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The Role of Community Gardens in Enhancing Social Cohesion and Addressing Local Biodiversity

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The Role of community Gardens in Enhancing Social Cohesion and Addressing Local Biodiversity

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Abstract

Community gardens have emerged as multifunctional spaces for fostering social cohesion and enhancing biodiversity as urbanization continues to alter social structures and environmental landscapes. This master thesis investigated their role in both social and ecological dimensions, particularly within the Swedish context.

The study combines both literature review and an online survey, reviewing existing literature on the topic and examine participants' social experiences and gardening practices in community gardens. The findings highlighted that community gardens significantly contribute to social cohesion by fostering neighbourhood relationships, strengthening social networks, product and skills-sharing, collaboration and community engagement. Conceptualized as "third spaces," these gardens enhance place attachment and social capital, foster belonging and social bonds across diverse groups. Additionally, community gardens play a critical role in promoting local biodiversity, from offering habitats for pollinators, native and threatened species, nesting animals and insects, to further enhance people’s ecological awareness. The study categorised the common types of community gardens in Sweden, and revealed a strong preference for sustainable gardening practices such as organic and permaculture, which further support ecological conservation. Participants also emphasized the need for climate adaptation strategies, urban planning integration, and municipal support to enhance the long-term sustainability of these spaces.

Recommendations included fostering inclusive management practices, expanding access to gardening spaces in low-income areas, and promoting biodiversity-friendly gardening practices. These insights contribute to urban planning discussions, emphasizing the role of community gardens in shaping resilient and socially cohesive urban environments.

Keywords: Community gardens, social cohesion, biodiversity, gardening,

gardening practices, ecosystem services

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Abbreviations

Abbreviation	Description
BNB	Bring nature back into cities
CI	Confidence interval: gives a range of values that is likely to contain the true population mean with a certain level of confidence (usually 95% or 99%).
CSA	Community-supported agriculture
d	Cohen's d (effect size)
FOR	Fritidsodlingens Riksorganisation
g	Hedges' g (effect size)
IKL	Indigoes and Local Knowledge: refers to folk traditions and practical interactions with nature
IP address	Internet Protocol version: a unique numerical label assigned to devices connected to a network
IPBES	Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services.
M	Mean (the average value of a dataset): represents the sum of all values divided by the number of observations.
N	Sample Size (number of observations)
NRC	National Research Council in Washington (DC)
NCP	Nature contribution to people
p-value	Probability value (statistical significance)
PPP Model	Place, person, process Model, Scannell and Gifford's (2010)
RQ	Research question
SD	Standard deviation: measure of how spread out the values in a dataset are. It tells us how much the individual data points deviate from the mean
SC	Social capital
SCT	Social capital theory
SLU	Swedish University of Agricultural Sciences
SLU CBM	Center of biological diversity at Swedish University of Agricultural Sciences
Z	Z-score: measures how far the observed proportion is from the test value, in terms of standard errors.

1. Background

1.1 Urban Challenges and the Rise of Community Gardens

As cities face rapid urbanization and weakening social ties (Sakketa, 2023), community gardens are increasingly recognized as crucial urban commons that enhance both ecological and social well-being. Contemporary urbanization is not only a demographic shift but a complex socio-economic transformation that often leads to social fragmentation, the breakdown of traditional community networks, and increased inequality, particularly in rapidly growing cities (Sakketa, 2023; Wan et al., 2022). While urbanization may offer economic growth and better access to services, it frequently disrupts social cohesion and marginalizes low-income communities, contributing to poverty, migration, overcrowding, and poor living conditions (Gizelis et al., 2021; Salgado de Snyder et al., 2011). At the same time, environmental consequences such as increased carbon emissions, habitat destruction, and biodiversity loss further intensify the challenges of urban living (Liu et al., 2016).

In response to these intertwined social and ecological issues, community gardens emerge as transformative spaces. These spaces offer a divers range of benefits such as food security, nutrition, health, and poverty reduction (Barron, 2016). Especially important in low-income neighborhoods or "food deserts," they provide direct access to fresh food production (Barron, 2016). Beyond their nutritional value, community gardens serve as calming retreats from urban life, offering psychological relief and stress reduction (Milligan et al., 2004).

1.2 The Social and Ecological Value of Community Gardens

Community gardens are deeply connected to the concept of space as both a social product and a driver of social relations. They allow residents to reshape their urban experience through shared cultural practices and community activities

(Barron, 2016). As dynamic, multilayered environments, these gardens exist at the intersection of food politics, urban planning, environmental activism, horticulture, and social movements (Borčić et al., 2016). From the perspective of ecosocial work, community gardens provide a powerful entry point to address social and ecological justice, active citizenship, and public health (Fisch, 2023). Early research on community gardens primarily emphasized their physical and psychological health benefits. Numerous studies have examined their impact in various areas, such as improving dietary habits (Alaimo et al., 2008), generating household economic savings (Algert et al., 2014), and promoting physical well-being among gardeners (Armstrong, 2000). In recent years, attention has expanded to include the ecological role of community gardens, particularly their contribution to urban biodiversity (Paris et al., 2013). Researchers have increasingly recognized these spaces as important habitats that support a diverse range of plant species, as well as animals and insects vital to healthy ecosystems (Egerer et al., 2024). Community gardens are now seen as key to enhancing the quality of life not only for people but also for non-human species through the conservation of urban biodiversity (Fisch, 2023). As such, they are believed to integrate ecological and social values across residential and educational contexts (Di Pietro et al., 2018).

1.3 The Swedish Context and Research Gaps

This paper investigates this significant dual role of the community gardens of enhancing social cohesion and contributing to the local biodiversity particularly in the Swedish context, where the concept of “community garden" is still relatively unfamiliar to the public and was only recently introduced (Larsson, 2009). Existing research on community gardens in Sweden reveals both the promise and challenges of these spaces in fostering sustainable urban development. Larsson (2009) introduces the concept of self-organised district gardens, showing how grassroots cultivation creates public spaces that are ecologically aware and socially meaningful, blending communal access with a sense of personal belonging. Similarly, Bonow and Normak (2018) demonstrate the challenges in

Stockholm, where enthusiasm for community gardening is growing, but its sustainability is undermined by unclear roles, mismatched expectations, and a lack of long-term planning between citizens and local authorities.

Complementing these social and governance perspectives, a comparative study by Lim (2016) adds an international and horticultural dimension. Their research compares Swedish and Singaporean community gardens and identifies practical barriers; such as insufficient education, and societal norms that limit horticultural success. The study underscores the untapped potential of gardens in areas like food self-sufficiency and waste reduction, calling for stronger policy support and educational programs. Together, these studies illustrate the multifaceted role of community gardens as spaces of ecological learning, social cohesion, and urban sustainability, while also emphasizing the structural and educational barriers that must be addressed for their full potential to be realized.

While existing studies have established the social and ecological potential of community gardens in Sweden, several key gaps remain. Although Larsson (2009) provides deep insight into self-organised gardens as “socio-ecological” spaces; which are are environments, that are shaped by both social (human) and ecological (natural) interaction, and are characterized by the interdependence between people and nature, where human activities influence the ecosystem, and vice versa. The work is primarily conceptual and theoretical, with limited empirical exploration across diverse garden types.

Likewise, Bonow and Normak (2018) emphasize institutional tensions but focus narrowly on governance issues in urban policy, without detailing the on-the-ground experiences of participants or the ecological contributions of gardens. In Lim (2016) reveal the horticultural limitations and potential of community gardens but offer little in-depth analysis within the Swedish context, particularly regarding the relationship between gardening practices and local biodiversity. Moreover, there is a lack of clarification of the types of community gardens in Sweden, in addition to lack of integrated research worldwide that examines both social cohesion and biodiversity as interconnected outcomes of community gardening.

This study addresses some gaps, investigates how community gardens in Sweden contribute to both social cohesion and local biodiversity, offering an insight on this dual role while also highlighting participants' perceptions, practices, and needs, which are essential for informing more inclusive, sustainable, and participatory urban gardening policies. Additionally, this study attempts to classify the common types of community gardens in Sweden, and seeks to offer insights for the field of urban planning at the municipal level. Urban planners and landscape architects could benefit from the set of recommendations provided, serve as a guide for establishing socially focused, biodiversity-promoting community gardens.

1.4 Key Definitions

In the following text, I provide definitions and insights into the key concepts explored in this study, i.e. social cohesion and biodiversity. I also identify different types of community gardens and outline their global classifications. All are essentials for this study.

Community Gardens:

The concept of community gardens is widely used but somewhat loosely defined. It has been described as a public garden based on factors such as ownership, access, and the level of democratic control (Ferris, 2001). Traditionally are collectively managed by groups of individuals and/or households who share resources and land (Mintz & McManus, 2014). Pudup (2008) outlined three key distinctions in community gardens: they can involve various affiliations, ranging from local residents to broader social groups; they can be either collectively maintained or divided into private plots; and they may be used for growing food. Glover (2004) indicated community gardens as organized initiatives where urban land is used by individuals or groups to grow food or flowers. These gardens foster shared use of resources such as land, tools, and water, and provide a space for collective participation, relationship building, and community development. In this paper I use a definition of community gardens that combines both Pudup's

outlines (2008) and Glover's indication (2004), as a shared section of land for personal or collective purpose which is managed by initiative(s) and can involves a wider group of residents that can share both activities and resources for both social and horticultural serve.

Community gardens are known by various names worldwide, each reflecting cultural and use differences (Samkova, 2013). In Turkey, they are called "hobby gardens," emphasizing leisure over production (Henden Şolt & Kaymak Heinz, 2017), while in the UK "allotment gardens" focus on individual plots for food cultivation (Dobson et al., 2020). In Japan, "citizen farms" stress sustainability (Harada et al., 2021); in Africa, "food gardens" emphasize nutrition and food security (Wills et al., 2010). Across North America and Australia, "community gardens" highlight shared participation (Pascoe & Howes, 2017), and in Europe, the term "urban gardens" is often used to denote multifunctional green spaces within cities. In Austria, "kleingarten" or small gardens have been officially supported since the early 20th century for urban agriculture(Henden Şolt & Kaymak Heinz, 2017).

Despite their wide presence, community gardens differ significantly in size, purpose, and user demographics (Pudup, 2008). Literature offering a comprehensive categorization of these gardens is limited (Kordon et al., 2022). Generally, spaces such as school gardens, therapy gardens, and neighborhood gardens fall under the broad category of community gardens but vary widely in form and function. Assist. Dr. Sinan Kordon from Turkey, is a faculty member at Kahramanmaraş Sütçü İmam University, Faculty of Forestry, Department of Landscape Architecture, also serves as the Vice Chair of the Department, has developed a classification identifying eight types of community gardens based on their main functions and the nature of the participating community groups. (Kordon2024), (see Table 1).

1. **Neighbourhood gardens** are collaborative spaces where community members grow fruits, vegetables and flowers often divided into individual plots with an annual fee. Typically they include amenities like picnic areas and communal tool storage.

2. **Youth/school gardens** blend gardening with school lessons, teaching students about plants and science to encourage healthy eating. Located in schoolyards, and often featuring raised beds, these gardens are managed by teachers or volunteers.

3. **Entrepreneurial/farmers' market gardens** focus on reducing poverty and social exclusion by allowing participants in low-income areas to sell produce to local markets, gaining income and business skills.

4. **Residential gardens** used for personal food production are either home gardens in single-family backyards or shared apartment gardens in affordable housing courtyards. Costs like tools and water are shared among residents, and these gardens are typically closed to outsiders.

5. **Healing or therapeutic gardens** focus on the restorative power of plants to support social, psychological, and physical well-being. Often linked to hospitals, senior centers, or rehabilitation facilities, they aim to provide mental and physical rehabilitation, skill training, and wellness activities, and are designed to be accessible to individuals with mobility or sensory limitations.

6. **Demonstration gardens** educate the public on sustainable practices like composting and water conservation, often through expert-led workshops. They serve as outdoor classrooms and can overlap with other garden types in their functions.

7. **Plot gardens** divide a larger community garden into individual plots assigned to each gardener or family, often through short-term contracts. 20 Located frequently in urban areas, these gardens provide personal green space, with each gardener being responsible for maintaining their plot.

8. **Communally managed gardens** or urban farms are shared spaces where gardeners collectively maintain the entire area as a single agricultural unit, without individual plots. This collaborative approach highlights the diversity of community garden structures and purposes in urban settings.

