CONFLICTUAL INTERPLAY BETWEEN RURAL AND URBAN AREAS: DEMARCATION OF PERI-URBAN AREAS AND CHALLENGES IN PLANNING, THE CASE OF İZMİR

A Thesis Submitted to
the Graduate School of Engineering and Sciences of
İzmir Institute of Technology
in Partial Fulfilment of the Requirements for the Degree of

MASTER OF SCIENCE

in Urban Design

by

Sena AYDEMİR

July 2024

We approve the thesis of **Sena AYDEMİR**

Examining Committee Members:

Assoc. Prof. Dr. Figen AKPINAR

Department of City and Regional Planning, İzmir Institute of Technology

Asst. Prof. Dr. Mehmet Ali ÇELİK

Department of Geography, Iğdır University

Prof. Dr. Yavuz DUVARCI

Department of City and Regional Planning, İzmir Institute of Technology

Asst. Prof. Dr. Umut ERDEM

Department of City and Regional Planning, Demokrasi University

Assoc. Prof. Dr. Gizem Erdoğan AYDIN

Department of City and Regional Planning, Demokrasi University

21 July 2023

Assoc. Prof. Dr. Figen AKPINAR

Supervisor, Department of City and Regional Planning, İzmir Institute of Technology

Asst. Prof. Dr. Mehmet Ali Çelik

Co-Supervisor, Department of Geography, Iğdır University

Prof. Dr. Hasan Engin DURAN

Head of Department of City and Regional Planning

Prof. Dr. Mehtap EANES

Dean of the Graduate School of Engineering and Sciences

ACKNOWLEDGEMENTS

Before anything else, I would want to sincerely thank everyone who provided their time, knowledge, and skill to inform my research, and who contributed to it in one way or another.

First, I would like to express my gratitude to Assoc. Prof. Dr. Figen AKPINAR, my supervisor, has helped me along the way, guided me, and contributed to this process with her knowledge, experience, and enthusiasm for the studies that I have been doing since I was a bachelor's student in the City and Regional Planning Department. Also, I express my gratitude to Asst. Prof. Dr. Mehmet Ali ÇELİK for his invaluable contributions to my studies of geographic information systems.

I would like to express my gratitude to my friends who accompanied me during this process, and I would like to give particular thanks to my friends for their valuable contributions to my studies and unwavering moral support during my master's education.

I would like to express my heartfelt gratitude to my family, Günay and Sevda AYDEMİR, for their support throughout the process of writing this thesis. Completing this work would not have been possible without your loving encouragement and unwavering patience. I am truly thankful for you always believing in me and providing endless support.

Finally, I would like to extend my deepest gratitude to my beloved dog, Ice, for her constant companionship and unwavering support throughout this thesis journey. Thank you for always being by my side.

Thanks to everyone I met on this journey, it has been a great one.

ABSTRACT

CONFLICTUAL INTERPLAY BETWEEN RURAL AND URBAN AREAS: DEMARCATION OF PERI-URBAN AREAS AND CHALLENGES IN PLANNING, THE CASE OF İZMİR

The mode of production has evolved due to Western central liberalization, globalization, and capital accumulation, leading to a shift in urban sprawl. This has led to the emergence of urban peripheries, transitional zones where urban and rural activities merge. In Turkey, urban sprawl, decentralization, and fragmentation processes increase urban pressure on peripheral areas, eroding ties to the countryside. This study focuses on the demarcation of Izmir's peripheral areas, which are frequently subject to shifts in administrative boundaries due to legislative policies and socioeconomic changes. The study uses a quantitative methodology that integrates multi-criteria decision analysis with geographic information systems, utilizing Landsat satellite images and government data sources. The method employs a weighted overlay technique in GIS software, allocating weights to predefined criteria based on urban or rural indices. These criteria include land use, changes in land use based on spatial sprawl over 36 years (1986-2022), population size, density, and growth over the same period (1986-2022), slope in terms of suitability for settlement, change in land surface temperature, distance to the city center (30-50 km), and proximity to major transportation networks. The findings indicate that the province of Izmir is surrounded by a heterogeneous distribution of areas with varying degrees of urban and rural features, demarcated as inner and outer peripheries. The areas caught in the transition from rural to urban cannot fully urbanize, nor can they retain their rural characteristics. Therefore, special management and intervention are needed for peripheral areas because of the unique features that distinguish them from urban and rural areas.

Keywords: *Peri-Urban Areas, Rural-Urban Interaction, and Spatial Planning of the Metropolitan Areas*

ÖZET

KENTSEL VE KIRSAL ALANLAR ARASINDAKİ ÇATIŞMALI ETKİLEŞİM: KENTSEL ÇEPER ALANLARININ BELİRLENMESİ VE PLANLAMASINDAKİ ZORLUKLAR, İZMİR ÖRNEĞİ

Üretim tarzı, Batı'nın merkezi liberalizasyonu, küreselleşmesi ve sermaye birikimi nedeniyle gelişmiş ve kentsel yayılmada bir değişime yol açmıştır. Bu durum kentsel ve kırsal etkinliklerin birleştiği geçiş bölgeleri olan kentsel çevrelerin ortaya çıkmasına neden olmuştur. Türkiye'de kentsel yayılma, âdem-i merkeziyetçilik ve parçalanma süreçleri çevre bölgelerdeki kentsel baskıyı artırarak kırsal alanla bağları aşındırıyor. Bu çalışma, mevzuat politikaları ve sosyoekonomik değişimler nedeniyle sıklıkla idari sınır değişikliklerine maruz kalan İzmir'in çevre bölgelerinin sınırlarının belirlenmesine odaklanmaktadır. Çalışma, Landsat uydu görüntülerini ve hükümet veri kaynaklarını kullanarak, çok kriterli karar analizini coğrafi bilgi sistemleriyle bütünleştiren niceliksel bir metodoloji kullanıyor. Yöntem, CBS yazılımında ağırlıkların kentsel veya kırsal endekslere dayalı olarak önceden tanımlanmış kriterlere tahsis edildiği ağırlıklı bir kaplama tekniği kullanır. Bu kriterler arasında arazi kullanımı, 36 yıllık (1986-2022) mekânsal yayılıma dayalı arazi kullanımındaki değişiklikler, aynı dönemdeki (1986-2022) nüfus büyüklüğü, yoğunluk ve büyüme, yerleşime uygunluk açısından eğim, arazi yüzey sıcaklığı, şehir merkezine uzaklık (30-50 km) ve ana ulaşım ağlarına yakınlık. Bulgular, İzmir ilinin, iç ve dış çevre olarak ayrılan, değişen derecelerde kentsel ve kırsal özelliklere sahip, heterojen bir alan dağılımıyla çevrelendiğini göstermektedir. Kırsaldan kente geçişte yakalanan alanlar tam olarak kentleşememekte ve kırsal özelliklerini koruyamamaktadır. Bu nedenle çevre bölgeleri kentsel ve kırsal alanlardan ayıran benzersiz özellikler nedeniyle özel yönetim ve müdahaleye ihtiyaç duyulmaktadır.

Anahtar Kelimeler: *Kentsel Çeper Alanlar, Kırsal-Kentsel Etkileşim ve Metropoliten Alanların Mekânsal Planlaması*

TABLE OF CONTENTS

TABLE OF CONTENTS v

LIST OF FIGURES viii

LIST OF TABLES x

CHAPTER 1 1

RESEARCH CONTEXT 1

1.1. Introduction 1

1.2. Problem Definition 3

1.3. Aim of Research Study 4

1.4. Research Questions 5

1.5. Methodology Approach 5

1.6. Structure of Research Study 6

CHAPTER 2 9

CONCEPTUAL FRAMEWORK OF THE PERI-URBAN 9

PART A: Comprehensive Understanding of the Peri-Urban Areas 9

2.1. Concept of Peri-Urban Areas 9

2.2. Conceptual Formation: Peripheries through Urban-Rural Interactions 12

2.3. The Process of Peri Urban Formation: Becoming Urban 15

2.4. Types of Peri-Urban Land Use 21

2.5 Addressing the Demarcation of Peri-Urban Areas 24

PART B: Critical Issues and Challenges in Peri-Urban Areas 27

2.6. Development and Urbanization Pressure 27

2.7. Dynamics of Land Use Change 29
2.8. Environmental Challenges and Lack of Resources 31
2.9. Transformation of Agricultural Land 32
2.10. Social Form and Demographic Change 34
2.11. Transportation Networks 36
2.12. Poverty Situation Encountered 37
PART C: Planning and Policy Context for Peri-Urban Areas 38
2.13. An Overview of Policy and Planning 38
2.14. Spatial Planning in Urban and Rural Contexts 40
2.15. Land Use Planning and Policies in Peri-Urban Areas 42
2.16. Controlling Urban Sprawl and Planning Approaches 44

CHAPTER 3 46
THE CASE STUDY OF IZMIR 46
3.1. Location of the Research Area: İzmir, Turkey 46
3.2. The Evolution of Urbanization in İzmir Metropolitan Area: A Historical Perspective 48
3.2. Scope of Planning and Territorial Jurisdiction in İzmir's Metropolitan Area 50
3.3. Planning Functions for the Peripheral Areas of Izmir Province 54
3.4. Dataset and Analysis of İzmir Research Area 56
3.4.1. Land Use in the Metropolitan Area of Izmir 57
3.4.2. Measuring Land Use Change in the Metropolitan Area of Izmir 61
3.4.3. Population in the Metropolitan Area of İzmir 70
3.4.4. Distance from the City Center of İzmir 77
3.4.5. Slope in terms of Suitability for Settlement 78
3.4.6. Proximity to Major Transportation Networks 79
3.4.7. Change in Land Surface Temperature 81

3.5. Case study methodology 85
3.6. Limitation of the Study 92

CHAPTER 4 94
THE CASE STUDY FINDINGS 94

CHAPTER 5 102
DISCUSSION AND CONCLUSION 102

REFERENCES 107

APPENDICES 123
APPENDIX A 123
APPENDIX B 127
APPENDIX C 128

LIST OF FIGURES

Figure 1. Research Structure 8
Figure 2. The range of conceptions of the term "Peri-Urban" 10
Figure 3. Cyclical model of the rural-urban relationship, Source: (Cloke & Edwards[34]) 14
Figure 4. No limit in the periphery, New urban construction on top of the hills. Photo taken from Çeşme-İzmir highway on 28th of June 2024 16
Figure 5. Simplified process of modernisation, Source: (Lynch[2]) 20
Figure 6. New apartment constructions are moving toward olive groves, Yelki. Photo taken in 28th of June 2024 30
Figure 7. Changes in rural and world population, Source: (Global Share of Urban and Rural Population 1960-2021 | Statista, n.d.) 34
Figure 8. Principles and Outcomes - Spatial Planning in Peri-Urban Areas (Source; Gallent et al[27]). 41
Figure 9. İzmir, the metropolitan city of Turkey, which is the content of the study area. (Source: The official administrative boundaries of İzmir city are used by the author to elaborate. UTM Zone 35N, Datum WGS 84). 47
Figure 10. Urban areas sprawl of İzmir 48
Figure 11. Legal Regulations Associated with Urban Areas in İzmir over a 36-year period (1986–2022), Source: Created by the author. 52
Figure 12. Change in Agricultural Areas in İzmir over a 36-year period (1986–2022), Source: Created by the author. 53
Figure 13. Land Use Land Cover 2018, (Source: CORINE) 59
Figure 14. Land Use 2022, Source: Created by the author. 60
Figure 15. (a) Land cover satellite image for the year 1986; (b) Land cover satellite image for the year 1998; (c) Land cover satellite image for the year 2010; (d) Land cover satellite image for the year 2022 Source: USGS web sites (https://earthexplorer.usgs.go) 63
Figure 16. Process Flow Chart for Making Land Use Maps 64
Figure 17. Land use change of Izmir province from 1986 (a) to 1998 (b) 67

Figure 18. Land use change of Izmir province from 1998 (a) to 2010 (b) 68
Figure 19. Land use change of Izmir province from 2010 (a) to 2022 (b) 69
Figure 20. Population Size in 2022 73
Figure 21. Population Density (Inhabitants per sq.km.) 74
Figure 22. Population Growth (1986-1998) 75
Figure 23. Population Growth (1998-2010) 76
Figure 24. Population Growth (2010-2022) 77
Figure 25. Distance to the City Core 78
Figure 26. Slope Status of Izmir, Source: Created by the author using DEM model from USGS 79
Figure 27. Proximity to Major Transportation Networks 81
Figure 28. Methodology flow for estimation of LST using GIS Software, Source: [131] .. 82
Figure 29. The land surface temperature of İzmir in 1986 83
Figure 30. The land surface temperature of İzmir in 2022 84
Figure 31. Surface temperature difference of Izmir between 1986 and 2022 85
Figure 32. Methodology flow chart 86
Figure 33. Urban, Rural, and Peri-Urban Areas in Izmir (Weighting, Spatial > Demographic > Environmental) 98
Figure 34. Urban, Rural, and Peri-Urban Areas in Izmir (Equal Weighting) 99
Figure 35. Surprising architectural elements, a scrapped plane inside the campus of a private school, converted for educational purposes. Private school campuses have recently become one of the most common uses in the peri-urban areas. Yelki, İzmir, Photo take in 28th of June 2024 100
Figure 36. Horse farms as a recreation place targeted exclusively toward city people, Urla, İzmir, Photo take in 28th of June 2024 101
Figure 37. Ship scrapyard Urla, İzmir, Photo take in 28th of June 2024 103
Figure 38. Golf course in Urla, İzmir, Photo take in 28th of June 2024 104

LIST OF TABLES

Table 1: Satellite Imagery Information in the Study Area 62
Table 2: Land Use Classification 65
Table 3: Land Use Distribution by Years (% in percentage) 65
Table 4: The Population of Izmir in 1986, 1998, 2010, and 2022 71
Table 5: Population of Izmir according to its districts in 1986, 1998, 2010 and 2022 ... 72
Table 6: Criteria used to Demarcate Peri-Urban Areas 88

CHAPTER 1

RESEARCH CONTEXT

1.1. Introduction

The trajectory of human history is advancing toward an urbanized existence, and the expansion of cities is now recognized as a global phenomenon.[1] The liberalization of the global center in the Western world, along with globalization and the accumulation of capital, has led to a rise in human mobility and significant progress in transportation and communication. These developments have significantly enhanced the connection between urban and rural areas.[2] These advanced connections are integrating cities with rural areas and vice versa. This situation leads to greater interaction between urban and rural areas, making the boundaries between them unclear. Consequently, the concept of peri-urban areas has emerged due to the limitations of the urban-rural dichotomy.[3] Peri-urban areas are typically located on the outskirts of cities, where urban sprawl occurs, and the effects of urbanization are experienced. In a broad sense, the peri-urban area is where rural and urban areas meet and interact, resulting in changes in both.[4] In these areas, there is a state of being caught in between them.[4,5] Moreover, defined as the interface between urban and rural areas, peri-urban areas are characterized by their dynamic nature and constant change.[6] The boundaries of peri-urban areas are not fixed; they are diffuse.[7] Therefore, it can be stated that peri-urban areas are associated with historical-geographical development dynamics, experiencing periods of both stagnation and gradual growth.[8] In addition, Pryor[9] noted that peri-urban areas vary from city to city and over time. Thus, accurately characterizing and demarcating the boundaries of peri-urban areas becomes more complicated.[10] Moreover, the work of developing efficient policies and strategies to handle the growth in peri-urban areas is getting more difficult because these places are in a state of transition between rural and urban and have seen fast urbanization for many years. This ongoing pressure from urbanization jeopardizes the region's long-term sustainability. The peri-urban areas are highly

significant due to their hosting of substantial agricultural lands, ecosystem services, and biodiversity habitats. Consequently, new social dynamics brought about by globalization, such as nation-state deregulation and economic liberalization, necessitate the redefinition of these areas. Therefore, immediate action is required to demarcate peri-urban areas that are ambiguous or open to interpretation.

In Turkey, rapid urbanization and urban sprawl have been occurring since the 1970s. With centralization processes, cities are increasingly sprawling into rural areas, leading to increased construction pressure, a decline in agricultural production, and a loss of natural resources. Notedly rural areas, particularly those near urban areas, are becoming more vulnerable to construction and urban development pressures, risking disappearance or abandonment. Thereby, rural areas are being transformed into urban uses such as shopping, tourism, and entertainment centers. The urbanization witnessed in the 2000s has resulted in the sprawl of cities, the dispersal of populations, the fragmentation of urban regions, and the invasion of cities into rural areas. This has led to increased construction demands and the proliferation of commercial spaces. In addition, the economic policies of the new age have led to a fall in conventional production activities in rural areas, a reduction in employment opportunities, and the migration of the young and energetic population from rural areas. In Turkey, recent legal regulations have altered metropolitan municipalities' boundaries, transitioning to an urban governance model in which an entire province is considered urban. This has increased urban representation within metropolitan governance, allowing rural regions to benefit more from urban services. The peri-urban areas at the edges of urban settlements are valuable for hosting a wide range of human activities such as environmental and cultural assets, natural resources and agriculture, water supply, recreation, and tourism. Additionally, they are recognized for their landscape resources, fertile soils, valuable minerals, and scenic beauty. The land use in these areas is crucial for the planning and management of urban peripheries. Therefore, defining the boundaries of urban peripheries is an important issue in terms of planning stakeholder management. With the development of urban areas, the peripheral areas affected by this growth constantly change in terms of geographical location and land use. Evaluating these changes is essential for planning studies at local, regional, and national levels. Particularly in major cities like Izmir, factors such as increasing population, lack of sufficient space in the center, high-cost urban lands, and new transportation connections

have led to the expansion into surrounding areas and the loss of fertile lands. To understand the nature of this situation, one must focus on the city's historical growth processes and socio-spatial extensions. In this context, the specific aim of the research is to demarcate the boundaries of the peri-urban areas of Izmir, a developed metropolitan city, and identify the characteristics of these areas. If a formation distinct from the classical center-periphery system, which is defined by and linked to a single center, is being discussed, it becomes evident that defining a distinct form is challenging.

Primarily, the study employs a quantitative methodology that combines multi-criteria decision analysis with geographic information systems using Landsat satellite images and government data sources to demarcate the boundaries of peri-urban areas. Utilizing a case study approach, this study examines the land use status of Izmir province, spatial distribution-based changes in land use over a 36-year period (1986–2022), population size, density, and growth during the same period (1986–2022), factors such as slope, land surface temperature, distance from the city center (30–50 km), and proximity to major transportation networks in terms of suitability for settlement. Based on the criteria of limitations and a review of the literature, the areas have been categorized according to their level of urbanization. The determined criteria were subsequently overlaid using GIS technologies to demarcate the boundaries of urban, rural, and peri-urban areas for the province of Izmir. The study demarcated the locations of these areas within the İzmir province, and based on these findings, recommendations for the future planning of peri-urban areas were proposed.

1.2. Problem Definition

With the process of globalization, many cities around the world tend to urbanize by increasingly being brought into rural areas. This trend has resulted in the emergence of conflict between urban and rural areas due to factors such as rapid urbanization, rivalry for resources, and the disruption of traditional farming techniques. These conflicts have brought forward another phenomenon, awareness of peri-urban areas. As a result, urban peripheries become vulnerable to pressures from urban centers, and intricate, non-linear processes and ambiguities effects have occurred in these areas. This

uncertainty in peri-urban areas leads to erroneous planning and management practices, which in turn cause numerous problems. These include the deterioration of environmental balance, pollution or disappearance of water resources, destruction of natural ecosystems, loss of biodiversity, decline of traditional production activities due to decreased agricultural lands, increase in energy consumption, and deepening social inequalities.

Many countries, including Turkey, are struggling with similar problems. In line with global Western liberalization, globalization, and capital accumulation, Turkey is experiencing the expansion of rural areas into urban areas due to the effects of urban sprawl, decentralization, fragmentation. Particularly in metropolitan cities like Izmir, factors such as increasing population, insufficient space in the center, high-cost urban lands, and new transportation connections lead to the city's sprawl into peripheral areas and the loss of fertile lands. The improper demarcation of peri-urban areas and the misdirection of urban sprawl boundaries are closely linked to the inadequacy of policy instruments. In particular, legal regulations and policies that classify entire provinces as urban areas lead to diminished villages' control over their resources, resulting in the decline of traditional production activities. For these reasons, we must handle the relations between rural and urban areas in a balanced manner, eliminate the uncertainty of their border areas, and improve their management. Research to be conducted specifically in Izmir province will help understand the conflictual interplay between urban and rural areas and demarcate peri-urban areas.

1.3. Aim of Research Study

The ambiguous boundaries between urban and rural areas have created dynamic and anonymous peri-urban areas, causing conflicts and agreements. Therefore, new social dynamics like nation-state deregulation and globalization's economic liberalization necessitate the re-demarcation of these areas. Moreover, it's crucial to examine temporally changing administrative and spatial boundaries, understand the changing interaction between city and countryside, and consider how peripheral areas should be handled in spatial planning. Instead of examining rural and urban areas

separately, the mutual interaction between the two is focused on in this study. The development of a comprehensive rural-urban interface concept and planning approach will both contribute scientifically and create new potential for metropolitan city governance. In this context, the specific objectives of the research are to demarcate the peripheral areas of Izmir city and reveal the characteristics of these areas. In addition, it aims to present strategic solutions by addressing how planning and management affect these areas, and the challenges encountered and to emphasize how peripheral areas should be approached.

1.4. Research Questions

According to the definition of the problem and the aim of the study, the following research questions will guide this research:

I. What are the peri-urban areas? How did it emerge? What challenges do these areas suffer from?

II. What are the significant land-use changes that have occurred in İzmir over time? How did this change affect the peri-urban areas of Izmir?

III. What are the accurately demarcated peri-urban areas for İzmir province?

IV. What are the appropriate approaches for Izmir province's peri-urban areas in the planning process? Which strategies should be implemented in these areas?

These research questions will be addressed to provide recommendations and strategies to policymakers, practitioners, planners, and other stakeholders involved in the planning and implementation of the city of Izmir.

1.5. Methodology Approach

A rigorous methodology for demarcating peri-urban areas has been developed through a comprehensive review of relevant literature and careful consideration of

research objectives, ensuring the reliability and validity of the results. The case study employed a quantitative methodology approach that integrates multi-criteria decision analysis with geographic information systems, utilizing Landsat satellite images and government data sources. Initially, a systematic literature review was conducted to comprehensively understand and demarcate the concept of peri-urban areas, which has been discussed both explicitly and implicitly in the literature. Subsequently, this case study specifically focused on demarcating and planning Izmir's peripheral areas, which experience frequent shifts in administrative boundaries due to legislative policies and socioeconomic changes. Additionally, based on the literature review, appropriate and achievable criteria were established for demarcating peri-urban areas. These criteria encompass changes in land use patterns over a 36-year period (1986-2022), population size, density, growth trends during the same period, slope suitability for settlement, variations in land surface temperature, distance from the city center (30-50 km), and proximity to major transportation networks. These criteria were overlaid using the Weighted Overlay tool in GIS software, based on urban-rural indices.

Finally, urban-rural and peripheral areas were demarcated for Izmir province. Peri-urban areas were demarcated by considering interactions between rural and urban areas, aiming to clarify uncertainties specific.

1.6. Structure of Research Study

The study consists of five chapters, including a case study. The first chapter constitutes the general content of the research; the second chapter contains the literature review; the third chapter contains the case study; and the last two chapters constitute the findings, and conclusion sections.

Regarding each section's specifics,

The first chapter of the study, known as the introduction, describes the problem being researched, the research questions, and the aim and methodology of the research. The second part will focus on understanding the concept of peri-urban areas and exploring their details. This includes examining the characteristics that define peri-

urban areas, such as their transitional nature between urban and rural environments, the mixed land uses, and the socio-economic dynamics at play. By clarifying these aspects, we aim to provide a comprehensive framework for demarcating peri-urban areas, particularly in the context of İzmir. In the third chapter, a case study focusing on İzmir is presented, explaining in detail why İzmir was chosen and describing the process of identifying its peri-urban areas. Additionally, this section provides a detailed examination of land use changes in the study area, as well as the weaknesses in planning for these areas in İzmir. Finally, in the fourth and fifth chapters, it is shown to complete the study by including the typologies for the peri-urban areas as the final product, discussing the results, and then making general evaluations and inferences (Figure 1).

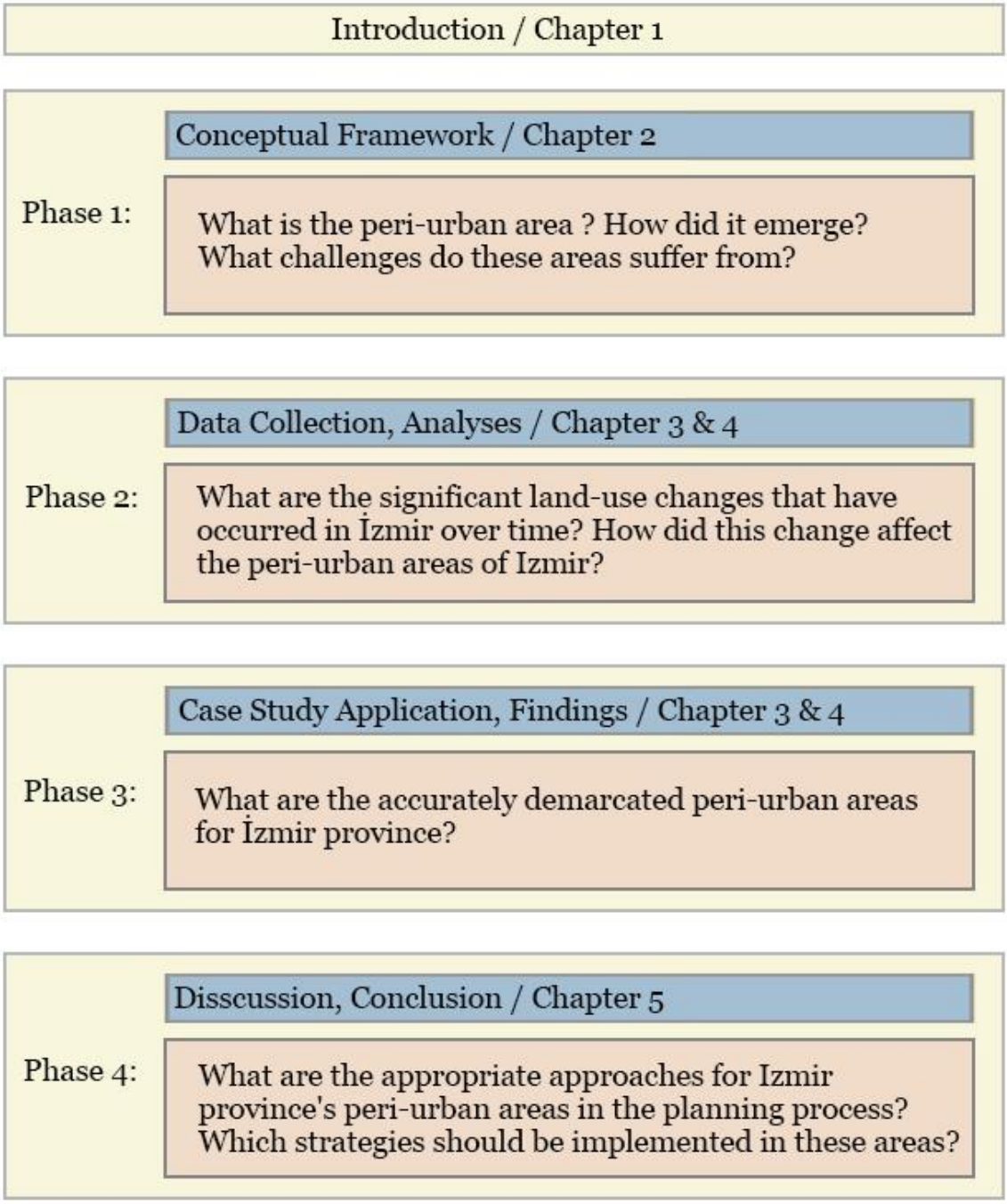


Figure 1. Research Structure

CHAPTER 2

CONCEPTUAL FRAMEWORK OF THE PERI-URBAN

PART A: Comprehensive Understanding of the Peri-Urban Areas

2.1. Concept of Peri-Urban Areas

The settlement trends of societies from the past to the present have changed over time, and today's increasing population movements and the gradual sprawl of urban centers into rural areas have increased awareness of peri-urban areas. Despite the increasing number of studies, the concept of peri-urban definition remains unclear in terms of spatial and conceptual aspects.[11,12] In essence, peri-urban areas, which extend from the end of cities to the countryside, are complex, dynamic, and variable phenomena in which rural and urban uses coexist.[13] The complexity of peri-urban areas appears to be the main obstacle to making sense of the phenomenon. With its unique spatial structure, ideas, practices, actions, people, and commodities are constantly moving, while their borders can be redefined, and this state of movement makes them uncertain.[6] Therefore, these areas are characterized by ambiguous boundaries, frequently spanning across multiple administrative units.[14]

Approaches to defining the concept vary both over time and according to theoretical perspectives;[13] they generally differ depending on the case or situation studied. Furthermore, it may vary by country and city, ranging from technical analysis to social, cultural, and structural perspectives.[15] For this reason, the concept of peri-urban is still a controversial issue today, with attempts to define it both conceptually and geographically continuing.[11]

Peri-urban areas can be mentioned as challenging regions with a relatively low population density, dispersed settlements, fragmented communities, and deficiencies in

spatial management.[14,16] The variety of terms used to conceptualize peri-urban areas raises serious concerns, as with many concepts.[1] Due to the parallelism of different approaches and models, the peri-urban concept constantly suffers from ambiguity and a lack of a widely accepted definition.[13] The literature attempts to understand the concept of peri-urban by conceptualizing it with partially synonymous words and using various terms.

Among the many terms used to describe the peri-urban area, the most commonly used today is peri-urban[17] but it has also been referred to as urban fringe belt [8,17], rural-urban fringe[9], rural-urban interface[2], (exurban) exurbia[18], peri-urban interface[19,20], peri-urban environment[3], and urban shadow[21], etc. (Figure 2). The researchers agree that there is a dividing line between 'rural' and 'urban', as well as surrounding areas that pass beyond the central area as a result of the city center's development.[22] Thus, it can be partially stated that peri-urban areas are defined according to their distinctiveness and characteristics.

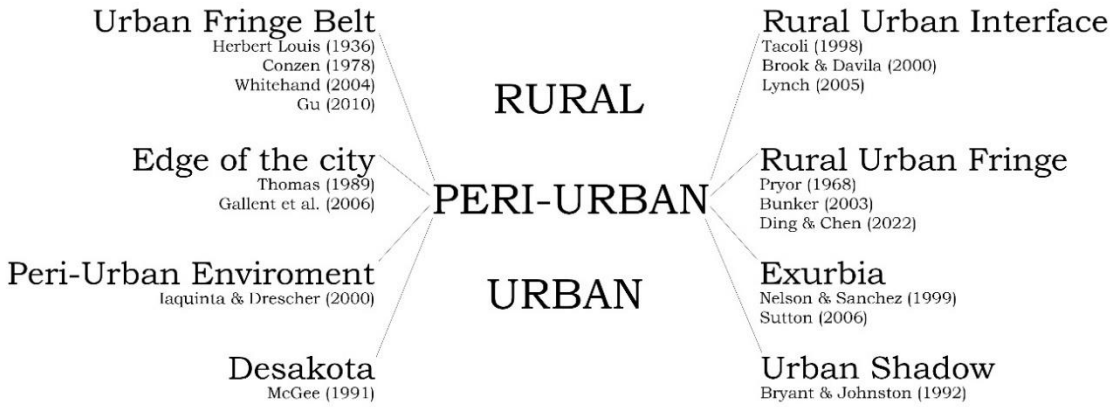


Figure 2. The range of conceptions of the term "Peri-Urban"

The PLURAL project defines it as the area between urban and rural lands,[23,24] a while many other authors view it as a transitional zone where the distinction between countryside and city becomes ambiguous and intertwined.[25] Due to its transitional nature, urban peripheries denote an interface within a process that establishes various contexts connecting fluidly between rural to urban or urban to rural.[26] These fluidities, in a way, make the walls constantly evolve and transform. However, Gallent[27]

emphasizes that contrary to the discourse in the literature which describes the peri-urban area as a broad buffer zone between rural and urban areas, these areas possess unique and distinctive characteristics rather than being merely transitional deviations. The unique nature of peri-urban areas is differentiated by larger property parcels, fewer residential developments, more open spaces, less built-up area, lower street density, and more vegetation.[8,28]

Observable peri-urban areas in medieval settlements, as well as accompanying city plans, received little attention from scientists and professionals until the 1930s.[1] One of the authors who first drew attention to the phenomenon of the peri-urban (fringe belt) (from the German Stadtrandzon) in history, Herbert Louis, in his research on the city of Berlin in 1936,[8] and the other, Smith, in 1937,[9] introduced the concept of the peri-urban (urban fringe). Louis highlighted the notion of the peripheral, which refers to the outside edges of a city where urban growth is constrained by physical barriers, and the peri-urban areas, which are located on the outer edges of the city, gradually became integrated into the urban area.[8] Based on the ideas of Louis, his student Conzen continued the research, examining the relationships between urban sprawl and peri-urban areas, and proposed that the uneven nature of urban sprawl is the root of the concept of the peri-urban areas.[1,17] Conzen was the first to provide a comprehensive definition of peri-urban areas (urban fringe), describing them as urban units that have become buried in the inner regions due to city growth, and differ in terms of texture and land use in the densely built areas of the city.[8]

By the 1950s, in an effort to clarify the diversity of terminology and distinguish between commonly used terms, Kurtz and Eicher[29] defined the peri-urban phenomenon as distinct from suburbs. They described it as a location beyond legal city boundaries, characterized by agricultural hinterland, mixed land use, and a lack of dense residential patterns.[9,29] They noted that residents living in peri-urban areas (urban fringe), which represent regions with unique characteristics beyond the suburbs, possess mixed rural and urban attributes and integrations.[13,29] In the 1990s, peri-urban areas (fringe) began to be examined under the synonymous name exurbia. This shift in terminology reflected the growing recognition of the distinct characteristics and dynamics of these areas. Nelson and Shanchez [18] by attempting to define some differences and similarities between suburbs and exurbia, it was determined that exurbia does not extend into the true hinterlands beyond the commuting range of central cities or edge cities.[18]

Thomas[1] after various terminology assumptions, uniquely defined peri-urban areas as distinct from rural and urban zones, and also noted that they possess a specific character of human settlements. According to Gallent[27] it similarly, is suggested that peri-urban areas extend beyond urban boundaries, delaying the onset of true rural areas and forming a unique land surrounding the city. These unique areas are in constant motion but also involve a reaction that counteracts all these changes. Thus, peri-urban areas are associated with historical-geographical development dynamics, characterized by periods of stagnation and gradual growth.[8] Additionally, peri-urban areas are a landscape phenomenon that can vary from city to city and change over time.[9] In conclusion, when considering the present day, peri-urban areas are the product of mobility, rapid change, fragmented politics, control and land speculation, uncertainty, lack of community, political interest, economic change, redundancy, and consumption.[27]

2.2. Conceptual Formation: Peripheries through Urban-Rural Interactions

For descriptive purposes of the peri-urban areas, one must consider the unclear boundaries between rural and urban areas, the interaction between rural and urban areas[2] and the continuity of cities-oriented outward towards the countryside.[13] From the past to the present, without disregarding the components of cities, peri-urban areas have been viewed both as a component of rural areas and as an integral part of them. Scholars have sought to understand the nature and role of peri-urban areas in this context.[1,9,27] Thus, it is not enough to define the concept of peri-urban areas, where these two areas come into contact, without addressing the dilemma between rural and urban. The concept of the classical urban-rural divide is not new and refers to the conceptual discussion surrounding the interaction between rural and urban areas. Nevertheless, the absence of a universally accepted definition for rural, or urban frontier areas can be attributed to the disparities in disciplinary perspectives and methodologies between rural and urban traditions. The concept of peri-urban is closely linked to the idea of maintaining connections between urban and rural areas. This lack of relationship and meaning necessitates a review of basic principles that support and contribute to clarifying its meaning and related phenomena. Leo Marx[30] compared “one identified with rural peace and simplicity, the other with urban power and sophistication”. The

concepts of city and countryside are dominant representations that suggest a well-planned landscape. The perception of both rural and urban areas can be analyzed independently, as these perceptions change over time within each civilization. The perception of the peri-urban areas becomes a crossroads where the town meets the countryside, or the urban competes with the rural.[31] Peri-urban areas have emerged due to the weaknesses in the rural-urban dichotomy, addressing the origins of both rural and urban settings.[3] Thus, peri-urban areas can be defined not as separate from rural and urban zones but as areas formed by the intersection and interaction of these elements.[6] In fact, the growing interest in the boundary between urban and rural areas indicates that there is no clear distinction; rather, there is an overlap that facilitates both positive and negative flows in both directions.[2] Similarly, interactions between rural and urban areas have long been linked to complementary needs and opportunities. In this context, the geographical distinction between urban and rural areas has become increasingly unclear. This highlights the importance of peri-urban areas, which lie between the advancing fronts of urban and rural development. Allen[20] noted that although there is no consensus on the definition of peri-urban areas, there is an awareness that rural and urban characteristics increasingly tend to coexist at the edges or beyond the boundaries of cities. Yet urban and rural uses mix, and conflicts between these uses are constantly reproduced. Although the distinction between rural and urban is inevitable for descriptive purposes,[22] the areas where rural meets urban should be considered by making sense of the relationships between them rather than focusing on urban and rural areas separately. Peri-urban locations possess distinct traits that set them apart from urban and rural surroundings, as the literature acknowledges. Although peri-urban areas and rural-urban areas are managed in constant communication, these two systems of fragility coexist at the same time.[20,32] In other words, these are areas that possess rural characteristics but are precursors to urban development. Despite transformation, they retain their rural past and establish various pathways to integrate into the urban context.[3]

Lynch[2] views the forms of rural-urban and peri-urban areas as interconnected systems subjected to influences and processes, describing them as "a multidimensional continuum, regular or irregular." The urban and rural can be considered interconnected systems, integrated and complementary to each other, characterized by flows and juxtapositions. Pahl[33] who studied the concept of rural-urban continuity, pointed out that it is possible to find elements of ruralism in urban areas and vice versa. In general, the

theoretical evaluation of rural-urban relations has been seen as a fluid, cyclical model scheme[34] (Figure 2). Although this model is not an accurate representation of temporal changes in 'rural' and 'urban' areas, it appears to follow the oscillation between rural and urban views through various processes.[34]

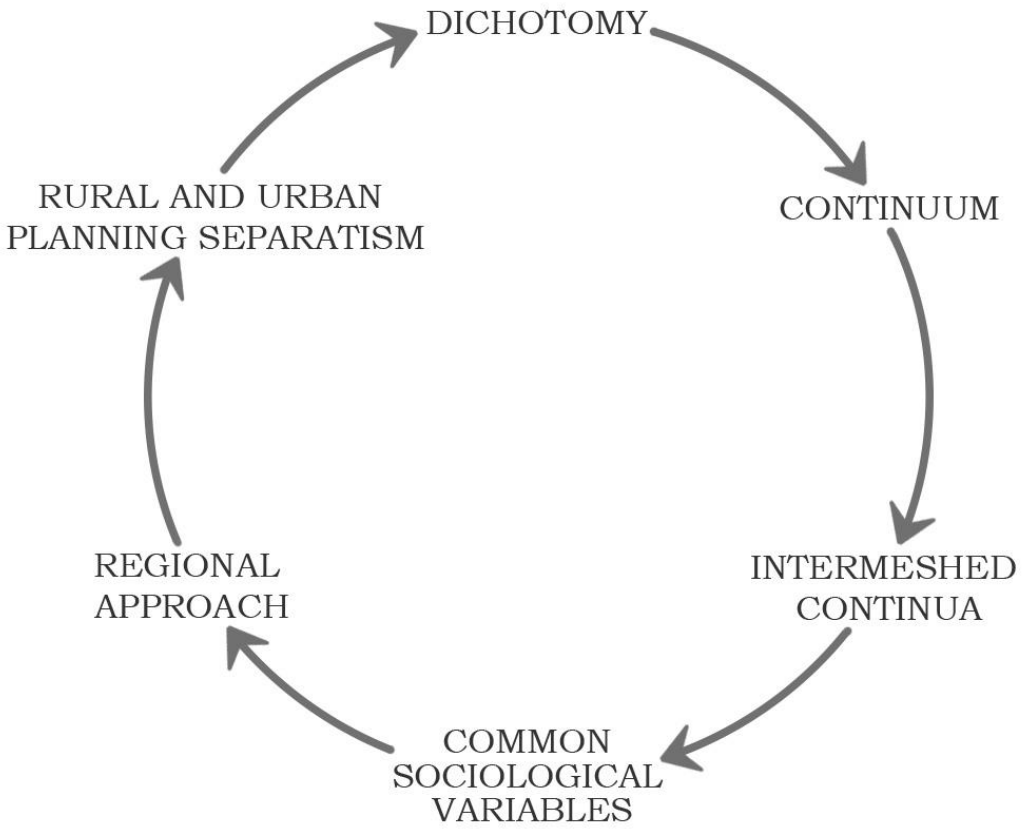


Figure 3. Cyclical model of the rural-urban relationship, Source: (Cloke & Edwards[34])

The intersection and flow of people, environment, money, food, and ideas between rural and urban areas, as well as their transformation from one to the other, should be considered. Considering the ongoing transformation of rural and urban areas, various flows such as population migration, financial transactions, food distribution, and capital investment play crucial roles in movements, contributing to phenomena such as urbanization, economic development, and social change.[2,22] In this process of change, economic, social, environmental, cultural, etc. in general. The flows between the factors must be followed.[35] Since, merely focusing on geographic location fails to provide a comprehensive understanding of the dynamic, transformative, and interactive characteristics of the urban periphery.[3] Allen[20] asserts that urban peripheries are heterogeneous mosaics of "natural, productive, and urban" ecosystems, influenced by

material and energy flows demanded by rural-urban systems. Each of these systems conditions is conditioned by the others. In this context, rural-urban interaction is at its highest level outside of areas with permanent construction.[22]

Lynch[2] has discussed that without good governance of rural-urban linkages, it can lead to exploitative effects. When food production, water, and energy systems are considered to meet the needs of the city, the countryside remains in the background. While rural areas may be perceived as non-urban spaces or simply defined as such, the prevailing view suggests that the rural region represents a regional segment characterized by relatively low population density and a regional economic structure, typically consisting of small to medium-sized towns surrounded by extensive open space. This perception reflects the situation of a particular country.[36] While economies, employment, education, services, accessibility, ethnic origins, and other aspects may differ between urban and rural areas, comprehensive studies that consider flows, networks, and development corridors—rather than strict demarcations between urban and rural areas—demonstrate how peri-urban areas can be understood by considering multiple definitions and urban-rural gradients.[37] Given that rural and urban areas are defined differently from writer to writer and country to region, there is no universally applicable definition to constrain them.[36–38] The peri-urban areas, situated between rural and urban areas, form a highly complex system as an interconnected rural-urban continuum. Classification into a continuum from rural to urban is necessary, and in addition to the complexity of this system, the concept of peri-urban areas comes into play at the intersection where rural and urban systems overlap, with one foot in the rural and the other in the urban.[2]

2.3. The Process of Peri Urban Formation: Becoming Urban

The global phenomenon of urbanization, characterized by the rapid growth of cities, has been widely considered a significant development in human history.[1] The emergence of globalization has brought about complex and profound changes that have impacted the connections between different communities. Today, with the perception of globalization, multifaceted fundamental changes also affect the relations between

settlements. When society leaves the city center and its immediate surroundings, the most appropriate solution in terms of transportation, communication, and infrastructure is to settle on the periphery or inside of old small cities. This process radically alters the city's settlement pattern.[39] The increased mobility of humans, and the development of transportation and communication have resulted in a heightened level of connectivity between rural and urban locations. Such advanced connections link the urban to the rural, and the rural to the urban.[2] This situation is evident in new urban constructions on top of the hills, as captured in the accompanying photo taken from the Çeşme-İzmir highway (see Figure 4).

