urban science

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Review

Framework for Enhancing Urban Living Through Sustainable Plant Selection in Residential Green Spaces

Udayasoorian Kaaviya Priya [1,2] and Ramalingam Senthil [3,*]

[1] School of Architecture and Interior Design, SRM Institute of Science and Technology, Kattankulathur, Chennai 603203, India; ku4232@srmist.edu.in
[2] Department of Architecture, Prime Nest College of Architecture and Planning, Tiruchirappalli 621105, India
[3] Department of Mechanical Engineering, SRM Institute of Science and Technology, Kattankulathur, Chennai 603203, India
* Correspondence: senthilr@srmist.edu.in

Abstract: Residential greening is a critical strategy for mitigating the negative impacts of urbanization on the environment, biodiversity, and human well-being. Proper plant species selection is essential for the success of residential greening projects, as it influences the ecological, aesthetic, and health outcomes. This review provides a comprehensive framework for selecting plant species for residential greening, considering environmental suitability, aesthetic values, maintenance requirements, and potential health effects. The plant's adaptability to local climatic conditions, soil type, and water availability are key considerations. Aesthetic factors like plant form, texture, color, and seasonal interest should be balanced with maintenance needs, including pruning, fertilization, and pest control. Potential health concerns, like allergenic pollen or toxic properties, must also be evaluated while deploying residential greeneries. The guide emphasizes the importance of selecting native or well-adapted non-invasive species to support local biodiversity and minimize ecological disruption. Employing a systematic approach to plant selection for urban vegetation and residential greening initiatives can enhance the environmental, social, and health benefits. Plant species invasiveness is a critical global concern, with substantial ecological, economic, and social impacts that demand careful consideration in species selection and management. This method maximizes these advantages and promotes long-term sustainability and resilience against the challenges posed by climate change. This present review supports the UN's Sustainable Development Goal 11: Sustainable Cities and Society.

Keywords: sustainable development; urbanization; residential greenery; urban climate; urban heat island; biodiversity; ecological sustainability; health and well-being; environments; climate change

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Citation: Priya, U.K.; Senthil, R. Framework for Enhancing Urban Living Through Sustainable Plant Selection in Residential Green Spaces. *Urban Sci.* **2024**, *8*, 235. https://doi.org/10.3390/urbansci8040235

Academic Editor: Luis Hernández-Callejo

Received: 8 October 2024
Revised: 11 November 2024
Accepted: 22 November 2024
Published: 1 December 2024

1. Introduction

Urbanization is altering landscape patterns and replacing natural ecosystems with built environments globally. Ecological processes, biodiversity, and microclimates are all significantly altered by this shift [1]. According to the United Nations Sustainable Development Goals (SDGs) Report 2024 by the UN's Department of Economic and Social Affairs, cities grew 3.7 times faster than their densification rates between 2000 and 2020, leading to negative impacts on land use and the environment. Due to rising rates of urbanization, it is anticipated that by 2050, about 70% of the world's population will reside in cities. Regarding the impact on the climate, global temperatures continue to set new records; 2023 was officially the warmest year on record, according to the World Meteorological Organization, with average worldwide temperatures rising by 1.45 °C, over pre-industrial levels. Global greenhouse gas emissions struck a new high of 57.4 gigatons of CO_2 equivalent, as reported in the Emissions Gap Report 2023 of the United Nations Environment Program [2]. To build resilient and sustainable cities that meet everyone's needs, it is essential to provide critical infrastructure, affordable housing, efficient transportation systems, and key social services.

Building adaptation strategies are emphasized as a means of halting climate change and minimizing environmental damage [3]. Adopting vegetation in building design, also known as "green building" or "green infrastructure" or "urban greening" is a highly effective architectural adaptation strategy for mitigating microclimate and climate change. This approach can enhance a building's resilience to environmental changes, significantly reduce its ecological impact, and yield various positive socioeconomic, and ecological outcomes [4]. However, amidst the climatic shifts, incorporating greenery into urban residential areas, or "residential greening", becomes a critical tactic to lessen the negative impacts of urbanization. Residential greening has several ecological, social, and health advantages in addition to improved visual appeal. However, choosing plant species for residential greening is one of the challenges and the selection process must consider several variables, like ecological appropriateness, aesthetic values, upkeep needs, and potential health effects.

1.1. Background on Residential Greening

Urbanization is profoundly altering the environment by replacing natural ecosystems with built environments, leading to the displacement of microclimates, biodiversity, and biological processes. To address these consequences, various mitigation techniques have been developed. One such technique includes incorporating vegetation into urban residential areas to improve their social and environmental benefits, a practice known as residential greening. Residential greening, encompassing gardens, trees, vegetation cover, green roofs, and green walls, significantly enhances the quality of life in urban environments by providing ecosystem services and promoting public health [5]. Green spaces significantly impact physical and psychological well-being by providing relief from the urban heat island (UHI) effect, reducing temperatures in their vicinity, and offering areas for relaxation and physical activity [6]. Research has demonstrated that green spaces positively impact physical health by providing areas for exercise and recreation. Furthermore, green areas enhance people's overall well-being and mental health by offering opportunities for leisure, relaxation, and sociability [7]. By creating oxygen and removing contaminants from the air, vegetation in residential areas enhances air quality. An analysis of the impact of a green curtain system on urban balconies indicated that this significantly reduced high concentrations of PM2.5 by 15–18 $\mu g/m^3$, thereby decreasing health risks for residents and demonstrating the potential of affordable, low-maintenance green infrastructure in mitigating urban air pollution and its associated health hazards [8]. Greenery, including trees, green roofs, green walls, and potted plants, in residential areas has proven to be a successful method for reducing indoor and outdoor temperatures in urban settings. The green infrastructure can help to alleviate the UHI effect, decrease greenhouse gas emissions, and enhance thermal comfort within a building [9]. Green roofs and walls reduced indoor temperatures by up to 19.9 °C in Mexico [10] and local ambient temperatures by up to 10 °C in subtropical zones [11]. Potted plants placed on the residential balcony reduced indoor air and surface temperatures by up to 3 °C [12].

Gonçalves et al. [13] investigated the role of residential backyards in fostering urban bird diversity by considering various backyard and neighborhood features in Brazil. They found that larger backyards with taller vegetation and located near other green spaces were more likely to support a greater variety of native bird species. The private green areas are emphasized in enhancing the diversity of urban birds and conservation of urban biodiversity. Lerman and Warren [14] revealed that the implementation of native landscaping designs in residential yards led to an increase in the number of native bird species, indicating that the management of green spaces in residential areas can have a substantial impact on biodiversity.

Interestingly, residential greening with vegetation landscaping around residential areas contributes to a reduction in noise levels. Improving the greenery in residential areas is linked to decreased annoyance caused by road and railway noise. Specifically, increased vegetation can reduce noise by approximately six decibels for road traffic and three decibels for railways. It is noteworthy that having visible plant life and accessible green spaces in urban areas can significantly reduce the annoyance caused by road traffic noise [15]. Residential greening significantly enhances the quality of life in urban areas by reducing the adverse impacts of urbanization on the environment, promoting social integration, improving mental and physical well-being, reducing heat stress, supporting biodiversity, and attenuating noise and air pollution. The major keywords, "residential greenery" and "ecosystem services" were used to search the most relevant documents using the Scopus database. VOSviewer tool is used to visualize the co-occurrence of keywords using the comma-separated values file. Figure 1 provides an overview of the ecosystem services provided by residential greenery, divided into five clusters. Each cluster is formed based on closely associated keywords and their maximum co-occurrences in the same documents and publications. Keywords that frequently co-occur are assumed to represent related topics. The colored frames highlight the nodes of each cluster, showing the most common keyword pairings. This visualization helps researchers quickly identify key topics and their relationships in the selected research landscape.

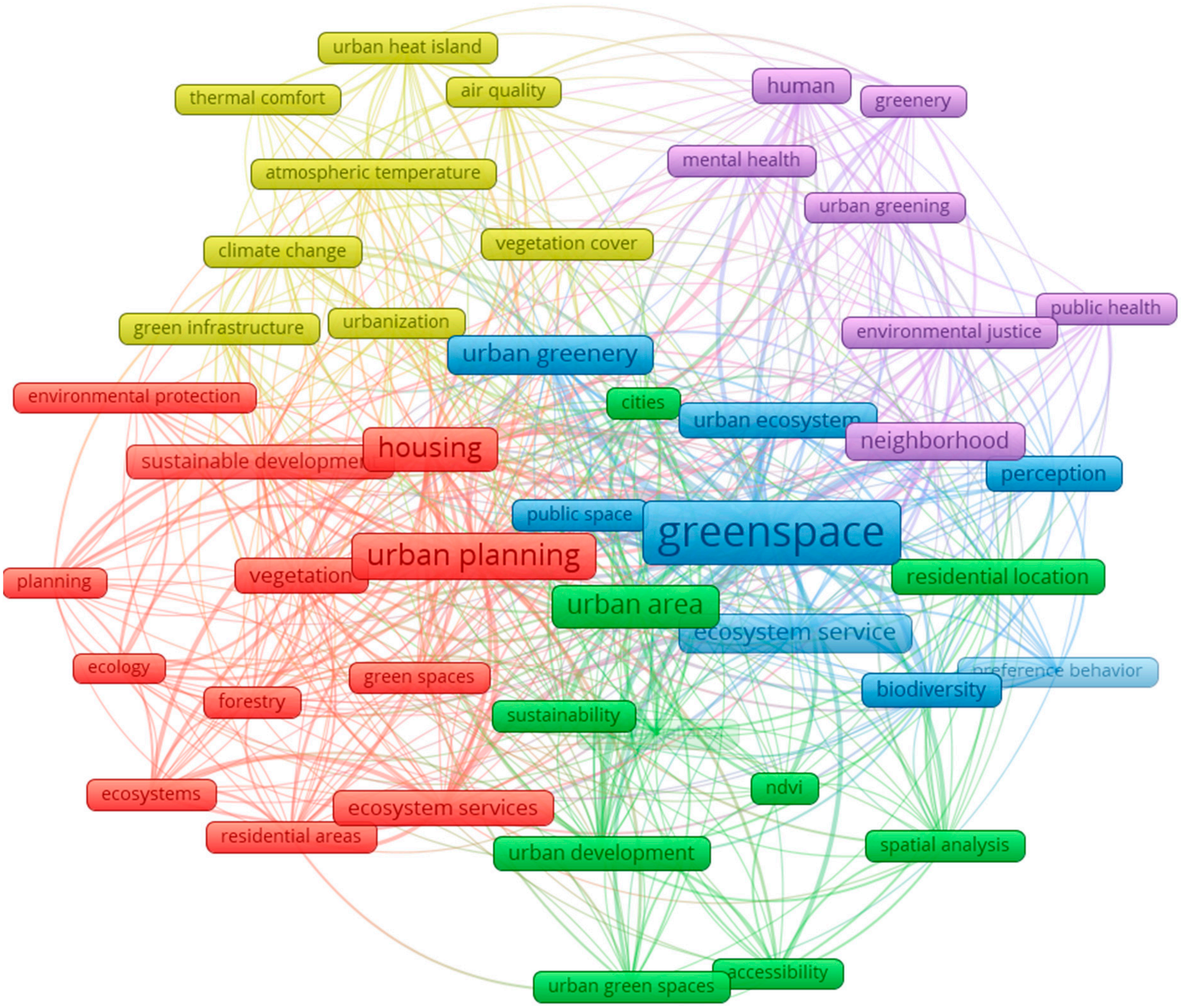

Figure 1. Ecosystem services of residential greeneries.

Residential greenery offers numerous benefits to urban ecosystems, significantly enhancing thermal comfort by reducing heat islands, improving air quality by absorbing pollutants, and promoting mental health through increased access to nature. It also supports biodiversity, fosters environmental protection, contributes to sustainability, and provides a range of ecological benefits for urban areas.

1.2. Importance of Proper Plant Selection

Although numerous challenges related to urbanization negatively impact biodiversity and environmental quality, implementing residential greening presents a practical solution to mitigate these issues. An appropriate plant species is critical to enhance the efficacy of urban green spaces (UGSs) in addressing concerns like air pollution, heat islands, and biodiversity loss. Proper plant selection for residential greening directly influences the success and sustainability of UGSs, which are essential for mitigating the adverse effects of urbanization and climate change. The choice of plant species can influence the ecological dynamics of an area, with native species often supporting greater biodiversity and requiring less maintenance compared to exotic species [16].

The selection of plants with high water-use efficiency is of particular importance, as it ensures that plants can adapt and thrive in environments with water deficits, thereby contributing to the ecological functionality of green spaces [17,18]. Selecting the appropriate plants is essential to prevent financial and environmental losses and to avoid potential health issues. For example, choosing inappropriate plants can result in increased maintenance costs and negative impacts on human health, as demonstrated by the case in Nanjing, China, where plants with airborne pollen caused allergic reactions and increased user dissatisfaction [19]. In addition to their primary function, plant attributes like color, leaf size, type, height, shape, and residents' preferences are trivial for implementing and maintaining residential green spaces. A study found that the preferences of residents differ based on the area of the home, highlighting the significance of location-specific factors in selecting indoor vegetation [20]. Furthermore, a high quantity of greenery and flowering plants are typically the most desired. Recognizing these inclinations can aid in optimizing the design and arrangement of indoor plants to maximize their advantages for the inhabitants. Tall foliage plants with wide leaves are the least preferred across different home areas.

1.3. Need for the Study

Effective plant selection for residential greening is critical for maximizing the benefits of UGSs. Proper plant choices can enhance ecological functions, support biodiversity, and reduce maintenance costs. Selecting plants with high water-use efficiency and low allergenic potential can mitigate negative environmental and health impacts. By aligning plant selection with ecological and aesthetic criteria, residential greening can better address urban challenges, improve quality of life, and contribute to sustainable urban development. A comprehensive review of plant selection factors for urban residential green spaces is limited in the literature. The novelty of this extensive review lies in its focus on effective plant selection for urban greening in residential areas. This review aims to provide information to enhance ecological functions, support biodiversity, and reduce maintenance costs. Additionally, it provides insights into certain plant species' harmful effects on human health and the environment. The present review does not cover the larger landscape greenery such as forests, mountains, lakes, and other rural and urban-related greeneries.

The major objectives of the present review are as follows.

- To review the various plant species documented in the literature that enhance ecological functions and support biodiversity in urban residential green spaces, we aim to identify species exhibiting high water-use efficiency, low allergenic potential, minimal maintenance costs, and reduced negative impacts on humans and the environment.
- To make a framework for the plant selection for respective Köppen climate classifications by considering environmental benefits to address urban challenges and improve quality of life.