Garden type	Participation groups	Land type	Garden space	Use of products	Primary purpose
Neighbourhood gardens	People in community	Public Private	Individual Communal single-plot	Personal Give away	Gathering Socializing
Youth/school gardens	Students Teachers Families	Private Government Schoolyard	Raised beds Individual plots	Using in school kitchen only	Education, nutrition, science classes
Farmers markets gardens	Unemployed residents, growers	Public Private	Individual plots	Sell to local markets, restaurants	Income, skill-building, poverty reduction
Residential gardens	Individuals or people in housing groups	Private Government supported housing yard	Individual plots	Personal Share with residents	Gardening Gathering Socializing
Therapeutic gardens	Patients, elderly, rehab clients	Institutions (hospitals, churches, senior centers)	Individual plots Communal single-plot	Used in institution kitchen Donated	Education Reha Job training Skill develop
Demonstration gardens	Public people Students Job and skill learners	Part of botanical gardens Education institutions	Individual plots Communal single-plot	Used in institution kitchen Donated	Outdoor classroom Public education programs
Plots garden	Individual gardeners Families	Public Private	Individual plots	Personal use	Gardening Urban greening
Communally Managed Gardens	Community group Urban farmers	Public Private	Collectively managed space (no individual plots)	Shared among all members	Urban agriculture Community cooperation Food

Table 1. Summary of the types of community gardens according to Kordon (2024).

Social Cohesion:

Social cohesion is a multifaceted concept, refers to the degree of connection and mutual sense of belonging shared among individuals and groups within a society. It reflects how strongly people feel part of a collective, underpinned by shared values, trust, and a commitment to common goals. This sense of unity contributes to social stability and cooperative relationships across different segments of the population (Larsen, 2014).

From an urban and spatial perspective, social cohesion also encompasses how people interact within their physical environments, such as neighborhoods. The layout of residential areas, proximity to others, and opportunities for daily social interaction can significantly influence how connected residents feel to their communities (De Kam & Needham, 2003). In this context, social cohesion becomes not only a matter of social and emotional ties but also one shaped by the physical and institutional design of cities and neighborhoods.

Moreover, Kearns and Forrest (2000) identified five key elements of social cohesion including:

(1) Common values and a civic culture, which encompass shared values, norms, and behaviours, along with civic engagement and participation, helping to build collective identity and solidarity.

(2) Social order and control which refer to mechanisms that maintain safety, respect, and stability within communities, fostering a predictable social environment.

(3) Social solidarity, combined with a commitment to reducing wealth disparities, encourages mutual support and fair resource distribution, reinforcing community ties.

(4) Social networks and social capital which highlight the importance of strong, trusting relationships and networks, and facilitate cooperation and collective action.

(5) Place attachment and identity reflect individuals' sense of belonging to a specific place or community, strengthening their emotional and social connections

to the environment. Together, these elements contribute to the strength of social cohesion within a community.

Collectively, these elements shaped the framework developed by Kearns and Forrest (2000), which examined the concept of social cohesion within the context of urban governance.

Biodiversity:

A foundational concept in ecology and conservation, has been examined and interpreted through various disciplinary lenses, reflecting its multifaceted value to both natural and human systems.

In Perspectives on Biodiversity: Valuing Its Role in an Ever-changing World, the National Research Council in Washington (DC) (1999) underscores the importance of biodiversity not merely as a biological construct but also as a vital component of social, economic, and ecological resilience. The report highlights the difficulty of providing a single, all-encompassing definition of biodiversity, noting that its meaning often varies depending on context, ranging from genetic and species diversity to ecosystem diversity. Importantly, the NRC frames biodiversity in terms of its value: instrumental (e.g., provision of ecosystem services), intrinsic (value in and of itself), and cultural (symbolic and identity-based associations). This framing helps to broaden the understanding of biodiversity beyond ecological science, promoting interdisciplinary discourse on its preservation and management.

Stork's (2009) contribution to the Encyclopedia of Insects presents a more concise, taxonomically grounded definition of biodiversity. He defines biodiversity as the variety of life on Earth, encompassing diversity at genetic, species, and ecosystem levels. Stork places particular emphasis on the role of taxonomy in quantifying and understanding biodiversity, stressing the challenges in estimating total species numbers, particularly among invertebrates and microorganisms. He also emphasizes biodiversity's functional importance in ecosystems, where interactions among species maintain ecological processes. This

approach highlights the scientific imperative for classification and cataloguing, and its role in revealing both known and unknown dimensions of life.

Swingland's (2013) entry in the Encyclopedia of Biodiversity offers perhaps the most integrative and philosophical treatment. He defines biodiversity as "the totality of genes, species, and ecosystems in a region," and extends this view to include the spatial and temporal dimensions of biological variety. Swingland stresses the historical development of the term, originating from the contraction of "biological diversity," and its adoption as a political and conservation-oriented term in the 1980s. He also explores the relationship between biodiversity and ecosystem stability, evolutionary potential, and anthropogenic pressures. This comprehensive overview reflects how biodiversity is not only a measurable phenomenon but also a policy-relevant construct shaped by human values, scientific discovery, and global environmental change.

SLU center for biological diversity (SLU CBM) defines biodiversity as the web of life that includes diversity of species, genes and ecosystem. It further defines the term of biological cultural heritage "biologiskt kulturarv" as the intersection of biological diversity and cultural traditions. Traditional agricultural, cultivation methods and plant varieties are clear examples of this heritage, which refers to the indigenous and local knowledge (IKL), practices and species that have co-developed through human interaction with nature over time. This heritage, in its turn, is crucial for maintaining the biodiversity by traditional land-use that often preserve habitats and support many species. Therefore protecting heritage is not only about species' conservation but also for safeguarding cultural identity, local knowledge and sustainable land management (SLU CBM, 2025).

SLU CBM's project "Biological Cultural Heritage in Practice and Research" has developed and applied interdisciplinary methods to identify and use the ecological fingertips resulting from the historical land use. Suggesting that builds up both cultural and nature conservation, offering new tools for protecting biodiversity, while highlighting cultural values embedded in plants, habitats, and landscapes (SLU CBM, 2009)

The key arguments that guide SLU CBM's work is that nature's diversity offers humans not only wide benefits of raw materials, but also contributes to a wide range of cultural, spiritual and social values. In addition to the "intrinsic" value of biodiversity i.e. species life and variety, where species have a right to exist independently of human needs and humans don't have the right to destroy species and years of evolution.

Furthermore, the concept of ecosystem services has long been criticised for being limited to nature's goods and services, but it encompasses valuing nature and its contribution to humanity's values. In this context, SLU's center divides the ecosystem services into four categories:

- **Supplying services** include raw material e.g. grain, drinking water, timber, bioenergy.
- **Regulating services** include air purification, pollination, and climate regulation.
- **Cultural services** include outdoor life, health, natural heritage and tourism.
- **Supporting services** for other services to function, such as photosynthesis and soil formation.

Additionally, SLU CBM addresses the challenge of biodiversity loss in Sweden, where over 2,000 species are endangered and about 5,600 are red listed. Sweden facilitates many polices and tools, for example, establishing nature reserves, protecting specific species by various types of direct biotope improvement, using measured dimensions (e.g., number, occurrence and trends of species, Swedish Red List) making the biodiversity's value visible.

Collectively, those four influential sources, National Research Council (1999), Stork (2009), and Swingland (2013), and SLU CBM's definitions offer this study distinct yet complementary perspectives on biodiversity's definition, scope, and significance.

2. Aim

The aim of this study is to investigate the role of community gardens in enhancing social cohesion and addressing local biodiversity for balancing social and ecological goals in community gardening. This study seeks to investigate the following research questions:

RQ1. What types of community gardens exist in Sweden?

RQ2. How do community gardens contribute to fostering stronger relationships among community members and improving social cohesion?

RQ3. How can community gardens enhance local biodiversity?

3. Method

The study combines both quantitative and qualitative approach, to comprehensively explore the role of community gardens in enhancing social cohesion and supporting local biodiversity in Sweden.

This study also employs a mixed-methods combining a literature review with empirical data collection through an online survey. This combination enables both a theoretical foundation and real-world insights to inform a deeper understanding of the phenomena. One key advantage of mixed-methods research is its ability to answer research questions that neither quantitative nor qualitative methods could answer alone, enriching the experiences of researchers as different insights illuminate the issues being studied (Mohanasundari & Padmaja, 2019).

The structure of the paper and the research process are further illustrated in the following figure (see Figure 1).

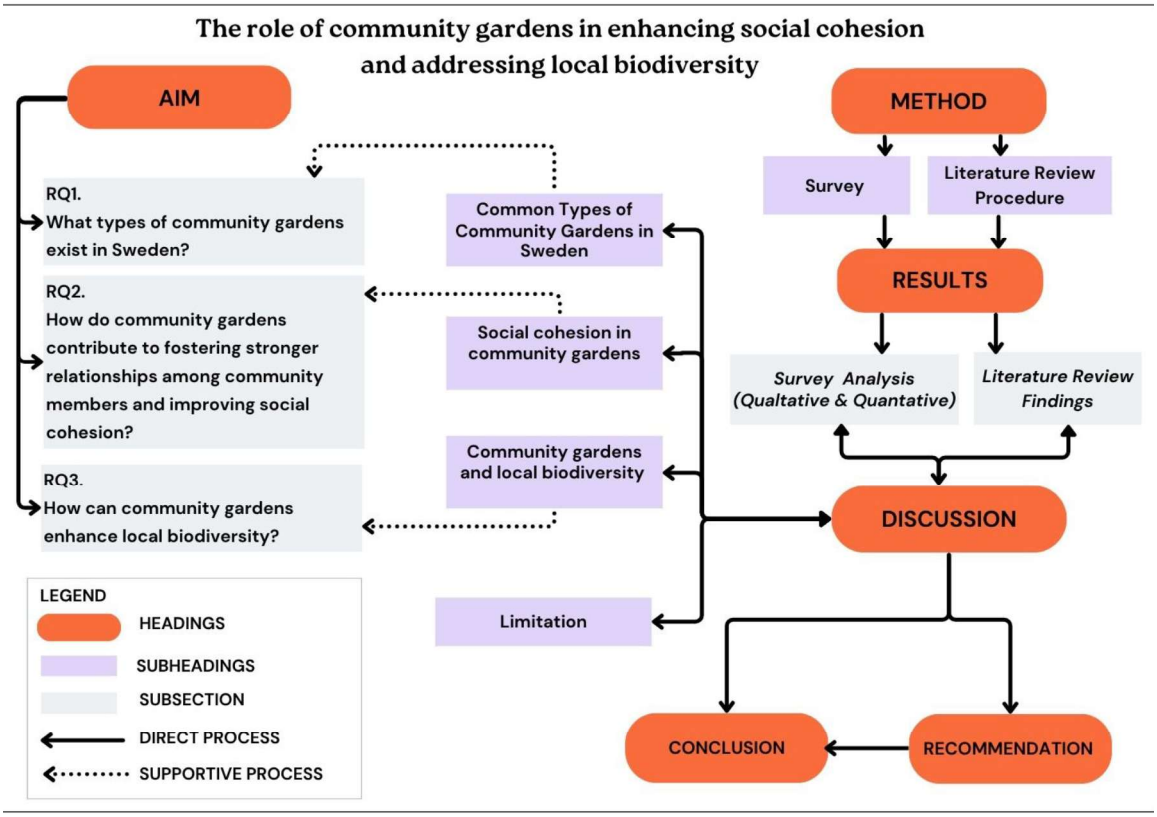

Figure 1. The structure of the paper and the research process.
The layout explains the structure and the arrows explain the research process

3.1 Literature Review Procedure

The literature review served as a critical foundation for the study, offering a broad overview of previous research on community gardens and their social and ecological functions. It helped identify existing definitions, terms (e.g., social capital, place attachment, third space theory), and determine earlier research in both social and ecological role significance and further highlighted their findings. The motivation behind using this approach is to define the scope of the study, and inform the survey design. Booth et al. (2016) argue that the literature review is not just a background task, but a **strategic method** that shapes the entire research process.

Search Strategy: The literature search was carried out using academic databases including ResearchGate, SinceDirect, Google Scholar, JSTOR, SLU's library search engine and publications of SLU center for biological diversity. To ensure a

comprehensive overview, peer-reviewed journal articles, books, and relevant grey literature e.g., Master's and doctoral thesis between 2000 and 2024 were considered. Priority was given to sources focusing on community gardens in urban contexts, particularly in Sweden and other comparable European settings. Special attention was paid to studies that addressed research gaps, including the studies classified different types of community gardens worldwide.

Keywords and Search Terms: The search terms and keyword combinations were used in various arrangements for instance:

- "Community gardens" AND "social cohesion"
- "Community gardening" AND "biodiversity"
- "Urban gardening" AND "place attachment"
- "Community gardens" AND "social capital"
- "Permaculture" AND "biodiversity"
- "Allotment gardens" AND "Sweden"
- "Community gardens" AND "Gardening practices"
- "Connectedness to nature" AND "green spaces"

Synonyms, alternative terms and specific types' names of community gardens were also used in both English and Swedish, especially during the mapping of types in Sweden (e.g., "allotments," "koloni," "stadsdelträdgårdar," "residential gardens," "therapeutic garden," etc) were also included to ensure broader coverage.

