ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL

CONSERVING IRANIAN GARDENS: A QUICK STEP TOWARD SUSTAINABLE DEVELOPMENT GOALS

M.Sc. THESIS

Seyyedeh Mahsa MOUSAVIGHARALARI

Department of Landscape Architecture

Landscape Architecture Programme

NOVEMBER 2024

ISTANBUL TECHNICAL UNIVERSITY ★ GRADUATE SCHOOL

CONSERVING IRANIAN GARDENS; A QUICK STEP TOWARD SUSTAINABLE DEVELOPMENT GOALS

M.Sc. THESIS

Seyyedeh Mahsa MOUSAVIGHARALARI
(502201615)

Department of Landscape Architecture

Landscape Architecture Programme

Thesis Advisor: Assoc. Prof. Dr. Elif KISAR KORAMAZ

NOVEMBER 2024

ISTANBUL TEKNİK ÜNİVERSİTESİ ★ LİSANSÜSTÜ EĞİTİM ENSTİTÜSÜ

İRAN BAHÇELERİNİN KORUNMASI: SÜRDÜRÜLEBİLİR KALKINMA HEDEFLERİNE DOĞRU HIZLI BİR ADIM

YÜKSEK LİSANS TEZİ

Seyyedeh Mahsa MOUSAVİGHARALARİ
(502201615)

Peyzaj Mimarligi Anabilim Dalı

Peyzaj Mimarliği Programı

Tez Danışmanı: Doç. Dr. Elif KISAR KORAMAZ

KASIM 2024

Seyyedeh Mahsa MOUSAVIGHARALARI, a M.Sc student of İTU Graduate School student ID 502201615, successfully defended the thesis entitled "CONSERVING IRANIAN GARDENS; A QUICK STEP TOWARD SUSTAINABLE DEVELOPMENT GOALS", which she prepared after fulfilling the requirements specified in the associated legislations, before the jury whose signatures are below.

Thesis Advisor : **Assoc. Prof. Dr. Elif KISAR KORAMAZ** .....
Istanbul Technical University

Jury Members : **Assoc. Prof. Dr. Ebru ERBAŞ GÜRLER** .....
Istanbul Technical University

Assoc. Prof. Dr. Özlem ÖZER .....
Gebze Technical University

Date of Submission : 17 October 2024
Date of Defense : 13 November 2024

To all who never give up greening…,

FOREWORD

I would like to express my deepest gratitude to Assoc. Prof. Dr. Elif KISAR KORAMAZ for her unwavering motivation and invaluable support throughout this journey. I also extend my sincere thanks to all jury members and interview participants, whose comments and insights greatly contribute to the enhancement of this thesis. I am also profoundly grateful to my family for their support and encouragement.

November 2024 S.Mahsa MOUSAVIGHARALARI
(Architect)

TABLE OF CONTENTS

Page

ABBREVIATIONS

Sustainable Development Goals: SDGs

Urban Green Spaces: UGS

United Nations: UN

OECS: The Organisation for Economic Co-operation and Development

GHG: Global Greenhouse Gass

WHO: World Health Organization

WACOSS: Western Australia Council of Social Services

LIST OF TABLES

Page

LIST OF FIGURES

Page

CONSERVING IRANIAN GARDENS; A QUICK STEP TOWARD SUSTAINABLE DEVELOPMENT GOALS

SUMMARY

Population growth and urbanization represent two of the most significant challenges facing cities in a rapidly changing world, particularly in developing nations. These challenges put increasing pressure on natural resources, which are essential for providing food and energy. Issues such as environmental degradation, land use changes, climate change, biodiversity loss, declining per capita green space, the destruction of cultural heritage, and impacts on health and well-being demand urgent attention from both local and global governments.

To address these pressing issues and safeguard the planet, 17 Sustainable Development Goals (SDGs) have been established. The SDGs offer a comprehensive framework aimed at fostering a more sustainable and equitable future. They address a broad spectrum of global challenges, including poverty, inequality, climate change, environmental degradation, and the promotion of peace and justice.

According to the 2023 Sustainable Development Report, Iran faces significant challenges in meeting the SDGs, particularly Goals 11 (Sustainable Cities and Communities), 13 (Climate Action), and 15 (Life on Land). In addition, rapid and unplanned urbanization has led to the loss of many urban green spaces in Iran, and Iranian gardens are not exempt from this process of destruction. Historically, these gardens have played a crucial role in cities from multiple perspectives.

Although numerous studies have examined Iranian gardens, most focus on their aesthetic appeal and design characteristics. Few, however, critically assess the current status of these gardens within urban settings or their potential contribution in contemporary cities to the SDGs as valuable green public spaces. In this context, this study seeks to explore the potential of Iranian gardens to contribute to the achievement of the SDGs in urban areas. Highlighting these potentials could support cities in advancing toward global sustainability objectives.

In pursuit of this aim, the study's objectives are, first, to investigate the relationship between Iranian gardens and Sustainable Development Goals, exploring how these gardens might be integrated into modern urban contexts to support sustainability goals and second, to examine the condition of Iranian gardens in the 21st century and identify the barriers preventing these gardens from fulfilling their potential within urban areas.

To achieve these objectives, the study seeks to answer the following key questions:

- How can Iranian gardens be integrated into contemporary cities and daily life to help achieve the Sustainable Development Goals (SDGs)?
- What obstacles do Iranian gardens face in fulfilling their potential in today's cities?

Given the study's focus on understanding the relationship between Iranian gardens and the SDGs, a qualitative research approach is employed. Within the framework of qualitative research methods, in-depth interviews were identified as the most suitable tool for addressing the research questions. Due to the limited research on the connection between Iranian gardens and the SDGs, interviews with experts in the fields of landscape architecture, urban planning, and sustainable development were deemed an appropriate means of gathering insights. Both national and international experts with experience in working on Iranian gardens and familiarity with the SDGs were selected for semi-structured interviews.

The data collected through these interviews were analyzed and coded using the MAXQDA program. Based on the research questions and study objectives, the interviews were coded into main codes and subcodes, including the following:

Problems and obstacles facing Iranian Gardens: conservation and restoration issues, lack of attention to users' needs, application of wrong policies and functions into gardens, urbanization pressure, registration in UNESCO list.

Iranian Gardens in the Context of Environmental sustainability: the ability of gardens to improve air quality, climate adaptation, reduce urban heat, resilient plant species, and moderate harsh weather.

Importance of Iranian Gardens: heritage importance, solution for environmental challenges, triple benefits, safe spaces for women and children.

Contribution of Iranian Gardens to Contemporary Urban Life: multifunctional urban green spaces, improve users' well-being and fulfill the need for urban green spaces.

Iranian Gardens as Cultural heritage: public awareness and engagement, and insufficient knowledge about cultural heritage.

The results of the data analysis reveal that Iranian gardens hold considerable potential to contribute to SDGs 11, 13, and 15 within urban contexts. If effectively integrated into urban planning and daily life, these gardens could serve as multifunctional green spaces that support climate resilience, enhance public health, and promote sustainable urban development. However, the findings also indicate that issues related to conservation and restoration are the most significant barriers preventing these gardens from fully realizing their potential. A critical concern is the lack of specific studies and strategies outlining how these gardens can be restored or adaptively reused in ways that best serve both cities and their residents.

Iranian gardens represent invaluable cultural, environmental, social, and economic assets that provide substantial benefits not only to Iranian cities but also to urban landscapes worldwide. Their potential to address key challenges associated with the SDGs is considerable. Therefore, there is an urgent need to raise awareness of the importance of policies focused on the conservation, restoration, and regeneration of these gardens before the opportunity to protect these vital urban resources is irretrievably lost.

İRAN BAHÇELERİNİN KORUNMASI; SÜRDÜRÜLEBİLİR KALKINMA HEDEFLERİNE DOĞRU HIZLI BİR ADIM

ÖZET

Nüfus artışı ve kentleşme, özellikle gelişmekte olan ülkelerde, hızla değişen bir dünyada şehirlerin karşı karşıya olduğu en önemli zorluklardan ikisini temsil etmektedir. Bu zorluklar, gıda ve enerji sağlamak için olmazsa olmaz olan doğal kaynaklar üzerinde artan bir baskı oluşturmaktadır. SKA' ları, yoksulluk, eşitsizlik, iklim değişikliği, çevresel bozulma, arazi kullanımındaki değişiklikler, iklim değişikliği, biyolojik çeşitliliğin kaybı, kişi başına düşen yeşil alanın azalması, kültürel mirasın tahribi ve sağlık ve refah üzerindeki etkiler gibi konular, hem yerel hem de küresel hükümetlerden acil ilgi gerektirmektedir.

Bu acil sorunları ele almak ve gezegeni korumak için 17 Sürdürülebilir Kalkınma Amaç (SKA) oluşturulmuştur. SKA'ler, daha sürdürülebilir ve adil bir gelecek sağlamayı amaçlayan kapsamlı bir çerçeve sunmaktadır. Yoksulluk, eşitsizlik, iklim değişikliği, çevresel bozulma barış ve adaletin teşvik edilmesi dahil olmak üzere geniş bir yelpazedeki küresel mücadele konularını ele almaktadırlar.

2023 Sürdürülebilir Kalkınma Raporu'na göre İran, özellikle SKA-11 (Sürdürülebilir Şehirler ve Topluluklar), SKA-13 (İklim Eylemi) ve SKA-15 (Karada Yaşam) olmak üzere SKA'leri karşılamada önemli zorluklarla karşı karşıyadır. Ek olarak, hızlı ve plansız kentleşme İran'da birçok kentsel yeşil alanın kaybına yol açmıştır ve İran Bahçeleri de bu yıkım sürecinden olumsuz etkilenmektedir. Tarihsel olarak, İran Bahçeleri İran kentlerinde birçok açıdan önemli bir rol oynamıştır.

İran Bahçeleri pek çok araştırmada ele alınmış olsa da araştırmaların çoğunda odaklanılan konular İran Bahçelerinin tasarım özellikleri ve estetik yönleriyle sınırlı kalmaktadır. Ancak araştırmaların çok azında İran Bahçelerinin günümüz kentleşme süreçlerindeki güncel durumu ele alınmakta veya çağdaş şehirlerde kamusal yeşil alanlar olarak İran Bahçelerinin sürdürülebilirliğe ve SKA'na katkıları eleştirel bir şekilde değerlendirmektedir. Bu bağlamda, bu çalışma, Sürdürülebilir Kalkınma Amaçlarına ulaşma süreçlerinde İran Bahçelerinin katkılarının neler olabileceğini belirlemeyi amaçlamaktadır. İran Bahçelerinin bu yöndeki potansiyellerin belirlenmesinin ve vurgulanmasının, şehirlerin küresel sürdürülebilirlik amaçlarına erişmesine katkıda bulunması beklenmektedir.

Bu amaç doğrultusunda, çalışmanın hedefleri, İran bahçeleri ile sürdürülebilir kalkınma amaçları arasındaki ilişkiyi araştırmak, İran bahçelerinin sürdürülebilirlik amaçlarını desteklemek için modern kentsel bağlamlara nasıl entegre edilebileceğini ortaya koymak; ardından günümüzde İran bahçelerinin durumunu inceleyerek ve bu bahçelerin kentsel alanlarda potansiyellerini gerçekleştirmesinin önündeki engelleri belirlemektir. Bu çerçevede, araştırmayı yönlendiren araştırma soruları aşağıdaki gibidir:

• İran Bahçeleri Sürdürülebilir Kalkınma Amaç (SKA) ulaşmaya yardımcı olmak için çağdaş şehirlere ve günlük yaşama nasıl entegre edilebilir?

• İran Bahçeleri günümüz şehirlerinde potansiyellerini yerine getirmede hangi engellerle karşılaşıyor?

Çalışmada İran Bahçeleri ile SKA'lar arasındaki ilişkiyi çözümlemek amacıyla nitel bir araştırma yaklaşımı kullanılmıştır. Nitel araştırma yöntemleri çerçevesinde, derinlemesine görüşmeler araştırma sorularını ele almak için en uygun araç olarak belirlenmiştir. İran Bahçeleri ile SKA'ler arasındaki bağlantıya ilişkin sınırlı araştırma nedeniyle, peyzaj mimarlığı, şehir planlama ve sürdürülebilir kalkınma alanlarındaki uzmanlarla görüşmeler içgörü toplamanın uygun bir yolu olarak görülmüştür. İran Bahçeleri üzerinde çalışma deneyimi olan ve SKA'lere aşinalığı olan hem ulusal hem de uluslararası uzmanlar yarı yapılandırılmış görüşmeler için seçilmiştir. Bu görüşmeler yoluyla toplanan veriler MAXQDA programı kullanılarak analiz edilmiş ve kodlanmıştır. Araştırma soruları ve çalışma hedeflerine dayanarak, görüşmeler aşağıdaki başlıkarı içeren ana kodlar ve alt kodlara ayrılmıştır. İran Bahçelerinin karşı karşıya olduğu sorunlar ve engeller: Koruma ve restorasyon sorunları, kullanıcıların ihtiyaçlarına dikkat edilmemesi, bahçelere yanlış politikalar ve işlevler uygulanması, kentleşme baskısı, İran Bahçeleri ve UNESCO Dünya Miras Listesi ile ilişkili konular.

Çevresel sürdürülebilirlik bağlamında İran Bahçeleri: Bahçelerin hava kalitesini iyileştirme, iklime uyum sağlama, kentsel ısıyı adası etkisini azaltma, dayanıklı bitki türleri ve sert hava koşullarını hafifletme yeteneği ile ilişkili konular

İran Bahçelerinin önemi: Miras değeri, çevresel zorluklara çözüm, üçlü faydalar, kadınlar ve çocuklar için güvenli alanlar ile ilişkili konular.

İran Bahçelerinin Çağdaş Kentsel Yaşama Katkısı: Çok işlevli kentsel yeşil alanlar, kullanıcıların refahını iyileştirme ve kentsel yeşil alanlara olan ihtiyacı karşılama ile ilişkili konular.

Kültürel miras olarak İran Bahçeleri: Halkın farkındalığı ve katılımı ve kültürel miras hakkında yetersiz bilgi ile ilişkili konular .

Veri analizinin sonuçları, İran bahçelerinin kentsel bağlamlarda SKA 11, 13 ve 15'e katkıda bulunma konusunda önemli potansiyellere sahip olduğunu ortaya koymaktadır. Kentsel planlama ve günlük yaşama etkili bir şekilde entegre edilirlerse, bu bahçeler iklim dayanıklılığını destekleyen, halk sağlığını geliştiren ve sürdürülebilir kentsel gelişimi teşvik eden çok işlevli yeşil alanlar olarak hizmet verebilir. Ancak bulgular ayrıca, koruma ve restorasyonla ilgili sorunların bu bahçelerin potansiyellerini tam olarak gerçekleştirmesini engelleyen en önemli engeller olduğunu göstermektedir. Araştırma sonuçları, bu bahçelerin hem şehirlere hem de sakinlerine en iyi şekilde hizmet edecek şekilde nasıl restore edilebileceğini veya uyarlanabilir şekilde yeniden kullanılabileceğini ana hatlarıyla açıklayan belirli çalışmaların ve stratejilerin eksikliğinin temel kaygılardan biri olduğunu ortaya koymuştur.

İran Bahçeleri, yalnızca İran şehirlerine değil aynı zamanda dünya çapındaki kentsel peyzajlarada da önemli faydalar sağlayan paha biçilmez kültürel, çevresel, sosyal ve ekonomik varlıkları temsil etmektedir. İran Bahçelerinin SKA'lerle ulaşma sürecindeki potansiyellerinin hayata geçirilmesi önem taşımaktadır. Bu nedenle, bu hayati kentsel kaynakları koruma fırsatı geri dönülemez şekilde kaybolmadan önce, bu bahçelerin korunması, restore edilmesi ve yenilenmesine odaklanan politikaların önemi konusunda farkındalığın artırılmasına acil ihtiyaç vardır.

1. INTRODUCTION

Rapid urbanization and population growth present significant challenges for cities, particularly in developing countries, where they exert considerable pressure on urban areas, especially green spaces. Despite the growing demand for urban green spaces and their essential role in promoting urban sustainability, many cities are losing their historically significant green areas. Iranian gardens, historically significant elements of the local landscape that have long contributed to urban sustainability, are now at risk of deterioration due to multiple challenges. With nine of these gardens registered on the UNESCO World Heritage list, their global significance is also recognized. Numerous studies highlight the importance of urban green spaces in achieving the Sustainable Development Goals (SDGs), yet no specific research has focused on the relationship between Iranian gardens and the SDGs. Therefore, given the essential economic, environmental, and social roles that Iranian gardens play in Iranian cities, alongside their global significance, it is crucial to conduct studies that first highlight their potential contribution to the Sustainable Development Goals (SDGs) in modern urban life. Additionally, research should investigate the factors contributing to the degradation of these gardens, which prevent them from fully realizing their potential within urban areas and communities.

Iran is a country with a mainly arid and semi-arid climate condition. In recent years, the government has faced many challenges regarding environmental degradation, social issues, and economic difficulties. Accordingly, many Persian gardens in Iran have been destroyed and many of them are dilapidated or under threat of deterioration due to fast and unplanned urbanization. Consequently, concerns are raised about the condition of these gardens, which not only represent the history existing behind Iran's urban landscape and indicate the culture and events that lives and happened in that time but alos are vital urban green spaces that serve city and citizans in many ways.

Accordingly, this study aims to investigate the possible potential of Iranian gardens in contributing to the achievement of Sustainable Development Goals (SDGs) in urban

areas. Within the aim of the study, the motivation of this study is to highlight gardens' potential that help cities progress toward global objectives.

In line with the aim, the study's objectives are to understand the relationship between gardens and sustainable development, exploring how these gardens can be integrated into contemporary urban settings to support sustainability goals. Additionally, the study seeks to examine the state of Iranian gardens in the 21st century and identify the obstacles that prevent these gardens from realizing their potential in urban areas.

Within this scope, the thesis seeks answers to the following questions:

How can Iranian gardens be integrated into contemporary cities and daily life to help achieve the Sustainable Development Goals (SDGs)?

What obstacles do Iranian gardens face in fulfilling their potential in today's cities?

To accomplish the research objectives and address its questions, the study employed qualitative research methods for data collection. These methods included interviews with experts and academicians in architecture, landscape architecture, and urban planning, as well as with environmental activists.

This thesis consists of four chapters. The first chapter introduces the research topic, defines the problem, outlines the study's aims and objectives, and provides an overview of the thesis structure. The second chapter reviews the relevant literature on sustainability and the Sustainable Development Goals (SDGs) and their associated targets. It then examines Iranian gardens as urban green spaces. This section also studies the current situation of Iranian gardens in cities and explores the effects of urbanization on the gardens in recent years by investigating aerial maps of them. Then, the following section reviews the existing studies about Iranian gardens and identifies the gaps in the current body of research, concluding with the relation between Iranian gardens as urban green spaces and SDGs.

The third chapter, which examines the contributions of Iranian gardens to achieving the Sustainable Development Goals (SDGs), outlines the methodology employed in the thesis, explaining the research methods used to address the research questions. It then presents the data collected from the interviews, describes the analysis process, and evaluates the findings in relation to the research questions. Finally, the fourth chapter conclude the study, offers recommendations concerning Iranian gardens and the SDGs, and suggests subjects for future research.

2. LITERATURE REVIEW

This study section examines existing literature to provide context, identify research gaps, and inform the theoretical and methodological framework. It begins with a definition review of sustainability and Sustainable Development Goals (SDGs) and explores their relationship and connection to urban environments. Also, the study reviews the goals and their targets to gain a deeper insight into each goal, identifying relevant indicators for urban green spaces.

Since Iranian gardens are a central focus of the study, the second part of this section investigates these gardens from various perspectives. It includes an analysis of the concept of gardens, their design features, and the impact of urbanization over time, examined through three case studies. Additionally, it reviews previous studies conducted on Iranian gardens. Summarizing the existing literature enables the study to identify gaps.

Another focus of the literature review is the interaction between urban green spaces and SDGs. This section examines existing literature on how urban green spaces interact with cities and explores the relationship between these spaces and the needs of users.

2.1 Sustainability and Sustainable Development Goals

Over the past two decades, cities and urban centers have become the predominant human habitats due to demographic and economic changes (United Nations, 2012). Currently, 55% of the global population resides in urban areas, and this figure is projected to increase to 68% by 2050 (United Nations, 2018). This indicates that urbanization, characterized by the migration from rural to urban areas and overall population growth, will result in an additional 2.5 billion people living in cities by 2050. This growth will be particularly significant in Asia and Africa, which are expected to contribute to over 90% of the increase.

Rapid and in most cases unplanned urbanization challenges cities in different ways, especially in developing countries. These issues threaten cities in many respects; intensive population growth increases poverty, concentrated energy use makes air pollution that significantly affects human health, and the accumulation of uncollected waste presents numerous risks to the environment and its ecosystems. At the same time, urban development exacerbates environmental hazards such as flash floods, pollution, and physical impediments to root growth, contributing to the decline of urban green spaces. Additionally, the presence of vehicles, harmful chemicals, and habitat destruction have detrimental effects on both wildlife populations and plant species. (UN, 2010). As a result, contemporary urban issues such as air and water pollution, water scarcity, waste disposal, the reduction of urban green spaces, and high energy consumption are becoming increasingly critical due to rising population density and growing demand for urban environments (OECD, 2023).

Global greenhouse gas (GHG) emissions are expected to rise by 50%, primarily due to a 70% increase in CO2 emissions from energy sources. The average global temperature is projected to increase by 3 to 6 degrees Celsius by the end of the century, surpassing the internationally agreed target of 2 degrees. These changes will also endanger biodiversity. By 2050, terrestrial biodiversity is predicted to decline by 10% worldwide, with significant losses in Asia, Europe, and southern Africa (OECD, 2012). The main causes of biodiversity loss include land-use changes, commercial forestry expansion, infrastructural development, human intrusion and habitat fragmentation, pollution, and climate change.

Regarding water, global demand is estimated to increase by approximately 55% due to rising needs from manufacturing, thermal electricity generation, and domestic use. Under these circumstances, there will be little capacity to increase irrigation water consumption because of competing demands. Emerging economies are expected to see the largest increases in water consumption (OECD, 2012).

Research on the impacts of unplanned and rapid urbanization on humans and the environment identifies four major issues: environmental degradation, social instability, poverty, and health problems. These are the most significant risks facing cities and their inhabitants (National Geographic, 2015). These outcomes highlight the urgent need for action to protect the planet not only for current users but also for future generations by seeking ways to achieve economic and social equity without causing

further environmental harm. Consequently, concepts such as sustainability, sustainable urbanization, and sustainable urban development have been recognized as practical approaches to address these environmental, economic, and social challenges.

Given the growing importance of sustainability in recent decades, the concept has been interpreted in various ways in the literature. The main idea of sustainable development originated in 1972 during the United Nations (UN) Conference on the Human Environment in Stockholm. A core definition of sustainability is the societal goal of enabling people to coexist on Earth for an extended period. Experts often describe sustainability as encompassing three dimensions: social, economic, and environmental. The United Nations Brundtland Commission in 1987 defined sustainability as "meeting the needs of the present without compromising the ability of future generations to meet their own needs." This comprehensive definition, which will be utilized in this thesis, effectively encapsulates all theories related to sustainability. Yigitcanlar and Kamruzzaman (2015) broadly described sustainability as a normative concept that outlines how individuals should interact with the environment and be accountable to one another and future generations.

As evident from the definition, sustainability is an interdisciplinary approach. According to the American Society of Landscape Architects Funds, a sustainable landscape is regenerative, environmentally sensitive, and actively promotes the development of healthy communities. The American Society of Landscape Architects (2017) states that sustainable landscapes enhance energy efficiency, restore ecosystems, purify air and water, sequester carbon, and provide significant social, economic, and environmental benefits.

Almost 140 developing nations are looking for strategies to satisfy their development needs, and more than half of the world's population currently resides in metropolitan areas (United Nations, Academic Impacts). Rapid urbanization is known to have negative effects on the environment, including poverty, hunger, and the depletion of natural resources, damage of natural areas, climate change, deforestation, habitat loss, and freshwater extraction (The Sustainable Development Goals, 2018). Also, cities are increasingly driving global prosperity in a world where resources are rapidly depleting. It is essential to discover strategies for achieving social justice and economic progress without endangering the environment. Sustainable development, which is based on the principle of sustainability, aims to meet fundamental human needs while preserving

the essential ecosystems that sustain life on Earth. Sustainable development can be considered a key to successful development in urban areas, which are the core of economic activities, because of the concentration of financial and human resources, the exceptional increase in urban centers, and the percentage of the world's population that lives in cities (Mensah, 2019).