This review aims to support sustainable development by guiding the creation of effective and resilient green spaces in urban residential areas, promoting long-term urban sustainability and environmental stewardship. The study is organized into seven sections. Section 1 introduces the study and its significance. Section 2 discusses the materials and methods used in this comprehensive review. Section 3 details the various factors involved in selecting plant species. Section 4 describes the different types of residential greenery. Section 5 examines the characteristics of residential greenery. Section 6 provides recommendations for plant species, the limitations of the present review, and the potential for further research. Section 7 summarizes the major conclusions of the study.

2. Materials and Methods

The methodology for plant species selection in residential greening involves a multi-step approach that ensures a well-rounded and informed decision-making process. Figure 2 shows the process flow for the selection of literature for this present study. The first step is a comprehensive literature review using the following primary keywords: urban greening, residential greenery, and urban green infrastructures. The scrutinizing search keywords include: sustainable landscaping, native plant selection, climate-resilient species, urban biodiversity, green space planning, ecological landscaping, residential horticulture, green roofs, vertical greenery systems, sustainable urban development, drought-tolerant species, UHI mitigation, tree canopy design, urban ecosystem services, and low-maintenance landscaping. Based on the search outcomes, stage 1 focused on identifying the key factors that influence plant species selection. These factors encompass various considerations like climate adaptability, maintenance requirements, aesthetic appeal, and ecological benefits. Additionally, the specific urban context, including soil conditions, space availability, and pest and disease resistance were analyzed.

In addition to the benefits of residential greening plant species, this study discusses the harmful effects that certain plant species can have on humans and ecosystems. Simultaneously, the typology of greening applications was systematically extracted for their relevance to urban environments. This comprehensive extraction process ensures that the chosen plant species and greening typologies are not only suitable for the local climate but also align with the broader objectives of sustainable urban development and environmental enhancement. The analyzed typology includes trees, green roofs, green walls, shrubs, grass or ground covers, and edible and flowering species. The plant species selection was extracted from the literature to frame the criteria for suitable plant species and greening strategies selection, specifically for residential greening. Figure 3 shows the various parameters of the present study.

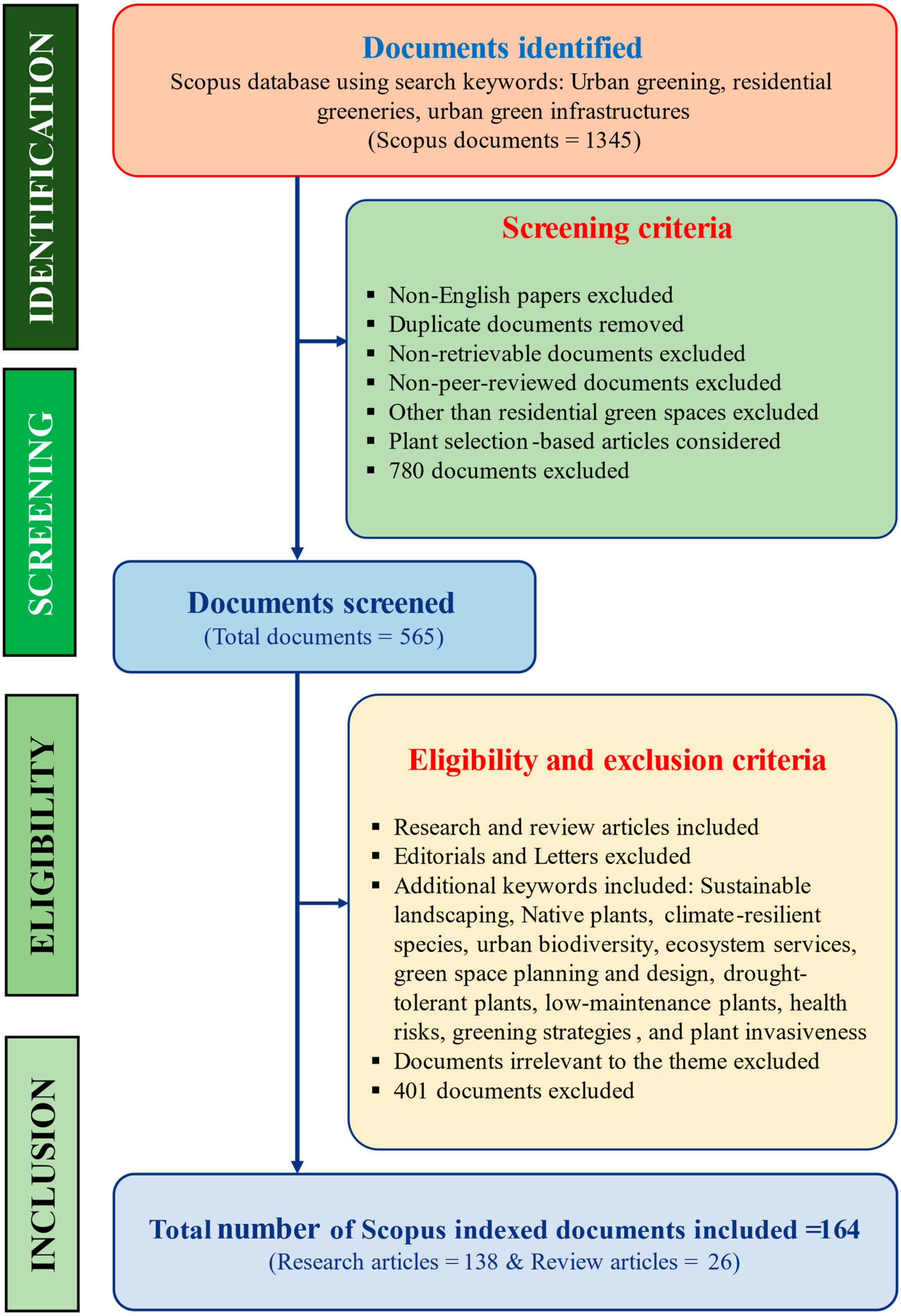

Figure 2. Selection procedure of earlier studies for the present review.

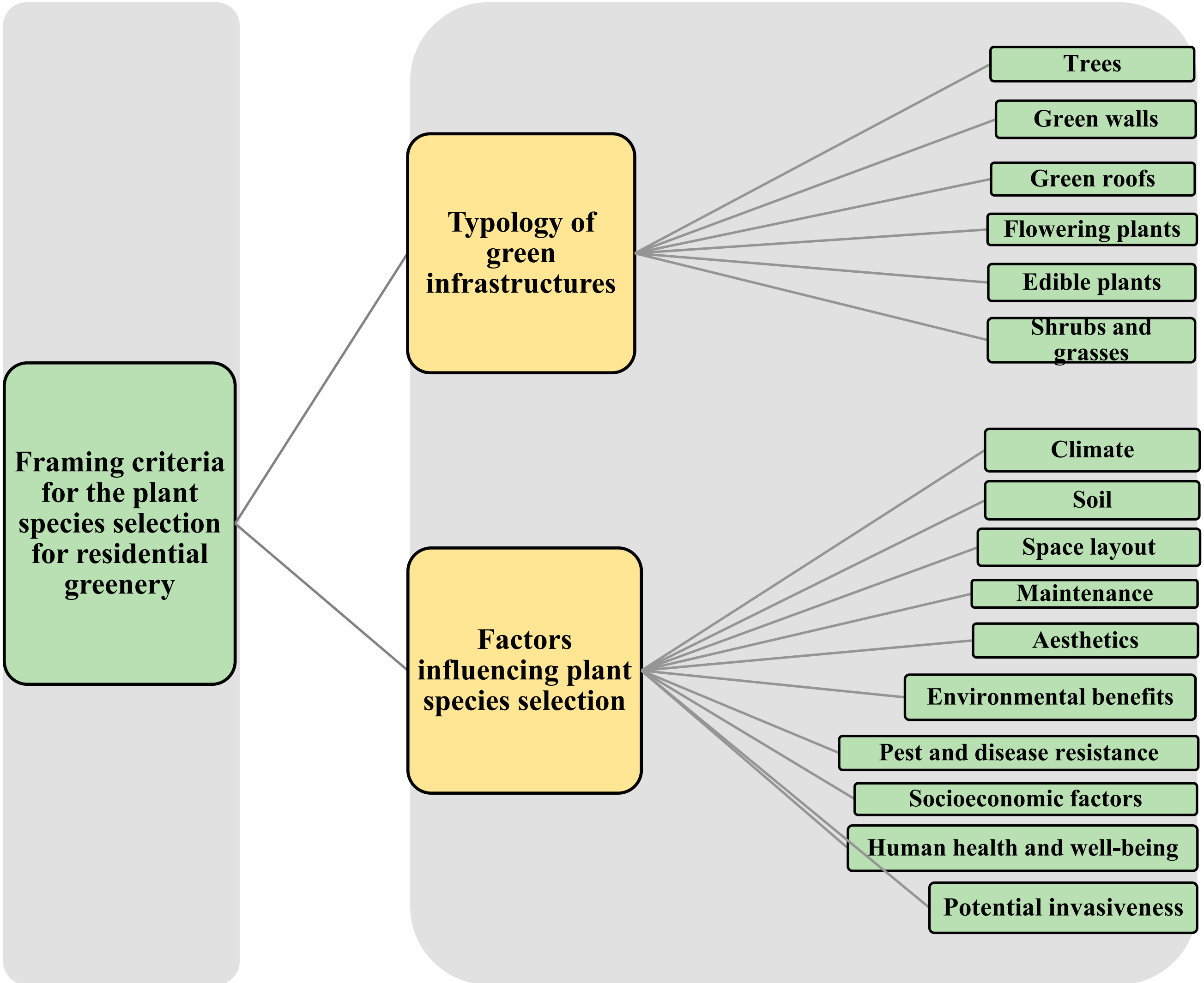

Figure 3. Parameters considered in this study.

3. Factors Influencing Plant Selection

3.1. Climate and Microclimate

Plant species selection is influenced by climate through various mechanisms. Climate factors like temperature, precipitation, and extreme weather events play a significant role in determining plant behavior, distribution, and interactions with other species [21]. Key considerations include temperatures, relative humidity, irradiance levels, wind speed, and rainfall patterns. The process of selecting suitable plants for urban greening is quite challenging due to the wide variety of plant species found in each region. Such plants can thrive in the regional climate, and they must be capable of surviving in the specific microclimates where they are planted. To tackle the difficulties posed by these challenges, it is vital to collect information from a range of climatic situations and suggest the most suitable plant species. Furthermore, anticipating adverse weather changes can impact public support for greening policies, with a preference for species that offer functional benefits like protection from climatic stressors [22]. The performance of plant species to climate is not only contingent upon climate but also varies among distinct species [23]. Hence, researchers emphasize the significance of employing native species that have already adapted to the local environmental conditions [24].

3.2. Soil Conditions

Plant selection for greening projects must consider soil conditions to ensure successful establishment and growth. Soil type, quality, and water availability are critical factors influencing plant adaptability and survival [24,25]. A study in California found that better soil management, particularly enhancing water-holding capacity, helps maintain stable soil moisture, making gardens more resilient under extreme conditions. Improving soil quality is key to sustaining these green spaces [26]. Moreover, the ecological compatibility of plant species with the local environment is crucial. Non-native or invasive species may not only struggle to thrive but can also disrupt local ecosystems [27]. Loam soil, with its granular texture, is an ideal choice for gardening and landscaping purposes. It possesses the ability to retain moisture while facilitating rapid root distribution, and it is rich in key nutrients. Additionally, it aids in the prevention of soil erosion and supports the restoration of land by fostering the growth of various plant species, including trees, crops, and flowers.

3.3. Space Layout

The plant selection for a residential garden is significantly influenced by the garden's size and design. Larger gardens present a wider array of possibilities, including trees, shrubs, and extensive flower beds, while smaller gardens often require more compact or vertical-growing plants. The garden's layout, whether open or enclosed, also has an impact on plant selection; open layouts typically favor broad-leafed plants that flourish in sunlight, while enclosed layouts are better suited for shade-tolerant species. The overall design, whether formal or informal, plays a vital role in guiding the plant selection that aligns with the aesthetic and practical objectives of the garden. The plant selection for a residential garden is indeed influenced by several factors, including the garden's size and design. According to a study in tropical climates, garden design is unique to each site and is influenced by factors like size, microclimate, and the preferences of the creators [28]. In tropical regions, the importance of trees as a structural element in gardens is emphasized, suggesting that the size of the garden could dictate the scale and type of plant structures that are feasible [28]. Contrarily, another study indicates that residents' landscaping preferences, which include plant selection, are more heavily influenced by perceived neighborhood norms and socio-demographic factors than the physical attributes of the garden itself [29]. They suggested that while the size and design of a garden are important, the social context in which the garden exists cannot be disregarded [29]. Thus, while the physical characteristics of a garden, like its size and design, are significant factors in plant selection, the influence of social norms and individual preferences also plays a crucial role. The interaction between space factors can shape the ultimate appearance and composition of residential gardens [28,29].

3.4. Socioeconomic Factors

The impact of socioeconomic factors on the plant species selection in residential gardens is significant. Household income, access to resources, cultural preferences, and the availability of space are among the determinants of plant diversity in residential gardens. Rajagopal et al. [30] reviewed UHI's impact on environmental measures, identified research gaps in connectivity infrastructure, evaluated measurement tools, and highlighted the benefits to scientific and architectural communities while supporting SDGs. In peri-urban or rural areas, gardens may prioritize edible or medicinal plants to support food security and health needs, reflecting a "subsistence effect" [31,32]. Furthermore, the local community's tastes and cultural importance should be considered. The choice of plants is also shaped by cultural values and ethnobotanical knowledge, which can lead to the cultivation of species with symbolic or ceremonial importance [32]. The diversity of plants in residential gardens reflects individual preferences and gardening behaviors, which are influenced by a complex interplay of personal taste, plant traits, and environmental considerations [33].

3.5. Aesthetics

The significance of the aesthetic value of plants should not be overlooked when it comes to selecting plants for residential greening. Different plant species are utilized to create landscapes that are visually appealing due to their diverse textures, colors, and shapes. The dynamic and captivating green areas that result from seasonal changes in plant structure, blooming patterns, and foliage color are a testament to this. Some studies focus on the practical aspects of plants, while others explore non-native species, like ornamental species, to enhance botanical diversity [34]. In the United Arabian Emirates, landscaping designs inspired by Western landscapes often prioritize aesthetic appeal and have been adopted despite the environmental challenges [24].