Inclusion and Exclusion Criteria : The search was conducted in both English and Swedish and included studies that focused on social engagement and addressed either social outcomes (e.g., community engagement, place attachment, inclusion, identity) within the context of social cohesion in community gardens. Additionally, studies examining gardening practices, land tenure, biodiversity, nature contribution to people and ecological impacts (e.g., pollinator support, habitat creation) were included for their relevance to the role of community gardens in promoting local biodiversity. While the search encompassed studies on

urban gardening, including market-oriented and entrepreneurial gardens, it excluded those focused exclusively on commercial farming, large-scale agriculture, or rural contexts. Studies that concentrated solely on other benefits aspects of community garden such as household economics, food security, mental health, or stress reduction were also excluded; these topics were referenced only to provide broader contextual background. Moreover, experimental studies lacking theoretical relevance to the dual focus on social and ecological benefits were not considered for inclusion.

Selection and Analysis: Initial searches yielded over 200 articles. After screening titles and abstracts, approximately 100 sources were selected for full-text review. Of these, around 54 key references were integrated into the literature review. Articles were categorized into two thematic clusters: (1) social dimensions (e.g., place attachment, social capital, third spaces), and (2) ecological dimensions (e.g., biodiversity, sustainable gardening practices, bringing nature to cities, nature's contribution to people). These clusters structured and presented in the Results (see Section 4).

3.2 Survey

Another selected procedure for this mixed-method is an online survey, that was conducted to gather insights into participants' experiences and practices in community gardening. The survey employed both quantitative and qualitative questions to ensure a comprehensive understanding of the research topics (see Appendix 1). The motivation behind using an online survey is to reach out to diverse range of participations. Surveys are a practical and efficient method for gathering data from a large group of people. They are especially useful for uncovering attitudes, opinions, behaviors, or traits within a population (Fink, 2017). This aligns with the aim of the current study, which seeks to understand both the social and ecological dimensions of community garden participation across diverse groups in Sweden.

Quantitative data were collected using closed-ended survey questions (e.g., Likert scales, multiple-choice formats) to explore patterns in social participation and ecological practices (see Appendix 1). Closed-ended questions are typically helpful when you're looking to identify or explain trends in people's knowledge, attitudes, or behaviors through statistical analysis (Fink, 2017). Making this approach suitable for capturing general trends across a diverse sample of gardeners. These questions were designed to systematically evaluate aspects such as type of participation, most visited type of community gardens in Sweden, gardening activities, plants preferences to grow, plants origin, attitude towards using new gardening technology and the most valued habitat features etc.

Qualitative data were obtained through open-ended questions that allowed participants to elaborate on their personal experiences and perspectives (see Appendix 1). According to Fink (2017), open-ended questions allow respondents to express themselves in their own words, making them particularly valuable for exploring new subjects or gaining insight into people's feelings, opinions, and personal experiences. Which is essential when studying the social meaning and values associated with community gardening. These responses captured nuanced insights into the emotional experiences in community gardens, as well as participants' reflections on new ideas to improve the gardening in community gardens.

Tool and language: I designed the survey of 18 questions in Netigate and offered it in multiple languages, including English and Swedish. Special care was taken through translation to avoid changing the meaning of both questions and multi-choice answers.

Survey instrument: The survey was structured to address two key objectives:

1. **Social participation:** Questions explored participants' social experiences and the benefits derived from community gardening, such as building social networks, fostering friendships, gaining skills, being a member in

some social association and enhancing neighbourhood relationships (see Appendix 1).

2. **Gardening participation:** Questions focused on understanding the current practices and preferences in community gardening, including the types of plants grown, dominant gardening methods (e.g., organic, permaculture), and the significance of insect/animal habitat features like insect hotels and beehives (see Apspendix 1).

The survey design took consideration to those primarily engaged in social events in gardens and those involved in both social and gardening activities, therefore the questionnaire was designed to first gather data on social engagement. Then a logic matrix was implemented using a Likert scale from 1 to 7 (where 1 = Never and 7 = Often) to assess the frequency of gardening participation. If a respondent selected (1 = Never) for gardening participation, the survey was designed to end at that point.

Target group and distribution: The survey targeted individuals who are involved in community gardens across various settings, including neighbourhood gardens, therapeutic gardens, residential gardens, and school gardens. I distributed the survey between January 8, 2025, and February 28, 2025, with recruitment facilitated through online platforms and social networks. Initially, the survey was shared in Swedish gardening groups on Facebook such as Kolonilottsliv, Trädgårdsvänner and Odla ihop (see Appendix 1), additionally I sent it via email to some individuals who involved in gardening to reach a relevant sample. After one week, I noticed that only a small number of participants had completed the survey. To ensure validity and gathering a sufficient number of complete responses from individuals actively engaged in gardening, I reached out to communication representatives from various gardening organizations in Sweden, such as Riksförbundet Svensk Trädgård and Fritidsodlingens Riksorganisation (FOR), (see Appendix 1).

FOR distributed the survey on its online channels mainly Facebook and Instagram and I provided an AI-generated image (see Figure 2) for publication that showed people engaged in planting, watering, harvesting, and socializing to attract participation. Their support helped expand the reach of the survey and encouraged participants to complete the questionnaire.

Figure 2. AI-generated image of community gardens for (FOR) publication of survey. (Image created with ChatGPT from the prompt "Community gardens with raised beds, lush greenery, and people gardening", Instruction by. Sarah Saleh 2025).

Inclusion and exclusion criteria: The exclusion criteria involved discarding responses that did not reach one of the two designated endpoints in the survey. While a total of 134 responses were collected, only 61 were fully completed and included in the final dataset. Data collected through this survey provided a rich dataset for analyzing both the social impact and practical aspects of community gardening.

3.3 Data Analysis

This study employs a mixed-methods approach, requiring two distinct but complementary strategies for data analysis: one for the quantitative survey data, and another for the qualitative open-ended responses. The aim was to capture both statistical trends and contextual meanings related to community gardening in Sweden.

Quantitative responses were statistically analyzed by using IBM SPSS 29.02, descriptive analysis (e.g., frequency counts, means, percentages) were conducted on multi- choice questions. These results were used to identify trends in participant demographics, types of gardens, frequency of gardening practices, and perceived benefits related to social and ecological outcomes. Descriptive statistics are useful in early-stage research to identify meaningful patterns and support later qualitative interpretations (Fink, 2017).

Moreover, I conducted inferential statistics for questions on Likert scale (e.g., one-sample t-test compared to natural value, one-sample proportion Z-test comparing the observed proportion to the hypothesized value) to further understand the importance of perceived social benefits and skill-sharing through participation in community gardens. In addition to investigate the attitude towards using new technology of gardening. This analysis of survey data helped describe the population or phenomenon being studied, test hypotheses, and explore relationships among variables using the responses obtained (Fink, 2017).

Qualitative responses on open-ended questions were thematically analyzed to uncover deeper insights into participants' experiences and perspectives. Thematic analysis, following the six-phase process outlined by Braun and Clarke (2006). This involved:

1. **Familiarization with data:** reading responses several times to gain an overall understanding.

2. **Initial coding:** labeling key phrases or sentences based on recurring concepts (e.g., “accessibility,” “greenhouse” “municipal support,” “social activities”). In this step I also incorporated word clouds generated via Netigate, these visual tools represent the most frequently used words in participants’ open-ended responses. The words, presented in both English and Swedish to reflect the bilingual format of the survey, helped me coding the answers. Specially when I identified additional types of community gardens in Sweden and examined emotional experiences. Frequently occurring words appear larger and centrally placed, while less common terms are displayed in smaller fonts and side placed.

3. **Searching for themes:** grouping codes into broader categories such as “social activities,” and “ planting events,” were grouped into broader category “Community gardens as social hubs”. Where as “greenhouse,” “climate-smart crops” and “sustainable practices” were grouped into category “Climate adaptation and all year-around growing”.

4. **Reviewing themes:** refining and collapsing overlapping categories.

5. **Defining and naming themes:** such as social themes and ecological themes when I analyzed new ideas suggested by participants to improve the gardening. This step ensured each theme reflected a distinct aspect of the data.

6. **Writing the analysis:** integrating direct quotes to illustrated themes in the results chapter. Particular care was taken during the translation of participants’ quotes written in Swedish into English to preserve the original meaning and ensure cultural accuracy.

The qualitative analysis was conducted manually using Microsoft Word, without specialized software, due to the small scale of the study, which involved responses to only three open-ended questions. To enhance transparency and consistency, I presented word clouds in the results section (see Section 4). Collectively, these word clouds offer a clear and accessible visual summary of the qualitative data,

especially within analysis of the emotional experiences and the additional types of community gardens, supporting the credibility of the manual analysis process.

To enhance credibility and trustworthiness, both **quantitative** and **qualitative** data were analyzed iteratively and cross-validated, a process known as triangulation (Creswell & Plano Clark, 2017). The quantitative findings were used to confirm broader patterns observed in the qualitative responses, while the open-ended answers provided deeper insight and context to support the interpretation of numerical trends. For instance, in the exploration of social cohesion (see Subsection 4.2.2), quantitative findings indicated a high frequency of social interactions. Participants reported sharing resources, and developing a stronger sense of belonging within their communities, patterns that also found in the qualitative data, which were visually supported by a word cloud highlighting recurring terms such as "community," "sharing," and "belonging. These analyses of quantitative and qualitative data ensured that the findings were both robust and contextually meaningful, contributing significantly to the study's overall objectives. Additionally, individual responses were interpreted cautiously and not taken out of context, in order to maintain the integrity of the participants' perspectives.

3.4 Research Ethics

The research adhered to ethical principles to ensure the integrity of the study, valid findings, and participant protection.

Ethical approval was obtained firstly from the supervisor and course leader at the Swedish University of Agricultural Sciences (SLU), with a risk assessment confirming no physical risks against environment or animals, and addressing potential risks to personal data such as tracking IP address in an online survey.

Before distributing my online survey, I formally registered the data processing activity with SLU's Dataskydd (Data Protection) under the category of a student's independent thesis work. The registration was conducted under the institution unit

"People and Society," and I was assigned the registration ID number 128. The purpose of the data processing was clearly defined as part of my master's thesis titled “The Role of Community Gardens on Social Cohesion and Local Biodiversity.” I explicitly selected consent as the legal basis for data processing, in accordance with GDPR regulations. I also ensured that technical and organizational safeguards were in place where access to the data was restricted, and no personally identifiable information such as names or addresses was collected. No third-party processors were involved, and no data was transferred outside the EU/EEA. The processing is set to conclude in June 2025, and all personal data will be deleted by July 2025, as specified in the data retention plan. This process ensured full compliance with SLU’s data protection policies and GDPR requirements.

In the survey, informed consent was secured by providing participants with clear information on the study’s educational purpose and obtaining consent at the start of the survey (see Appendix 1). Only minimal, non-identifying demographic data (age, gender, profession) were collected to maintain anonymity and confidentiality (see Appendix 1), with data securely stored for six months according to GDPR regulations.

Under the analysis period I ensured limited access to the collected data and anonymized for reporting, available just for me in locked folders. The study minimize harm to participants and was conducted with transparency and honesty, keeping participants assured of unbiased reporting. Compliance with the Swedish Research Council's Good Research Practice (2017) and SLU data protection standards was maintained. Participation was entirely voluntary.

Regarding the usage of AI tool (i.e. ChatGPT) I declare using it for generating the images for survey, cover page and poster publication to attract participation and to publish an image that is not restricted by copyright issues. I also declare using the ChatGPT-free version to improve general English writing in some instances, specifically abstract and recommendation sections. Later on and due to the delayed edition of thesis, I used ChatGPT- free version in some sections such as

biodiversity definitions and expanding the literature review of biodiversity role in community gardens, to finalize the texts, reduce repetition, concentrate the summary of additional studies and improve the English writing. Importantly, the improvement of English writing did not involve generating ideas or conducting any analysis, but rather summarizing and rewriting the section, to ensure the language structure is more concrete and precise.

4. Results

4.1 Common Types of Community Gardens in Sweden

4.1.1 Literature Review Findings

Though the concept of community gardens is relatively new in Sweden, their popularity has grown significantly in the 21st century (Bonow & Normark, 2018). Sweden has a long history of urban farming “stadsjordbruk” and food production was an important part of the comprehensive welfare system Björklund (2010). Allotment gardens, thriving spaces for urban farming, are predominantly owned by local authorities with, in many cases, individual allotment societies renting the land and letting lots out to tenants (Larson & Giritli Nygren, 2024), which in turn have individual access and management, often called in Swedish “kolonilott” or commonly “koloni.” Allotments are often distinguished from the community gardens in terms of ownership and access Ferris et al. (2001). Swedish agriculture was largely influenced by English and Scottish agriculture Björklund (2010) where allotment gardens are dominant. The first allotment garden in Sweden was established in Malmö in 1895 (Lim, 2016), following earlier attempt in Landskrona in 1888, initially providing urban poor workers with spaces to grow food (Hadgu, 2021). Allotment gardens provided an alternative by allowing multiple people to share plots in a communal space. In Stockholm allotment gardens established in 1906, these gardens were driven by concerns for industrial workers' well-being (Hadgu, 2021). They advocated for green spaces where families could grow food, children could play, and social connections could flourish. The allotments were seen as offering economic, nutritional, and

psychological benefits, serving as a "uniting bond" for families and providing both sustenance and personal fulfillment (Hadgu, 2021). During World War II, interest in allotment gardens increased, with around 10,000 cultivation plots in Uppsala by the 1950s, when the city had a population of approximately 89,000. These plots were used for growing fruit and vegetables (Hadgu, 2021). The idea of community gardens emerged due to the lack of available allotments and long waiting lists for municipal land plots to grow plants or build summer houses (Luokkala, 2014).Based on this historical review of allotments and urban farming for food production, popularity and importance of allotments during the time, in addition to the influence of English agriculture in Sweden, where allotments are dominating, this paper tends to include allotments “kolonilträdgårdar” in community gardens that commonly exist in Sweden as a unique type and category.