Figure 4. No limit in the periphery, New urban construction on top of the hills. Photo taken from Çeşme-İzmir highway on 28th of June 2024

Gallent[27] argues that contemporary transportation infrastructure has had an important effect on the growth of cities, influencing both their physical form and the lived experiences of their inhabitants. Therefore, the development of road and rail networks in city centers has facilitated the process of decentralization in the greatest urban systems, resulting in a transformation of the rural-urban boundaries.[27] This transformation can be characterized by dispersed sprawl in urban areas, population growth in easily accessible rural areas, or the exact opposite: a society moving away from agriculture.[40] In addition to globalization, another feature that has emerged in recent times and affects fringe formation is the trend of counter-urbanization, particularly observed in developed countries. Rural areas have noticed a surge of wealthier individuals as a result of urban challenges stemming from the clustering of the city center, including overcrowding, social isolation, security concerns, and rising levels of urban poverty. The peripheral areas disappeared as settlements grew, but eventually reformed or sprawled beyond their former borders and expanded into rural areas, a process that continued for centuries. Due to its flexible structure, peri-urban areas encompass a formation process within dynamics and change. As a result, peri-urban areas form their landscape and peri-urban areas can be described as dynamic landscapes because they face constant pressure and survive as a melting pot between urban and rural, between the pressure for growth and the desire to preserve.[41] Friedman[41] (p. 431) defines these areas as "zones of encounter," "conflict," and " transformation surrounding large cities" zones, viewing them as a process called "becoming urban". A few researchers like Friedmann[41] have found the utility of subdividing the peri-urban area into two distinct areas, one being the inner periphery close to the edge of the city core and beyond it, the outer periphery where urban presence is attenuated and perhaps less visibly apparent.[41] Treating the peri-urban in this way leads to the examination of specific urban regions and their recent and contemporary spatial histories.[41] On this scale, based on their historical progress, it may be inferred that the subject being investigated here is a complex phenomenon that cannot be easily generalized.

The urban periphery interface is characterized by its heterogeneity, resulting from the intricate combination of urban, rural, and natural systems. Geographically, it is situated in an intermediate position between urban and rural areas, experiencing significant demand pressures and undergoing different changes. Specifically, land located in metropolitan areas is often subject to urban development.[32] Depending on the

specific conditions in which it is placed, it produces varying results on each occasion. By its nature, it is highly dynamic and is expected to continue growing rapidly in the coming decades.[42] Conversely, in the more extensive rural regions, the rate of physical transformation may be considerably more gradual, but societal and economic transformations will undoubtedly alter the environment in the years to come.[27]

Historically, outlying areas have functioned as a service to the city. As cities develop, surrounding neighborhoods transform from rural to urban characteristics. Urban perspectives view urban sprawl as a strategy for prioritizing the city's needs and achieving urban demands through resource provision. Rural perspectives generally perceive urban sprawl as a threat. However, there are instances where it can be considered an opportunity for rural development since it can bring in new sources of revenue and skills to places outside the city. Urban expansion into rural areas is a significant catalyst for change in urban peripheries. This phenomenon persists due to the decline and dissolution of rural areas, which are unable to compete with the opportunities provided by cities. However, this process includes a phase known as peri-urban existence, which is poorly defined and characterized by rapid and unpredictable changes in space and time. This transitional period can extend for many years. The historical environment in the peri-urban areas today is often shaped by industrial and service activities that have developed in response to the growth of the surrounding urban center.[27] Alternatively, it may have originated from its previous existence as a dispersed settlement in prehistoric times.

Globalization can be defined as hyper-accelerated urbanization in certain rapidly industrializing regions of the world.[25] Urbanization refers to the complicated interplay of different forces that ultimately transform rural landscapes into urban-like surroundings. This phenomenon can be regarded as a gradual spatial expansion process that slowly changes the spatial structure, hence generating new landscape patterns.[43,44] Moreover, urbanization encompasses more than just the expansion of urban areas into rural areas and the conversion of rural areas into cities. In fact, urbanization essentially refers to the concentration of population in urban spaces, i.e., centralization, whereas metropolitanization involves the outward movement of population from the center, differentiation, fragmentation, suburbanization, and expansion into the surrounding environment.[45] Peri-urban areas are complex areas that bear the effects of urbanization. Due to urbanization, metropolitan cities and towns all over the world are continually

expanding their territories into nearby urban areas.[46] Peri-urban areas, identified as the primary battlegrounds of urban growth, also assist in determining the developmental phases of cities throughout their historical-geographical evolution and outward sprawl.[47] In the literature, peri-urban areas are depicted as a phase rather than a place, and the peri-urban is seen as the most active urbanization area influenced by the urban core. Urbanization directly and indirectly impacts rural areas through increasingly urban sprawl. There is a situation of being stuck in between as both the rural and urban create a state of transition.[4] Urban sprawl is the main driver of these changes, as cities gradually expand and consume rural areas, leading to their eventual transformation. As a result, urban sprawl is the first step in defining urban boundaries. Understanding the formation of peri-urban areas involves examining what happens in the actual process of formation as a result of urban sprawl.[48] It is therefore envisaged that an inclusive rural area will be replaced by a fully urbanized area, and borderline irregular landscapes characterized by a mixture of urban and rural activities are evaluated according to this established succession and set aside as temporary places that will soon disappear.[4] The sprawling city "continuously absorbs the edge area and creates a 'new' edge away from the city center," a process resulting in the continuous movement (or dynamism) of the peri-urban.[49] Peri-urban areas function as both boundaries and dynamic frontiers that sprawl and advance. Lynch[2] portrays the modernization of the urbanization process, considering the development of urban areas as inevitable. According to him, the variable lies in the development process's pace. This phenomenon suggests that urban and rural areas will eventually equalize (Figure 5). Furthermore, it can encompass a stagnant response that opposes these changes while remaining in continuous movement. Similarly, (p. 89) '… a long period of time in a growing city a site is likely to be transformed from a peripheral location to one deeply embedded within the built-up area.'[50]

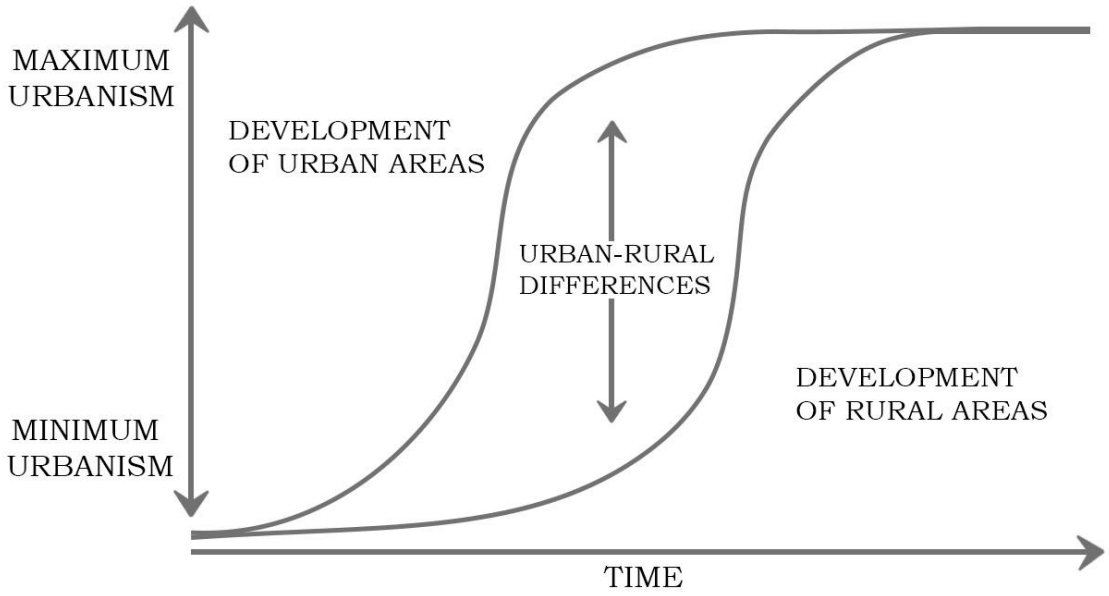


Figure 5. Simplified process of modernisation, Source: (Lynch[2])

Peri-urban areas gradually move away from the center of urban settlement over time and are typically in outward motion.[7] Since the formation of fringes involves the gradual transformation of a completely rural area into an urban one over time and pauses, the best approach is to provide descriptions of the events that transform these areas and to understand why they occur from a historical perspective. A periphery is an area that tends to survive sometimes as a continuous belt, distinguishing the old development from the new development when environmental land uses are enveloped by later outward growth of settlement.[27] Given that the gradual transformation of a rural area into an urban one forms the periphery, it is most effective to provide detailed accounts of the events that drive this shift and to understand their historical causes. Peripheral areas, which previously had a rural character and were urban precursors, have, despite their transformation, largely incorporated the rurality of their past and could establish location-specific and different ways of integrating into the city. Peri-urban areas are highly fragmented, and this affects their productivity, investment, resources, and character.

Furthermore, the act of establishing transitional or third spaces has been defined and characterized in different ways. According to Leaf [25], developments located in the farthest reaches of the sprawled metropolitan area are spatially and demographically defined as "peri-urbanization". Peri-urbanization is claimed to be primarily

characterized by the increasing transformation of rural structures into urban activities, coupled with the rise of jobs and spatial discrimination.[7] This process of peri-urbanization is closely linked to the formation of fringe areas, Urbanization steadily sprawls upon rural landscapes, hence changing the interface between urban and rural environments.

2.4. Types of Peri-Urban Land Use

While peri-urban areas are generally recognized as transition zones from urban to rural areas, they constitute a distinct area with unique land use patterns that differentiate them. They encompass a diverse range of additional uses classified as urban and rural, presenting a multifaceted spectrum of land utilization.[27] Peri-urban areas take on specific shapes based on their interactions with the central city, and because of these differences, they develop their own unique characteristics.[48] In other words, the dynamics of changing opinions uses, and attitudes of the people who interact with it distinguish it from rural or urban landscapes.[4] Peri-urban areas, intrinsically multifunctional, clearly represent a different spatial organization.[27] In addition, these areas have unique values in terms of spatial, social, economic, and environmental aspects.

Peri-urban areas also have land use diversity that meets personal and social needs because they allow urban residents to establish relationships with the countryside and provide mental and physical health and social services.[2] In particular, there are different acceptance levels among urban residents regarding the various requirements included in social needs. Urban residents generally accept needs belonging to the social basis (facilities, community, housing, and retirement), but they are relatively less accepting of needs belonging to the economic sphere (industry and R&D). Motels, service stations, distribution warehouses, out-of-town shopping malls, and science parks often represent the land use in these areas. In environments closer to the urban population, there are areas characterized by energy production and distribution. Additionally, urban peripheries include vacant and unsealed lands, highly fragmented agricultural lands, remnant forest areas around settlements, and urban green spaces.[43]

Moreover, these areas have environmental values such as various natural resources, ecosystem services, and landscapes. This diversity offers enormous potential to meet the needs of urban residents, both environmentally and socially. It is home to numerous habitats and biodiversity, encompasses water basins and reservoirs, and serves as a hub for food production and various agricultural activities.[2] Additionally, the surrounding regions have a rich and diverse archaeological and historical heritage.[27] It contains traditional historical values, such as rural manors and castles. These areas may be classified as mountainous and rugged terrain, or they may include land awaiting development. These regions may also have service activities such as waste management, water supply and treatment, energy production, and storage and retail.[27] Modern incineration plants, in particular, are valuable in terms of energy production and have the potential to compost urban waste. These regions also contain old mining sites, old factories, and mining areas specifically designed to prevent flooding.[27]

What characterizes the peri-city is an economic transformation from agrarian culture, particularly land loss, to real estate development, industrial production, and logistics facilities, which, in many contexts, also leads to environmental degradation, slums, and food insecurity.[3,13,46] Urban expansion has absorbed large areas of land for housing, commercial buildings, and infrastructure, and there is still a significant need for land.[13] Such constant demand necessitates inevitable transformations and various functions in peripheral areas, ultimately leading to a change in internal land use.[51] Peripheral areas, in particular, have become the most suitable place for many foreign investors to establish factories and companies because they are looking for land that is not only much cheaper than urban land but also has access to fertile land. Accordingly, land use is also changing in this process of economic transformation, and agricultural areas of use are turning into new forms of use such as real estate development, industrial zones, and logistics facilities.[48,52]

Numerous factors, varying from country to country and city to city, can affect peri-urban areas, particularly urban income and lifestyle. In developing countries, informal settlements are often associated with problems such as soil and water pollution, sewerage works, landfills, gas depots, vehicle dismantling areas, highway junctions, industrial waste dumps, and poverty. Because peripheral areas in developing countries often host low-income immigrants, reflecting problems such as unplanned settlement, poor infrastructure, and poor sanitation.[7] On the other hand, in developed

countries, issues such as landscape protection, ecosystem quality, heritage, and rural settlements are important for landscape integrity.[2] In developed countries, peri-urban areas may include commercial recreational facilities such as go-kart tracks, bicycle tracks, golf courses, water sports lakes, garden centers, football fields, and stadiums, as well as suitable locations for animal shelters and dog hotels; additionally, they may host farm shops, nurseries, garden furniture retail, equestrian centers, hunting, and recreational areas.[27] In this context, the status and use of peri-urban areas vary greatly depending on the complexity of both economic and social factors. In other words, it shows that the peri-urban areas offer highly valuable resources such as land, space, and landscaping for the wealthy and powerful class, and that for the lower class, the urban periphery is merely a waste dump that pollutes production at a low cost.[53]

Peri-urban areas are also rich in scenic resources, fertile agricultural lands, valuable minerals, and visual beauties. These areas, which interact with cities, improve people's quality of life by allowing them to maintain their lifestyles in harmony with nature and providing them with the opportunity to escape from urban areas. Since peri-urban areas offer valuable resources in terms of land value and environmental regulation, the land in these areas plays a crucial role in the planning and management of urban areas.[27] It is imperative to meticulously strategize the development of peri-urban areas in order to effectively accommodate marginalized communities that have high population density and significant poverty rates. These areas are also very important in terms of protecting environmental and cultural assets, sustainable use of natural resources, supporting agriculture, protecting water resources, and providing environments suitable for human activities such as recreation and tourism.[53] As urban areas develop, the affected fringe areas are constantly changing in terms of time, geographical location, and land use. To evaluate these changes, it is very important to examine land use and change for planning studies at local, regional, and national levels.[46]

The construction of numerous cities in strategic locations near fertile land and water resources has unavoidably resulted in conflicts over the diversity of land use.[2] In this context, peripheral areas are seen as areas where residents experience constant conflicts regarding land use.[46] Additionally, the diversity in land use in peripheral areas poses a serious competitive problem for land use when available urban land is insufficient.[54] In other words, peri-urban areas also face increasing demands from urban

residents. Urban land use, characterized by high population density and limited activities, can no longer meet residents' diverse needs such as proximity to nature, ecological support, leisure, recreation, and cultural experiences.[55,56] When city centers are densely populated and do not have enough area for recreation, urban residents turn to peri-urban areas.[57] The increasing demands of urban residents may often be incompatible with existing land use functions in peri-urban areas.[56] Therefore, implementing more adaptable and varied land use regulations in urban planning and managing peri-urban areas in a more equitable and environmentally conscious way is necessary.

2.5 Addressing the Demarcation of Peri-Urban Areas

With the rapid growth of urbanization and the continuous sprawl of urban areas into rural areas, it is becoming more and more important to properly demarcate these peri-urban areas. The boundaries of peri-urban areas are not rigid; they are diffuse.[7] Peri-urban areas, situated on the interface between urban and rural areas, are characterized by their dynamic nature and continuous change. As a result, understanding peripheral areas, as well as demarcating and measuring them, is quite challenging.[13] Peri-urban are proximate areas that include biodiversity habitats, forested areas, agricultural lands, and transportation infrastructures, and this proximity further unclear the boundary between urban, rural, and peri-urban areas.[46] Moreover, the task of managing and planning urban, peri-urban, and rural areas through distinct policy guidelines becomes extremely challenging due to the inherent ambiguities in demarcating peri-urban areas.[58]

Although challenging, peri-urban areas can be measured and separated into diverse geographical areas.[27,59] The spatial, socioeconomic, demographic, and physical characteristics of the variables, as well as their cost and availability, all influence the measurement of peri-urban areas.[46,60,61] Within a metropolitan area, one would expect a transition from high to low density as one moves from the center toward the periphery. The demarcation of the boundaries may not always occur in a single direction or a uniform manner, and overlaps may occur. The rate and form of urbanization can vary depending on the dynamics of the region in which the city is situated. Techniques for

demarcating peri-urban areas must be geographically specific and take into account regional and local contexts, including political systems, institutional regulations, societal characteristics, environmental qualities, and economic factors that support peri-urban area development.[46] Similarly, due to physical and anthropogenic barriers, these techniques vary around cities and countries.[13] The literature indicates that all methodological approaches have used various quantitative measures to demarcate peri-urban boundaries. Generally, literature sources have focused on various socioeconomic and spatial indicators for demarcating peri-urban areas. However, most approaches identify urban sprawl by analyzing the spatial-temporal dynamics of urban growth rather than the boundaries of peri-urban areas.[46,62] Nevertheless, establishing clear boundaries for peri-urban areas is crucial for accurately demarcating the size of urban sprawl and is a vital part of the process of demarcating peri-urban areas.[63] Although the spatial demarcation of peri-urban areas has evolved into process-focused transformations, the initial approaches concentrated on identifying geographies extending 30 to 50 km beyond cities that encompass both urban and rural land uses.[13]

Since peri-urban areas are not uniform around the world, a general method is not used to measure these areas. Literature indicates that various studies have developed indices to demarcate peri-urban areas, but often these indices either give equal weight to all indicators or only consider spatial data, neglecting the potential impact of socioeconomic factors. For example, peri-urban areas appear to have different characteristics in developed countries (north) and developing countries (south).[7,64] In developing countries, in the absence of robust planning regulations, these areas are subject to development pressures and often transition from primarily rural activities to a mix of rural and urban activities and land uses.[7] Furthermore, these are typically areas dominated by urban poverty and informal settlements.[32,65]

Cities and towns do not remain at a fixed density relative to their administrative boundaries. Instead, they often sprawl and grow, causing their population density to change over time. Periphery areas are unique and dependent on the local level, so their planning is a long and labor-intensive process. Inadequate policy tools may cause planners to fail to predict the extent of urban sprawl, making it difficult to demarcate peri-urban areas.[46] Accurate measurement of the peri-urban areas is crucial for future planning tools. Necessary policies and strategies need to be developed to demarcate, plan, manage, and protect peripheral areas. Furthermore, it is crucial to clearly delineate

urban fringe areas that encroach upon ecologically sensitive zones to articulate the responsibility of each stakeholder in conserving ecosystem resources.[47] Beyond the urban and rural divide, it is necessary to demarcate and focus on these areas in different ways, even if they do not have fixed boundaries (although they vary).

The criteria and methods used in previous studies to demarcate peri-urban areas include the following:

Merciu et al[66] studied the influence area of Focșani city, a second-ranked urban center in Vrancea County. They hypothesize that Focșani city shapes its surrounding areas through its influence and attraction. They use comparative methods to analyze transport systems, and economic, demographic, social, and cultural aspects, revealing peri-urban areas are primarily located next to the urban core.[66] Mustak et al.'s[67] 2018 study uses diurnal earth observation datasets to analyze peri-urbanization processes. They use multiple correlations, simple, and conditional linear regression to identify factors responsible for urbanization. The study generates three functional zones: urban, rural, and peri-urban. they are revealing the Spatial distribution of informal settlements/economy largely shapes peri-urban growth.[67] Gonçalves et al[11] developed a transdisciplinary approach for identifying peri-urban typologies in the Lisbon Metropolitan Area (LMA), Portugal. The approach involves identifying important peri-urban dimensions, defining indicators, summarizing redundant information, and applying cluster analysis. The study identified seven types of parishes, two urban and five peri-urban, with distinct features.[11] However, this method is excessively time-consuming and unsuitable for making prompt decisions. Sutton et al.'s[68] study uses nighttime satellite imagery to map Australia's urban and peri-urban areas. They use a population-weighted measure of urban sprawl and low-light areas to characterize urban-bush interfaces. The study finds 82% of the population lives in urban areas, 15% in peri-urban or exurban areas, and 3% in rural areas.[68]

Furthermore, the literature, shows that peri-urban areas in developing countries are characterized by poverty, informal settlements, and pollution, while those in developed countries have low economic performance, environmental degradation, and poor mobility. Therefore, the political system, institutional arrangement, social context, and economic drivers also vary globally, necessitating geographically specific planning for peri-urban areas.

PART B: Critical Issues and Challenges in Peri-Urban Areas

2.6. Development and Urbanization Pressure

Not only does half of the world's population already live in cities, but urbanization continues to increase.[69] Most cities in the developing world are experiencing very rapid urbanization. It also increases the need for space in cities, and the resulting sprawl process leads to a rapid expansion of cities in space [56]. With the advent of the Anthropocene era, many countries and regions have experienced temporal and spatial changes in urban and rural areas.[70] The literature often conceptualizes urbanization as a process of changing demographic structures through migration, rapid natural urban growth, physical urban expansion, and the extension of the city's influence to rural areas. With increasing urbanization, there is a growing interest in urban land by people, primarily as a means to finance economic growth, and solely for human use [71]. Additionally, the urbanization process transforms the urban-rural system due to the flow and concentration of production factors, altering the spatial patterns of both urban and rural areas.[72] With the construction of highways and the increase in automobile use, commercial enterprises are choosing to locate on the city periphery, thus accelerating the process of cities expanding towards the periphery.[27] It is generally observed that urban areas adjacent to cities specializing in services, industry, trade, and logistics have a higher growth rate.[48] As urban land faces construction booms, rivalries between cities emerge.[71] Land use competition in urban periphery regions is severe because land is scarce and used for development, local food systems, recreation, and biodiversity offsets.[54] Because urbanization and development (economic growth) create increasing demand, especially in peri-urban areas, this demand often occurs in an unplanned and uncontrolled manner. It is clear that this situation will create serious problems in many cities around the world, especially in metropolitan areas, if the necessary precautions are not taken.[73] Furthermore, in urbanization, villages and towns in peri-urban areas are spontaneously enthusiastic about urbanization.[53]

Following the urbanization process, with the effect of increasing urban density, peri-urbanization occurs by unclear the boundaries between rural and urban areas. Peri-urbanization can be described as a multifaceted process rather than just a process of land use change.[42] This process includes peri-urbanization, sprawl, peri-urban areas, and functional urban areas. Each refers to a different type of land use, distinguishing between urban and rural areas and creating their own landscapes.[42] Peri-urbanization is defined as a bustling city with an uneven form of development. This process is a matter of scale in vertically integrated and hierarchically organized capitalist production and investment relations.[48] As a result, it creates a chaotic, differentiated, disorganized and incomplete urban space. Economic activities in core cities greatly influence the nature of the urbanization process, and peripheral urban areas are shaped by their relationship with the core city, which develops their unique characteristics.[48] Particularly, the peri-urbanization situation is causing more critical problems in developing countries. One of the most significant issues associated with urbanization is the emergence of urbanism and the decline of the peasantry, as both market-based and government-run economies exploit rural areas for their own benefit.[2] Institutional barriers make it hard to move rural land rights to urban land and make land rights available to everyone. This has caused agricultural lands to be turned into illegal settlements and a lot of informal settlements to pop up in unplanned peri-urban areas.[32]

As a result, peri-urban areas experience the complex effects of urbanization and development pressure. Particularly in the 1980s, the issues arising from the city's spatial expansion gained prominence, prompting consideration of the susceptibility of urban peri-urban areas to these challenges. In other words, urban sprawl is most noticeable in the interface between urban and rural areas, namely in the peri-urban areas.[74] Urban construction expropriates rural areas and cultivated lands Peri-urban areas consume non-urban areas for urban purposes, resulting in the loss of previously non-urban lands that once provided support and services.[74] Over time, rural settlements on the fringe, especially those closer to the city, will become part of the urban fabric, facing the dilemma of losing their distinctive characters. Thus, understanding urbanization models is crucial for aiding urban planning and improving natural resource management, considering the various challenges posed by urbanization to global ecosystems and human populations.[75]

2.7. Dynamics of Land Use Change

Our planet is threatened by human activities. With humanity dominating nature, Jaung and Carrasco[70] describe the Anthropocene era as the human-centered structure that has become popular since the 1970s, drawing attention to the fact that one of the biggest threats to our planet originating from capitalism is the cheap exploitation of nature. Thus, the land cover on the Earth's surface changes significantly.[76] The drivers of land changes arise from economic, social, technological, and political factors.[77] These driving forces combine to cause significant and permanent changes in land cover.[78] The consequences of land cover change include increased impermeability, soil deterioration and erosion, loss of agricultural land, reduced soil fertility, food scarcity, pollution, wetland pollution, increased flood risk, reduced rainfall, alterations in wind patterns, decline in air and water quality, increased susceptibility to illnesses, changes in urban landscape patterns, deforestation, exhaustion of natural resources, decline in biodiversity, unprecedented species loss, and ecosystem deterioration.[2,78–80] The issues arising from these changes are universally accepted.[81] Peri-urban areas are the most affected by land use changes due to the complex relationship between urban sprawl and land use patterns. These areas, once predominantly rural with agricultural land use, are now transitioning into mixed-use zones with a blend of residential, commercial, and industrial activities (Figure 6). This transformation is driven by factors such as population growth, economic development, and infrastructural advancements, resulting in a patchwork of land uses reflecting both urban and rural characteristics.

Figure 6. New apartment constructions are moving toward olive groves, Yelki. Photo taken in 28th of June 2024

Most land use changes occur without clear and logical planning, and without consideration of environmental impacts. Governments, institutions, and management continue to fail to address this situation.[78] Particularly in peri-urban areas, land use planning and management are more difficult. Controlling, managing, and predicting the problems caused by land use change and future trends require detailed knowledge about land use and changes across different spatial dimensions. To effectively control and manage land use change, it is essential to systematically monitor and map changes across spatial and temporal scales, ensuring an understanding of the contributing factors and the role and importance of each of these factors.[82] It's hard to judge changes in land use because you have to figure out how they relate to physical and socio-demographic factors, guess how they will affect the whole country, and manage long-term urban growth. But city socio-demographic growth isn't always the same in different places and times.[52]

2.8. Environmental Challenges and Lack of Resources

Peri-urban areas are a segment of land that encounters significant challenges. The peri-urbanization process, in particular, leads to significant changes in land use, and these changes lead to an increase in environmental problems. In this perspective, the sprawl of the urban periphery results in a net consumption of fertile and productive land.[43] In other words, environmental problems that arise as a by-product of urbanization create serious pressures on ecosystems in peri-urban areas and lead to the loss of natural areas in these areas. Experts agree that, of all the activities taking place in peri-urban areas, urbanization has the potential to create the most significant and negative changes in this environment. The primary environmental impacts of peri-urban areas under urban pressure are habitat fragmentation and biodiversity loss, soil and land degradation, wetland losses, climate change, a decline in water quality, and desertification. Urban planning, environmental protection policies, and sustainable development strategies can address these challenges. In the future, sustainable management of resources on the periphery of cities will be vital for the long-term health, prosperity, and resilience of cities [83]. These events impact access to water and destroy shelter, undermine agricultural activity, overwhelm waste management and drainage systems, expand habitat for certain disease vectors, and create fragile socio-ecological conditions vulnerable to other public health problems.[26]

Its resources, especially green areas on the city periphery, host many ecosystem services (food production, carbon sequestration and oxygen production, water conservation, soil retention, etc.). During the urbanization process, forest, rural, and agricultural ecosystems inevitably disrupted the structure and function of previous ecosystems and ignored ecosystem services.[84] Losses in ecosystem services result in reductions in both economic (e.g., agricultural production) and noneconomic (e.g., aesthetic, recreational, and cultural) resources.[85] The concept of ecosystem services has become part of the response to managing environmental challenges and impacts, and it plays an important role in rethinking how we respond sustainably.

Peri-urban areas can be viewed not only as a transition zone between a city and rural land but also as a stage on which complex interactions such as urban growth, agricultural production, and natural resource management are played out. There are a

variety of elements on the periphery of cities, such as water, land, energy, biodiversity, and human resources. However, excessive use of resources for recreational activities or excessive urbanization processes can reduce rural wealth and homogenize rural characters, bringing them closer to typical urban ones.[86] The loss of resources on the periphery of cities brings with it consequences such as a decrease in livelihoods and a decrease in the historical-cultural natural landscape. Traditional livelihoods such as agriculture, forestry, and animal husbandry are important for people living in these areas. Human resources and environmental sustainability are crucial in managing resources on the periphery of cities, preserving cultural diversity, and promoting economic, environmental, and social growth, thereby ensuring long-term health, prosperity, and resilience. Thus, it is necessary to create appropriate policies to encourage rational land use in peri-urban areas. In this case, spatial delimitation of peri-urban areas can allow policymakers to identify pockets of potential growth and thus help estimate the resources required to meet future growth needs.

2.9. Transformation of Agricultural Land

Agriculture remains the most widely practiced economic activity, but it is shifting towards a wider range of additional services (agritourism, social farming, etc.) and extending beyond rural boundaries to intermediate and urban areas (urban and peri-urban agriculture).[87] Because agricultural activities take place in the ring closest to the city, dairy farming and intensive agriculture (vegetables, fruits, perishable products, milk, and other dairy products) are grown with the highest profit.[88] As a result, peri-urban areas are defined as those with a high level of agricultural land use and practices.[88] One major factor contributing to the decline of peri-urban agricultural land is the gradual urban sprawl into the most productive agricultural lands.[13,46,55] According to some literature sources urbanization is defined as two basic processes: the first phase is the migration of households and individuals from rural to urban areas, mostly to work in non-agricultural activities; the second phase is the change in attitudes, beliefs, and values, as well as the change in lifestyles. Agricultural land loss is now a reality, generally characterized by economic scarcity, unemployment, exodus to the suburbs, and expansion of the metropolitan periphery and adjacent rural areas. As a result, the

unprecedented urbanization and the development pattern have resulted in the quick disappearance or total alteration of fertile agricultural lands in peri-urban areas. And this has affected the livelihoods and quality of life of rural communities, which rely on the agricultural sector as their main economic activity.[89] For instance, Lasisi et al[88] found in their study of the Peri-Urban Area of Osun State, Nigeria, that the high level of urban encroachment significantly hinders agricultural activities and farming. The uncontrolled housing encroachments are a result of the government's inadequate response to the trend of unplanned urban sprawl, where agriculture is the primary source of livelihood.[88] Observations show that urbanization exposes service providers in the sector to negative shocks. Additionally, Lawton and Morrison[90] revealed in their Greater Western Sydney, Australia, study that housing priorities and private market interests will continue to cause agricultural land losses unless solutions to current urbanization problems and related political priorities change. Landowners in urban and peri-urban areas continue to focus on the economic value of land and invest in activities that will provide higher returns than agricultural practices.[88] The reasons for the loss of farmland in this peri-urban region are more than a largely market-driven process.[90]

Zasada[55] states that farming in peri-urban areas should be an integral part of the cultural landscape. Gallent[27] asserts that the increasing division of fields by highways and railways is driving large-scale farming away from the urban fringe. This makes livestock transportation difficult, and for the same reason, farms are becoming more and more fragmented, with many becoming little more than small farms.[27] Additionally, it shows that urban sprawl affects the characteristics of peri-urban farms, changing economic size, crop production, and social characteristics of farmers, and widening the spatial separation between large peri-urban farms and peri-urban small farms.[91] The lack of land in urban areas has a negative impact on the livelihood of suburban farmers, who make up the majority of the impoverished population. As a result, residential, industrial, commercial, municipal, and cultural land uses tend to take precedence over agricultural land in peri-urban areas.

Planning policy, systems, and relevant actors not only play nuanced but also significantly influenced roles in the loss of agricultural land.[90] Agricultural land protection policies should limit the rate of conversion of these lands for urbanization needs or impact the land market by enhancing the productive value of agricultural lands [89]. Green belts and urban growth boundaries have not been able to contain the ongoing

urban demand. Planning has not found an appropriate response to these changes.[92] Regarding this situation, Barr[92] described it as "a perennial challenge to the planning profession," (p. 127) highlighting the difficulty of agricultural land transformation.

2.10. Social Form and Demographic Change

During the 20th century, the global population experienced unprecedented exponential growth.[93] Considering the rural-urban interaction, the majority of the population lived in rural areas before the 2000s, but this situation gradually reversed after the 2000s (Figure 7). In 1960, roughly one-third of the world lived in an urban environment. This figure is expected to reach two-thirds by 2050. Lynch[2] made a forecast that during the next two decades, all of humanity will reside in urban areas.