3.6. Environmental Benefits

The plant selection for residential greening is influenced by the environmental benefits. Qin et al. [35] found a significant correlation between vegetation species diversity and landscape function, suggesting that various tree species can enhance the landscape effect more than shrubs and herbs. Mwageni and Kiunsi further supported the idea that plant selection is influenced by environmental benefits, as residents in Dar es Salaam City invest in shade trees for cooling and aesthetic purposes [36]. Therefore, when selecting plants for residential greening, it is vital to consider the specific environmental benefits they provide, like air purification or stormwater management, in addition to their aesthetic and cooling qualities. Furthermore, it is important to choose plants that are well-suited to the local climate and soil conditions, as this will ensure that they can thrive and provide their full range of benefits over the long term. Additionally, incorporating several plant species can help to create a more diverse and resilient landscape to withstand environmental challenges like drought or disease.

3.7. Pest and Disease Resistance

Interestingly, while some studies focus on the attraction of pests to certain plants, others explore methods to repel or manage pests. For homeowners, choosing the right plants for their garden is decisive in maintaining a healthy, low-maintenance outdoor space. Plants that attract pests can quickly become hotspots for unwanted insects, leading to potential damage to the garden itself and nearby homes. Selecting plant species that are less prone to pest infestations is decisive for creating a thriving garden. Research on garden pests and plant diversity underscores the importance of this consideration, highlighting how careful plant selection can help prevent pest problems and ensure a more enjoyable garden experience. A study in Malaysia highlighted the issue of garden pests in home gardens, suggesting a biological control approach with ladybirds as predators of common pests [37]. Another study discusses the potential of plant diversity to control pests in vineyards, indicating that certain plants can repel or attract pests and beneficial insects [38].

Liu et al. [39] further supported the idea that certain plants, known as refugia or functional plants, can repel pests or attract natural enemies, enhancing pest control. Therefore, it is desirable to prioritize plants that are naturally pest-resistant or do not produce substances that attract pests. For instance, choosing herbs like lavender, rosemary, or mint, which repel common pests, can be an excellent choice to keep the garden healthy and beautiful without chemical interventions. Selecting plant species that do not act as sources of diseases in humans is an important consideration when designing residential gardens. Certain plants can harbor pathogens, allergens, or toxic substances that pose health risks to residents, particularly those with allergies, asthma, or sensitivities. For instance, some plants produce pollen that can trigger respiratory issues, while others might harbor fungi or bacteria that can cause infections. Research conducted in Nanjing, China found that the health of residents was negatively affected by airborne pollen and plant fibers. Furthermore, the study revealed that an increase in the varieties of plants with these characteristics was correlated with a higher prevalence of self-reported allergic and respiratory illnesses, resulting in a lower level of contentment with residential greening [19].

By carefully selecting plants for safety and allergen-free qualities, homeowners can create a garden that enhances well-being and minimizes health risks. This thoughtful approach ensures a safer, more enjoyable space, making the garden a welcoming retreat for everyone.

3.8. Human Health and Well-Being

Plant species in residential green spaces have significant impacts on human health and well-being, as evidenced in the literature. The presence of diverse plant species in residential green spaces contributes positively to human health and well-being. The plant selection for residential greening must be balanced with environmental suitability and health considerations. For instance, in Nanjing, China, the increased diversity of plants with airborne pollen and fibers was correlated with higher reported cases of allergic and respiratory diseases [19]. Therefore, plant selection should consider not only the aesthetic value of plants but also their environmental suitability and potential health impacts.

Baruch et al. [40] found that plant species richness was positively associated with soil bacterial diversity, which could have implications for human health benefits. UGSs with diverse vegetation serve as key components for preserving urban ecosystem well-being, enhancing air and water quality, and reducing UHI effects [41]. The growing impact of airborne pollens on respiratory allergies amid climate change emphasized the need for effective monitoring and management strategies to protect public health [42]. Additionally, the visible green index in residential areas affects human health and well-being by 60% to 80%, and a three-layer vegetation structure is most suitable for human brain activity [43]. UGSs generally provide numerous benefits for human health and well-being, but certain plant species can have negative impacts on residents' health in residential areas. To mitigate these negative impacts, researchers suggested examining the adverse effects of plants with health risks on public experiences and expectations of residential greening. Certain plant species' potential adverse effects on public health and satisfactory residential greening need to be considered.

Ren et al. [44] studied the introduction of ornamental plants enhanced biodiversity in UGSs; it also increases emissions of biogenic volatile organic compounds that are harmful to air quality and human health. Urban areas were found to have higher volatile organic compounds emission intensity of about 20% higher compared to rural surroundings, indicating a potential negative impact on air quality in residential areas. The diversity of plant species in residential green spaces significantly impacts human health and well-being, providing both positive and potential adverse effects. To balance the benefits of biodiversity with these health risks, careful selection of plant species that limit airborne allergens and biogenic volatile organic compounds emissions is essential. Similarly, research on *Robinia pseudoacacia* highlighted its dual role as both an invasive and beneficial species, depending on its environment.

Wilkaniec et al. [45] indicated that while black locust was valued for soil restoration and wood production, its health in urban settings, particularly along streets, was compromised by increased metal toxicity and pest and pathogen pressures. By prioritizing both biodiversity and health, urban planners and ecologists can design residential green spaces that maximize the benefits of nature while mitigating potential drawbacks, fostering healthier, more resilient urban communities. Organic farming excludes chemical fertilizers, pesticides, growth hormones, and livestock feed additives, and combining these practices with new technologies is central to overcoming challenges, promoting sustainability, and enhancing productivity [46].

3.9. Maintenance

The maintenance requirements of plant species also play a role in the choice of plants for residential gardens. The maintenance costs include the initial purchase of plants and soil amendments, ongoing expenses like water, fertilizers, pest control, and maintenance labor for activities like watering, pruning, weeding, and managing plant health. A recent survey conducted in a major Indian city in the tropical region indicated that the user perceptions mainly showcased the preference of plant species with cost-effective and less maintenance requirements [47]. Madushika et al. [48] compared the life cycle cost of green walls and conventional walls and found that despite a 15% higher initial cost, green walls yielded 45% cost savings in Sri Lanka. Green walls can help combat global warming and enhance urban vegetation, but perceptions of high initial and maintenance costs hinder their adoption. Effective maintenance is important for sustainability and encourages further implementation of green roofs. Ismail et al. [49] assessed maintenance practices in Klang Valley high-rise buildings and emphasized structural and vegetation maintenance to ensure sustainability.

3.10. Potential Invasiveness

The invasiveness of plant species is a significant global issue, with serious ecological, economic, and social implications. When selecting plant species, particularly in the context of "sustainable plant selection", the potential for invasiveness should be a primary consideration. Invasive species can disrupt local ecosystems, outcompete native plants, and reduce biodiversity. Sustainable plant selection involves choosing species that contribute positively to the environment while avoiding those that could become invasive. By carefully assessing a plant's invasiveness, unintended ecological consequences could be prevented and promote long-term environmental stability, ensuring that horticultural practices support biodiversity conservation and ecosystem resilience. The native plants in one region could behave as invasive in other regions.

Fascetti [50] explored the floricultural potential of wild geophytic species from Southern Italy. By examining species' attributes, they highlighted opportunities for using these native plants in urban landscapes, such as street furniture and gardens. The importance of promoting biodiversity while offering novel horticultural opportunities was emphasized. Trotta et al. [51] investigated the flora of the critically endangered pine rocklands in South Florida using community phylogenetics. They observed a strong phylogenetic signal for endemism but no clear signal for invasiveness and suggested the utility of phylogenetic methods in identifying conservation priorities for threatened ecosystems. Fernandez et al. [52] reviewed the impacts of Ligustrum lucidum, a highly invasive East Asian tree. They outlined the species' ecological impacts, rapid spread, and challenges in management and emphasized the need for further research into its eco-physiology and the development of early warning systems to mitigate its expansion.

Wang et al. [53] examined the co-invasion of two invasive plants, Erigeron annuus and Solidago canadensis, in East China and highlighted how each species influences plant community diversity and stability differently. They suggested that co-invasion affects functional diversity and could alter ecosystem stability in complex ways. El-Barougy [54] investigated the trait–environment relationships of native and alien species in urban and non-urban areas of Egypt. It showed how urbanization homogenizes plant traits, favoring alien species' adaptability, and concentrating on the threat of biotic homogenization in urban ecosystems, urging further studies on species composition in cities. Czortek et al. [55] assessed the surrounding landscapes' influence and invasion success of Solidago canadensis. They found that landscape features like river networks and agricultural land affected biomass allocation and invasion patterns, offering insights into invasion ecology and potential landscape-level control strategies for managing this species.

Sittaro et al. [56] effectively modelled the future spread of invasive plant species in Germany under changing climate conditions using machine learning techniques for 46 species and highlighted key factors like climate, soil, and infrastructure in shaping distribution patterns. Marinova and Anev [57] explored how light intensity influences the physiology of urban landscaping tree species. They found that shade-intolerant species like Paulownia tomentosa demonstrate high carbon use efficiency and resilience. They suggested that this species' adaptability may contribute to its potential invasiveness in urban environments. Pušić et al. [58] assessed the ecosystem services and invasiveness of ornamental trees in Novi Sad. They found that non-native species provide valuable services but also pose risks to native biodiversity. They also emphasized managing invasive species to balance ecosystem services by minimizing ecological disservices like seed spread and green waste accumulation. Vojík et al. [59] investigated the germination and cytological variability of two ornamental species, Stachys byzantina and Lychnis coronaria, known for their potential invasiveness. They showed that temperature influences germination success, supporting the idea that these species could become problematic invaders in European grasslands under favorable climatic conditions.

Singh et al. [60] reviewed the ecological and therapeutic potential of Tecoma stans, an invasive ornamental shrub. They suggested that, despite its invasiveness, the plant's ability to restore degraded lands and support biodiversity through pollinator attraction may provide ecological benefits when carefully managed in non-invasive regions. Hazarika et al. [61] assessed stakeholder perceptions of non-native tree species in the European Alpine Space, emphasizing the divide between those who see benefits in terms of ecosystem services and those concerned about invasiveness. They highlighted the need for balanced management of non-native species to adapt to climate change while protecting native biodiversity. Werchan et al. [62] investigated Ailanthus altissima's allergenic potential and its distribution in Berlin. They showed that urban areas with higher concentrations of this invasive species pose a significant allergy risk. They recommend including this species in routine pollen monitoring to manage its emerging allergenic impact in temperate regions. Kawawa Abonyo and Oduor [63] explored the interactive effects of artificial light at night and soil nutrient enrichment on the growth of invasive and non-invasive alien plants in Nairobi. They suggested that these environmental changes can promote the growth of invasive species, highlighting the role of urbanization in exacerbating plant invasions.

4. Categories of Plants for Residential Greening

The major categories of plants used for residential greenery include green walls, green roofs, trees, shrubs, edible plants, and flowering plants. These categories are illustrated in Figure 4, which provides a visual representation of each type and how they contribute to enhancing residential environments. Green walls and roofs are innovative ways to integrate plant life into building structures, while trees and shrubs add both aesthetic appeal and functional benefits to outdoor spaces. Edible plants offer the advantage of producing home-grown food, and flowering plants bring vibrant colors and beauty to residential landscapes.

Figure 4. Major categories of plants for residential greening.

4.1. Trees

The benefits that trees offer in residential greening extend to a wide range of ecosystem advantages, as well as enhancements to human well-being. In residential neighborhoods, trees offer shade, lower temperatures, and contribute to the aesthetic value of the area, which is highly valued by residents [64]. There are three primary ways in which trees affect the temperature of their surroundings. These include providing shade by intercepting solar radiation, facilitating evapotranspiration, and increasing the albedo or reflectivity of surfaces [65]. There are multiple characteristics of trees such as crown height, crown density, permeability, leaf size, and leaf shape that influence cooling mechanisms [66]. The impact of trees on temperature is more significant in outdoor environments than indoors. Very few studies have investigated the effects of trees on indoor temperatures and have identified the requirements for trees in residential greening. The leaf area density of the trees is one of the significant factors in deciding the tree species selection for cooling. This is the leaf surface area per unit volume of the tree canopy. Higher leaf area density means more leaves, which can provide greater shade and a cooling effect through evapotranspiration. Denser foliage leads to a more significant cooling effect. The orientation of the trees towards the building is another central factor. Trees situated on the south side have the most considerable impact. This is because the south side receives the most direct sunlight and is subject to shading. Furthermore, trees situated closer to the building (within 2 m) have the most considerable impact on reducing the cooling load [67].

Similarly, trees with higher leaf density at the lower crown can provide more effective cooling. Therefore, species with this characteristic should be preferred to maximize cooling benefits. It is also recommended that trees with darker leaves, higher leaf area index (LAI), and multi-layer canopy design provide more cooling [68]. In tropical regions, like Malaysia and Miami, species that can thrive in warm and humid conditions with minimal care like *Ficus elastica*, *Samanea saman*, and *Erythrina variegata* are often chosen. Their dense canopy structures provide effective shade and cooling, thereby reducing the microclimate of the surroundings. In arid environments like Tehran and Cairo, species that are drought-resistant and require less water like *Gleditsia triacanthos*, *Ziziphus jujuba*, and *Peltophorum pterocarpum* are selected. These species also have deep root systems that stabilize soil and prevent erosion, which is beneficial for landscaping in dry climates. In temperate zones like Melbourne, Los Angeles, and Manchester, species like *Acer platanoides*, *Tilia cordata*, and *Eucalyptus grandis* are common choices. These species are chosen based on LAI, tree height, crown diameter, crown height, diameter at breast height, and their ability to handle seasonal changes, offering aesthetic appeal (e.g., fall colors) and practical benefits (e.g., shade in summer, light penetration in winter).

Liang and Huang [69] highlighted key traits—leaf area, crown size, height, and shape—and proposed a "trait-service" framework to guide urban tree planting research. Table 1 shows the different trees investigated in previous studies. In colder climates like Toronto, Dresden, and Munich, species like *Tilia cordata*, *Ginkgo biloba*, and *Acer saccharinum* are selected. These species are resilient to cold temperatures and harsh winters, making them ideal for greening in these regions. Often shade-tolerant species with less water using efficiencies and native species are selected. Species with deciduous nature allow sunlight to reach homes during winter, reducing heating costs, while in summer, their foliage provides shade, improving energy efficiency. Trees in cities are necessary for urban ecosystems and residents' well-being, providing habitats, food, temperature reduction, and aesthetic benefits. While studies often examine green space broadly, fewer focus on how specific tree traits affect ecosystem services.