In order to map the categories of community gardens in Sweden this paper uses categories that Kordon (2024) has identified (see Table 1) as an instrument or guideline in scanning and classifying the types of community gardens in Sweden. While no formal classification system currently exists at the national level, recent scholarship in environmental psychology, landscape architecture, and outdoor pedagogy has increasingly focused on community gardens, highlighting a growing diversity in their design, purpose, and governance.

It is essential to note that school gardens, educational and botanical gardens, as well as therapy gardens, all have a significant importance in the Swedish context. More specifically school gardens have attracted interest throughout Swedish literature and many have recommended gardening activities in school gardens and highlighted their impact on both physical and psychological health (Mårtensson et al. 2010), where school gardens are a place of initiatives that engage students and teachers in educational and recreational purposes. Therapy gardens have been studied widely for their potential to impact health and wellbeing throughout gardening activities (Grahn et al., 2022). They are usually started by health initiatives and/or by educational institutes such as the therapeutic garden at the

Alnarp campus of the Swedish University of Agricultural Sciences (SLU), (see Figure 3).

Figure 3. Rehabilitation Garden at SLU in Alnarp. Frederik Tauchnitz, landscape architect and gardener, "Photo: Jenny Svennås-Gillner, SLU Mediabank, 2013"

Meanwhile, neighbourhood gardens are commonly provided by community housing companies such as Stockholmshem (Bonow & Normak, 2018). Neighbourhood gardens "innergårdar, stadsdelsträdgårdar" are clear popular examples of a shared plot of land in urban settings. These gardens have become increasingly visible in Swedish cities such as Stockholm, Malmö, and Gothenburg, often arising from grassroots initiatives motivated by social inclusion and sustainability goals. Swedish neighbourhood gardens are typically characterized by informal organization, though they sometimes partner with municipalities or housing companies for land access, material support, or coordination (Bonow & Normak, 2018). Another type of residential gardens such as rooftops "takträdgårdar" and vertical gardens "vertikala trädgårdar," are much more rare in Sweden (Bonow & Normak, 2018). Additionally, private housing gardens, or "privata trädgårdar," are often regarded as typical plot gardens. Berg (2022) explains that these gardens were typically positioned facing one another to create a social space over the fences at the back of the house. This arrangement is

especially common in villas and private backyards of single or connected houses, referred to as "radhus." Both neighbourhoods and residential gardens offer opportunities for food growing and planting flowers for both nutrition and beautification purposes.

Furthermore, market gardening in Sweden, a small-scale horticultural practice, has recently gained attraction by the influence of the "back to the land" movement and the availability of specialized handbooks (Drottberger et al., 2021). Once widespread until the mid-1900s, modern market gardens typically occupy less than 1 hectare and focus on diverse crops, organic practices, manual labour, and direct-to-consumer sales through farmers' markets, community-supported agriculture (CSA) programs e.g. digital platforms such as online marketplaces on Facebook, or mobile applications such as Local Food Nodes (Drottberger et al., 2021).This type of community garden often arises through initiatives in various types of parks, such as "naturträdgårdar" or "fritidsträdgårdar." These gardens combine entrepreneurship with goals of self-realization and food production programs. Growing interest is evidenced by an increase in small-scale vegetable production courses and the publication of a Swedish handbook to aspiring market gardeners (Drottberger et al., 2021).

This diversity of community gardens types underscores the alignment of Swedish community gardens with global typologies (Kordon, 2024) (se Table 1), while reflecting their unique cultural and historical context. The results can also be classified in six unique types distinguished from each other by participation groups, initiatives and the primary purposes (see Table 2). Those types include:

1. **Allotment Gardens:** Allotment gardens are the most historically rooted form of community gardening in Sweden. These gardens consist of individually assigned plots within a larger shared area, typically governed by an association or federation. Gardeners are responsible for cultivating their own plots. While each plot is privately managed, the surrounding infrastructure, such as water access, shared sheds areas, and fences is collectively maintained.

2. **School Gardens:** Educational spaces for children to learn about nature, food, and cooperation. In Sweden, school gardens are often linked to municipal education programs and serve as early interventions for promoting sustainable lifestyles and food literacy from a young age.

3. **Healing or Therapeutic Gardens:** Designed for physical and mental well-being, often used in care settings. In Sweden, these gardens are increasingly recognized within public health and landscape architecture as interventions that address stress, loneliness, and trauma recovery.

4. **Neighbourhood Gardens:** In Sweden are community-driven green spaces initiated and collectively managed by residents within a local urban district or housing area.

5. **Residential Gardens** are typically smaller community gardens integrated within the common areas of housing complexes, courtyards, or apartment blocks. These gardens are maintained by the residents themselves, sometimes with the involvement of housing companies or tenant associations. They function as semi-private spaces, balancing the social aspects of community gardening with the intimacy of domestic environments. Residential gardens can be spaces for shared food production, leisure, and casual neighborly interactions, making them valuable for fostering micro-level social capital and improving the quality of everyday life in urban housing areas.

6. **Entrepreneurial Market Gardens** represent a more economically-oriented form of community gardening. These are usually initiated by social enterprises, NGOs, or local food movements with the goal of producing food for sale at farmers' markets, community-supported agriculture (CSA) schemes, or small-scale retail. While still emphasizing ecological and social goals, these gardens integrate economic sustainability, job creation, and vocational training particularly for marginalized groups or newcomers to Sweden.

Type “known in Swedish”	Participation groups	Organisations/ Initiatives	Primary purpose
Plot gardens or allotments “koloniträdgårdar”	Urban residents Families	Municipalities	Food production Recreation
School gardens “skolträdgårdar”	Students Teachers	Municipalities Institutional initiatives	Gardening activities Educational purposes Recreational purposes School kitchen
Healing or therapy gardens “terapiträdgårdar”	Patients Instructors Landscape architects	Educational institutes Hospitals	Rehabilitation Skills sharing
Neighbourhood gardens “innergårdar, stadsdelsträdgårdar”	Residents Families	Housing agencies	Gardening Socializing Beautification
Residential gardens “privata trädgårdar”	Residents Families	Individuals Owners Tenants	Gardening Socializing Beautification
Entrepreneurial market gardens “naturträdgårdar, fritidsträdgårdar”	Different participants	Different initiatives	Income improvement Sustainability Self-reliance

Table 2. Types of community gardens in Sweden

4.1.2 Survey Analysis

Quantitative analysis of most visited types of community gardens in Sweden

A descriptive statistics of the most visited types of community gardens, based on N=61 valid responses on multi-choice question “ What type of community gardens do you usually visit? (Please select all that apply)”, revealed that the most popular type is residential gardens “privata trädgårdar” with 67% choosing this type.. This was closely followed by allotments “kolonilott” with 44%, and entrepreneurial market gardens “naturträdgårdar, fritidsträdgårdar” with 42%. Neighbourhood gardens “innergårdar, stadsdelträdgårdar” were chosen by 30%, while other types of community gardens accounted for 18%. School educational gardens were chosen by 13%, and therapeutic gardens 5%.

Qualitative analysis of Additional types of community gardens in Sweden

In order to find out more types that were not included in the survey's choices I further did a qualitative analysis of the "other" category that yielded into 18 % of responses. The word cloud in Figure 4 illustrates various types of community gardens that were identified by participants in the open-ended responses (see Figure 4).

Figure 4. Word Cloud from Nettigate, Visualisation of additional types of community gardens in Sweden.

The word cloud visually represents the additional types cited by participants. Both in English and Swedish due to the bilingual survey. Larger and central- placed words are more frequent, while smaller, side-positioned words are less frequent. Different colors increase readability.

The most commonly cited garden types considered as community gardens were botanical gardens "botaniska" and forest gardens "skogsträdgårdar", highlighting the diverse spaces where people engage in communal gardening activities. Additionally, responses mentioning pocket parks "fickparker" suggest that community gardening in Sweden extends beyond traditional shared plots. Churchyard gardens "kyrkogård" were also cited, indicating that spiritual institutions play a role in community-based gardening initiatives.. Other responses

referenced allotment gardens "koloniträdgårdar", private residential gardens "uteplats", and school gardens "skolan", all of which were already included in the original survey. Meanwhile, parks "parker" were excluded from the definition of community gardens, as they are categorized as public spaces in urban environments, and cultivation plot "odlingslott" was classified as part of agricultural farming rather than community gardening.

4.2 Community Gardens and Social Cohesion

4.2.1 Literature Review Findings

Veen, Bock, et al. (2015) built upon the concept of "social cohesion," originally defined by De Kam and Needham (2003), as the connections individuals share within society. They explored social cohesion in community gardens through two main aspects: the relationships formed among garden participants and the mutual support they provide, illustrating the depth and breadth of social bonds in a Dutch context. However, Veen, Bock, et al. (2015) also highlighted that measuring social cohesion remains a significant challenge due to its complexity and the interdependence of its various elements, which must be carefully examined to understand how they function together. This paper aligns with the perspective of Veen, Bock, et al. (2015) by adopting the definition of “social cohesion” while acknowledging its complexity. In particular, this research draws on the foundational framework of Kearns and Forrest (2000), focusing on two key dimensions: the individual’s connection to the social life within the garden, and the broader community’s sense of interconnectedness. These dimensions are explored through the lenses of place attachment and social capital (see Figure 5).. These gardens were also conceptualized as a "third space,” outdoor environments where individuals can relax, connect with others, and experience a welcoming atmosphere that fosters interaction and cultural exchange (Cheatham, 2001). Expanding on this concept, Larson and Giritli Nygren (2024), drawing on Lefebvre’s (1991) concept of place, interpreted urban gardens as spaces that that soften traditional dualisms, (e.g., urban/rural, nature/cultur). They offered

significant potential to foster ecological awareness and strengthen community building, highlighting their transformative role in socio-spatial relations (Larson & Giritli Nygren, 2024). To clarify my discussion in this paper, Figure 5 is an attempt to illustrate the explored theoretical components and social aspects of social cohesion in community gardens as third space on both individual and community levels.

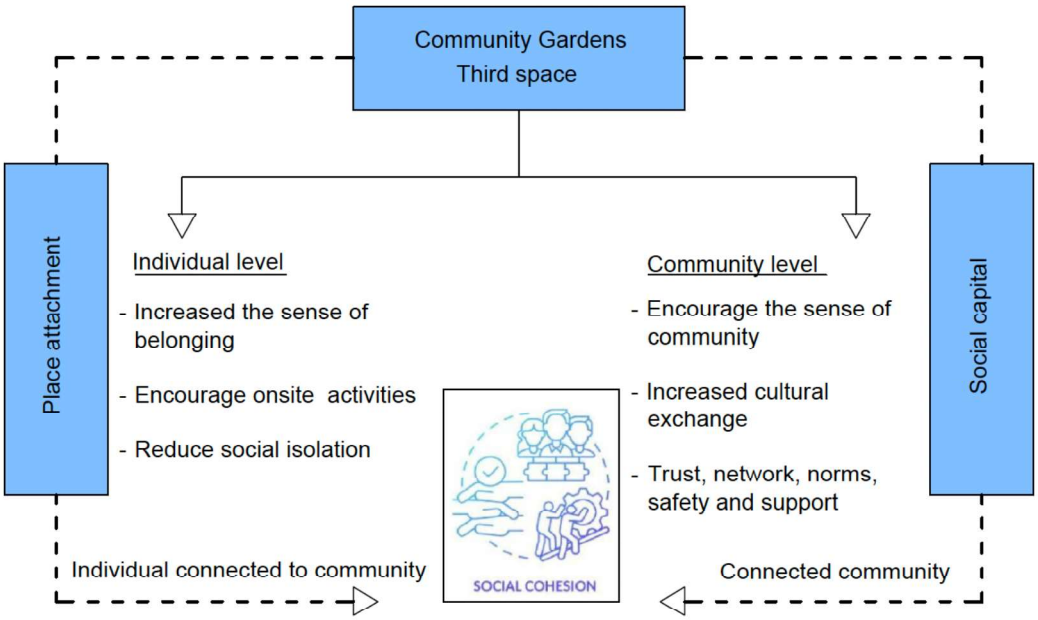

Figure 5. Social cohesion mechanism in community gardens as third space. Place attachment (left) enhances belonging, encourages activities, and reduces isolation, connecting individuals to the community. Social capital (right) strengthens trust, cultural exchange, and support, fostering community connections. The arrows indicate dynamic interactions: the solid arrows link community gardens to both dimensions. The dashed arrows highlight the continuous reinforcement of social cohesion.