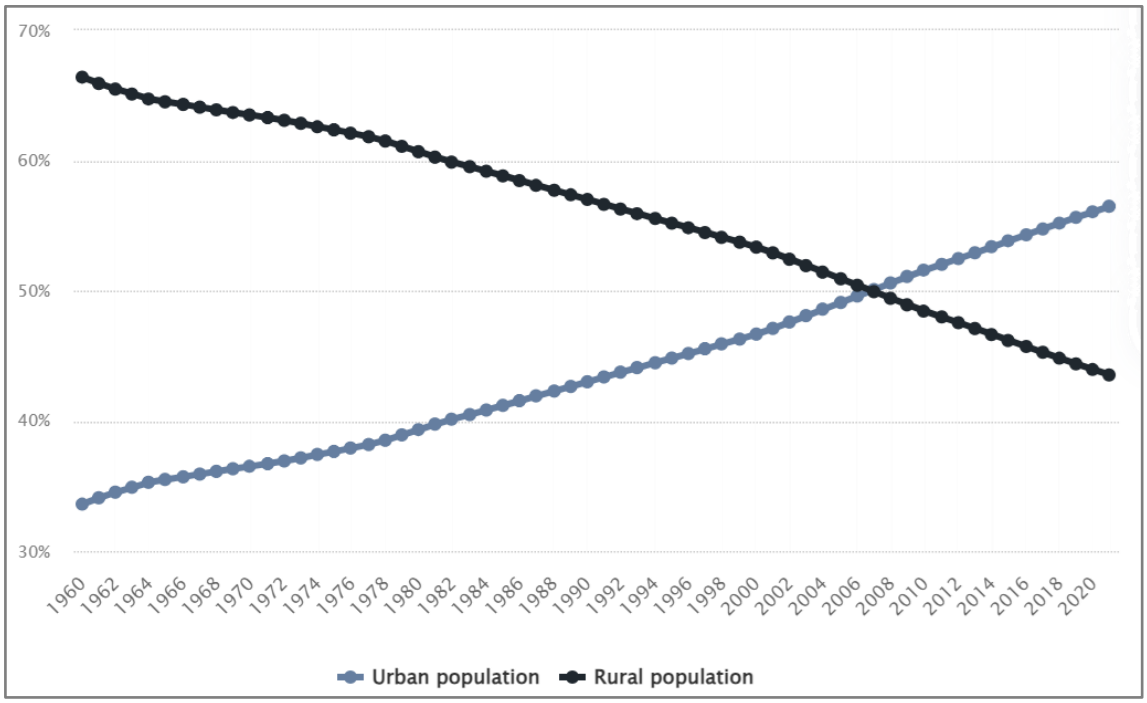


Figure 7. Changes in rural and world population, Source: (Global Share of Urban and Rural Population 1960-2021 | Statista, n.d.)

The growth of peri-urban settlements is attributed to the movement of people towards urban edges.[2] Most of this dissolution will occur in developing

countries. Therefore, peripheral areas are seen as places of social compaction and dynamic social change.[3] These rapid and large-scale changes have a significant impact on rural, urban, and peri-urban areas. In the periphery area, where there is intense rural-urban interaction, population flows may occur in varying proportions and directions, either from rural to urban, from urban to rural, or on a periodic basis. In other words, although urbanization is inevitable, there are counter-urbanization processes. Cyclical migration refers to the movement of individuals from rural areas to urban areas, driven by factors like reverse migration, retirement from urban employment, or the desire to return to their birthplace. When migrating to a new city, the ultimate goal is to return. In terms of migration and urbanization, peri-urban areas mediate between rural and urban.[3] Thus, peri-urban areas are described as areas where the social fabric has evolved significantly in recent times.[94] In peri-urban areas, a more complex and diversified economic structure is replacing the traditional lifestyles and economic activities of rural communities. As a result, peri-urban areas are rapidly transforming into regions where both rural and urban dynamics coexist. As population density increases in these regions, people from different social, cultural, and economic backgrounds come together. Additionally, the rapid land-use changes in peri-urban areas often lead to the displacement of local populations, creating another significant social problem. Displacement is a form of dispossession where people are forcibly moved from their homes.[95] These displaced individuals face numerous challenges as they are forced to leave their homes and adapt to new environments. The loss of familiar surroundings and community support networks can lead to social disintegration and psychological stress. Furthermore, the lack of adequate resettlement planning, and support exacerbates their difficulties, often resulting in economic instability and reduced quality of life.

Rural-to-urban migration as a result of rapid urbanization growth continues to be one of the most studied phenomena regarding slum formation in developing countries.[94] The population of the area surrounding the city increases as city dwellers move in. Thus, immigrants seek housing options in the urban peripheral areas, which gradually become part of the city through a process of integration.[96] This situation increases the demand for infrastructure and services on urban fringes and puts tremendous pressure on local governments. These areas need to be carefully managed for sustainable and balanced urban development.[94] In addition, this rapid transformation process can bring about social cohesion and integration problems in urban peripheries, so effective

planning and management are required. A national population strategy that connects the structure and concentration of sustainability, social inclusion, and livability targets is required. All systems must explicitly incorporate environmental sustainability, while also incorporating social and economic sustainability.

2.11. Transportation Networks

The interconnection between transportation networks and settlement patterns is intricate. The transportation infrastructure reduces distances between settlements on urban peripheries, enhancing accessibility to employment opportunities and services primarily located in central urban areas.[2] This increases commute time and necessitates the reorganization of public spaces and services. For instance, as the surrounding areas develop, land can be allocated for important urban services such as schools, community centers, and roads. As a result, transportation networks significantly shape the physical structure and sprawl of cities, determining the direction of urban development and transforming social and economic dynamics by increasing connectivity and accessibility between different regions.[27] Peripheries serve as areas between urban centers and rural areas, encompassing both urban and rural transportation dynamics. Modern transportation infrastructure plays a crucial role in creating rural-urban peripheries, shaping not only their physical appearance but also their experiences.[27] The density of road networks in peripheral areas can accelerate the urbanization of rural areas surrounding cities, since highways primarily serve city centers and aim to facilitate access to them. As a result, the construction of advanced highway connections leads to urban sprawl. Also, urban sprawl tends to follow transportation infrastructure.[97] Developments in peripheral areas during highway construction occur more serendipitously than through planned design, influenced by processes, the need for better roads, post-war decentralization, and land fragmentation associated with road construction. These processes, including urban expansion, road construction, and rapid development of infrastructure, clearly define the boundary. Any urban area larger than in the past likely includes remnants of old edge uses.[27]

Urban sprawl, increased space requirements not met in the city center, widespread use of automobiles, and the emergence of new transportation connections have led cities to spread towards the peripheries, accelerating outward transportation connections from the city and branching with the fragmentation. These developments accelerate the transformation of rural areas. To understand the nature of this change, one must focus on the city's historical growth processes and socio-spatial extensions. This situation has begun to affect sustainability principles and urban planning concepts because the most adverse effects of urban sprawl accelerated by transportation infrastructure are increasing transportation emissions and spatial fragmentation.[98] Planned infrastructure development can particularly promote counter-urbanization, internal migration, and re-urbanization. Therefore, infrastructure can be a highly effective planning tool to steer human activities. Planning processes should adopt a participatory and inclusive approach, taking into account the needs and feedback of local communities.

2.12. Poverty Situation Encountered

The poverty situation in the peri-urban areas becomes increasingly prominent as a result of urban sprawl and migration. The lack of adequate public services and support mechanisms in peri-urban areas deepens poverty in these regions and increases social inequalities. Urbanization, in particular, leads to violent land expropriation because rural areas surrounding cities are characterized by institutional insecurity, disorganization, underproduction of economic growth, and incompatibility with modernity.[89] Uncontrolled urbanization is, in some ways, in some ways, the main problem with disorder and poverty. Because of these circumstances, the rural population flocked to cities and towns, causing rural areas to face challenges such as labor shortages, shrinking local markets, and economic stagnation. The rural poor's effective control of productive resources, especially land, enables them to create rural livelihoods and is critical to their ability to overcome poverty.[89] The first goal of sustainable development is 'to end poverty in all its forms everywhere', which attracts the attention of different countries and international communities.[99] Today, there is a growing interest in considering rural-urban integrations as having the potential for positive development.[2]

Sustainable livelihood frameworks as a rural development planning approach are gaining more attention as they provide a useful conceptual basis for understanding urban poverty as well as the situation of people living in poverty in urban settlements.[89] Therefore, the poverty situation encountered in peripheral areas appears to be a serious problem that requires comprehensive and sustainable policies. In peripheral areas where rural and urban interaction is intense, the institutional structure is fluid and difficult to balance due to different and competing interests. This situation primarily affects the poorest social segments and the natural environment. Within this framework, it is difficult for the poor to protect their resources or to make their voices heard.[2] The conclusion of many studies is that the possible effects and opportunities of rural-urban interaction should be evaluated very well in future policy formulation. For this, it is necessary to negotiate and hold discussions with the people, communities, and/or households affected by this interaction and to understand well the livelihood strategies shaped by their economic and social behavior within the rural and urban continuum. The study of the connections between rural and urban areas is a significant area of research and a crucial aspect of future policy-making. In order to achieve long-term sustainability for both urban and rural areas, it is imperative to strengthen the linkages between the city and its surrounding rural areas.[100]

PART C: Planning and Policy Context for Peri-Urban Areas

2.13. An Overview of Policy and Planning

There is a certain lawlessness regarding peri-urban areas, extending to how these areas are used and managed.[27] Because the government neglects these areas, the planning profession, and the public.[12] In particular, rural areas lack land use planning and regulation and are characterized by inadequate governance.[101] Peri-urban areas can also clearly feel the impact of this situation. Lack of consensus is evident in defining peripheral areas and standardizing policy.[102] The pressure of urban sprawl and the need to preserve rural structures trap peripheral areas. Peri-urban areas have been called the 'last frontier of planning' and are a ‘mutated' area alive with different urban-rural

interactions where local planning is presented with unique challenges, creating a complex management context.[102] Managing this area is challenging because it extends beyond urban administrative boundaries and includes many nearby municipalities.[87] Bunker & Houston[103] see peri-urban areas as a critical area for sustainability, while Scott et al[104] see peri-urban areas as a testing ground for introducing and validating new planning perceptions.[46,103,104] This perception strongly rejects contemporary planning theories and significantly underestimates the significance of these areas.[46] The urban periphery, therefore, represents the conflicts between the urban management system and local development arising from political transformation.[75] Insufficient governance and inadequate planning result in uncontrolled and haphazard growth in outlying regions, endangering their economic, social, and environmental viability. The lack of capacity to plan and manage urban land, as well as institutional weakness in policy implementation leading to inefficient land use, raises questions about the extent to which urban planning can produce a specific urban pattern in peripheral areas.[105]

By largely implementing policies that primarily focus on controlling urban and rural areas, while overlooking the continuity and special characteristics of peri-urban areas. Furthermore, they only refer to the managed areas, failing to promote integrated institutions for the joint management of peri-urban areas.[87] Considering the peri-urban areas as edges, they are places where very few people live, and there is no large community or electorate to protest the decisions affecting these areas or hold politicians accountable.[27] For this reason, Gallent[27] argues that these areas have become acceptable dumping grounds, as decisions lead to little or no political backlash.[27] In recent years, however, policymakers have suddenly turned their attention to the extremes, claiming that this is a forgotten landscape, and that planning should do something about it and realize its potential.[102] As for policy standardization, there is an ongoing debate on whether to follow existing planning techniques or develop new policy instruments for rural-urban management.[46] In the past, many planning policies and practices have focused on compartmentalizing land uses, creating activity zones, and failing to foster beneficial interactions that manifest at city edges, while also failing to embrace forward-thinking or proactive development agendas, instead adopting a reactive and mostly ad-hoc response to development pressures.[27] Therefore, Gallent[27] has argued that the planning system was never intended to be merely a regulatory tool; he maintains that it should be forward-looking and visionary. The fact that planning precedes and follows

land change processes illustrates the particular challenge for planners and policy makers in managing peri-urban areas.[42] References to planning and policy intervention revealed that regulations on the fringes, in general terms, tend to be looser than in the wider countryside (where land-use change is tightly controlled) and cities (where) the landscape can appear organic and anarchic, where planning apparently has less influence, where planning controls are disregarded, or where zoning control and enforcement clearly ignore breaches of planning regulations.[102] Barral and Guillet[54] based on the analysis of 20 case studies, demonstrate that peri-urban areas are significant land providers to facilitate regional development. However, the main challenge remains in the hands of local authorities, who are often reluctant to exclude the land from future urbanization, along with elected officials. Inadequate policy tools, coupled with difficulties in properly delimiting urban peripheral zones, mislead policymakers and planners in estimating the size of the urban growth boundary.[106] As a result, appropriate demarcation of peri-urban areas is critical for determining the projected urban sprawl border and meeting future planning requirements.

2.14. Spatial Planning in Urban and Rural Contexts

Today, researchers call urban sprawl a spatial planning challenge of the twenty-first century, requiring digital tools for environmental-urban planning to analyze interconnected problems, forecast future needs, engage stakeholders, and build iterative scenarios.[107] Spatial planning is a powerful tool for applications that aim to broaden the scope of planning. Urban planning encompasses strategic efforts to achieve more than just land use regulation; it serves as a catalyst that mobilizes wider support and resources to realize a shared vision.[108] Spatial planning, a socio-spatial process guided by the public sector, shapes, and frames what a place is and can be through a vision, actions, and implementation tools [102]. Furthermore, recent changes in public intervention in the planning field, as well as the prerogatives of private stakeholders, influence the specific spatial planning systems, governance scales, and multi-actor dynamics in which it occurs.[87] Gallent[27] developed a resource called (Figure 8) which offers a comprehensive framework for implementing planning reform. This model

emphasizes the importance of leadership, partnership, management, and inclusiveness in the planning process. It is an adapted spatial planning agenda, emphasizing the need for leadership, partnership, integration, and inclusion in 'place-making' at the fringe. It aims to understand partners' different priorities and offers a simple model for action, focusing on partnership, integration, and inclusion. This model acknowledges the need to manage multiple fringes in unison for coherent outcomes, recognizing the need for a simple approach to planning.[27]

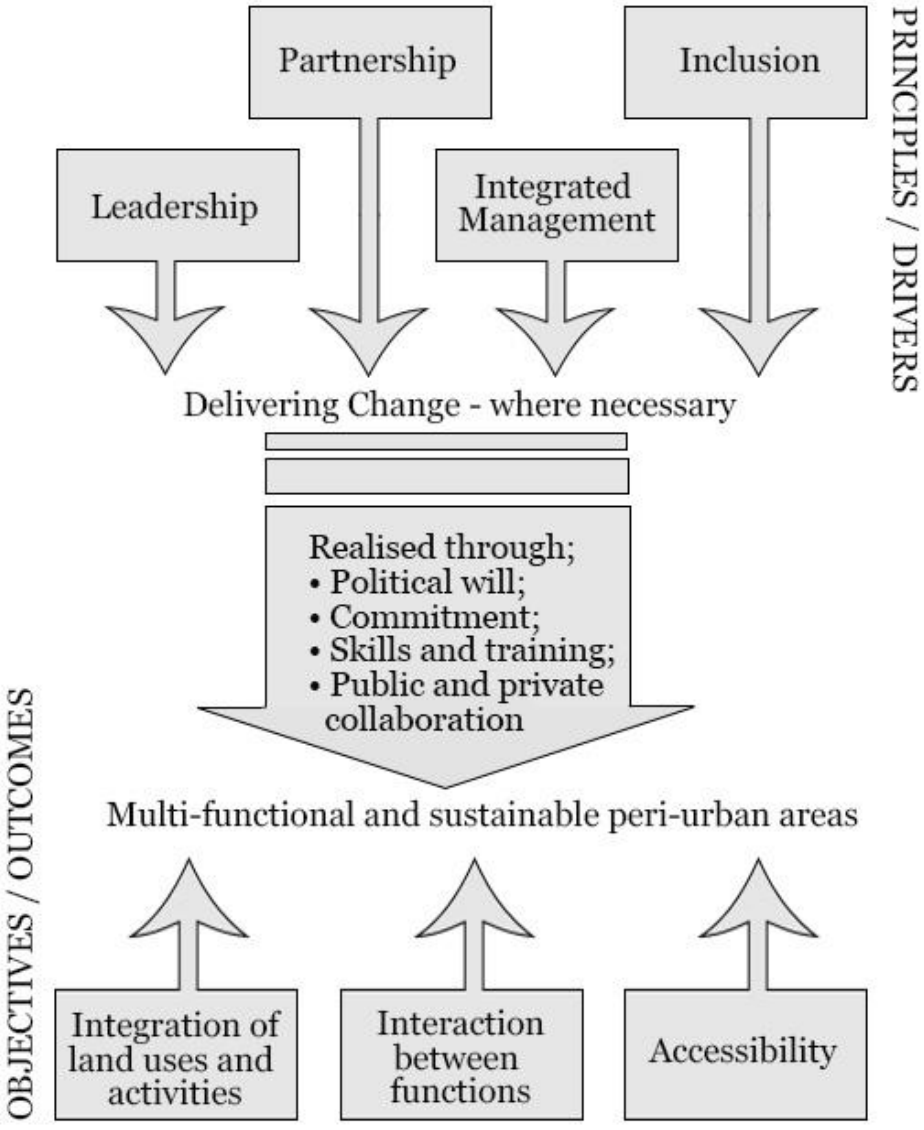


Figure 8. Principles and Outcomes - Spatial Planning in Peri-Urban Areas (Source; Gallent et al[27]).

Multifunctionality is a vision for peri-urban areas that can be achieved through strategic spatial planning.[102] Managing multifunctionality also needs a new way of

doing things that reflects many of the goals of spatial planning, like dealing with uncertainty and complexity and making sure that the activities of different groups working at different spatial scales and between different sectoral departments and agencies are coordinated.[102] Spatial planning offers opportunities and tools to realize the renewed interest in managing change in multifunctional environments more efficiently. The ability to plan the built environment to promote more sustainable lifestyles, possibly by reducing vehicle dependency, has significantly shaped the belief that strategic partnerships' spatial planning can facilitate more effective and efficient use of space, thereby enhancing the effectiveness of multifunctional strategies.[102] The legal and administrative structure of the planning system closely relates to the problems of city plans and urban planning. It has been shown that when faced with legal and administrative struggles and disputes, fragmentary planning decisions that manipulate existing master plans increase in severity and are the main reason for a widespread, amorphous, and haphazard spatial expansion pattern.[27]

2.15. Land Use Planning and Policies in Peri-Urban Areas

Land use conflicts and resident expectations often clash in peri-urban areas.[102] The outputs generated by various land use systems, which are directly or indirectly linked to the production of goods or services for human civilization, vary across different forms of land use.[109] While urban uses are organized according to a pattern of streets and squares, edge uses have a much looser arrangement; urban use can be integrated and connected, whereas edge uses can be fragmented and disconnected, partly due to the fragmented policies of the peri-urban areas.[27] Land use planning is extremely difficult because of uncertainties about land use, the precise definition of peri-urban areas, and the constant change in jurisdictional boundaries. However, the creation of an accurate regional strategy for the management and planning of urban-rural areas becomes critical in rapidly changing socioeconomic contexts, and it is particularly difficult to investigate the hidden interactions between local governance, economic development, and sustainable land management.[91] Land use planning has traditionally been based on the preparation of 'appropriate policies' for different forms

of development, often seeking separation between potential land uses to avoid anticipated conflict. This system's key function, policy control, relied on assumptions about the compatibility and incompatibility of uses and relied on limited 'co-production' of plans and policies.[102]

The land use planning model and containment strategies tend to promote a narrow 'vision' for peri-urban areas and rarely reflect the need to integrate the land. The examination of the historical, aesthetic, economic, sociocultural, and ecological functions of peri-urban areas reveals the need to develop a model of intervention or management based on clear leadership, effective partnership work, integrated management, and inclusivity. An intervention through a planning and management approach that avoids being reactive and knows what it aims to achieve in specific fringe areas can explore the potential for greater integration between land uses and fringe functions.[27] Additionally, understanding the status of urban land use efficiency, addressing land prices and housing scarcity, and monitoring policies to ensure sustainable land use, protect agricultural lands, and protect the environment require combating land hoarding, urban sprawl, and informal settlements. Economic development and urbanization rely heavily on land, and the efficient use of urban land is crucial for ensuring sustainable urbanization and economic growth. Therefore, urban growth should focus on efficient and sustainable land use rather than insatiable land consumption and frontier expansion.[105]

"Sustainable land management" is a multidimensional and evolving concept involving a wide range of stakeholders and requiring the integration of ecological, economic, and social aspects. It impact on land cover change, land use change, and management intensity. Land cover change is understood as the " alterations of biophysical characteristics of the Earth’s surface" such as the expansion of forests or the reduction of agricultural lands.[110] Changes in land use and management intensity are defined as "changes in the levels of socioeconomic inputs (e.g., labor, resources, water, energy, or capital) and/or modified outputs (value or quantity) per unit area and time." Land use science discusses the underlying driving forces—i.e., the social and ecological factors triggering these human actions—as a promising approach for addressing complex, multifaceted "real-world problems" and designing strategies and solutions for sustainable development through the implementation of interdisciplinary projects.[110]

Landscapes are not just physical elements but also the meanings associated with them. Peri-urban areas can be negatively perceived due to negative activities and land uses, affecting the perception of the landscape. Peripheral areas are often the destination of illegal urban waste, especially in developing countries. Transitional, temporary landscapes, such as allotments, travelers' campsites, and caravan sites, are ideal for temporary uses. This is because these areas are often the product of consumer society and the political acceptability of development on the margins. Therefore, addressing these issues is crucial for a positive peri-urban area.[27]

2.16. Controlling Urban Sprawl and Planning Approaches

Since urbanization is a recurring phenomenon, continuous urban sprawl into nearby peri-urban areas and a constant reduction of the most productive rural-urban agricultural lands seem inevitable.[46] To ensure sustainable development, it is crucial to understand the complex spatial and socioeconomic links between urban and rural areas.[35] Sustainable development in a rural-urban context requires the protection of existing peripheral areas, better environmental conditions, and equitable resource distribution. Appropriate policies should encourage rational land use in rural, peri-urban, and urban areas, ensuring fair treatment and protection of existing peripheral areas.[46] In this case, spatial demarcation of peripheral areas can help policymakers identify potential growth areas, thus estimating the resources required to meet future growth needs and protect agricultural areas and the natural environment. Developers and local communities significantly influence rural-urban growth, with the speed and intensity of land use changes determining urban sprawl.[46,111] Therefore, it is important to demarcate peripheral areas and integrate the local context with rural-urban plannings.[40] It can thus encourage policymakers to rationalize development decisions.[46]

Local planning is better suited for peri-urban areas than general policies because it allows for a more holistic approach that accounts for multifunctionality.[42,102] The approach known as ‘multifunctionality' provides a framework for understanding peripheral areas and also serves as a target for future planning.[102] Therefore, future management of the landscape should be based on an approach that includes

multifunctionality. Function assignment should be the outcome of an inclusive process. This socio-spatial process produces a vision, actions, and means of implementation that shape and frame what a place is and can be.[102]

The green belt is another strategy for urban sprawl that has been developed and implemented.[4,46,102] However, such a strategy often succumbs to urbanization pressure and gradually becomes tolerant of allowing peri-urban sprawl in the green belt zone [46,103]. By imposing restrictions on peri-urban areas, the green belt, the most widely used from the peri-urban perspective, controls urban sprawl through various planning and management approaches.[112] The green belt approach should expand into a more comprehensive strategic framework to provide ‘meaning and content' to previously fragmented and degraded areas near the city.[102] For society in general and for planning in particular, the existence of green belts suggests that planning has a more direct, practical relevance to what is happening on the periphery, even if the edge is sometimes out of sight. But such enclosures can create a seemingly more orderly landscape and can strengthen the divide between cities.[102] The green belt probably encourages separation rather than integration. Therefore, the definitions were extremely rigid and permanent, necessitating a flexible approach.

The lack of effective governance structures for the management of peripheral areas and the inadequacies in urban planning tools increase the need for more effective and comprehensive tools to control the expansion of cities. The management of urban areas necessitates a more holistic approach that addresses both socio-economic and spatial aspects of these areas in light of the demands and preferences of various stakeholders.[42] Planning has often failed to think ahead or pursue proactive development agendas, often responding to development pressures in an ad hoc manner. However, this is driving the planning agenda towards greater integration of landscape functions and a more multi-functional edge. Creating 'action plans' for border areas is a viable solution, requiring a thorough evaluation of the local context and understanding of the interplay between boundary's key functions in a specific environment. A new planning system, coordinated through partnership working, will benefit from stakeholder participation and a multi-functional philosophy. It will be nested within a strategic planning framework and include a 'delivery plan'. A partnership agreement will coordinate it across borders, incorporating both land use and management recommendations.[27]

CHAPTER 3

THE CASE STUDY OF IZMIR

3.1. Location of the Research Area: İzmir, Turkey

Turkey is a country experiencing rapid urbanization at a globally significant pace, with diminishing connections to rural areas.[113] As a developing country, Turkey experienced a demographic shift where, before the 2000s, the majority of its population lived in rural areas. By 2019, the urban population surpassed the rural population. Additionally, Turkey is home to one city with over 15 million inhabitants (Istanbul) and 24 cities with populations exceeding 1 million. As Turkey experiences rapid urbanization and population growth, the metropolitan city of İzmir also shares in this process due to its significant position within the country[114] Izmir, one of the world's oldest port cities with approximately 8,500 years of human history, is strategically located on the western coast of Turkey, along the Aegean Sea (Figure 9). As one of Turkey's three largest cities, with a metropolitan population of around 4.5 million, Izmir has been in a constant state of transformation since its founding, influenced by various social, political, economic, and physical dynamics.

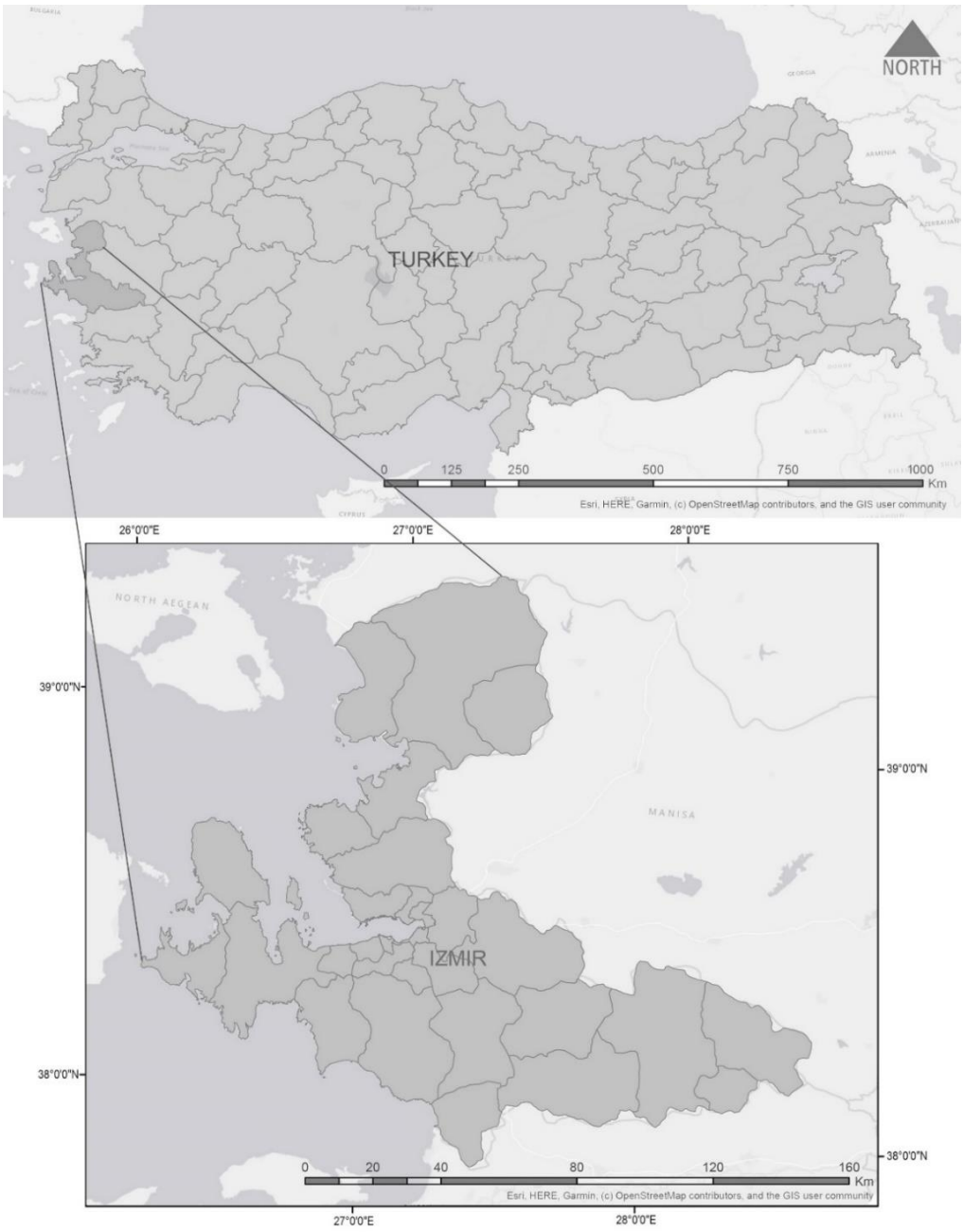


Figure 9. İzmir, the metropolitan city of Turkey, which is the content of the study area. (Source: The official administrative boundaries of İzmir city are used by the author to elaborate. UTM Zone 35N, Datum WGS 84).

3.2. The Evolution of Urbanization in İzmir Metropolitan Area: A Historical Perspective

In the era of globalization, although their impact sprawls far beyond the borders of any single country, metropolises are considered the primary units of the settlement system, being among the most important and highly urbanized hubs of activities and relationships.[115] Metropolises play an important role in not only urban centers but also rural and peri-urban areas. Peri-urban areas, as integral parts of metropolitan regions, have multifaceted, non-linear impacts and processes. In this context, Izmir stands out as a significant metropolitan city with dynamic peri-urban areas. Because, in Izmir, the urbanization process has evolved from rural, low-density settlement typologies to urban, high-density expansion.[116]

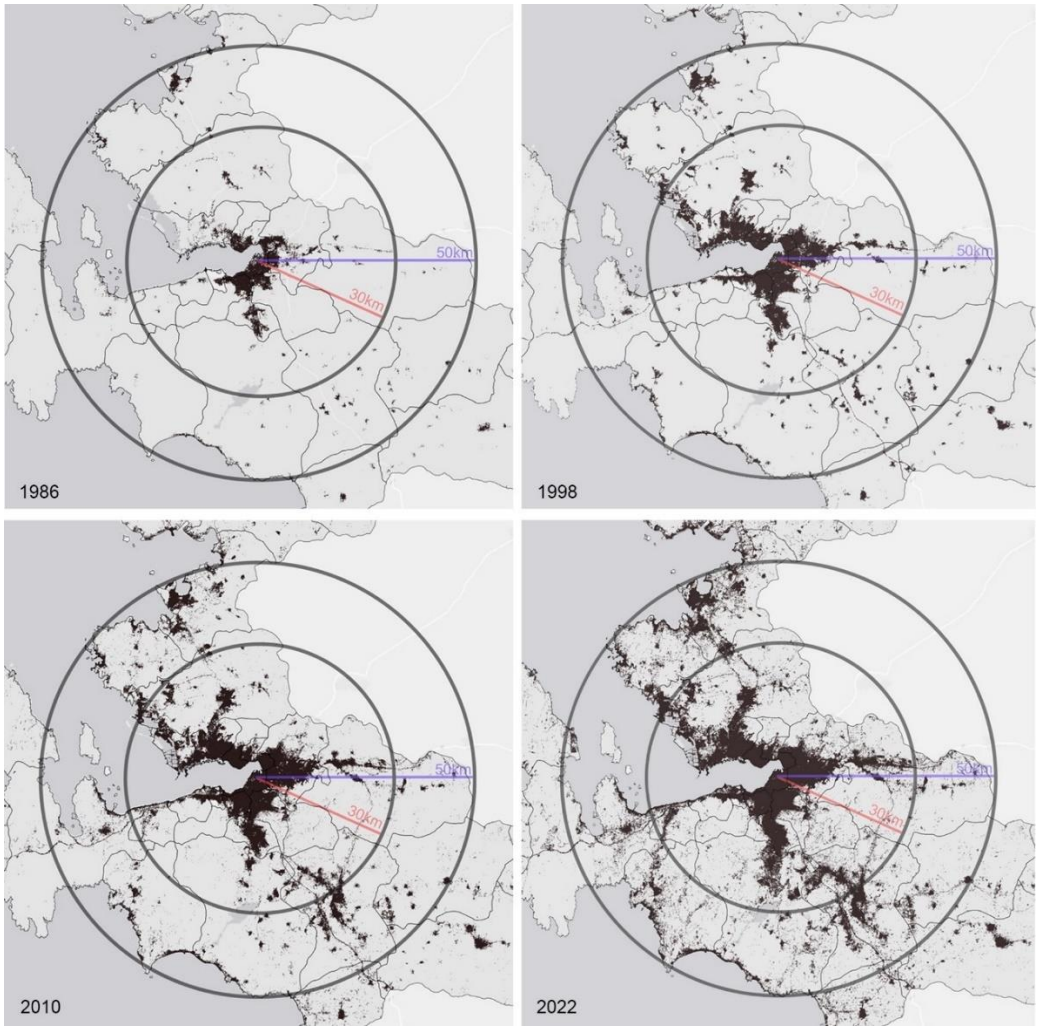


Figure 10. Urban areas sprawl of İzmir

Izmir witnessed a significant flow of migrants after 1950, similar to other metropolises in Turkey. Particularly from the 1950s to the 1970s, there was a significant migration from rural to urban areas, and this trend continues to evolve.[117] During the 1960s period, spatial development remained limited to specific regions and neighborhoods. In the 1970s, the city's functional accumulation increased. The surplus value derived from agricultural and industrial products began to impact the entire city, leading to developments in the manufacturing, construction, and trade sectors. This was driven by the introduction of industry-based activities and advancements in the manufacturing sector. During this period, the service sector rapidly developed, fostering growth in the tertiary sector, which does not produce goods directly for consumption, thereby creating employment opportunities and causing structural changes in the city.[118] Due to neoliberal policies, Izmir attained metropolitan status in 1984 as part of Izmir Province. This designation was expanded in 2004 to include all settlements within a 50 km radius, thereby redefining it as the Izmir Metropolitan Area. This expansion not only reinforced Izmir's metropolitan role but also extended urban dynamics to peri-urban and even rural areas. Since the 1980s, Izmir has undergone economic restructuring processes in response to global economic changes. As a result, the city's spatial pattern has begun to shift, leading to the emergence of non-urban developments.[119]

As a result of these structural changes, Izmir became a center, attracting more internal migration compared to other cities. Since 1985, the increasing job opportunities in various service and trade sectors have influenced the formation of physical spaces and accelerated the city's expansion. In the 1990s, the development of transportation networks and legal regulations transformed Izmir into an urban metropolis, with its urban growth radius extending to 35 km (Figure 10). The urbanization trend has led to the modification of rural areas, affecting their physical, social, and economic structure. As the number of people living in rural areas shrinks, the economic impact of agriculture on the country's economy also declines, while urban areas suffer the negative consequences of having too many people.[117] Subsequent to the population exchange, there was a significant increase in mobility beyond the anticipated levels, resulting in spontaneous urban settlements and thus, the extension and spread throughout the city.[118]

3.2. Scope of Planning and Territorial Jurisdiction in İzmir's Metropolitan Area

Izmir is the third-largest metropolitan city in the western part of the Turkish Republic. The total population of the Greater İzmir Municipality is 4.462. 056 (2022). Throughout its history, Izmir has lagged behind neoliberal urbanization trends [120],but since the 1990s, neoliberal policies led to Izmir City becoming a metropolitan city. Along with the 2000s, İzmir's increasing population, which is increasingly being brought into rural areas, the high cost of urban land, the widespread use of automobiles, and new transportation connections have led to urban sprawl and the fringes. Therefore, this study encompasses İzmir province, where the interaction between rural and urban areas has increased due to a shift in administrative boundaries resulting from legislative regulations. In the 2000s, Turkey's public administration system witnessed a reorganization process driven by globalization. This process embraced the idea of "metropolitan governance" as a new management concept.[121] With Law No. 3030 on Metropolitan Municipalities in 1984, Izmir Municipality was transformed into Izmir Metropolitan Municipality, encompassing the historical center of Izmir, Konak, and its surrounding districts. Starting in the 2000s, economic restructuring, changing political conditions, and demographic shifts led to expanding the metropolitan municipality's boundaries under Law No. 5216 on Metropolitan Municipalities, enacted on July 10, 2004, commonly known as the "caliper law" in the public. This law extended the jurisdiction of the İzmir Greater Area Municipality to include all district municipalities and villages within a 50-kilometer radius of the city center, thereby abolishing the first-tier municipalities with predominantly rural characteristics.[117] The Law of 6360, a complete city law enacted in March 2013, has significantly impacted Turkey's municipal administration of rural areas in the vicinity of the metropolitan cities of the country. The Law has expanded the city limits to encompass not only the provincial areas but also the villages and mid-size provincial districts located inside the metropolitan areas. This enlargement led to the centralization of jurisdiction under the central city administration. The law abolished all the villages' rural status and converted them to the ordinary neighborhoods of the central metropolitan city. The greater area municipality boundary was extended and overlapped with the province limits. As a result of these legislative regulations, while approximately 2.8% of İzmir's total area

was urban in 1986, this ratio increased to about 4.2% in 1998. By 2010, with the development of transportation networks, approximately 6.4% of İzmir's total area was covered by urban areas. Finally, in 2022, this ratio reached 10.48%. This has led to urban areas increasingly being brought into rural areas (Figure 11).