Table 1. Trees investigated in different climates.

Reference and Location	Scientific Name
Köppen climate "A"	
Rahman et al. [68]	*Ficus elastica*
Wong et al. [70], Miami, Florida	*Erythrina variegata*
Yahia and Johansson [71], Syria	*Ulmus Americana*
Junid et al. [72], Malaysia	*Dyera costulata*, *Mesua ferrea*, *Samanea saman*, *Brownea ariza*, *Khaya senegalensis*, *Milletia atropurpurea*, *Ficus benjamina*, *Callophyllum inophyllum*, *Melaleuca cajuputi*, *Peltophorum pterocarpum*, *Hopea odorata*
Ali and Patnaik [73], Bhopal, India	*Azadirachta indica*, *Albezia lebbek*, *Delonix regia*, *Ficus religiosa*, *Peltophorum pterocarpum*, *Pterocarpus marsupium*, *Samanea saman,Alstonia scholaris*, *Artocarpus heterophyllus*, *Ficus benghalensis*, *Kigelia africana*, *Magnifera indica*, *Pongamia pinnata*, *Schleichera oleosa*, *Spathodea campanulata*, *Syzygiumcumini*, *Terminalia tomentosa*
Misni [74], Malaysia	*Dalbergia oliveri*, *Schizolobium parahyba*, *Samanea saman*, *Erythrina fusca*
Ali and Patnaik [75], Bhopal, India	*Ficus religiosa*, *Ficus benghalensis*, *Artocarpus heterophyllus*, *Peltophorum pterocarpum*, *Azadirachta indica*, *Schleichera oleosa*, *Terminalia arjuna*, *Magnifera indica*, *Spathodea campanulata*, *Mimusops elengi*, *Delonix regia*, *Pongamia piñata*
Shahidan et al. [76], Malaysia	*Mesua ferrea*, *Hura crepitans*
Shahidan et al. [77], Malaysia	*Ficus benjamina*
Köppen climate "B"	
Rahman et al. [68], Santa Marta City, Brazil	*Terminalia catappa*, *Prosopis juliflora*
Asgarzadeh et al. [78], Tehran	*Gleditsia triacanthos*, *Quercus coccinea*, *Parrotia persica*, *Ziziphus jujuba*, *Sorbus aucuparia*, *Cinnamomum camphora*, *Aesculus glabra*, *Quercus douglasii*, *Morus alba (male)*
Fahmy et al. [79], Cairo, Egypt	*Ficus elastica*, *Peltophorum pterocarpum*
Köppen climate "C"	
Rahman et al. [68], Taipei, Taiwan, China	*Ulmus parvifolia*
Rahman et al. [68], Manchester, UK	*Tilia europea*, *Crataegus laevigata*, *Sorbus arnoldiana*, *Prunus Umineko Pyrus calleryana*, *Malus Rudolph*
Rahman et al. [68], Melbourne, Australia	*Fraxinus excelsior*, *Angophora floribunda*
Köppen climate "D"	
Rahman et al. [68], Toronto, Canada	*Morus alba*, *Acer saccharinum*, *A. saccharum*, *Quercus robur*, *Fraxinus pennsylvanica*, *Gleditsia triacanthos*, *Betula pendula*, *Tilia cordata*
Rahman et al. [68], Munich, Germany	*Robinia pseudoacacia; Tilia cordata*, *Tilia cordata*, *Acer platanoides*, *A. campestre*, *Carpinus betulus*, *Ostrya carpinifolia*, *T. tomentosa*
Rahman et al. [68], Budapest, Hungary	*A. pseudoplatanus*, *Fraxinus excelsior*, *Tilia cordata*, *T. tomentosa*
Rahman et al. [68], Beijing, China	*Ginkgo biloba*, *Populus tomentosa*
Rahman et al. [68], Gothenburg, Sweden	*Acer platanoides*, *Aesculus hippocastanum*, *Prunus serrulate*, *Betula pendula*, *Fagus sylvatica*, *Quercus robur*, *Tilia cordata*
Rahman et al. [68], Basel, Switzerland	*Acer platanoides*, *Aesculus carnea*, *T. tomentosa*, *A. hippocastanum*, *Platanus acerifolia*, *Tilia cordata*, *T. platyphyllos*

4.2. Shrubs and Groundcovers

In urban design, shrubs and grasses are commonly utilized for their aesthetic appeal. Shrubs are characterized by their diverse forms, textures, and colors. They serve to create visually appealing and well-organized landscapes. They can effectively define spaces, establish privacy, and soften the harsh lines of buildings and other human-caused structures. Grasses, known for their uniform appearance, offer a calming and cohesive look to vast open spaces. They provide a lush, green carpet that is pleasing to the eye and can be enjoyed in parks, gardens, and residential lawns. Beyond their visual appeal, shrubs and grasses make significant contributions to the improvement of urban environments. Jeong et al. [80] highlighted the role of shrubs in carbon sequestration, indicating that they can sequester a substantial amount of carbon, which is essential for mitigating urban greenhouse gas emissions. They support biodiversity by furnishing habitat and sustenance for various wildlife species, including birds, insects, and mammals. Additionally, they aid in soil stabilization, erosion control, and pollutant filtration from the air and water. One of the most significant functions of shrubs and grass in urban landscapes is their ability to reduce temperature and enhance thermal comfort, especially in warm climates [81]. Shrubs can act as windbreaks, diminishing wind speed and the impact of cold winds during winter, thus enhancing thermal comfort in outdoor spaces [82]. Green spaces, including those featuring shrubs and grasses, have a positive impact on mental health and well-being. They provide a sense of tranquility, alleviate stress, and create a more pleasant environment for individuals to live and work [83]. A list of shrubs and grasses from the literature on different Köppen climate classifications is listed in Tables 2 and 3.

Table 2. Shrubs investigated in different climates.

Reference and Location	Scientific Name
Köppen climate "A"	
Wong et al. [70]	*Heliconia* spp., *Rhapis excelsa*, *Pandanus amaryllifolius*, *Erythrina variegata*, *Bougainvillea*, *Ixora coccinea*
Nugroho [84], Indonesia	*Amaranthus hybridus*, *Brassica juncea*
Galagoda et al. [85]	*Thunergia laurifolia*, *Dracaena reflexa*
Abdul-Rahman et al. [86], Malaysia	*Psophocarpus tetrogonobulus*
Widiastuti et al. [87], Indonesia	*Passiflora flavicarva*, *Pseudocalym maalliaceum*
Jaafar et al. [88], Malaysia	*Thumbergia selecta*
Charoenkit and Yiemwattana [89]	*Cuphea hyssopifola*, *Tibouchina urvilleana*, *Excoecaria cochinchinensis*
Widiastuti et al. [90]	*Dracaena warneckii*
Ismail et al. [91], Malaysia	*Ipomoea pescapre*
Tan et al. [92]	*Heliconia "American Dwarf"*
Köppen climate "B"	
Schneider et al. [93], Denver	*Amorpha fruticosa "Nana"*, *Cercocarpus breviflorus*
Pérez et al. [94], Lleida, Spain	*Lonicera japonica*, *Clematis* sp.
Köppen climate "C"	
Bianco et al. [95], Turin, Italy	*Lonicera nitida* L.
Cameron et al. [96], UK	*Jasminum officinale "Clotted cream, Fuchsia" Lady Boothby*, *Lonicera "Gold Flame"*
Akther et al. [97]	*Lavandula dentata*
Köppen climate "D"	
Zhao et al. [98]	*Caragana pekinensis*, *Caragana rosea*, *Euonymus alatus*, *Euonymus maackii Rupr*, *Forsythia suspensa*, *Lespedeza bicolor*, *Philadelphus incanus Koehne*, *Physocarpus amurensis*, *Prunus triloba*, *Ribes mandshuricum*, *Rosa davurica*, *Spiraea fritschiana*, *Syringa oblata*, *Syringa reticulata* ssp. *Pekinensis*, *Viburnum opulus Linn. var. calvescens (Rehd.) Hara*, *Weigela florida*
Larking et al. [99]	*Alnus alnobetula*, *Betula glandulosa*

Table 3. Grasses investigated in previous studies.

Reference and Location	*Scientific Name*
Köppen climate "A"	
Wong et al. [70]	*Hymenocallis littoralis*, *Ophiopogon*
Jaafar et al. [88]	*Ophiopogon verigated*
Wong et al. [100]	*Ophiopogon japonicus*
Rupasinghe and Halwatura [101]	*Axonopus compressus*
Leite and Antunes [102]	*Zoysia japonica*
Köppen climate "B"	
Ondoño et al. [103], Murcia, Spain	*Lagurus ovatus* L.
Bousselot et al. [104], Fort Collins, CO, USA	*Bouteloua gracilis (Kunth) Lag.*
Ntoulas et al. [105], Athens, Greece	*Zoysia matrella*
Sánchez-Reséndiz et al. [106]	*Tall fescue (grass)*
Köppen climate "C"	
Cheng et al. [107], Hongkong	*Zoysia japonica*
Bakhshoodeh et al. [108], Perth, Western Australia,	*Hardenbergia violacea*, *Drosanthemum hispidium*
Lin and Lin [109], Taipei, Taiwan; China	*Eremochloa ophiuroides*
Armson et al. [110], UK	*Rye grass*
Nagase and Dunnett [111], UK	*Anthoxanthum odoratum*, *Festuca ovina*, *Koeleria macrantha*, *Trisetum flavescens*
Mårtensson et al. [112]	*Molinia caerulea*
Köppen climate "D"	
Vandegrift et al. [113]	*Eragrostis spectabilis*, *Koeleria macrantha*, *Schizachyrium scoparium*, *Sporobolus heterolepis*

Species mentioned in the literature were selected based on their ability to adapt to local climatic conditions. Most literature shows nativity-based plants in the location of their natural habitat or ecosystem. Species like *Heliconia* spp., *Bougainvillea*, and *Ixora coccinea* thrive in warm, humid environments. Drought-resistant species like *Amorpha fruticosa* and *Bouteloua gracilis*, can withstand limited water availability. Species like *Lavandula dentata* and *Zoysia japonica* can endure moderate seasonal variations. Select hardy species like *Caragana* and *Schizachyrium scoparium* can survive harsh winters. The environmental service and aesthetic appeal also influence the selection of shrubs and grasses. Shrubs like *Heliconia spp*., *Bougainvillea*, and *Ixora coccinea* in tropical (A) climates and grasses like *Zoysia japonica* and *Ophiopogon* in the same regions, offer visually striking landscapes while also contributing to urban cooling and air quality improvement, shrubs like *Dracaena reflexa* and grass like *Zoysia japonica* are effective in carbon capture. Shrubs with trees and other plant types can even enhance the microclimate of the surroundings. Grasses like *Axonopus compressus* and shrubs like *Passiflora flavicarva* are beneficial in tropical regions.

4.3. Flowering Plants

Many homeowners choose a combination of perennials and annuals that provide brilliant, season-long color and a range of textures when selecting blooming plants for their residential gardens. Low-maintenance, drought-tolerant, and climate-appropriate plants are frequently preferred since they require less care. Environmentally adapted native and non-native plants are also well-liked for nectar production and to draw in pollinators from the area, like butterflies and bees [114,115]. Due to the sensory appeal that fragrant flowers, like lavender and roses, bring to outdoor settings, they are in great demand. Studies have demonstrated that certain ornamental flowering species are well-suited for specific garden settings. For instance, *Begonia spp.*, *Dianthus caryophyllus*, and *Catharanthus roseus* are among the species found to be best suited for vertical gardening in summer conditions [116]. Important factors to consider are color harmony and overall landscape aesthetic harmony. Table 4 shows the flowering plant species studied earlier.

Table 4. Flowering plant species investigated in different climates.

Reference	Scientific Name
Köppen climate "B"	
Rahman et al. [68]	*Platymiscium pinnatum*
Asgarzadeh et al. [78]	*Gleditsia triacanthos*, *Aesculus glabra*
Fahmy et al. [79]	*Peltophorum pterocarpum*
Schneider et al. [93]	*Amorpha fruticosa "Nana"*, *Cercocarpus breviflorus*
Pérez et al. [94]	*Clematis* sp.
Leite and Antunes [102]	*Sedum spectabile*
Ondoño et al. [103]	*Silene vulgaris*, *Lagurus ovatus* L.
Bousselot et al. [104]	*Antennaria parvifolia Nutt.*, *Delosperma cooperi (Hook. f.) L. Bol.*, *Eriogonum umbellatum Torr. aureum 'Psdowns'*, *Opuntia fragilis Nutt.*, *Sedum lanceolatum Torr.*
Sánchez-Reséndiz et al. [106]	*Sedum reflexum*, *Sedum mexicanum*, *Sedum moranense*, *Sedum obtusifolium*, *Sedum crassulaceae*
Carlucci et al. [117]	*Gazania rigens var. leucolaena*, *Lavandula anguistifolia*, *Mentha spicata*, *Origanum vulgare*, *Portulaca grandiflora*, *Rosmarinus officinalis*, *Thymus vulgaris.*
Razzaghmanesh et al. [118]	*Carpobrotus rossii*, *Dianella caerula "Breeze"*
Köppen climate "A"	
Wong et al. [70]	*Erythrina variegata*, *Heliconia* spp., *Hymenocallis littoralis*, *Erythrina variegata*, *bougainvillea*, *Ixora coccinea*
Junid et al. [72]	*Mesua ferrea*, *Brownea ariza*, *Milletia atropurpurea*, *Peltophorum pterocarpum*,
Ali and Patnaik [73]	*Delonix regia*, *Kigelia africana*, *Spathodea campanulata*,
Misni [74]	*Schizolobium parahyba*, *Erythrina fusca*
Ali and Patnaik [75]	*Mimusops elengi*, *Delonix regia*
Shahidan et al. [76]	*Hura crepitans*
Nugroho [84]	*Amaranthus hybridus*
Galagoda et al. [85]	*Thunergia laurifolia*
Widiastuti et al. [87]	*Passiflora flavicarva*, *Pseudocalym maalliaceum*
Jaafar et al. [88]	*Thumbergia selecta*
Charoenkit and Yiemwattana [89]	*Cuphea hyssopifola*, *Tibouchina urvilleana*,
Widiastutia et al. [90]	*Phalaenopsis* sp.
Tan et al. [92]	*Heliconia "American Dwarf"*
Safikhani et al. [119]	*Blue trumpet vine*
Köppen climate "C"	
Rahman et al. [68]	*Caesalpinia peltophoroides*, *Cassia fitula*, *Prunus Umineko*, *Malus Rudolph*, *Aesculus hippocastanum*, *Prunus cerasifera*, *Jacaranda chelonia*, *Lagerstroemia indica*, *Koelreuteria paniculata*
Cameron et al. [96]	*Fuchsia 'Lady Boothby'*
Akther et al. [97]	*Callisia repens*
Bakhshoodeh et al. [108]	*Wisteria sinensis*

