the green spaces was more apparent during the pandemic as according to Latinopoulos 2022, during the COVID-19 crisis large population groups were facing difficulties in visiting green areas due to the restrictive measures and large distances they had to cover. At the same point, the proximity to large parks was one of the main parameters associated to better health and well-being outcomes during COVID-19 (Mouratidis and Yiannakou 2022).

MATERIALS AND METHODS

There is a need to develop new policies for improving the green areas in the city of Thessaloniki. This research focuses mainly on identifying the areas where urban greening ratio is low and to give

guidance on priorities for the urban tissue of the municipality of Thessaloniki. Therefore, at this stage, the analysis mainly focuses on the existing green areas and their distribution on the urban tissue to recognize areas of priority for improving green open spaces. The methodology of the research uses spatial and urban data from national and international databases.

The Urban Atlas – Copernicus Land monitoring service database (Urban Atlas – Copernicus Land Monitoring Service n.d.) is used for recording green areas, land use and land cover and built up and impervious surfaces. In addition, the Mapping Panorama of Greek Census Data 1991 – 2011 (EKKE [National Centre for Social Research] – ELSTAT [Greek Statistical Authority] 2015) geospatial data was used for retrieving data for the population distribution and the population density. The Municipality of Thessaloniki is divided into 280 polygons which represent the spatial units of the analysis. For the elaboration of the data and the creation of relevant maps, ArcGIS Pro software has been used.

For the examination of the evolution of open spaces both the evolution of the quantity (in terms of surface area) and the quality (in terms of ownership status, use status (vehicles circulation, recreation, or no specific use) and quality of surface material (green surfaces, quality and density of greening, hard impermeable surfaces etc.).

First, the land use and land cover of the open spaces is examined. Concerning the land coverage, it is obvious that different uses imply varied surface materials. For example, streets or sidewalks are more often covered by hard impervious materials, while parks tend to have more green and permeable surfaces. Under this ascertainment it is interesting to examine the effect of redesigning strategies considering the existing open spaces by changing the quality of the covered surfaces.

Second, the population density and building density of the urban tissue is analysed.

Third, the distribution of green spaces is examined in relation to the previous parameter to analyse the potential of increasing green areas. Denser areas where the open spaces are limited and their quality, in terms of vegetation remains low, should be places of priority in a green intervention strategy.

Therefore, the main questions this research investigates are:

- The form and distribution of open spaces in the Greek cities and their correlation to the population and built density
- The condition of ownership of these spaces and the dedicated uses
- The proportion of green against hard impermeable surfaces

RESULTS

The main objective of the research is to figure out the quantity, quality and spatial distribution of green spaces in relation to urban and population density. This is why the main results are presented through a series of GIS maps.

Figure 1 presents the land cover, land use in the city of Thessaloniki. In the map only the open spaces (included also in the legend) are indicated to describe the distribution of open spaces, their use and the potential targeting areas of the green interventions. Former open areas of industrial or military use could be potential areas to be set in priority for an increasing green surfaces strategy.

Figure 2a presents the population density as distributed in the urban area of Thessaloniki. Population density has been calculated through the division of the surface area of each polygon on the map in m² and the total population of the polygon.

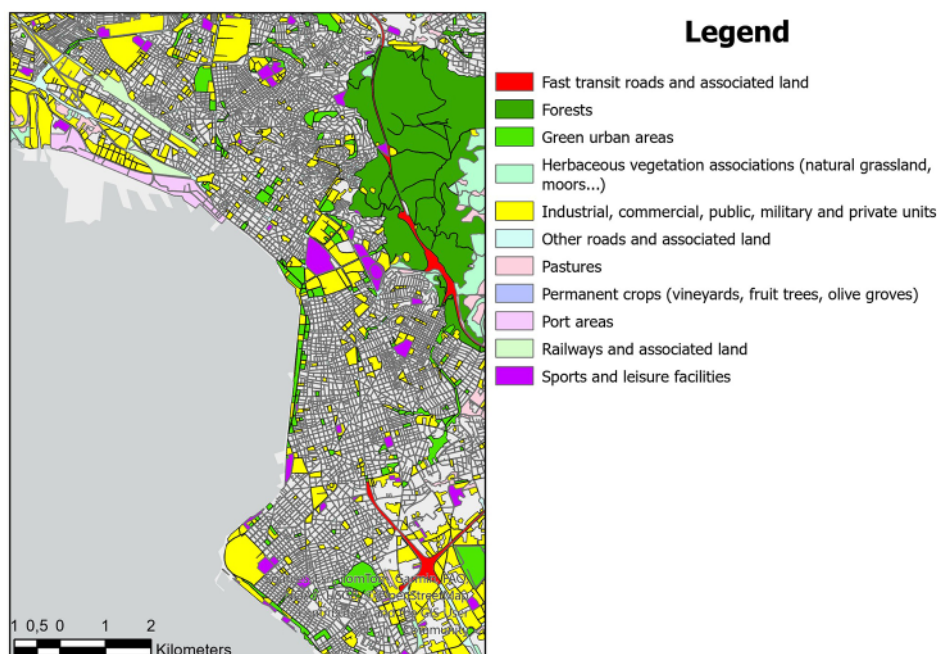


Figure 1: Land use map of the city of Thessaloniki showing open spaces and their current use (source data: DOI: <https://doi.org/10.2909/fb4dffa1-6ceb-4cc0-8372-1ed354c285e6>, map elaborated by the author in ArcGIS Pro).