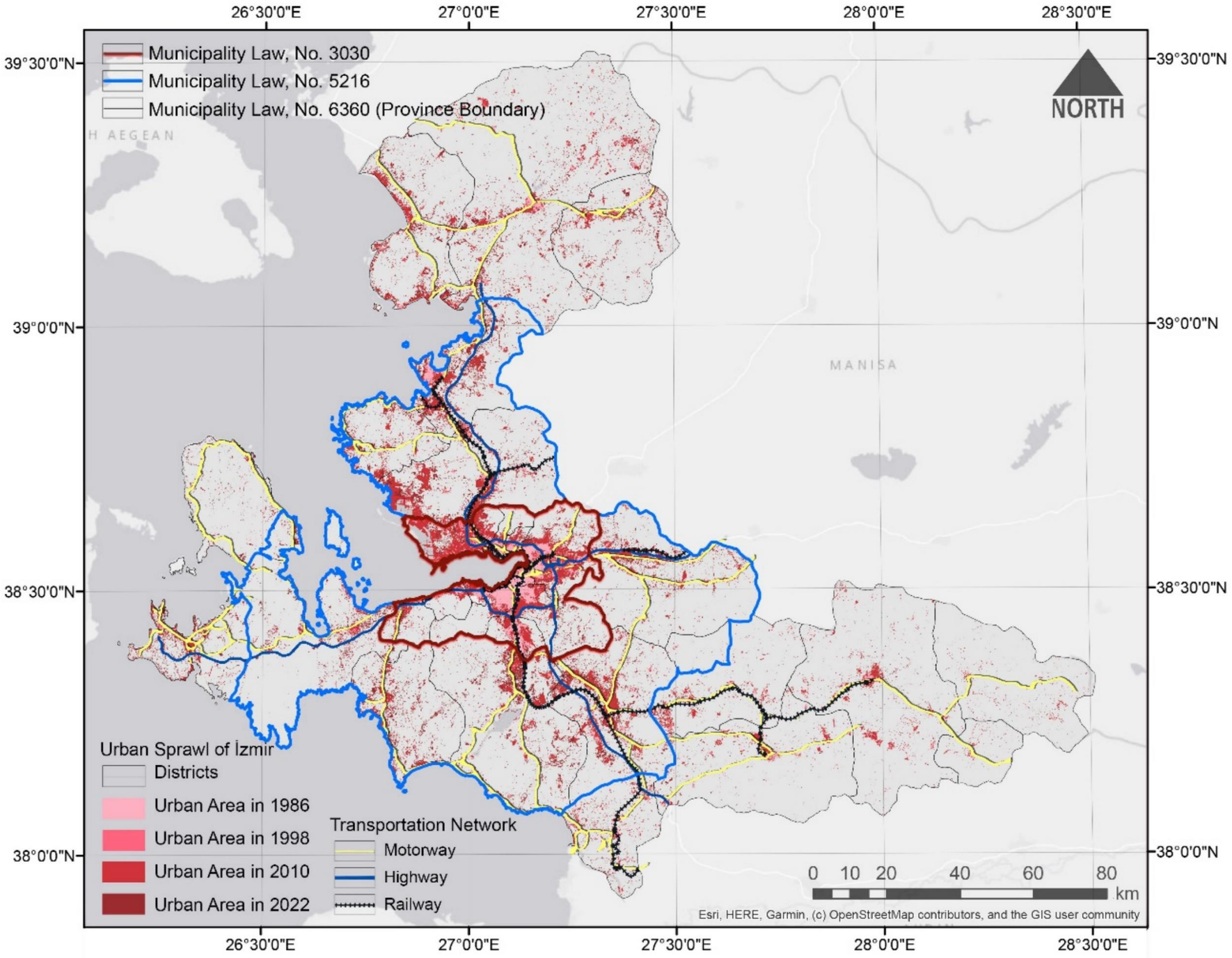


Figure 11. Legal Regulations Associated with Urban Areas in İzmir over a 36-year period (1986–2022), Source: Created by the author.

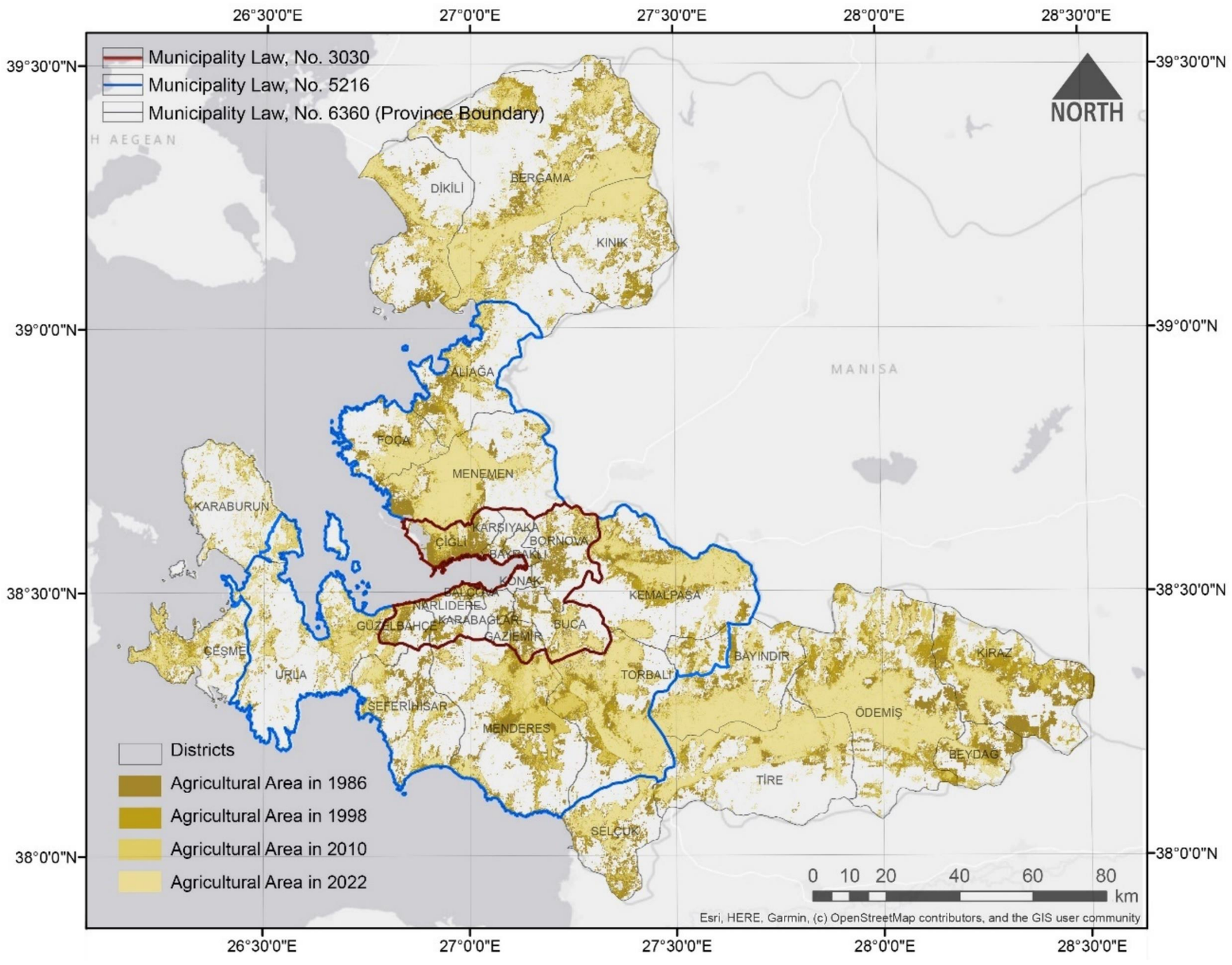


Figure 12. Change in Agricultural Areas in İzmir over a 36-year period (1986–2022), Source: Created by the author.

Izmir witnessed a significant flow of migrants after 1950, similar to other metropolises in Turkey. Particularly from the 1950s to the 1970s, there was a significant migration from rural to urban areas, and this trend continues to evolve.[117] During the 1960s period, spatial development remained limited to specific regions and neighborhoods. In the 1970s, the city's functional accumulation increased. The surplus value derived from agricultural and industrial products began to impact the entire city, leading to developments in the manufacturing, construction, and trade sectors. This was driven by the introduction of industry-based activities and advancements in the manufacturing sector. During this period, the service sector rapidly developed, fostering growth in the tertiary sector, which does not produce goods directly for consumption, thereby creating employment opportunities and causing structural changes in the city.[118] Due to neoliberal policies, Izmir attained metropolitan status in 1984 as part of Izmir Province. This designation was expanded in 2004 to include all settlements within a 50 km radius, thereby redefining it as the Izmir Metropolitan Area. This expansion not only reinforced Izmir's metropolitan role but also extended urban dynamics to peri-urban and even rural areas. Since the 1980s, Izmir has experienced economic restructuring due to global changes,[119] causing a shift in the city's spatial pattern and loss of agricultural areas (Figure 12).

3.3. Planning Functions for the Peripheral Areas of Izmir Province

Globalization and privatization have significantly impacted planning, leading to a lack of integrated positive approaches since the 1980s. During the Republican period, İzmir implemented piecemeal regulations instead of comprehensive planning, serving as an early example of urban planning in Turkey, adapted to political and socio-economic circumstances and Western approaches.[118]

Rural regions, or villages, lack a single description due to their diverse physical traits, defining criteria, and factors like economic roles, administrative structures, and population features, which differ from urban settlements. In Turkey, the first significant legislation to classify settlements was the Village Law (No. 442) enacted in 1942, which designated settlements with a population below 2,000 as villages. Subsequent developments in the classification of rural and urban areas were outlined in various

national development plans. According to the 8th Five-Year National Development Plan (2001), the 9th and 10th National Development Plans (2006), and the National Rural Development Strategy (2006), urban settlements are defined as those with a population of more than 20,000. Conversely, all settlements with a population of less than 20,000 are considered rural areas.[117]

Legal regulations in Turkey since the 2000s have profoundly influenced the planning system. Law No. 5216, for instance, has defined extensive responsibilities for metropolitan municipalities while limiting the tasks and authorities delegated to local municipalities. District municipalities are tasked with preparing 1/1000 scale zoning plans, which are implemented after approval by the metropolitan municipality. Subsequently, Law No. 6360 replaced Law No. 5216, reflecting increased service expectations from local governments in urbanized areas of the country. Under Law No. 6360 alone, an amendment to Law No. 5216 was introduced to incorporate large rural areas into the boundaries of metropolitan municipalities. This amendment granted both metropolitan and district municipalities the authority to engage in all types of activities and services aimed at supporting agriculture and livestock. These legislative changes aimed to address the challenges of urbanization and the protection of peri-urban areas, which lacked specific planning regulations in Turkey, particularly under the unplanned areas zoning regulation.[122]

There are three basic legislations, namely the Zoning Law No. 3194 and the Unplanned Areas Zoning Regulation, which regulate planning and construction in rural settlement areas. The purpose of this regulation is stated in its 1st article as 'to ensure that the constructions within and outside the borders of the municipality and the adjacent areas and in the areas without a master plan (Additional phrase: RG-11/7/2021-315384) are formed in accordance with the science, health and environmental conditions', has been done. Article 2 applies to settlements within the boundaries of municipalities and contiguous areas without a zoning plan and/or with a population below 10,000 according to the latest census. In settled areas of villages and hamlets within municipal and contiguous area boundaries, as well as in areas without a zoning plan outside these boundaries, and in informal settlements both within and outside municipal and contiguous area boundaries, these regulations are enforced. Additionally, it applies to rural settled areas and their surroundings falling under the scope of metropolitan municipalities pursuant to Article 8(g) of Law No. 3194 dated 3/5/1985.

Areas falling within the scope of an approved environmental plan are primarily subject to the decisions of the environmental planning. Article 3 states that if the areas listed in Article 2 fall within the scope of an approved environmental plan, priority is given to compliance with the decisions of the environmental plan. The rest of the regulation provides detailed information about the depth and height of buildings that can be built in rural settlements. Moreover, the Zoning Law and Unplanned Areas Zoning Regulation introduce an exception for building structures without a license in village settlements. However, owners of these buildings may face administrative sanctions under Articles 32 and 42 of the Zoning Law and Article 184 of the Turkish Penal Code No. 5237 under "Crimes Against the Environment." Penalties for demolition, zoning fines, and prison sentences are stipulated in the Zoning Law. Administrative sanctions for development include sealing buildings, canceling building permits and occupancy permits, and non-utilization of public services and facilities.

The İzmir Greater Area Municipality expanded its responsibility to redraw a new metropolitan boundary, but other central and regional public institutions also play a role in planning at different scales and scopes. It's challenging to establish relationships between regional, urban, and local planning frameworks and scales, and to ensure integration between short-medium-medium regions and smaller-size plans. Planning activities reveal numerous activities with different scales, scopes, and jurisdictions, sometimes contradictory. The common feature of these planning efforts is a focus on urban areas, neglecting the inherent qualities and vulnerability of rural areas. particularly standard construction layouts are applied everywhere, ignoring the unique characteristics of rural areas.[117]

3.4. Dataset and Analysis of İzmir Research Area

The data collection and analysis phase plays a critical role in shaping the core findings of the research. This phase involves gathering, compiling, organizing, and analyzing the necessary data in line with the research hypotheses. Primarily, images from the Landsat satellite, chosen for their accessibility and extensive historical database, were obtained from the United States Geological Survey (USGS) to analyze

land use changes and urban sprawl. Secondly, data on land cover and use produced by the Coordination of Information on the Environment (CORINE) as determined by the European Environment Agency was accessed via the link (https://land.copernicus.eu/en/products/corine-land-cover). CORINE data is used in various influential land cover studies to evaluate regional urbanization beyond administrative boundaries in Europe. In the literature review, various indicators were identified to frame the research in terms of degrees of urbanity and rurality. Some of these indicators were obtained from the Turkish Statistical Institute (TÜİK). When the collected data for specific years was incomplete, projections based on population growth rates were made by Dr. Ümit Kuvvetli. Finally, current plans and report documents from the Izmir Metropolitan Municipality were utilized. In this study, GIS software was used for image processing and map preparation. All the collected data was organized and analyzed in the GIS software.

3.4.1. Land Use in the Metropolitan Area of Izmir

For centuries, Izmir has been a metropolitan city evolving through human interactions and activities. However, as a result of policies promoting urbanization, it has faced various challenges. The city hosts both extensive agricultural lands and areas where industry and commerce have developed. Agricultural lands are particularly widespread in the north and southeast of the province, especially in the districts of Menemen, Bergama, and Torbalı. The diversity of land use in Izmir significantly impacts the city's economic, social, and environmental structure. Land use decisions in Turkey and globally are governed by various laws and regulations. However, these frameworks often fail to ensure the sustainability of living beings and natural objects. In Turkey, laws lacking sufficient sanctions often fail to achieve their intended goals. For example, Law No. 4342, aimed at protecting olive groves, has small financial penalties and minimal deterrent effect. Law No. 5403 on Soil Protection and Land Use also suffers from inadequate enforcement capabilities. Effective enforcement mechanisms and sanctions are crucial for achieving desired conservation levels for biodiversity and natural resources.

Land Cover data from the CORINE Land Cover 2018 dataset was used to evaluate urbanization patterns and dynamics, categorized into nine groups. The first group, artificial areas, includes predominantly administrative/public/residential buildings, the areas occupied by these buildings, and their related urban structure, such as continuous urban fabric, discontinuous urban fabric, industrial, commercial, and transport units. The second group consists of mining extraction sites, dump sites, and construction sites. The third group comprises artificial green spaces and sport and leisure facilities (open spaces). The fourth group includes non-irrigated arable land, permanently irrigated land, rice fields, vineyards, orchards, and olive groves (agricultural areas). The fifth group covers pastures. The sixth group includes agricultural areas with natural vegetation, complex cultivation patterns, and areas primarily used for agriculture and grazing. The seventh group comprises broad-leaved forests, coniferous forests, and mixed forests. The eighth group includes natural grasslands, moors and heathland, sclerophyllous vegetation, transitional woodland-shrub, beaches, dunes, sands, bare rocks, sparsely vegetated areas (areas with low vegetation cover). Finally, the ninth group includes inland marshes, salt marshes, watercourses, water bodies, coastal lagoons, estuaries, deltas, and seas and oceans, categorized under wetlands. (Figure 13).

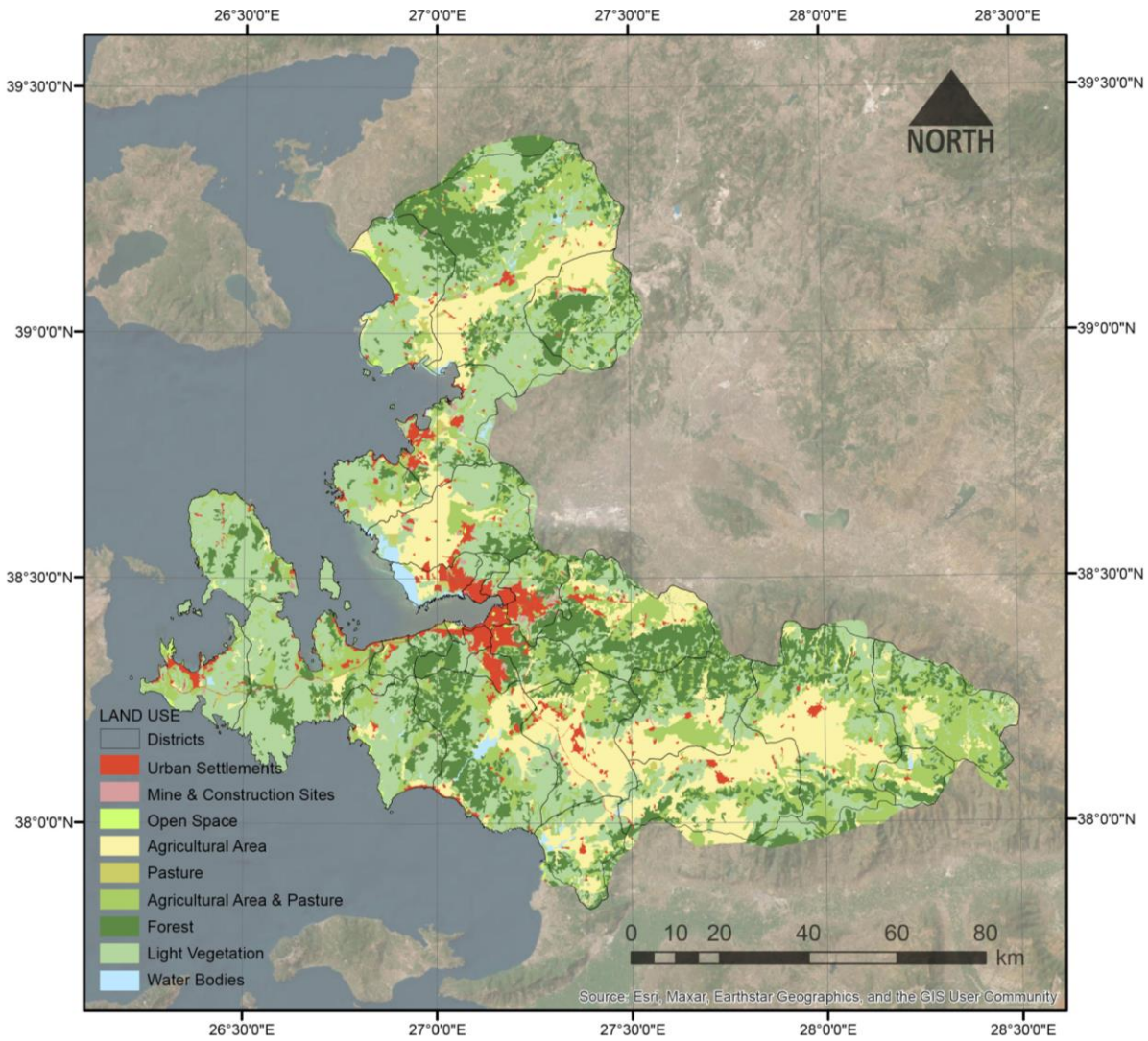


Figure 13. Land Use Land Cover 2018, (Source: CORINE)

Finally, to examine more recent land use, satellite images obtained from the United States Geological Survey (USGS) were processed in a Geographic Information Systems (GIS) environment. The map produced through this process (Figure 14) is used in the subsequent stage to analyze land use changes.

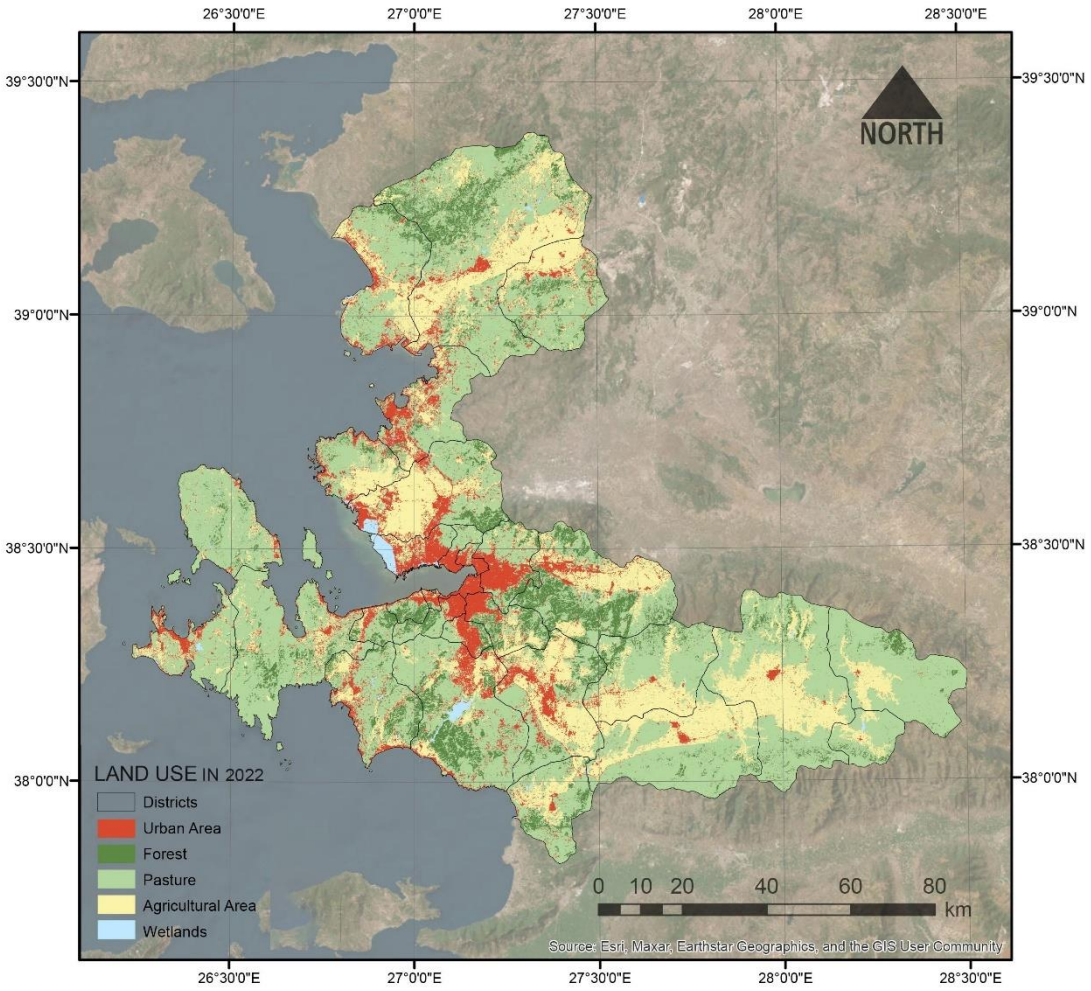


Figure 14. Land Use 2022, Source: Created by the author.

By utilizing the existing datasets and creating a land use map from satellite images, it is possible to achieve more accurate and reliable results in demarcating peri-urban areas. Examining land use based on CORINE data, there has been a noticeable loss of forest and agricultural lands and an increase in urban areas by 2018 (Figure 13). Finally, to analyze more recent land use, satellite imagery obtained from the United States Geological Survey (USGS) was processed using Geographic Information Systems (GIS) through maximum likelihood classification. According to the land use map for 2022, (following the enactment of Law No. 6360) urban areas have significantly increased in districts outside the city center, with a corresponding loss of agricultural and forest lands (Figure 14).

3.4.2. Measuring Land Use Change in the Metropolitan Area of Izmir

This study, which covered the Izmir province, used remote sensing applications to identify land use and changes, thereby detecting the spatial development and transformation of the study area. The demarcation of peri-urban areas necessitates a spatial consideration of the rate of land change, precision requirements, and subjectivity of conditions. For urban planners, the production of growth policies requires the measurement of the rate of growth, the growth pattern, and the degree of growth. At this point, the use of digital planning tools and software within the GIS (Geographic Information System) framework offers a significant solution.[59,123] Change detection analyses are widely used tools to better understand and evaluate urban sprawl and land use changes.[124,125] Additionally, they identify and measure the differences between images of the same area taken at different times.[123] To demarcate peri-urban areas, land use, the urban-rural relationship, and land transformation must first be addressed. Analyzing land use and changes helps us better understand the history of interactions between human activities and the environment and demonstrates land transformations. This, in turn, enables the development of more realistic and multifaceted scenarios.[124] Urban areas, despite occupying a small share of land regionally and globally, are incredibly dense, host a large portion of human activities, and are in constant flux. Therefore, they have significant economic and environmental impacts. Monitoring changes in land cover is a crucial way to understand these dynamics.

Satellite data is used for periodic monitoring of land patterns, enabling effective planning for economic and ecological sustainability, allowing for quick detection of variations in land cover changes.[126] Over a 36-year period, changes in land use between 1986, 1998, 2010, and 2022 were analyzed using remote sensing and Geographic Information Systems technologies through satellite imagery. This study utilized GIS software for image processing and map creation. Care was taken to select satellite images that were cloud-free and clear. Additionally, the satellite images were chosen specifically from July–August of each designated year, as these months are optimal for interpreting agricultural lands. Further details about each image are provided in Table 1.

Table 1. Satellite Imagery Information in the Study Area

Years	Product Name	Satellite Sensor	Location in the Research Area
1986	LT05_L1TP_181033_19860727_20200917_02_T1_B1	Landsat 4-5 TM C2 L2	West
	LT05_L1TP_180034_19860720_20200917_02_T1_B1	Landsat 4-5 TM C2 L2	South
	LT05_L1TP_180033_19860720_20200918_02_T1_B1	Landsat 4-5 TM C2 L2	East
1998	LT05_L1TP_181033_19980829_20200908_02_T2_B1	Landsat 4-5 TM C2 L2	West
	LT05_L1TP_180034_19980806_20200908_02_T1_B1	Landsat 4-5 TM C2 L2	South
	LT05_L1TP_180033_19980721_20200908_02_T1_B1	Landsat 4-5 TM C2 L2	East
2010	LT05_L1TP_181033_20100729_20200824_02_T1_B1	Landsat 4-5 TM C2 L2	West
	LT05_L1TP_180034_20100706_20200823_02_T1_B1	Landsat 4-5 TM C2 L2	South
	LT05_L1TP_180033_20100706_20200824_02_T1_B1	Landsat 4-5 TM C2 L2	East
2022	LC08_L1TP_181033_20220730_20220806_02_T1_B1	Landsat 8-9 OLI/TIRS C2 L2	West
	LC09_L1TP_180034_20220731_20220731_02_T1_B1	Landsat 8-9 OLI/TIRS C2 L2	South
	LC08_L1TP_180033_20220723_20220802_02_T1_B1	Landsat 8-9 OLI/TIRS C2 L2	East

All collected raster datasets were projected into the universal coordinate system: 'WGS_1984_UTM_Zone_35N'. Subsequently, band combinations were selected for dataset alignment and consistency: bands 4-3-2 for TM and 5-4-3 for OLI/TIRS infrared and agriculture bands. This choice was more useful for creating noticeable distinctions between urban and non-urban pixel clusters and emphasizing the contrast between bare agricultural lands in open areas and natural vegetation. Composite processing was performed using bands of the same wavelength, and a composite band image was created by combining all bands of multiple satellite images from the same year, cropped to the administrative boundary of Izmir Metropolitan City (Figure 15).

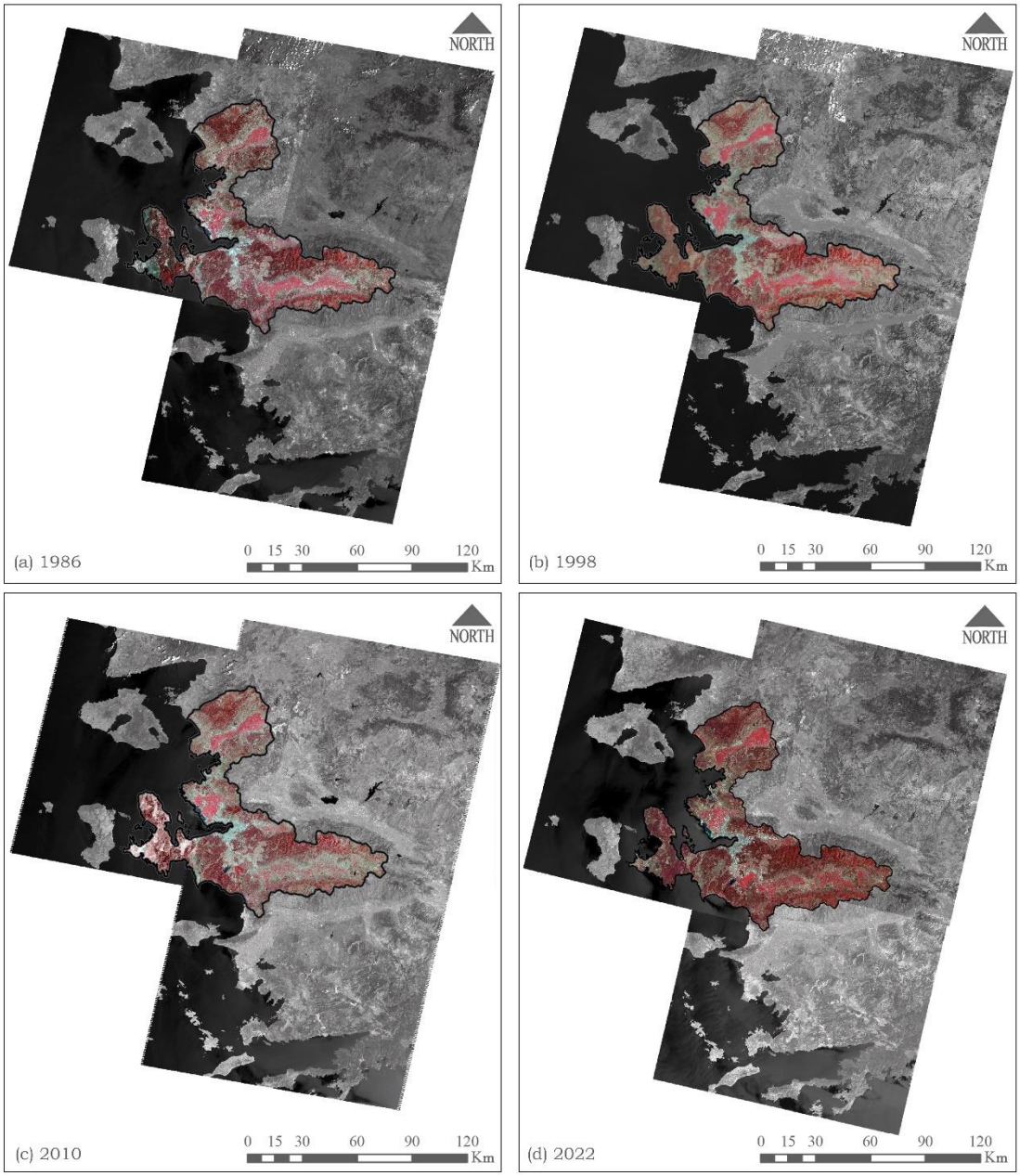


Figure 15. (a) Land cover satellite image for the year 1986; (b) Land cover satellite image for the year 1998; (c) Land cover satellite image for the year 2010; (d) Land cover satellite image for the year 2022 Source: USGS web sites (https://earthexplorer.usgs.go)

To generate land use/land cover maps (Figure 15) using supervised classification, training samples were collected for each category based on the extent of a specific class. The selected samples were then used with the Maximum Likelihood Classifier Algorithm to classify all images. The schematic representation of creating land use maps from satellite images is shown in Figure 16.

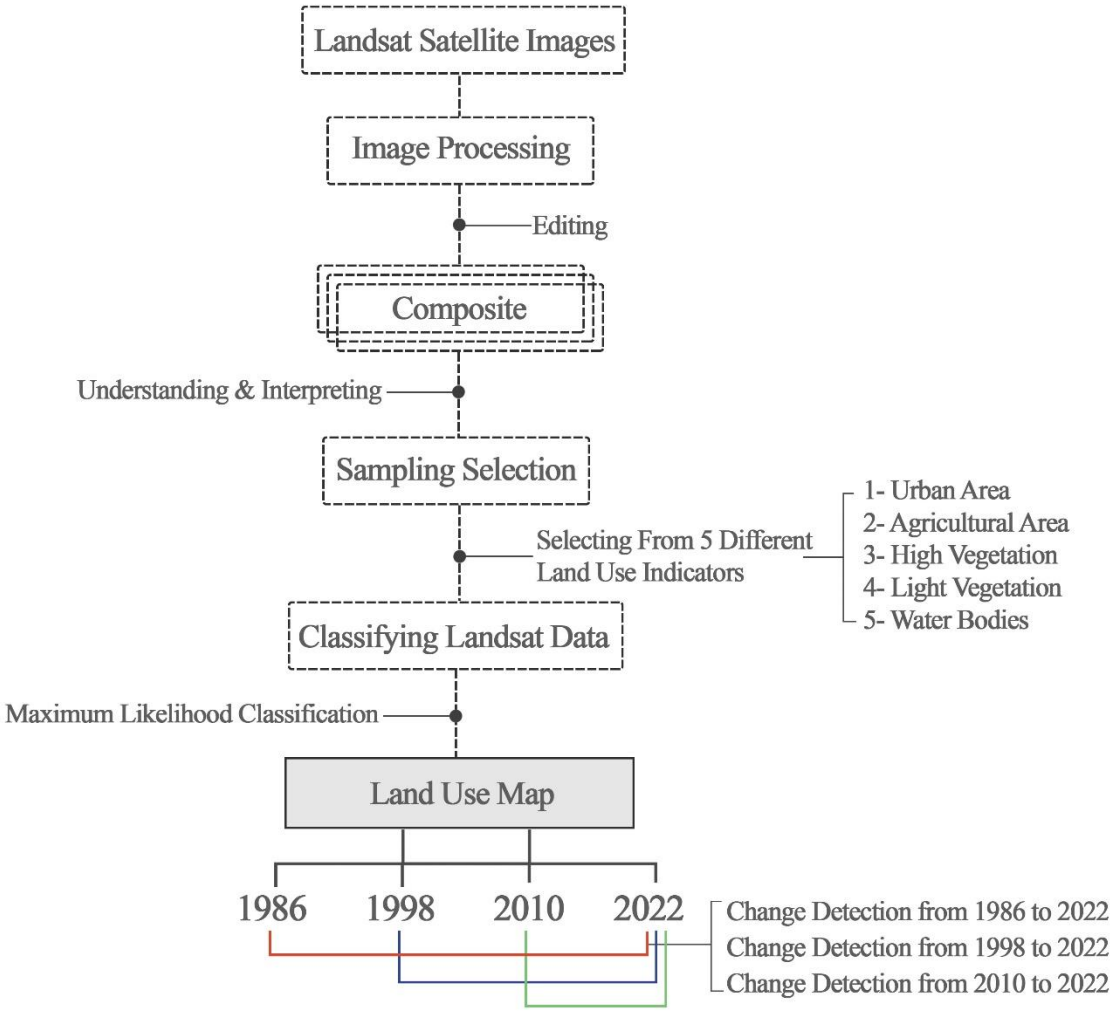


Figure 16. Process Flow Chart for Making Land Use Maps

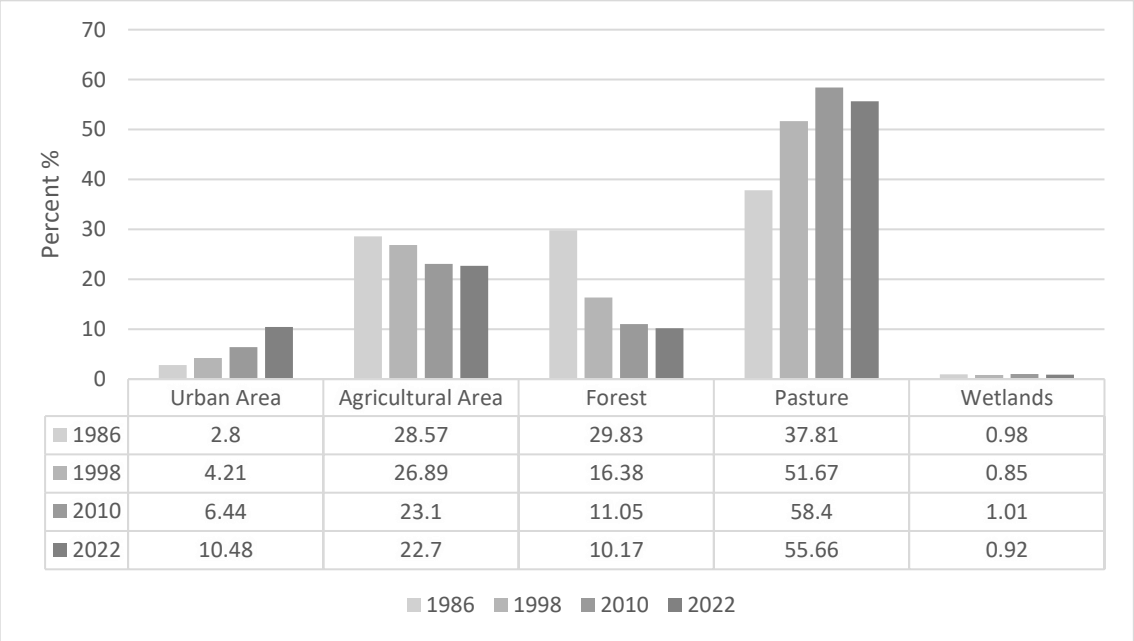
To minimize error rates, each selected Landsat image was classified into five land cover categories: urban areas, agricultural areas, pastures, forests, and wetlands. Table 2 displays the detailed content of this classification. The study applied the widely used Maximum Likelihood Supervised Classification (MLSC) technique. This choice was made because acquiring appropriate training samples for classifying Landsat data produces more accurate classification results than adapting any specific classification technique itself.[127]

Table 2. Land Use Classification

Urban Area	Impervious areas consist of built-up regions that are impermeable to water. These areas typically include residential buildings, commercial centers, industrial zones, public buildings, and infrastructure facilities.
Agricultural Areas	Agricultural areas are regions where either irrigated or rainfed farming activities take place.
Forest	Areas rich in diverse plant species and dense vegetation characterize natural habitats. These include areas such as forests, rainforests, or meadows.
Pasture	Areas with sparse vegetation, where plant cover is low and predominantly consists of shrubs, grasses, and low-growing plants.
Wetlands	Water bodies are significant areas that host aquatic life and natural ecosystems. These include lakes, marshes, rivers, and seas, representing various water resources.

In this study, to determine changes in land use, the intersection operation of two maps obtained at different time periods in GIS software was conducted. This operation (geoprocess-intersection) shows both the unchanged areas and the changed land uses in the land cover classes, reflecting the spatial impact of changes. The resulting data were analyzed to evaluate urban expansion, transformation of agricultural areas, and changes in forested areas during this period. Table 3 summarizes these findings.

Table 3. Land Use Distribution by Years (% in percentage)



	Urban Area	Agricultural Area	Forest	Pasture	Wetlands
1986	2.8	28.57	29.83	37.81	0.98
1998	4.21	26.89	16.38	51.67	0.85
2010	6.44	23.1	11.05	58.4	1.01
2022	10.48	22.7	10.17	55.66	0.92

In 1986, Izmir province comprised only 2.8% urban areas and 28.57% agricultural areas, with the remainder consisting of forests, grasslands, and wetlands. By 2022, the urban area had increased to 10.48%, marking a 7.68% increase, which corresponds to an area of 905.205571 square kilometers. Conversely, agricultural areas had decreased to 22.7%, reflecting a 5.87% reduction amounting to 577.207075 square kilometers. The conversion of agricultural lands and forests into urban areas or barren lands was the most significant change observed. Over a 36-year period, with intervals of 12 years between 1986–1998, 1998-2010 and 2010–2022, land use changes were analyzed using GIS technologies. The maximum likelihood classification method was implemented, utilizing satellite imagery for analysis. Urbanization surged during the 1986–1998 period, leading to a significant reduction in agricultural and especially forest lands (Figure 17).