As stated by the United Nations (2016), sustainable development is defined as progress that satisfies current needs without jeopardizing the capacity of future generations to satisfy their own needs. It entails coordinated efforts to create a future that is resilient, inclusive, and sustainable for both people and the environment. Sustainable development, according to Allen (1980), is development that meets human needs and raises standards of living while ensuring that ecosystems continue to replenish themselves. Therefore, to achieve sustainable development, it is essential to consider the three main dimensions of sustainability—economic, environmental, and social—in a balanced and simultaneous manner. These dimensions, regarded as the pillars of sustainable development, must be given equal importance (Kosmopoulos, 2023). On the other hand, any kind of action that overweighed one of the pillars to others creates an imbalance in the system and changes into an unsustainable system (Ayodele and Ogunlala, 2016). In 1994, John Elkington discussed the value and inclusion of the financial bottom line, profit and loss, and environmental and social line with three overlapping circles (Figure 2.1). According to this diagram, sustainability is typically defined as the place where the economy, environmental health, and social issues overlap.

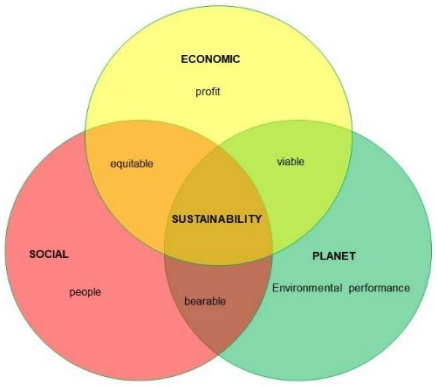


Figure 2.1 : John Elkington's Triple Bottom Line Model (Adapted from Silva, 2023)

Considering the mentioned issues, it is essential to responsibly manage the Earth's current resources to ensure their availability for future generations. Consequently, establishing a unified plan for promoting peace and prosperity for both humanity and the planet is a crucial global mission. Increasing urbanization and migration from rural areas create a new era of environmental concerns affecting the planet's ecology and users' well-being. With every passing day, the growing population's footprint on the earth becomes more visible, and consequently, environmental challenges become more noticeable. The UN has adopted governance to promote sustainable development as a result of all these concerns. The United Nations Conference on Sustainable Development in Rio de Janeiro in 2012 gave birth to the Sustainable Development Goals (SDGs). In 2015, the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development, which includes 17 broader objectives, 169 targets, and 232 indicators. The 17 goals are intended to foster both a prosperous environment and a society that is equitable on a global scale. To successfully affect society, the 2030 Agenda's governance concept seeks to integrate the governments of all 196 UN member states with all other private and public players (IFLA, 2019). These 17 goals cover the three dimensions of sustainable development; the economy, social development, and environment, and aim to transform the world in a way that keeps these three dimensions equal (UN, 2015). Furthermore, the Sustainable Development Goals serve as a roadmap for achieving a more sustainable and better future for all. They target the world's major problems, such as those of poverty, inequality, the environment, climate change, peace, and justice (United Nations, 2016). The Sustainable Development Goals (SDGs) mark a transformative shift in development theory, moving beyond economic growth to envision a future that is inclusive, fair, peaceful, and environmentally sustainable (UNESCO, 2017).

Landscape architecture is one of the most effective strategic approaches to sustainable urban development. ASLF (2017) describes sustainable landscapes as being regenerative, environmentally aware, and actively promoting the development of thriving communities. This field plays a pivotal and unique role in ensuring environmental sustainability and users' well-being during design interventions on local, regional, and global scales. A green landscape provides a natural ecosystem while simultaneously creating opportunities for social interaction and well-being among its users. Thus, many countries are supporting green efforts, such as the

construction of parks, squares, and leisure spaces. This is particularly the case in Asian nations and regions that are rapidly industrializing and urbanizing while also seeing alarming rates of population increase (Liu & Zhu, 2021). Also, many cities in developed countries have presented new frameworks to apply sustainability in their urban planning and development process. In developing countries, even though a few of them like China, Korea, Malaysia, Turkey, and Vietnam, are making some attempts to practice sustainable urban development, much more has to be done to improve the situation in the developing world's quickly rising economies. (Yigitcanlar & Kamruzzaman,2015).

The 17 Sustainable Development Goals (SDGs) aim to create a sustainable and equitable world by addressing interconnected global challenges. These goals include eradicating extreme poverty (SDG1- No Poverty) and ending hunger while promoting food security and sustainable agriculture (SDG2- Zero Hunger). They seek to ensure healthy lives and well-being for all ages (SDG3- Good Health and Well-being), provide inclusive and equitable quality education (SDG4- Quality Education), and achieve gender equality and empower women and girls (SDG5- Gender Equality). The SDGs also emphasize the availability and sustainable management of water and sanitation (SDG6- Clean Water and Sanitation), access to affordable and clean energy (SDG7- Affordable and Clean Energy), and the promotion of sustained economic growth and decent work for all (SDG8- Decent Work and Economic Growth). Building resilient infrastructure, fostering innovation (SDG9- Industry, Innovation, and Infrastructure), reducing inequalities (SDG10- Reduced Inequality), and making cities inclusive, safe, resilient, and sustainable (SDG11- Sustainable Cities and Communities) are crucial components. Additionally, they advocate for sustainable consumption and production patterns (SDG12- Responsible Consumption and Production), urgent climate action (SDG13- Climate Action), and the conservation and sustainable use of marine and terrestrial ecosystems (SDG14- Life Below Water, and SDG15- Life on Land). The goals also emphasize the importance of promoting peaceful, inclusive societies, providing access to justice, and building effective institutions (SDG16- Peace, Justice, and Strong Institutions), as well as strengthening global partnerships to support these initiatives (Partnerships for the Goals). Figure 2.2 provides a schematic representation of the 17 Sustainable Development Goals (SDGs),

illustrating their interconnectedness and comprehensive approach to addressing global challenges (United Nations).

Figure 2.2 : 17 goals of sustainable development (EU neighbors, 2019)

Each of the 17 goals is interconnected, and all of them are relevant to cities (Freyling, 2015). As mentioned previously, the biggest challenge for cities and governments is finding solutions to the negative effects of fast urbanization, and especially from the point of view of architecture and landscape architecture, the solution can be found in cities and the way they are governed.

Nabiyeva et al. (2023), believe Sustainable Development Goals provide an essential framework for steering sustainable urban development. Cities are considered a key driver for achieving a sustainable future and have a lot to offer when tackling global challenges (Siragusta et al., 2020).

Urban Green Spaces are vital for achieving the SDGs at the local level. They provide recreational benefits, regulate bioclimatic conditions, and function as carbon sinks (Lorenzo-S´aez et al., 2021). Thanks to this and following the European Handbook for Local SDGs (Siragusta et al., 2020), urban green spaces contribute directly to three SDGs at the urban level:

- SDG11- Sustainable cities and communities: the “Urban Goal”, calls for making cities and human settlements inclusive, safe, resilient, and sustainable.

- SDG13- Climate action: take urgent action to combat climate change and its impacts, and without a doubt, protecting and promoting carbon sinks such as GUA is a mitigation and adaptation action against climate change.
- SDG 15- life land: calls for protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halting and reversing land degradation and halt biodiversity loss.

Each SDG's indicator will be discussed in its section of this thesis. Since the nature of this thesis on a larger scale contributes to Iranian gardens as historical urban green spaces in cities, these three goals will be measured in gardens as well to figure out gardens' possible potential. Further details about the connection between urban green spaces and the Sustainable Development Goals will be provided in Section 2.2.5.

2.1.1 Goal 11- Making cities and human settlements inclusive, safe, resilient, and sustainable

Cities are crucial sites for sustainable development (Nabiyeva et al., 2023). As urbanization increases, cities will become more critical to implementing the 2030 Agenda beyond SDG 11 (Akuraju et al., 2020). The objective is to create cities and human settlements that are inclusive, safe, resilient, and sustainable. This involves eradicating slum-like conditions, offering accessible and affordable transportation, minimizing urban sprawl, boosting participation in urban governance, preserving cultural heritage, addressing challenges related to urban resilience and climate change, improving the management of urban environments including pollution and waste, ensuring safe public spaces for everyone, and enhancing urban management through better policies and regulations (UN habitat, 2016). The ten objectives and fifteen indicators of SDG11 address a wide range of topics, from infrastructure and affordable housing to cultural and natural assets (Nabiyeva et al., 2023). In addition, goal 11 connects to every aspect mentioned in the SDGs, with an emphasis on urban open spaces and green areas (Figure 2.3). Research shows Urban Green and Blue Spaces (UGBS) can reduce the negative effects of urbanization on the environment and offer fair access to resources that lower social and health disparities (Tate et al., 2023). The poor management of cities and their lack of attention to sustainable urban development can have direct and indirect results on climate change, ecosystems, energy security,

waste management, housing, and urban mobility, which are the most important threats to achieving sustainable development goals.

Figure 2.3 : Relation between goal 11 and other SDGs (UN system, 2019)

In recent years many scholars have evaluated SDG11 from the point of urban green spaces by using different indicators. Following UN-Habitat's (2018a) definition, the dimensions and standards of public spaces can serve as a good indicator of shared prosperity (Kuklina et al., 2021). The United Nations (2019) has proposed an indicator that determines whether a resident has easy walking access to green urban spaces if they live less than 400 meters away from such regions (Lorenzo-S´aez et al., 2021). Moreover, another proposal for evaluating SDG 11 is through an indicator that measures the Green Urban Area and sports facilities per inhabitant (Sanchez et al. 2018). In addition, Fox and Macleod (2019) developed an approach for assessing social behavior and Green Urban Area use in Bristol (United Kingdom) by examining indicators like visits to parks or walking areas, sports activities, healthy living, and the percentage of people who go to a park a minimum of once a week (Lorenzo-S´aez et al., 2021).

The United Nations has defined 10 targets and 15 indicators for Goal 11. However, given the focus of this study on green spaces and Iranian gardens, the following section specifically examines two targets that are most relevant to their cultural heritage and urban green space features.

Target 11.4- Strengthen efforts to protect and safeguard the world's cultural and natural heritage: Our culture defines our identity and the way we perceive the world. The only way to guarantee human-centered, inclusive, and equitable development is to place culture at the core of development policy (UNESCO, 2017). However, urbanization puts pressure on heritage assets, thus cities need to protect cultural heritages and give priority to culture while renovating historic sites and landscapes and creating inclusive urban plans. Considering the speed at which urbanization is growing and the prediction that 70% of people will live in cities by 2020, there is an immediate need to preserve cultural heritage. This will put pressure on cities' liveability and preservation of urban history (Heritage in Urban Contexts, 2020). Cultural components will be essential to the 2030 Agenda's success, especially in countries where the implicit relationship between the SDGs and the cultural dimension is common.

Despite being severely impacted by urbanization, climate change, and other natural and human-caused deterioration, cultural and natural heritage assets are vital to the local economy, way of life, and general well-being of human communities (Heritage for Sustainability, UN HighLevel Political Forum Event Booklet, ICOMOS & IUCN, 2018). Heritage is essential to guaranteeing healthy lives and fostering well-being for people of all ages, especially in historic urban areas with a focus on pedestrian circulation and cultural lands (Labadi et al., 2021). Historic urban areas benefit cities and citizens in many ways. They enhance liveability and promote social inclusion, cohesiveness, and well-being because of their human scale, walkability, vitality, and range of functions as public spaces. The common use of streets, open and green spaces, and the historic urban landscape encourage communities to engage, exchange ideas, and integrate. In addition, cultural heritage has the power to support the development of the creative and cultural sectors, draw tourists and investment, and create jobs by supplying basic infrastructural services (Labadi et al., 2021). As a result, cities need to think about how heritage can help build local communities' identities, cultures, and sense of belonging, create jobs and sustainable livelihoods, foster dialogue between groups, and promote community inclusion, especially for vulnerable and disadvantaged groups. To reach all these potentials, governments and city managers must save heritage against problems such as unsustainable development and

urbanization, natural catastrophes, climate change, and other problems made by humans (Labadi et al., 2021).

Target 11.7- By 2030, provide universal access to safe, inclusive, and accessible, green and public spaces, in particular for women and children, older persons, and persons with disabilities: There are many ideas in indicator 11.7.1 that call for international consensus and consultation to reach them. Among the most significant ones are cities, urban areas, and public spaces like public parks, urban gardens, etc (SDG indicator metadata, 2021). Public space is defined by the global public space toolkit as any area that is owned or used by the public, free of charge, open to everybody, and not tied to profit. Additionally, any open, undeveloped land without buildings or other constructed structures that is free to the public, offers recreational opportunities for locals, and contributes to improving the aesthetics and environmental quality of neighborhoods is referred to as open public space (SDG indicator metadata, 2021). Cities contain several types of open public space, but in general, parks, gardens, playgrounds, public beaches, riverbanks, and waterfronts are the most popular cases (UN-Habitat, 2018). According to UN-Habitat (2020), the average percentage of a city's built-up area that is open space for everyone to access, regardless of gender, age, or disability, is one indicator of this goal. This statistic calculates the total population with access to public spaces by age, gender, and disability as well as the percentage of land allocated to public spaces.

Cities contribute to solving health issues since research indicates that living in an urban, rural, or distant area can have an impact on one's health (Siragusta et al., 2021). Lifestyle changes are linked to increased vehicle use and decreased levels of physical exercise as a result of urbanization (Nathalie Röbbel et al., 2016). The World Health Organization (WHO) estimates that 3.2 million deaths occur each year because of physical inactivity. As major threats to health and sustainable development, non-communicable diseases (NCDs) and climate change are two of the 21st century's most pressing issues (NCD, shared opportunities for action, 2016). According to WHO (2016), NCDs—which include diabetes, cancer, heart disease, chronic respiratory conditions, mental and neurological disorders, and diabetes—account for 68% of all deaths worldwide today. By 2030, however, the organization projects that climate change will be a major contributor to several hundred thousand deaths per year. Inactivity and exposure to air pollution are risk factors for NCDs (WHO, 2016).

Therefore, great strides should be made to improve people's health in the present and the upcoming years. Given the link between urban green spaces and health, giving top priority to the number and quality of these areas during the urban development process, to entice people to spend more time there, is essential. (UN-Habitat, 2019).

About half of the urban population under observation is exposed to air pollution, which is at least 2.5 times greater than the levels recommended by the World Health Organization (WHO), according to the UN-Habitat (2020) study. Worldwide, particulate matter pollution is a health concern for individuals, but low- and middle-income nations—particularly those in the WHO's Western Pacific and South-East Asia regions—bear a disproportionate share of the cost of outdoor air pollution, accounting for 88% of premature deaths (UN-Habitat, 2020). As urban areas continue to expand, green spaces are disappearing. So, there should be urgent action to improve air quality in cities. Trees are important in air pollution control and there are many benefits to trees and green spaces beyond aesthetic appeal, such as improved air quality, reduced urban temperatures, and a greater level of physical activity (Food and Agriculture Organization, 2013).

A city's productivity is directly correlated with the amount of land it dedicates to streets and open public areas, which also has a major impact on the social aspects and general health of its citizens (UN-Habitat, 2020). All those who live in cities have the opportunity to improve their health and quality of life through using public and green areas (Daniel, 2015). Target 11.7 provides areas for physical activity to control NCDs (United Nations, 2015). In addition, when open public spaces are well-distributed in a way that everyone has access to them and support a variety of activities, it will enhance the urban environment and quality of life in cities. (UN-Habitat, 2020).

2.1.2 Goal 13- Climate action; take urgent action to combat climate change and its impacts

Climate change is one of the most pressing global issues of the present time (Filha et al., 2023). The cities are known as the source of pollution. Human activities cause climate change and threaten life on Earth. Climate change will influence all people wherever they live (United Nations, 2015). Most vulnerable citizens, such as the elderly and children, are severely inconvenienced by heat waves in urban areas. Climate change is occurring much faster than anticipated due to rising greenhouse gas

emissions. Its potentially catastrophic impacts include extreme and variable weather patterns and increasing sea levels (United Nations, 2015). According to the United Nations (2023), emissions need to begin decreasing immediately and must be reduced by nearly 50% by 2030 to limit global warming to 1.5°C above pre-industrial levels. But the world is wildly drifting from this objective. In addition, it may be more difficult to achieve sustainable development and maintain current development gains as a result of the effects of climate change (United Nations Development Programme, 2017). As a result, quick action is required to prevent disastrous outcomes and guarantee a sustainable future for coming generations.

SDG 13 has 3 targets. Target 13.1 is about strengthening resilience and adaptive capacity to climate-related hazards and natural disasters in all countries. The indicator for this aim, according to SDG indicator mata data (2023), counts the number of individuals per 100,000 population who passed away or were directly impacted by catastrophes. Target 13.2 is to integrate climate change measures into national policies, strategies, and planning. Its indicator is connected to the annual amount of greenhouse gas emissions. Reaching a stable level of greenhouse gas concentrations in the atmosphere would stop hazardous human interference with the climate system, which is the ultimate goal of the United Nations Framework Convention on Climate Change (UNFCCC). A crucial component of the efforts to accomplish this goal is estimating the quantities of greenhouse gas (GHG) emissions and removals (SDG indicator mata data, 2023). Target 13.3 of this goal focuses on enhancing education, raising awareness, and building human and institutional capacity for climate change mitigation, adaptation, impact reduction, and early warning. The indicator measures the extent to which a country's educational systems incorporate Education for Sustainable Development (ESD) and Global Citizenship Education (GCED) (SDG indicator metadata, 2023).

There are two approaches to combating the impact of climate change on the environment and civilization: Mitigation is the first one that involves reducing emissions of climate-changing gases that cause global warming. The second one is adaptation, which involves reducing the vulnerability of environmental, social, and environmental systems and improving their climate resilience (Sturial and Scuderi, 2019). Green Infrastructures (GIs) play a crucial role in the sustainable development of urban areas. Thus, maintaining, improving, and expanding street trees and urban

and peri-urban forests is essential to the sustainable growth of metropolitan regions (Sturial and Scuderi, 2019). In addition, regardless of type, any type of urban green space contributes to battling climate change and its impacts (Hyder & Haque, 2022). A further crucial component of the mitigation effort required in the next ten years is reducing carbon emissions, which can only be achieved by protecting and restoring natural areas on land and in the ocean (Nature for Climate Action fact sheet (UNEP, 2021).

2.1.3 Goal15- Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss

Goal 15 is about conserving life on land. Protecting and restoring terrestrial ecosystems, managing forests sustainably, combatting desertification, halting and reversing land degradation, and preserving biodiversity are among the objectives.

There are many cultural, spiritual, and economic values associated with the earth's ecosystems. Ecosystems are vital to human survival, contributing over half of global GDP (United Nations, 2010). However, climate change, pollution, and loss of biodiversity are all intertwined crises in the world. A minimum of 100 million hectares of productive and healthy land are lost to degradation every year, impacting 1.3 billion people (United Nations, 2010). In addition, the increasing loss of forests, land degradation, and species extinction pose significant threats to the health of both the planet and humanity (United Nations, 2023). Thus, both regional and global efforts must be made to maintain forest ecosystems, especially in emerging nations and tropical regions (United Nations 2010). Without a significant change in how people interact with the environment, Goal 15 will not be achieved (United Nations, 2023).

Similarly to other SDGs, cities play an important role in meeting or moving away from SDG 15. Although expanding cities have destroyed natural habitats, scientists are realizing that urban landscapes can provide habitat for threatened and endangered species (Marinelli, 2021). Urban forests provide wildlife habitat, absorb air pollution, reduce greenhouse gas emissions, protect communities from the impacts of climate change (for example, heat waves), and improve mental health (Community Foundations of Canada, 2022). Also, creating biodiversity corridors, protecting biodiversity, preserving green spaces, and protecting natural spaces in communities help reduce emissions and mitigate climate change (Urban SDG knowledge, 2017).

Therefore, a call for green spaces within cities is also a call for quality of life, places to walk, and places to enjoy, but also a call to protect biodiversity and combat global warming (Sachs, 2019).

Governments, and especially the local governments are instrumental in implementing the SDGs. As part of urban planning strategies, local governments can incorporate biodiversity and ecosystem considerations and ensure that community views are solicited and taken into consideration (Urban SDG knowledge, 2017). According to Community Foundations of Canada (2022), local strategies for achieving this SDG include:

- Establishing and managing community conservation areas.
- Purchasing and using environmentally-friendly products.
- Planting and safeguarding trees in urban, rural, and wilderness areas.
- Creating local wildlife corridors to facilitate species movement between natural habitats.
- Promoting urban greening and biodiversity, including both plant and wildlife.
- Supporting Indigenous Protected and Conserved Areas (IPCAs) that are led by Indigenous communities and prioritize traditional knowledge and conservation methods.

Similar to SDGs 11 and 13, this SDG and Urban Green Spaces are closely related, and it has distinct indicators. The Normalized Difference Vegetation Index (NDVI) derived from satellite imagery has been proposed by Siragusa et al. (2020) for measuring the contribution of Green Urban Spaces to SDG 15. Another indicator is assessing the social behavior of participants who visit Urban Green Spaces at least once a week. This indicator is defined by the Cabot Institute for the Environment of the University of Bristol (CIE 2019). Also, Sanchez et al. (2018) and Ajuntament de Barcelona (2019) suggest using natural area per capita and the area of Green Urban Spaces per capita as indicators.

2.1.4 SDGs implementation and their linkage to SDG11

All over the world, towns and regions are implementing the SDGs. International efforts to achieve the Sustainable Development Goals are placing an increasing emphasis on cities (United Nations, 2020). In addition to making cities and communities more sustainable, achieving SDG 11 will help achieve other objectives of sustainable development (Akuraju et al., 2019). Urban areas are the hubs of development. Human, economic, and societal changes are enabled and empowered by cities. Given the significance of cities, achieving SDG 11 quickly is essential to the SDG process as a whole (Nabiyeva et al., 2023).

According to the ICLEI briefing sheet (2015), local governments are responsible for connecting all global goals to their specific areas to benefit the local community. With an anticipated influx of 3 billion people into cities by 2050, their primary challenge and responsibility will be to develop and support new regions while fostering sustainable environmental, social, and economic conditions. As a result, the achievement of the SDGs is most probable when local governments possess the necessary skills, resources, and capacity to implement them effectively. Also, even though local governments' roles vary from country to country and from state to state, they can still be frontrunners in transformational development. According to the ICLEI briefing sheet (2015), every SDG is interconnected with urbanization and local government.

Cities play a pivotal role in the realization of all Sustainable Development Goals (SDGs), underscoring the critical importance of SDG 11 in relation to the others. Achieving sustainable development by 2030 necessitates a particular focus on SDG 11, which highlights the significance of cities and local governments. Given the direct relationship between local governments and the populace, these entities bear the responsibility for providing public services and engaging in urban planning. According to ICLEI (2015), key actions include:

- Fostering inclusive governance alongside participatory, integrated, and sustainable urban planning and management.
- Ensuring affordable, adequate, and safe housing services.
- Enhancing neighborhood and population resilience to disasters and climate change.

- Developing a sustainable urban mobility system and a public, inclusive transportation system.
- Providing access to green and public spaces while preserving cultural and natural heritage to improve urban quality of life.
- Promoting economic, social, and environmental connections between urban, peri-urban, and rural areas through city-region cooperation.
- Encouraging city-to-city cooperation via partnership agreements and thematic networks, with outcomes that can be scaled globally by local and subnational government organizations.

Several factors have an impact on people's health, including air quality, green areas, food accessibility, safe housing and sanitation, and medical services (ICLEI, 2015). Even though the implementation of projects to reach each goal can vary from country to country, ICLEI (2015) suggests that local governments should pay attention to issues like regulating and preventing pollution of the air, water, and soil; managing wildlife; maintaining parks, sports fields, stadiums, swimming pools, and camping areas; and promoting safe, dependable, and convenient public transportation as well as walking and bicycling as healthy modes of urban transportation.

The link between SDG 11 and SDG 13 is based on the effects of climate change. The effects of climate change are already causing significant harm to people throughout the world, including changes in weather patterns, more extreme weather events, and rising sea levels. It is important to pay attention that those who are most vulnerable and poor are the most affected group by climate change. Cities consume 78% of the world's energy resources and generate over 70% of the carbon dioxide emissions related to energy use. This is mostly due to the transportation and energy production that is based on fossil fuels, although industry and biomass usage also play a significant role (ICLEI, 2015). Therefore, planning low-emission development strategies and reducing greenhouse gas emissions are human responsibilities. To start implementing these practices, ICLEI proposes several responsibilities for governments:

- Establish inclusive approaches to achieve political, economic, environmental, and societal goals related to climate change mitigation and adaptation.

- Create comprehensive low-emission development strategies, including plans for carbon-neutral transportation systems, promoting smart grid networks, and exploring green growth within this framework.
- Monitor progress and impacts by regularly conducting community-level greenhouse gas emission inventories using the latest standards.
- Update building codes, zoning bylaws, and construction standards to ensure buildings and infrastructure are more resilient to climate change risks.
- Develop innovative financing mechanisms to mobilize investments that address climate risks arising from inadequate basic infrastructure and environmental amenities, particularly for the most economically vulnerable urban residents.