Table 4. *Cont.*

Reference	Scientific Name
Mårtensson et al. [112]	*Achillea millefolia*, *Dianthus deltoides*, *Nepeta faassenii*, *Salvia nemorosa*
Koyama et al. [120]	*Ipomoea tricolor*
Ferrante et al. [121]	*Gazania uniflora*, *Gazania nivea*, *Mesembryanthemum barbatus*
Rey et al. [122]	*Achryrocline bogotensis*
Köppen climate "D"	
Rahman et al. [68]	*Liriodendron tulipifera*, *Platanus x hispanica*, *Aesculus x carnea*, *Aesculus hippocastanum*, *Prunus serrulata*
Vandegrift et al. [113]	*Allium cernuum*, *Anemone virginiana*, *Asclepias tuberosa*, *Aster laevis*, *Campanula rotundifolia*, *Coreopsis lanceolata*, *Echinacea purpurea*, *Liatris aspera*, *Monarda fistulosa*, *Penstemon hirsutus*, *Tradescantia ohiensis*, *Aster oolentangiensis*
Zhang et al. [123]	*Phedimus aizoon*, *Phedimus floriferus*
Thuring et al. [124]	*Delosperma nubigenum*, *Dianthus deltoides*

4.4. Edible Plants

Incorporating edible plants (vegetables and medicinal plants) into residential gardens is becoming increasingly popular among homeowners who aim to combine practicality and aesthetics. The preference for edible plants in residential gardens is influenced by various factors, including cultural practices, the desire for food security, and the therapeutic uses of plants. Studies have documented a wide range of edible plants cultivated in home gardens, with preferences often reflecting local dietary habits and the multifunctional roles of these gardens [125]. Homeowners showed an interest in growing edible plants, including herbs, vegetables, and fruit-bearing shrubs, contributing to sustainable living. The efficacy of home gardens in producing sustenance is contingent upon factors like plot dimensions and layout, existing land cover patterns, and accessible productive land, as well as the urban or suburban form and pertinent social, cultural, and economic elements [126]. An investigation of food production in a high-rise public housing building was carried out through the implementation of various gardening systems, food crops, and sunlight exposure. The study found that rooftop gardening with a shallow growing medium, with a depth of less than 15 cm, had the potential to fulfil 3% of the demand. In contrast, façade gardening was estimated to meet 43% of the demand due to the larger space available [127]. Table 5 shows the edible plants investigated earlier.

In contrast, the use of medicinal plants has persisted for several generations in traditional medicine, and they are known for their therapeutic benefits. Ethnobotanical research has highlighted the richness and cultural importance of medicinal flora in home gardens across various regions, from the Argentinean Atlantic Forest [128]. These studies revealed a commonality in the composition of medicinal plants in home gardens, suggesting a "core repertoire" of plants used for treating similar ailments across diverse cultures and environments. By growing these plants at home, residents can connect with a long-standing custom of utilizing plant-based remedies for health purposes while also ensuring a natural, readily accessible source of medicinal treatments. This practice is influenced by cultural, environmental, and social factors in the transmission of ethnobotanical knowledge across generations and communities [129].

Table 5. Edible plant species studied earlier.

Reference	Scientific Name
Köppen climate "A"	
Ali and Patnaik [73]	*Artocarpus heterophyllus*, *Magnifera indica*, *Syzygiumcumini*,
Ali and Patnaik [75]	*Mimusops elengi*
Köppen climate "B"	
Rahman et al. [68]	*Terminalia catappa*, *Melicoccus bijugatus*
Asgarzadeh et al. [78]	*Ziziphus jujuba*, *Cinnamomum camphora*, *Morus alba (male)*
Köppen climate "C"	
Rahman et al. [68]	*Crataegus laevigata*, *Sorbus arnoldiana*, *Malus Rudolph*, *Olea europea*
Koyama et al. [120]	*Momordica charantia*, *Pueraria lobata*, *Apios american Medikus*
Köppen climate "D"	
Rahman et al. [68]	*Morus alba*, *Corylus corluna*, *Fagus sylvatica*
Vandegrift et al. [113]	*Allium cernuum*, *Asclepias tuberosa*, *Coreopsis lanceolata*, *Geum triflorum*

4.5. Green Roofs

Green roofs, also known as vegetated roof systems, offer a multitude of environmental benefits. These systems contribute to stormwater management by reducing runoff and improving water quality, conserving energy by providing insulation, mitigating the UHI effect, enhancing air quality, and promoting biodiversity by creating habitats for various species [130]. Green roofs impact the microclimate of the surroundings through several mechanisms. Plants on green rooftops emit water vapor through evapotranspiration, which lowers the surrounding air temperature and the surface temperature of the rooftop. The vegetation also provides a shading effect, which decreases the roof surface temperature and minimizes the heat load on the building. The substrate and vegetation layers function as thermal mass and insulation, thereby hindering heat transfer into the building and preserving a more stable indoor temperature [131]. The thermal efficiency of green roofs is influenced by variables like LAI, foliage density, and substrate layers, similar to green walls. Furthermore, the implementation of multi-layer canopies may enhance the overall cooling effect.

Green roofs are typically classified into two types, which are determined by the depth of the growing medium and the kinds of vegetation they can support. These types are referred to as intensive and extensive green roofs. To ensure the success of extensive green roofs, which have limited soil depths (usually between 10–15 cm), it is recommended to select plants with shallow root systems, like sedums and mosses. On the other hand, intensive green roofs that have deeper soil layers (30 cm or more) can support plants with deeper root systems, like shrubs, small trees, and larger perennials [132]. Considering the climate, species like *Heliconia spp.*, *Bougainvillea*, and *Zoysia japonica* are frequently chosen for their ability to thrive in warm, humid environments with consistent rainfall. In regions with semi-arid and arid climates, where water scarcity is a concern, drought-tolerant species like *Bouteloua gracilis* and *Opuntia fragilis* are beneficial. In colder climates (Köppen climate classification "D"), species like *Schizachyrium scoparium* and *Eragrostis spectabilis* are valuable for their ability to survive harsh winters. Table 6 shows the commonly used green roof plants in the literature.

Table 6. Green roof species investigated earlier.

Reference and Location	Scientific Name
Köppen climate "A"	
Wong et al. [70]	*Heliconia spp., Hymenocallis littoralis, Ophiopogon, Rhapis excelsa, Pandanus amaryllifolius, Erythrina variegata, bougainvillea, Ixora coccinea*
Ismail et al. [91], Malaysia	*Ipomoea pescapre*
Tan et al. [92], Singapore	*Phyllanthus ochinchinensis, Heliconia "American Dwarf", Sphagneticola trilobata*
Leite and Antunes [102]	*Zoysia japonica*
Köppen climate "B"	
Schneider et al. [93], Denver	*Amorpha fruticosa "Nana", Cercocarpus breviflorus*
Leite and Antunes [102]	*Sedum spectabile*
Ondoño et al. [102], Murcia, Spain	*Silene vulgaris, Lagurus ovatus* L.
Bousselot et al. [104], Fort Collins, CO, USA	*Antennaria parvifolia Nutt., Bouteloua gracilis (Kunth) Lag., Delosperma cooperi (Hook. f.) L. Bol., Eriogonum umbellatum Torr. aureum "Psdowns", Opuntia fragilis Nutt., Sedum lanceolatum Torr.*
Ntoulas et al. [105], Athene, Greece	*Zoysia matrella*
Razzaghmanesh et al. [118], Adelaide, Australia	*Carpobrotus rossii, Lomandra longifolia "Tanika", Dianella caerula "Breeze", Myoporum parvifolium*
Köppen climate "C"	
Akther et al. [97]	*Sedum floriferum, Sedum hispanicum, Sedum hybridum, Sedum kamtschaticum, Sedum lineare, Sedum r. "Angelina," Sedum reflexum, Sedum rupestre, Sedum sexangulare, Sedum sediforme, Sedum spurium, Callisia repens, Lavandula dentata*
Leite and Antunes [102]	*Sedum acre, Sedum aizoon*
Ferrante et al. [121], Palermo	*Phila nordiflora, Gazania uniflora, Gazania nivea, Sedum Aptenia lancifolia Mesembryanthemum barbatus, Aptenia lancifolia*
Rey et al. [122], Bogotá (Colombia)	*Paepalanthus alpinus, Echeveria ballsii, Achryrocline bogotensis*
Köppen climate "D"	
Leite and Antunes [102]	*Sedum Aizoon, Sedum kamtschaticum, Sedum lineare, Sedum spectabile, Sedum spurium*
Vandegrift et al. [113]	*Allium cernuum, Anemone virginiana, Asclepias tuberosa, Aster laevis (syn. Symphyotrichum laeve), Aster oolentangiensis (syn. Symphyotrichum oolentangiense), Campanula rotundifolia, Coreopsis lanceolata, Echinacea purpurea, Eragrostis spectabilis, Geum triflorum, Koeleria macrantha, Liatris aspera, Monarda fistulosa, Penstemon hirsutus, Schizachyrium scoparium, Sedum album, Sedum kamtschaticum (syn. Phedimus kamtschaticus), Sedum reflexum (syn. Sedum repestre), Sedum sexangulare, Sedum spurium (syn. Phedimus spurius), Sporobolus heterolepis, Tradescantia ohiensis*
Olszewski et al. [133], USA	*Sedum spurium, Sedum floriferum*
Thuring et al. [124], Central Pennsylvania, PA, USA	*Sedum album, Sedum sexangulare, Delosperma nubigenum, Dianthus deltoides, Petrorhagia saxifraga*

Table 6. *Cont.*

Reference and Location	Scientific Name
Durhman et al. [134], MI, USA	*Phedimus spurious*, *Sedum acre* L., *S. album* L., *S. middendorffianum* L., *S. reflexum* L., *S. sediforme* J., *S. spurium*
Rowe et al. [135], MI, USA	*Phedimus spurius*, *Sedum middendorffianum*, *Sedum acre*, *Sedum album*, *Graptopetalum paraguayense*, *Phedimus spurius*, *Rhodiola pachyclada*, *Rhodiola trollii*, *Sedum acre*, *S. album*, *Sedum clavatum*, *Sedum confusum*, *Sedum dasyphyllum*, *S. dasyphyllum*, *Sedum diffusum*, *Sedum hispanicum*, *S. kamtschaticum*, *Sedum mexicanum*, *Sedum middendorffianum*, *Sedum moranense*, *Sedum pachyphyllum*, *S. reflexum*, *Sedum sediforme*, *S. spurium*, *Sedum surculosum var. luteum*, *Sedum x luteoviride*, *Sedum x rubrontinctum.*

4.6. Green Walls

Vertical greening system (VGS) is increasingly recognized as a sustainable approach to mitigate the adverse effects of urbanization in tropical climates by enhancing thermal performance and reducing heat transmission in buildings [101]. Field experiments and reviews have demonstrated the potential of VGS to provide significant temperature reductions and energy savings in tropical climates [101]. VGS is categorized into two main types: green facades (direct or indirect) and living walls. Green facades are typically composed of climbing plants that are either directly attached to the wall or use a supporting structure, while living walls are pre-vegetated panels or integrated systems that can be attached to the exterior of a building [136]. These systems, which include green facades and living walls, offer benefits like temperature reduction, energy savings, and improved indoor environmental quality [137]. VGS indeed utilizes a wide variety of plant species to achieve their intended benefits. Plant species selection is critical for the success of VGSs, as varied species have varying capacities for particulate matter collection, adaptation to climate conditions, and contributions to biodiversity [138]. The appropriate species selection is influenced by factors like the system's design, local climate, and the specific environmental benefits sought, like air quality improvement or acoustic insulation [139]. The effectiveness of VGS in reducing temperature and improving thermal comfort is dependent on the density of the plants, which is quantified by LAI.

Jaafar et al. [140] indicated that a modular system with lush vegetation has a higher cooling effect compared to a cable system, suggesting that plant density plays a role in the effectiveness of VGS. For instance, Shuhaimi et al. [141] highlighted that the linear green wall system achieved the highest reduction in overall thermal transfer value, which may be due to factors beyond plant density. Considering the climatic influence, the arid and semi-arid climate cover species have drought tolerance, resilience to high solar radiation, and ability to thrive in low humidity. In tropical locations, species with high moisture tolerance, resistance to rot, and adaptability to high humidity are selected. In temperate climates, a mix of herbaceous perennials and ground covers, like *Achillea millefolia* and *Dianthus deltoides*, are selected for their ability to withstand temperate climates' moderate but variable conditions. These species are resilient to both summer warmth and winter chills, making them ideal for regions with seasonal variation. In continental climates, these species can survive harsh winters and hot summers, making them suitable for regions with a wide range of seasonal temperatures. Wong et al. [142] found that certain VGSs have better cooling efficiency and could be attributed to differences in plant density and coverage. However, it is important to note that while plant density is a significant factor, it is not the sole determinant of VGS effectiveness. Other factors like the type of plants, the system's design, and the local climate also contribute to the thermal performance of VGS. Table 7 shows the plant species investigated for green walls in different climates.

Table 7. Plant species studied for green walls.