Understanding place attachment is critical when analyzing the social impacts of community gardens. Scannell and Gifford's (2010) person–place–process (PPP) model outlines how attachment emerges through social interactions and emotional investment in a space (see Figure 6). Social features, such as the opportunity to "hang out" with neighbors and family, play a central role in developing this connection. Frequent interpersonal exchanges, whether casual or meaningful, are positively correlated with stronger neighborhood attachment.

Empirical research supports these theoretical claims. Community gardens have been shown to enhance social life by encouraging interactions and building bonds among residents, which foster a sense of community (Armstrong, 2000; Bellows et al., 2004). These gardens not only beautify neighborhoods but also contribute to individual attachment, even for non-gardeners (Hale et al., 2011). Corcoran (2010) argues that this collective use of space builds a sense of belonging and nurtures positive community relationships. In the context of Latin America, Munguía-Uribe and Yurrita (2022) conducted a case study on two community gardens in Mexico City, finding that voluntary participation cultivated strong personal attachment through on-site activities and social networks. Participants expressed pride and a sense of belonging, reinforcing the idea that community gardens can be emotionally and socially meaningful spaces.

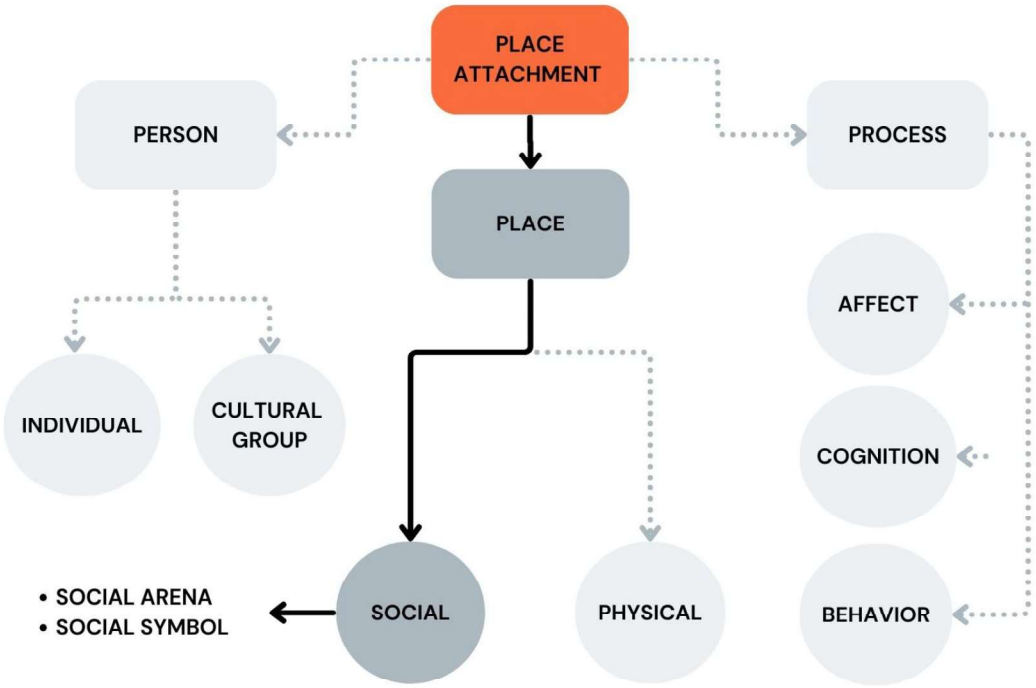

Figure 6. Social factors of place attachment
This figure is adapted from Scannell and Gifford's (2010) original PPP Model, illustrating key social factors that contribute to place attachment.

Secondly, it is crucial to discuss the role of **social capital**. Social Capital Theory (SCT) was first identified by Bourdieu in 1986 (Tsounis & Xanthopoulou, 2024). Bourdieu (1986) defined social capital as the resources that individuals or groups gain through their social networks and relationships. He argued that social capital is embedded in the structure of these networks, which can provide access to various resources, such as information, support, or opportunities, and is influenced by the level of trust, mutual obligation, and reciprocity within the network. Bourdieu's conceptualization of social capital focuses on how individuals use their social engagement to gain advantages, both in terms of material resources and social recognition (Bourdieu, 1986) (see Figure 7). He also emphasized that access to social capital is not equally distributed, as it is often tied to one's position in society, such as class or social status (Tsounis & Xanthopoulou, 2024).

However, the definition of social capital can vary across disciplines and among authors.While Bourdieu's conceptualization of social capital focuses on how individuals benefit. Putnam (1995), SC concerns the collective approach. Putnam's triangle structure, i.e. "trust-network-norm," is widely recognized by scholars. He defined social capital as the characteristics of social organizations such as trust, networks, and norms, that enhance societal efficiency by promoting cooperative actions. According to Putnam (2000), social capital encompasses mutually beneficial norms and networks of civic engagement. Moreover, according to Scannell and Gifford (2013), social capital, derived from community ties, offers individuals safety, and emotional support, allowing communities to mobilize resources and maintain quality. In the context of community gardens, social capital manifests in both individual and collective forms, considered as spaces that foster solidarity and collective social action, as well as hubs for urban agriculture programs that, in some views, serve as a social safety net, where gardening has been characterized as an activity that promotes community building, cooperation, and democratic engagement (Barron, 2016). Many studies reinforce the capacity of gardens to promote social cohesion through the cultivation of social capital. San Ward et al. (2022), in their evaluation of

Sydney's Royal Botanic Gardens and Community Greening Program, found that participants experienced increased social confidence and fulfillment through their involvement in collaborative gardening efforts. These outcomes illustrate the tangible social benefits of community-based greening initiatives.

In Sweden, Ouis and Lisberg Jensen (2009) examined community gardens as "multicultural spaces," highlighting their potential to bridge cultural divides, reduce social isolation, and enhance intercultural dialogue. For migrant communities, gardening also serves as a conduit for integration, enhance belonging to the new host society by building communication network and even bridge memory by allowing individuals to grow plants from their homelands and share their cultural heritage through horticulture activities. (see Figure 7).

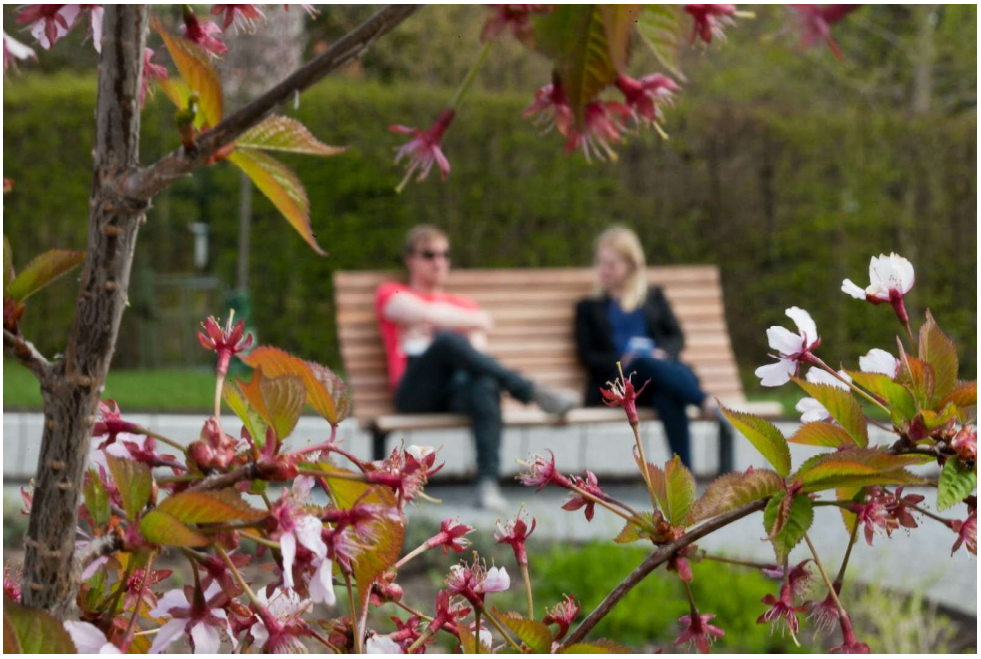

Figure 7. Social engagement in "Kunskapsparken" at Ultuna, Uppsala, Sweden "Photo: Jenny Svennås-Gillner, SLU Mediabank, 2013"

However, some gardens promote social capital, while others face challenges due to poor design and management. A case study by Ding et al. (2020) examined the impact of design and social factors on social capital in Chinese community gardens. The study showed that gardens with better design, such as shorter commuting distances, larger planting spaces, and appropriate infrastructure, were more effective in promoting social capital. Social factors, such as stakeholder

involvement and management practices, were found to have a greater impact than design alone. Additionally the study showed that a fair and transparent management system is essential to reduce inequality and foster social capital. These findings aligned with Bonow and Normak (2018) emphasized that gardening in community gardens involves a diverse range of stakeholders, including citizens, authorities, housing companies, and non-governmental organisations. Successful community gardens have been shown to develop their own community through the feeding of social capital in three key areas (Firth et al.,2011). These areas are:

(a) **bonding social capital** through providing a meeting place for people,

(b) **bridging social capital** through membership of networking organisations,

(c) **linking social capital** via contact with other organisations

These **key factors** for social success are illustrated hierarchically in Figure 8 acknowledging the complex relationships between them, with community garden proximity location and design forming the foundation at the base, reflecting their crucial role in social-based community gardens, while active participation through gardening programs and initiatives, along with effective management, occupy the top tiers. Where the management of the space plays a central role in coordinating and overseeing all other aspects, ultimately fostering the success of socially driven community gardens.

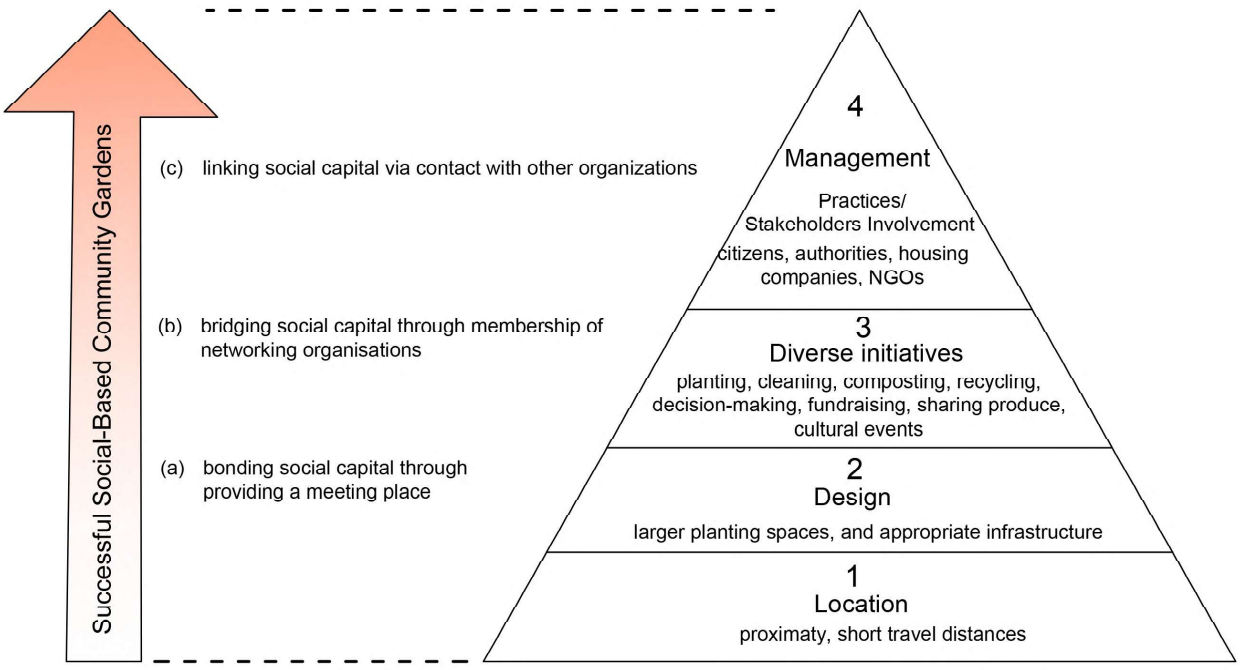

Figure 8. Pyramid of social key factors for community garden success

The pyramid illustrates the foundation of successful community gardens, with an arrow showing the growth of social capital as gardens advance. At the base, location & design focus on physical elements, bonding social capital through providing a meeting place. As the garden progresses, diverse initiatives foster broader engagement, bridging social capital through membership. At the top, management involves stakeholders, linking social capital with organisations. This progression from infrastructure to organized management ultimately enhancing social capital.