2.2 Iranian Gardens As Historical Urban Green Spaces

Originally, "garden" indicated an area of land, profit, share, heir, or part. It was used to describe a plantation of shrubs, trees, or even seeds (UNESCO, 2011). An appreciation of nature is reflected in the design of a garden and all of its supplies, which are the result of decades' worth of ideas and experiences. As described by the Florence Charter in 1981, a historic garden is a significant type of cultural heritage that is recognized as a dynamic living system as opposed to a simple composition assembling different heritage pieces (Lian et al., 2024). Additionally, it is mentioned as a unique kind of cultural landscape in the UNESCO Operational Guidelines (1992) (Lian et al., 2024). A garden is a constructed work of art that also helps with the commonplace but incredibly beneficial chore of cleaning the air we breathe (Pechere, 1977). However, to fully understand historic gardens as a cultural landscape, one has to see them more broadly and sustainably, especially within the framework of a landscape (Antrop, 2006).

Gardens have expanded along with human understanding over time, and historical gardens now provide a priceless repository of ideas and examples of how people have historically incorporated nature into their living spaces and how they might continue to do so in the present or the future (Babnik, 2020). Moreover, the historic garden is a complex cultural witness of scientific, technological, and artistic concerns that have shaped its development, upkeep, and alteration during its existence (Prigioniero et al.,

2020). Historical gardens have a significant impact on society because they instill in the general public a feeling of the worth of the person. Furthermore, they serve as the greatest entry point to the priceless gems found in the natural world and the arts. (Pechere, 1977).

Just like other historical landmarks and buildings, gardens can be endangered by unplanned urban development, industrial growth, and different forms of pollution such as highways, flyover constructions, alterations in groundwater levels or terrain, as well as contamination of air, water, or soil that poses risks to plant life, including the impact of parking areas (Pechere, 1977). Therefore conservation and restoration of gardens is a crucial issue in landscape and urban studies. In the conservation process, it is important to highlight that ecological evolution and cultural transformations are aligned with the multifaceted characteristics of the historic garden, encompassing both unique functional scenarios and universally applicable principles (Lian et al., 2024). Considering the spirit of a time and new users' needs is another important matter regarding the restoration and conservation of historical gardens (Pechere, 1977).

Geographically Iran is located in the Middle East. Situated in arid and semi-arid terrain, Iran has restricted access to freshwater resources, accounting for no more than 0.36 percent of global freshwater resources. However, the country is home to around 1% of the world's population (Lemohammad & Gharari, 2010). The extensive desert parts of Iran lack green space, which has compelled architects to come up with several creative ways to combat the heat and dryness (Fadai & Shemirani, 2022) and gardens are one of them.

Iranian gardens represent one of the most distinctive and significant features of the Iranian landscape. Their importance is particularly pronounced given the country’s arid climate and the scarcity of water resources for agriculture (Fekete & Heidari, 2015) (Figure 2.4). The gardens are the oldest evidence of creation, dating back to 529 BC in Pasargadae, demonstrating generally modern features (UNESCO, 2011). The Iranian Garden demonstrates a significant exchange of values of integrity (UNESCO, 2011) and is considered a cultural phenomenon that has spread beyond the territory of Iran (Baraati, 2011). It was created as a representation of Eden and the four fundamental Zoroastrian elements: sky, earth, water, and vegetation (UNESCO, 2011). During history, Iranian Garden has impacted other gardens in the east such as the Taj Mahal in Agra or the Alhambra in Spain in the west (Mehdizadeh, 2014). The

garden's primary physical aspects include its surrounds, walls, gates, the Chahar Bagh, the two axes, water and its connected elements, flora, shade, and architectural elements like pavilions (UNESCO, 2011). Moreover, Iranian gardens not only offer green areas for their residents but also serve as platforms for increased interaction between humans and nature, provide various functions, and promote Persian culture (Gharipour, 2011).

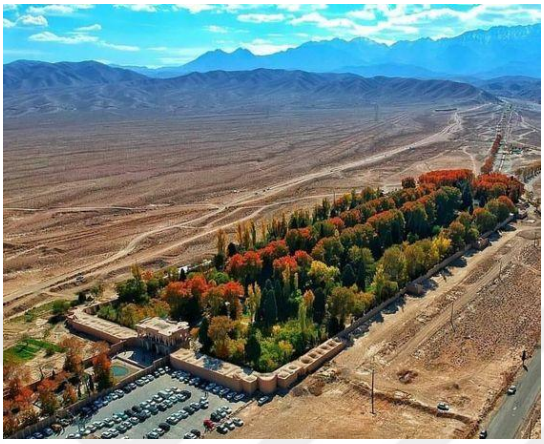


Figure 2.4 : Shazde Garden, Kerman, Iran, built in 1870 (UNESCO, 2015)

The gardens are important, not only for their historical and beauty values but also for representing a heritage that reflects an important exchange of human values in terms of Iranian society's cultural and social aspects. They used to serve a variety of social purposes over time. For example, they were used as holiday residences for the king at the time, as public gathering points, or as places for public ceremonies among the upper class of society (UNESCO, Persian Garden, 2011).

Iranian gardens are an important natural and cultural heritage for Iranian cities. According to Rostami et al., (2016), Hosseini and Mohammadzade, (2014), Aliyas and Nezhad, (2019), Iranian gardens can be considered good urban green spaces for spending time and doing social activities due to their historical, natural, social and recreational functions. Also, these gardens can fulfill the mental needs of users and answer their daily well-being needs. Aside from all the mentioned benefits, Iranian gardens because of their historical background can make sense of belonging, value, and identity among individuals and groups by remembering how nature has been important for society over time.

2.2.1 Design features in Iranian gardens

The design features of Iranian gardens demonstrate a profound connection to nature, culture, and spirituality. These gardens are typically arranged with a symmetrical layout, often divided into quadrants based on the **Chahar Bagh** concept, symbolizing the four elements: sky, earth, water, and vegetation. Water plays a central role in the garden's aesthetic and functional aspects, with pools, streams, and fountains creating a cooling effect in the arid climate. Additionally, the selection of plant species, such as cypress and fruit trees, is carefully considered to provide both shade and beauty, while also symbolizing life and eternity. The balance of geometric design, water, and vegetation reflects a harmonious integration between human design and the natural environment.

2.2.1.1 Gardens geometry

The idea of the Persian Garden derived from the Avestan word “Paridaeza” and the old Persian “Paridaida” which means walled garden. Paradise, according to the mystic Islamic scriptures of the Mughul era, is a perfect garden of plenty with four rivers dividing it into the north, west, south, and east. These rivers flow from a central spring or mountain (UNESCO, 2011).

The geometric framework is the most prominent feature of Persian gardens (Shayanfar, 2019). Originally, the gardens were divided into quadripartite divisions with pavilions at their intersections (Mahmoudi et al., 2016). According to Massoudi (2009), this concept was initially inspired by the pre-Islamic Iranian practice of dividing the earth into four parts, which may have been influenced by the geometric designs seen in Mesopotamian civilizations. According to UNESCO's (2011) description of Iranian gardens, the whole garden is considered a symbol of the world with a pool of life in the center. The major axis that divides the garden into four parts is the streams. Chahar Bagh is the name given to this pattern, which is typical of most gardens (Figure 2.5). Four rivers provided water to the Garden of Eden, which is referenced in this pattern. This divide is mixed with a feeling of endless life, sweet-scented trees, a mystical love of flowers, and different hues. Through exceptional purity, the combination creates a serene haven from the busy and dirty outer world.

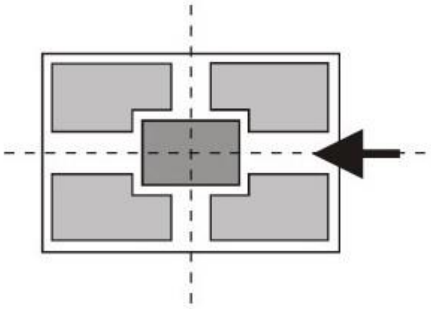


Figure 2.5 : Basic view of garden geometry (Abbas et al., 2016)

2.2.1.2 Qanat system

According to Donald Wilber's book (1962), the main factors that make Persian gardens paradisian sites are their abundant greenery and well-developed water systems, which are situated in an area that is distinguished by Iran's arid deserts and intense heat. In most studies, the common features of the gardens include being surrounded by walls and having water in the main axis that divides the gardens into four sections. Vegetation and soil are other important elements of the gardens. All these characteristics make gardens a place that symbolizes Paradise or heaven on earth to users (UNESCO, 2011). Fadai and Shemirani (2014), divide Persian gardens' main design elements into natural elements including water and vegetation, and built elements including a pavilion, an axis, and walls. Therefore, a Persian garden usually has a conceptual design, with its constructed and natural components arranged around a central axis (Fadai & Shemirani, 2014).

Iranians attempted to extract and flow underground water through subterranean pathways in arid and scorching regions of Iran where there was little surface water. This system is named Qanat and leads water from mountains to villages and fields (Figure 2.6).

Figure 2.6 : Iranian Qanat System, (UNESCO, 2015)

The Qanat system provides water from underground water through a network of shafts that use gravity to raise water to the surface (Fekete & Haidari, 2015). They are passageways that carry water from melting mountain snow hundreds of meters away to human settlements. Every qanat is made up of a virtually horizontal tunnel that is lowered to the proper level of the aquifer and collects water from an underground water source. Along the tunnel's length, well shafts are regularly excavated to provide for ventilation and spoil disposal. Because of the tunnel's mild slope, water is carried through underground tunnels, or "koshkan," to the source (Mazhar), where it is dispersed by channels to the agricultural land (UNESCO, 2016). Finally, it should be noted that Qanat typically discharges its water into a garden pool from which it may be utilized to irrigate, mill, and supply electricity to every area of the bagh (UNESCO, 2011).

2.2.1.3 Water

Various studies consider water as the most important element in nature, which usually impacts other elements and has a deep relationship with the environment. When it comes to art, water is highly esteemed and associated with life, innocence, happiness, and light. It also plays a significant role in both joy and mourning rituals (Mahdi Nejad, 2017).

Ever since ancient Persia recognized water as the symbol of cleanliness and light, water has always been valued in Iran (Fekete & Haidari, 2015). Water is essential because, without it, the existence of gardens would not be viable (UNESCO, 2011). It plays the main role in the formation of an Iranian garden, and trees, plants, and flowers play the most important role after water, whose existence is rooted in water (Alamolhoda, 2003). Typically, water channels are positioned to create the geometric division of Persian gardens (Shayanfar, 2019). Alamolhoda (2003), in her study, considers water existence in gardens in two main ways:

- Water in two main axes (Chaharbagh pattern): In square and sometimes rectangular gardens, water is formed on the two main axes in the form of a stream, fountain, or water feature, and at the intersection of the two axes, the accommodation mansion (Koushk) with a view in four directions and the entrance mansion at the beginning of the longitudinal axis (Figure 2.7). Fin garden is an example of the pavilion of Iranian gardens in the Safavid period,

where water is formed on the two main axes, the residence pavilion is formed at their intersection, and the entrance pavilion is at the beginnings of the two longitudinal axes (Alamolhoda, 2003).

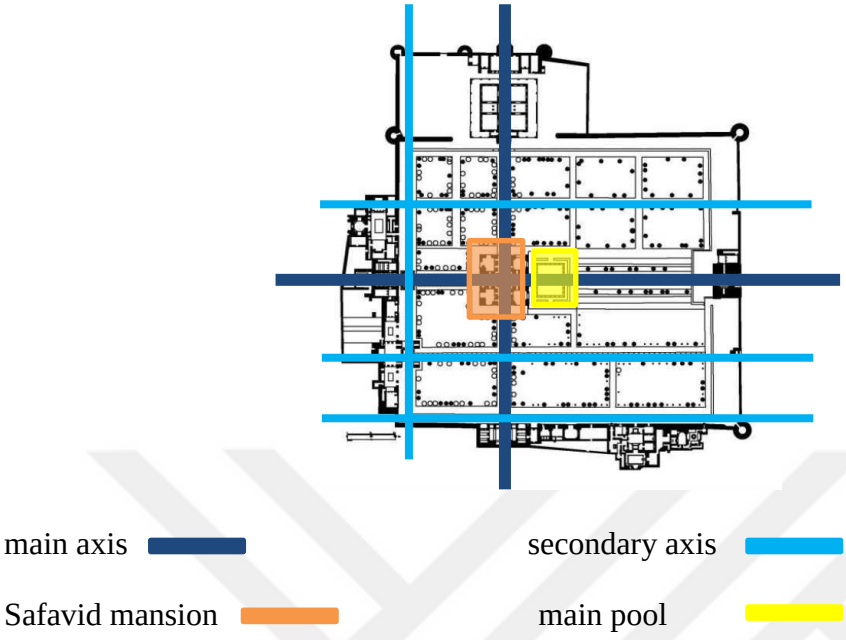
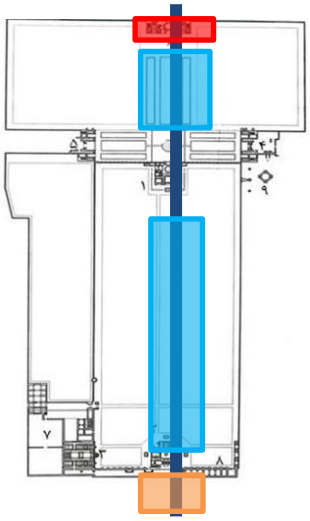


Figure 2.7 : Water in Iranian gardens (Adapted from Ansari, 2015)

- Water in longitudinal axis (gardens with rectangular geometry): the water appears on the longitudinal axis and the entrance mansion is located in the beginning part of the axis. The location of the residential mansion can vary from the middle of the axis to the end of it along the axis. Daulat Abad Garden is one of the most prominent examples of these gardens, with water on two longitudinal and transverse axes. However, the emphasis is on the longitudinal axis with the presence of three pavilions and fountains (Alamalhoda, 2003).



main axis Entrance mansion

Pond and fountain Summer mansion

Figure 2.8 : Water in Iranian gardens, rectangular form (Adapted from Ansari, 2015)

Considering the fact that water is the key element in the gardens it includes three aspects in the gardens (Goker, 2017):

- Conceptual aspect: How the water moves and flows in the gardens shapes the geometry and architecture of most Iranian gardens. The main axes in gardens are two perpendicular, full-of-water axes that divide the rectangle area into four parts. The chahar bagh (four gardens) pattern originated at this intersection. At the intersection of the axes, a pond or fountain is built and emphasizes the importance of water as an element that evokes feelings of purity, and joy.
- Functional aspect: The water irrigation system in gardens depends on the slope of the ground. Also, combining the water stream and wind makes the garden air pleasant and cool for users, especially in hot weather.
- Aesthetic aspect: in Iranian gardens, water has been used in different ways and water features include a pool at the intersection of two axes, water ways, fountains, brooks and channels and small waterfalls. All these factors contribute to better water volume and symphonies in gardens. Figure 2.9 shows water features and their aspects.

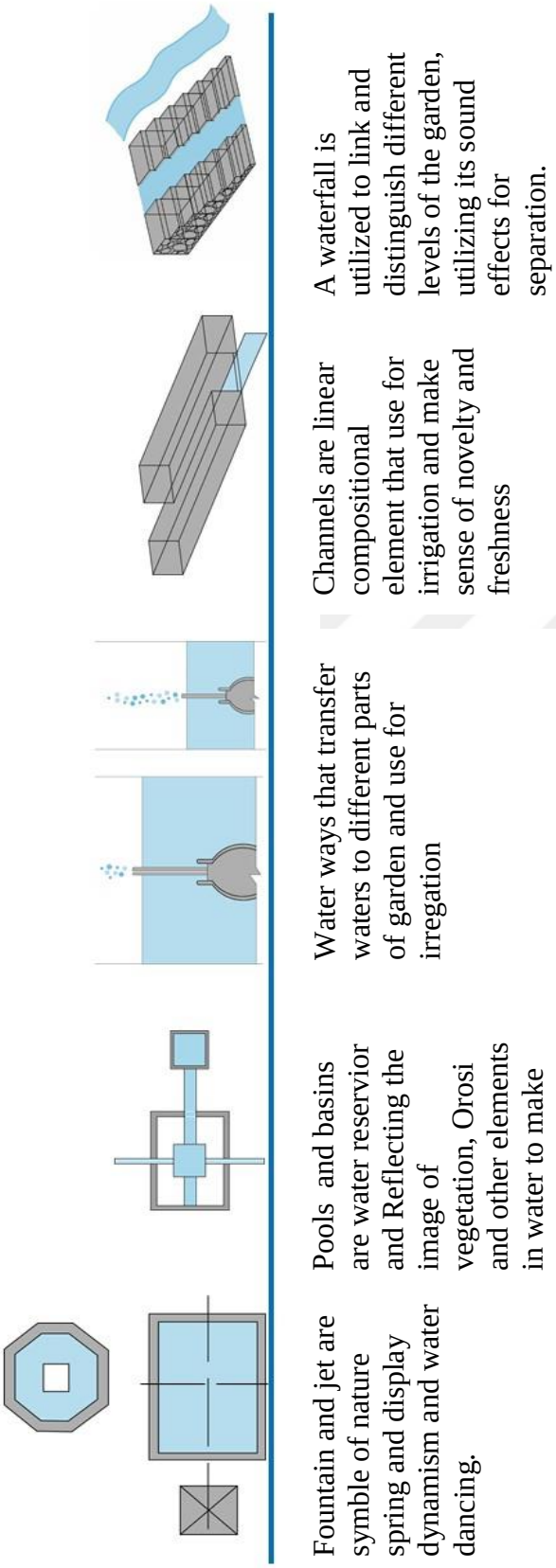


Figure 2.9 : Water features in gardens (Adapted from Zamani et al., 2009)

2.2.1.4 Vegetation and plants

Trees are the second most significant element in the development of a Persian garden, after water (Mahdi nejad et al., 2017). Vegetation is another important element in Iranian gardens because of their aesthetic and functional aspects. The plants in the garden soften the ordered and geometric patterns (Ferdows Foundation, 2016). Shade, yield, and garden ornamentation are some main reasons to use trees in gardens. The Persian garden's plant life comprises trees (both evergreen and deciduous), shrubs (with or without blossoms), bushes, and flowers. The selection of trees in these gardens is deliberate, serving different roles like minimizing evaporation, creating shade, preserving the microclimate, and occasionally for their medicinal benefits. They were essential in maintaining the micro-climate of the garden in relation to its hot and arid surroundings (UNESCO, 2011). Aspects of plants in gardens can be classified as below:

- Functional aspect: Plants were employed to create shade in some areas and transform the hot weather of the gardens into a pleasant atmosphere where people could relax and enjoy the shadow of the trees. Some edible trees such as pomegranates, almonds, apricots, apples, figs, and grapes were a wealthy source of nutrition products. Also, there are some windbreak trees including pine and cedar. Besides creating shadows, trees like elm, rowan, sycamore, and aspen also resist the area's climate.

- Aesthetic and decorative aspects (Figure 2.10): using trees, shrubs, and flowers in different colors, sizes, forms, scales, and textures enhances the beauty of the gardens. Additionally, there is typically a contrast in the height of the plants. Trees like Pine and Cypress are in the background, then there are shrubs, and finally, flowers are in front of the shrubs. Also, using evergreen trees like pine is connected to its mysterious meaning. Pine in ancient Persian was used as a symbol of freedom. Moreover, pine has a vertical harmonic shape that can help show the garden's harmony and geometry (Ansari, 2015).

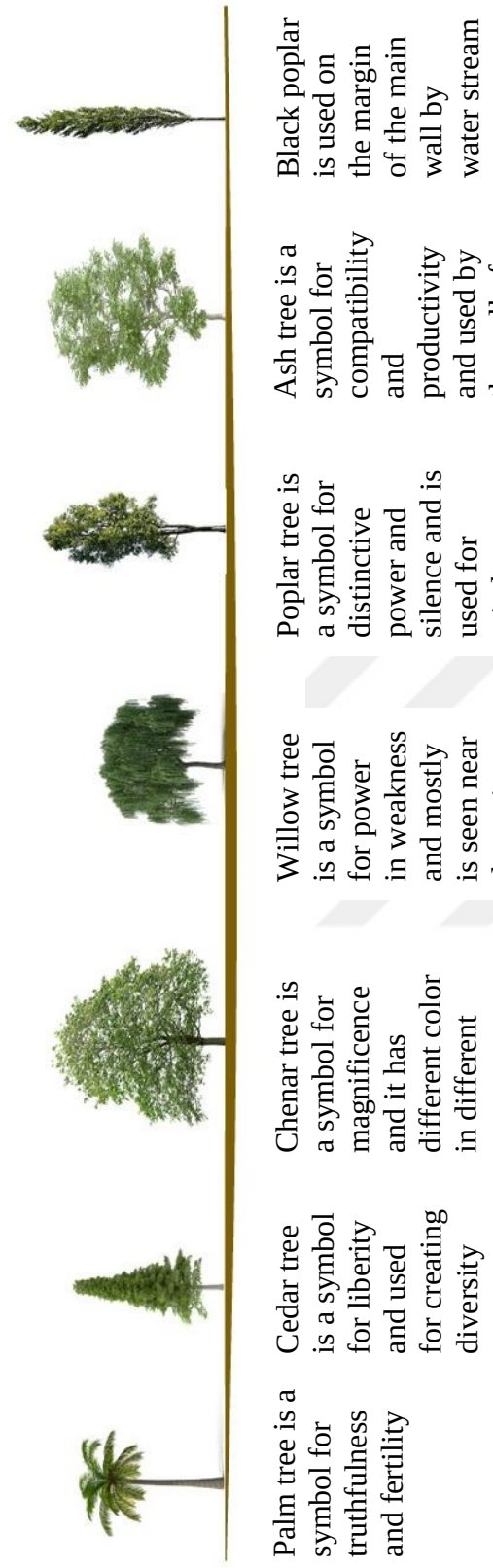


Figure 2.10 : Types of plants in gardens (Adapted from UNESCO, 2017)

Some of these gardens are registered in the UNESCO heritage list and this feature makes the gardens more popular among scholars. However, this thesis includes all types of historic gardens in Iran. Also, to draw the attention of scholars and to emphasize the importance of protecting all gardens, we refer to gardens as "Iranian Gardens" rather than "Persian Gardens," regardless of their UNESCO registration status.

2.2.2 The present state of Iranian Gardens and the effects of urbanization

In Iran, rapid population growth and a lack of economic and proper urban development strategies have negatively affected jobs, housing prices, urban development, traffic congestion, inflation, and marginalization, especially in big cities (Pilehvar, 2021). Due to the attractiveness of jobs and the cultural and social facilities of cities, migration of rural populations to cities over the past few decades caused rural populations to decline by 8.7 percent, while urban populations increased by 51.9%. Today, 72 percent of Iran's population is living in cities which is estimated to increase to 87 percent by the end of 2026 (Alizadeh, 2019). Information collected from the population and housing census and the comprehensive housing survey of Tehran (2017), show that the urban population of the country, particularly in large cities like Tehran, Urmia, Tabriz, Mashhad, Esfahan, and Shiraz is facing several threats and challenges. Increase in the number of immigrants, environmental degradation, the aggravation of air pollution, marginalization, increase of social damages, and finally, the dualization of cities, and unbalanced population growth due to the physical and natural capability of cities are the result of unplanned urbanization and rapid population growth in Iran (Safayipour et al., 2021).

Iran's urban development has encountered several difficulties in recent decades since there isn't a documented strategy to reconcile physical structures with social, cultural, and economic development (Irandoust & Alizadeh, 2018). Iran faces significant environmental challenges due to its arid climate, rapid urbanization, and dependence on oil. Additionally, the imbalance between the physical expansion of cities and population growth disrupts the relationship between people and nature. Consequently, many environmental areas, such as green spaces, are being converted into residential, commercial, and industrial zones. Research indicates that rapid and unplanned urban development threatens the environment and the security and health of citizens in Iran

(Barzegar and Beladi, 2016). This has resulted in the emergence of "gray cities" with minimal green spaces, lacking fountains or colorful sidewalks. In these "gray cities," concrete dominates, depriving residents of greenery and the opportunity for a healthy and breathable environment, ultimately neglecting their physical health and well-being (Figure 2.11).

Figure 2.11 : A view of Tehran and Mashhad (Irna, 2023)

As previously noted, Iran is grappling with environmental deterioration, which has become a significant concern (Layin & Mostajabi, 2018). The country faces several critical environmental challenges, including severe water and air pollution, deforestation, land degradation, desertification, climate change, and biodiversity loss (Mostajabi, 2018). Historically known for its gardens, flowers, and Qanats, Iran is now suffering from a significant loss of green spaces. Over the past century, cities in Iran have lost a substantial number of their gardens, with many more at risk of destruction due to urbanization (Bahrami & Grose, 2021).

Finally, a comprehensive review of the current literature on garden maintenance and conservation policies facilitates the classification of gardens into those listed as UNESCO World Heritage sites and those not listed. This section of the study investigates the effects of urbanization on both categories of gardens.