Reference and Location	Scientific Name
Köppen climate "A"	
Nugroho [84], Indonesia	*Amaranthus hybridus*, *Brassica juncea*
Galagoda et al. [85], Sri Lanka	*Crissie bird nest*, *Thunergia laurifolia*, *Fruitzluthi maidenhair*, *Caledonium Orchid*, *Dracaena reflexa*, *Ficus pumila*, *Ferns (Caledonium)*
Abdul-Rahman et al. [86], Malaysia	*Psophocarpus tetrogonobulus*
Widiastuti et al. [87], Indonesia	*Passiflora flavicarva*, *Pseudocalym maalliaceum*
Jaafar et al. [88], Malaysia	*Thumbergia selecta*, *Ophiopogon verigated*
Charoenkit and Yiemwattana [89], Thailand	*Cuphea hyssopifola*, *Tibouchina urvilleana*, *Excoecaria cochinchinensis*
Widiastutia et al. [90], Indonesia	*Phalaenopsis* sp., *Dracaena warneckii*
Wong et al. [100], Singapore	*Nephrolepis exaltat*, *Urechites lutea*, *Ophiopogon japonicus*, *Tradescantia spathacea*
Rupasinghe and Halwatura [101], Sri Lanka	*Rhoeo spathacea*, *Axonopus compressus*
Safikhani et al. [119], Malaysia	*Blue trumpet vine*
Sunakorn and Yimprayoon [143], Thailand	*Blue trumpet vine*
Jim [144], Malaysia	*Psophocarpus tetrogonobulus*
Köppen climate "B"	
Pérez et al. [94], Lleida, Spain	*Hereda helix*, *Lonicera japonica*, *Parthenocissus quinquefolia*, *Clematis* sp.
Sánchez-Reséndiz et al. [106], Mexico	*Sedum reflexum*, *Sedum mexicanum*, *Sedum moranense*, *Hedera hélix (ivy)*, *Sedum obtusifolium*, *Sedum crassulaceae*, *Tall fescue (grass)*, *Chlorophytum comosum*
Carlucci et al. [117], Nicosia, Cyprus	*Gazania rigens var. Leucolaena*, *Lavandula anguistifolia*, *Mentha spicata*, *Origanum vulgare*, *Portulaca grandiflora*, *Rosmarinus officinalis*, *Thymus vulgaris.*
Refaat [145], Egypt	*Hedera hélix (ivy)*
Köppen climate "C"	
Bianco et al. [95], Turin, Italy	*Lonicera nitida L.*, *Bergenia cordifolia L.*
Cameron et al. [96], UK	*P. Laurocerasus*, *Jasminum officinale "Clotted Cream"*, *Hedera helix*, *Stachys byzantine*, *Fuchsia "Lady Boothby"*, *Lonicera "Gold Flame"*
Bakhshoodeh et al. [108], Perth, Australia	*Wisteria sinensis*, *Hibbertia scandens*
Mårtensson et al. [112], Malmö, Sweden	*Achillea millefolia*, *Bergenia cordifolia*, *Dianthus deltoides*, *Molinia caerulea*, *Nepeta faassenii*, *Salvia nemorosa*, *Sesleria heuffleriana*, *Antennaria dioica*, *Armeria maritima*, *Iberis sempervirens*, *Pilosella aurantiaca*
Koyama et al. [120], Japan	*Momordica charantia*, *Ipomoea tricolor*, *Canavalia gladiate*, *Pueraria lobata*, *Apios american Medikus*
Pan and Chu [146], Hongkong	*Peperomia claviformis*
Köppen climate "D"	
Zhang et al. [123], Beijing	*Phedimus Aizoon*, *Phedimus floriferus*
Susorova et al. [147], Chicago	*Parthenocissus tricuspidata*

5. Discussion

Proper plant selection is fundamental for optimizing UGSs and mitigating urbanization's negative effects, like air pollution, heat islands, and biodiversity loss. Effective residential greening relies heavily on choosing suitable plant species. Native plants are particularly valuable because they adapt well to local conditions and support greater biodiversity compared to non-native species. They usually require less maintenance and fewer resources, which is important in resource-limited urban settings. In contrast, exotic plants, while potentially adding aesthetic appeal, might not integrate well with local ecosystems and could disrupt ecological balance. Water-use efficiency is also essential. Urban areas often face water scarcity, so selecting plants that thrive in low water conditions is critical. Figure 5 shows the majorly studied plant species regarding various greening types.

Figure 5. The most studied plant species.

Plants with high water-use efficiency support green space sustainability and reduce the need for extra irrigation, enhancing the resilience of urban green areas. Poor plant selection can lead to increased maintenance costs and health issues. For example, in Nanjing, China, plants that released allergenic pollen resulted in allergic reactions among residents, highlighting the need to consider health impacts. Additionally, plant attributes like color, size, and form affect both aesthetics and functionality. Thus, plant species selection is vital for maximizing the benefits of residential green spaces. Although there is a lack of comprehensive reviews on this topic, this study aims to fill that gap by providing a detailed examination of plant selection factors. The goal is to support sustainable urban development and create green spaces that enhance ecological balance. Table 8 shows the major parameters of green infrastructures for different Köppen climates. Plant species selection is heavily influenced by climate factors like temperature, precipitation, and extreme weather, which determine plant behavior, distribution, and interactions. Native plants are often selected for their resilience and functional benefits, making them ideal for withstanding climatic stressors [12,24]. Aesthetic and environmental benefits were the second most important reason for selecting tree species. Other reasons include their cultural values, food production, and biodiversity. Trees are selected based on their ability to provide shade, cooling, and aesthetic value, with species selection tailored to the local climate and minimal maintenance. The criteria for tree species primarily involved native adaptation, its LAI, tree height, crown diameter, and shade provision. Trees offer significant cooling benefits, especially when strategically placed and selected for characteristics like high leaf area density and orientation. Trees with dense foliage, particularly on the south side of buildings, can lower temperatures by providing shade and facilitating evapotranspiration. To maximize these cooling effects, it is important to choose species with dense lower crowns, darker leaves, and a high LAI, ensuring a more comfortable and energy-efficient environment.

Table 8. Major parameters of green infrastructures over different Köppen climate classifications [148–150].

Köppen Climate	Parameters	Trees	Green Walls	Green Roofs	Shrubs	Grasses
A (Tropical climate)	LAI	High (>4) (e.g., *Erythrina variegata, Ficus elastica, Delonix regia*)	Medium to High (2–4 to >4) (e.g., *Nephrolepis exaltata, Ophiopogon japonicus*)	Medium to High (2–4 to >4) (e.g., *Heliconia* spp., *Zoysia japonica*)	Medium (2–4) (e.g., *Rhapis excelsa, Ixora coccinea*)	Low (<2) (e.g., *Ophiopogon* spp., *Hymenocallis littoralis*)
	Leaf density	Medium (30–70% coverage) (e.g., *Ficus benjamina, Azadirachta indica*)	High (>70% coverage) (e.g., *Ficus pumila, Tradescantia spathacea*)	Medium (30–70% coverage) (e.g., *Ixora coccinea, Bougainvillea*)	Medium (30–70% coverage) (e.g., *Bougainvillea, Rhapis excelsa*)	High (>70% coverage) (e.g., *Zoysia japonica*)
	Crown shape	Diverse (high variation) (e.g., *Samanea saman, Delonix regia*)	Low (dense coverage, uniform) (e.g., *Tradescantia spathacea, Ficus pumila*)	Low (uniform) (e.g., *Zoysia japonica*)	Various shapes (medium) (e.g., *Heliconia* spp., *Rhapis excelsa*)	Low (uniform) (e.g., *Zoysia japonica*)
	Foliage color	Medium to High (varied, bright colors) (e.g., *Delonix regia, Spathodea campanulata*)	Medium to High (varied, bright colors) (e.g., *Thunbergia laurifolia, Tradescantia spathacea*)	Medium to High (varied, bright colors) (e.g., *Heliconia* spp.)	Medium to High (varied colors) (e.g., *Heliconia* spp., *Bougainvillea*)	Low (basic green tones) (e.g., *Ophiopogon* spp.)
	Plant height	High (>5 m) (e.g., *Ficus elastica, Delonix regia, Samanea saman*)	Low (<1 m) (e.g., *Nephrolepis exaltata, Tradescantia spathacea*)	Low (<1 m) (e.g., *Zoysia japonica, Ophiopogon japonicus*)	Medium (1–5 m) (e.g., *Rhapis excelsa, Ixora coccinea*)	Low (<1 m) (e.g., *Ophiopogon* spp., *Hymenocallis littoralis*)
B (Dry climate)	LAI	Medium (2–4) (e.g., *Gleditsia triacanthos, Quercus coccinea, Ziziphus jujuba*)	Medium (2–4) (e.g., *Sedum reflexum, Sedum mexicanum, Hedera helix*)	Medium (2–4) (e.g., *Sedum spectabile, Delosperma cooperi*)	Medium (2–4) (*Amorpha fruticosa, Cercocarpus breviflorus*)	Low (<2) (*Bouteloua gracilis, Zoysia matrella*)
	Leaf density	Medium (30–70% coverage) (e.g., *Gleditsia triacanthos, Quercus douglasii*)	High (>70% coverage) (e.g., *Hedera helix, Lonicera japonica*)	Medium (30–70% coverage) (e.g., *Sedum spectabile, Lagurus ovatus*)	Medium (30–70% coverage) (e.g., *Amorpha fruticosa, Cercocarpus breviflorus*)	High (>70% coverage) (e.g., *Zoysia matrella*)
	Crown shape	Diverse (high variation) (e.g., *Gleditsia triacanthos, Quercus coccinea*)	Low (uniform) (e.g., *Sedum reflexum, Sedum mexicanum*)	Low (uniform) (e.g., *Sedum spectabile, Delosperma cooperi*)	Various shapes (medium) (e.g., *Amorpha fruticosa*)	Low (uniform) (e.g., *Zoysia matrella*)
	Foliage color	Medium (some variation) (e.g., *Gleditsia triacanthos, Ziziphus jujuba*)	Medium (some variation) (e.g., *Hedera helix, Lonicera japonica*)	Medium (some variation) (e.g., *Sedum spectabile, Delosperma cooperi*)	Medium (some variation) (e.g., *Amorpha fruticosa*)	Low (basic green tones) (e.g., *Zoysia matrella*)
	Plant height	High (>5 m) (e.g., *Gleditsia triacanthos, Quercus coccinea, Ziziphus jujuba*)	Low (<1 m) (e.g., *Sedum reflexum, Hedera helix*)	Low (<1 m) (e.g., *Sedum spectabile, Delosperma cooperi*)	Medium (1–5 m) (e.g., *Amorpha fruticosa, Cercocarpus breviflorus*)	Low (<1 m) (e.g., *Bouteloua gracilis, Lagurus ovatus*)

Table 8. *Cont.*

Köppen Climate	Parameters	Trees	Green Walls	Green Roofs	Shrubs	Grasses
C (Temperate climate)	LAI	Medium to High (2–4 to >4) (e.g., *Ulmus parvifolia*, *Acer platanoides*, *Pistacia chinensis*)	Medium (2–4) (e.g., *Lonicera nitida*, *Hedera helix*)	Medium (2–4) (e.g., *Sedum acre*, *Gazania uniflora*)	Medium (2–4) (e.g., *Lonicera nitida*, *Lavandula dentata*)	Low (<2) (e.g., *Zoysia japonica*, *Festuca ovina*)
	Leaf density	Medium (30–70% coverage) (e.g., *Prunus cerasifera*, *Ligustrum lucidum*)	Medium to High (30–70% to >70% coverage) (e.g., *Hedera helix*, *Lonicera nitida*)	Medium (30–70% coverage) (e.g., *Sedum acre*, *Sedum kamtschaticum*)	Medium (30–70% coverage) (e.g., *Lavandula dentata*, *Fuchsia*)	High (>70% coverage) (e.g., *Zoysia japonica*, *Anthoxanthum odoratum*)
	Crown shape	Various shapes (medium variation) (e.g., *Acer platanoides*, *Pyrus calleryana*)	Low (uniform) (e.g., *Hedera helix*)	Low (uniform) (e.g., *Sedum acre*)	Various shapes (medium) (e.g., *Lavandula dentata*)	Low (uniform) (e.g., *Festuca ovina*)
	Foliage color	Medium (some variation) (e.g., *Liquidambar formosana*)	Medium (some variation) (e.g., *Lonicera nitida*, *Salvia nemorosa*)	Medium (some variation) (e.g., *Sedum acre*, *Lavandula dentata*)	Medium (some variation) (e.g., *Lavandula dentata*, *Lonicera nitida*)	Low (basic green tones) (e.g., *Zoysia japonica*, *Festuca ovina*)
	Plant height	High (>5 m) (e.g., *Ulmus parvifolia*, *Acer platanoides*, *Platanus occidentalis*)	Low (<1 m) (e.g., *Lonicera nitida*, *Bergenia cordifolia*)	Low (<1 m) (e.g., *Sedum acre*, *Gazania uniflora*)	Medium (1–5 m) (e.g., *Lavandula dentata*, *Jasminum officinale*)	Low (<1 m) (e.g., *Festuca ovina*, *Zoysia japonica*)
D (Continental climate)	LAI	Medium (2–4) (e.g., *Morus alba*, *Acer saccharum*, *Quercus robur*)	Medium (2–4) (e.g., *Parthenocissus tricuspidata*, *Phedimus aizoon*)	Medium (2–4) (e.g., *Sedum album*, *Sedum kamtschaticum*)	Medium (2–4) (e.g., *Euonymus alatus*, *Viburnum opulus*)	Low (<2) (e.g., *Schizachyrium scoparium*, *Koeleria macrantha*)
	Leaf density	Medium (30–70% coverage) (e.g., *Gleditsia triacanthos*, *Betula pendula*)	High (>70% coverage) (e.g., *Parthenocissus tricuspidata*)	Medium (30–70% coverage) (e.g., *Sedum album*, *Sedum kamtschaticum*)	Medium (30–70% coverage) (e.g., *Euonymus alatus*)	High (>70% coverage) (e.g., *Koeleria macrantha*, *Schizachyrium scoparium*)
	Crown shape	Various shapes (medium variation) (e.g., *Quercus rubra*, *Fraxinus pennsylvanica*)	Low (uniform) (e.g., *Parthenocissus tricuspidata*)	Low (uniform) (e.g., *Sedum album*, *Sedum kamtschaticum*)	Various shapes (medium) (e.g., *Viburnum opulus*)	Low (uniform) (e.g., *Sporobolus heterolepis*)
	Foliage color	Medium (some variation) (e.g., *Acer saccharinum*, *Tilia cordata*)	Medium (some variation) (e.g., *Parthenocissus tricuspidata*)	Medium (some variation) (e.g., *Sedum album*, *Sedum kamtschaticum*)	Medium (some variation) (e.g., *Euonymus alatus*, *Viburnum opulus*)	Low (basic green tones) (e.g., *Schizachyrium scoparium*, *Koeleria macrantha*)
	Plant height	High (>5 m) (e.g., *Ulmus x hollandica*, *Liriodendron tulipifera*)	Low (<1 m) (e.g., *Phedimus aizoon*, *Bergenia cordifolia*)	Low (<1 m) (e.g., *Sedum album*, *Sedum kamtschaticum*)	Medium (1–5 m) (e.g., *Euonymus alatus*, *Philadelphus incanus*)	Low (<1 m) (e.g., *Koeleria macrantha*, *Schizachyrium scoparium*)

Urban greening also often prioritizes species with strong visual appeal [47]. For example, *Delonix regia* and *Jacaranda chelonia* are chosen for their striking flowers, which can enhance the beauty of the surroundings. Ficus elastic is chosen outdoors in warm climates for its large, glossy leaves and tolerance to low light conditions. The most observed species in the literature were *Samanea saman*, *Ficus benjamina*, *Peltophorum pterocarpum*, *Mesua ferrea*, *Azadirachta indica*, *Artocarpus heterophyllus*, *Magnifera indica, and Spathodea campanulata* in climate "A"; *Ficus elastic* and *Peltophorum pterocarpum* in climate "B"; *Tilia cordata*, *Acer platanoides*, *Ficus microcarpa*, *Pyrus calleryana, and Platanus occidentalis in climate "C"; and*

Tilia cordata, Acer platanoides, Ginkgo biloba, Aesculus hippocastanum, Fraxinus excelsior, Robinia pseudoacacia, and *Quercus robur* in climate "D".