4.2.2 Survey Analysis

Quantitative analysis of demographics and types of involvement

Descriptive statistics of gender revealed that out of 61 participants, N=60 provided valid responses. Among them, 13% identified as male, and 87% identified as female. One response was missing from the dataset. This indicates that the sample was mainly female which may indicate that women are more engaged in community gardens activities. And most of the female responses completed the gardening questionnaire.

A total of 61 participants reported their age, with N=60 valid responses, 1 missing from the dataset. The highest count is in the 55-64 age group, with 38%. The 45-54 age group follows with 23%, followed by the 65 and older group with 17%,

the 35-44 group with 15%, the 25-34 group with 5%, and the 18-24 group has the lowest count with 2%.

Participants also reported their professional status, totally N = 61 valid responses. The most common category was full-time employment, with 46%. This was followed by students, who accounted for 17%, and retirees with 11%. Additionally, 10% were self-employed, while 8% worked part-time. Other types of employment were reported by 5%, and 3% were unemployed.

Participants also reported their types of involvement in community gardens. Out of total valid responses N=61, the results show that 54% were engaged in both social and gardening activities, 25% focused solely on gardening, 15% were involved only in social events. And 6% reported "other" types of involvement, primarily individual activities like walking and relaxation, which were excluded. This highlights that the majority of the sample actively participated in both social and gardening events of the community gardens.

Quantitative analysis of social benefits and resources gained

The survey obtained more specific data of social benefits experienced from participating, based on 60 valid responses, one missing from the dataset. The results suggest that the most significant social benefit participants gained from their involvement in community gardens was strengthening neighbourhood relationships 33%, followed by enhancing their sense of community 30%. Developing friendships 17% and building social networks 15%. The "other" category, which included 10% of responses, was excluded from this analysis due to the individualized benefits of nature reported, such as walking, sunbathing, sitting, and reading in a quiet place.

To gain insight into the importance of friendships formed through participation in community gardens, participants rated how important are these relationships to their social life on a Likert scale. A one-sample t-test was conducted to assess whether participants rated the importance of friendships formed through community garden participation significantly higher than a predefined test value

of 4. In statistical testing, a test value serves as a benchmark to compare against sample data. Here, a Likert scale ranging from 1 (Not important) to 7 (Very important) was used, with 4 representing a neutral level of importance. This test helps determine whether participants' ratings significantly differ from that midpoint.

Based on N=52 valid responses, 9 missing from the dataset, the results showed that the mean importance rating was M = 4.37 with a standard deviation (SD) of 1.47. However, the difference was not statistically significant, as indicated by both the one-tailed p= 0.039 > 0.005 and two-tailed p= 0.079 > 0.005, 95% confidence interval (CI) ranged from -0.04 to 0.77, meaning that the true difference could be very small or even negative. Additionally, the effect size was small, with Cohen's d = 0.25 (95% CI [-0.03, 0.52]) and Hedges' g = 0.25 (95% CI [-0.03, 0.52]), indicating that while participants rated friendships as slightly more important than the test value, the difference was minimal. These findings suggest that while participants rated their friendships as important, the difference from a neutral or expected value (4) was not strong enough to be statistically significant.

Similarly, the survey examined the types of resources gained by individuals through their gardening participation in community gardens. Participants were allowed to select multiple answers from a list of potential benefits. With N=59 valid responses, 2 missing from the dataset, the most commonly reported resource was social contacts, such as being a member of associations or social media groups, with 68%. Collaborating with others on shared products was reported by 39% of participants, while learning opportunities such as courses were mentioned by 25%. Skills development through workshops was the least selected structured resource, reported by 16%. These findings suggest that the primary benefit of community garden participation is the establishment of social connections, cooperation and shared products while formal learning opportunities and skill development are less commonly reported.

A one-sample t-test was conducted to assess how participants rate the importance of gaining skills and learning opportunities through community garden

participation on Likert scale ranging from 1 (Not important) to 7 (Very important). This test helps determine whether participants' ratings significantly differ from the midpoint, test value of 4.

Based on N=52 valid responses, 9 missing from the dataset, the results indicated that the mean importance rating (M = 4.79, SD = 1.6) was significantly higher than 4, p = .001< 0.005 (for one- and two-tailed), with a 95% confidence interval CI [0.34 to 1.23], suggesting that the true population mean is likely above the neutral value 4. The effect size Cohen's d = 0.493 95% CI [0.202, 0.778] and Hedges' g = 0.48595% CI [0.199, 0.767] indicates a moderate practical significance. These findings suggest that participants generally perceive the skills and learning opportunities gained through community gardens as important, rather than neutral.

Qualitative analysis of new ideas to improve gardening- Social aspects

The open-ended question "What ideas do you have to make gardening practices better in community gardens?" was proposed to gather insight into the ecological aspects that may enhance the gardening events. But during the qualitative analysis I found several social aspects like accessible design and inclusivity, governance and social-educational initiatives were frequently mentioned. While these fall outside the expected ecological scope of this question, they underscore key social factors that contribute to the success of community gardens. However, the word cloud in Figure 10 showcases key themes suggested by participants that highlight both essential ecological and Social themes that can help shape future community gardening practices in Sweden, such as adaptation to climate conditions.

Key themes of social aspects to improve community gardening:

1. **Expanding gardens in low-income areas:** Many respondents expressed the need to establish more gardens in lower-income neighborhoods, emphasizing accessibility and proximity to residential areas. As one participant pointed out: "Many community gardens are still not spread in lower economic areas of cities."

2. **Ensuring accessibility for marginalized groups:** Participants highlighted the importance of making gardens more accessible to people with disabilities, the elderly, and other marginalized groups. This aligns with the need for inclusive infrastructure. As one respondent noted: "More accessible gardens for more people." Another added: "More areas that are natural, open landscapes accessible to everyone, including considerations for children, people with disabilities."

3. **Community gardens as social hubs:** Gardens should serve as spaces for social connection, with participants advocating for events like planting days, BBQs, and festivals. As one noted: "Organized activities such as planting or a barbecue evening." Others emphasized the value of gardening courses, workshops, and mentorship programs to foster community engagement and sustainable practices, as one participant noted: "Gardening courses for all community members." And another cited:"Monthly meetings with theory and practice. In the winter, where you can read about different crops and care, learn about climate-smart plants, exchange plants with other gardens, and order organic seeds."

4. **Fair Leadership and Governance:** There is a call for greater transparency, inclusivity, and democratic management in community gardens. Participants stressed the need to eliminate hierarchical control, ensure equitable access, and strengthen city governance support. One participant shared: "Eliminate dominance: often, a small group controls with an iron fist and doesn't allow others in." Another suggested: "Improve accessibility for all societal groups, with more support from the local council and budgets." And another participant cited: "Gardens should be spaces where everyone is welcome under the guidance of garden helpers."

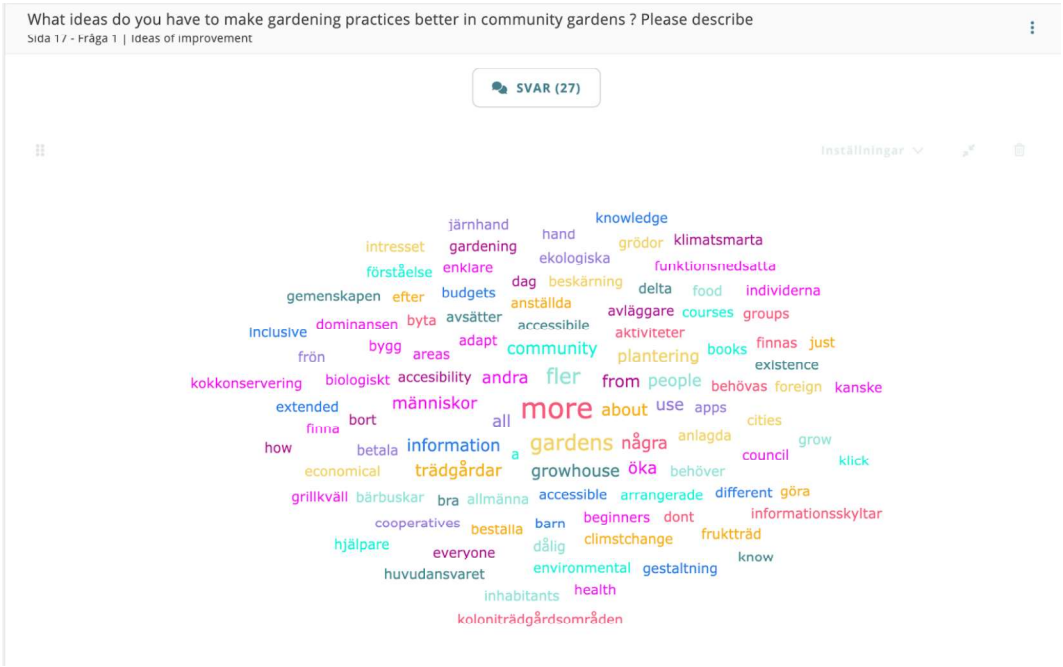

Figure 9. Word Cloud from Nettigate, Visualisation of new trends of community gardening A word cloud visually represents the most frequently used words from participants' quotes. Both in English and Swedish due to the bilingual survey. Larger and more centrally placed words appear more often, while smaller, side-positioned words are less frequent. Different colors help distinguish words for easier readability.

4.3 Community Gardens and Local Biodiversity

4.3.1 Literature Review Findings

A. The role of community gardens in local biodiversity

Community gardens are often seen as a places of reintroducing nature into urban environments, aligning with the growing interest in the concept of “nature in the city” within both environmental science and public discourse (Di Pietro et al., 2018). The idea of "bringing nature back into cities" has became a key theme in discussions on sustainability and urban biodiversity conservation. This movement emphasizes the ecological and social value of restoring natural elements in urban settings. Recent studies highlight the broad benefits that natural environments provide to both humans and non-human species, prompting a surge in research on how best to manage urban ecosystems (Mata et al., 2020). The term “bringing nature back into cities” (BNB) specifically refers to efforts that promote the return

of native species, including soil microorganisms, plants, and larger animals, into urban spaces where they have declined or disappeared (Mata et al., 2020). In this context, the present study examined biodiversity through both human and non-human levels, consistent with the definitions put forward by the National Research Council (1999), Stork (2009), and Swingland (2013) and the perspectives of SLU center of biological diversity (CBM) that previously provided (see Subsection 1.4). By bridging these human and non-human dimensions, the study presents biodiversity as both a social and ecological phenomenon, embedded in everyday practices and urban landscapes. Figure 10 offers a visual representation of the core components addressed in this research, illustrating the contribution of community gardens to local biodiversity.

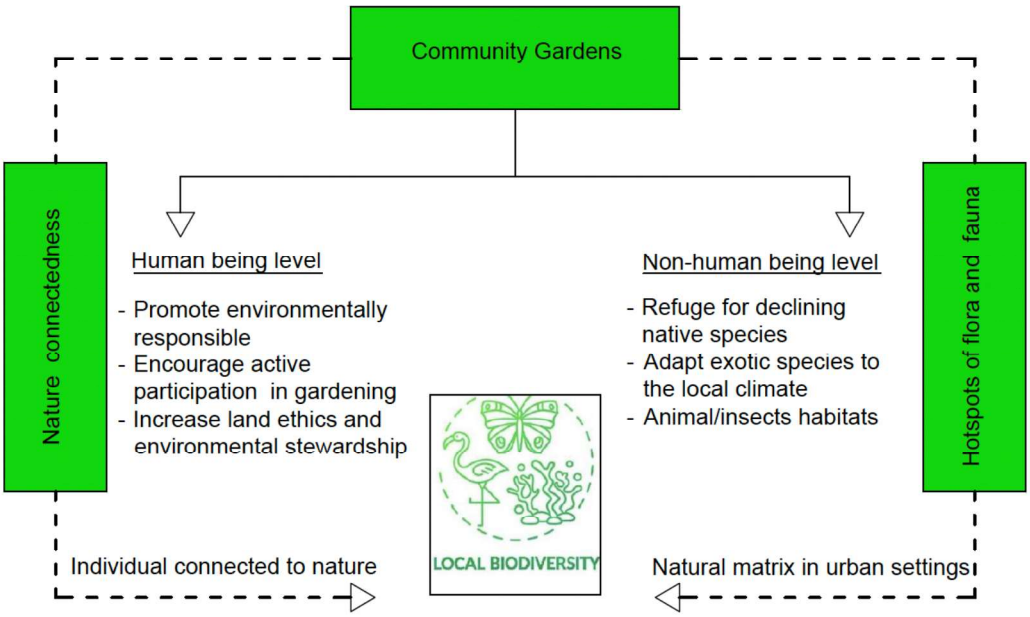

Figure 10. Local biodiversity components in community gardens. Connectedness to nature (left) enhances environmental values at the human beings level. Hotspots of flora and fauna (right) accommodates species at the non-human beings level. The arrows indicate dynamic interactions: the solid arrows link community gardens to both dimensions, and the dashed arrows highlight the continuous contribution of community gardens in local biodiversity.