2.2.2.1 Iranian gardens registered on the UNESCO

Nine of Iranian gardens are registered in UNESCO list that are selected from different cities of Iran including Kashan, Isfahan, Yazd (3), Shiraz (2), Birjand, and Behshahr (Figure 2.12). The gardens are classified as a Cultural Landscape by UNESCO in March 2011. They reveal the Chahar Bagh's flexibility and durability, or the fundamental idea of the Persian Garden, which hasn't altered in over two millennia. Its first fully developed manifestation may be discovered at Pasargadae, in the garden of Cyrus the Great's royal complex. (UNESCO, 2011).

Figure 2.12 : Location of gardens (Author)

UNESCO's 1372 report describes the concept of Persian garden as Originally, "gardens" were only fenced-in areas of land with some plants. However, over time, this technique developed into a recognized kind of art (UNESCO, 2011). The internal elements and the external settings are two factors for considering the Persian garden. Right angles, two perpendicular axes that divide the garden into four parts, symmetry and geometry and having wall around it are fundamental components of the Persian garden. So, among lots of gardens have been created the nominated ones are the gardens that, in particular, demonstrate a tangible expression of the original concept (UNESCO, 20110) (Table 2.2).

The following 5 criteria are outlined by UNESCO for the incliusion of these gardens in the list:

The Iranian gardens in the list represent a masterwork of human creativity. Chahar Bagh feature, water management system in an arid region (Qanat system), selection of flora and its harmony with the desert region.

Garden design in Western Asia, Arab nations, and even Europe has been influenced by Iranian gardens' geometric and symmetrical architecture, as well as sophisticated water management systems.

Gardens reflect the growth of cultural traditions in Iran and the Middle East over the past two and a half millennia. During this time, the gardens serve as both cultural and social gathering places.

The gardens are exceptional samples of garden design that combines natural and human components while combining Persian culture into physical and symbolic-artistic expression in harmony with nature.

The gardens are directly connected to cultural developments of Outstanding Universal Values and artworks such as poetry, Persian carpet design, miniature painting, music, and architectural ornaments.

Table 2.1 : List of registered gardens in UNESCO (Adapted from UNESCO Nomination Report, 2010)

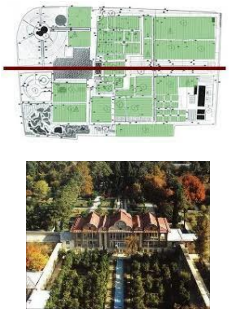
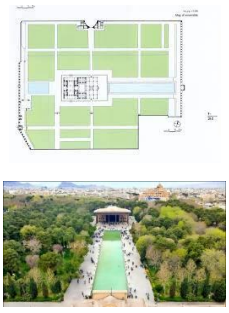
Name of the garden/ Location	Area	Era related to	Criteria for choosing	Plan and photos
Ancient garden of Pasargad/ Pasargad	249.65 ha	6th century	Pasargadae was chosen as the model for the Persian Garden because preserves the Chahar Bagh construction.	
Bagh-e Eram/ Shiraz	12.70 ha	Qajar	In terms of vegetation, water systems, and architectural design, Eram Garden is considered the greatest example.	
Bagh-e Chehel Sotoun/ Isfahan	5.80 ha	Safavid	The stunning water feature, garden design, plant arrangement, and architecture of the Chehel Sotun garden were the deciding factors.	

Table 2.1 (continued) : List of registered gardens in UNESCO (Adapted from UNESCO Nomination Report, 2010)

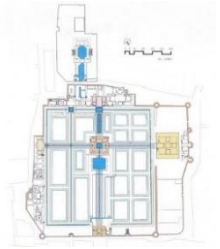
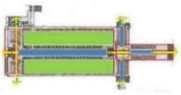
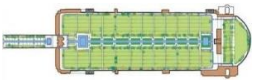
Name of the garden/ Location	Area	Era related to	Criteria for choosing	Plan and photos
Fin garden/ Kashan	7.60 ha	Safavid	The Fin Garden presents essential aspects of the Persian Garden pattern, including the arrangement of water features, ancient vegetation, and artistic and architectural characteristics. 3.5	 
Dolat Abad garden	8 Ha	Zand	Of all the remaining Persian gardens, this one has the most comprehensive design.	 
Shahzade agrden/ Kerman	5.5 ha	Qajar (18th19th century CE)	Designed in an arid area using creative irrigation techniques and the thoughtful and beautiful use of water, the garden is a prime example of the Takht Persian Garden format.	 
Pahlavanpour garden/ Mehriz	3.50 ha	Qajar	The garden is an example of the Persian Village Garden style, which combines a traditional garden with a contemporary setting.	

Table 2.1 (continued) : List of registered gardens in UNESCO (Adapted from UNESCO Nomination Report, 2010)

Name of the garden/ Location	Area	Era related to	Criteria for choosing	Plan and photos
Akbariye garden/ Birjand	3.40 ha	Zand and Qajar	Through its vegetation, water features, and architectural style, the garden embodies the spirit of South Khorasan Gardens.	 
Abbas Abad garden	420.20 ha	Safavid	The Persian garden can be adjusted to thrive in a moist environment, as evidenced by the Abas Abad garden.	 

2.2.2.2 Gardens not registered on UNESCO list

There are limited critical studies on gardens, and most of these focus on cities like Tehran, Isfahan, and Shiraz. Furthermore, precise statistics on the number of destroyed gardens versus those still standing are lacking. According to the "Plan for Organizing Gardens and Cultivated Lands in Tehran" (2010), the garden area decreased from 14,167 hectares in 1989 to 10,286 hectares in 2002, further declining to 9,932 hectares in 2009 (Suzanchi, 2015). In recent decades, half of the gardens have disappeared due to rapid urbanization, inadequate policies, and insufficient legislation for garden management and conservation (Milani, 2023).

Despite the increasing rate of garden destruction, little practical action has been taken to prevent this issue. Arash Hosseini Milani, who served on the Tehran City Council from 2017 to 2021, stated in an interview with journalist Yashar Soltani (2023) that there are no specific statistics on the number of gardens destroyed. He did, however, note that in 1956, the area of gardens was approximately 5000 hectares in Tehran. Over time, and according to city council statistics from 2021, this area has decreased to between 2400 and 2500 hectares. Additionally, he mentioned that 12,000 trees dried up between 2014 and 2017. Figure 2.13 summarizes the situation of gardens in Tehran over time.

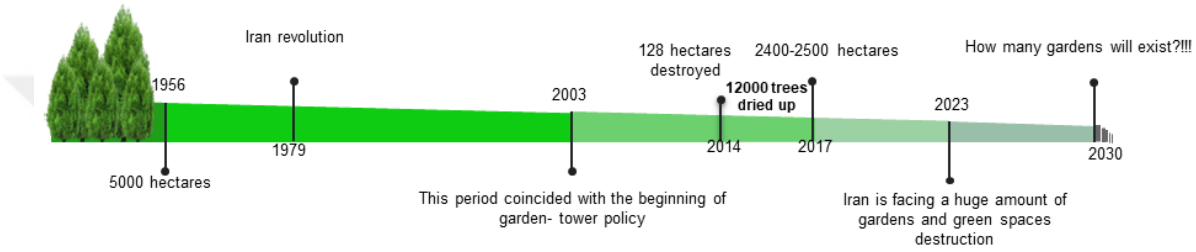


Figure 2.13 : Timeline for Gardens of Tehran (Adapted from Milani's interview, 2023)

Interviews with academics and environmental activists, along with searches for the term "Iranian garden", in Farsi (باغهای ایرانی), on Google Scholar and social media platforms like Twitter and Instagram, have identified several gardens recently at risk of deterioration. In this section of the study, the Barareh, Can, and Tehran botanical gardens, selected based on the aforementioned criteria, are examined. The temporal changes in the green areas of these gardens are analyzed through a comparison of aerial maps from various periods. This analysis provides insights into the historical evolution of the gardens and elucidates the factors contributing to their degradation.

Barare garden

Barare Gardens was built in the Pahlavi era. The Garden area is 21600 m2, with more than 200 types of trees, including apple, fig, persimmon, apricot, and walnut trees. Before Iran's 1979 revolution, the garden belonged to a private owner. Both neighbors and the garden's owner celebrated the harvest season through different ceremonies and shared the garden's crops. In addition to having positive environmental effects, the garden was a place for social activities.

After 1979, one of the Islamic Republic's governmental foundations confiscated the garden. Barare Garden gradually began to shrink in size of green space as well as in tree number of trees after this time, according to aerial maps (Figure 2.14).

Figure 2.14 : Barare garden 2005, 2010, 2015, 2023 (Google Earth, 2024)

Garden irrigation was primarily provided by Ganat systems. Due to massive construction in the area after the revolution, the Ganat's route changed and the amount of rainfall decreased, which led to the drying up of many trees in the garden. Following the approval of the policy by Tehran municipality in 2002, trees dried up and the government owner did not address the problem. According to evidence, some trees also dried up due to acid and gasoline. The demolition process was delayed due to protests by NGOs associated with the environment and environmental activists during the destruction process. Currently, however, the municipality has approved the construction of a tower on a plot measuring 6500 square meters (Isna, 2019).

Can garden

Can lands are more than 1000 hectares. These gardens are the last interconnected and dense gardens that remain in Tehran (Haghani, 2022). The garden has many different types of trees including apple, fig, and persimmon trees (Figure 2.15). However, due to urbanization, the need for shelter due to the growing population, and the need to

improve the road building system, the garden is divided into two parts by the Hemmat highway.

Figure 2.15 : Persimmon trees of garden (Mohammadseyyedali, 2018)

Once the garden had been split into its north and south sections, the municipality of that time established a policy prohibiting development and tree removal in the region for thirty years to save the remaining parts of the garden. The area of northern gardens is 240 hectares with a huge amount of trees. In the land-use plan, the function of this part is designated as green spaces and city gardens, with a significant portion of the gardens being preserved. However, because of city expansion, housing needs, and construction, the 160-acre southern part of the gardens cannot be completely preserved. Aerial maps taken from 2004 until 2014 demonstrate approximately 470-hectare gardens have been destroyed and their function is changed (Figure 2.16).

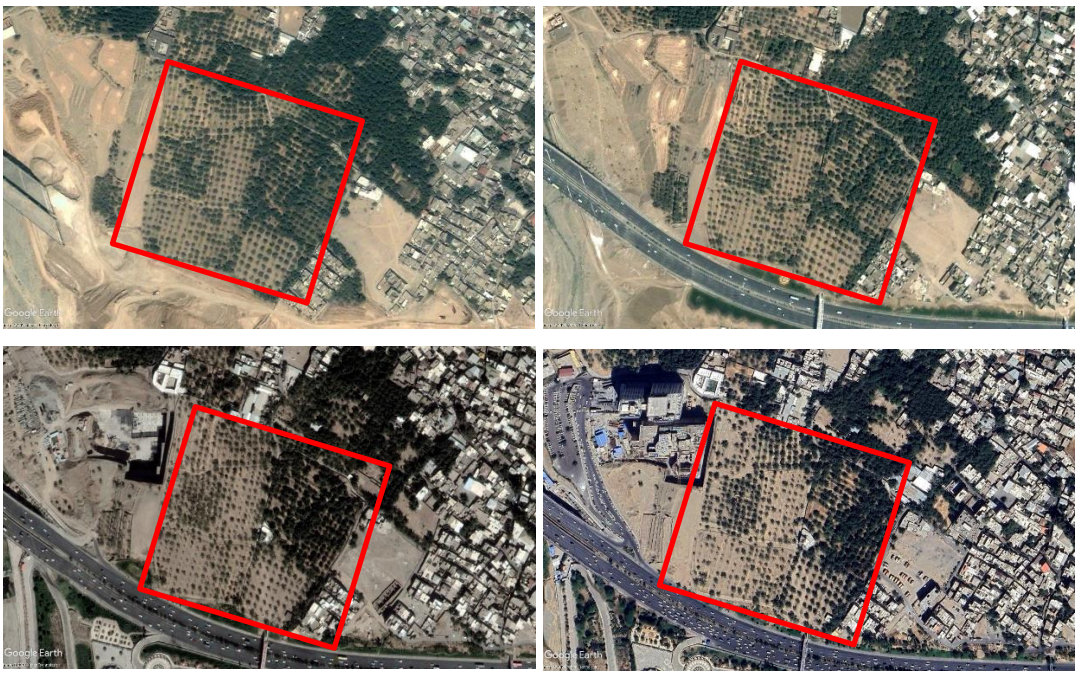


Figure 2.16 : Kan garden, 2004, 2008, 2014, 2023 (Google Earth, 2024)

In different parts of this area, the gardens and rural context are still preserved. Even though, these gardens have a high ecological value the municipality without considering this issue has provided ideas like constructing towers and residential buildings to renovate the area (Haggani, 2016).

As mentioned in the design features of gardens, the Qanat system is an important part of gardens that plays a crucial role in the garden's irrigation system. The irrigation of gardens is primarily provided by the Kan River and the existing seven Ganats in the area. The water of the Qanats is supplied by seasonal snowfall and rain. Most of these Qanats are depleted in late autumn and their water volume increases again in early spring. Also, the amount of water in the Qanats is different from each other. Therefore, of seven active Qanats six of them are working actively and are used for garden irrigation (Mohebali, 2021).

Tehran botanical garden

The national botanical garden of Iran is located northwest of Tehran with an area of 145 hectares. It was designed and planned by Iranian and foreign architects and landscape architects in 1969 as Iran's main horticultural and taxonomy center. Numerous thematic collections are available for educational research and demonstrations in the garden. There are more than four thousand plant species in the garden. Among the designed habitats, 7 habitats are related to Iran, 6 habitats are related to the world, and there are 8 collections and thematic gardens. Furthermore, there are gardens containing non-Iranian plants, including species from the Himalayas, America, Japan, Africa, and Australia. The site also features six lakes, a waterfall, a wetland, a desert plant area, a salt lake and wadi, a river about one kilometer long, and picnic areas for visitors (Figure 2.17).

Figure 2.17 : Tehran Botanical Garden (Afrasiyabi 2021, Oftade, 2023)

Currently, local development, construction activities in the garden's buffer zone and the demolition of its water resources put this garden at risk of destruction despite its 4000 plant species. The problem began when the municipality of Tehran approved the building of a high-rise residential tower containing 38 floors. As environmental activists have warned, constructing such a project will first and foremost reduce and destroy the garden's water resources. Initially, this botanical garden had a water quota of 200 liters, but due to construction in the 22nd district of Tehran, its water quota has now been reduced to 95 liters (Jalili, 2021). A second concern of environmental activists is that the presence of many buildings, the large population in this area, noise and air pollution, and the lowering of the water level will lead to the destruction of certain species of plants within the botanical garden and defiling the scenery (Figure 2.18).

Figure 2.18 : Tehran Botanical Garden, 2001, 2023 (Google Earth, 2024)

2.2.3 Research Examples on Iranian Gardens and Research gaps

Numerous scholars have investigated Iranian gardens, primarily focusing on their design features and aesthetic qualities. However, over time, most of these gardens, except those listed by UNESCO, have encountered numerous challenges due to urbanization and have been largely neglected within cities. Consequently, there are relatively few studies addressing the current condition of these gardens and their

interaction with urban spaces. Mahdizadeh is a pioneer scholar in this field with her critical examination of gardens in 2014. In her doctoral research, she analyzed the impact of political changes on various approaches to garden management. Mahdizadeh offered insightful recommendations for the conservation of gardens in Iran, addressing the contemporary challenges they face.

In 2016, Rostami et al. undertook an in-depth investigation into the popularity, diversity, distinctiveness, and comfort of Iranian gardens. Their research concluded that Iranian gardens serve as exemplary public spaces, primarily due to their historical significance, natural beauty, multifunctional roles (encompassing social and recreational functions), and emotional resonance. The study centered on four prominent gardens as case studies. The authors emphasized the need for further research encompassing a broader range of gardens to achieve more comprehensive and accurate insights.

Another significant study on the maintenance and conservation of Iranian gardens is the research conducted by Mahdizadeh and Rajendra in 2019. This paper retrospectively examines the shifts in the perception of cultural heritage as reflected in the treatment of historical gardens in twentieth-century Iran. The study offers new insights and understandings that aim to better inform policymakers about the conservation of these gardens in contemporary contexts.

In 2021, Bahrami and Grose conducted an analysis of the neglected gardens in Kerman City. Their research identified the 1970 master plan as the primary cause of garden loss in this area. They proposed that this finding could be generalized to explain garden loss in other cities as well. Based on their study, they recommended that substantial research is needed to explore the potential functions of these gardens in contemporary urban contexts.

The most recent study on gardens was conducted by Bahriny and Bell in 2021. In their comparative analysis, they selected two cases of Iranian historical gardens and two modern parks. The study found that, in terms of recreation, accessibility, and cultural relevance, modern parks were generally preferred over traditional gardens. However, it was observed that traditional gardens were more frequently used by the educational population. This study raises important questions about the evolving needs of garden users in response to changes in their lives. It highlights the necessity for a deeper

understanding of how these changes impact the preferences and requirements of people using these spaces.

Therefore, the research gaps can be summarized as below:

- There are various studies about Iranian gardens. However, most of them examine gardens from the aesthetic and beauty perspective. In addition, a few studies analyze gardens critically.
- Most of the case studies are selected from the gardens registered on the UNESCO Heritage List or some other famous and well-known gardens.
- Most of the Iranian gardens are located in cities. However, Only a few studies have examined how urbanization affects gardens during the development process.
- During the interviews with academicians and environment activism about gardens and reviewing a few existing studies related to Iranian gardens and urbanization, some gardens were found to be at risk of deterioration because of urbanization. In the literature, there are really few studies related to these gardens.
- Various studies have examined the role of Urban Green Spaces in achieving SDGs, and most of them come from developed countries. In light of this, the literature review demonstrates that Iranian gardens can be considered public Urban Green Spaces. On the other hand, literature reveals the fact that a lot more needs to be done to reach SDGs, especially in developing countries. Despite this, few scholars examine the connection between historical Urban Green Spaces and SDGs, especially in Iran.

2.3 Relation between Iranian Gardens as Urban Green Spaces(UGS) and Sustainable Development Goals (SDG)

In an increasingly urbanized world that faces different challenges, urban green spaces can be regarded as invaluable solutions. They offer numerous benefits to cities and societies, addressing environmental, social, and economic issues effectively. From 2020 until now more than half of the world's population has lived in urban areas, and it is estimated to rise 70 percent of people live in cities by 2050 (United Nations, 2023).

On the other hand, urbanization affects humans in many ways. Lower levels of physical activity and more insistence on automobile use are outcomes of urbanization for citizens. Climate change and non-communicable diseases (NCD) are challenges for the current century while they are significant threats to human health and sustainable development. So, we need to ask “Are many of the cities ready for this rapid population growth and urbanization?” and “How can cities keep safe from urban sprawl, air pollution, and limited open public and green spaces?”

The significance of green spaces in cities has drawn the attention of several scholars to these spaces, especially in light of the expansion of cities and the prevalence of cement and gray infrastructure on urban green infrastructures. There are various studies and interpretations about the important role of Urban Green Spaces in human life as well. Vidal et al. defines Urban Green Space as open areas where the land is partly or completely covered with grass, trees, water sources, shrubs, or other types of vegetation (Guedes Vidal et al., 2019). All these green infrastructure serves cities and users in various positive ways. Regarding the United Nations 2030 Agenda, green spaces are invaluable resources for delivering sustainable urban health and citizens’ well-being. Also, UGS are the wealthiest sources for cities which makes them healthier and resilient places for long-term living.

Currently, one of the crucial solutions to solve the problems caused by urbanization is the use of urban green spaces including parks, green spaces, and waterways (United Nations, 2016). In addition to providing significant benefits for the city's economy, urban green spaces are also considered an important source of social interaction and well-being. By providing areas that are conducive to physical activity and reducing stress levels, these areas can have a significant impact on human health and enhance mental wellness. In addition, increasing and improving the quality and quantity of green spaces help reduce short-lived climate pollutants, which have a major impact on global warming and cause over 7 million premature deaths each year from air pollution (United Nations, 2015). According to the World Health Organization's "Urban Green Spaces: A Brief for Action," Urban Green Spaces are inventive methods that raise the standard of urban areas, enhance local resilience, promote sustainable living, and enhance the health and well-being of city residents.

The link between Urban Green Spaces and health has been summarized in many publications (Hartig et al., 2014). In addition to the mentioned linkage, adequate opportunities that Urban Green Spaces give to residents can be listed below:

- Interact with nature
- Protect and preserve urban biodiversity
- Decrease environmental risks and challenges like air and noise pollution,
- Mitigate the impacts of extreme weather phenomena like heat waves, heavy rain, or flooding
- Promote the quality of urban living, and improve the health and well-being of residents.

Consequently, urban green spaces are a worthwhile investment for communities that have health-promoting settings for all members regardless of their age, nationality, or other characteristics. Therefore, it is necessary to ensure that all members of society have an equal chance to access to adequate amount of green space.

The ability of urban green areas to offer several urban services to a diverse range of stakeholders makes them essential components of every single city (Belmezit et al., 2018). Green spaces operate also as spaces of social experience (Haase, 2022). They have the potential to gather all members of society with different backgrounds of origin, different lifestyles, and daily routines to practice living together and use the same public space (Haase, 2022). Additionally, leisure and social contact at UGS can foster a feeling of place connection, identity, and belonging that benefits residents' physical and mental well-being (Yang et al., 2022). In addition to their social advantages, these spaces contribute to urban climate adaptation by altering ecosystem services in various ways, including regulating urban temperatures, managing water flow, mitigating runoff, and moderating environmental extremes (Graça et al., 2022). Parks, playgrounds, and residential greenery are examples of urban green spaces that can improve mental and physical health as well as lower mortality rates among urban dwellers. Additionally, these spaces promote community bonding, encourage physical movement, decrease exposure to air pollution, noise, and excessive heat, and offer mental relaxation and stress alleviation (WHO, 2016).

The reviewed literature indicates that urban green spaces serve as a common intersection between SDGs 11, 13, and 15. Urban green spaces are identified as one of the most vital elements in cities for environmental conservation (Najihan & Abdullah, 2019). Urban green spaces encompass a variety of environments, including both permeable hard surfaces and predominantly "soft surfaces" like soil, grass, plants, and trees (Dunnett et al., 2002; Lee et al., 2015). As a result, they comprise a diverse range of areas such as parks, gardens, residential green spaces, city farms, grasslands, private green areas, sports fields, and agricultural lands (Najihan & Abdullah, 2019). In addition, the literature on Iranian gardens suggests that these spaces can be classified as urban green spaces. The relationship between urban green spaces and the Sustainable Development Goals (SDGs) is illustrated in Figure 2.19. This study specifically focuses on SDG 11, which directly contributes to the sustainability of cities.

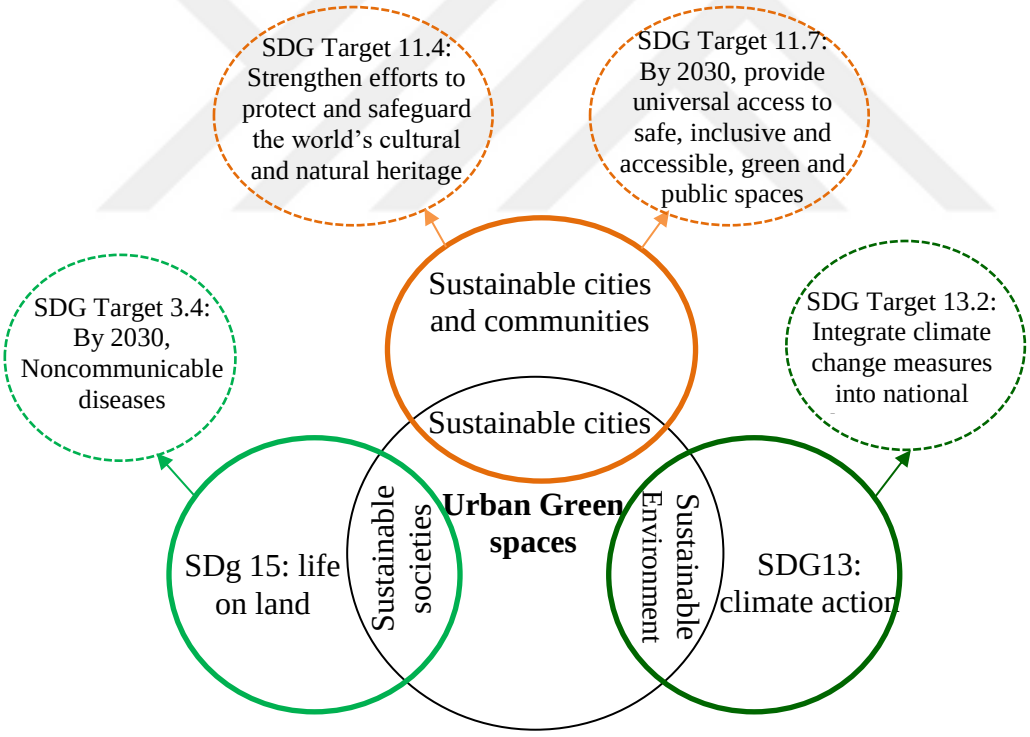


Figure 2.19 : Linkage of urban green spaces and SDGs (Author)

Finally, in this section of the literature, because of the nature of the study that deals with Iranian gardens and to better understand their position in contemporary and growing cities, the study tries to examine firstly the types of urban green spaces and answer the question “Which category of urban green spaces Iranian gardens can be classified as a subset of?” . Then, following the review of previous literature on

Sustainable Development Goals (SDGs), this study explores the relationship between Iranian gardens and the specified SDGs.