In urban design, shrubs and grass enhance both aesthetics and environmental quality. Shrubs offer visual interest and contribute to carbon sequestration, habitat provision, and soil stabilization, while grasses create cohesive, calming spaces and support thermal comfort by reducing temperatures. Native species are often preferred for their adaptability and support of local biodiversity, offering habitat. Together, they improve mental well-being by providing tranquil green spaces, making them essential components of urban landscapes. The most observed species of shrub in the literature were *Heliconia spp.*, *Bougainvillea*, *Ixora coccinea*, *Ophiopogon japonicas*, and *Zoysia japonica* in climate "A"; *Amorpha fruticosa "Nana"*, *Cercocarpus breviflorus*, *Lonicera japonica*, and *Lagurus ovatus L.* in climate "B"; *Lonicera nitida L*, *Jasminum officinale "Clotted Cream"*, and *Zoysia japonica* in climate "C"; and *Caragana pekinensis*, *Caragana rosea*, *Spiraea fritschiana*, *Schizachyrium scoparium*, and *Koeleria macrantha* in climate "D".

Green roofs provide significant environmental benefits, including improved energy conservation and reduced UHI effects [151]. The plant species selection for green roofs is driven by several critical factors. Species like *Sedum* are versatile, appearing across multiple climate zones, due to their low-maintenance requirements, drought tolerance, and ability to establish quickly on green roofs. Species are also chosen for specific functional roles, like temperature regulation and biodiversity support, which are critical for the success of green roofs in urban environments. The use of temperature regulation was based on factors like LAI. Plant species for stormwater management must be capable of absorbing and retaining significant amounts of water to mitigate runoff during heavy rain events. *Sedum* species, like *Sedum album*, *Sedum kamtschaticum*, and *Sedum spurium*, are known for their water-retentive properties, as they can store water in their leaves, stems, and roots. In regions with semi-arid and arid climates, where water scarcity is a concern, selecting drought-tolerant species like *Bouteloua gracilis* and *Opuntia fragilis* is beneficial. Additionally, grasses like *Zoysia japonica* provide a dense ground cover that slows down water flow and enhances infiltration.

VGS is gaining traction as a sustainable solution for mitigating UHI in various climates by enhancing thermal performance and reducing heat transmission [152,153]. Their effectiveness is influenced by factors like plant density, LAI, species selection, and system design. Across all climates, the selection prioritizes species that not only survive but also contribute to the overall functionality of green walls. This includes considerations like minimal maintenance requirements, resistance to local pests and diseases, and aesthetic contributions, like flowering or foliage color. Many of the selected species exhibit low water and nutrient requirements, which aligns with the growing emphasis on sustainable urban greening practices. Such a requirement is readily satisfied by most of the native species. The most used species in green walls were blue trumpet vine (*Thunbergia laurifolia), Psophocarpus tetrogonobulus, and Amaranthus hybridus in climate "A"; Sedum reflexum*, *Sedum mexicanum*, and *Sedum moranense* in climate "B"; *Achillea millefolia*, *Dianthus deltoids*, and *Nepeta faassenii* in climate "C"; and *Parthenocissus tricuspidata*, *Phedimus aizoon*, and *Phedimus floriferus* in climate "D". Various other factors also influence the plant selection for residential greening. Understanding soil conditions is vital for plant survival, with loam soil being particularly beneficial. Garden size, design, and social context shape plant choices, with larger gardens allowing for diversity and smaller spaces favoring compact growth. Socioeconomic factors, like income and cultural preferences, influence plant diversity, with wealthier areas tending to have more ornamental species. Environmental benefits, like air purification and stormwater management, are prioritized alongside aesthetics, while pest-resistant and non-allergenic plants are favored for low-maintenance and safe gardens. The integration of edible and medicinal plants reflects a growing trend towards sustainability and the preservation of cultural practices.

The thermal performance of green infrastructure in urban environments is particularly significant in tropical and coastal settings. Nyuk Hien et al. [154] explored the impact of extensive rooftop greenery in Singapore and highlighted its effectiveness in mitigating the UHI effect. They revealed that well-vegetated green roofs could achieve surface temperature reductions of up to 18 °C compared to conventional roofs by significantly lowering heat flux and maintaining cooler substrate temperatures. Yuan et al. [155] assessed urban albedo and green coverage in Osaka and found that a lower urban albedo combined with moderate vegetation (20%) yielded the best microclimate improvement. Zhang et al. [156] investigated greening strategies in Qingdao's coastal urban spaces, emphasizing the importance of tree selection and placement. Their findings indicated that trees with higher LAI improved thermal comfort near the coastal areas. Chidambaram et al. [157] assessed terrace gardens' role in moderating building microclimates and observed a 2–3 °C reduction in winter and 5–7 °C in summer, alongside providing urban farming benefits.

Rai and Singh [158] explored the ecological impacts of invasive alien plant species, biotechnological prospects, and health risks by emphasizing the need for integrated research and effective management strategies using geospatial technologies. Hui et al. [159] explored integrating urban natural resources and smart technologies to enhance sustainability in smart cities. They highlighted the benefits of green spaces and advanced technologies for environmental management and public health, emphasizing the need for effective policies and data analysis strategies. Tan and Abdul Hamid [160] studied the impact of urbanization on biodiversity and advocate for long-term ecological studies to link urban ecology with sustainability efforts in Singapore. Jamei et al. [161] explored heat mitigation strategies for tropical cities by emphasizing combined approaches like shading and ventilation over vegetation to combat UHI and thermal discomfort. Wong and Baldwin [162] explored the feasibility of double-skin green façades in Hong Kong's high-rise buildings, demonstrating significant energy savings for cooling while emphasizing the need for further research on vertical greenery. Nalini and Dutt [163] explored the impact of socioeconomic and political processes on urban vegetation patterns in Bengaluru, and they revealed significant transformations in green cover and temperature dynamics during the urbanization phases. Gopal et al. [164] analyzed vegetation in Bangalore's slums and revealed lower tree density and diversity compared to wealthier areas. They observed native species with economic and cultural significance dominating the need for utility-focused greening efforts in urban poverty contexts. Collectively, these studies emphasize the critical role of vegetation in enhancing urban thermal environments and inform strategies for effective urban design and planning in varying geographical contexts.

The following certain criteria are considered for a proper plant species selection for effective residential greening [10,24,69,102,131,141].

- Native status and resilience refer to whether the plant is indigenous to the region, which contributes to its resilience and reduces the risk of ecological disruption. The plant's tolerance to climate stressors—such as drought, heat, poor or dry soil, salt, air pollution, frost, and wind—ensures its survivability in varying environmental conditions.
- Plant structure and foliage characteristics encompass the plant's height, spread, shape, and overall growth habit, including factors such as crown diameter, LAI, and leaf area density. These characteristics should be considered to enhance shade provision and cooling effects.
- Water needs and maintenance requirements include the plant's moisture levels and watering needs. Selecting species with low water requirements is imperative for sustainability in regions with limited water availability. Additionally, consider the time and effort needed for tasks such as watering, pruning, weeding, fertilizing, and plant replacement. Favoring species that are low-maintenance, pest-resistant, and non-allergenic can help ensure safe, sustainable, and low-intervention gardens.
- Growth speed refers to the rate at which the plant grows—slow, moderate, or fast. Choose species that match the intended purpose, whether for rapid coverage or long-term establishment.

- Edibility indicates whether the plant can be used in cooking, tea, or other culinary applications. Integrating edible and medicinal plants reflects a trend towards sustainability and cultural preservation.
- Aesthetic appeal describes the visual impact of the plant's foliage and flowers, including their shape, color, and form. Select species that enhance the beauty of the environment through striking flowers or attractive foliage.
- Blooming period specifies the months during which the plant blooms, ensuring either year-round or seasonal visual interest and ecological benefits.
- Ecological impact evaluates the plant's ability to support biodiversity by attracting pollinators, insects, or wildlife. Consider how the plant contributes to local ecosystems and enhances the regional environmental quality.

Limitations of the Present Study and Further Scope

The major challenges of plant species invasiveness in urban residential green spaces include biodiversity loss, as invasive species can outcompete native plants and disrupt ecosystems, diminishing vital services like pollination and soil health. Invasive species also incur higher maintenance costs due to their rapid spread, requiring frequent removal and control efforts. They can alter soil composition and water availability, disrupting the balance of urban landscapes. In addition, they may introduce pests and diseases that negatively affect plant health. Some invasive species pose health risks, such as allergenic pollen or toxicity, impacting residents. Regulatory challenges arise from local and national policies that restrict the use of certain species. Invasive plants are often more adaptable to urban environments, thriving in disturbed conditions, which makes them attractive but problematic for landscaping. Furthermore, aesthetic preferences for visually appealing species can conflict with ecological sustainability, and a lack of public awareness exacerbates the spread of invasives, making education crucial for responsible plant selection.

Further in-depth studies beyond the Köppen climate classifications and sub-classifications are essential for maximizing the benefits of residential plant species selection and deployment. The more critical parameters are terrestrial solar radiation, air moisture, wind patterns, mean sea levels, and other landscape and terrain factors. Relative humidity refers to the amount of moisture in the air compared to the maximum it can hold at a given temperature. High humidity can affect plant growth, while low humidity may lead to dehydration. Sunlight is essential for photosynthesis, influencing plant growth, flowering, and ecosystem development. Wind, caused by air pressure differences, can spread seeds, pollen, and pollutants and affect soil moisture levels. Changes in elevation impact environmental conditions like temperature and oxygen, influencing plant and animal distributions. These factors are crucial in urban planning, shaping plant selection and ecosystem health in residential green spaces.

The integrated approach to residential plant selection has limitations that must be addressed to improve sustainability. Plant species may not suit every local climate or soil type, requiring specific amendments for optimal growth. Although low-maintenance plants reduce upkeep, they still need some care, such as pest control and pruning. Budget constraints can make the initial cost of diverse plant species higher. All plants are native to some region, but a native plant becomes invasive only when introduced outside its natural range. Invasive plants are non-native species that spread rapidly, disrupting ecosystems and harming native species. While native plants may be aggressive in managed landscapes, they rarely invade natural areas or cause significant ecological damage when used within their native range. Overemphasis on certain plant traits might reduce biodiversity, and personal preferences may not always align with ecological goals. Additionally, practical challenges like space constraints and existing infrastructure can complicate residential green implementation. Negative impacts of residential greenery include increased pests, maintenance challenges, high water usage, potential structural damage from roots, fire hazards in dry climates, allergy issues, biodiversity concerns from non-native species, soil erosion, and limited sunlight. Balancing these drawbacks is essential for effective greening strategies. Future studies are essential for addressing these issues and improving the effectiveness and sustainability of residential greening projects.

6. Recommendation of Plant Species for Residential Greenery

Table 9 provides a comprehensive overview of suitable plant species for different climate zones, emphasizing their roles in enhancing ecosystem values. It categorizes plants' species selection based on soil conditions, space layout, maintenance requirements, aesthetics, environmental benefits, and their contributions to human health and well-being. This potential information could benefit the users to create a lush tropical garden, a resilient arid landscape, or a serene temperate environment. Further, this resource offers tailored suggestions for shrubs, trees, grass, and vertical garden options in residential green spaces. By selecting the right plants, users can cultivate thriving green spaces that beautify, support biodiversity, and improve human as well as environmental health. Residential greening strategies aim to enhance green spaces in residential areas through various initiatives [156]. Key strategies include encouraging urban gardening, installing green roofs and walls, promoting native plant landscaping, and designing rain gardens to manage stormwater. Creating community green spaces fosters interaction, while tree-planting initiatives increase urban canopy cover. Sustainable hardscaping with permeable materials reduces runoff, and wildlife habitat creation supports local fauna. Education and workshops inform residents about greening benefits, and incentives provide resources to encourage participation. These strategies collectively improve environmental quality, aesthetics, and community spirit in residential neighborhoods.

Table 9. Suggestion of plant species (scientific names) as per the ecosystem services and climate zones.