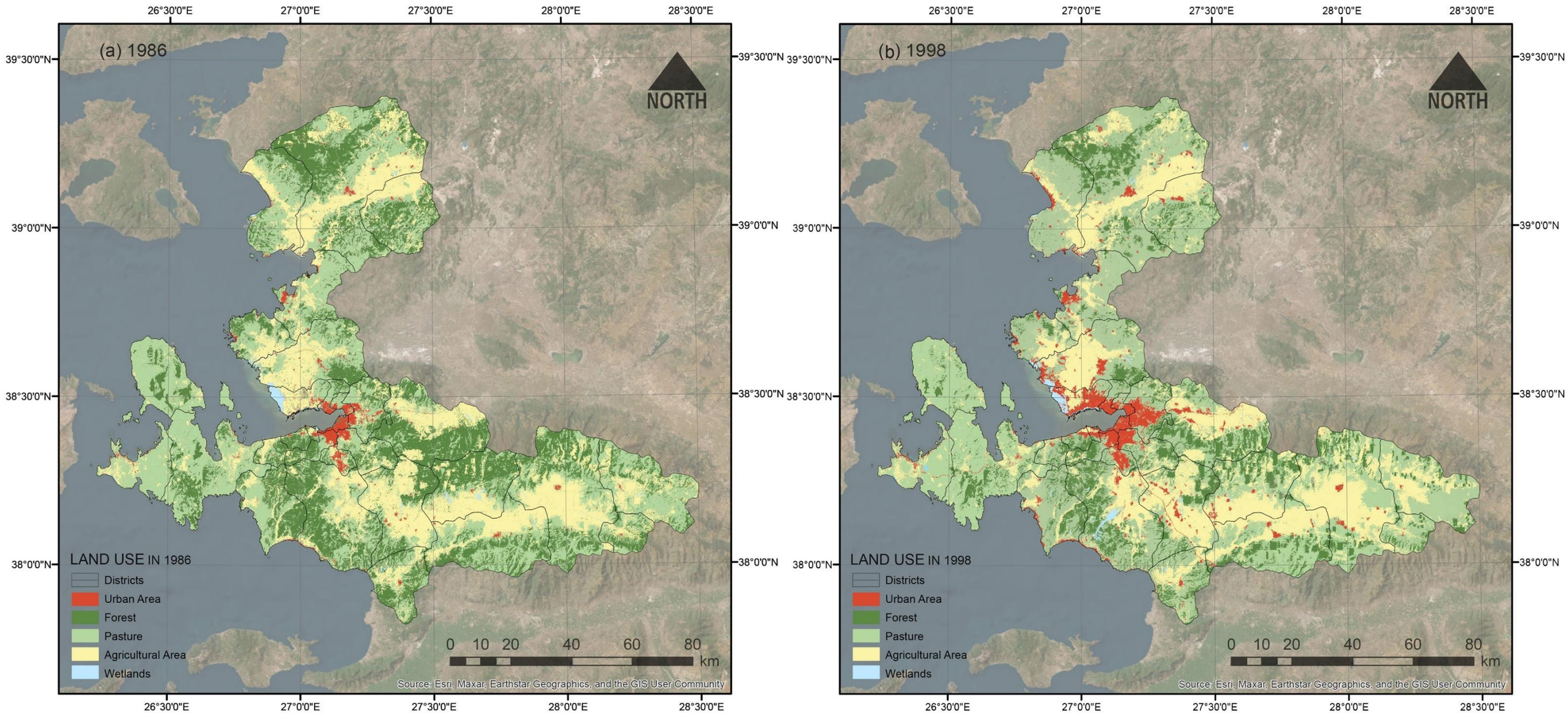


Figure 17. Land use change of Izmir province from 1986 (a) to 1998 (b)

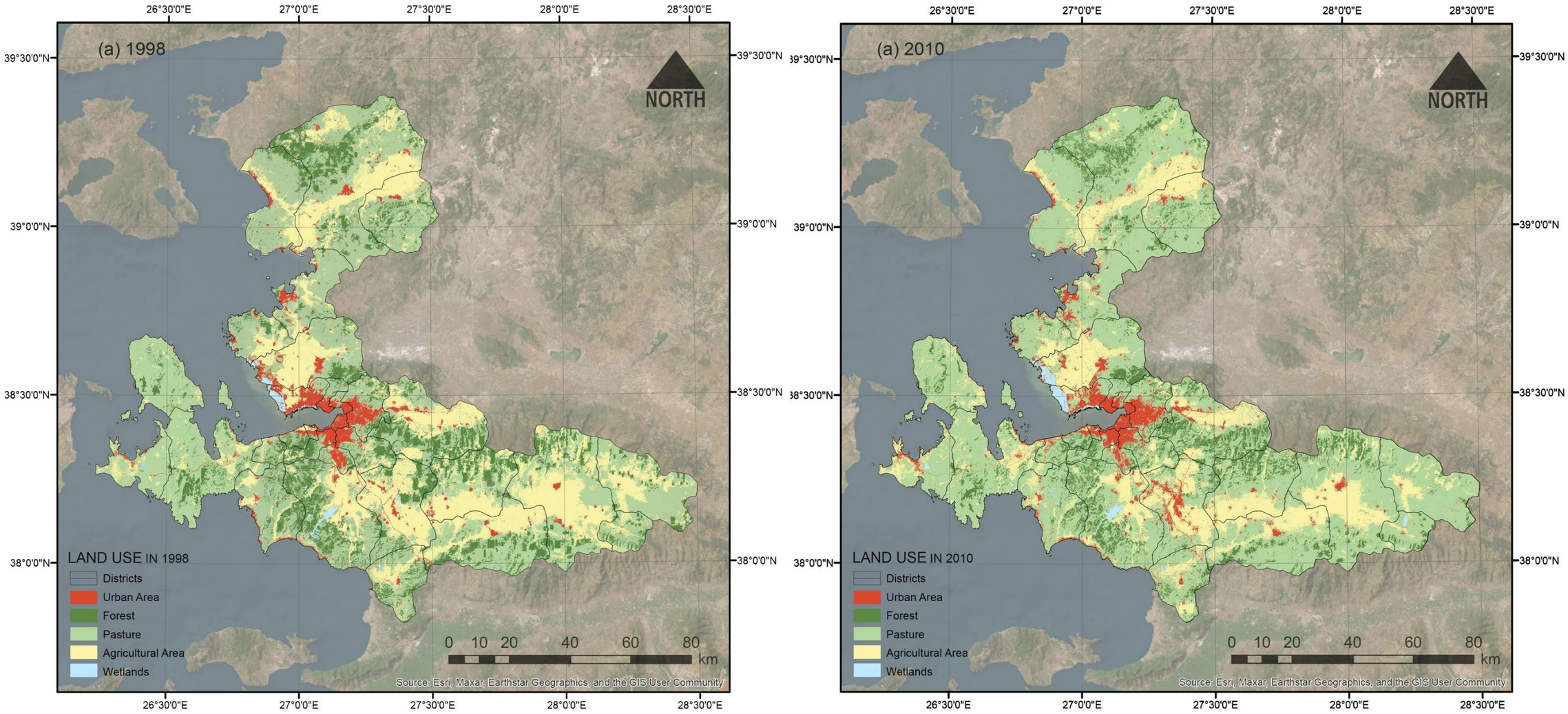


Figure 18. Land use change of Izmir province from 1998 (a) to 2010 (b)

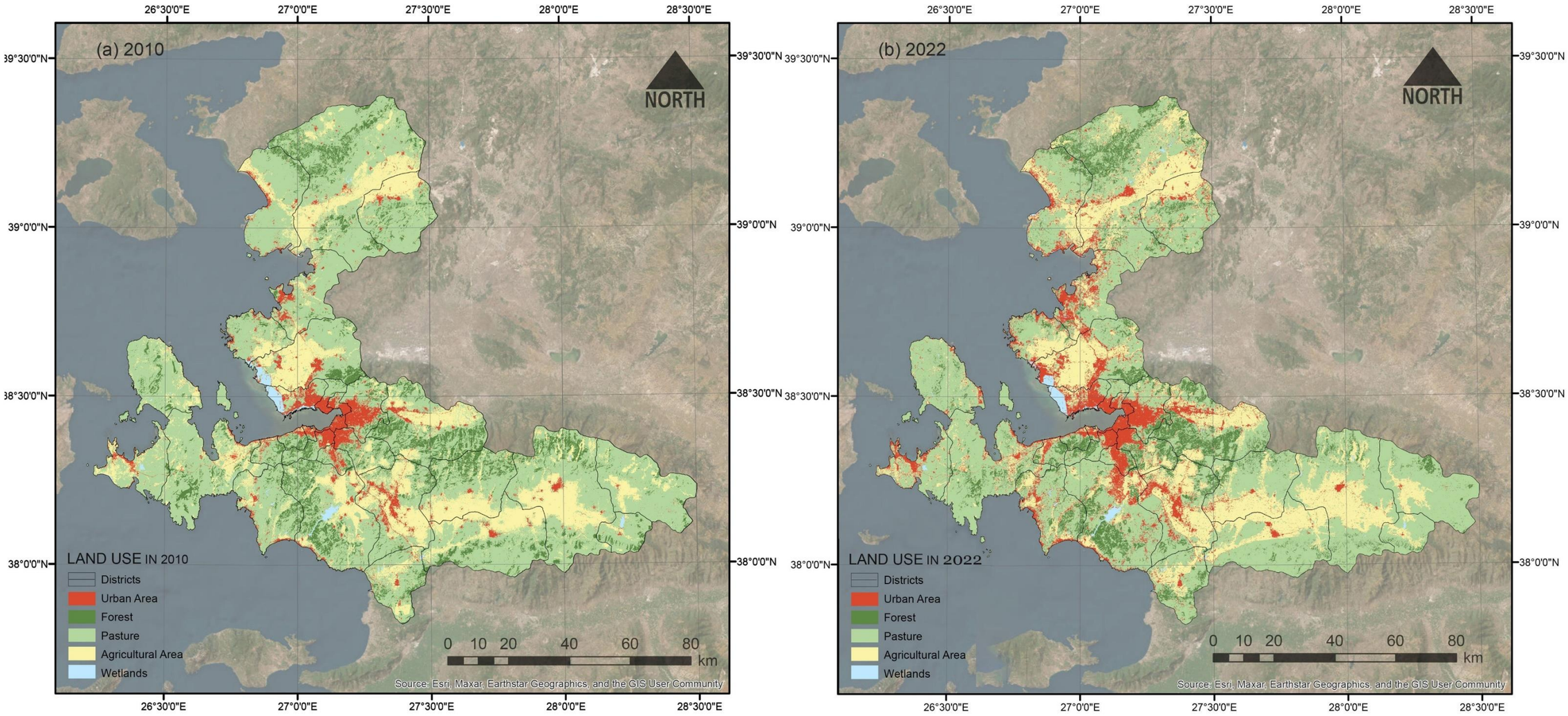


Figure 19. Land use change of Izmir province from 2010 (a) to 2022 (b)

Similarly, the 1998–2010 period saw an increase in urbanization and the loss of agricultural and forest lands (Figure 18). During the 2010–2022 period, urbanization increased the most. Likewise, agricultural and forest areas continued to decrease, with a notable rise in urbanization around the city center (Figure 19).

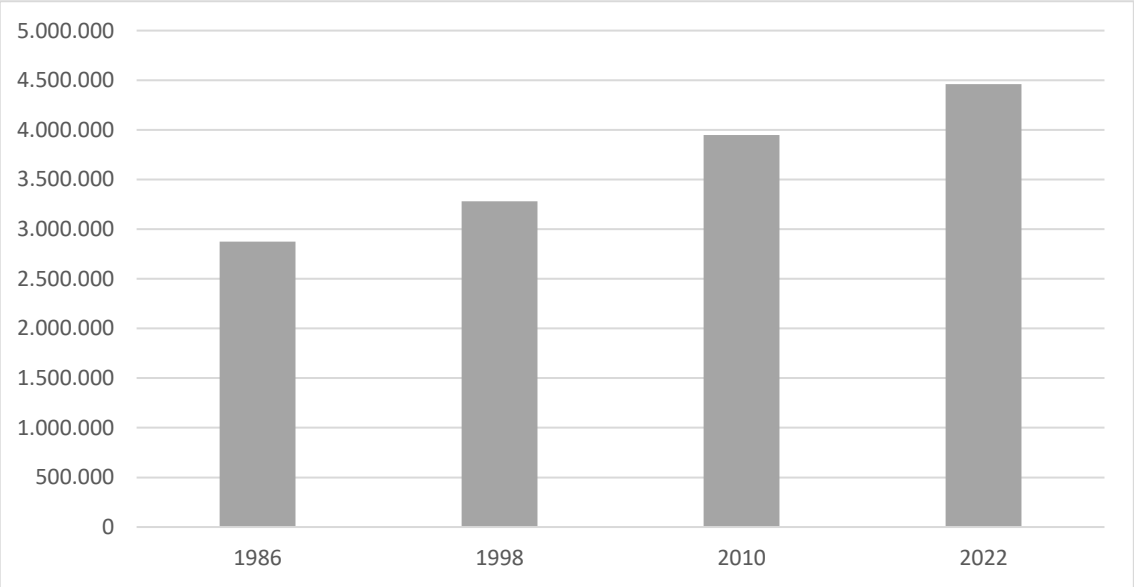
Urban areas covered 2.8% of İzmir's total area in 1986. This increased to 4.2% in 1998, 6.4% in 2010, and 10.4% in 2022. Conversely, agricultural areas covered 28.5% of İzmir in 1986, which decreased to 26.8% in 1998, 23.1% in 2010, and 22.7% in 2022. Over the 36-year period, 5% of İzmir's total area shifted from agricultural land to urban areas, covering an area of 577.207075 km2. Forests accounted for 29.8% of İzmir in 1986, but this decreased to 16.3% in 1998, 11% in 2010, and 10.1% in 2022. Over this 36-year period, 19.7% of İzmir's forest areas transitioned to different land uses. The most significant changes involved the conversion of agricultural and forest lands into urban areas or barren lands. These findings indicate that, since 1986, the lack of proper planning and management has been evident. Legislative regulations have had a devastating effect on rural areas, leading to a significant loss of control and efficacy over their resources. Despite these negative changes, the continuation of agricultural production has been partially secured due to the İzmir municipality's specific rural policies. It is a two-stage research process: the first stage integrates both the drivers and impacts of land change across space and time, while the second stage focuses on land management and the models governing land use. Understanding land dynamics necessitates attention to both land cover (biophysical conditions) as an integrated human-environment system and land use (human activities).[101] In recent years, Izmir has experienced significant land use changes that merit consideration. Such transformations underscore the region's evolving urbanization and, consequently, the impacts on natural ecosystems and agricultural activities in Izmir.

3.4.3. Population in the Metropolitan Area of İzmir

During the 20th century, the global population experienced unprecedented exponential sprawl. Considering the rural-urban interaction, most of the population

lived in rural areas before the 2000s, but this situation gradually reversed after the 2000s. Lynch[2] forecasted that during the next two decades, all of humanity will reside in urban areas. Turkey, like many countries globally, is experiencing rapid urbanization trends. Cities like Izmir are witnessing significant population growth and urban expansion, driven by factors such as industrialization, rural-urban migration, and economic development. In Izmir specifically, as one of the largest cities in Turkey and a hub of economic activity and cultural heritage, urbanization impacts are notable. The population of İzmir was 2,875,317 in 1986, increased to 3,281,175 in 1998, and reached 3,948,848 in 2010. As of 2022, the total population of İzmir is 4,462,056 (Table 4). The population of the province is on an upward trend, with the most significant increase occurring between 1998 and 2010. Izmir is clearly experiencing rapid population growth as a metropolitan area. However, more importantly, the pattern of population growth is noteworthy; it demonstrates a significant shift from the urban core towards surrounding settlements.

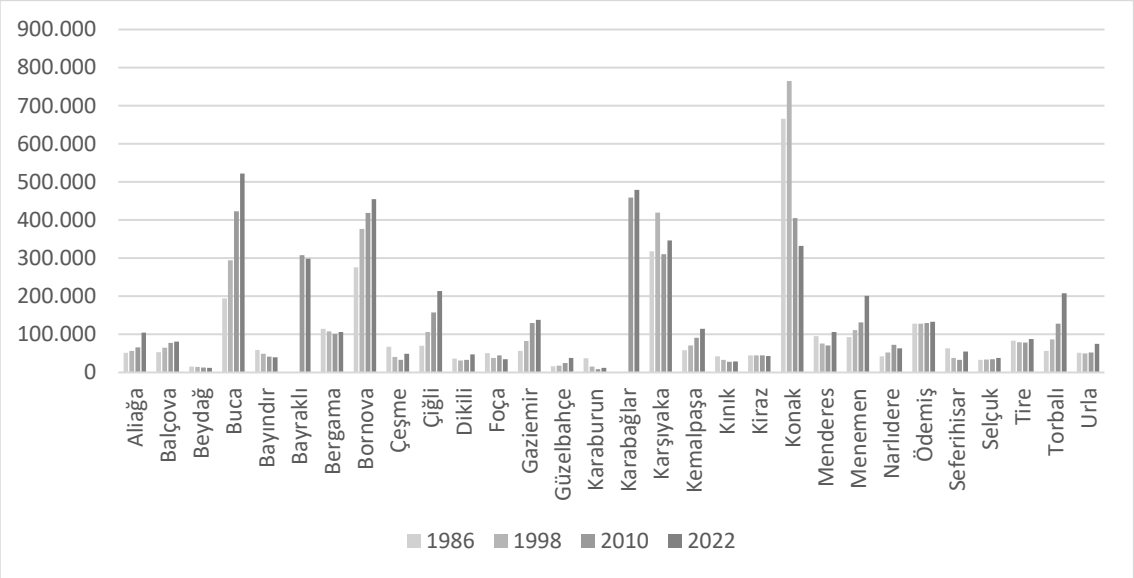
Table 4. The Population of Izmir in 1986, 1998, 2010, and 2022



The central city region area of Izmir, as defined within the boundaries of the Metropolitan Municipality, includes the districts of Konak, Karabağlar, Karşıyaka, Bayraklı, Bornova, Buca, Narlıdere, Balçova, Gaziemir, Çiğli, and Menemen. In the last

twelve years, the population trend of center districts Buca, Karşıyaka, Karabağlar, Bornova, Güzelbahçe, Gaziemir, Çiğli, and Menemen increased, while Bayraklı, Narlıdere, and Konak districts decreased (Table 5).

Table 5. Population of Izmir according to its districts in 1986, 1998, 2010 and 2022



In recent times, population growth has been particularly notable in the areas surrounding the central districts, specifically in the district of Aliağa, Kemalpaşa, Torbalı, and Urla. Based on the rural and urban population, it is observed that only two districts of İzmir province comply with the rural typology. Eight districts show an ambiguous area status, and the remaining 20 districts appear to have urban typologies (Figure 20). Similarly, when evaluating the population density, seven districts of İzmir province appear to fit the rural typology due to their size. All the central districts, except for Güzelbahçe, have an urban status. The remaining 13 districts display an ambiguous area status (Figure 21). EUROSTAT defines densely populated areas at NUTS-2 and NUTS-3 levels as places with over 50,000 inhabitants, based on urban threshold research conducted in the early 1980s, excluding areas with a lower threshold of 20,000 (Beyazlı, 2014). At NUTS-2 and NUTS-3 levels, densely populated regions have a density of over 500 people per km², moderately populated regions have a density between 500 and 100 people per km², and sparsely populated regions have a density of less than 100 people per km².[128]

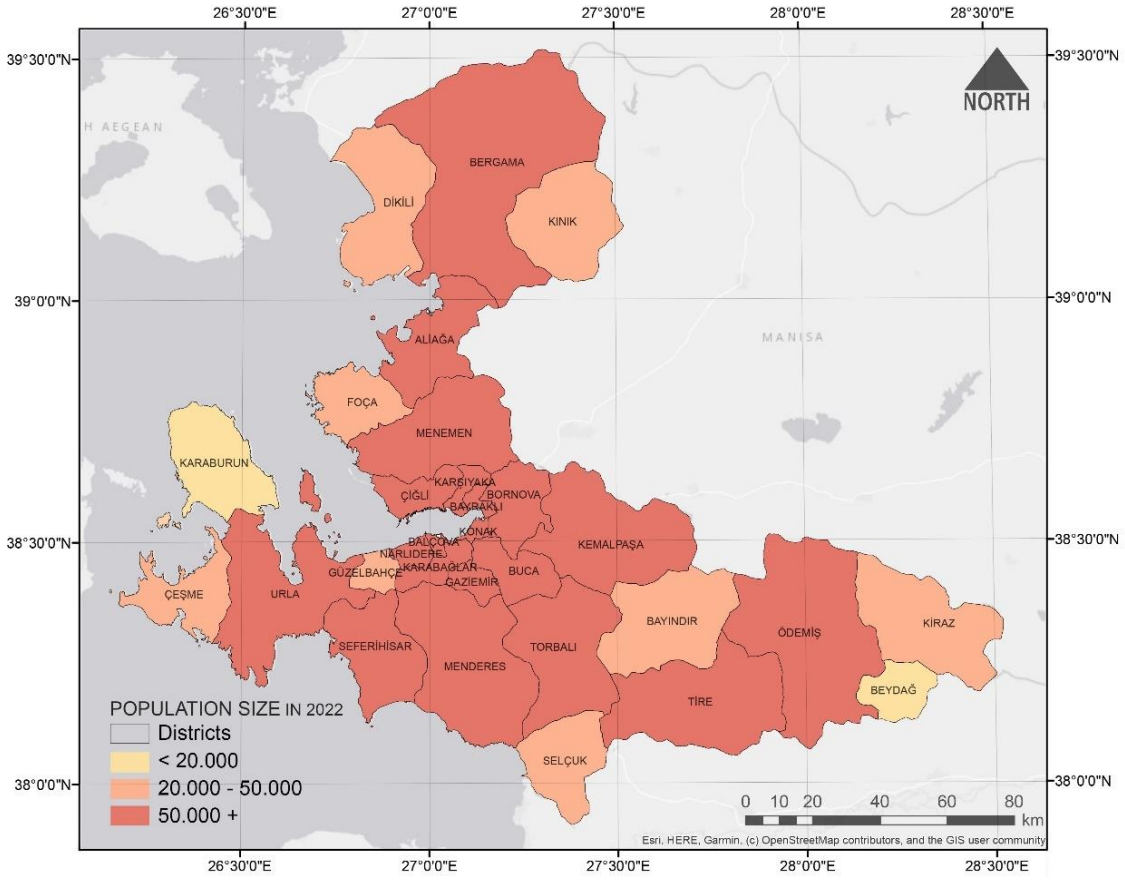


Figure 20. Population Size in 2022

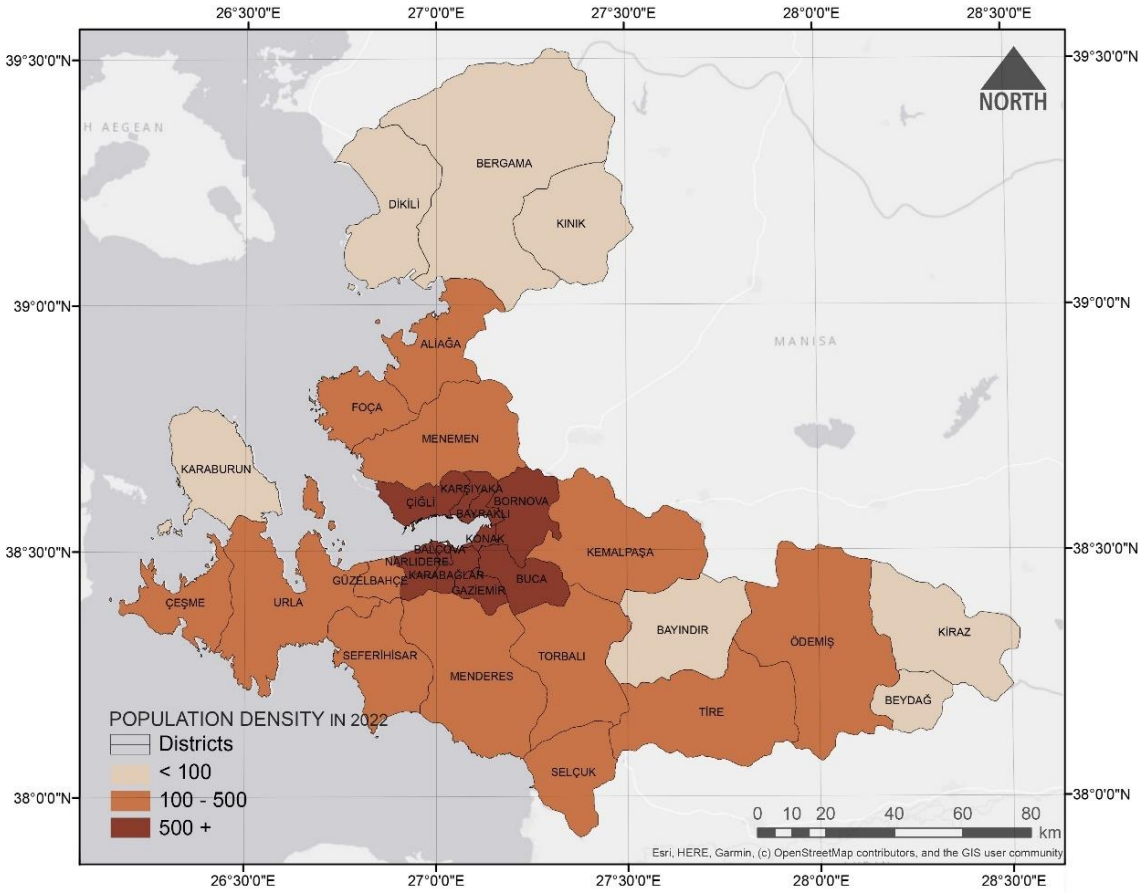


Figure 21. Population Density (Inhabitants per sq.km.)

Between 1986 and 1998, the central districts of Izmir exhibited an average population growth rate increase of 1.8%. Districts such as Çiğli, Karşıyaka, Bayraklı, Gaziemir, Buca, and Torbalı experienced a growth rate higher than this average. This indicates a trend of population expansion not only within the central areas of Izmir but also spreading to the surrounding regions (Figure 22).

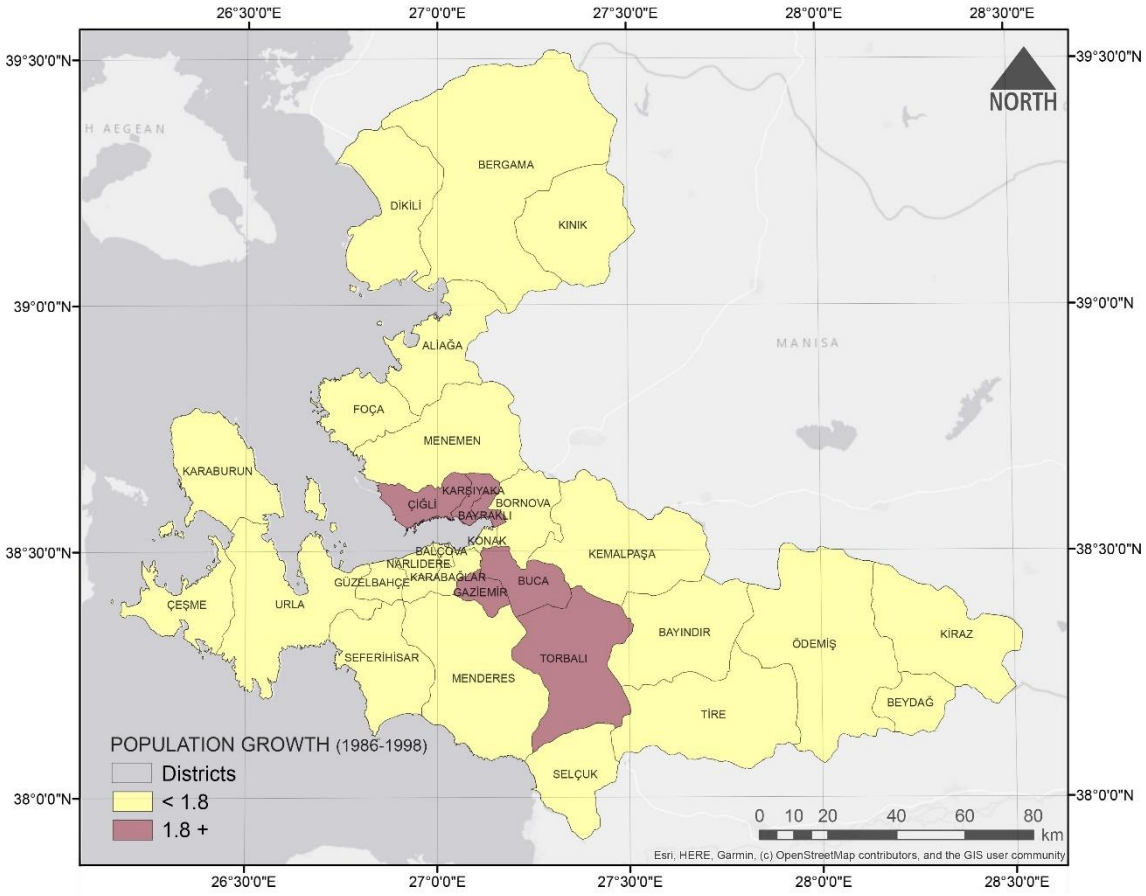


Figure 22. Population Growth (1986-1998)

Between 1998 and 2010, the central districts of Izmir exhibited an average population growth rate of 1.8%. Districts such as Karaburun, Torbalı, Kemalpaşa, Gaziemir, Güzelbahçe, Narlıdere, Balçova, Çiğli and Bayraklı experienced a growth rate higher than this average. This indicates a trend of population expansion not only within the central areas of Izmir but also spreading to the surrounding regions (Figure 23).

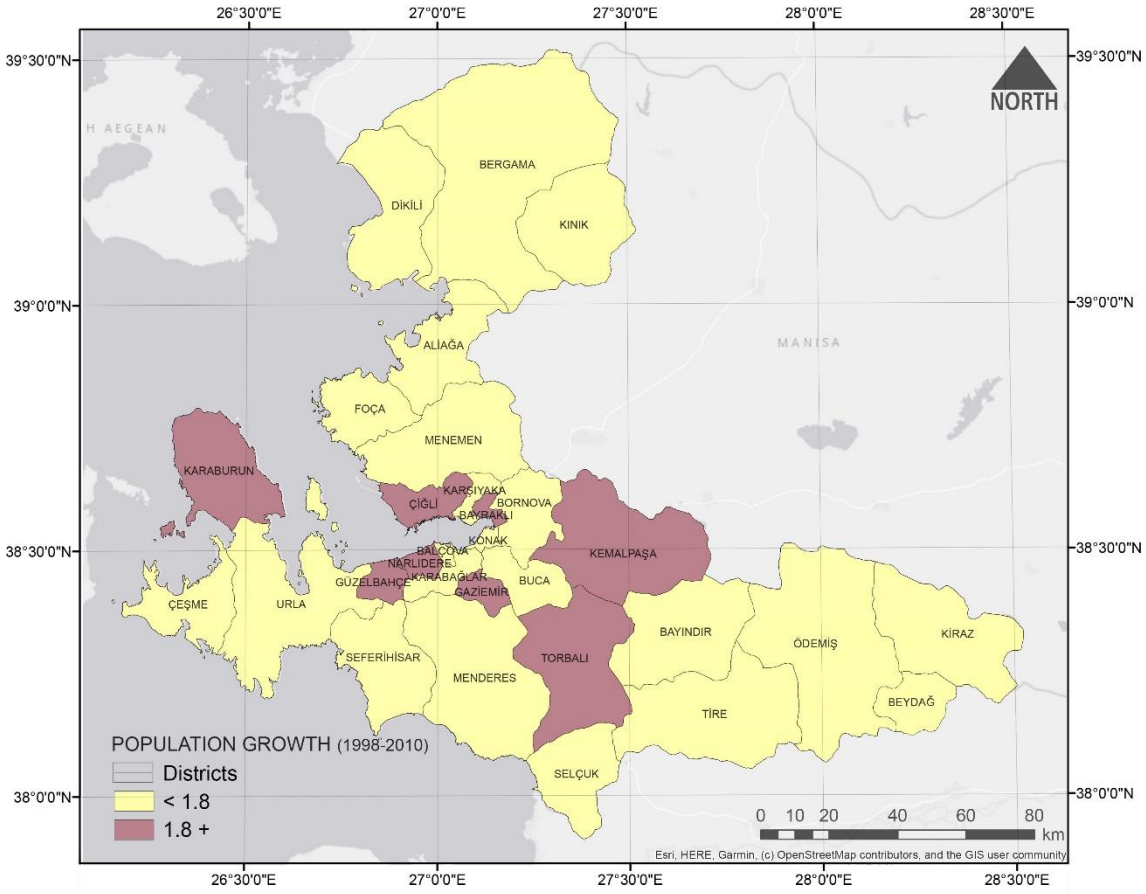


Figure 23. Population Growth (1998-2010)

Between 2010 and 2022, the central districts of Izmir exhibited an average population growth rate of 0.5%. Districts such as Bayındır, Beydağ, Bornova, Foça, Güzelbahçe, Karaburun, Kiraz, Narlıdere, Ödemiş, and Konak experienced a growth rate lower than this average. During this period, although the population growth in the central districts was more stagnant, all other districts experienced a growth rate higher than that of the central districts. (Figure 24). The contrast between population growth in the outskirts of the metropolis and population decline in the core of the metropolis is clearly evident.

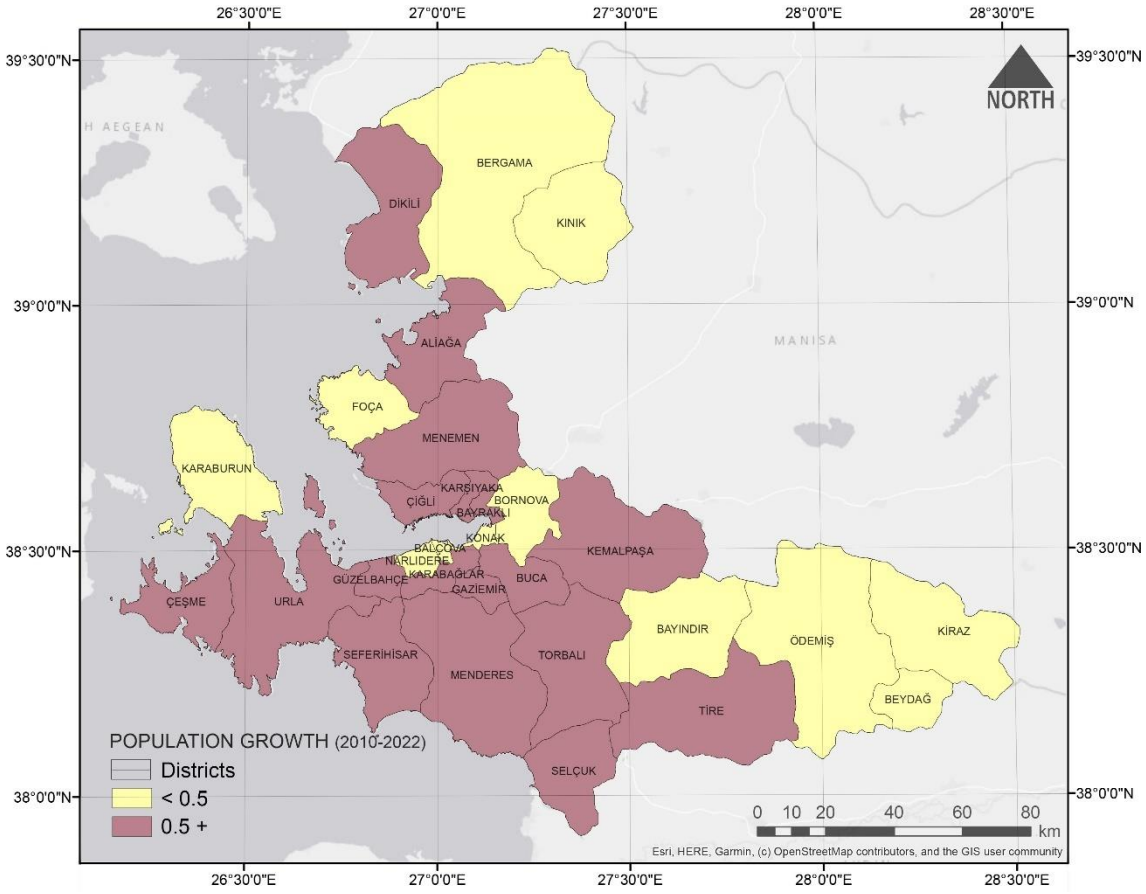


Figure 24. Population Growth (2010-2022)

3.4.4. Distance from the City Center of İzmir

Izmir exhibits a complex relationship between its urban core, rural areas, and peri-urban zones, influenced by distance from the city center and the dynamics of urbanization. As one moves away from the urban core, the nature of the landscape and land use changes. Therefore, the indicator of distance from the city center is a crucial factor in demarcating the urban periphery. This situation may vary from city to city, but according to Simon the inner peri-urban area for metropolitan areas is determined as being 30-50 km away from the urban core. The spatial relationship to urban areas has been emphasized by Reginster and Rounsevell (2006), who defined peri-urban areas as areas that are close to large cities (distance < 30 km), in a large buffer zone around large cities (distance between 30 and 100 km), close to medium-sized cities (distance < 30 km), or close to small cities (distance < 10 km). Additionally, for Izmir, according to the

Metropolitan Municipality and Law No. 6360, the metropolitan jurisdiction covers an area with a diameter of 50 km from the center, encompassing the entire Izmir region (Figure 25).