According to forest research, Great Britain's principal organization (2010), types of green spaces include community woodlands, green roofs, landscape around buildings, street trees, urban parks and gardens, and wetlands. Considering the explanation for urban parks and gardens, Iranian Gardens can be viewed as a subset within this category. These spaces are characterized by their accessibility to everyone, regardless of gender, age, or ethnic background. They foster a sense of identity, serve as venues for leisure and entertainment, and function as democratic platforms for the public. Also, according to Bristol City Council (2008), Iranian gardens can be categorized as formal green spaces that are organized with a layout recognized by its aesthetic component and are ornamented with plants and tree species.

The second part of this section, explain a result of separate examination of the existing literature on Iranian gardens and the defined SDGs in the literature review section that enables this study to establish a connection between these two subjects.

SDG 11, sustainable cities and communities, aim to make cities and human settlements inclusive, safe, resilient and sustainable. Ensuring access to adequate housing and essential services for all, promoting accessible and sustainable urbanization and transportation, and protecting the world's cultural and natural heritage are among the key targets. This study focuses on Targets 11.4 and 11.7 of the United Nations Sustainable Development Goals (SDGs). Target 11.4 emphasizes "strengthening efforts to protect and safeguard the world's cultural and natural heritage." This target underscores the critical importance of preserving cultural landmarks, traditions, and sites of historical and cultural significance.

Iranian gardens are a vital component of Iran's cultural heritage. They encapsulate centuries of design principles, philosophical thought, and architectural practices that reflect the Iranian worldview. These gardens, with their distinctive layouts, use of water, and symmetry, have had a significant influence on garden design worldwide, symbolizing a paradise on earth. They often serve as both cultural and natural sanctuaries, merging aesthetic beauty with profound cultural meaning.

The relevance of Target 11.4 to Iranian gardens lies in the need to preserve these historically and culturally significant sites. These gardens exemplify cultural heritage

that requires protection and conservation. They are not only physical spaces of beauty but also embody intangible cultural practices, philosophies, and histories that are essential to preserve. Protecting these gardens is in line with the objectives of Target 11.4, which seeks to safeguard the world's cultural heritage. Efforts in restoration, sustainable tourism, and education are necessary to maintain and promote the cultural significance of these gardens, ensuring that they continue to be valued and studied by future generations.

Target 11.7 of the United Nations Sustainable Development Goals (SDGs) seeks to "provide universal access to safe, inclusive, and accessible, green and public spaces, in particular for women and children, older persons, and persons with disabilities." This objective highlights the importance of creating and maintaining urban spaces that are open and accessible to all, thereby enhancing the quality of life in cities.

Iranian gardens, also known as Persian gardens, are a significant component of Iran's cultural heritage, embodying a profound integration of environmental, architectural, and cultural values. Historically, these gardens have served not only as private retreats but also as communal spaces, particularly in later periods when many became part of larger public or religious complexes. The garden’s landscape and green spaces were intended to create environments where people could engage with nature, find tranquility, and participate in social interactions.

The relationship between Target 11.7 and Iranian gardens is rooted in the potential of these historical spaces to contribute to contemporary urban development. Preserving and repurposing Iranian gardens as public spaces aligns with the goal of providing inclusive and accessible green areas for all segments of the population. These gardens can offer a model for the creation of urban green spaces that are not only aesthetically pleasing but also inclusive and conducive to community engagement. By ensuring that such spaces are accessible to everyone, including women, children, the elderly, and individuals with disabilities, cities can promote social inclusion and enhance the well-being of their residents.

Furthermore, the principles underlying the design of Iranian gardens can inform modern approaches to urban planning and public space development. Integrating these principles into contemporary public spaces can promote sustainability, cultural appreciation, and environmental stewardship, thereby supporting the broader

objectives of Target 11.7. Through such efforts, the cultural legacy of Iranian gardens can be preserved while also contributing to the creation of vibrant, inclusive urban environments.

The other one is goal 13 of the United Nations Sustainable Development Goals (SDGs) that emphasizes the necessity for urgent action to combat climate change and mitigate its effects. This target advocates for enhancing resilience and adaptive capacity to climate-related hazards and natural disasters, emphasizing the importance of sustainable practices and strategies to address the escalating challenges posed by climate change.

Iranian gardens exemplify a historical model of sustainable landscape design that is closely aligned with the objectives of Target 13. These gardens were traditionally developed in arid and semi-arid regions, where the scarcity of water and challenging climatic conditions required innovative environmental management practices. The design principles of Iranian gardens—such as the efficient use of water, strategic planting for shade and cooling, and the creation of localized microclimates—demonstrate a profound understanding of, and adaptation to, the local environment.

The link between Target 13 and Iranian gardens lies in their potential to serve as models for climate adaptation and sustainable landscape practices in the context of contemporary climate change. The traditional water management techniques employed in these gardens, such as the Qanat system—an ancient method of transporting water from distant underground sources—illustrate a longstanding approach to water conservation that is still relevant today. These techniques offer valuable insights for developing sustainable water management systems in regions increasingly affected by water scarcity due to climate change.

Furthermore, the methods used in Iranian gardens to create cooler microclimates through strategic vegetation and garden design can inform modern urban planning and landscape architecture, especially in cities facing rising temperatures and more frequent heatwaves. By integrating the principles of Iranian garden design into contemporary urban settings, cities can enhance their resilience to climate change, reduce energy demands for cooling, and create more sustainable and livable environments.

Target 15.9 of the United Nations Sustainable Development Goals (SDGs) emphasizes the integration of ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies, and accounting systems by 2020. This target highlights the importance of recognizing and incorporating the intrinsic value of biodiversity and ecosystems into broader development frameworks and policy decisions. The connection between Target 15.9 and Iranian gardens is evident in how these gardens embody the integration of biodiversity values into landscape design and management practices. Historically, Iranian gardens have featured a diverse range of plant species, including fruit trees, ornamental flowers, and medicinal plants, which enhance the ecological diversity and resilience of the garden ecosystem. This biodiversity supports not only the aesthetic and cultural functions of the garden but also its ecological sustainability, contributing to local wildlife habitats and promoting a symbiotic relationship between humans and nature.

The principles of Iranian garden design offer valuable insights for contemporary efforts to incorporate ecosystem and biodiversity values into urban and rural planning. By applying these principles, modern planners and policymakers can create green spaces that serve both as cultural and recreational areas and as critical sites for biodiversity conservation. This approach aligns with the objectives of Target 15.9, which advocates for the integration of ecosystem services and biodiversity into development strategies at both national and local levels. Table 2.1 summarizes the relationship between Iranian gardens and related SDGs.

Table 2.2 : Relationship between Iranian Gardens as urban green spaces and related SDGs

Goal	Target	Relation to the Iranian garden
Goal 11: sustainable cities and communities	Target 11.4: Strengthen efforts to protect and safeguard the world's cultural and natural heritage	Iranian gardens are valuable cultural heritage not only for Iran but also for the entire world. As cultural heritage, the gardens reflect the Iranian perception of the world. Their unique features, such as walkability, vitality, diverse plant species and water features, have the potential to enhance livability, promote social inclusivity, and improve the well-being of their users. As cultural heritage sites, in case Iranian gardens are maintained and conserved appropriately as historic urban landscapes, they have potential to benefit cities in many ways.
	Target 11.7: By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities	The preservation and revitalization of Iranian gardens, when considering users' needs, can significantly enhance urban green spaces, making them more accessible and inclusive. These gardens possess the potential to provide safe and welcoming environments that foster social interaction, cultural activities, and community well-being, thereby contributing to the broader objectives of Sustainable Development Goal 11.
Goal 13: climate action	13.1, 13.2, 13.3: build knowledge and capacity to meet climate change	Iranian gardens, renowned for their historical and cultural significance, also offer valuable insights into sustainable land management and climate resilience. Historically, gardens were designed to mitigate the arid climate of cities, transforming them into more enjoyable places to live. The use of water in these gardens, in harmony with the different types of plants, exemplifies how humans coexist with nature. Learning from these past practices, Iranian gardens, as green infrastructure, can play a crucial role in the sustainable development of urban areas. With their diverse types of trees, these gardens can significantly contribute to combating climate change, they have the potential to absorb air pollution and protect cities from the impact of climate change.

Table 2.2 (continued) : Relationship between Iranian Gardens as urban green spaces and related SDGs

Goal	Target	Relation to the Iranian garden
Goal 15: life on land	15.9: integrate ecosystem and biodiversity in governmental planning 15.5: protect biodiversity and natural habitats	Iranian gardens, when integrated into urban landscapes, offer substantial contributions toward meeting the targets of goal 15. These gardens, characterized by their extensive trees and diverse plant species, serve as vital habitats that support a wide range of flora and fauna. They typically have a mix of fruit trees, flowering plants, and medicinal herbs, which together foster local biodiversity. Additionally, Iranian gardens can play a significant role in moderating urban microclimates. Their dense vegetation and substantial tree cover can help mitigate extreme temperatures and contribute to improved environmental conditions within the city.

3. FINDINGS ON THE CONTRIBUTION OF IRANIAN GARDENS TO ACHIEVING SUSTAINABLE DEVELOPMENT GOALS

The primary aim of this research is to investigate the possible potential of Iranian gardens in contributing to the achievement of Sustainable Development Goals (SDGs) in urban areas. It aims to understand the connection between Iranian gardens and SDGs to help cities progress toward global objectives. To reach this aim it is important to explore gardens potential and ways that they can be integrated into contemporary urban settings to support sustainability goals. Also, examining the state of Iranian gardens in the 21st century helps the study identify the obstacles preventing these gardens from realizing their potential in urban areas.

The research addresses two key questions: 1) How can Iranian gardens be integrated into contemporary cities and daily life to help achieve the Sustainable Development Goals (SDGs)? 2) What obstacles do Iranian gardens face in fulfilling their potential in today's cities?

To address the research questions and achieve the study's objectives, interviews were employed as the primary research method. Given the limited literature on the topic, interviews provided a direct and effective approach to gathering relevant insights.

This section, which includes methodology, main codes, and subcodes of analysis, presents the findings from the analysis of expert interviews, focusing on the potential of Iranian gardens and the obstacles to fully utilizing this potential. The section starts with an explanation of the methodology and procedure of the research, including the data collection, analysis, and interpretation methods. Afterward, the results are explained within a framework of the prominent themes conceptualized through main codes and subcodes. Following this, each code is examined in detail, accompanied by schematic representations. The connection between these codes, the research questions, and the overall objectives of the study is then discussed.

3.1 Methodology

This study aims to investigate the possible potential of Iranian gardens in contributing to the achievement of Sustainable Development Goals (SDGs) in urban areas. Highlighting these potentials can help cities progress toward global objectives.

In line with the aim of the study, the study's objectives are to understand the relationship between gardens and sustainable development, exploring how these gardens can be integrated into contemporary urban settings to support sustainability goals. Additionally, the study seeks to examine the state of Iranian gardens in the 21st century and identify the obstacles that prevent these gardens from utilizing their potential in urban areas.

The study commenced with a comprehensive review of existing literature on the Sustainable Development Goals (SDGs) and Iranian gardens. The literature review focused on two main areas: Iranian gardens as urban green spaces and relevant SDGs. By examining these topics separately, the study was able to identify and articulate potential connections between Iranian gardens and specific SDGs. Based on the insights gained from this literature review, a set of interview questions was subsequently developed. These questions are designed to further explore the relationship and integration of Iranian gardens with related SDGs into modern urban settings and to assess the obstacles they face in contributing effectively to the achievement of the SDGs.

In the initial phase of this thesis, the aim of the study was established by considering existing gaps and problems in the literature. The gaps identified in the literature highlighted the need to explore the potential of Iranian gardens in contributing to the achievement of the SDGs. Additionally, the impact of urbanization on these gardens emerged as a significant issue requiring further investigation. To examine this impact, in the previous section, several Iranian gardens were analyzed using aerial maps, providing insights into how urbanization has influenced these historically significant green spaces.

Subsequently, data collection method was identified to address the research questions. Since the study aims to understand the relationship between Iranian gardens and Sustainable Development Goals, qualitative approach is employed to collect the data. This method is well-suited for exploring questions related to experience, meaning, and

perspective, primarily from the participants' viewpoint (Hammarberg et al., 2016). A qualitative research approach with its effectiveness helps the study in obtaining in-depth insights (Creswell, 2017) into the association between Iranian gardens and the Sustainable Development Goals, a association that can be multifaceted. The association between Iranian gardens and SDGs cannot be fully understood without considering the specific historical, social, and urban contexts in which these gardens exist. Qualitative methods enable this study to delve into these contexts, uncovering how local practices, traditions, and values intersect with global sustainability objectives. Additionally, this qualitative approach gives the study chance to explore the issue from various perspectives and through the insights of different experts.

Within the qualitative research methods framework, the appropriate tool for answering the research questions was identified as conducting in-depth and semi-structured interviews. Given the limited research on the association between Iranian gardens and SDGs, conducting interviews with experts in the field was deemed an appropriate method to explore their perspectives and address the research questions.

A purposive sampling strategy was employed to address the research questions, which focus on how Iranian gardens can be integrated into contemporary urban environments to support SDGs and the challenges these gardens face. International and national experts in the fields of landscape architecture, urban planning, and sustainable development were selected for semi-structured interviews. The selection criteria included expertise in relevant areas, experience working with Iranian gardens, and familiarity with the SDGs. A total of 37 individuals were invited to participate in interviews via email, resulting in interviews with ten experts, ensuring a diverse range of insights.

Data collection was conducted through in-depth, semi-structured interviews with open-ended questions, allowing for a comprehensive understanding of participants' views while maintaining consistency in addressing the research objectives. The interviews were recorded. Some of them were manually transcribed while others were transcribed using speech notes. Then, the data collected from the interviews were coded and analyzed using MAXQDA software, which facilitated the coding and interpretation of the study’s findings. Thematic analysis was employed to identify key codes in the data, assisting a comprehensive understanding of the relationship between Iranian gardens and SDGs.

To ensure the trustworthiness of the findings the results were checked by 4 member of interviewees at the end of data analyzation. Ethical considerations were also addressed, with informed consent obtained from all participants, and measures taken to ensure the confidentiality and anonymity of their responses.

This methodology provides a framework for exploring the potential of Iranian gardens in contributing to Sustainable Development Goals and aligns with the study's aim of advancing knowledge in this under-researched area. Figure 3.1 summarizes the methodology of the study.

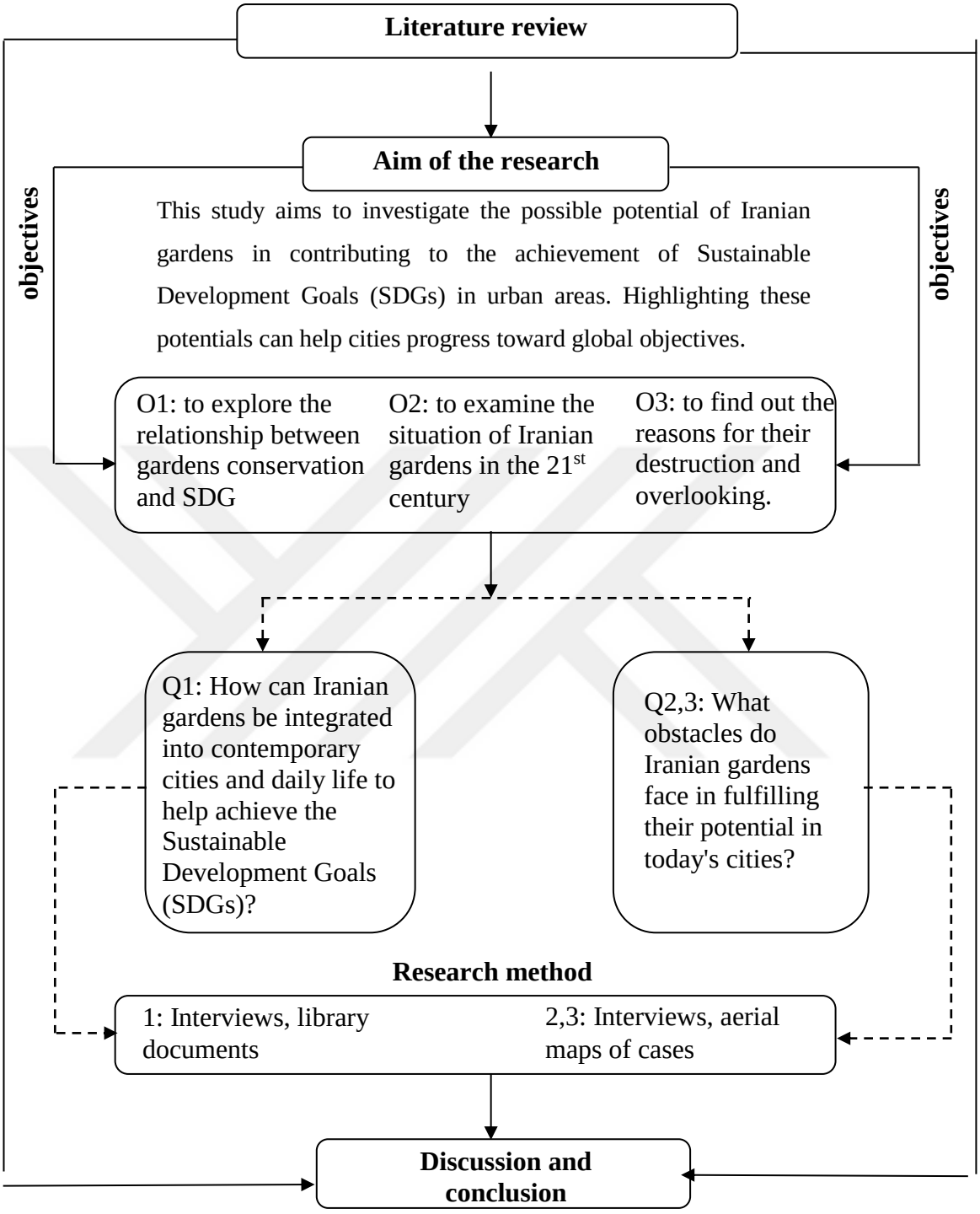


Figure 3.1 : Methodology of the study

3.1.1 Interviews

In qualitative research, interviews are one of the most widely used methods for data collection (Jamshed, 2014). Oakley (1998) describes the qualitative interview as a framework where practices and standards are observed, questioned, and reinforced.

Semi-structured interviews, a common form of in-depth interviewing, require participants to respond to predetermined, open-ended questions (Jamshed, 2014). These interviews are typically conducted once with either an individual or a group and may range from 30 minutes to over an hour in duration (Bloom & Crabtree, 2006). The interview process involves a limited number of unstructured, open-ended questions aimed at eliciting participants' perspectives and insights (Creswell, 2017). Semi-structured interviews are guided by an interview schedule, which outlines the key topics or questions that the interviewer must address (Jamshed, 2014). Creswell (2017) identifies several types of interviews, including face-to-face, telephone, focus group, and online formats, and highlights the strengths of this method, emphasizing its ability to allow participants to provide historical context while giving the researcher control over the flow of the conversation.

This study utilized online semi-structured interviews as its primary data collection method. An email, as an interview request, was sent to 37 individuals. As a result, 10 people accepted to participate in the interview. The interviewees are categorized into three groups: academics, environmental activists, and city managers. The first group included six academics from various disciplines, such as architecture, landscape architecture, and urban planning. Of these, four are affiliated with universities in Iran, while two are associated with institutions outside of the country, both of whom have conducted research related to Iranian gardens and the SDGs. The second group consisted of two environmental activists with significant expertise in gardens and contemporary challenges they face. The third group comprised of two city managers with executive experience in the protection and restoration of gardens

The interviews were conducted for two primary purposes: first, to explore the potential role of Iranian gardens in contributing to the achievement of the Sustainable Development Goals (SDGs), and second, to identify the obstacles that hinder the effective utilization of these gardens in achieving those goals. By gathering insights from various disciplines, the study aimed to better understand the potential of Iranian gardens and identify the most effective strategies to harness this potential. The semi-structured interviews feature open-ended questions to fully capture the interviewees' views on the potentials and threats facing gardens. Additionally, these interviews help identify specific gardens that are currently at risk of damage.

Each interview includes 7 semi-structured and open-ended questions to obtain further information on the research questions.:

1. What characteristics make Iranian gardens important and distinctive in cities and communities, in your opinion?
2. How do Iranian gardens contribute to contemporary urban life?
3. How do you evaluate Iranian gardens' current role and contribution to meeting the public's need for green space and recreational needs?
4. How do you evaluate the status of gardens in terms of cultural heritage? In your opinion**,** is this feature being sufficiently utilized today?
5. Has enough awareness been raised about their cultural values? Do you have any recommendations for further increasing this awareness?
6. How do you evaluate the role of Iranian gardens in promoting sustainability and combating climate change (e.g., creating resilient cities, and reducing air pollution)? Are their potentials being adequately utilized, or what barriers exist?
7. What obstacles do Iranian gardens face in fulfilling their potential in today's cities? What measures would you recommend regarding factors such as garden design, facilities, conservation policies, management, etc.?

Each interview lasts approximately 30 to 50 minutes, and conducted via online platforms like Zoom and Google Meet. While some of the interviews were recorded, notes were taken during the others.

3.1.2 Data analyzing process

The interview data were analyzed using the hierarchical framework proposed by Creswell (2017) and the guidelines provided by Radiker and Kuckartz (2020) (Figure 3.2). According to Creswell, the initial phase of qualitative data analysis involves organizing and preparing the data for detailed examination. Since the interviews were specifically conducted for this study as the primary tool to answer the research questions, the first step involved transcribing the interviews. The transcription process was facilitated by the use of Speechnote, which was employed to document the content of the interviews.

Following the hierarchical framework (Figure 3.2), the second step involved thoroughly reading the transcriptions to gain a general understanding of the data and to become familiar with the content. This was achieved by reading the transcriptions multiple times and making initial notes while marking significant observations. As an interpreter, reflective questions such as "What general ideas are participants conveying?" and "What is the overall impression of the depth, credibility, and utility of the information?" (Creswell, 2017) were used to develop a comprehensive understanding of the subject matter.