The most densely populated areas are mainly located in the southern part of the city at the eastern part of the Konstantinou Karamanli Street. This part of the city is newer as it is an expansion of the byzantine inner wall city of Thessaloniki in the Southeast. For the northern part of the city (inner wall city) the most densely populated areas are at the Agiou Dimitriou and Iasonidou street near the Kamara area.

Figure 2b presents the building density values and their distribution. Building density is expressed as a percentage of the built to the unbuilt space. As remarked, the city is densely built with values exceeding in many cases the 90%. It is noticeable that the mean value is 89% with a standard deviation 0.12.

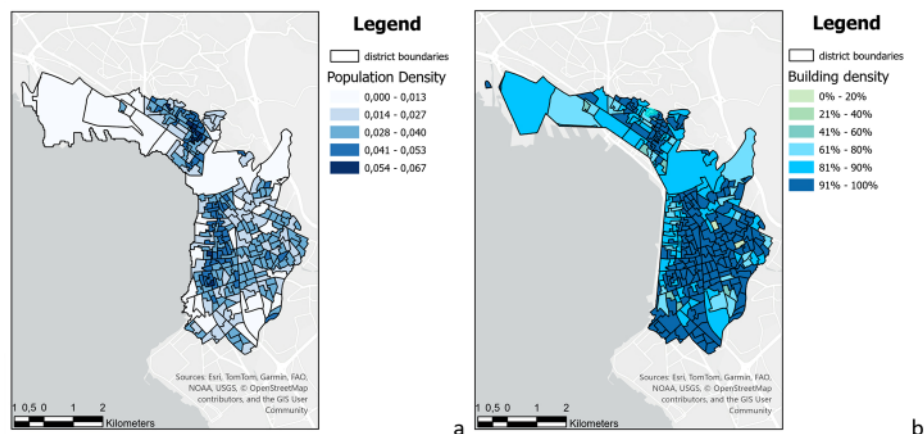


Figure 2: a. Population density, b. Building density, for the city of Thessaloniki (data source: (EKKE [National Centre for Social Research] – ELSTAT [Greek Statistical Authority] 2015, map elaborated by the author in ArcGIS Pro).

Lower values are mostly remarked in areas where churches or other public use buildings are located (e.g. schools). It is obvious that the city, in its majority, is densely built and that the free spaces are already places where parks or public squares are located.

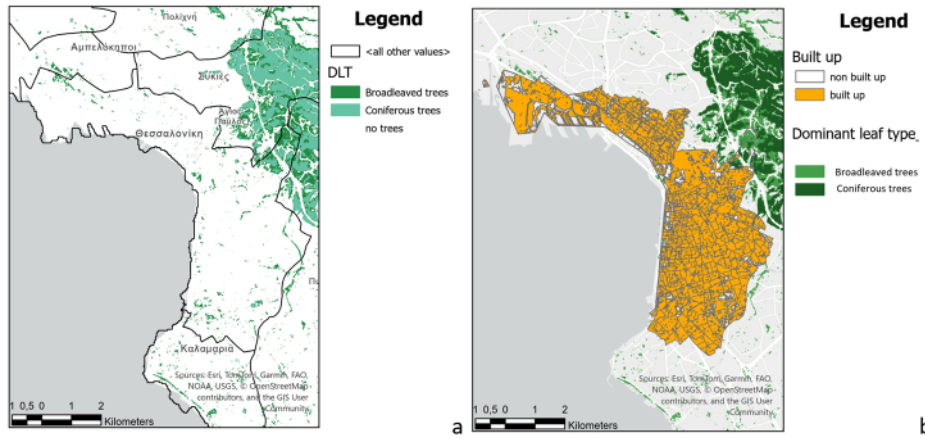


Figure 3: a. Distribution of green at the area of Thessaloniki, b. Map with overlapped data for the green and the built-up areas (data source: DOI: <https://doi.org/10.2909/7b28d3c1-b363-4579-9141-bdd09d073fd82018>, map elaborated by the author in ArcGIS Pro).

Figure 3a and 3b presents the distribution of green areas within the city's boundaries and the built-up space, indicating, on the one hand, the scattered distribution of small green areas within the urban tissue which mostly consist of street trees or small parks, and on the other hand, the dominating green space of the peri urban forest Seigh Su. Besides, other researchers have also pointed out the inadequate quantity and distribution of green spaces concluding that green spaces should be situated at distance of no more than 400 m which corresponds to 5 minutes' walk and indicates accessibility for all age groups (D. Latinopoulos 2022). However, maximum distance may vary according to the function and impact of a green space on the urban environment (Van Herzele and Wiedemann 2003).

CONCLUSIONS

In conclusion, this research investigated the existing form of green spaces in the city of Thessaloniki. The results have proved that Thessaloniki is a densely built urban area, where green spaces are inadequate in number and size and most of them (excluding large parks) appear scattered in the area. The research data presented the areas which have higher building densities and lower green surfaces and therefore need to be prioritized in a green intervention strategy of the municipality.

Further research should include analysis of the microclimate in the urban neighbourhoods to also figure out areas which present higher temperatures during summer and to include them in priority areas for increasing greening or changing urban surfaces in an overall low thermal accumulation regeneration strategy. Despite the various approaches to describe the green urban spaces in Thessaloniki there is still a need for a comprehensive tool to provide guidance for the strategic management and evolution of green spaces for the sustainable development of the city.

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