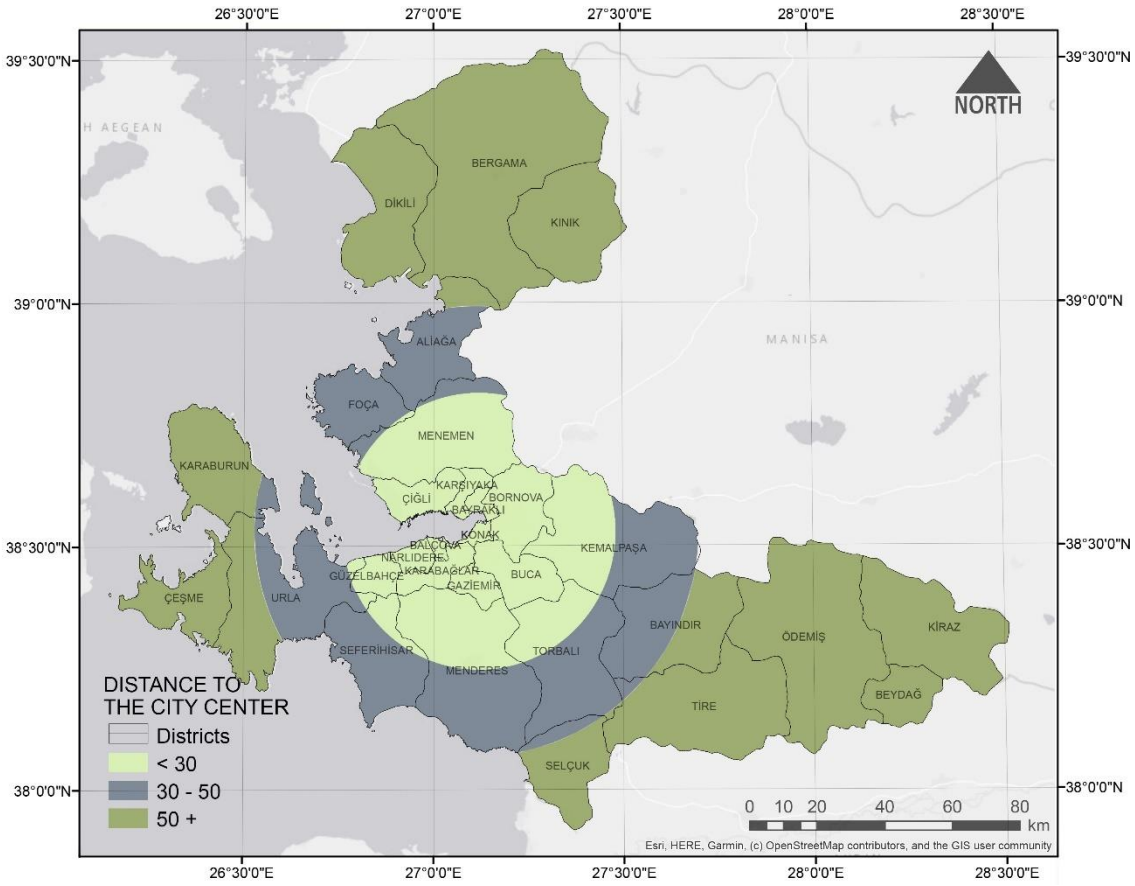


Figure 25. Distance to the City Core

3.4.5. Slope in terms of Suitability for Settlement

The slope has been critical in determining the potential limits of human occupation and development. For example, gentle slopes are attractive for agricultural production and local development, and therefore, these areas are more likely to experience land cover changes. In contrast, areas with steep slopes are less likely to undergo significant changes. A slope higher than 20% is considered unsuitable for settlement and serves as a limiting factor for urban sprawl. Thus, it was taken into

consideration in demarcating the peri-urban areas. The areas of İzmir with slopes lower than 20% are generally urbanized or allocated for agricultural use (Figure 26).

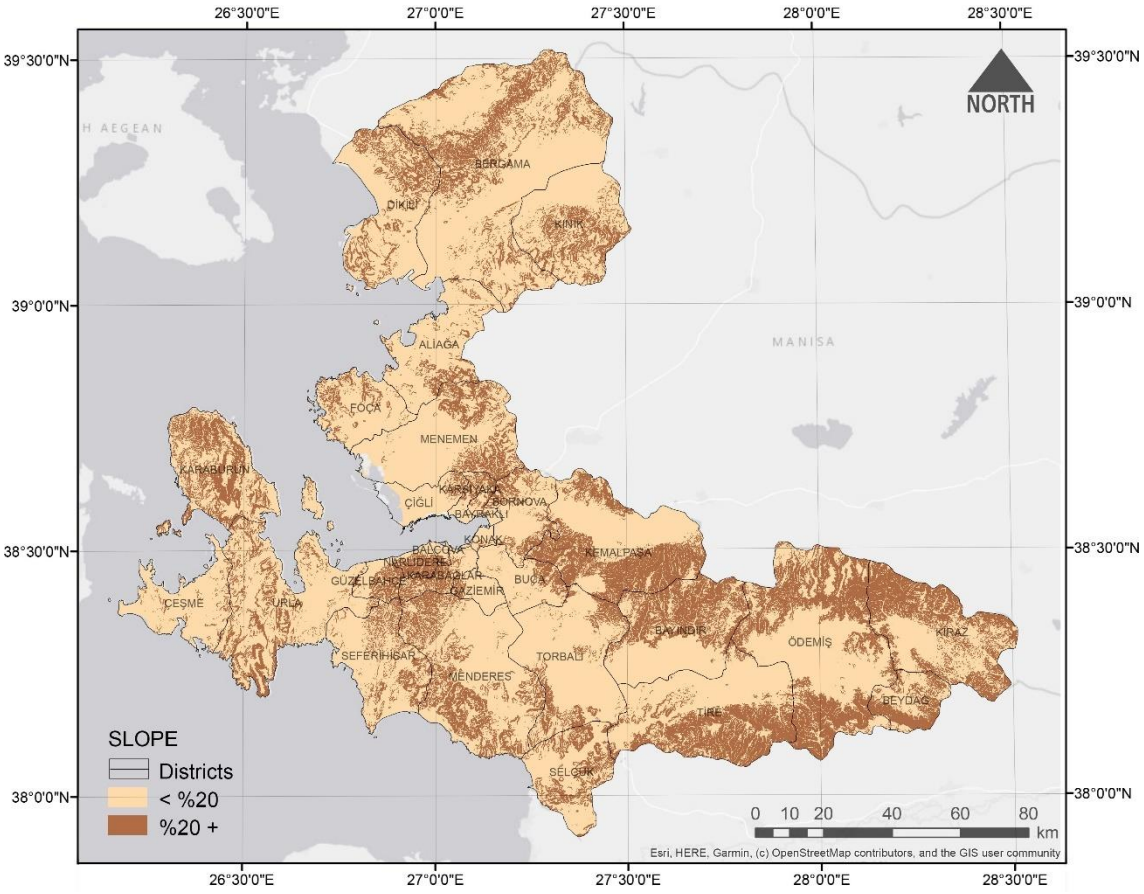


Figure 26. Slope Status of Izmir, Source: Created by the author using DEM model from USGS

3.4.6. Proximity to Major Transportation Networks

Gallent[27] argues that contemporary transportation infrastructure significantly impacts the growth of cities, influencing both their physical forms and the lived experiences of their inhabitants. Urban transportation systems, in particular, have interrelated connections with the urban development fabric in terms of form and density. Consequently, the development of road and rail networks in city centers has facilitated

the process of decentralization in the largest urban systems and transformed rural-urban boundaries.[27]

In terms of transportation networks in Izmir province, there is a highway passing through its agricultural hinterland, facilitating access to the airport and connecting the metropolitan core to the tourism and cultural centers on Turkey's southwestern coast. Another highway between the Izmir metropolitan core and the coastal tourist centers and summer houses has contributed to the conversion of vacation homes into primary residences along this route, while another highway links the Port of Izmir with manufacturing centers to the east. Other transportation projects include the construction of a highway passing through agricultural production centers east of Izmir, connecting the region with Bursa and Istanbul, and the improvement of highways linking the Port of Izmir to industrial centers in the north and east and to agricultural centers in the east. Several highways connecting the metropolitan core to various coastal settlements from north to south have been upgraded, increasing the attractiveness of these settlements as tourist destinations and secondary home locations.[129] Regarding the railway network, sections of the existing national rail lines have been upgraded not only to facilitate the transport of agricultural products from Izmir's eastern hinterland to the port but also to serve as a gateway to Turkey's northern, eastern, and southern regions. Portions of the existing railway network have been converted into a high-speed transit system, facilitating commuting. Another railway line extends to the industrial center in the north, while another connects with agricultural centers and the airport in the southeast. Finally, the suburban railway system provides regular service to major districts within the metropolitan area, facilitating the transport of workers and contributing to the metropolitan area's expansion.

The transportation networks are crucial for Izmir's urbanization and interactions between urban and rural areas. Therefore, to determine the degree of urbanization and rurality and thus delineate the boundaries of peri-urban areas, a buffer analysis was applied to the transportation networks. Given that highways and railways extend more towards the outskirts of the city, a 500-meter buffer was determined, while a 1000-meter buffer was set for major roads as they are more centrally located (Figure 27).

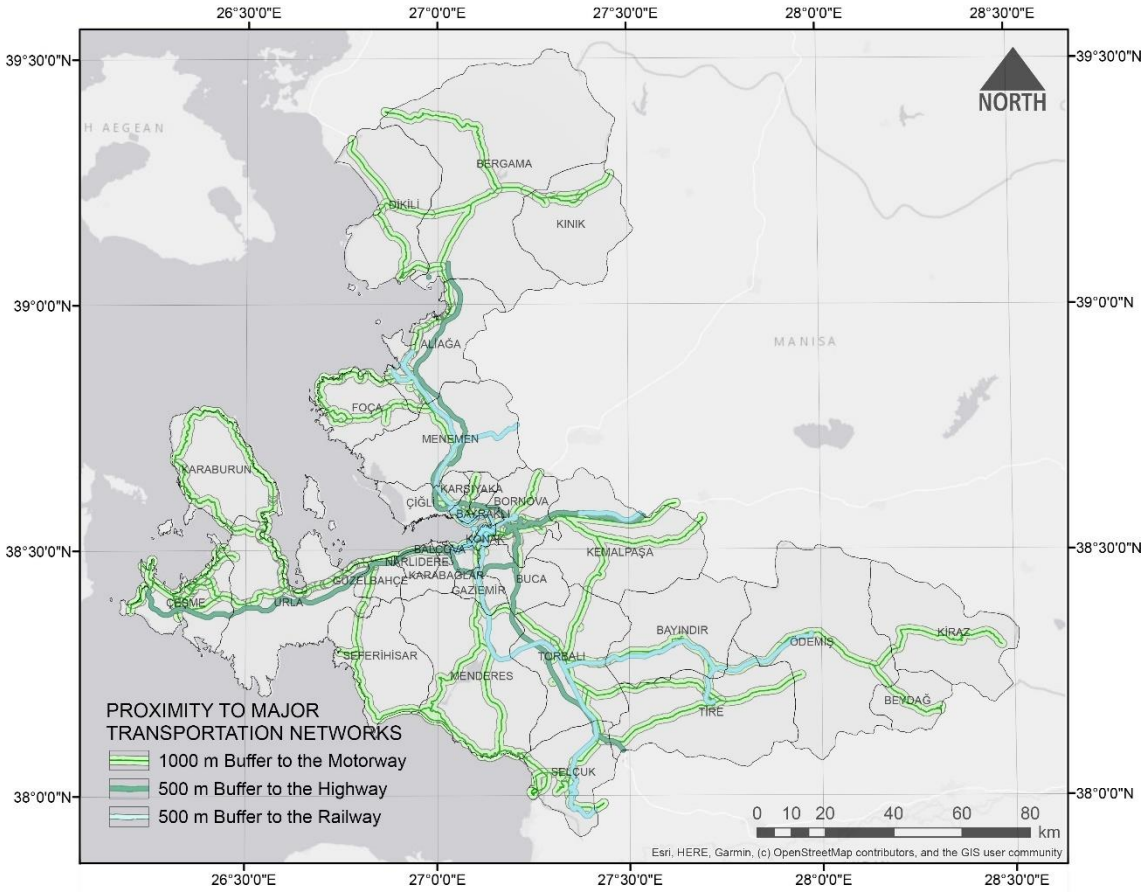


Figure 27. Proximity to Major Transportation Networks

3.4.7. Change in Land Surface Temperature

The surface temperature environment refers to the balance of heat exchange between the ground and the atmosphere and it can be precisely measured and represented as the land surface temperature (LST). The local solar radiation, air characteristics, and surface properties collectively affect the Land Surface Temperature (LST) through the surface energy balance.[130] Land Surface Temperature analysis is a critical method for determining surface temperature also shown in stages in Figure 28. Landsat satellite data provided by the USGS is commonly used for LST analysis, which is performed by processing thermal infrared (TIR) bands. A series of Landsat satellite images spanning 36 years were used to derive land surface temperatures (LST) of selected urban areas and their surroundings in the province of İzmir. The data were used to calculate temperature differences between the urban area and rural areas. The images

used within the scope of this study were taken in July. For Landsat 4-5 satellite images, Band 6 is utilized, while for Landsat 8, Band 10 is used. The downloaded data is processed using GIS software. To prevent clouds from affecting surface temperature measurements, a cloud mask is created. Digital number (DN) values are converted to radiance values through radiometric calibration. For Landsat 8, the surface reflectance is calculated using the Normalized Difference Vegetation Index (NDVI). This process involves obtaining the NDVI value using the near-infrared (NIR) and red (RED) bands. After calculating surface reflectance, the surface emissivity is determined using the NDVI. Emissivity is derived based on the fraction of vegetation and soil. Finally, the brightness temperature is converted to the surface temperature. This conversion takes surface emissivity into account. Thus, surface temperature data for the years 1998 and 2022 for İzmir, Turkey, is obtained from Landsat satellite data.

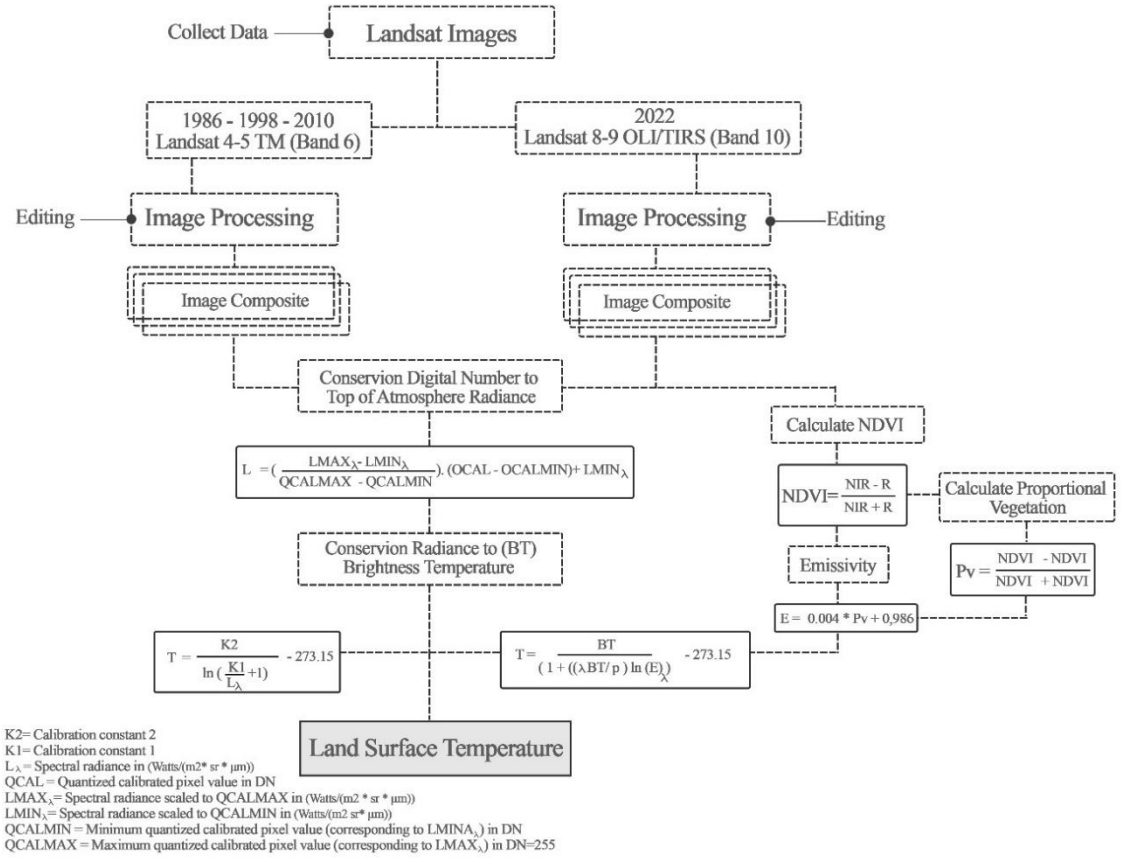


Figure 28. Methodology flow for estimation of LST using GIS Software, Source: [131]

It is a well-known phenomenon that the Land Surface Temperature of urban areas is higher than that of rural areas. Hence urban areas exhibit a more pronounced impact on the surface temperature environment compared to rural areas, mostly due to the release of heat from human activities and the absorption, retention, and reflection of solar radiation by urban structures.[130]

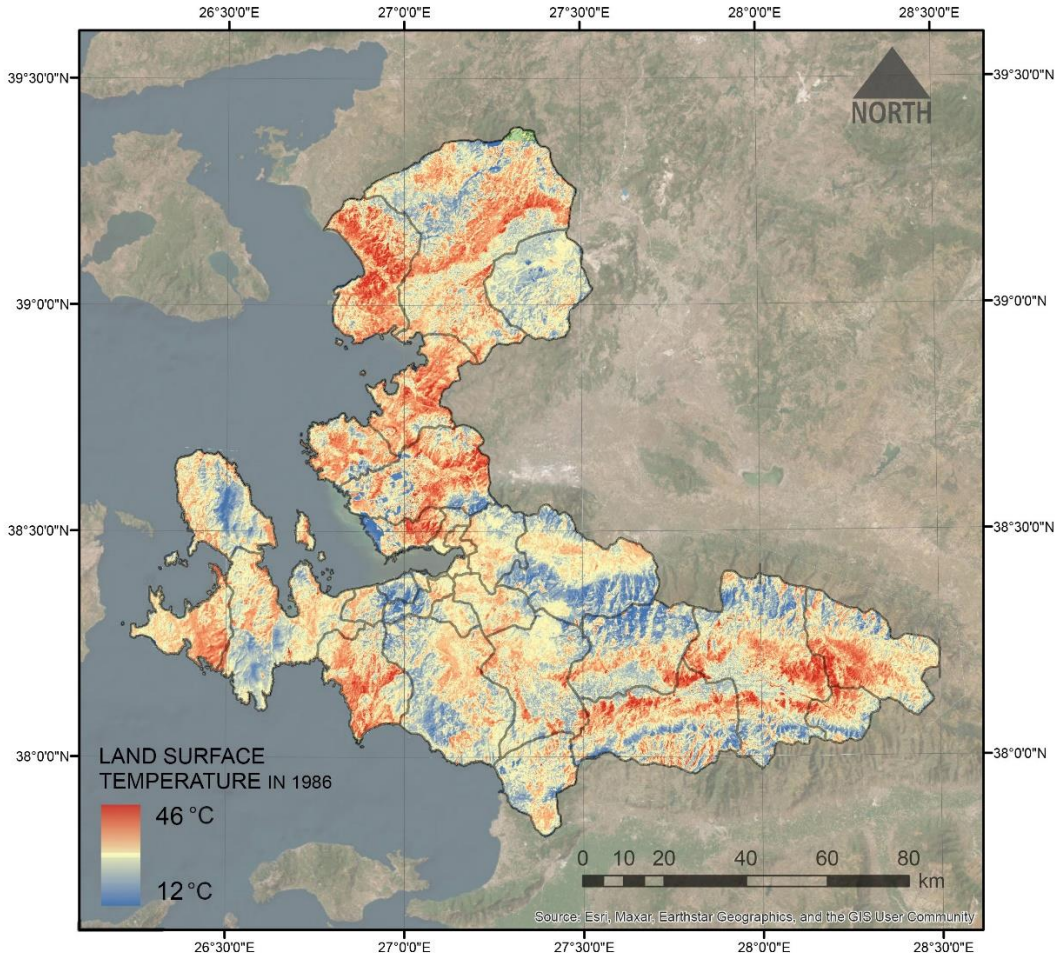


Figure 29. The land surface temperature of İzmir in 1986

According to the images taken in July, it can be seen that the land surface temperatures in Izmir province dropped to at least 12 degrees in 1986, while the highest values were up to 46 degrees (Figure 29). In 2022, it is expected that land surface temperatures will drop to at least 18 degrees, while the highest values will rise to 51 degrees (Figure 30).

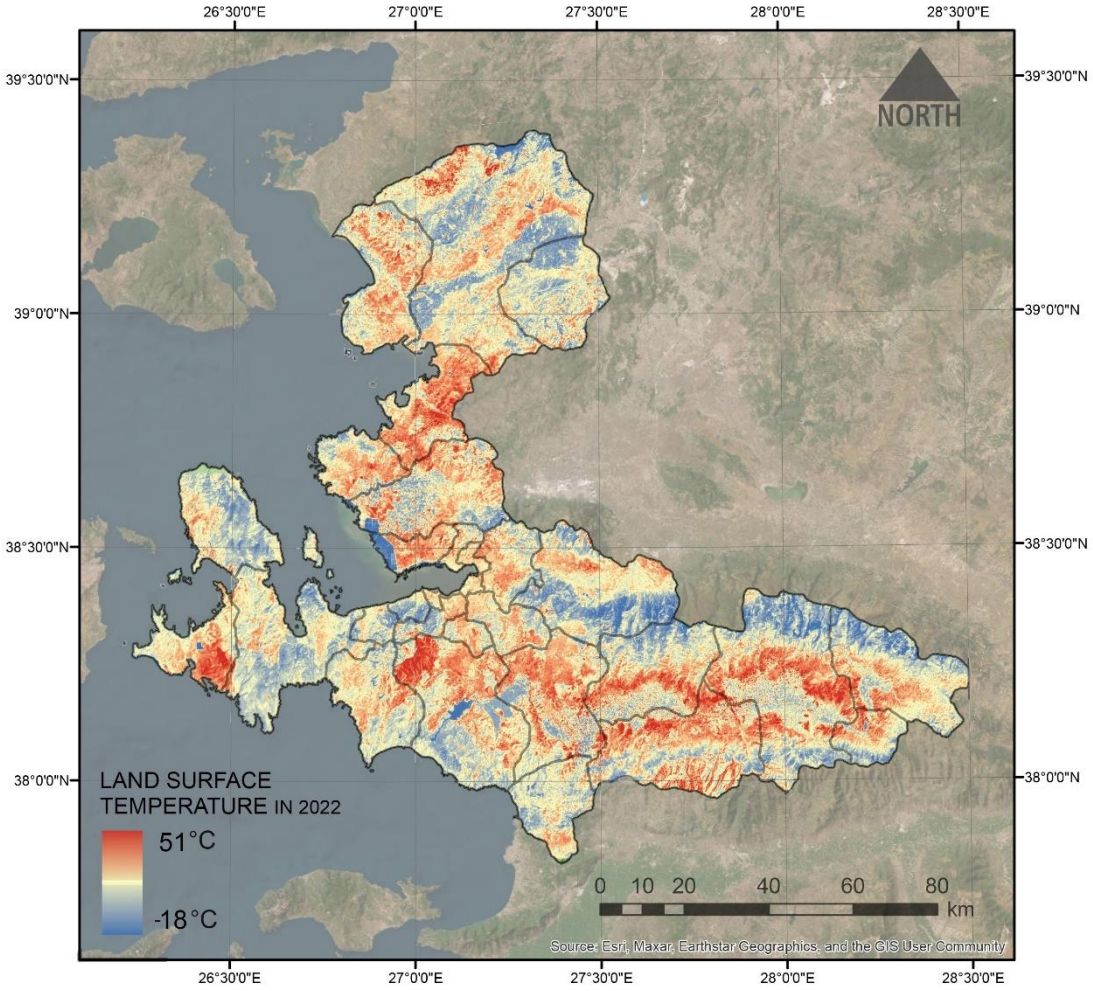


Figure 30. The land surface temperature of İzmir in 2022

Since the images were taken during the summer month of July, temperature differences in the study also consider the higher temperatures in elevated areas of the terrain. Therefore, the temperature difference between these years was also taken into account. Elevated regions tend to have higher temperatures during the summer due to their exposure and lack of vegetation cover, which contributes to greater solar heating. This temperature variation is an important aspect of the analysis, as it helps to understand the spatial distribution of surface temperatures and the impact of topography on thermal patterns. By examining these differences, the study provides a more comprehensive understanding of the surface temperature distribution of the landscape in İzmir for the years 1986 and 2022 (Figure 31).

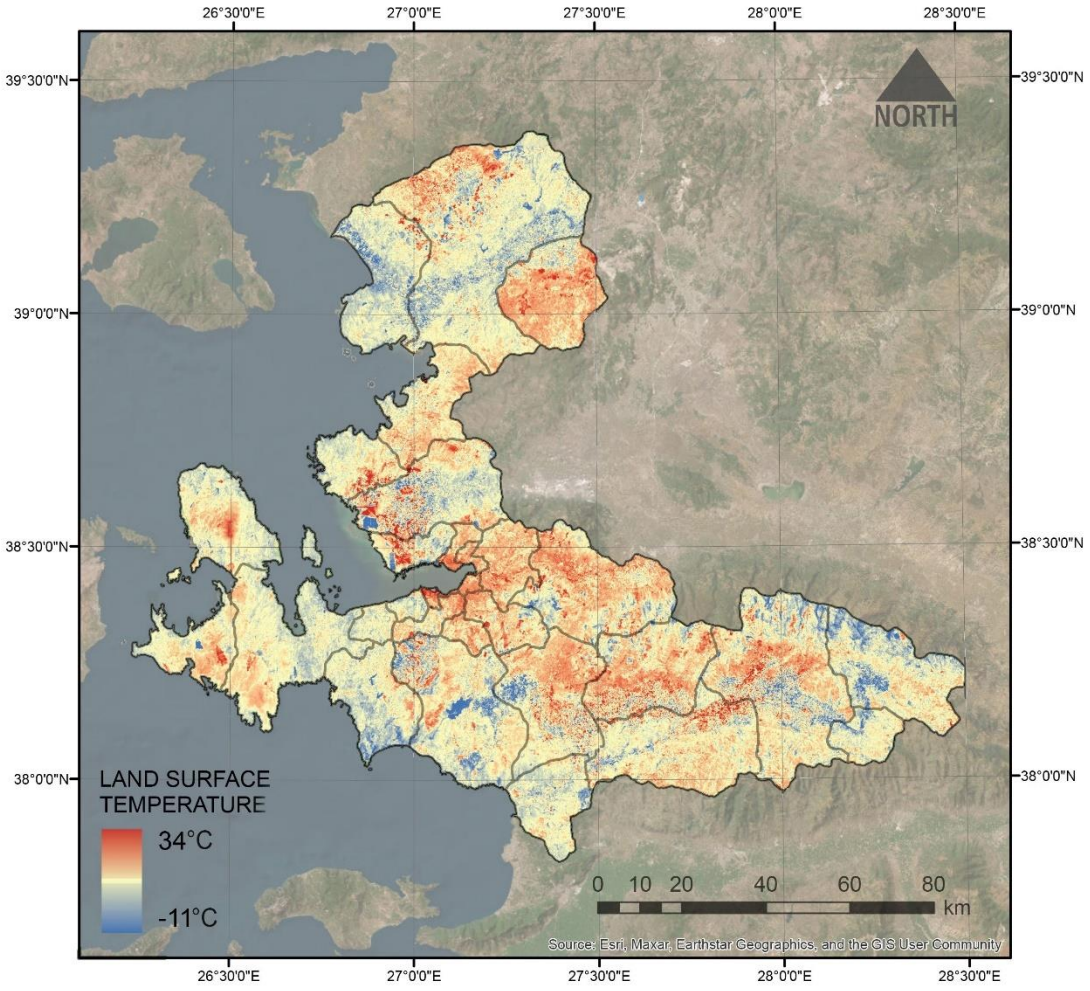


Figure 31. Surface temperature difference of Izmir between 1986 and 2022

3.5. Case study methodology

Most of the existing literature contains pragmatic research on peripheral areas problems. This type of research encompasses all types of areas surrounding the city, including suburban, fringe, urban, and similar places, referred to as peri-urban areas. In contrast, several studies have attempted to spatially separate urban peripheries based on socioeconomic structures or land use change analysis. However, peri-urban areas are highly dynamic and vary across locations and regions.

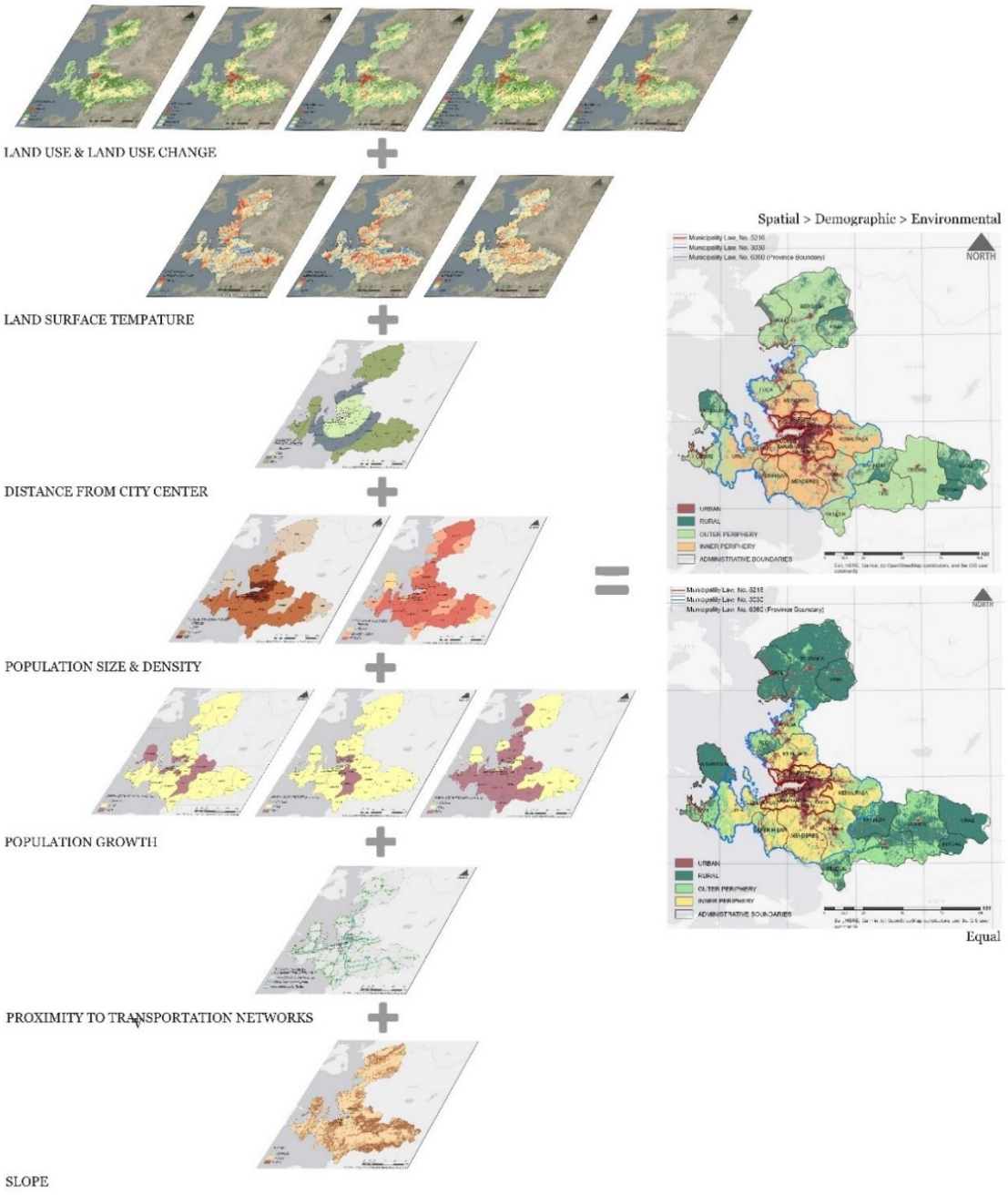


Figure 32. Methodology flow chart

As a result of literature research, the criteria affecting the urban and rural indexes were determined. These criteria include specific criteria such as land use, changes in land use over a 36-year period (1986–2022), population size, density, growth, settlement suitability, land surface temperature changes, distance to the city center (30–50 km), and proximity to major transportation networks. weighted based on criteria. Using these criteria, urban, rural and peri-urban areas were determined through

weighted overlay using GIS software. The weights of the determined criteria were obtained with the help of the literature (Table 6). All the data obtained was reclassified in raster format in the GIS software and adapted to the overlay. In the final stage, the reclassified analyses were subjected to weighted overlay analysis using weights according to the information obtained from the literature in the GIS software environment. The weighted overlay tool is used to evaluate suitability in a region based on certain criteria and create a weighted total score. It is an ideal method for solving complicated problems, such as urban or rural location selection. In this context, the impact rates of the main indicators were determined according to the urban or rural index by using the weighted overlay tool. According to the table 6, spatial, demographic, and environmental criteria were subjected to weighted stratification analysis twice. First, as a result of giving equal values, the inner perimeter, outer periphery, and urban and rural areas were demarcated (Figure 34). Secondly, the weights of spatial values increased, the weights of demographic values increased less, and the environmental dimension was reduced (Figure 33). Weighted overlay analysis has found rural-urban, inner periphery, and outer periphery areas by multiplying each criterion by its assigned weight and then putting the region's suitability values on top of each other.

Table 6. Criteria used to Demarcate Peri-Urban Areas

DIMENSION	INDICATOR	SUB-INDICATOR	RATING SCORE	SOURCE
SPATIAL	Land Use (2013) * Izmir Special Province Administration, 2013 (Entry into force of Soil Conservation and Land Use Law No. 5403 in 2005)	Pasture	3	Past studies have been utilized to understand what could be included in fringe areas.[2] Allen[20] traditional approaches to characterizing urban and peri-urban areas have been utilized. Gallent[27] The use of land classification in peri-urban areas has been utilized. 'Mixed e.g., between limits of exclusively urban or rural land'.[9] (p. 204) Urban areas are characterized by high-density residential, commercial, industrial, and various service activities, while rural areas consist of low-density settlements and natural or agricultural lands, and peri-urban areas combine these mixed-use characteristics.[17,36,132]
		Moderate Agricultural Area	4	
		Planted Agricultural	3	
		Specific Crop Area	3	
		Marginal Agricultural Area	2	
		Urban Settlements	9	
		Rural Settlements	1	
		Water Bodies	3	
		Forest	5	
	Land Use (2018) * Corine, (Coordination of Information on the Environment)	Urban Area	9	
		Mine& Construction Sites	8	
		Open space	7	
		Pasture	3	
		Agricultural Area	2	
		Agriculture & Grassland	3	
		Hight Vegetation	5	
		Light Vegetation	4	
		Water Bodies	3	
	Land Use (2022) * (USGS) Produced by the author to elaborate.	Agricultural Area	1	
		Forest	5	
		Pasture	4	
		Wetlands	3	
		Urban Area	9	

Table 6 (cont.)

	Land Use Change From 1986 to 2022 *(USGS) + Produced by the author to elaborate +change detection	Urban area that has been developed upon of forest	7	Secondary activities and urban uses are replacing agricultural activities and rural uses.[7] + Due to its flexible structure, peri-urban areas encompass a formation process within dynamics and change.[41] Peri-urban areas gradually move away from the center of urban settlement over time and are typically in outward motion.[7]
		Urban area that has been developed upon of agricultural area	8	
		Urban area that has been developed upon of grassland	6	
		Urban area that has been developed upon of wetlands	5	
		Agricultural area that has been developed upon of grassland	4	
		Agricultural area that has been developed upon of urban area	2	
		Agricultural area that has been developed upon of forest	3	
		Agricultural area that has been developed upon of wetlands	5	
	Land Use Change From 1998 to 2022 *(USGS) + Produced by the author to elaborate +change detection	Urban area that has been developed upon of forest	7	
		Urban area that has been developed upon of agricultural area	8	
		Urban area that has been developed upon of grassland	6	
		Urban area that has been developed upon of wetlands	5	
		Agricultural area that has been developed upon of grassland	4	
		Agricultural area that has been developed upon of urban area	2	
		Agricultural area that has been developed upon of forest	3	
		Agricultural area that has been developed upon of wetlands	5	

Table 6 (cont.)

	Land Use Change From 2010 to 2022 *(USGS) + Produced by the author to elaborate +change detection	Urban area that has been developed upon of forest	7	
		Urban area that has been developed upon of agricultural area	8	
		Urban area that has been developed upon of grassland	6	
		Urban area that has been developed upon of wetlands	5	
		Agricultural area that has been developed upon of grassland	4	
		Agricultural area that has been developed upon of urban area	2	
		Agricultural area that has been developed upon of forest	3	
		Agricultural area that has been developed upon of wetlands	5	
	Distance from the Center Produced by the author to elaborate.	< 30 km2	9	Based on empirical evidence, it is commonly observed that large cities have diameters ranging from 30 to 50 km. In metropolitan areas, these diameters may be even wider.[13] The jurisdiction of the İzmir Greater Area Municipality was extended to include all district municipalities and villages within a 50-kilometer radius of the city center under Law No. 5216 on Metropolitan Municipalities, commonly known as the "caliper law."
		30-50 km2	4	
		50 > km2	1	

Table 6 (cont.)

	Distance from the highway	500 m buffer	3	Since roads play a crucial role in settlement formation, they also affect rural, urban, and peripheral areas.[2]
	Distance from the motorway	1000 m buffer	6	While highways are generally concentrated in city centers, motorways are located around cities, connecting outer regions and leading to urban sprawl. On the other hand, railways serve as lines that traverse city centers and connect to intercity and rural areas.[27]
	Distance from the Railway	500 m buffer	2	In rural areas, there is a less extensive road network compared to urban areas.[132]
ENVIROMENTAL	Slope	< %20	9	A slope exceeding 20% is considered unsuitable for habitation.[133]
		%20 >	3	Slope is an inhibiting factor in urban expansion.[134]
	Land Surface Temperature Change from 1986 to 2022 +LST method	< 18 °	2	Moffet (2019) used the average temperature of Portland (Oregon, USA) in their urban-rural LST study. According to meteorological data, the average temperature in İzmir between 1938 and 2022 is 18 degrees Celsius.[135]
		18 ° >	8	

Table 6 (cont.)