At the human level, this research addresses how community gardening fosters a sense of connectedness to nature, environmental stewardship, and bicultural diversity, particularly among immigrant gardeners who grow culturally meaningful crops. These practices reinforce ecological values, place attachment,

and sustainable behavior, resonating with the National Research Council's (1999) framing of biodiversity as holding not only ecological and economic value but also intrinsic and cultural significance, and aligns closely to SLU CBM's definition of biological cultural heritage, valuing biodiversity for its intrinsic importance and enable understanding the cultural services provided by ecosystem.

The concept of **"connectedness to nature,"** which refers to an individual's sense of connection to the natural world and is commonly employed in studies that investigate the human-nature relationship (Sato et al., 2021). Gardens are where humans and nature intensively interact (Soga & Gaston, 2020) and irregular and limited contact with the natural world threaten the interconnected aspects of well-being, impacting humans holistically (San Ward et al., 2022). Thus, community gardens can act as a nexus of and multiplier of nature- and biodiversity- based social and ecological activities within and beyond the surrounding neighbourhood (Egerer et al., 2024) reflecting the biocultural heritage, local knowledge and practices (SLU, 2025). For instance, Hadgu (2021) highlighted that 100% of participants in the Ekebydalen allotment garden in Uppsala cited connection to nature as a primary motivation for their involvement, linking gardening to social and ecological well-being. While San Ward et al. (2022) indicated that community gardeners take pride in their cultivation efforts, enjoy sharing their harvest, and participate enthusiastically in communal cooking activities. These positive experiences in nature, combined with increased physical activity, can foster a deeper appreciation for ecological values. Through engaging in gardening and associated tasks like planting, cleaning, composting, recycling, making decisions, fundraising, sharing produce, and hosting cultural events (Glover, 2005), community gardens facilitate a hands-on approach to environmental care that engages individuals, small groups, non-profit organizations, and broader collective networks and impact people's values. This interconnected web of participants contributes to biodiversity preservation and reinforces the principles of sustainable living.

Furthermore, Díaz et al. (2018) introduced the concept of nature's contributions to people (NCP), conforming to the culture's role in the relationship between people

and nature. NCP highlights biodiversity's support for material, regulating, cultural, spiritual, and identity-related benefits, asserting that biodiversity conservation is essential to maintain these contributions. This is reflected in the Swedish context, a recent article by researchers in Gothenburg's University that suggested adapting the NCP concept instead of "ecosystem services" to fully understand nature's biodiversity value, including ecological, cultural, social, and spiritual benefits. Sweden, actively involved in IPBES (UN biodiversity panel), closely follows this shift, although "ecosystem services" is still a widely used term (University of Gothenburg, 2018).

Therefore, it has been believed that community gardens play a significant role in fostering ecological values by enhancing individuals' sense of natural connectedness, bringing nature to urban landscape and contribute to people social and cultural values. This, in turn, promotes environmentally responsible behaviors (Colding & Barthel, 2013). Influential conservationist Leopold (1887–1949) emphasized that cultivating a land ethic, where humans view themselves as part of the natural community, is essential for true environmental stewardship. Community gardens embody this ethic, encouraging proactive and participatory involvement that supports both biodiversity and ecosystem health (Leopold, 1949/2013).

At the non-human level, the study explored species and habitat diversity by examining how community gardens support a wide range of flora and fauna, including both native and exotic plants, pollinators, and small urban wildlife through the integration of features like insect hotels, birdhouses, and pollinator-friendly flowers. This reflects Stork's view of biodiversity as species richness and ecological function, as well as Swingland's emphasis on biodiversity as the totality of genes, species, and ecosystems within a region.
It has been evidenced that community gardens are considered important refuges for declining native plant species. For instance, community gardens in Berlin and Munich, have been shown to act as **biodiversity hotspots**. Over 3 years Egerer et al. (2024), documented 793 herbaceous plant species across 39 gardens (Berlin: 606 species, Munich: 543 species). These included 36 threatened species in

Berlin, representing 23% of the city's Red List, and 43 threatened species in Munich, accounting for 10% of its Red List. Additionally, in terms of pollinators, Egerer et al. (2024) recorded over 100 wild bee species (about 40% of Berlin city's total), with 24 listed on the Red List. In Munich, approximately 120 wild bee species were found. Some rare species, like Coelioxys Lanceolata (highly threatened), were identified. The findings underscored that these gardens provide crucial floral resources throughout the year, supporting various pollinators, including rare bees.

Another study was conducted by Seitz et al. (2021) also examined 18 community gardens in Berlin and found a total of 404 plant species, including 184 wild-growing taxa. Notably, six of these wild species were classified as endangered or extinct in the region, such as Anthemis arvensis, Verbena officinalis, and Galium spurium, the latter previously considered extinct but rediscovered in a rooftop garden. This highlights the role of urban community gardens as important refuges for threatened plant species. The authors describe these gardens as "novel ecosystems" that merge biodiversity conservation with urban food production, emphasizing their ecological value. These findings support Egerer et al.'s (2024) argument that community gardens are not only social spaces but also key habitats for rare and threatened species within European urban landscapes.

Moreover, Klepacki and Kujawska (2018) surveyed 64 urban allotment gardens across three Polish cities and documented 257 plant taxa belonging to 72 families. Among these, they recorded several species of conservation concern, namely pasqueflower (Pulsatilla spp.), bride's feathers (Aruncus dioicus), and English yew (Taxus baccata), which are rare or protected under Polish legislation, even if likely grown as cultivars. The study highlights that urban community gardens function as significant reservoirs of biodiversity, not only through conventional food and ornamental plants but also by preserving species with conservation value.

Furthermore, Segar et al. (2022) explore the potential of urban conservation gardening as a practical and scalable strategy to support biodiversity within cities,

especially during the UN Decade on Ecosystem Restoration (2021–2030). The authors argue that urban gardens, when designed with ecological principles in mind, can function as important habitats for native and threatened species. They emphasize that conservation gardening prioritizes native plant species and habitat complexity, directly contributing to the restoration of ecological networks in fragmented urban landscapes. The paper also highlights the importance of public engagement, policy support, and scientific guidance in promoting these gardens. Through case studies and a synthesis of emerging research, Segar et al.2022 demonstrate that with careful planning and community participation, urban conservation gardening can play a vital role in restoring biodiversity, enhancing ecosystem resilience, and reconnecting people with nature in densely populated environments. These findings align with another study made in South Africa by Kanosvamhira and Tevera (2022) explores the sustainability challenges faced by 34 community gardens in low-income areas of Cape Town, emphasizing that land-tenure insecurity is a central barrier to their long-term viability. Most gardens operate without formal legal tenure, instead relying on informal or verbal agreements that leave them at risk for displacement. The study argues that perceived and de facto tenure arrangements, though lacking legal recognition, provide a crucial sense of stability and should be supported through policy. It calls for improved coordination among government departments, more bottom-up engagement with gardeners, and a shift in policy focus toward strengthening existing informal land-use systems. According to SLU center of biological diversity, biodiversity can be widely promoted, while we use ecosystem services for our needs by planing land-use for ecological process (SLU CBM, 2025).

However, in the Swedish context, there is notable attention not only to native species but also to exotic species, particularly in the realm of plants, vegetables, and food cultivation. This dual focus arises from the growing need to adapt a diverse range of species to local climatic conditions. Ouis and Lisberg Jensen (2009) explored this dynamic in their research on biological diversity in Malmö, Sweden. Their findings revealed an intriguing interplay between native and exotic plant species, especially within immigrant gardens. These gardens serve as spaces

where traditional Swedish crops like potatoes and beans coexist alongside newer additions, such as squash and coriander. The introduction of exotic plants, some brought from immigrants' home countries, has added a vibrant layer to the local biodiversity. For instance, fenugreek and aubergine, which are not traditionally Swedish crops, have increasingly been cultivated and adapted to thrive in Sweden’s climate.

Importantly, there is no evidence to suggest that all exotic species pose invasion risks, as they are carefully chosen for cultural value and edibility. Most are food crops that need active cultivation and remain contained within gardens. Tyler et al. (2015) assessed over 700 non-native plants in Sweden, finding some invasive flora like Rosa rugosa, but culturally important edibles like fenugreek and aubergine were not considered threats to local biodiversity. Jansson and Ebenhard (2024) at SLU center for biological diversity (CBM), during their study of spread pathways for invasive species of Unsion and national importance, inclusive plants and animals, they operationalized two hypothetical future scenarios for how invasive species may spread in Sweden: first one assumed that people keep growing prohibited ornamental plants in their private gardens, for instance, but controlling their trade and transport could be difficult in Sweden and EU, while second scenario suggested that a warmer climate will increase allowing more species, which do not exist in Sweden’s natural environment, to establish themselves in wild nature within next 50 years.

However, for many immigrant gardeners, cultivating plants from their homeland carries deep cultural and emotional significance. This connection to their heritage is exemplified by a Macedonian woman who successfully nurtured a hazelnut sprout grown from a nut brought from her native country (Ouis & Lisberg Jensen, 2009). Such practices highlight the resilience of immigrant communities in preserving cultural traditions while simultaneously contributing to the diversity and adaptability of local ecosystems aligning with SLU CBM’s perspective of bicultural heritage includes knowledge, practices and species varieties. Through these interactions, Sweden’s approach to biodiversity reflects an inclusive model that integrates cultural heritage with ecological adaptation. This blend of native

and exotic species, particularly in urban settings like Malmö, demonstrates the dynamic relationship between people, plants, and their environments, embedding a rich biocultural diversity.

B. The role of gardening practices in promoting biodiversity

Although the community gardens could address the local biodiversity in different urban settings, it is essential to mention that the gardening practices can vary in their types and impacts on the local biodiversity. Traditional ornamental plants and relevant horticulture practices provide multiple environmental (e.g., climate regulation), economic (e.g., energy saving), social (e.g., improved privacy, security), and aesthetic (e.g., communit, building beautification) benefits for health and wellbeing (Francini et al., 2022). However, using pesticides in relevant practices can harm soil, water, and other vegetation. In addition to killing insects or weeds, pesticides can be toxic to a host of other organisms including birds, fish, beneficial insects, and non-target plants (Aktar et al., 2009).

In contrast sustainable horticulture techniques are vital for reducing environmental impacts and ensuring the long-term viability of the horticultural sector. Practices such as organic farming, integrated pest management, water conservation, soil health management, and environmental impact assessments promote resource efficiency and minimize negative environmental effects. These approaches lead to benefits such as improved soil health, reduced chemical use, better water efficiency, and decreased pollution. (Verma et al., 2024).
Similarity, organic horticulture is a sustainable and eco-friendly method of growing plants, which avoids the use of synthetic chemicals and fertilizers. It emphasizes conserving natural resources such as water and soil, while also fostering biodiversity and improving soil fertility. This approach prioritizes renewable resources and focuses on agro-ecological practices that enhance the nutritional content and quality of crops (Verma et al., 2024). Organic horticulture aims to create long-term sustainability in agriculture by reducing dependence on external inputs and promoting environmental health (Verma et al., 2024).
Meanwhile, permaculture is proposed as a tool to design and manage agro-

ecological systems in response to environmental challenges such as climate change and biodiversity loss. According to Reiff et al. (2024), permaculture practices have demonstrated promising results, including 27% higher soil carbon content, 20% lower soil bulk density, and 201% greater earthworm abundance compared to conventional plots. Moreover, permaculture sites exhibited higher levels of various macro- and micronutrients, suggesting improved soil conditions for cultivation. However, while these findings are encouraging, the authors caution that scientific evidence regarding the broader ecological impact of permaculture remains limited, and further empirical research is necessary.
The role of gardening practices in shaping biodiversity outcomes has also been highlighted in empirical studies. For example, a study made by Di Pietro et al. (2018) examined community gardens in France and their potential to enhance urban biodiversity. The research found that the contribution of these gardens to urban biodiversity depends primarily on their longevity, which is influenced by their location on development land and local government initiatives. Emphasizing that the horticultural practices employed by gardeners play a significant role in determining their ecological value.

This approach of using cultivation methods and gardening practices clearly reflects the biological cultural heritage and interaction of biological diversity and cultural traditions that SLU CBM has identified for their importance to ecosystem services. By employing sustainable cultivation methods, we not only preserve biological cultural heritage but also reinforce ecosystem's supporting services (e.g. soil formation), which in turn enables other ecosystem services to function effectively (SLU CBM, 2009, 2025).

In sum, the literature confirms that community gardens serve as critical urban infrastructures that support biodiversity conservation, environmental values, and biocultural diversity. Their contribution is most effective when they are supported by sustainable horticultural practices, community participation, and policy frameworks that recognize both their ecological and cultural roles. Previously concluded key practices and policies are presented and illustrated in figure 11.