Factor	Climate Zone	Shrubs	Tree Species	Grass Species	Green Wall Species	Green Roof Species
Soil	A (Tropical)	*Amaranthus hybridus*, *Ocimum tenuiflorum*, *Dracaena trifasciata*, *Monstera delisiosa*	*Ficus elastica*, *Erythrina variegata*	*Hymenocallis littoralis*, *Ophiopogon japonicus*	Blue trumpet vine, Amaranthus hybridus, Epipremnum aureum, Syngonium angustatum, jasminum auriculatum, Brassica juncea	*Heliconia* spp., *Hymenocallis littoralis*, *Ophiopogon*, *Rhapis excelsa*, *Pandanus amaryllifolius*, *Erythrina variegata*, *Bougainvillea*, *Ixora coccinea*
	B (Arid)	*Lonicera japonica*, *Clematis* sp.	*Quercus coccinea*, *Prosopis juliflora*	*Bouteloua gracilis*, *Zoysia matrella*	*Sedum reflexum*, *Sedum mexicanum*, *Hedera helix*, *Lonicera japonica*	*Sedum spectabile*, *Silene vulgaris*, *Lagurus ovatus*
	C (Temperate)	*Lavandula dentata*, *Lonicera nitida*	*Liquidambar formosana*	*Rye grass (Lolium perenne)*, *Festuca ovina*	*Lonicera nitida*, *Bergenia cordifolia*	*Gazania uniflora*, *Sedum acre*, *Sedum aizoon*, *Sedum reflexum*
	D (Continental)	*Caragana pekinensis*, *Rosa davurica*	*Quercus robur*, *Acer saccharinum*	*Koeleria macrantha*, *Eragrostis spectabilis*	*Parthenocissus tricuspidata*, *Phedimus aizoon*, *Phedimus floriferus*	*Allium cernuum*, *Anemone virginiana*, *Echinacea purpurea*, *Coreopsis lanceolata*

Table 9. *Cont.*

Factor	Climate Zone	Shrubs	Tree Species	Grass Species	Green Wall Species	Green Roof Species
Space layout	A (Tropical)	*Thunbergia laurifolia, Dracaena reflexa, Brassica juncea*	*Dyera costulata, Azadirachta indica*	*Axonopus compressus, Ophiopogon verigated*	*Blue trumpet vine, Thunbergia laurifolia, Tradescantia spathacea*	*Heliconia* spp., *Bougainvillea, Ophiopogon*
	B (Arid)	*Cercocarpus breviflorus, Amorpha fruticosa "Nana"*	*Gleditsia triacanthos, Ziziphus jujuba*	*Lagurus ovatus, Tall fescue (Festuca arundinacea)*	*Sedum crassulaceae, Hedera helix, Parthenocissus quinquefolia*	*Sedum spectabile, Opuntia fragilis*
	C (Temperate)	*Lonicera nitida, Fuchsia "Lady Boothby"*	*Prunus serrulata, Malus Rudolph*	*Anthoxanthum odoratum, Molinia caerulea*	*Lonicera* "Gold Flame", *Jasminum officinale*	*Gazania uniflora, Sedum reflexum, Callisia repens*
	D (Continental)	*Spiraea fritschiana, Philadelphus incanus*	*Betula pendula, Carpinus betulus*	*Schizachyrium scoparium, Sporobolus heterolepis*	*Philadelphus incanus, Spiraea fritschiana*	*Allium cernuum, Coreopsis lanceolata, Echinacea purpurea*
Maintenance	A (Tropical)	*Psophocarpus tetragonolobus, Heliconia* spp.	*Ficus benjamina, Pongamia pinnata*	*Ophiopogon* spp., *Zoysia japonica*	*Psophocarpus tetragonolobus, Dracaena reflexa*	*Heliconia* spp., *Hymenocallis littoralis, Bougainvillea*
	B (Arid)	*Amorpha fruticosa "Nana", Cercocarpus breviflorus*	*Parrotia persica, Cinnamomum camphora*	*Bouteloua gracilis, Lagurus ovatus*	*Sedum mexicanum, Sedum reflexum*	*Sedum spectabile, Silene vulgaris*
	C (Temperate)	*Lavandula dentata, Fuchsia "Lady Boothby"*	*Brachychiton discolor, Angophora floribunda*	*Eremochloa ophiuroides, Drosanthemum hispidum*	*Achillea millefolia, Bergenia cordifolia*	*Sedum acre, Gazania uniflora*
	D (Continental)	*Forsythia suspensa, Philadelphus incanus*	*Tilia cordata, Robinia pseudoacacia*	*Koeleria macrantha, Sporobolus heterolepis*	*Forsythia suspensa, Philadelphus incanus*	*Allium cernuum, Echinacea purpurea*
Aesthetics	A (Tropical)	*Thunbergia selecta, Cuphea hyssopifolia*	*Delonix regia, Brownea ariza*	*Hymenocallis littoralis, Axonopus compressus*	*Blue trumpet vine, Tradescantia spathacea*	*Heliconia* spp., *Bougainvillea, Ixora coccinea*
	B (Arid)	*Lonicera japonica, Clematis* sp.	*Cinnamomum camphora, Sorbus aucuparia*	*Lagurus ovatus, Zoysia matrella*	*Gazania rigens* var. *leucolaena, Lavandula angustifolia*	*Sedum spectabile, Opuntia fragilis*
	C (Temperate)	*Lonicera "Gold Flame", Lavandula dentata*	*Jacaranda chelonia, Crataegus laevigata*	*Hardenbergia violacea, Anthoxanthum odoratum*	*Lonicera* "Gold Flame", Jasminum officinale	*Gazania uniflora, Sedum reflexum*
	D (Continental)	*Forsythia suspensa, Syringa oblata*	*Aesculus hippocastanum, Liriodendron tulipifera*	*Eragrostis spectabilis, Schizachyrium scoparium*	*Wisteria sinensis, Syringa oblata*	*Allium cernuum, Echinacea purpurea, Anemone virginiana*

Table 9. *Cont.*

Factor	Climate Zone	Shrubs	Tree Species	Grass Species	Green Wall Species	Green Roof Species
Environmental benefits	A (Tropical)	*Passiflora flavicarva*, *Rhapis excelsa*	*Kigelia africana*, *Callophyllum inophyllum*	*Zoysia japonica*, *Ophiopogon japonicus*	*Blue trumpet vine*, *Thunbergia laurifolia*, *Ficus pumila*	*Heliconia* spp., *Bougainvillea*, *Erythrina variegata*
	B (Arid)	*Cercocarpus breviflorus*, *Amorpha fruticosa "Nana"*	*Aesculus glabra*	*Tall fescue*, *Bouteloua gracilis*	*Sedum reflexum*, *Gazania rigens*	*Sedum spectabile*, *Opuntia fragilis*
	C (Temperate)	*Lavandula dentata*, *Lonicera nitida*	*Ficus macrocarpa*, *Ligustrum lucidum*	*Molinia caerulea*, *Trisetum flavescens*	*Achillea millefolia*, *Bergenia cordifolia*	*Sedum acre*, *Gazania uniflora*, *Phila nordiflora*
	D (Continental)	*Viburnum opulus* var. *calvescens*, *Spiraea fritschiana*	*Fraxinus pennsylvanica*, *Platanus acerifolia*	*Eragrostis spectabilis*, *Sporobolus heterolepis*	*Parthenocissus tricuspidata*, Philadelphus incanus	*Allium cernuum*, *Echinacea purpurea*, *Coreopsis lanceolata*
Pest and disease resistance	A (Tropical)	*Excoecaria cochinchinensis*, *Bougainvillea*	*Samanea saman*, *Syzygium cumini*	*Ophiopogon japonicus*, *Axonopus compressus*	*Amaranthus hybridus*, *Brassica juncea*	*Heliconia* spp., *Bougainvillea*
	B (Arid)	*Cercocarpus breviflorus*, *Amorpha fruticosa "Nana"*	*Quercus douglasii*, *Sorbus aucuparia*	*Bouteloua gracilis*, *Zoysia matrella*	*Sedum mexicanum*, *Lonicera japonica*	*Sedum spectabile*, *Bouteloua gracilis*
	C (Temperate)	*Lonicera nitida*, *Lavandula dentata*	*Bambusa ventricosa*, *Cedrus deodar*	*Festuca ovina*, *Rye grass (Lolium perenne)*	*Lonicera nitida*, *Bergenia cordifolia*	*Sedum acre*, *Gazania uniflora*
	D (Continental)	*Philadelphus incanus*, *Spiraea fritschiana*	*Quercus robur*, *Corylus colurna*	*Koeleria macrantha*, *Eragrostis spectabilis*	*Philadelphus incanus*, *Spiraea fritschiana*	*Echinacea purpurea*, *Anemone virginiana*
Human health and well-being	A (Tropical)	*Pandanus amaryllifolius*, *Heliconia spp.*	*Magnifera indica*, *Artocarpus heterophyllus*	*Hymenocallis littoralis*, *Zoysia japonica*	*Psophocarpus tetragonolobus*, *Nephrolepis exaltata*	*Heliconia* spp., *Hymenocallis littoralis*
	B (Arid)	*Lonicera japonica*, *Clematis* sp.	*Melicoccus bijugatus*, *Enterolobium ciclocarpum*	*Zoysia matrella*, *Lagurus ovatus*	*Hedera helix*, *Lonicera japonica*	*Sedum spectabile*, *Opuntia fragilis*
	C (Temperate)	*Lavandula dentata*, *Jasminum officinale*	*Ulmus parvifolia*, *Pistacia chinensis*	*Rye grass (Lolium perenne)*, *Festuca ovina*	*Achillea millefolia*, *Jasminum officinale*	*Gazania uniflora*, *Echinacea purpurea*
	D (Continental)	*Syringa oblata*, *Spiraea fritschiana*	*Ginkgo biloba*, *Acer pseudoplatanus*	*Schizachyrium scoparium*, *Sporobolus heterolepis*	*Syringa oblata*, *Spiraea fritschiana*	*Allium cernuum*, *Anemone virginiana*

Table 9. *Cont.*

Factor	Climate Zone	Shrubs	Tree Species	Grass Species	Green Wall Species	Green Roof Species
Potential adverse impacts on human health and ecosystem	A (Tropical)	*Bougainvillea, Ixora coccinea*	*Ficus religiosa, Spatheodea campanulata*	*Hymenocallis littoralis, Ophiopogon japonicus*	*Bougainvillea, Ixora coccinea*	*Bougainvillea, Ixora coccinea*
	B (Arid)	*Prosopis juliflora*	*Prosopis juliflora, Morus alba (male)*	*Tall fescue, Zoysia matrella*	*Prosopis juliflora*	*Opuntia fragilis*
	C (Temperate)	*Platanus occidentalis*	*Acer platanoides, Platanus occidentalis*	*Rye grass (Lolium perenne), Anthoxanthum odoratum*	*Platanus occidentalis*	*Platanus occidentalis*
	D (Continental)	*Betula pendula, Acer saccharinum*	*Betula pendula, Robinia pseudoacacia*	*Eragrostis spectabilis, Koeleria macrantha*	*Betula pendula, Acer saccharinum*	*Betula pendula, Acer saccharinum*

The complex dynamics of plant invasions and their environmental, ecological, and societal impacts are important aspects. While some invasive species may provide ecological or aesthetic benefits, the majority disrupt native biodiversity and ecosystem stability. Effective management strategies, early warning systems, and further research are critical for balancing these trade-offs in urban and natural ecosystems. The present review offers an overview of plants studied in specific cities or ecoregions within a particular Köppen climate zone. Further studies are needed to explore the potential negative impacts outside of this range and assess the suitability of these plants for use beyond the areas where they were originally studied.

As environmental conditions shift, future residential plant selection will rely on understanding how urban temperature, rainfall, solar radiation, air moisture, wind patterns, sea levels, and terrain affect plant biology. Advances in biotechnology, climate modeling, and ecological research will guide plant choices that promote resilience, biodiversity, and sustainability. These practices will be key to creating climate-resilient landscapes that support carbon sequestration, water conservation, and urban biodiversity. By considering these complex environmental interactions, plant selection can evolve beyond aesthetics, enhancing ecological sustainability and fostering environmental stewardship in the face of climate change.

7. Conclusions

The design and implementation of residential green spaces are critical components for enhancing the urban ecosystem, environmental resilience, and human well-being. Through an in-depth examination of factors influencing plant selection, this review highlights the necessity for a multifaceted approach that aligns plant choices with the unique demands of climate, soil, spatial constraints, and health effects. The major conclusions drawn from the present review are summarized here.

Thoughtful plant selection not only strengthens the sustainability and resilience of green spaces but also contributes to broader urban ecological health. Selecting plants based on specific climatic zones supports sustainable landscaping that thrives with minimal intervention. Species adapted to the regional climate reduce reliance on irrigation, pest management, and fertilizers, promoting low-maintenance and cost-effective green spaces. In tropical regions, humidity-tolerant species such as *Heliconia* spp. and Ixora coccinea grow with reduced water consumption and promote biodiversity. Similarly, drought-tolerant species such as *Sedum spectabile* and *Opuntia fragilis* thrive in arid climates, conserving water and maintaining vegetation in arid conditions. The climate-centric approach minimizes resource utilization, reinforces resilience against climatic shifts, and supports sustainable urban greening. Soil quality and water-holding capacity are fundamental for plant health and longevity. Urban soils often exhibit significant variability, necessitating plants that are adaptable to diverse soil profiles. Species such as *Sedum spurium* and *Zoysia japonica*, which thrive in well-drained loads or tolerate moderate water stress, enhance the establishment and persistence of green spaces.

Residential greening necessitates consideration of the spatial constraints and design preferences that influence each green space. Species with compact or vertical growth habits, such as *Sphagneticola trilobata*, are optimal for confined or enclosed areas, while expansive, open gardens may incorporate broad-leafed trees like *Erythrina variegata* to establish structure and enhance visual appeal. Socioeconomic factors, including cost constraints, maintenance resources, and cultural preferences have a significant influence on plant selection for residential greening. Low-maintenance species such as *Lavandula dentata* and culturally significant plants like *Ipomoea pescapre* offer both ecological benefits and cultural value, fostering engagement and stewardship among residents. The incorporation of plants with local significance or utility such as those with medicinal or edible properties enables UGSs to not only contribute to environmental health but also promote community resilience, food security, and cultural continuity.

UGSs are increasingly acknowledged for their contributions to mental and physical well-being. The selection of non-allergenic and air-purifying species such as Echinacea purpurea and Geum triflorum mitigates adverse health impacts and enhances resident satisfaction. Trees and shrubs with high canopy cover like Pandanus amaryllifolius reduce urban heat and create cooler, more comfortable living environments, which is particularly advantageous in hot urban climates. The strategic selection of plant species for residential green spaces is integral to achieving both ecological and anthropocentric objectives in urban planning. By considering factors such as climate adaptability, soil compatibility, space design, maintenance requirements, health impacts, and biodiversity, urban planners and residents can collaboratively create thriving green spaces that enrich urban landscapes, support public health, and contribute to environmental sustainability. A thorough analysis of human health risks or issues associated with the selective plant species must be explored before deployment.

Invasive species impact biodiversity and ecosystem stability, with some offering aesthetic benefits. Effective management, early warning systems, and research are essential for balancing these trade-offs. Future plant selection will consider solar radiation, moisture, wind, sea levels, and terrain in addition to the temperature and precipitation, guided by biotechnology and ecological research to promote resilience and environmental sustainability.

Author Contributions: Conceptualization, Formal analysis, Methodology, Investigation, Visualization, Data validation, Writing—Original draft, Writing—Review: U.K.P. and R.S. All authors approved the submission of the final manuscript. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: Data will be made available on reasonable request.

Acknowledgments: The authors thank the SRM Institute of Science and Technology, Kattanku-lathur, Chennai, for the research facility.

Conflicts of Interest: The authors declare that there are no conflicts of interest.

Abbreviations

LAI	Leaf area index
SDG	Sustainable development goal
UGS	Urban green spaces
UHI	Urban heat island
VGS	Vertical greening system

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