DEMOGRAPHIC	Population Size in 2022	< 20.000	1	Places with a population of over 50,000 at NUTS-2 and NUTS-3 levels are defined as densely populated areas, according to EUROSTAT. The State Planning Organization determined a lower threshold of 20,000 as a result of urban threshold research conducted in the early 1980 s. 10th National Development Plan (2011)
		20.000 - 50.000	5	
		50.000 >	9	
	Annual growth rates (1986-2022)	< 1,5	1	The average population growth rate of İzmir's central districts during this period has been taken as a basis.
		1,5 >	9	
	Annual growth rates (1998-2022)	< 1,4	1	
		1,4 >	9	
	Annual growth rates (2010-2022)	< 1	1	
		1 >	9	
	Population Density/2022	< 100 sq.km	1	At the NUTS-2 and NUTS-3 levels, areas with a density of more than 500 people per km² are defined as densely populated regions; areas with a density between 500 and 100 people per km² are defined as moderately populated regions; and areas with a density of less than 100 people per km² are defined as sparsely populated regions.[128]
		100-500 sq.km	6	
		500 sq.km. >	9	

Note: * A rating score ranging from 1 (rural) to 9 (urban)

3.6. Limitation of the Study

Concerning this study contributes to understanding and demarcating peri-urban areas. Furthermore, the remote sensing (RS)-based peri-urban demarcation approach used in this study is primarily effective for understanding the structural aspects of peri-urban growth, including considering urban sprawl in these areas. However, some limitations need to be considered. The primary limitation of the research is that it only examines one case study, making is not to draw broad conclusions on it. Izmir has been selected as a case study because it is a province in Turkey that maintains significant

agricultural activities while undergoing urbanization, with its boundaries frequently shifting due to legal regulations. Therefore, replicating this study in areas with similar and different characteristics could be beneficial to determine if different results can be obtained.

A second major limitation of this research is that it focuses on demarcating urban, rural, and peri-urban areas solely within the boundaries of Izmir province. However, considering the region more broadly could yield different results, especially given the proximity of Manisa, a neighboring province with its own urban center. Including Manisa and other nearby areas might reveal additional dynamics and interactions that could influence the study's findings. Future research could benefit from a more regional approach to capture the broader spatial and socio-economic factors at play.

A third major limitation of this research is its reliance on literature-based weighting. While the study primarily draws from existing academic sources to structure its findings, incorporating expert opinions could provide a more nuanced and comprehensive analysis. Future studies could benefit from including insights from experts in the field, which would enhance the depth and applicability of the research conclusions. This approach would also help verify and potentially refine the theoretical frameworks used in the study, making the findings more robust and generalizable.

Lastly, another limitation of this study is the issue of data availability and accessibility. While various criteria should be considered when demarcating peri-urban areas, especially those impacting Izmir province, the lack of or difficulty in accessing relevant data has constrained this research. Despite the importance of these criteria, the inability to obtain comprehensive data has limited the study's scope and depth. Future studies could be enhanced by improving data access and incorporating a wider range of relevant information.

CHAPTER 4

THE CASE STUDY FINDINGS

The urban center of Izmir predominantly exhibits high densities of commercial and residential areas. Particularly notable are districts such as Konak, Alsancak, and Karşıyaka, which are characterized by intense commercial and service sectors. Industrial zones, on the other hand, are primarily concentrated outside the city center, notably in the north around Aliağa and in the south around Torbalı. Agricultural activities play a significant role in Izmir's rural areas, especially in districts like Menemen, Torbalı, Bayındır, Tire, Kınık, and Kemalpaşa. Furthermore, Izmir boasts a rich cultural and historical heritage due to its history of hosting various civilizations over the centuries. Along Izmir's coastline, tourism and recreational areas are prevalent, contributing to its vibrant cultural landscape. This review underscores the diverse spatial dynamics and the interplay of urbanization, industrialization, agriculture, and cultural heritage in shaping Izmir's land use patterns. This study provides a detailed overview of various land use types and their changes over the 36-year period. Urban areas in Izmir province increased by 7.6% during this period, equivalent to 908.563284 km². The highest increase in urban areas occurred between 2010 and 2022. The spatial sprawl was notably observed in Seferihisar, Güzelbahçe, Bergama, and Dikili districts. Additionally, rapid urbanization was evident in Torbalı, Buca, Gaziemir, and Karabağlar districts, albeit more integrated with the city center. Another significant change was the decrease in agricultural areas, which decreased by 5.8% across Izmir province. Particularly, rural transformation led to the shrinking of agricultural lands and a decline in agricultural production. This trend has had important economic and ecological consequences, negatively impacting food production and biodiversity. A stark decrease was also observed in forested areas, which decreased by 19.6% across Izmir province. Furthermore, institutional regulations, particularly under Law No. 6360, have played a role in shaping urban sprawl. Around 412 villages in the Izmir metropolitan area were reclassified from legal entities to ordinary neighborhoods, leading to changes in land

prices, decreased agricultural production, and increased demand for rural landscapes. This transition has often resulted in abandonment and land degradation.

Between 1986 and 2022, Izmir experienced rapid population growth and urbanization trends over a span of 36 years. Starting from 2010 onwards, there was a notable increase in population growth. From 1986 to 1998, higher population growth rates were observed only in Buca, Torbalı, Gaziemir, Karşıyaka, Çiğli, and Bayraklı districts. Between 1998 and 2010, Torbalı, Kemalpaşa, Karaburun, Gaziemir, Güzelbahçe, Narlıdere, Bayraklı, and Çiğli districts exhibited higher population growth rates compared to central Izmir districts. Particularly from 2010 to 2022, this trend continued with Torbalı, Kemalpaşa, Gaziemir, Güzelbahçe, Narlıdere, Bayraklı, Çiğli, Çeşme, Urla, Aliağa, Dikili, Selçuk, Tire, Menemen, Seferihisar, Karabağlar, Buca, Karşıyaka, and Menderes districts showing higher population growth rates than central Izmir districts. Regarding the classification of urban and rural populations according to Eurostat's criteria, out of Izmir's 30 districts, only Karaburun and Beybağ districts conform to the rural typology. In terms of population density, 7 districts—Karaburun, Dikili, Bergama, Kınık, Bayındır, Beybağ, and Kiraz—are classified under rural typology, while the others are classified under the urban typology. Overall, Izmir has undergone significant urbanization and population growth from 1986 to 2022. Particularly since 2010, the population growth rate in urban surroundings has been higher than in the central urban areas.

İzmir's topography, characterized by varying degrees of slope, significantly influences the relationship between its urban center, rural areas, and peri-urban zones. The city center is typically situated on flat or gently sloping terrain. The slope conditions across Izmir vary depending on its geographical location and topographic features. Coastal areas and plains such as the Menemen Plain formed by the Gediz River are generally flat and low-sloped, making them suitable for agriculture and settlement. Districts along the coast like Karşıyaka, Bayraklı, Konak, and Balçova exhibit relatively low slopes. In contrast, inland areas, especially in the east and southeast, feature more rugged and steep terrain. Districts such as Bornova, Buca, Kemalpaşa, and Torbalı are characterized by these hilly landscapes. The surrounding mountains like Yamala, Nif, and Yunt Mountains exhibit pronounced changes in slope. Areas with slopes exceeding 20% are generally considered unsuitable for settlement, and this factor is taken into consideration in urban planning and development strategies.

Overall, Izmir's diverse topography plays a crucial role in shaping land use patterns, determining areas suitable for urban development, agriculture, and preserving natural landscapes.

The surface temperature situation in Izmir province, as analyzed through Land Surface Temperature (LST) studies, reflects its Mediterranean climate influences, resulting in high temperatures during summer months. Consequently, surface temperatures, particularly in urban centers and dense residential areas, are notably elevated. Additionally, there has been an observed increase in maximum surface temperatures over the years. For instance, in 1986, the highest recorded surface temperature was 46 degrees Celsius, whereas by 2022, it had risen to 51 degrees Celsius.

Izmir exhibits a complex relationship between the city center, rural areas and peri-urban areas, affected by distance from the city center and urbanization dynamics. Izmir is geographically located on the Aegean Sea coast, and the city center is generally located in coastal areas. As one moves away from the city center, one encounters sloping and more mountainous areas, especially in the east and southeast directions. According to the Metropolitan Municipality and Law No. 6360 for Izmir, the metropolitan jurisdiction covers an area 50 km in diameter from the center, covering the entire Izmir region. However, it is seen that this limit is exceeded with the increase in urbanization.

The highways surrounding Izmir connect it to other major cities and integrate it into the national road network. The urban center of Izmir, distinguished by dense commercial and residential areas, is typically well-connected by highways and main roads. For instance, the O-30 highway linking Izmir to Istanbul and the Izmir-Aydın Highway (O-31) manage traffic incoming from the north and south of the city. These highways expand towards peri-urban and rural areas as they move away from the city center, influencing the urbanization processes of these regions. Main roads within the city and its surroundings form crucial arteries, supporting local transportation and regulating traffic flow by connecting different parts of Izmir. Therefore, the development of transportation infrastructure significantly impacts the development of both urban and rural areas.

Finally, considering the criteria, we obtained two different results for İzmir: the first by assigning equal weights to all criteria (Figure 34), and the second by assigning greater weight to spatial and demographic dimensions while giving less weight to the environmental dimension (Figure 33). These analyses allowed us to demarcate the rural, urban fringe, inner periphery, and outer periphery areas of İzmir.

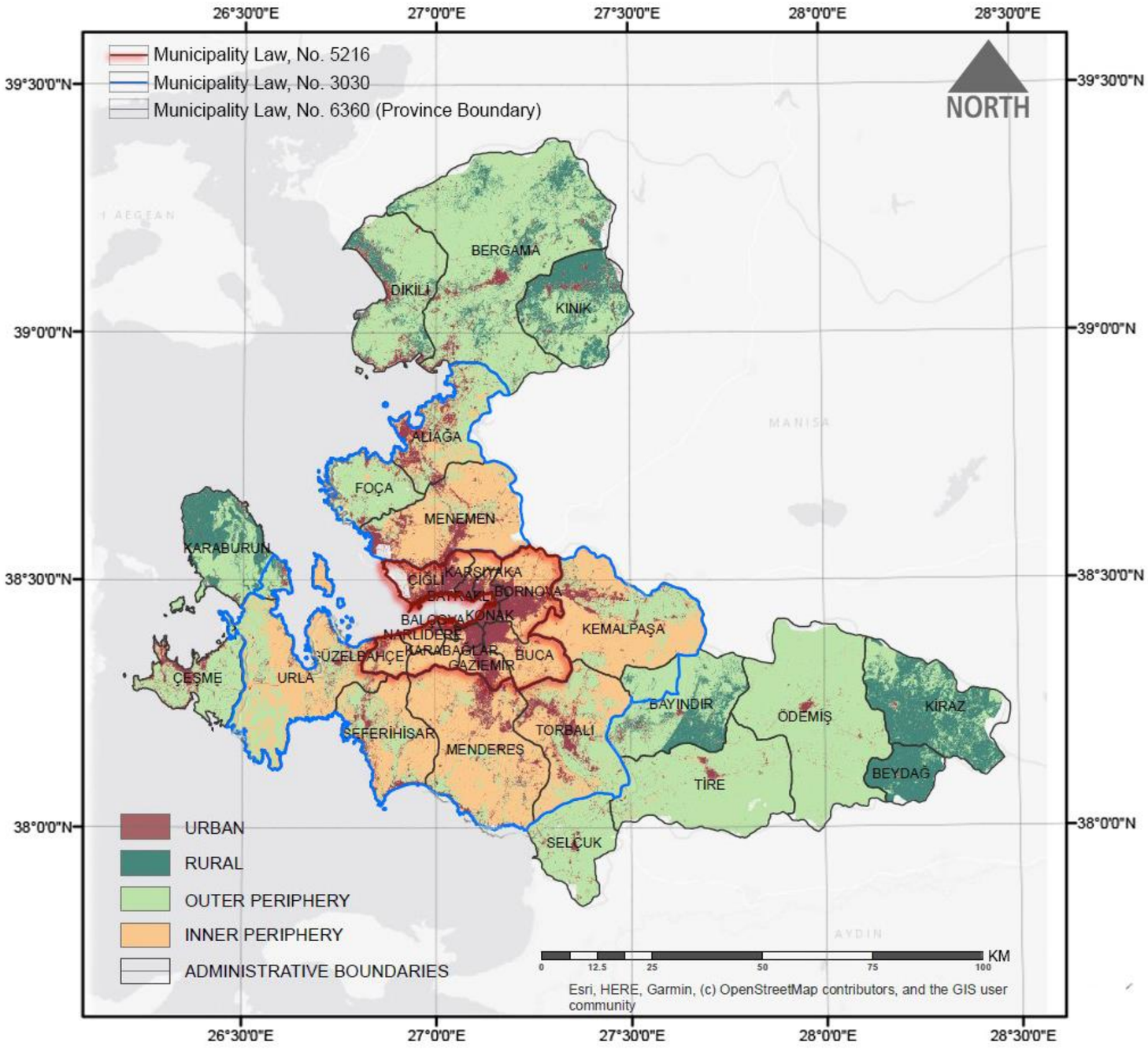


Figure 33. Urban, Rural, and Peri-Urban Areas in Izmir (Weighting, Spatial > Demographic > Environmental)

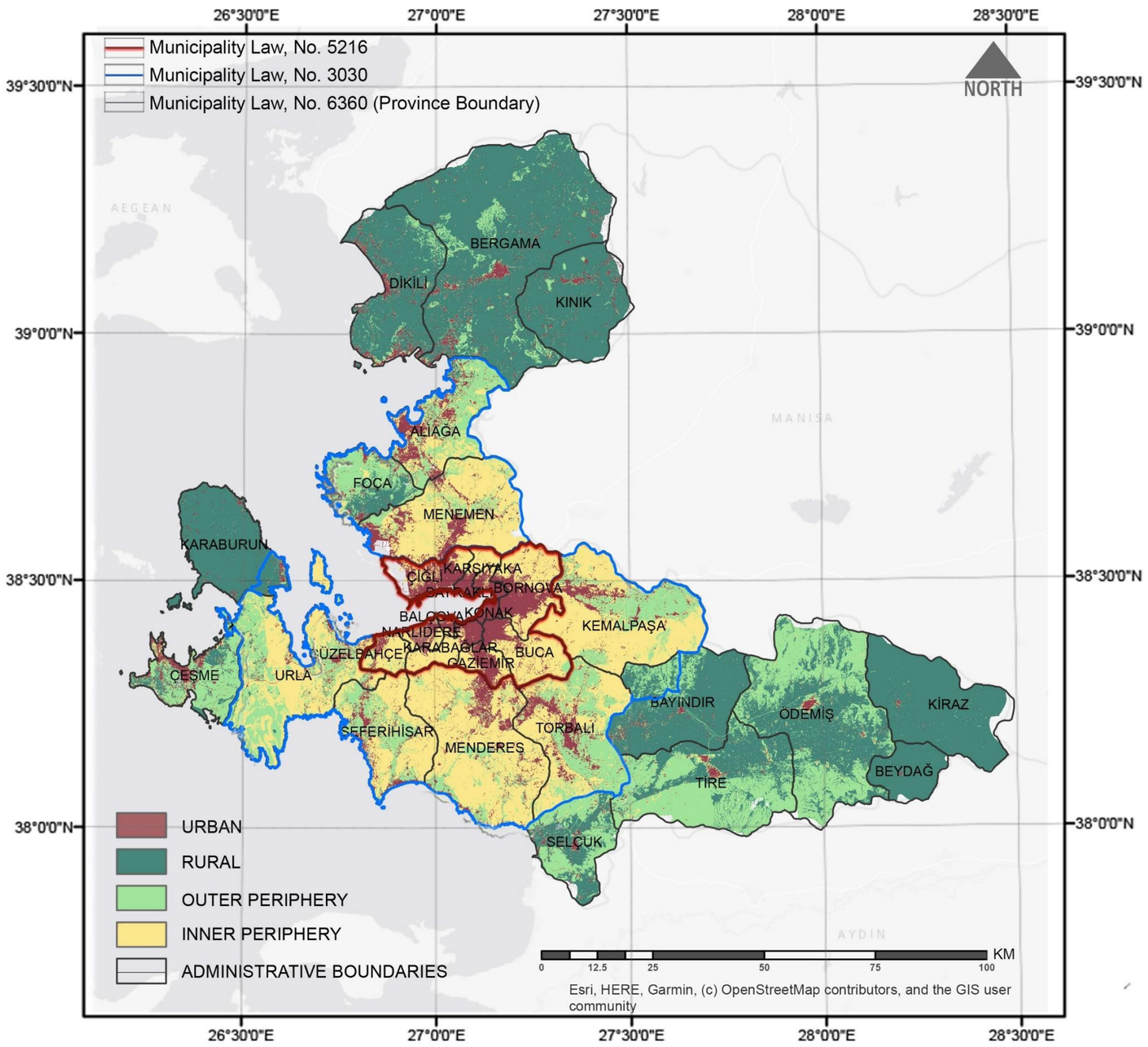


Figure 34. Urban, Rural, and Peri-Urban Areas in Izmir (Equal Weighting)

It is seen that the districts determined as the inner periphery of Izmir province are Urla Menderes, Menemen, Kemalpaşa, Seferihisar, and partly Torbalı. Its outer borders include the districts of Ödemiş, Bayındır, Tire, Selçuk, Çeşme, Foça, Dikili and Bergama. It is seen that Beydağ, Kiraz, Karaburun and partly Bayındır districts maintain their rurality. According to this case study's findings, in a situation of in-betweenness in the transition process from rural to urban areas, peripheral areas neither become fully urbanized nor maintain their existence as a rural character. When we compare the results in the two cases, it is seen that rural areas decrease when we increase the weights of spatial and demographic variables. The Izmir province in general and Torbalı, Bergama, Bayındır, Tire, and Urla are in danger of losing vital agricultural land and commercially high-value agricultural goods due to lax and ineffective land use planning and uncontrolled urban development extending into rural areas.

Figure 35. Surprising architectural elements, a scrapped plane inside the campus of a private school, converted for educational purposes. Private school campuses have recently become one of the most common uses in the peri-urban areas. Yelki, İzmir, Photo take in 28th of June 2024

Finally, by considering the findings in our analysis and overlaying them through weighted overlay (equally weighted or by determining the degree of weight), we indicate that the province region of Izmir is surrounded by a heterogeneous distribution of areas with varying degrees of urban and rural features demarcated as inner and outer peripheries. The peri-urban areas of İzmir display a combination of characteristics. This different nature of peri-urban areas results in a unique blend of land use and

socioeconomic dynamics (Figure 35). These locations possess characteristics of both urban and rural regions, displaying certain urban aspects while also exhibiting traits of rural regions (Figure 36).

Figure 36. Horse farms as a recreation place targeted exclusively toward city people, Urla, İzmir, Photo take in 28th of June 2024

CHAPTER 5

DISCUSSION AND CONCLUSION

The term "peri-urban" is frequently used in literature and policy discussions; however, definitions are largely situational and context-specific. The objective of this research is to improve the understanding and clarification of the peri-urban area concept, as well as to demarcate the periphery areas of Izmir province. The study's spatial analysis methods face limitations due to inaccessible data sets and subjective overlay analysis. However, overlay analysis is a highly subjective method as it relies on the researcher's choice of criteria.[136] It will contribute to understanding the true scope of this field and to its future planning and management.

Izmir's economic and demographic growth has been accelerated by internationalization and globalization since the 1980s. The primary feature of this transformation and the resulting spatial reorganization is the rise of settlements on the outskirts of the metropolitan area, each in distinct mixed-use land. The results provided in this research indicate that the distribution of urban sprawl has changed, with a movement towards communities located in both the inner and outer periphery.

The peri-urban areas of Izmir exhibit both similarities and differences compared to those in other countries. Similar to global trends, Izmir's peri-urban regions experience a blend of urban and rural characteristics, driven by rapid metropolitan expansion and economic growth. However, unique to Izmir are the specific socio-cultural and geographic factors influencing these areas, such as regional agricultural practices and local land use patterns. Unlike many other contexts, where peri-urban areas might predominantly reflect suburban sprawl, Izmir's peri-urban spaces are marked by a complex interplay of traditional agricultural landscapes and emerging urban features, reflecting both a continuity of rural elements and the transformation into new peri-urban forms. This interplay highlights the distinctiveness of Izmir's peri-urban dynamics within the broader framework of global urban and peri-urban development. For instance, according to the Asian discourse, peri-urban areas (Desakota) refer to largely unregulated peri-urban development in the context of rapidly expanding

metropolitan growth patterns and rapid economic growth, extending towards high-density paddy (rice) fields surrounding fast-growing cities.[137]

For the demarcated peri-urban areas of Izmir, we argue that the overlap or intermingling of urban and rural characteristics is a fundamental feature of peri-urbanization in Asia (and consequently Asia's urban transition), distinguishing it from traditional concepts of suburbanization. Thus, we can consider the peri-urban not only as pre-urban but also as post-rural, with some elements and aspects of the rural past persisting and perhaps being rearticulated in new forms within the post-rural peri-urban context.

Figure 37. Ship scrapyard Urla, İzmir, Photo take in 28th of June 2024

Although scholars from different disciplines and countries agree on the idea of the urban-environment interface as a transition zone characterized by the coexistence of rural and urban activities, the task of standardizing the process of defining these areas faces challenges arising from urban transformation. There are many concepts and

understandings of these spaces, and they are all valid given their complexity and multiplicity. Although there is a wide variety of initiatives in the peri-urban areas, they are often fragmented and uncoordinated. As can be understood, peri-urban areas are dynamic and undergo many changes over some time. In these areas, changes in land use are experienced with rapid population growth, the shifting of livelihoods from agriculture to non-agricultural areas, and an increase in construction areas following urban sprawl. Therefore, Peri-urban areas are characterized by a hybrid nature that defies classification as purely urban or rural and is prone to ongoing conflicts over land use.

Figure 38. Golf course in Urla, İzmir, Photo take in 28th of June 2024

Peri-urban areas are often characterized by institutional weaknesses due to the transitional nature of urban governance structures in these environments. This transitional state results in a somewhat provisional (and uncertain) capacity to regulate or guide change. Peri-urban areas are typically within the jurisdiction of urban management authorities and are controlled as if they were urban spaces. These areas, with their hybrid characteristics of both urban and rural elements, necessitate a mixed approach that integrates urban and rural planning. While urban and rural planning have traditionally developed along distinct paths in the literature, it is anticipated that the gap between them will narrow over time. Designating rural-urban boundary areas for special

treatment could become a viable option through planning reform. Consequently, establishing a connection between rural and urban areas presents significant opportunities for urban planning. Like any relationship, this one will likely oscillate between maximizing benefits and exploitation. The planning system offers opportunities for more strategic, spatially positive, and locally sensitive planning. Additionally, strengthening the rural-urban relationship holds considerable potential for development and poverty alleviation. This potential will be meaningful if urban and rural households involved in the process can sustain their urban and rural livelihoods while preserving and enhancing their social, economic, and physical resources.

In general, traditional state planning tends to be limited by jurisdictional boundaries, resulting in a misalignment with the fragmented and regionally dispersed landscapes and policies of peri-urban areas, as observed in İzmir, Turkey. Urban development in a capitalist economy typically occurs through close interactions between capitalist developers and local government officials, which can lead to favoritism and corruption. In some cases, developers may assume the role of institutional entrepreneurs, guiding local government institutions rather than being regulated by them. Local strategic partnerships are crucial for fostering social cohesion, enhancing relationships between different communities within a region, and improving interactions with legal authorities. Additionally, these partnerships strengthen connections between public sector institutions, local governments, voluntary sectors, businesses, and local residents, as well as among these groups themselves. As an alternative to state-led approaches to shaping peri-urban areas, the role of the market can be considered. The market economy, with its long-standing practices, traditions, and institutions governing transactions between producers and consumers, contrasts with the capitalist economy's need for continuous economic growth. This distinction highlights the different dynamics influencing peri-urban development in Izmir compared to other regions.

In İzmir, special treatment is necessary for peri-urban areas because the issues faced by urban areas differ significantly in the peri-urban context. For example, agricultural activities differ from purely agricultural land uses. Urban agriculture practices, hobby gardening, and floriculture cater to urban demand, requiring specific designations, powers, and treatments. Recognizing this distinction is crucial for

effective action planning. Additionally, in İzmir, urban and rural policies frequently neglect peri-urban areas, resulting in intricate metropolitan metropolis structures. For instance, the peri-urban areas of İzmir contain shipyards and industrial sites, including facilities for the construction and production of marble and wind turbines. The presence of electricity pylons in the landscape and various other industrial types in Urla are reminiscent of those found in developing countries (Figure 37). Conversely, these areas also feature recreational spaces, horse farms, and golf courses more typical of developed nations (Figure 38). The combination of different uses highlights the variety of economic activities and land use patterns that are present in these areas of transition. These modifications present a challenge to planners and necessitate a reevaluation of conventional roles. Thus, peripheral areas require specialized management and intervention due to their distinct characteristics. This is essential to promoting environmental sustainability, social inclusion, and economic efficiency. Additionally, it helps facilitate cooperation between central and local authorities in spatial planning. Policy-level planning should involve creating programs, strategies, and action plans with timelines and objectives, ensuring flexibility, recognizing daily life realities, and involving citizen participation. Cooperation at various levels, departmental dialogue, and stakeholder interaction are crucial for multi-functionality. Thus, urgent attention must be given to formulating effective planning and comprehensive strategies for the peri-urban areas of İzmir.

REFERENCES

1. Thomas, D. The Edge of the City; 1990; Vol. 15. http://www.jstor.orgURL:http://www.jstor.org/stable/622860http://www.jstor.org/stable/622860?seq=1&cid=pdf-reference#references_tab_contents.

2. Lynch, K. Rural-Urban Interaction in the Developing World. Rural-Urban Interaction in the Developing World 2004, 1–209. https://doi.org/10.4324/9780203646274/RURAL-URBAN-INTERACTION-DEVELOPING-WORLD-KENNY-LYNCH.

3. Iaquinta, D. L.; Drescher, A. W. Defining Periurban: Understanding RuralUrban Linkages and Their Connection to Institutional Contexts. 2001.

4. Qviström, M. Landscapes out of Order: Studying the Inner Urban Fringe beyond the Rural - Urban Divide. Geogr Ann Ser B 2007, 89 (3), 269–282. https://doi.org/10.1111/J.1468-0467.2007.00253.X.

5. Levent, T. Kent ve Kır Arasında Bir Arayüz Olarak Kırsal-Kentsel Çeper. 8 Kasım Dünya Şehircilik Günü 41. Kolokyumu, Planlamada Kırsal Alanlar ve Bölge. https://www.researchgate.net/publication/364117166_Kent_ve_Kir_Arasinda_Bir_Arayuz_Olarak_Kirsal-Kentsel_Ceper (accessed 2024-06-12).

6. Dutta, V. Land Use Dynamics and Peri-Urban Growth Characteristics: Reflections on Master Plan and Urban Suitability from a Sprawling North Indian City. Environment and Urbanization Asia 2012, 3 (2), 277–301. https://doi.org/10.1177/0975425312473226.

7. Winarso, H.; Hudalah, D.; Firman, T. Peri-Urban Transformation in the Jakarta Metropolitan Area. Habitat Int 2015, 49, 221–229. https://doi.org/10.1016/j.habitatint.2015.05.024.

8. Whitehand, J. W. R.; Morton, N. J. The Fringe-Belt Phenomenon and Socioeconomic Change. http://dx.doi.org/10.1080/00420980600945138 2006, 43 (11), 2047–2066. https://doi.org/10.1080/00420980600945138.

9. Pryor, R. J. Defining the Rural-Urban Fringe. Social Forces 1968, 47 (2), 202–215. https://doi.org/10.1093/SF/47.2.202.

10. Ravetz, J.; Fertner, C.; Nielsen, T. S. The Dynamics of Peri-Urbanization. Peri-Urban Futures: Scenarios and Models for Land use Change in Europe 2013, 13–44. https://doi.org/10.1007/978-3-642-30529-0_2.

11. Gonçalves, J.; Gomes, M. C.; Ezequiel, S.; Moreira, F.; Loupa-Ramos, I. Differentiating Peri-Urban Areas: A Transdisciplinary Approach towards a Typology. Land use policy 2017, 63, 331–341. https://doi.org/10.1016/j.landusepol.2017.01.041.

12. Žlender, V. Developing a Spatially Explicit Method for Delineating Peri-Urban Landscape. Urbani Izziv 2021, 32 (2), 98–110. https://doi.org/10.5379/urbani-izziv-en-2021-32-02-03.

13. Simon, D. Urban Environments: Issues on the Peri-Urban Fringe. Annu Rev Environ Resour 2008, 33, 167–185. https://doi.org/10.1146/annurev.environ.33.021407.093240.

14. Westerink, J.; Haase, D.; Bauer, A.; Ravetz, J.; Jarrige, F.; Aalbers, C. B. E. M. Dealing with Sustainability Trade-Offs of the Compact City in Peri-Urban Planning Across European City Regions. European Planning Studies 2013, 21 (4), 473–497. https://doi.org/10.1080/09654313.2012.722927.

15. Sahana, M.; Ravetz, J.; Patel, P. P.; Dadashpoor, H.; Follmann, A. Where Is the Peri-Urban? A Systematic Review of Peri-Urban Research and Approaches for Its Identification and Demarcation Worldwide. Remote Sensing. MDPI March 1, 2023. https://doi.org/10.3390/rs15051316.

16. Jurgenson, E.; Sikk, K.; Hass, H.; Maasikamae, S. Methodology for the Determination of Peri-Urban Areas on the Basis of Data of Land Type and Use by Example of the Town Tartu. Economic Science for Rural Development 2017, 110–117.

17. Gu, K. Exploring the Fringe Belt Concept in Auckland: An Urban Morphological Idea and Planning Practice. N Z Geog 2010, 66 (1), 44–60. https://doi.org/10.1111/j.1745-7939.2010.01169.x.

18. Nelson, A. C.; Sanchez, T. W. Exurban and Suburban Households: A Departure from Traditional Location Theory?; 1997; Vol. 8.

19. Brook, R. M.; Davila, J. The Peri-Urban Interface: A Tale of Two Cities. World 2000, 25 (2), 183–188.

20. Allen, A. Environmental Planning and Management of the Peri-Urban Interface: Perspectives on an Emerging Field. Environ Urban 2003, 15 (1), 135–148. https://doi.org/10.1177/095624780301500103.

21. Bryant, C. R.; Johnston, T. Agriculture in the City's Countryside; 1992. https://www.researchgate.net/publication/266138832.

22. Tacoli, C. Rural-Urban Interactions: A Guide to the Literature. Environ Urban 2005, 10 (1), 147–166. https://doi.org/10.1630/095624798101284356.

23. Piorr, A.; Ravetz, J. Peri-Urbanisation in Europe; 2011. https://www.researchgate.net/publication/275349764.

24. Piorr, A.; Zasada, I.; Doernberg, A.; Zoll, F.; Ramme, W. Research for AGRI Committee - Urban and Peri-Urban Agriculture in the EU; 2018.

25. Leaf, M. The Politics of Periurbanization in Asia. Cities 2016, C (53), 130–133. https://doi.org/10.1016/J.CITIES.2016.01.008.

26. Matthew, R.; Chiotha, S.; Orbinski, J.; Talukder, B. Research Note: Climate Change, Peri-Urban Space and Emerging Infectious Disease. Landsc Urban Plan 2022, 218. https://doi.org/10.1016/j.landurbplan.2021.104298.

27. Gallent, N.; Andersson, J.; Bianconi, M. Planning on the Edge: The Context for Planning at the Rural-Urban Fringe. Planning on the Edge: The Context For Planning at the Rural-Urban Fringe 2006, 1–232. https://doi.org/10.4324/9780203099193/PLANNING-EDGE-NICK-GALLENT-JOHAN-ANDERSSON-MARCO-BIANCONI.

28. Conzen, M.; Gu, K.; Whitehand, J. Comparing Traditional Urban Form in China and Europe: A Fringe-Belt Approach. Urban Geogr 2012, 33 (1), 22–45. https://doi.org/10.2747/0272-3638.33.1.22.

29. Kurtz, R. A.; Eicher, J. B. Fringe and Suburb: A Confusion of Concepts. Social Forces 1958, 37 (1), 32–37. https://doi.org/10.2307/2573776.

30. Hejzlarová, A. The Conflict of Country and City in Flannery O'Connor's Short Stories. 2013.

31. Sieverts, T. Cities without Cities: An Interpretation of the Zwischenstadt. Cities Without Cities: An Interpretation of the Zwischenstadt 2003, 1–187. https://doi.org/10.4324/9780203380581/CITIES-WITHOUT-CITIES-THOMAS-SIEVERTS.

32. Adam, A. G. Land Tenure in the Changing Peri-Urban Areas of Ethiopia: The Case of Bahir Dar City. Int J Urban Reg Res 2014, 38 (6), 1970–1984. https://doi.org/10.1111/1468-2427.12123.

33. Pahl, R. E. The Rural-Urban Continuum. Sociol Ruralis 1966, 6 (3), 299–329. https://doi.org/10.1111/J.1467-9523.1966.TB00537.X.

34. Cloke, P.; Edwards, G. Rurality in England and Wales 1981: A Replication of the 1971 Index. Reg Stud 1986, 20 (4), 289–306. https://doi.org/10.1080/09595238600185271.

35. Ma, L.; Liu, S.; Fang, F.; Che, X.; Chen, M. Evaluation of Urban-Rural Difference and Integration Based on Quality of Life. Sustain Cities Soc 2020, 54. https://doi.org/10.1016/j.scs.2019.101877.

36. Bogdanov, N.; Meredith, D.; Efstratoglou, S. A Typology of Rural Areas in Serbia. Ekonomski Anali 2008, 53 (177), 7–29. https://doi.org/10.2298/EKA0877007B.

37. Öğdül, H. G. Urban and Rural Definitions in Regional Context: A Case Study on Turkey. European Planning Studies 2010, 18 (9), 1519–1541. https://doi.org/10.1080/09654313.2010.492589.

38. Gajić, A.; Krunić, N.; Protić, B. Towards a New Methodological Framework for the Delimitation of Rural and Urban Areas: A Case Study of Serbia. Geografisk Tidsskrift - Danish Journal of Geography 2018, 118 (2), 160–172. https://doi.org/10.1080/00167223.2018.1503551.

39. Kıray, M. B. Metropolitanization Processes in Underdeveloped Countries; Gazı University: Ankara, 1982.

40. Scott, M.; Russell, P.; Redmond, D. Active Citizenship, Civil Society and Managing Spatial Change in the Rural–Urban Fringe. Policy Polit 2007, 35 (1), 163–190. https://doi.org/10.1332/030557307779657702.

41. Friedmann, J. Becoming Urban: Periurban Dynamics in Vietnam and China - Introduction. Pac Aff 2011, 84 (3), 425–434. https://doi.org/10.5509/2011843425.

42. Shaw, B. J.; van Vliet, J.; Verburg, P. H. The Peri-Urbanization of Europe: A Systematic Review of a Multifaceted Process. Landscape and Urban Planning. Elsevier B.V. April 1, 2020. https://doi.org/10.1016/j.landurbplan.2019.103733.

43. Coluzzi, R.; Bianchini, L.; Egidi, G.; Cudlin, P.; Imbrenda, V.; Salvati, L.; Lanfredi, M. Density Matters? Settlement Expansion and Land Degradation in Peri-Urban and Rural Districts of Italy. Environ Impact Assess Rev 2022, 92. https://doi.org/10.1016/j.eiar.2021.106703.

44. Antrop, M. Changing Patterns in the Urbanized Countryside of Western Europe; 2000; Vol. 15.

45. Paül, V.; McKenzie, F. H. Peri-Urban Farmland Conservation and Development of Alternative Food Networks: Insights from a Case-Study Area in Metropolitan Barcelona (Catalonia, Spain). Land use policy 2013, 30 (1), 94–105. https://doi.org/10.1016/J.LANDUSEPOL.2012.02.009.

46. Mortoja, M. G.; Yigitcanlar, T.; Mayere, S. What Is the Most Suitable Methodological Approach to Demarcate Peri-Urban Areas? A Systematic Review of the Literature. Land use policy 2020, 95. https://doi.org/10.1016/j.landusepol.2020.104601.

47. Sınacı Özfındık, F. Ankara'da Kentsel Büyüme: Kent Çeperinde Büyümenin Kontrolüne Yönelik Planlama ve Politika Araçları. Journal of Planning 2022. https://doi.org/10.14744/planlama.2022.37880.

48. Petrovici, N.; Poenaru, F.; Mare, C. "Exploded Urbanism": Processes of Peri-Urban Formation in Romania. Cities 2023, 135. https://doi.org/10.1016/j.cities.2023.104218.

49. Golledge, R. G. Sydney's Metropolitan Fringe: A Study in Urban-rural Relations. Australian Geographer 1960, 7 (6), 243–255. https://doi.org/10.1080/00049186008702353/ASSET//CMS/ASSET/F25C2A24-2386-4309-8775-31201E86D11C/00049186008702353.FP.PNG.

50. Barke, M. The Changing Urban Fringe of Falkirk: Some Morphological Implications of Urban Growth. Scott Geogr Mag 1974, 90 (2), 85–97. https://doi.org/10.1080/00369227408736277.

51. Ahani, S.; Dadashpoor, H. A Review of Domains, Approaches, Methods and Indicators in Peri-Urbanization Literature. Habitat International. Elsevier Ltd August 1, 2021. https://doi.org/10.1016/j.habitatint.2021.102387.

52. Czekajlo, A.; Coops, N. C.; Wulder, M. A.; Hermosilla, T.; White, J. C.; van den Bosch, M. Mapping Dynamic Peri-Urban Land Use Transitions across Canada Using Landsat Time Series: Spatial and Temporal Trends and Associations with Socio-Demographic Factors. Comput Environ Urban Syst 2021, 88. https://doi.org/10.1016/j.compenvurbsys.2021.101653.

53. Sui, C.; Lu, W. Study on the Urban Fringe Based on the Expansion–Shrinking Dynamic Pattern. Sustainability (Switzerland) 2021, 13 (10). https://doi.org/10.3390/su13105718.

54. Barral, S.; Guillet, F. Preserving Peri-Urban Land through Biodiversity Offsets: Between Market Transactions and Planning Regulations. Land use policy 2023, 127. https://doi.org/10.1016/j.landusepol.2023.106545.

55. Zasada, I. Multifunctional Peri-Urban Agriculture-A Review of Societal Demands and the Provision of Goods and Services by Farming. Land Use Policy. October 2011, pp 639–648. https://doi.org/10.1016/j.landusepol.2011.01.008.

56. Gu, X.; Xu, D.; Xu, M.; Zhang, Z. Measuring Residents' Perceptions of Multifunctional Land Use in Peri-Urban Areas of Three Chinese Megacities: Suggestions for Governance from a Demand Perspective. Cities 2022, 126. https://doi.org/10.1016/j.cities.2022.103703.

57. Gu, X.; Xie, B.; Zhang, Z.; Guo, H. (David). Rural Multifunction in Shanghai Suburbs: Evaluation and Spatial Characteristics Based on Villages. Habitat Int 2019, 92. https://doi.org/10.1016/J.HABITATINT.2019.102041.

58. Al Mamun, M. M.; Kim, S. M. Stakeholder Analysis Matrix for Buffer Zone Management in the Peri-Urban Area of Chittagong, Bangladesh. Environ Dev Sustain 2020, 22 (6), 5503–5520. https://doi.org/10.1007/s10668-019-00435-z.