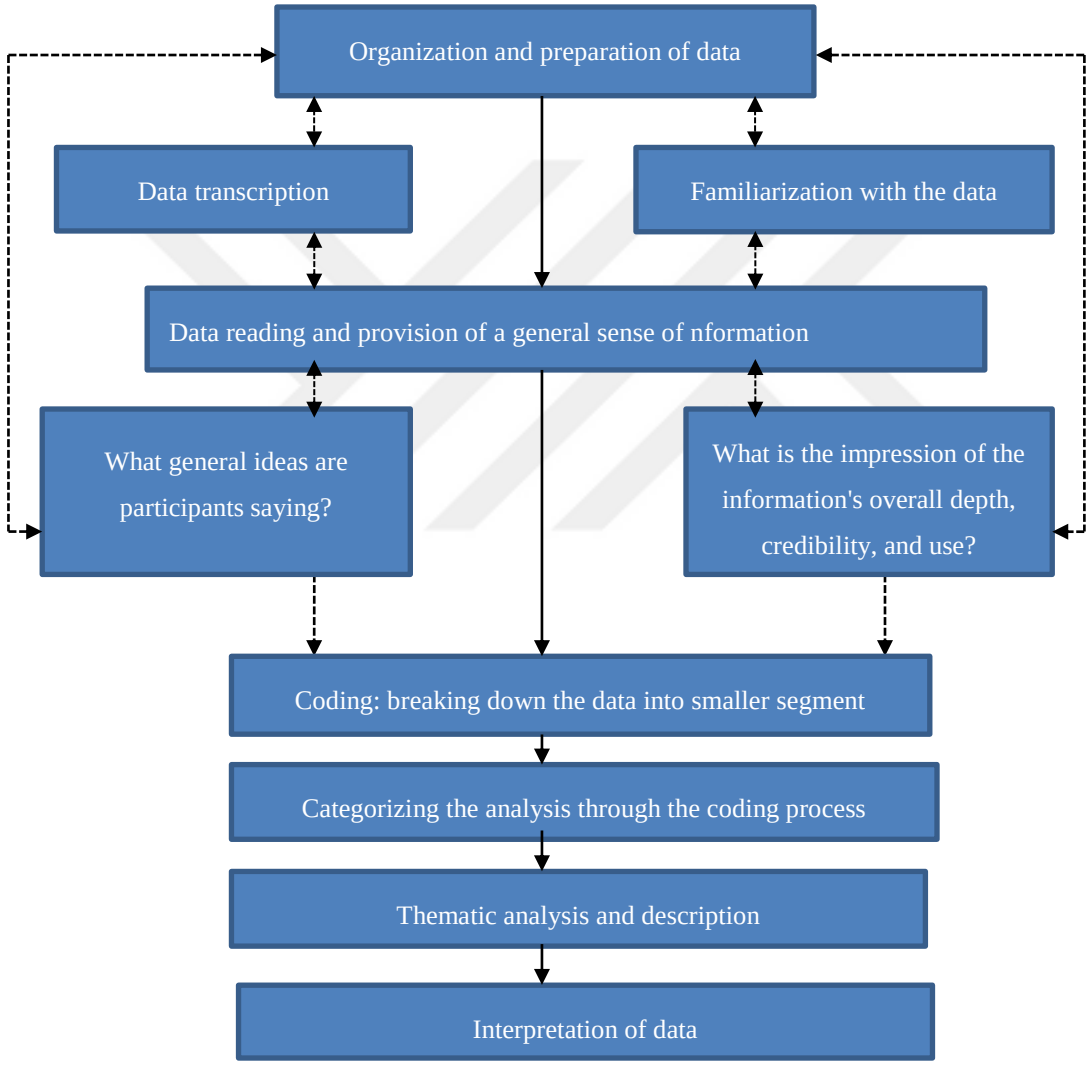


Figure 3.2 : Hierarchy for coding data

The third step in the process involved coding the data. Coding is defined as organizing the data by segmenting the text into distinct units and assigning category labels to each, often in the margins (Creswell, 2017). Creswell describes this step as dividing the text into smaller segments, such as sentences or paragraphs, and assigning them specific

category labels, which are often derived from the participants' language. During this step, the entire transcript was reviewed again, and coding was conducted using MAXQDA, with codes annotated in the margins. As a result of this process, a list of codes was generated and prepared during the initial phase of coding. The identified codes include solutions for environmental challenges, improving user well-being, resilient plants, climate adaptation, reduction of urban heat islands, heritage significance, addressing the need for urban green spaces, safe spaces for women and children, areas for cultural exchange and activities, triple benefits, insufficient knowledge about cultural heritage, UNESCO registration, lack of attention to users' needs, improvement of air quality, conservation and restoration challenges, and the application of inappropriate policies and functions.

In the fourth step, similar codes were grouped based on the corresponding interview questions. As a result, topics related to the same questions were categorized under common groups, with each group assigned a title and relevant subtitles. The first interview question focuses on the key characteristics of Iranian gardens, leading to the selection of the code-named "Importance of Iranian Gardens." The second question examines the association between Iranian gardens and contemporary urban life, for which the code-named "Contribution of Iranian Gardens to Contemporary Urban Life" was chosen. The third question explores the relationship between Iranian gardens and issues such as public spaces, green spaces, and recreational areas. As a result, the code "Multifunctional Urban Green and Public Spaces" was identified and considering their relationship, it was categorized under the contribution to contemporary urban life. The fourth and fifth questions address the cultural heritage aspects of the gardens, prompting the selection of the code "Iranian Gardens as Cultural Heritage." The sixth question investigates the link between Iranian gardens and sustainability, thus leading to the code " Iranian Gardens in the Context of Environmental Sustainability." Finally, the seventh question explores the obstacles that hinder the full utilization of these gardens' potential in urban settings, for which the code "Obstacles and Problems facing Iranian Gardens". Figure 3.3 summarizes all mentioned main codes and sub-codes.

Step 5 is about deciding how the description and themes will be represented in the qualitative narrative (Creswell, 2017). In this step, the codes are reviewed to identify broader themes. The final step of the hierarchy is interpreting the finding that leads to the result of the study. This step will be broadly explained in the results section.

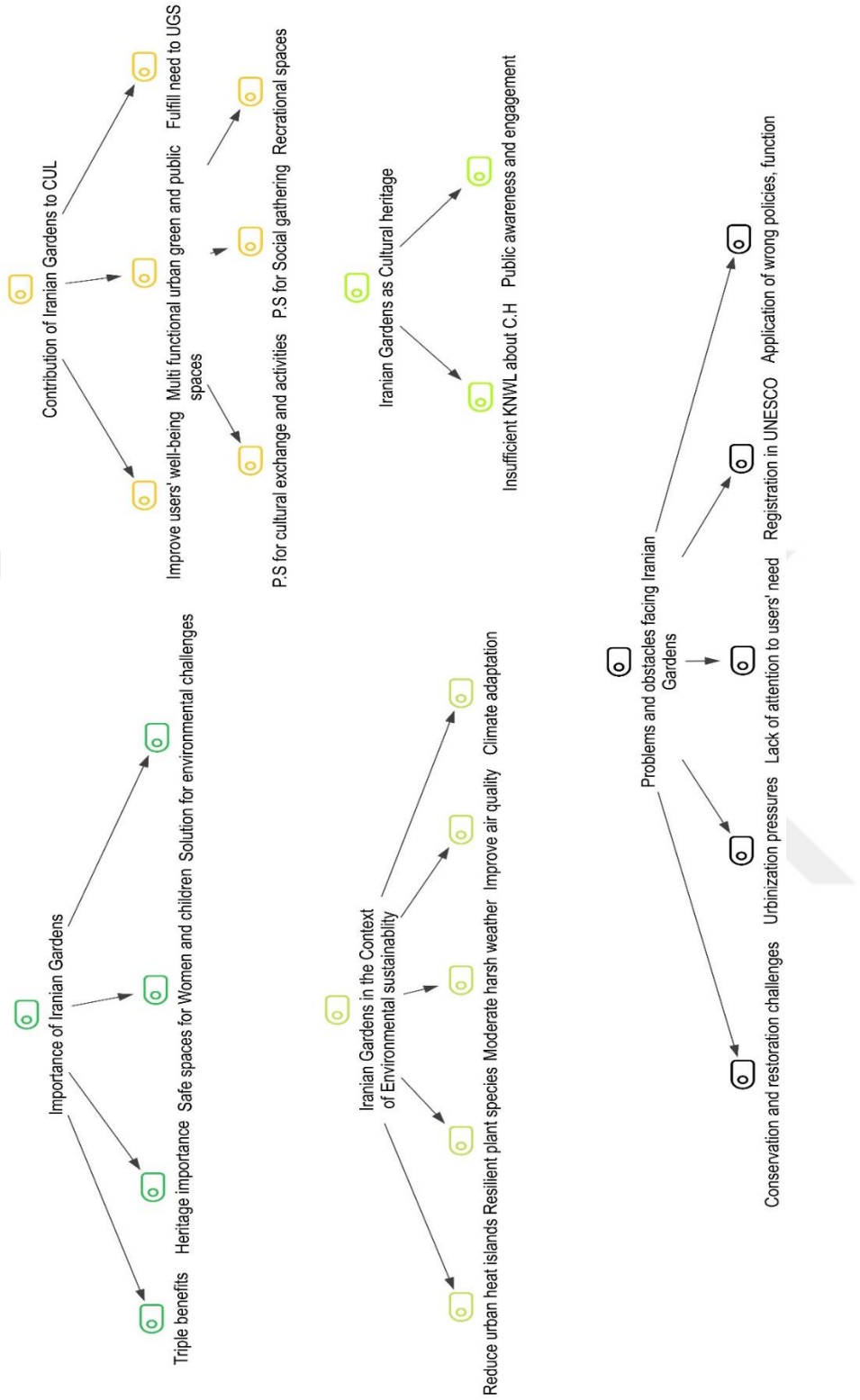


Figure 3.3 : Main codes and sub-codes

3.2 Analysis And Results

3.2.1 Main codes

As outlined in the previous section, the responses to the interview questions, designed to address the research inquiries, were systematically coded and subsequently categorized. This process resulted in identifying five primary codes, with 22 codes classified as subcodes under these main categories. The "Code System" pie chart shows five major codes relevant to Iranian gardens. The following section explains the main codes according to the pie chart generated in MAXQDA including problems and obstacles, environmental sustainability, importance of gardens, contribution to contemporary urban life, and cultural heritage (Figure 3.4).

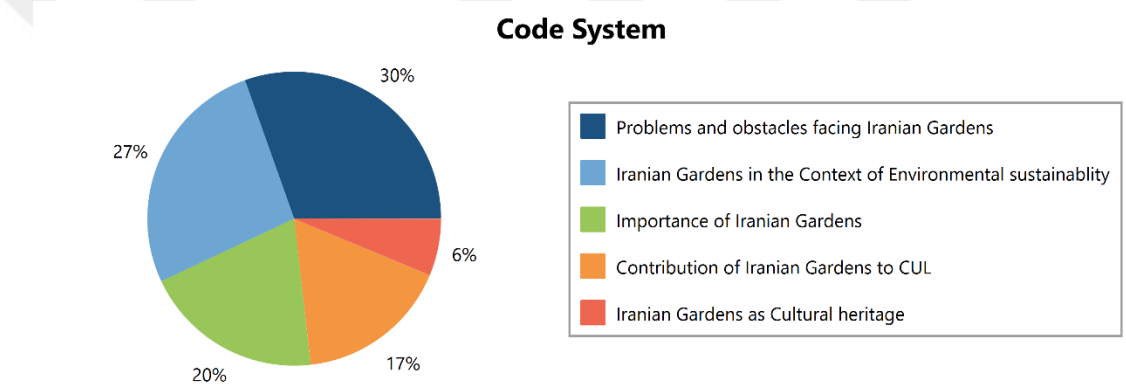


Figure 3.4 : Five key categories (main codes) related to Iranian gardens derived from the interview data

Problems and Obstacles facing Iranian Gardens(30%): Representing the largest segment of the coding pie chart, this section underscores the major challenges Iranian gardens currently encounter. Based on interview insights, these challenges encompass issues such as conservation and restoration difficulties, insufficient consideration of users' needs, improper policy implementation, the pressures of urbanization, and the complexities surrounding UNESCO registration. The following section will explore each of these topics in greater depth.

Iranian Gardens in the Context of Environmental Sustainability (27%): This category highlights the significance potential of Iranian gardens in solving environmental challenges. Participants emphasized the historical implementation of sustainable practices, such as managing moderate harsh weather conditions and giving a chance to Iranian to make a liveable environment. Additionally, they discussed the

role these gardens play in addressing climate change, enhancing biodiversity, mitigating urban heat island effects, and improving air quality.

Importance of Iranian Gardens (20%): Iranian gardens are not only aesthetically valuable but are also important cultural, social, and environmental assets. They serve as vital green spaces in urban settings, offering recreational opportunities, improving air quality, and enhancing overall public well-being. Their cultural and ecological significance increases their importance within modern cities. The interviewees emphasized that the significance of gardens should be recognized beyond their aesthetic appeal. In relation to this, they highlighted several key aspects during the interviews, including the heritage value of the gardens, their potential to address environmental challenges, their economic, environmental, and social benefits, as well as their capacity to serve as safe spaces for women and children

Contribution of Iranian Gardens to Contemporary Urban Life (CUL) (17%): This main code highlights three key issues that respondents identified as crucial for gardens' importance and positive impact: multifunctional urban green and public spaces, improving users' well-being, and meeting the demand for urban green spaces. Furthermore, to organize related topics more effectively according to responders' points of view, an additional subcode was created under the code for multifunctional urban green and public spaces, which includes areas for cultural exchange and activities, social gathering points, and recreational spaces.

Iranian Gardens as Cultural Heritage (6%): Although this section is smaller, it still emphasizes that Iranian gardens are deeply tied to Iran's cultural identity. The gardens are a key part of Iran’s cultural heritage, with many listed as UNESCO World Heritage Sites. Their contribution to the cultural landscape includes not only their historical significance but also their role as symbols of harmony between humans and nature. However, subjects like public awareness and engagement and insufficient awareness about their cultural heritage importance are issues to be considered.

3.2.2 Sub-codes of the main codes

In this study, subset codes are derived from the detailed responses of participants that explain the main codes in more detail. The following section outlines the subcodes of five main codes, highlighting significant issues related to Iranian gardens. It provides an in-depth analysis of respondents' viewpoints, aiding in the identification of the role

these gardens play in contemporary urban environments. Furthermore, this analysis underscores the importance of Iranian gardens in achieving Sustainable Development Goals (SDGs) and reveals the challenges that impede the realization of these roles. The subjects are presented in order of their prevalence, starting with those that have the highest percentage and progressing to those with the lowest.

3.2.2.1 Problems and obstacles facing Iranian Gardens

The pie chart titled "Problems and Obstacles" highlights five primary challenges related to Iranian gardens, ranked by their significance based on respondents' perspectives (Figure 3.5). This part of the study answers the second research question: What obstacles do Iranian gardens face in fulfilling their potential in today's cities?

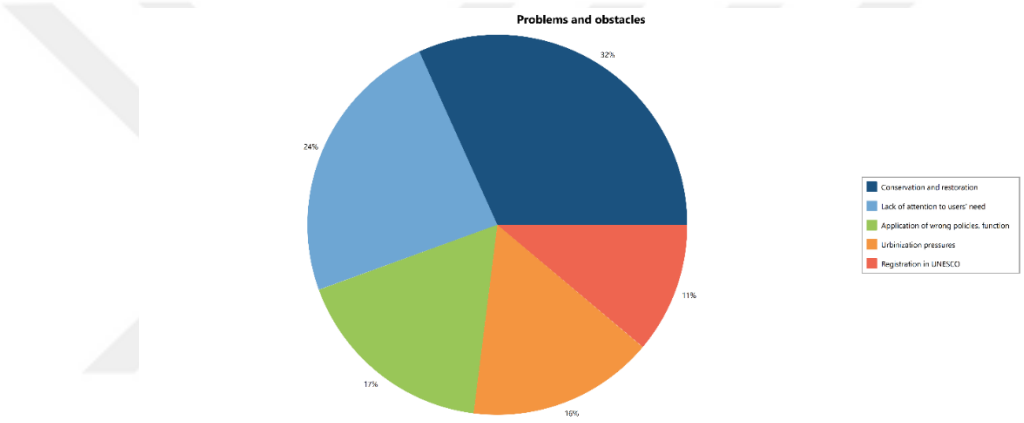


Figure 3.5 : Challenges and obstacles facing Iranian gardens as identified in interviews

The issue of **Conservation and Restoration (32%)** emerges as the most pressing concern among respondents, suggesting a significant level of apprehension regarding the preservation and maintenance of these gardens. During interviews, statements such as *"gardens are at high risk of deterioration," "conservation of gardens faces specific challenges,"* and *"restoration of gardens should be considered holistically, with both the buildings and the gardens requiring equal attention,"* guided the study in identifying conservation and restoration challenges as a key factor hindering these gardens from realizing their full potential.

Subsequently, the category of **Lack of Attention to Users' Needs (24%)** emerges as the second most significant concern. This underscores a notable disconnect between the adaptive reuse, maintenance, and functionality of the gardens and the actual needs or expectations of their users. Statements such as *"it is crucial to pay attention to users'*

needs and address them alongside all benefits" and *"there is a lack of understanding regarding the relationship between users' needs and gardens"* exemplify the insights that informed the study's determination of this gap in attention to users' needs. Additionally, responders considered a lack of attention to the users' needs as the main reason for applying the wrong function to gardens.

The third significant challenge identified is the **Application of Wrong Policies and Functions (17%)**, which reflects respondents' concerns regarding misaligned policies and ineffective management practices. A majority of respondents highlighted the Tower-Garden policy enacted by the Tehran municipality as particularly detrimental. This policy permits developers to construct 30% of a garden's area, contingent upon the preservation of the remaining 70%. Although intended to balance garden preservation with property rights, this policy has inadvertently contributed to the loss of numerous historical gardens and other urban green spaces. In practice, adherence to this regulation has frequently been overlooked in favor of greater financial incentives pursued by investors.

Another related concern raised by respondents was the lack of recognition of garden buffer zones and the neglect of considerations regarding surrounding construction. This oversight poses significant challenges for the vegetation within gardens, particularly in the Tehran Botanical Garden, impacting factors such as sunlight exposure and water supply.

Urbanization Pressures (16%) underscore the challenges that arise from the expansion of urban areas on green spaces. Throughout the interviews, respondents indicated that urban expansion often results in the conversion of historical gardens into residential, commercial, or industrial zones, leading to a decline in green spaces. This reduction negatively affects urban biodiversity and the quality of life for residents. Furthermore, participants stressed the necessity of *"considering gardens and their green spaces within a broader urban framework during the development process"* in interviews. Additionally, the majority of respondents highlighted the detrimental impact of unplanned and rapid urbanization on the deterioration of gardens. Rapid and unplanned urban development can disrupt the ecological balance by altering landscapes.

Finally, **Registration in UNESCO (11%)** is identified as the least emphasized issue among respondents. However, this does not imply that the matter is without significance. While the designation of gardens as UNESCO World Heritage sites is significant, participants expressed concerns such as, *"Nowadays, most people are only aware of the very famous gardens that are registered with UNESCO, while other gardens are at risk of being neglected and forgotten."* Additionally, respondents highlighted the necessity of ensuring that *"there should be no difference in the conservation and restoration of gardens listed by UNESCO and those that are not."* This issue highlights the disparities in maintenance and conservation practices that the UNESCO designation can create for gardens.

3.2.2.2 Iranian Gardens in the context of environmental sustainability

The pie chart illustrates codes that are interviewees' perspectives on the connection between Iranian gardens and environmental sustainability. The interview respondents believed Iranian gardens contribute to multiple aspects of sustainability, aligning with the SDGs. It classifies their responses into five key subcodes, each representing a different aspect of sustainability, along with the respective percentages (Figure 3.6). This portion of the results addresses the first research question regarding the role of Iranian gardens in supporting cities' role in achieving the Sustainable Development Goals (SDGs). Specifically, the research question asks: "How can Iranian gardens be integrated into contemporary cities and daily life to help achieve the Sustainable Development Goals (SDGs)?"

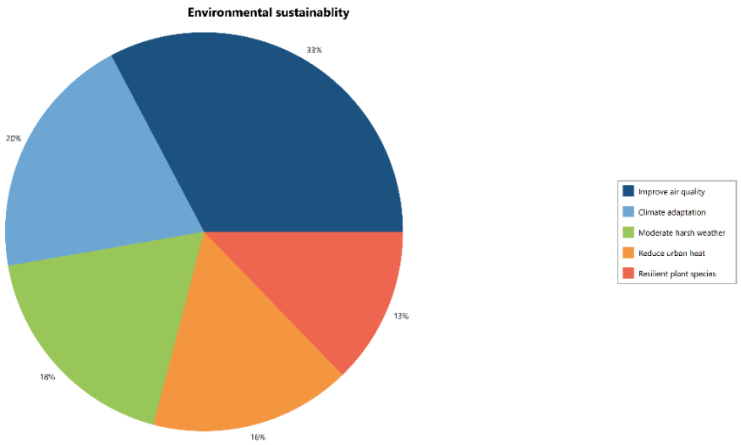


Figure 3.6 : Factors linking Iranian gardens to environmental sustainability based on interview findings

The largest segment of this part focuses on the gardens' role in **Improving air quality (33%)**. The gardens with their huge amount of green spaces and various plant species enhance air quality, these gardens can play a significant role in improving public health and reducing pollution in cities which are the most challenging problems in cities in Iran.

Subsequently**, climate adaptation (20%)** is the second issue that responders highlight the gardens' potential in indicating their ability to provide microclimate regulation. Elements such as shading and water features within these gardens are subjects that responders see as valuable in mitigating the effects of climate change and extreme weather events. The respondents highlighted numerous critical aspects, including the historical use of climate adaptation mechanisms in Iranian gardens, which enables their prosperity in dry and semi-arid areas. They highlighted features like underground water management systems, including qanats and pools, which optimize the utilization of limited water resources. Additionally, the garden layouts typically incorporate geometric designs that enhance airflow and cooling. Furthermore, plant selection focuses on drought-resistant species, supporting the sustainability of these gardens in harsh climatic conditions. These integrated strategies reflect a sophisticated approach to addressing extreme temperatures and ability of gardens to climate adaptation.

Gardens' ability to **Moderate harsh weather (18%)** is an issue that comes after climate adaptation. Respondents emphasized that the combination of trees, vegetation, and water features within the gardens contributes significantly to the creation of cooler, more temperate microclimates, enhancing the overall comfort and stability of the surrounding environment. The combination of plant species and different water features in the garden changes the harsh and dry weather of Iran to a place where users enjoy spending time.

The third aspect linking Iranian gardens to sustainability is their capacity to **Reduce urban heat islands effect (16%)**. Respondents noted that gardens, as green spaces, help lower local temperatures in densely populated areas through shading and natural cooling mechanisms. These mechanisms include water features and the strategic use of diverse plant species, such as trees and shrubs, which work together to create cooler urban environments and lower local temperatures, particularly in densely populated areas.

Finally, gardens' **Resilient plant species (13%)** is an issue that receives thirteen percent of responses. According to the interviews, the plant species within these gardens are well-adapted to their environment, allowing them to thrive in Iran's hot and arid climate. These resilient species have played a crucial role in the longevity of Iranian gardens, preserving their existence over centuries. Importance of Iranian gardens.

3.2.2.3 Importance of Iranian gardens

To better understand the historical and contemporary significance of gardens, interviewees were asked to identify the characteristics that distinguish Iranian gardens. Based on their responses, the resulting pie chart (Figure 3.7) illustrates four key dimensions that emphasize the importance of these gardens. This section also addresses the first research question, which explores the role of gardens in modern urban environments and their relevance to the lives of city residents.

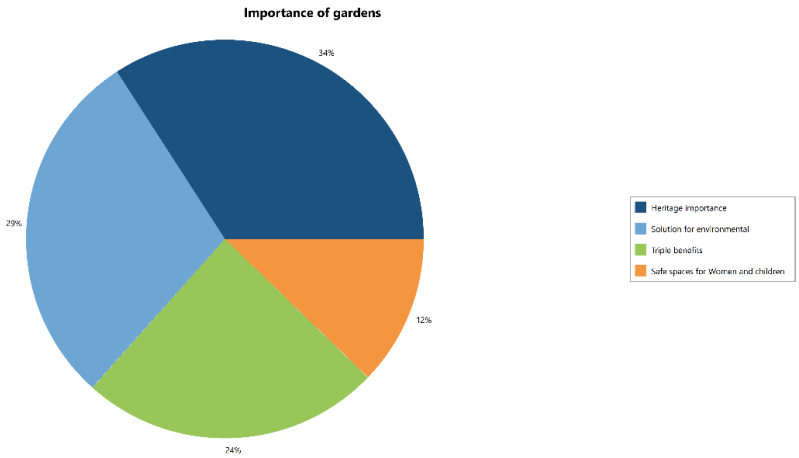


Figure 3.7 : Factors Relating to the Importance of Gardens as Identified by Interviewees

A significant proportion of experts emphasized the **heritage importance of gardens (34%)** and viewed them as vital heritage sites. These gardens, many of which have existed for centuries, are deeply embedded in Iran's cultural identity and stand as living representations of traditional Iranian landscape architecture. During the interviews, most respondents stressed the importance of the gardens' historical roots, noting their diverse functions within urban environments. They further remarked that these gardens are dynamic, valuable assets of Iranian culture, integrated into city life. This feature allows them to provide numerous benefits to urban areas. Additionally, the respondents highlighted that the heritage value of these gardens extends beyond their

aesthetic appeal, encompassing their symbolic roles within Iran's cultural and religious landscape, making them essential assets in the broader scope of urban heritage preservation.

A considerable number of experts regard gardens as effective **Solutions to contemporary urban environmental challenges (29%)**. They see these gardens as examples of human-made landscapes that function harmoniously with nature, making them unique elements within cities. Respondents noted that what distinguishes these gardens is not merely their aesthetic appeal, but their capacity to address various environmental issues, as discussed in the previous section. This ability to mitigate environmental problems further reinforces their significance in urban contexts. Also, this feature will be considered in answering the first research question.

The **"Triple Benefits" (24%)** subcode, accounting for nearly a quarter of expert responses, reflects the synergistic role gardens play in providing social, economic, and environmental benefits simultaneously. Respondents believed from an economic perspective, well-maintained gardens can attract tourism and increase property values, while from a social standpoint, they offer spaces for recreation and community engagement. Environmentally, they contribute to urban green space, improving air and water quality while providing habitats for local wildlife. This holistic view of gardens positions them as multifunctional spaces that generate a wide range of ecosystem services, essential for sustainable urban development.