59. Hussnain, M. Q. ul; Waheed, A.; Anjum, G. A.; Naeem, M. A.; Hussain, E.; Wakil, K.; Pettit, C. J. A Framework to Bridge Digital Planning Tools' Utilization Gap in Peri-Urban Spatial Planning; Lessons from Pakistan. Comput Environ Urban Syst 2020, 80. https://doi.org/10.1016/j.compenvurbsys.2019.101451.

60. Brown, D. L.; Champion, T.; Coombes, M.; Wymer, C. The Migration-Commuting Nexus in Rural England. A Longitudinal Analysis. J Rural Stud 2015, 41, 118–128. https://doi.org/10.1016/J.JRURSTUD.2015.06.005.

61. Xu, Q.; Zheng, X.; Zhang, C. Quantitative Analysis of the Determinants Influencing Urban Expansion: A Case Study in Beijing, China. Sustainability (Switzerland) 2018, 10 (5). https://doi.org/10.3390/su10051630.

62. Areola, A. A.; Gwebu, T. D.; Sebego, R. J. A Spatio-Temporal Analysis of Peri-Urbanisation in Sub-Saharan Africa: A Case Study from Lobatse, Botswana. African Geographical Review 2014, 33 (2), 174–201. https://doi.org/10.1080/19376812.2013.862477.

63. Danielaini, T. T.; Maheshwari, B.; Hagare, D. Defining Rural–Urban Interfaces for Understanding Ecohydrological Processes in West Java, Indonesia: Part I. Development of Methodology to Delineate Peri-Urban Areas. Ecohydrology & Hydrobiology 2018, 18 (1), 22–36. https://doi.org/10.1016/J.ECOHYD.2017.11.006.

64. Woltjer, J. A Global Review on Peri-Urban Development and Planning. Jurnal Perencanaan Wilayah dan Kota 2014, 25 (1), 1–16.

65. Wandl, A.; Magoni, M. Sustainable Planning of Peri-Urban Areas: Introduction to the Special Issue. Planning Practice and Research. Routledge January 1, 2017, pp 1–3. https://doi.org/10.1080/02697459.2017.1264191.

66. Merciu, F. C.; Marvu, I.; Iliescu, O. B.; Merciu, G. L. Delineation of the Urban Influence Area Using the Multi-Criteria Assessment Method. the Case of Focşani City, Romania. Journal of Settlements and Spatial Planning 2019, 10 (1), 13–28. https://doi.org/10.24193/JSSP.2019.1.02.

67. Mustak, S.; Baghmar, N. K.; Srivastava, P. K.; Singh, S. K.; Binolakar, R. Delineation and Classification of Rural–Urban Fringe Using Geospatial Technique and Onboard DMSP–Operational Linescan System. Geocarto Int 2018, 33 (4), 375–396. https://doi.org/10.1080/10106049.2016.1265594.

68. Sutton, P. C.; Goetz, A. R.; Fildes, S.; Forster, C.; Ghosh, T. Darkness on the Edge of Town: Mapping Urban and Peri-Urban Australia Using Nighttime Satellite Imagery. Professional Geographer 2010, 62 (1), 119–133. https://doi.org/10.1080/00330120903405006.

69. Asikainen, E.; Jokinen, A. Future Natures in the Making: Implementing Biodiversity in Suburban Land-Use Planning. Planning Theory and Practice 2009, 10 (3), 351–368. https://doi.org/10.1080/14649350903229794.

70. Jaung, W.; Carrasco, L. R. A Big-Data Analysis of Human-Nature Relations in Newspaper Coverage. Geoforum 2022, 128, 11–20. https://doi.org/10.1016/j.geoforum.2021.11.017.

71. Dogan, E.; Stupar, A. The Limits of Growth: A Case Study of Three Mega-Projects in Istanbul. Cities 2017, 60, 281–288. https://doi.org/10.1016/j.cities.2016.09.013.

72. Yang, R.; Zhang, J.; Xu, Q.; Luo, X. Urban-Rural Spatial Transformation Process and Influences from the Perspective of Land Use: A Case Study of the Pearl River Delta Region. Habitat Int 2020, 104, 102234. https://doi.org/10.1016/J.HABITATINT.2020.102234.

73. Sezgin, D.; Varol, Ç. Ankara'daki Kentsel Büyüme ve Saçaklanmanin Verimli Tarim Topraklarinin Amaç Dişi Kullanimina Etkisi. Metu Journal of the Faculty of Architecture 2012, 29 (1), 273–288. https://doi.org/10.4305/METU.JFA.2012.1.15.

74. McFarland, P. The Peri-Urban Land-Use Planning Tangle: An Australian Perspective. Int Plan Stud 2015, 20 (3), 161–179. https://doi.org/10.1080/13563475.2014.965250.

75. Zhao, P.; Lü, B.; Woltjer, J. Conflicts in Urban Fringe in the Transformation Era: An Examination of Performance of the Metropolitan Growth Management in

Beijing. Habitat Int 2009, 33 (4), 347–356. https://doi.org/10.1016/J.HABITATINT.2008.08.007.

76. Hegazy, I. R.; Kaloop, M. R. Monitoring Urban Growth and Land Use Change Detection with GIS and Remote Sensing Techniques in Daqahlia Governorate Egypt. International Journal of Sustainable Built Environment 2015, 4 (1), 117–124. https://doi.org/10.1016/J.IJSBE.2015.02.005.

77. Owoeye, J. O.; Ibitoye, O. A. Analysis of Akure Urban Land Use Change Detection from Remote Imagery Perspective. Urban Studies Research 2016, 2016, 1–9. https://doi.org/10.1155/2016/4673019.

78. de la Luz Hernández-Flores, M.; Otazo-Sánchez, E. M.; Galeana-Pizaña, M.; Roldán-Cruz, E. I.; Razo-Zárate, R.; González-Ramírez, C. A.; Galindo-Castillo, E.; Gordillo-Martínez, A. J. Urban Driving Forces and Megacity Expansion Threats. Study Case in the Mexico City Periphery. Habitat Int 2017, 64, 109–122. https://doi.org/10.1016/j.habitatint.2017.04.004.

79. D'Amour, C. B.; Reitsma, F.; Baiocchi, G.; Barthel, S.; Güneralp, B.; Erb, K. H.; Haberl, H.; Creutzig, F.; Seto, K. C. Future Urban Land Expansion and Implications for Global Croplands. Proceedings of the National Academy of Sciences of the United States of America. National Academy of Sciences August 22, 2017, pp 8939–8944. https://doi.org/10.1073/pnas.1606036114.

80. Andualem, T. G.; Belay, G.; Guadie, A. Land Use Change Detection Using Remote Sensing Technology. J Earth Sci Clim Change 2018, 9 (10), 1–6. https://doi.org/10.4172/2157-7617.1000496.

81. Shah, S.; Sharma, D. P. Land Use Change Detection in Solan Forest Division, Himachal Pradesh, India. For Ecosyst 2015, 2 (1). https://doi.org/10.1186/s40663-015-0050-7.

82. Tarimo, B.; Mtalo, E.; Liwa, E. Land Use Change Detection and Impact Assessment on an Agricultural Area. J Sustain Dev 2013, 6 (11). https://doi.org/10.5539/jsd.v6n11p55.

83. Erdogan, N.; Nurlu, E.; Erdem, Ü. Land Use/Land Cover Change Detection for Environmental Monitoring in Turkey: A Case Study in Karaburun Peninsula; 2015. https://www.researchgate.net/publication/279449193.

84. Wang, J.; Zhou, W.; Pickett, S. T. A.; Yu, W.; Li, W. A Multiscale Analysis of Urbanization Effects on Ecosystem Services Supply in an Urban Megaregion. Science of the Total Environment 2019, 662, 824–833. https://doi.org/10.1016/j.scitotenv.2019.01.260.

85. Sutton, P. C.; Costanza, R. Global Estimates of Market and Non-Market Values Derived from Nighttime Satellite Imagery, Land Cover, and Ecosystem Service Valuation; 2002; Vol. 41. www.elsevier.com/locate/ecolecon.

86. Cattivelli, V.; Stawinoga, A. E. Localisation and Determinants of the Creative Class in the Peri-Urban Areas. The Case of Northern Italy. City, Culture and Society 2023, 33. https://doi.org/10.1016/j.ccs.2023.100517.

87. Cattivelli, V. Delimiting Rural Areas: Evidence from the Application of Different Methods Elaborated by Italian Scholars. Land (Basel) 2022, 11 (10). https://doi.org/10.3390/LAND11101674.

88. Lasisi, M.; Popoola, A.; Adediji, A.; Adedeji, O.; Babalola, K. City Expansion and Agricultural Land Loss within the Peri-Urban Area of Osun State, Nigeria; 2017; Vol. 9.

89. Coulibaly, B.; Li, S. Impact of Agricultural Land Loss on Rural Livelihoods in Peri-Urban Areas: Empirical Evidence from Sebougou, Mali. Land (Basel) 2020, 9 (12), 1–20. https://doi.org/10.3390/land9120470.

90. Lawton, A.; Morrison, N. The Loss of Peri-Urban Agricultural Land and the State-Local Tensions in Managing Its Demise: The Case of Greater Western Sydney, Australia. Land use policy 2022, 120, 106265. https://doi.org/10.1016/J.LANDUSEPOL.2022.106265.

91. Duvernoy, I.; Zambon, I.; Sateriano, A.; Salvati, L. Pictures from the Other Side of the Fringe: Urban Growth and Peri-Urban Agriculture in a Post-Industrial City (Toulouse, France). J Rural Stud 2018, 57, 25–35. https://doi.org/10.1016/J.JRURSTUD.2017.10.007.

92. Barr, N. Future Agricultural Landscapes. Australian Planner 2003, 40 (2), 123–128. https://doi.org/10.1080/07293682.2003.9995268.

93. Taagepera, R.; Nemčok, M. World Population Growth over Millennia: Ancient and Present Phases with a Temporary Halt in-Between. Anthropocene Review 2024, 11 (1), 163–183. https://doi.org/10.1177/20530196231172423.

94. Argent, N. Trouble in Paradise? Governing Australia's Multifunctional Rural Landscapes. Australian Geographer 2011, 42 (2), 183–205. https://doi.org/10.1080/00049182.2011.572824.

95. Miller, F.; Ha, T. T. P.; Da, H. Van; Thuy, N. T. T.; Ngo, B. H. Double Displacement – Interactions between Resettlement, Environmental Change and Migration. Geoforum 2022, 129, 13–27. https://doi.org/10.1016/J.GEOFORUM.2021.12.016.

96. Adu-Gyamfi, A.; Owusu-Addo, E.; Inkoom, D. K. B.; Asibey, M. O. Peri-Urban Interface: An Alternative Residential Location of Low-Income Migrants in Kumasi, Ghana. Cities 2022, 123. https://doi.org/10.1016/j.cities.2022.103570.

97. Wehrwein, G. S. The Rural-Urban Fringe. Econ Geogr 1942, 18 (3), 217. https://doi.org/10.2307/141123.

98. Altınok, E.; Cengiz, H. The Effects of Urban Sprawl on Spatial Fragmentation and Social Segregation in Istanbul; 2008. https://www.researchgate.net/publication/301289886.

99. The 17 Goals | Sustainable Development. https://sdgs.un.org/goals (accessed 2024-06-06).

100. Dalal-Clayton, B. 73 5 The MDGs and sustainable development: the need for a strategic approach. IIED Publications Library. https://www.iied.org/g00449 (accessed 2024-06-06).

101. Jain, M.; Sikder, S.; Korzhenevych, A. Application of an Interdisciplinary Research Framework for Discerning Land Use Transitions in the Peri-Urban Areas of India. Applied Geography 2023, 155. https://doi.org/10.1016/j.apgeog.2023.102944.

102. Gallent, N.; Shaw, D. Spatial Planning, Area Action Plans and the Rural-Urban Fringe. Journal of Environmental Planning and Management. September 2007, pp 617–638. https://doi.org/10.1080/09640560701475188.

103. Bunker, R.; Houston, P. Prospects for the Rural-Urban Fringe in Australia: Observations from a Brief History of the Landscapes around Sydney and Adelaide. Aust Geogr Stud 2003, 41 (3), 303–323. https://doi.org/10.1046/J.1467-8470.2003.00236.X.

104. Scott, A. J.; Carter, C.; Reed, M. R.; Larkham, P.; Adams, D.; Morton, N.; Waters, R.; Collier, D.; Crean, C.; Curzon, R.; Forster, R.; Gibbs, P.; Grayson, N.; Hardman, M.; Hearle, A.; Jarvis, D.; Kennet, M.; Leach, K.; Middleton, M.; Schiessel, N.; Stonyer, B.; Coles, R. Disintegrated Development at the Rural–Urban Fringe: Re-Connecting Spatial Planning Theory and Practice. Prog Plann 2013, 83, 1–52. https://doi.org/10.1016/J.PROGRESS.2012.09.001.

105. Koroso, N. H.; Lengoiboni, M.; Zevenbergen, J. A. Urbanization and Urban Land Use Efficiency: Evidence from Regional and Addis Ababa Satellite Cities, Ethiopia. Habitat Int 2021, 117, 102437. https://doi.org/10.1016/J.HABITATINT.2021.102437.

106. Silva, C. Auckland's Urban Sprawl, Policy Ambiguities and the Peri-Urbanisation to Pukekohe. Urban Science 2019, 3 (1). https://doi.org/10.3390/urbansci3010001.

107. Hussnain, M. Q. ul; Waheed, A.; Anjum, G. A.; Naeem, M. A.; Hussain, E.; Wakil, K.; Pettit, C. J. A Framework to Bridge Digital Planning Tools' Utilization Gap in Peri-Urban Spatial Planning; Lessons from Pakistan. Comput Environ Urban Syst 2020, 80. https://doi.org/10.1016/j.compenvurbsys.2019.101451.

108. Albrechts, L. In Pursuit of New Approaches to Strategic Spatial Planning. A European Perspective. Int Plan Stud 2001, 6 (3), 293–310. https://doi.org/10.1080/13563470120026514.

109. Lyu, Y.; Wang, M.; Zou, Y.; Wu, C. Mapping Trade-Offs among Urban Fringe Land Use Functions to Accurately Support Spatial Planning. Science of the Total Environment 2022, 802. https://doi.org/10.1016/j.scitotenv.2021.149915.

110. García-Martín, M.; Quintas-Soriano, C.; Torralba, M.; Wolpert, F.; Plieninger, T.; García-Martín, M.; Plieninger, · T; Quintas-Soriano, C.; Torralba, · M; Wolpert, · F; Torralba, M. Landscape Change in Europe. 2021, 17–37. https://doi.org/10.1007/978-3-030-50841-8_2.

111. Kew, B.; Lee, B. D. Measuring Sprawl across the Urban Rural Continuum Using an Amalgamated Sprawl Index. Sustainability (Switzerland) 2013, 5 (5), 1806–1828. https://doi.org/10.3390/su5051806.

112. Ahani, S.; Dadashpoor, H. A Review of Domains, Approaches, Methods and Indicators in Peri-Urbanization Literature. Habitat International. Elsevier Ltd August 1, 2021. https://doi.org/10.1016/j.habitatint.2021.102387.

113. Balaban, O. The Negative Effects of Construction Boom on Urban Planning and Environment in Turkey: Unraveling the Role of the Public Sector. Habitat Int 2012, 36 (1), 26–35. https://doi.org/10.1016/j.habitatint.2011.05.003.

114. Kesgin Atak, B.; Ersoy Tonyaloğlu, E. Monitoring the Spatiotemporal Changes in Regional Ecosystem Health: A Case Study in Izmir, Turkey. Environ Monit Assess 2020, 192 (6). https://doi.org/10.1007/s10661-020-08357-4.

115. Habrel, M.; Denis, M.; Majewska, A.; Habrel, M.; Izdebski, M.; Fenchuk, O. Delimitation of the Metropolitan Areas of Warsaw and Lviv over the Last 100 Years. The Polish-Ukrainian Experience. Cities 2024, 144. https://doi.org/10.1016/j.cities.2023.104664.

116. Hepcan, S.; Hepcan, C. C.; Kilicaslan, C.; Ozkan, M. B.; Kocan, N. Analyzing Landscape Change and Urban Sprawl in a Mediterranean Coastal Landscape: A Case Study from Izmir, Turkey. J Coast Res 2013, 29 (2), 301–310. https://doi.org/10.2112/JCOASTRES-D-11-00064.1.

117. Akpınar, F. Planning of Rural Areas in the Vicinity of the Metropolitan Areas after the New Jurisdiction, 'Complete City Law': A Case from Izmir. In Sustainable Development and Planning VII; WIT Press, 2015; Vol. 1, pp 153–165. https://doi.org/10.2495/sdp150131.

118. Erdem, E. G. Urban Transformation in Turkey within Historical and Legal Framework: A Comprehensive Evaulation in Izmir. 2019.

119. Sonmez, I. O. Re-Emergence of Suburbia: The Case of Izmir Turkey. European Planning Studies 2009, 17 (5), 741–763. https://doi.org/10.1080/09654310802674526.

120. Tutar, Ö.; Bal, E. Transformation of the Space in the Context of Neoliberal Urbanization: The Case of Izmir New City Centre, Turkey. ICONARP International Journal of Architecture & Planning 2019, 7 (2), 428–459. https://doi.org/10.15320/ICONARP.2019.94-E-ISSN.

121. Tekel, A. Türkiye'de Metropoliten Alan Yönetiminden Metropoliten Yönetişime Geçiş: Ankara Örneğinde Bir Değerlendirme. Sosyal Ekonomik Araştırmalar Dergisi 2009, 9 (18), 191–214.

122. Tekeli, İ. Değişen-Dönüşen Kent ve Bölge. 8 Kasım Dünya Şehircilik Günü 28. Kolokyumu. 2004, pp 93–158. https://www.academia.edu/35865884/De%C4%9Fi%C5%9Fen_D%C3%B6n%C3%BC%C5%9Fen_Kent_ve_B%C3%B6lge_Prof_Dr_%C4%B0lhan_Tekeli_Onuruna_8_Kas%C4%B1m_D%C3%BCnya_%C5%9Eehircilik_G%C3%BCn%C3%BC_28_Kolokyumu_8_9_10_Kas%C4%B1m_2004_s_93_158 (accessed 2024-03-14).

123. Hegazy, I. R.; Kaloop, M. R. Monitoring Urban Growth and Land Use Change Detection with GIS and Remote Sensing Techniques in Daqahlia Governorate Egypt. International Journal of Sustainable Built Environment 2015, 4 (1), 117–124. https://doi.org/10.1016/j.ijsbe.2015.02.005.

124. Zanganeh Shahraki, S.; Sauri, D.; Serra, P.; Modugno, S.; Seifolddini, F.; Pourahmad, A. Urban Sprawl Pattern and Land-Use Change Detection in Yazd, Iran. Habitat Int 2011, 35 (4), 521–528. https://doi.org/10.1016/j.habitatint.2011.02.004.

125. Aburas, M. M.; Abdullah, S. H.; Ramli, M. F.; Ash'aari, Z. H. Measuring Land Cover Change in Seremban, Malaysia Using NDVI Index. Procedia Environ Sci 2015, 30, 238–243. https://doi.org/10.1016/J.PROENV.2015.10.043.

126. Çelik, M. A.; Gülersoy, A. E. Examining Temporal Changes in Relations between Land Uses and Land Use Capabilities in South of Sanliurfa Plains. Advances in Geoscience 2018, 2 (1). https://doi.org/10.18686/ag.v2i1.1114.

127. Li, C.; Wang, J.; Wang, L.; Hu, L.; Gong, P. Comparison of Classification Algorithms and Training Sample Sizes in Urban Land Classification with

Landsat Thematic Mapper Imagery. Remote Sens (Basel) 2014, 6 (2), 964–983. https://doi.org/10.3390/rs6020964.

128. Archive:Regional typologies overview - Statistics Explained. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Archive:Regional_typologies_overview&direction=next&oldid=376831 (accessed 2024-07-02).

129. Özatağan, G.; Eraydin, A. The Role of Government Policies and Strategies Behind the Shrinking Urban Core in an Expanding City Region: The Case of Izmir. European Planning Studies 2014, 22 (5), 1027–1047. https://doi.org/10.1080/09654313.2012.757588.

130. Peng, J.; Ma, J.; Liu, Q.; Liu, Y.; Hu, Y.; Li, Y.; Yue, Y. Spatial-Temporal Change of Land Surface Temperature across 285 Cities in China: An Urban-Rural Contrast Perspective. Science of the Total Environment 2018, 635, 487–497. https://doi.org/10.1016/j.scitotenv.2018.04.105.

131. Yu, X.; Guo, X.; Wu, Z. Land Surface Temperature Retrieval from Landsat 8 TIRS-Comparison between Radiative Transfer Equation-Based Method, Split Window Algorithm and Single Channel Method. Remote Sens (Basel) 2014, 6 (10), 9829–9852. https://doi.org/10.3390/RS6109829.

132. Gülümser, A. A.; Baycan Levent, T.; Nijkamp, P. Türkiye'nin Kırsal Yapısı: AB Düzeyinde Bir Karşılaştırma. İTÜDERGİSİ/a 2011, 9 (2).

133. Prasad Bhatta, B.; Kuikel, S. Suıtabılıty Analysıs to Identıfy the Suıtable Dumpng Sıte on Kanchacnpur Usıng MCDA. https://www.researchgate.net/publication/362231653.

134. Omar, N. Q.; Raheem, A. M. Determining the Suitability Trends for Settlement Based on Multi Criteria in Kirkuk, Iraq. Open Geospatial Data, Software and Standards 2016, 1 (1). https://doi.org/10.1186/s40965-016-0011-2.

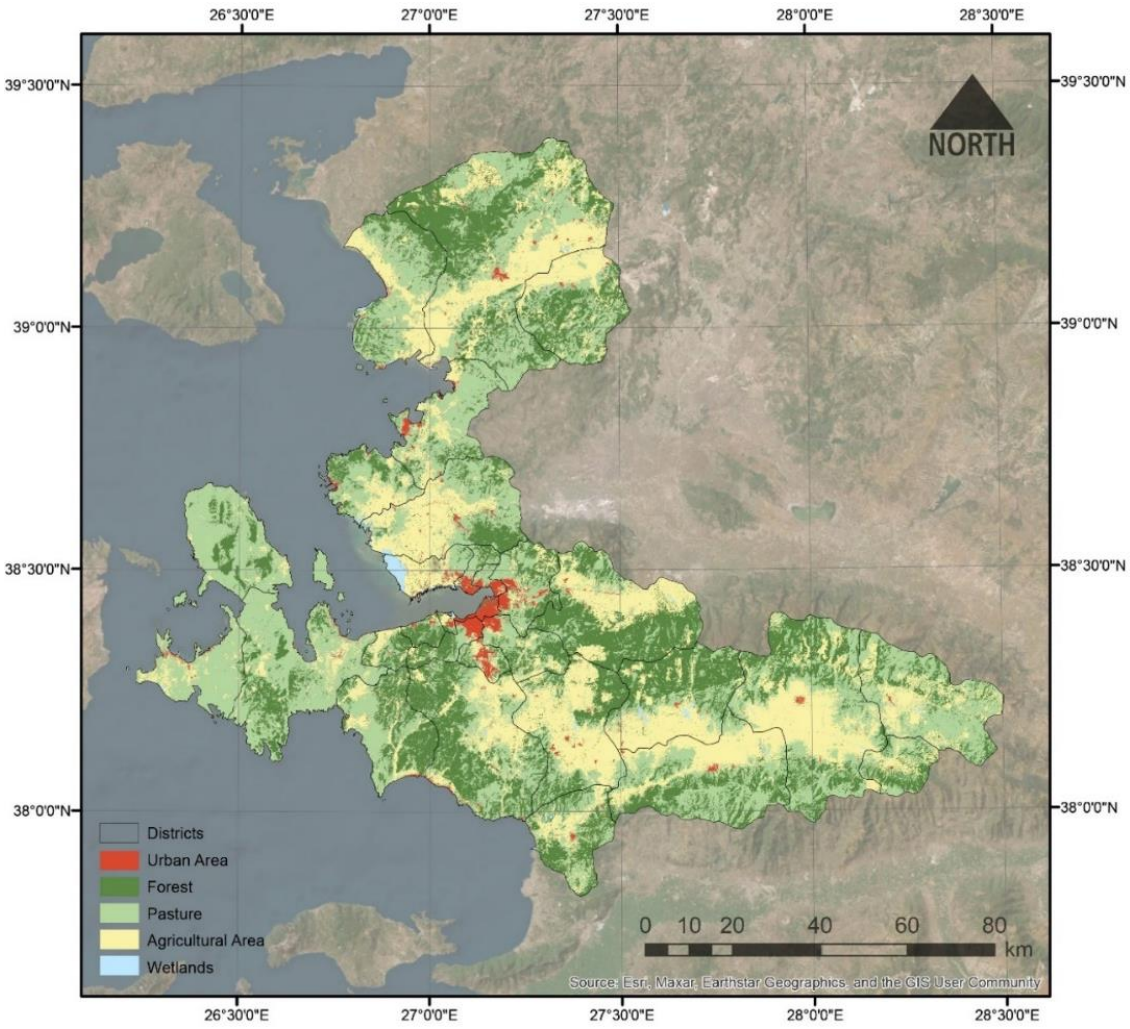
135. Moffett, K. B.; Makido, Y.; Shandas, V. Urban-Rural Surface Temperature Deviation and Intra-Urban Variations Contained by an Urban Growth Boundary. Remote Sens (Basel) 2019, 11 (22). https://doi.org/10.3390/rs11222683.

136. Žlender, V. Characterisation of Peri-Urban Landscape Based on the Views and Attitudes of Different Actors. Land use policy 2021, 101. https://doi.org/10.1016/j.landusepol.2020.105181.

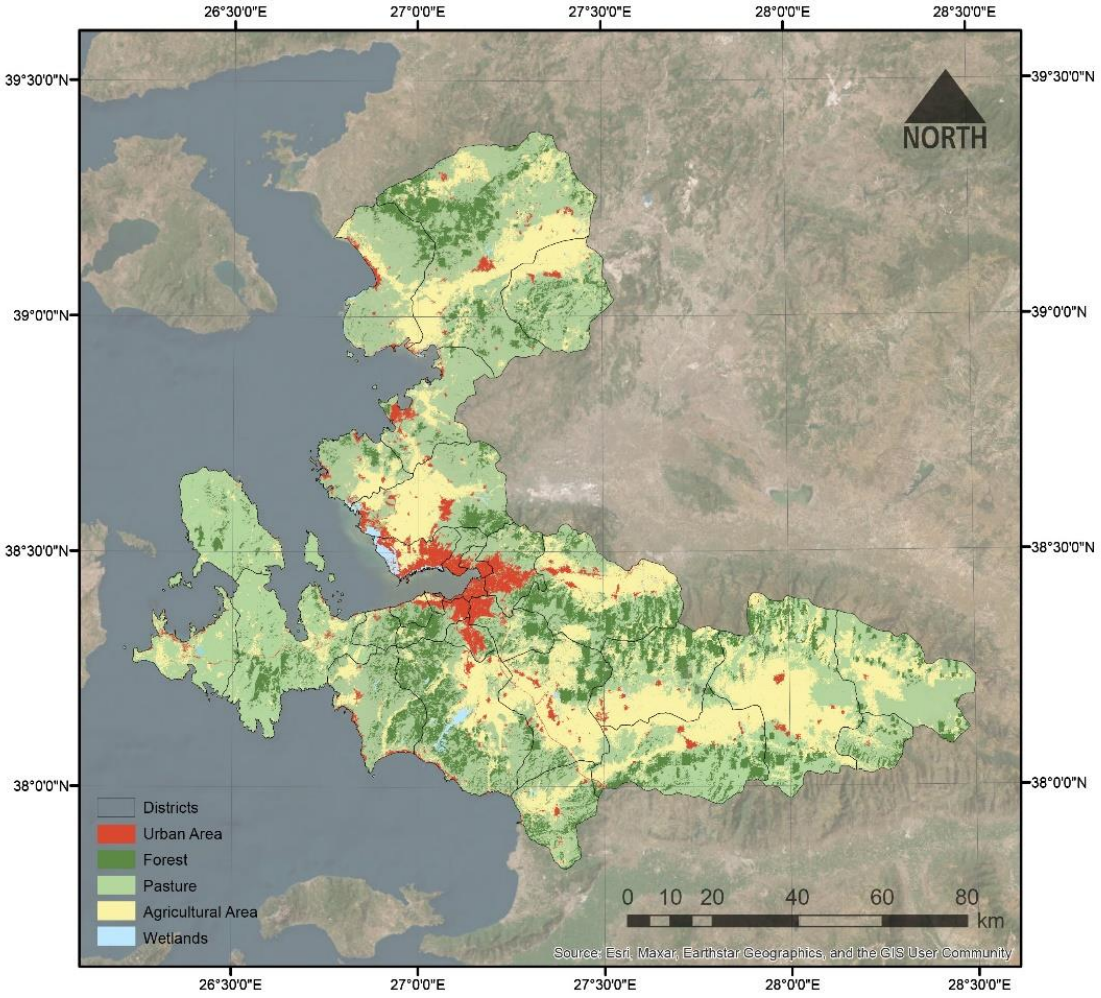
137. Sorensen, A. Periurbanization as the Institutionalization of Place: The Case of Japan. Cities 2016, 52, 1–7. https://doi.org/10.1016/j.cities.2015.11.014.

APPENDICES

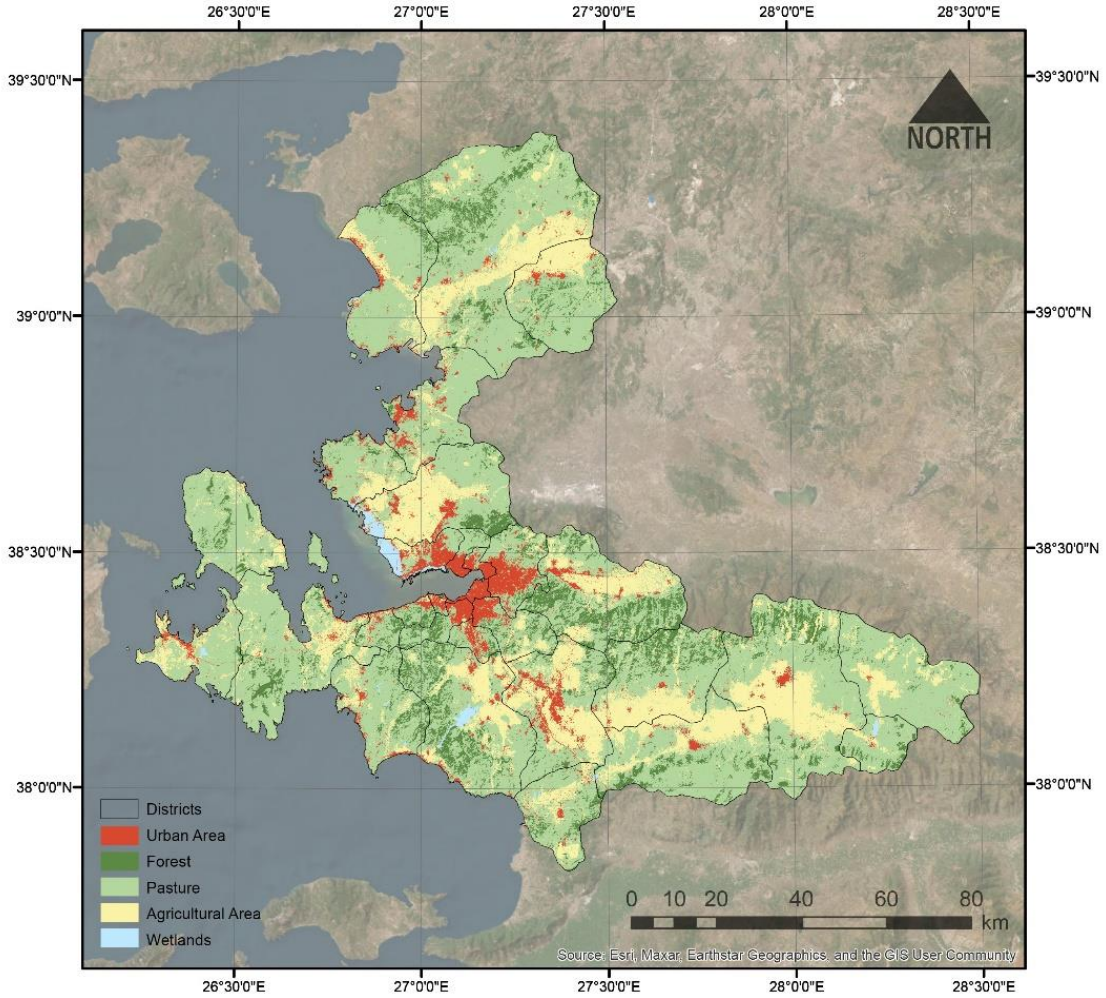
APPENDIX A



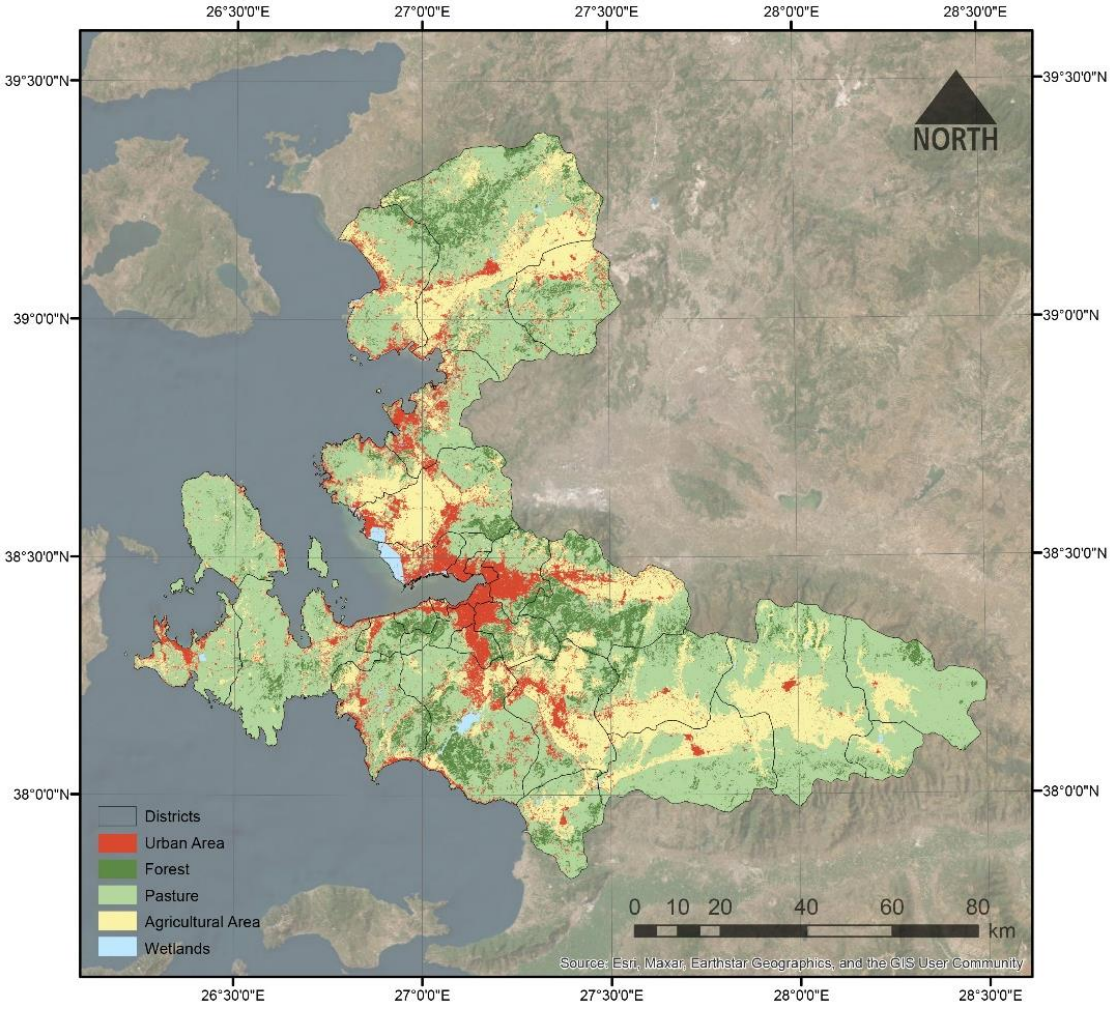
Land Use 1986 (Source: Created by the author with satellite images taken from USGS)



Land Use 19998 (Source: Created by the author with satellite images taken from USGS)



Land Use 2010 (Source: Created by the author with satellite images taken from USGS)



Land Use 2022 (Source: Created by the author with satellite images taken from USGS)

APPENDIX B

	1986	1998	2010	2022
Aliağa	51.890	56.403	65.753	104.828
Balçova	53.407	64.762	77.767	80.721
Beydağ	15.536	14.337	12.977	12.030
Buca	194.696	294.185	423.082	522.404
Bayındır	59.235	48.769	41.506	40.073
Bayraklı			307.898	298.519
Bergama	114.909	107.694	100.801	105.754
Bornova	275.501	376.624	419.070	454.470
Çeşme	67.558	40.670	33.051	48.924
Çiğli	70.347	106.037	157.530	214.065
Dikili	36.517	30.956	33.021	47.360
Foça	50.441	37.873	44.500	34.946
Gaziemir	56.456	82.345	129.691	137.754
Güzelbahçe	16.233	17.897	24.462	37.753
Karaburun	37.607	15.574	8.689	12.200
Karabağlar			458.890	479.338
Karşıyaka	318.250	419.090	310.061	346.264
Kemalpaşa	58.444	70.812	91.276	114.250
Kınık	42.412	33.411	28.210	28.694
Kiraz	44.588	44.864	44.555	43.510
Konak	665.444	764.434	405.580	332.277
Menderes	94.790	75.777	70.977	106.173
Menemen	93.062	111.123	131.394	200.904
Narlıdere	41.942	52.174	72.832	62.923
Ödemiş	128.271	128.261	129.695	132.740
Seferihisar	62.955	37.839	32.655	54.993
Selçuk	32.793	33.478	34.441	38.151
Tire	83.536	79.337	78.342	87.462
Torbalı	56.714	86.828	127.642	207.840
Urla	51.783	49.621	52.500	74.736

APPENDIX C

Power station

Animal resting under the tree, a rural touch

Farmlands, a rural touch

Industrial sites for the construction, production of the marble in Urla

Industrial sites for the construction, production of the marble in Urla

Tiny houses are sold, an ultimate figure that has been invading the periphery

Electricity pylons in the landscape, miscellaneous type

Wind turbines in the peninsula, their existence highly controversial