A smaller, yet crucial theme that emerged from the interviews was the role of gardens in providing **Safe and inclusive spaces, particularly for women and children (12%)**. According to the respondents, gardens are perceived as safe and tranquil spaces where women and children can participate in recreational activities without concerns about harassment or violence. Respondents highlighted several benefits for children, stating that "*these spaces can have many positive effects on children's lives, allowing them to interact with nature by touching trees, running, and exploring their surroundings.*" They further emphasized that "*if you examine the historical use of gardens, there is no evidence of crime or harassment occurring within these spaces, a fact that holds true for gardens currently functioning as public spaces.*"

3.2.2.4 Contribution of Iranian Gardens to Contemporary Urban Life

The pie chart presents expert insights into the role of Iranian gardens in Contemporary Urban Life, based on interviews conducted. Although numerous studies have explored the historical and cultural significance of Iranian gardens, few have focused on their role in modern urban contexts. The first research question of this study seeks to address this gap by asking: How can Iranian gardens be integrated into contemporary cities and daily life to contribute to the achievement of the Sustainable Development Goals (SDGs)? The chart identifies three key ways in which these gardens contribute to urban environments today (Figure 3.8).

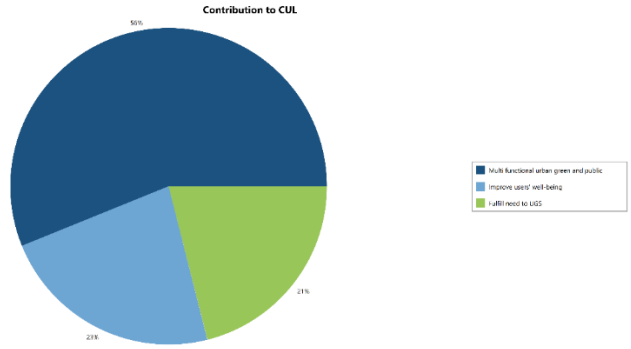


Figure 3.8 : Factors Linking Gardens to Contemporary Urban Life

Most respondents identify Iranian gardens as **Multifunctional urban green and public spaces (56%)** that facilitate various public activities. Throughout the coding process, interviewees highlighted several distinct functions of Iranian gardens that directly benefit users. To provide a comprehensive coding system and analysis of these multifunctional urban green spaces, this section is broken down into three subcodes: Public Spaces for social gathering, Public spaces for cultural exchange and activities, and recreational spaces which is represented by its pie chart (Figure 3.9).

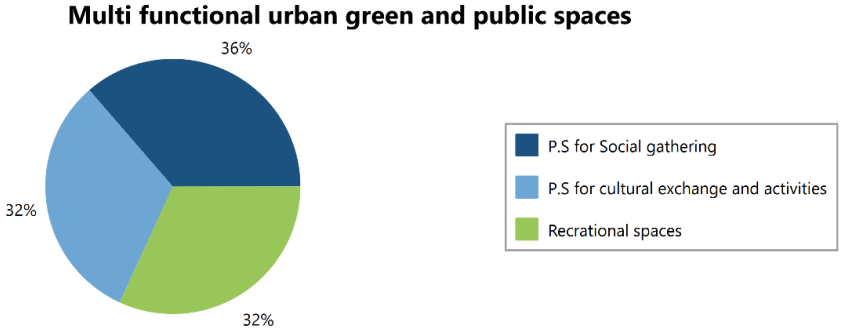


Figure 3.9 : Characteristics of gardens as multifunctional urban green and public spaces.

- **Public Spaces for social gathering (36%):** The largest proportion, accounting for 36%, is associated with social gathering points. According to the interviewees, Iranian gardens are considered essential public spaces that facilitate social interaction, where individuals can gather, engage in conversations, and reinforce social connections. Respondents emphasized the significance of these spaces in promoting community interaction and fostering collective engagement within urban settings. They also mentioned that the green spaces of gardens along with other natural elements are another attractive factor for visitors to select gardens as meeting points. These green and public spaces offer visitors not only the opportunity to connect with their historical and cultural roots but also to experience a sense of identity and belonging.
- **Public Spaces for cultural exchange and activities, and Recreational spaces (32%):** The second and third largest segments, each constituting 32%, represent areas for cultural exchange and Recreational spaces. Iranian gardens are perceived not only as places for leisure but also as important venues for cultural activities. Interviewees emphasized that these gardens serve as venues for cultural interaction, enabling the transmission of traditional values and the preservation of cultural heritage through diverse community-oriented activities. Celebrating different cultural activities in gardens offers local visitors the opportunity to connect with and strengthen their understanding of national cultural traditions. Furthermore, they serve as a platform for international visitors to gain a deeper appreciation of Iranian culture, promoting cross-cultural exchange and enhancing cultural awareness. Respondents emphasized that Iranian gardens function as public spaces for community gatherings and cultural celebrations. In Iran, each city is characterized by its unique cultural practices and seasonal activities, particularly those related to cuisine traditions and the celebration of seasonal events. According to the responses gathered, gardens play a significant role as important spaces for hosting these cultural activities. They provide a setting for community gatherings, where local traditions are celebrated and preserved. Moreover, their role as recreational spaces provides a serene environment where residents and visitors can relax and engage with others.

The second factor related to the contribution of gardens to contemporary urban life is improving users' physical and mental well-being. A significant proportion of respondents emphasized the role of gardens in **Improving users' well-being (23%)**. During the interviews, respondents highlighted the significant role Iranian gardens play in enhancing users' physical and mental well-being. Statements such as "*gardens are clean spaces, free from pollution, that support users' overall well-being, including both mental and physical health,*" underscore the therapeutic value of these spaces. Participants noted that gardens not only reduce stress but also offer adults the opportunity to reconnect with nature, which contributes to their emotional and physical health. Additionally, the gardens' aesthetic beauty and rich landscapes fulfill the inherent human need for connection with nature, further reinforcing their importance in promoting well-being. According to the perspectives of the interviewees, particularly academics, considering the lifestyle changes among Iranians—where individuals spend the majority of their time from morning until evening in workplaces dominated by concrete structures with limited access to green spaces—have increased the importance of these gardens. The green spaces within Iranian gardens are seen as valuable environments where individuals can relax and rejuvenate both physically and mentally after a long workday.

Finally, the remaining respondents underscored the importance of Iranian gardens in **Fulfilling the need for urban green spaces (21%)**. All respondents emphasized the crucial role of Iranian gardens in sustainable urban planning, especially in rapidly urbanizing areas where access to green spaces is becoming increasingly essential. Across all interview groups, participants recognized the potential of these gardens to meet the growing demand for green spaces in the urban environments of Iran. According to the interviewees, the significance of these green spaces extends beyond their contribution to environmental sustainability; they also serve as important public green spaces for city residents. Respondents made statements such as, "*Of course, the gardens are valuable resources for urban green spaces. They provide large areas where people can enjoy their time,*" and "*Gardens contribute a significant portion of green space to cities, enriching the urban environment.*" Additionally, they noted that Iranian gardens can play a key role in contemporary urban life by offering green spaces that not only enhance environmental quality but also preserve cultural heritage.

3.2.2.5 Iranian Gardens as Cultural heritage

The smallest portion of the coding system pie chart pertains to issues related to the cultural heritage features of gardens. This chart represents codes derived from respondents' answers to questions about public knowledge of the heritage significance of gardens and awareness of their cultural features. The pie chart illustrates interviewees' perspectives on the role of Iranian gardens in cultural heritage preservation, particularly focusing on public awareness and understanding of the gardens' cultural importance (Figure 3.10).

This section of the results addresses the second research question, which examines the obstacles and challenges that Iranian gardens face in the context of contemporary urban life.

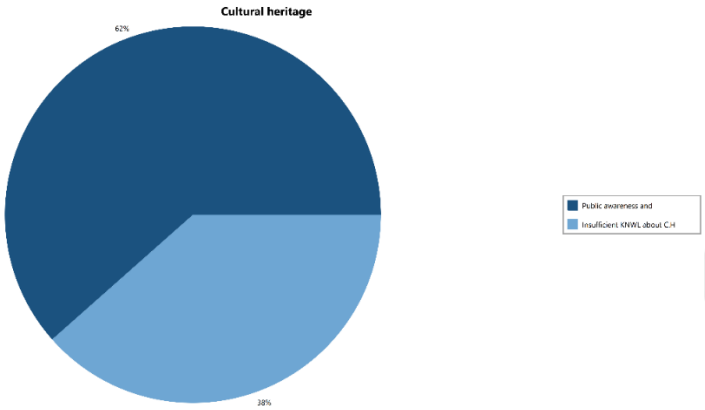


Figure 3.10 : Issues on Gardens from a Cultural Heritage Perspective

Most respondents highlighted the Importance of **Public awareness and engagement (62%)** concerning the cultural heritage of Iranian gardens. In particular, the academic group emphasized that public awareness and involvement in the preservation of these gardens are inadequate. Several scholars pointed out that, while the public may be familiar with prominent gardens, especially those recognized on UNESCO's World Heritage List, lesser-known gardens are at risk of being neglected. Additionally, the cultural heritage significance of these gardens is often undervalued, suggesting a need for more robust efforts to enhance awareness and promote preservation initiatives.

The smallest segment of the pie chart represents respondents' answers that contributed to the code titled **Insufficient Knowledge about Cultural Heritage" (38%)** regarding Iranian gardens. This reflects a notable gap in the understanding of the broader cultural significance of these gardens, despite their historical value. According

to interviewees, particularly academics and activists, the cultural heritage features of these gardens are not as widely recognized or understood as they should be. For instance, in the past, the connection between water and gardens played a central role in their design and function, but this relationship has since deteriorated. As a result, there is now only a superficial respect for these gardens, with the deeper significance often overlooked. Additionally, some respondents noted that while the cultural value of gardens inscribed on the UNESCO World Heritage List is well understood, more attention needs to be given to those gardens that are not as well-known.

3.3 Section Evaluation

According to the SDG Index (2024), Iran continues to face significant challenges in achieving SDGs 11 and 13, and major hurdles in reaching SDG 15. For SDG 11, the Sustainable Development Report (2024) demonstrates a decrease in the annual mean concentration of PM2.5 (µg/m³), shown in Figure 3.11, which is directly related to air quality—one of the biggest challenges facing cities in Iran. Regarding SDG 13, the most pressing issue, highlighted in Figure 3.12, is CO2 emissions resulting from fossil fuel combustion and cement production. Additionally, SDG 15 challenges, such as the mean area protected for biodiversity and imported deforestation, are critical concerns for urban areas, as depicted in Figure 3.13.

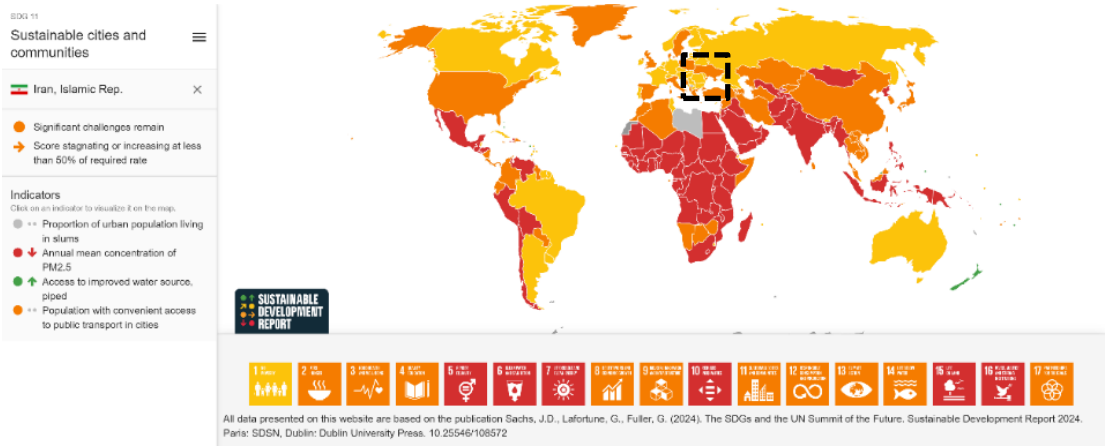


Figure 3.11 : State of Iran in reaching SDG 11 (SDG index, 2024)

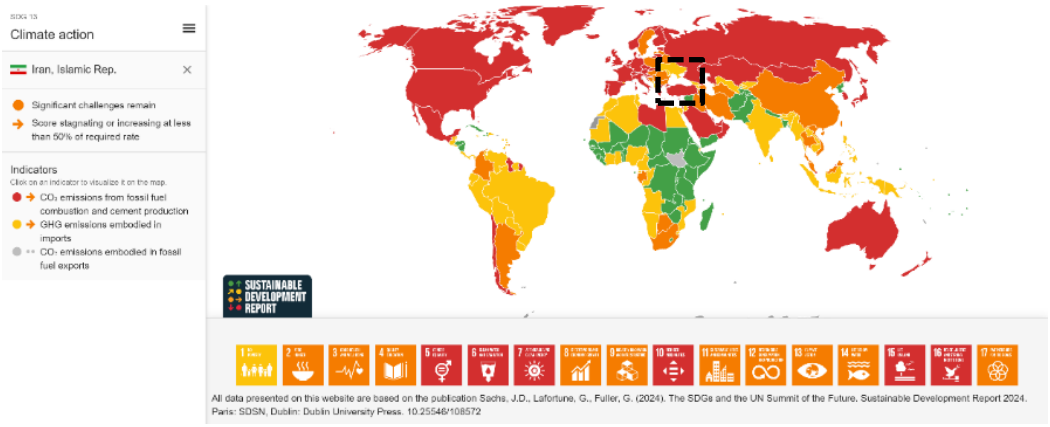


Figure 3.12 : State of Iran in reaching SDG 13 (SDG index, 2024)

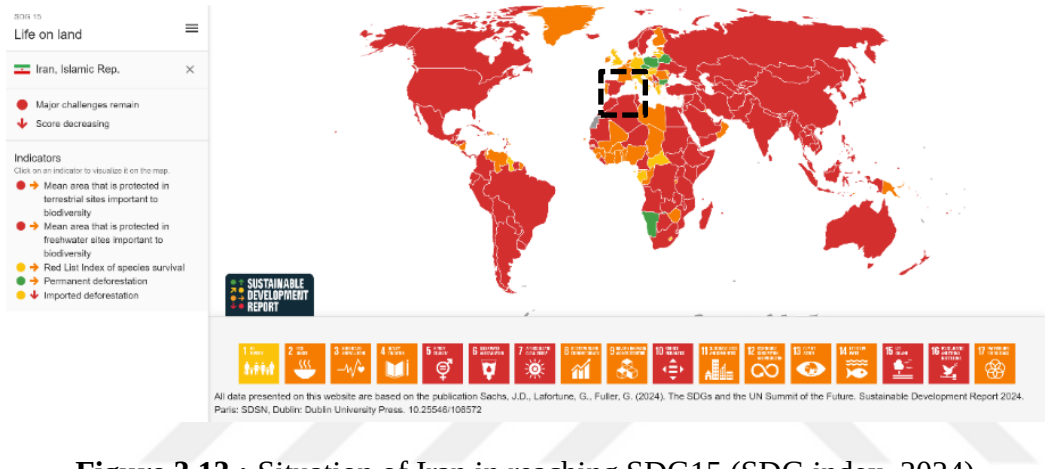


Figure 3.13 : Situation of Iran in reaching SDG15 (SDG index, 2024)

The analysis of interviews' data, addressing the research question, "How can Iranian gardens be integrated into contemporary cities and daily life to help achieve the Sustainable Development Goals (SDGs)?", reveals that these gardens hold substantial potential to contribute to SDGs 11 (Sustainable cities and communities), 13 (Climate action), and 15 (Life on land) in urban environments. If integrated effectively into urban planning and daily life, Iranian gardens can serve as multifunctional green spaces that support various SDGs, including climate resilience, public health enhancement, and sustainable urban development.

Contribution to Sustainable Cities and Communities (SDG 11): Iranian gardens play a pivotal role in supporting SDG 11 by promoting environmental sustainability, enhancing social well-being, and preserving cultural heritage. The findings from the data analysis highlight the cultural and historical significance of these gardens, which aligns with **Target 11.4**, focused on strengthening efforts to protect and safeguard the world's cultural and natural heritage. Beyond their aesthetic value, Iranian gardens hold symbolic importance within the Iranian cultural and religious context, making

them invaluable assets for urban heritage conservation. These gardens preserve traditional architectural, horticultural, and landscape design elements, ensuring that cultural heritage is passed on to future generations. Through the preservation and restoration of traditional elements such as water channels, pavilions, and plant compositions, cities can maintain the historical value of these gardens while promoting sustainable urban development.

The research results further emphasize that Iranian gardens, as multifunctional public green spaces, can be directly linked to **Target 11.7**, which promotes universal access to safe, inclusive, and accessible green spaces, particularly for women, children, the elderly, and persons with disabilities. Historically, Iranian gardens have been accessible to a wide range of societal groups, positioning them as exemplary inclusive public spaces. As green spaces, they offer opportunities for users of all ages to socialize, engage in cultural activities, and participate in recreational pursuits. Furthermore, the gardens contribute to temperature regulation and provide natural habitats that promote biodiversity. In addition to their environmental contributions, research results demonstrate that Iranian gardens also function as vital public spaces, fostering social interaction, community engagement, and recreational activities. The results of data analysis also reveal that these spaces are particularly beneficial for women and children, an important yet often overlooked aspect of their potential. The public nature of these gardens strengthens local communities, promoting social cohesion by providing inclusive venues for cultural and social gatherings. These spaces enhance the overall quality of life in urban settings, offering residents opportunities for recreation and community events, which are crucial for the livability of cities.

The result of the analysis suggests that these gardens have the potential to contribute significantly to urban resilience by improving air quality, reducing urban heat islands, and mitigating the effects of climate change. These aspects contribute to **Target 11.3**, which advocates for inclusive and sustainable urbanization. In the context of urban sprawl and development pressures, these gardens can serve as ecological buffers, supporting overall city sustainability.

Therefore, the integration of Iranian gardens into contemporary urban planning presents an opportunity to address multiple SDGs, particularly SDG 11. As multifunctional green spaces, these gardens contribute to urban sustainability by

promoting cultural heritage conservation, enhancing social well-being, and improving environmental resilience. With proper restoration and integration, Iranian gardens can fulfill their potential as vital components of sustainable urban development, offering both ecological and social benefits that align with the broader objectives of the SDGs.

Contribution to Climate Action (SDG 13): The data analysis highlights a strong relationship between Iranian gardens and SDG 13 due to their sustainable practices, ecological benefits, and resilience to climate challenges. Among the environmental sustainability characteristics, the ability of gardens to improve air quality is ranked as the most important aspect. Iranian gardens, with their rich vegetation and trees, contribute substantially to carbon sequestration and air quality enhancement, directly addressing climate change mitigation. The trees within these gardens serve as carbon sinks, absorbing and storing carbon dioxide, thus reducing the levels of greenhouse gases in the atmosphere. Additionally, these green spaces have the potential to improve urban air quality by absorbing pollutants and releasing oxygen, making their preservation even more critical in an era of increasing air pollution driven by climate change.

Furthermore, many of the plants found in Iranian gardens are drought-resistant species, which require minimal water. This demonstrates the importance of selecting vegetation that can adapt to the region's changing climate. Data also reveal the gardens' capacity to reduce urban heat islands and moderate the extreme weather conditions of Iran. A significant number of experts emphasized the environmental benefits of these gardens, identifying them as effective solutions to contemporary urban environmental challenges. Iranian gardens contribute to ecological sustainability by mitigating the impacts of urban heat islands, enhancing air quality, and promoting biodiversity within cities. Huge amount of urban greenery plays a crucial role in temperature regulation and pollution reduction, offering both immediate and long-term ecological advantages.

In conclusion, the results of the data analysis suggest a close connection between Iranian gardens and the achievement of SDG 13 in urban areas. These gardens provide crucial environmental solutions, making them vital assets in addressing climate-related challenges in cities across Iran.

Contribution to life on land (SDG 15): The data analysis demonstrates a strong connection between Iranian gardens and SDG 15, which focuses on the protection,

restoration, and sustainable use of terrestrial ecosystems, sustainable forest management, combatting desertification, halting biodiversity loss, and protecting natural habitats. According to respondents, Iranian gardens host a wide variety of resilient and diverse plant species, providing crucial habitats for wildlife. These gardens play a vital role in biodiversity conservation by sustaining a diverse range of plant species, many of which are adapted to the region's arid climate. They also offer habitats for birds, insects, and small animals, supporting species that thrive in urban settings and offering a refuge for wildlife threatened by urbanization and habitat destruction. This is closely aligned with **Target 15.5**, which seeks to halt biodiversity loss. Thus, the preservation of Iranian gardens is essential for maintaining biodiversity in areas vulnerable to desertification and urban sprawl, ensuring the preservation of vital ecosystems in and around urban areas.

Furthermore, the study findings indicate that, within cities, Iranian gardens function as key green spaces that enhance ecological health and provide recreational areas for users. Restoring these gardens contributes to the reclamation of degraded land, transforming it into vibrant, productive ecosystems. Through garden rehabilitation projects, degraded landscapes are restored to lush, sustainable environments, supporting both biodiversity and sustainable land use. These efforts align with **Target 15.3**, which emphasizes the restoration of degraded lands. Iranian gardens offer a historical model of how biodiversity and ecosystem values can be successfully integrated into human-designed landscapes. By applying these principles in contemporary urban planning and development, societies can improve the sustainability and resilience of their environments, thereby contributing to biodiversity conservation following **Target 15.9**.

In conclusion, Iranian gardens exemplify the integration of biodiversity and ecosystem values into urban landscapes, providing critical environmental benefits that contribute to the achievement of SDG 15. Their preservation and restoration play a pivotal role in halting biodiversity loss, combating desertification, and promoting sustainable land use, offering a model for sustainable urban development. Therefore, the integration of Iranian gardens into modern cities requires a comprehensive strategy that equally acknowledges and values their historical, cultural, economic, and environmental significance and potential. A primary focus of this strategy should be the development of policies for the conservation, restoration, regeneration, and adaptive reuse of these

gardens, ensuring their functions are aligned with contemporary urban needs, particularly for gardens not registered in the UNESCO list.

The analysis of data addressing the second research question, **"What obstacles do Iranian gardens face in fulfilling their potential in today's cities?"**, reveals that issues related to conservation and restoration are the most significant challenges preventing these gardens from fully realizing their potential. One of the primary concerns is the absence of specific studies or strategies outlining how these gardens can be restored or adaptively reused in ways that best serve both the cities and their citizens. The inadequate and inappropriate management of historical urban spaces and gardens, compounded by unsuccessful government policies on their conservation and restoration, has accelerated the degradation and shrinkage of these green spaces. Neglect and mismanagement of historical gardens substantially diminish urban green spaces and undermine their effectiveness. Thereby, it leads to depriving communities of essential leisure green and cultural public spaces.

For centuries, gardens have been an integral part of Iranian life, deeply embedded in the country's cultural, social, and environmental fabric. As a result, any efforts aimed at their conservation or restoration must consider the needs and preferences of users without compromising the gardens' historical integrity. Failing to engage the public in the planning and decision-making processes when restoring these gardens can result in the assignment of inappropriate functions that do not align with users' needs, ultimately leading to their underutilization. This mismatch between function and user preference is a significant obstacle that prevents historical gardens from realizing their potential in urban environments.

When historical gardens are reused without consideration of community needs, their utilization declines, undermining their role as valuable social and recreational spaces.

Rapid and unplanned urban development poses another critical threat to Iranian gardens. These spaces are essential for relaxation, recreation, and social interaction, acting as hubs for community well-being and social cohesion. However, their loss due to rapid urbanization disrupts these vital functions. The short-term economic benefits brought by such development often overshadow the long-term social, environmental, and economic advantages that preserved historical gardens can offer. In particular,

gardens hold immense potential for local economic stimulation through tourism, yet the deterioration of these spaces results in lost economic opportunities.

Iranian historical gardens also play a crucial role in addressing environmental issues, particularly through carbon sequestration and temperature regulation. Their degradation intensifies urban environmental challenges, such as the urban heat island effect, reduced biodiversity, and disrupted water management. By failing to preserve these gardens, cities abandon natural solutions to combat climate change and promote environmental sustainability.

Another primary obstacle to the preservation of these gardens is the prioritization of economic profit over long-term sustainability. While development projects may generate immediate financial gains, they often overlook the longer-term benefits of preserving gardens for tourism, local business growth, and community health. By focusing on short-term economic returns, cities place historical gardens at significant risk, leading to cultural, environmental, and social losses.

The degradation and shrinking of Iranian gardens are not issues confined to Iranian cities; their destruction has far-reaching global implications. The loss of these spaces contributes to global warming by eliminating critical carbon sinks, exacerbating urban heat, disrupting water management, and reducing biodiversity. Moreover, as urban air quality declines, air pollution worsens, and the overall environmental quality suffers. Preserving these gardens is thus not only essential for safeguarding Iran's cultural and historical heritage but also for their pivotal role in mitigating climate change and advancing global environmental sustainability.

In conclusion, Iranian gardens are vital urban green spaces that, if restored and managed appropriately, can contribute to cultural preservation, social cohesion, environmental sustainability, and economic growth. Overcoming the challenges posed by rapid urbanization, inappropriate function assignments, and misguided economic priorities is essential to unlocking their full potential in contemporary cities.

4. CONCLUSION

This study investigates the possible potential of Iranian gardens that help cities reach Sustainable Development Goals (SDGs) in urban areas. Highlighting these potentials can help cities progress toward global objectives.

In line with these aims, the study's objectives are to understand the relationship between gardens and sustainable development, exploring how these gardens can be integrated into contemporary urban settings to support sustainability goals. Also, this study tries to examine the state of Iranian gardens in the 2^{1st} century and identify the obstacles that prevent these gardens from realizing their potential in urban areas.

To answer the research questions which are in alignment with the research aim, this study implied qualitative research methodology. Conducting in-depth interviews was used as the main method of qualitative research methodology for data collection. Conducting interviews with academic experts, city managers, and activists provides the study with a comprehensive understanding of Iranian gardens, their potential, and the challenges they encounter in modern urban contexts.

The initial phase of this research started by reviewing the existing literature on Iranian gardens and Sustainable Development Goals (SDGs) separately. Studies on the SDGs highlight the critical role of urban green spaces in reaching different SDGs, particularly SDG 11 "Sustainable cities and communities", SDG 13 "Climate action" and SDG 15 "Life on land". Therefore, this insight led the study to identify a potential link between Iranian gardens and the SDGs. However, the lack of studies on this specific relationship continues a gap in the literature and emphasizes the importance of conducting and the need for this study. On the other hand, much of the existing literature related to Iranian gardens has predominantly focused on the aesthetic qualities of Iranian gardens and their design features, often overlooking the significant challenges these spaces face. This gap in research neglects the risks of deterioration and the obstacles that prevent these gardens from fully realizing their potential within urban environments. Therefore, the other objective of the study was to explore the pressing issues that threaten the preservation and sustainability of these gardens.

As mentioned in the previous section, to understand the connection between Iranian gardens and related SDGs, interviews were done with experts. The interview questions were designed with two primary objectives: first, to identify the potential and benefits of gardens in contributing to the achievement of the SDGs, and second, to explore the obstacles that prevent these gardens from fully realizing their potential. The final results of the study reveal a strong correlation between gardens and Sustainable Development Goals specifically, **Target 11.4**, focused on strengthening efforts to protect and safeguard the world's cultural and natural heritage, **Target 11.7**, which promotes universal access to safe, inclusive, and accessible green spaces, particularly for women, children, the elderly, and persons with disabilities, **Target 11.3**, which advocates for inclusive and sustainable urbanization, **Target 15.5**, which seeks to halt biodiversity loss, **Target 15.3**, which emphasizes the restoration of degraded lands, and **Target 15.9** which is contributing to biodiversity conservation. Additionally, the results of the data analysis suggest a close connection between Iranian gardens and the achievement of **SDG 13** in urban areas. These gardens provide crucial environmental solutions, making them vital assets in addressing climate-related challenges in cities across Iran.

Additionally, this study identifies several key challenges currently hindering Iranian gardens from realizing their full potential in urban settings, including issues related to conservation and restoration, insufficient attention to user needs, the implementation of inappropriate policies, urbanization pressures, and the impact of UNESCO World Heritage site registration. These findings address gaps in the literature concerning the contribution of Iranian gardens to the SDGs and highlight the reasons contributing to their risk of deterioration and underutilization in cities

This study seeks the answer to the questions "**How can Iranian gardens be integrated into contemporary cities and daily life to help achieve the Sustainable Development Goals (SDGs)?**" and "**What obstacles do Iranian gardens face in fulfilling their potential in today's cities?**"

The research findings indicate that gardens are among the most valuable urban green spaces, with the potential to provide significant environmental, social, and economic benefits when effectively integrated into contemporary cities. These gardens can serve as public green spaces, offering safe areas for social gatherings, cultural activities, and recreation, while also facilitating social exchange and community engagement. Iranian

gardens are considered effective solutions for contemporary environmental challenges. The gardens improve air quality and purify it, reduce urban heat islands effect, moderate the harsh weather with their resilient plant species, and slow down the climate change effects. Therefore, the first step in effectively integrating gardens into contemporary cities is to recognize, understand, and appreciate their features and functions beyond their aesthetic appeal. It is essential to acknowledge the crucial environmental, economic, and social roles these gardens can play in urban contexts. Without considering their potential contributions from these three perspectives, along with users' evolving expectations due to lifestyle changes, the preservation and adaptive reuse of gardens will be unattainable. Accordingly, the prioritization of identifying, defining, and implementing appropriate urban policies for the conservation, regeneration, and adaptive reuse of Iranian gardens that recognize the gardens as part of the city's green infrastructure is a crucial step in their integration into contemporary cities. These policies must equally consider the economic, environmental, and social benefits that gardens provide, ensuring a balanced approach. Moreover, this process must be carried out with careful attention to the needs and expectations of users, ensuring that the gardens remain relevant and functional in modern urban contexts.

About the second question, according to the 2024 SDG Index, Iran continues to face significant challenges in achieving the Sustainable Development Goals (SDGs). While the findings of this study highlight the cultural heritage significance of Iranian gardens and their substantial environmental benefits—such as improving air quality, enhancing climate adaptation, mitigating urban heat islands, and moderating extreme weather conditions—alongside their social advantages, these gardens represent key assets for advancing the SDGs in Iranian cities. However, obstacles such as issues with conservation and restoration, insufficient attention to users' needs during adaptive reuse or regeneration planning, the implementation of inappropriate policies (often tied to a disregard for user needs and not considering gardens as a whole system in urban development), urbanization pressures, and unequal consideration of gardens, whether listed by UNESCO or not, are contributing to their decline rather than facilitating their expansion and integration into urban landscapes. Also, implementing a strategy to protect gardens by addressing them at an urban planning scale, rather than on an individual basis is another important issue that should be paid attention to during urban

development process. It can help prevent the risks posed by urbanization and development decisions in areas adjacent to these gardens. At this point, it is essential to establish buffer zones around the gardens, where land use, function, and construction activities in these areas should be managed by prioritizing the sustainability of the gardens.

The findings of this study reveal that the majority of issues identified by experts concerning Iranian gardens pertain to challenges and obstacles associated with their preservation and use. Although the potential of these gardens was also highlighted as a significant factor, the existing problems have hindered their ability to be fully utilized in urban contexts. This suggests that, despite their capacity to contribute to achieving the Sustainable Development Goals (SDGs), the barriers must be addressed to unlock their full potential. Additionally, the Qanat system is a crucial part of gardens in terms of garden irrigation. However, during the interviews, while respondents acknowledged the importance of Qanat in gardens, its related challenges were expected to come to the fore more. This also serves as further evidence that gardens are facing more pressing problems in cities due to fast urbanization. Addressing these challenges in detail could be a valuable area for future research.

A significant concern regarding Iranian gardens that are not registered on the UNESCO World Heritage list is the lack of public awareness about their value. Organizing cultural festivals, which are often limited to more famous gardens, as well as promoting garden tours or heritage days dedicated to these lesser-known spaces, could enhance public understanding. By encouraging people to personally experience the beauty and historical importance of these gardens, a deeper appreciation for their cultural significance can be cultivated. Additionally, employing a participatory planning process in the regeneration of gardens can be an effective strategy for raising public awareness about their cultural significance. Exploring methods for implementing participatory regeneration planning could be a valuable focus for future research.

Furthermore, the results derived from the main codes underscore the importance of cultural heritage in everyday life and demonstrate how these cultural landscapes can positively impact urban environments. Thus, understanding the role of cultural heritage landscapes beyond their aesthetic value presents another critical area for future exploration. Also, the findings of this study reveal a significant gap in public

awareness and engagement in preserving these gardens. This issue highlights the fact that gardens listed as UNESCO World Heritage sites receive greater physical and cultural attention, while those not on the list suffer from a lack of recognition and knowledge. Consequently, this gap could be a focus for future research, particularly regarding the overlooked gardens that are deteriorating over time.

Gardens, particularly those not included on the UNESCO World Heritage list, should be restored using a comprehensive planning framework and holistic conservation principles. This approach should consider the various elements of the gardens, such as design features, landscape significance, and cultural heritage while adapting them to meet contemporary needs through adaptive reuse. Further research and practical applications are necessary in this direction.

Exploring the role of Iranian gardens in contemporary urban life, alongside the lack of consideration for users' needs in the reuse of gardens, presents a promising area for future research. Future studies needs to understand the relationship between users and Iranian gardens, investigating what users require, their expectations from gardens in light of changing lifestyles, and how gardens can be socially and culturally adapted to modern urban living.

Another key issue relates to the environmental sustainability of gardens, highlighting their potential to contribute to the development of sustainable cities. The role of gardens in regulating microclimates is particularly significant, and further research could explore how the functions of Iranian gardens can provide valuable insights for enhancing urban sustainability and improving microclimate regulation in urban development planning.

These gardens are invaluable cultural, environmental, social, and economic resources, offering significant benefits not only to Iranian cities and their inhabitants but also to urban landscapes globally. Their potential to address challenges related to the Sustainable Development Goals (SDGs) within Iranian cities is substantial. The diverse characteristics of Iranian gardens, along with issues related to their conservation, regeneration, and adaptive reuse, present a rich interdisciplinary field for research within urban and landscape studies. Iranian gardens, with their unique features such as historical design principles, diverse plant species, and wand methods for water management, serve as excellent examples of climate adaptation. Future

research focusing on these elements could provide valuable insights for urban areas facing similar climate conditions, potentially leading to the development of a sustainable model for such environments. Additionally, these studies could inform best practices for incorporating traditional landscape strategies into modern urban planning, fostering resilience and sustainability in cities worldwide. Therefore, it is imperative to raise awareness about the urgent need for policies focused on the conservation, restoration, and regeneration of these gardens before the opportunity to safeguard these vital urban assets is lost.

In conclusion, this study was conducted to fill a gap in the literature about the possible contribution of Iranian gardens to the Sustainable Development Goals (SDGs). Utilizing a qualitative methodology that gathered insights from relevant experts, the findings highlighted key themes such as the challenges and obstacles of Iranian gardens, their role in environmental sustainability, their significance, their contributions to contemporary urban life, and issues related to their cultural heritage. The study also identified the interconnections between these themes and gardens and provided a comprehensive analysis of the potential and challenges of Iranian gardens.

REFERENCES

Abbas, M. Y., Nafisi, N., & Nafisi, S. (2016). Persian garden, cultural sustainability and Environmental Design Case Study shazdeh garden. Procedia - Social and Behavioral Sciences, 222, 510–517. https://doi.org/10.1016/j.sbspro.2016.05.142

Akuraju, V., Pradhan, P., Haase, D., Kropp, J. P., & Rybski, D. (2020). Relating SDG11 indicators and urban scaling – an exploratory study. *Sustainable Cities and Society*, *52*, 101853. https://doi.org/10.1016/j.scs.2019.101853

Amani-Beni, M., Xie, G., Yang, Q., Russo, A., & Khalilnezhad, M. R. (2021). Socio-cultural appropriateness of the use of historic Persian gardens for modern urban Edible Gardens. *Land*, *11*(1), 38. https://doi.org/10.3390/land11010038

Ansari, S. (2015). *An investigation into water usage and water efficient design for Persian Gardens* (thesis).

Babnik, I. (2020). Historical gardens as an inspiration for the future of Urban Horticultural Gardens. *Urban Horticulture - Necessity of the Future*. https://doi.org/10.5772/intechopen.90350

Bahrami, F., & amp Grose, M. J. (2021). The surviving, partially destroyed, and lost Persian Gardens of Kerman, Iran. *Urban Forestry & Urban Greening*, *65*, 127367. https://doi.org/10.1016/j.ufug.2021.127367

Erkan, Y. (2018). The way forward with historic urban landscape approach towards Sustainable Urban Development. *Built Heritage*, *2*(4), 82–89. https://doi.org/10.1186/bf03545686

Environment, U. (2023). *Nature for climate action*. UNEP. https://www.unep.org/resources/factsheet/nature-climate-action

***European Union and United Nations Sign Agreement to help partner countries accelerate progress towards Sustainable Development Goals*. EU Neighbours**. (2022). https://south.euneighbours.eu/news/european-union-and-united-nations-sign-agreement-help-partner/

Fadaie, H., & Mofidi, S. M. (2014). The sustainability of Persian Gardens in arid regions: A comparative study: Case studies: Gardens of yazd and Kashan, Iran. *The International Journal of Architectonic, Spatial, and Environmental Design*, *7*(3), 45–56. https://doi.org/10.18848/2325-1662/cgp/v07i03/38371

Fekete, A., & Haidari, R. (2015). Special aspects of water use in Persian Gardens. *Acta Universitatis Sapientiae, Agriculture and Environment*, *7*(1), 82–88. https://doi.org/10.1515/ausae-2015-0007

Filho, W., Wall, T., Salvia, a, Pimenta Dinis, m, & Mifsud, m. (n.d.). The central role of climate action in achieving the United Nations' Sustainable Development Goals. http://www.nature.com/scientificreports

Gachkar, S., Gachkar, D., Abbaszadeh, M., Aghlmand, S., & Sattary, S. (2022). The characteristics of Persian Historical Gardens (case study: Emarat Birooni Garden of Urmia, Iran). *HABITAT*, *33*(3), 287–308. https://doi.org/10.21776/ub.habitat.2022.033.3.28

Göker, P. (2017). An analysis of water features in Persian Gardens; Bagh-e shahzadeh. *International Journal of Environmental Science and Development*, *8*(9), 661–664. https://doi.org/10.18178/ijesd.2017.8.9.1034

Hasna, A. M. (2012). Dimensions of sustainability. *Journal of Engineering for Sustainable Community Development*, *1*(2), 47–57. https://doi.org/10.3992/2166-2517-1.2.47

Hyder, Md. B., & Haque, T. Z. (2022). Understanding the linkages and importance of urban greenspaces for Achieving Sustainable Development Goals 2030. *Journal of Sustainable Development*, *15*(2), 144. https://doi.org/10.5539/jsd.v15n2p144

Idiata, D. (2016). Understanding the role of Green Infrastructure (GI) in tackling climate change in today's world. *International Journal of Environment and Sustainability*, *5*(1). https://doi.org/10.24102/ijes.v5i1.661

Irandoost, K., Alizadeh, H., & Rasouli, M. (2022). International Conference on Advanced Technology. Kuala Lumpur. Retrieved from https://www.researchgate.net/publication/322329694.

Jim, C. Y. (2004). Green-Space Preservation and allocation for sustainable greening of Compact Cities. *Cities*, *21*(4), 311–320. https://doi.org/10.1016/j.cities.2004.04.004

Khalilnezhad, S. M. R. (2017). Distinctive features of productive landscapes in Persian Gardens. *Acta Horticulturae*, (1189), 35–38. https://doi.org/10.17660/actahortic.2017.1189.6

Khoshouie, M. R., & Alborzi, F. (2016). The feasibility of using Persian garden elements in today's urban areas toward Social Interaction Enhancement. *TURKISH ONLINE JOURNAL OF DESIGN, ART AND COMMUNICATION*, *6*(JLYSPCL), 405–414. https://doi.org/10.7456/1060jse/007

Kosmopoulos, P. (2024). *Planning and management of solar power from space*. Academic Press, an imprint of Elsevier.

Kothencz, G., Kolcsár, R., Cabrera-Barona, P., & Szilassi, P. (2017). Urban Green Space Perception and its contribution to well-being. *International Journal of Environmental Research and Public Health*, *14*(7), 766. https://doi.org/10.3390/ijerph14070766

Koyunoğlu, A. B., & Zeren Gülersoy, N. (2022). What fundamental indicators should be used to measure the change in the historic urban landscape approach. *Iconarp International J. of Architecture and Planning*. https://doi.org/10.15320/iconarp.2022.217

Kuklina, V., Sizov, O., & Fedorov, R. (2021). Green spaces as an indicator of urban sustainability in the Arctic cities: Case of Nadym. *Polar Science*, *29*, 100672. https://doi.org/10.1016/j.polar.2021.100672

Laylin, D. (2018). Environmental and wildlife degradation in Iran. *Human Rights Documents Online*. https://doi.org/10.1163/2210-7975_hrd-0128-20180024

Lian, J., Nijhuis, S., Bracken, G., Wu, X., Wu, X., & Chen, D. (2024). Conservation and development of the historic garden in a landscape context: A systematic literature review. *Landscape and Urban Planning*, *246*, 105027. https://doi.org/10.1016/j.landurbplan.2024.105027

Liu, X., & Zhu, W. S. (2021). Sustainability approaches to Chinese landscape architecture. *Interdisciplinary Science Reviews*, *46*(4), 689–702. https://doi.org/10.1080/03080188.2021.1897748

Lorenzo-Sáez, E., Lerma-Arce, V., Coll-Aliaga, E., & Oliver-Villanueva, J.-V. (2021). Contribution of green urban areas to the achievement of sdgs. case study in Valencia (Spain). *Ecological Indicators*, *131*, 108246. https://doi.org/10.1016/j.ecolind.2021.108246

Mahdi Nejad, J.-D., Azemati, H., Zarghami, E., & Abad, A. S. (2017). The role of water in Persian Gardens. *Open Journal of Ecology*, *07*(01), 41–54. https://doi.org/10.4236/oje.2017.71004

Mahdizadeh, S. (2016). *Historical gardens in transition in 20th Century Iran: A critical analysis of garden conservation* (thesis). *Historical gardens in transition in 20th century Iran: a critical analysis of garden conservation*.

Mahdizadeh, S., & Rajendran, L. P. (2018). A renewed approach to conservation policy of Historical Gardens in Iran. *Landscape Research*, *44*(1), 48–61. https://doi.org/10.1080/01426397.2017.1413176

Mahmoudi Farahani, L., Motamed, B., & Jamei, E. (2016). Persian gardens: Meanings, symbolism, and design. *Landscape Online*, *46*, 1–19. https://doi.org/10.3097/lo.201646

Nabiyeva, G. N., Wheeler, S. M., London, J. K., & Brazil, N. (2023). Implementation of Sustainable Development goal 11 (Sustainable Cities and communities): Initial good practices data. *Sustainability*, *15*(20), 14810. https://doi.org/10.3390/su152014810

OECD (2012), *OECD Environmental Outlook to 2050: The Consequences of Inaction*, OECD Publishing, Paris, https://doi.org/10.1787/9789264122246-en.

Paiva, P. D., Sousa, R. de, & Alves, S. F. (2021). Patchwork quilt: A methodology proposed for the study of Historic Gardens. *Urban Forestry & Urban Greening*, *62*, 127169. https://doi.org/10.1016/j.ufug.2021.127169

Patrick, R., Shaw, A., Freeman, A., Henderson-Wilson, C., Lawson, J., Davison, M., Capetola, T., & Lee, C. K. (2019). Human wellbeing and the health of the environment: Local indicators that balance the scales. *Social Indicators Research*, *146*(3), 651–667. https://doi.org/10.1007/s11205-019-02140-w

Pilehvar, A. (2021). Spatial-geographical analysis of urbanization in Iran. *Humanities and Social Sciences Communications*, *8*(1). https://doi.org/10.1057/s41599-021-00741-w

Prigioniero, A., Sciarrillo, R., Spuria, L., Zuzolo, D., Marziano, M., Scarano, P., Tartaglia, M., & Guarino, C. (2020). Role of historic gardens in biodiversity-conservation strategy: The example of the giardino inglese of Reggia di Caserta (UNESCO) (Italy). *Plant Biosystems - An International Journal Dealing with All Aspects of Plant Biology*, *155*(5), 983–993. https://doi.org/10.1080/11263504.2020.1810812

Qi, Y., Bhunia, P., Zhang, T. C., Luo, F., Lin, P., & Chen, Y. (2020). Environmental degradation and Sustainability. *Sustainability*, 483–505. https://doi.org/10.1002/9781119434016.ch23

Razmara, M., Asadpour, H., & Taghipour, M. (2020). Healing landscapes: The effects of its parameters on different gender (Case study: Eram garden & azadi park of shiraz-iran). *Nature: National Academic Journal of Architecture*, *7*(2), 183. https://doi.org/10.24252/nature.v7i2a4

Rostami, R., Lamit, H., Khoshnava, S. M., & Rostami, R. (2014). The role of historical Persian Gardens on the health status of contemporary urban residents. *EcoHealth*, *11*(3), 308–321. https://doi.org/10.1007/s10393-014-0939-6

Rostami, R., Lamit, H., Khoshnava, S., Rostami, R., & Rosley, M. (2015). Sustainable Cities and the contribution of historical urban green spaces: A case study of historical Persian Gardens. *Sustainability*, *7*(10), 13290–13316. https://doi.org/10.3390/su71013290

SDG 11.7.1 - SDG indicator metadata - the United Nations. (2021). https://unstats.un.org/sdgs/metadata/files/Metadata-11-07-01.pdf

Shayanfar, A., & Rynnimeri, V. (2019). *Learning from the past: Recreating historic Persian Gardens in downtown Tehran* (thesis). *Learning from the past: recreating historic Persian gardens in downtown Tehran*.

Sturiale, l, & Scuderi, a. (2019). The role of green infrastructures in urban planning for climate change adaptation. *Climate*, *7*(10), 119. https://doi.org/10.3390/cli7100119

Tate, C., Wang, R., Akaraci, S., Burns, C., Garcia, L., Clarke, M., & Hunter, R. (2024). The contribution of urban green and blue spaces to the United Nation's sustainable development goals: An evidence gap map. *Cities*, *145*, 104706. https://doi.org/10.1016/j.cities.2023.104706

Tehran's air quality in orange status. (2023). https://www.irna.ir/news/85286975/کیفیت-هوای-تهران-در-وضعیت-نارنجی

UN-Habitat (2018). SDG Indicator 11.7.1 Training Module: Public Space. United Nations Human Settlement Programme (UN-Habitat), Nairobi.

UN system-wide strategy on Sustainable Urban Development. (2019). https://unhabitat.org/sites/default/files/documents/2019-07/un-system-wide-strategy-on-sustainable-urban-development-1.pdf

Vukmirovic, M., Gavrilovic, S., & Stojanovic, D. (2019). The improvement of the comfort of public spaces as a local initiative in coping with climate change. *Sustainability*, *11*(23), 6546. https://doi.org/10.3390/su11236546

Wey, Y. E., Sarma, V., Lechner, A. M., & Nath, T. K. (2022). Malaysians' perception on the contribution of urban green spaces to the UN Sustainable Development Goals. *Urban Forestry & Urban Greening*, *78*, 127792. https://doi.org/10.1016/j.ufug.2022.127792

Yigitcanlar, T., & Kamruzzaman, Md. (2015). Planning, development and management of Sustainable Cities: A commentary from the guest editors. *Sustainability*, *7*(11), 14677–14688. https://doi.org/10.3390/su71114677

YouTube. (n.d.). YouTube. https://www.youtube.com/watch?v=Wgyx-eMRL3M&list=PLbYUB-wRbjVz_LJeOU3gBineeJsbNi4su&index=3

Zamani, E., Leylian, M., Amirkhano, A., &Okhovat, H. (2009). Recognition and Analyses of the Persian Gardens` Elements with Respect to Ethical Principles, BaghMAnzar, Bagh-SJ. (n.d.). https://www.bagh-sj.com/article_118624_5656a4981ed991b6f71fc3592ca4dc39.pdf?lang=en

CURRICULUM VITAE

Name Surname **:** Seyyedeh Mahsa MOUSAVIGHARALARI

EDUCATION:

- **B.Sc.** **:** 2011, Islamic Azad University, Faculty of Architecture, Architectural Engineering Technology Department
- **M.Sc.** **:** 2017, Tehran Science and Research University, Faculty of Architecture, Architectural Engineering Department

PUBLICATIONS, PRESENTATIONS AND PATENTS ON THE THESIS:

- **Mousavigharali M., Kisar koramaz E.,** 2023: Conservaon of green spaces; A quick step to reach SDG; Case of Iranian gardens, XXX conference in the series of garden art and historical dendrology, XII international edition Sustainable development goals in managing the cultural and historic landscape. Online.

OTHER PUBLICATIONS:

- **Sabatsani N, Mousavigharalari S.Mahsa.,** 2018: Examining the importance of citizenship rights in historical urban spaces and architecture; a case study on Urmia city, The third national conference on the interpretation of citizenship rights, Urmia, Iran
- **Sabatsani N, Mousavigharalari S.Mahsa.,** 2017: Implementation of urban regeneration in order to improve the aspects of qualitative, social and cultural of urban life, case study: Enghelab square and lands around it, The fourth national conference on applied research in civil engineering, architecture and urban management, Tehran, Iran.
- **Mousavigharalari S.Mahsa.,** 2016: Public urban spaces; improvement of the contemporary peoples' social life.The third international conference on applied research in civil engineering, architecture, and urban management, K.N TOOSI University of Technology, Tehran, Iran.