In Figure 11 I then make an attempt to create a model of what factors are promoting or hindering local biodiversity within community gardens.

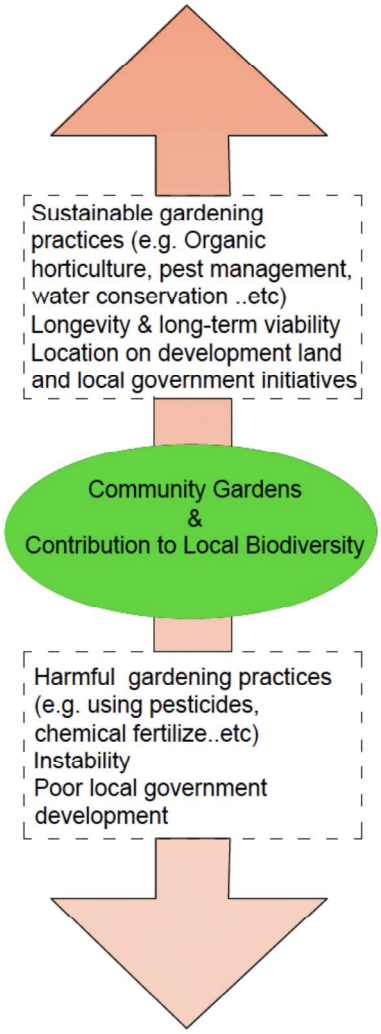

Figure 11. Model of promoting or demoting local biodiversity within community gardens. The arrows indicate a process of promoting or demoting. Upper arrow (higher contribution) represents how implementing sustainable gardening practices, government support and longevity community gardens lead to increased local biodiversity. Downward arrow (lower contribution) shows how harmful gardening practice, poor governmental support or unstable land of community gardens lead to decreased local biodiversity.

4.3.2 Survey Analysis

Quantitative analysis of gardening practices, plants preferences and origin

The survey explored the predominant gardening practices in community gardens through multiple-choice questions. With total valid responses N=59, 2 missing from the dataset, the findings revealed that 73% practice organic gardening, 47% follow permaculture, and 25% engage in traditional ornamental gardening. Additionally, 98% of respondents reported avoiding pesticides and chemical products, while only 2% acknowledged their use, based on a total of N=59 valid responses. The absence of harmful gardening practices with minimal chemical use

suggesting that community gardens in Sweden may contribute to promoting local biodiversity.

Regarding plant types, a multi-choice question was asked to gain insights into which types of plants are mostly grown by participants. With total N=59 valid responses, 2 missing from the dataset, 76% indicated a diverse mix of food crops, vegetables, fruits, flowers, and herbs. Meanwhile, 29% reported growing only flowers and herbs, and 27% focused solely on food crops. In terms of plant origin, 56% cultivated both native and non-native species, 47% grew exclusively native plants, and only one participant 2% reported growing plants from other countries. Overall, these findings indicate that community gardens in Sweden might be cultivated for the purpose of beautification; they also function as kitchen gardens, cultivating both native and exotic plants (see Figure 12).

Figure 12. An example of a diverse kitchen garden, cultivating a mix of native and exotic plants, including vegetables, herbs, and flowers—reflecting the 76% of survey participants that support biodiversity and household food security. Still life at the Garden Laboratory, SLU in Alnarp, "Photo: Jenny Svennås-Gillner, SLU Media Bank, 2013'

Quantitative analysis of preferred biodiversity features

The survey also examined participants' perspectives on essential habitat features in community gardens, with N=59 respondents selecting multiple valued elements. The most frequently identified feature was pollinator-friendly flowers 93%, underscoring the importance of attracting bees, butterflies, and other beneficial insects (see Figure 13). Additionally, shaded seating areas and accessible pathways were selected by 81%, emphasizing the need for comfortable spaces and inclusivity for individuals of all abilities. Other commonly valued features included water sources such as ponds and fountains with 73%, insect hotels with 71%, and bird feeding stations or bird houses with 47%. Beehives and small brush piles for habitat received moderate support 46%, while the "other" category 17% reflected diverse individual preferences, including habitats for bats and hedgehogs.

Figure 13. Pollinator-friendly flowers were identified as the most essential habitat feature, with 93% of survey participants prioritizing them. Here, a honeybee (Apis mellifera) is seen foraging on blue bugle (Ajuga reptans), highlighting the role of community gardens in supporting biodiversity. "Photo: Jenny Svennås-Gillner, SLU Media Bank, 2013"

Quantitative analysis of interest of using new tech

A one-sample proportion test was conducted to examine participants' interest in using new gardening technologies, such as smart app systems, smart watering systems, and Tertill weeding robots. Out of N=48 participants, only 16.7% expressed interest in these innovations. Confidence interval estimates were calculated using the Agresti-Coull, Jeffreys, and Wilson Score methods, all yielding similar results: 95% CI [.084, .298], [.082, .290], and [.087, .296], respectively. A one-sample z-test for proportions was performed, comparing the observed proportion (0.167) to the hypothesized value of 0.5. The results were statistically significant, $Z=-4.619$ and p value $<.001$, indicating that significantly fewer participants than expected expressed interest in adopting new gardening technologies. These findings suggest a generally low level of enthusiasm for incorporating smart gardening innovations among community gardeners.

Qualitative analysis of emotional experience in community gardens:

A qualitative analysis was made on the open-ended question “What feelings do you typically experience when spending time in community gardens? Please describe.” The word cloud, shown in Figure 14, visually represents the qualitative responses related to participants' emotional experiences in community gardens. The most frequently mentioned feelings include calmness “lugn,” harmony “harmoni,” joy “glädje,”curiosity “nyfikenhet,” and inspiration “inspiration,” highlighting the positive emotional impact of these spaces.

Other recurring themes include peace”fred,” freedom “frihet,” and belonging “gemenskap,” indicating that community gardens foster both relaxation and social connection. One participant noted: "Curiosity and interest for the garden, the different plants, and the people involved within the place. It is a great place to meet new people and socialize, which often brings a feeling of joy and comfort."

Additionally, words related to sensory and aesthetic experiences, such as beauty “skön,”freshness “färsk,” and fragrance “dofterna” suggest that natural elements and the aesthetic aspects of the designed spaces play a significant role in shaping

participants' emotions. Furthermore, the balance between design and the capacity to host people is an essential factor influencing experiences. As one participant explained: "It depends on how it is designed and how many people are there. If there is a flow that creates a sense of coherence, it feels good. But if there are too many different themes that keep changing, it can feel worn out and maybe even damaged in some areas. Likewise, if there are too many people, it creates stress."

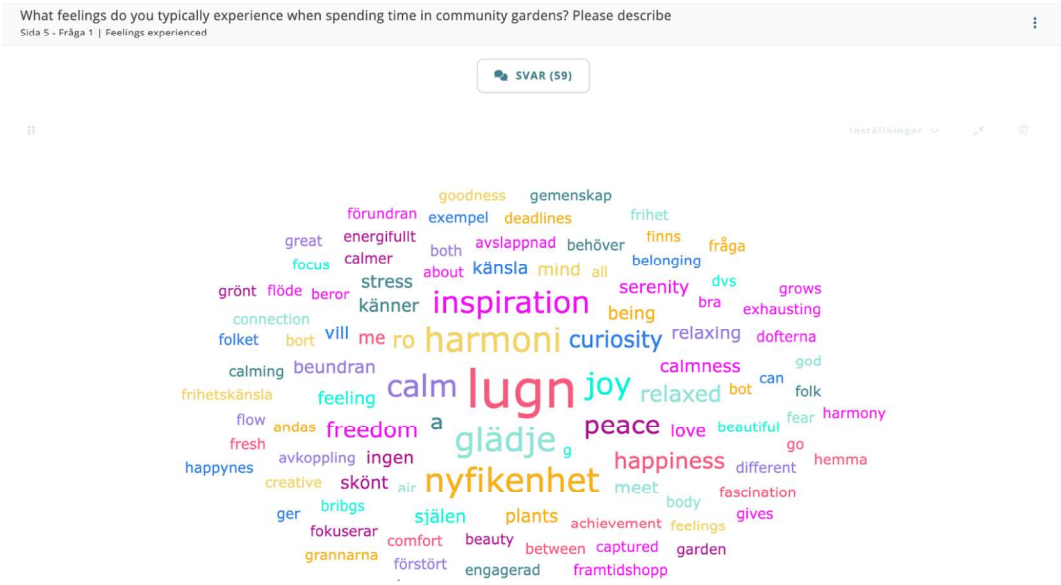

Figure 14. Word Cloud from Netigate, Visualisation of emotional experiences
A word cloud visually represents the most frequently used words from participants' quotes. Both in English and Swedish due to the bilingual survey. Larger and more centrally placed words appear more often, while smaller, side-positioned words are less frequent. Different colors help distinguish words for easier readability.

Beyond general emotional experiences, some responses highlighted specific feelings associated with engaging in gardening activities. While many participants described a sense of pride and accomplishment in seeing their plants grow, some also noted moments of stress related to gardening responsibilities. For example, one participant shared: "I feel proud and want to have a beautiful garden, but sometimes it gets stressful when the neighbors have, for example, mowed the lawn, but I haven't due to a lack of time."

Similarly, another respondent expressed mixed emotions: "On one hand, it is a bit stressful that you need to meet some deadlines for planting your seeds; it also can

be exhausting work. On the other hand, it gives me a sense of achievement and happiness when my plants grow." These insights reveal the dual nature of gardening experiences—while it can be rewarding and fulfilling, it may also introduce pressure due to seasonal tasks and social comparisons within the gardening community.

Qualitative analysis of new ideas to improve gardening- Ecological aspects

The qualitative analysis of previous open-ended question “What ideas do you have to make gardening practices better in community gardens?” reveal three different key ecological themes (see Figure 9) that could further enhance gardening through community gardens.

Key themes of ecological aspects to improve community gardening:

- **Climate adaptation and year-around growing:** Participants highlighted the need to adapt gardening to climate change by using greenhouse for extended food production, growing climate-smart crops and sustainable practices, and seed exchanges. As one participant noted : “Adapt to climate change, use a greenhouse for extended food growth.”

- **Urban planning and integration:** There is a push for community gardens to be a core part of urban planning, with suggestions for more land for urban gardening, gardens integrated into dense residential areas, fair distribution of land and support for urban gardeners from municipal park departments. This reflects the trend of making community gardening a key component of sustainable city living. As one participant noted: "More opportunities for gardening, the interest is high. Many people are on the waiting list for allotment gardens".

- **Digitalization and smart gardening:** The responses place less emphasis on integrating new technology. As one participant cited: “Using apps, books, tips from people, workshops” and another participant noted: “ Using digital information and tools”.

5. Discussion

The findings of this thesis underscore the significant role of community gardens in both enhancing social cohesion and addressing local biodiversity. They offer further a classification of common types of community gardens in Sweden, directly answering the research questions that this study seeks for. The following sections explore these findings in greater detail, discussing their implications for urban planning, community development, and ecological sustainability.

5.1 Types of Community Gardens in Sweden

Community gardens in Sweden vary widely, each fulfilling unique social and ecological roles. A literature review identified six main types. The findings highlight the popularity of residential gardens “privata trädgårdar” and allotments “koloniträdgårdar,” the latter deeply rooted in Swedish heritage (Björklund, 2010), and valued for their numerous benefits Hadgu (2021). The quantitative results also emphasized the increased interest in entrepreneurial market gardens “naturträdgårdar, fritidsträdgårdar” which corresponds with Drottberger et al. (2021) who explored the role of young Swedish market gardeners in alternative food networks, highlighting their values, motivations, and capacity-building efforts in food system transitions. Additionally, the results showed the significant use of neighbourhood gardens “innergårdar, stadsdelrädgårdar" and school gardens "skolträdgårdar", while therapy gardens "terapi-trädgårdar" seem to be less common.

Moreover, the qualitative results highlighted the role of botanical gardens "botaniska," forest gardens "skogsträdgårdar," and pocket parks "fickparkar" in contributing to communal gardening. Although pocket parks are small green spaces in urban areas, they often include various elements, such as community gardens. According to Zhang and Kiyai (2024), pocket parks are designed to meet the unique needs of their neighborhoods. They can reflect local culture and address specific requirements, such as creating play areas in family-oriented areas,

offering quiet green spaces in busy districts, or providing community gardens in locations with limited access to fresh produce.

Furthermore, the results shed a light on a unique example of community gardens cited by the participants, churchyard gardens "kyrkogårdar." This suggests that spiritual institutions also play a significant role in community-based gardening initiatives. An example of this type is Östad Churchyard Garden nearby Gutenberg, established over 120 years ago, is a historical site. Torin, who became the pastor in Östad in 1892, planted numerous trees and used the garden for services and personal recovery (Sundberg, 2022). The churchyard garden has evolved into a community space used for various activities, including gardening and nature walks.

Overall, these findings demonstrate the variety of community gardens in Sweden, mapping (see Table 2) provides a structured understanding of the community gardens type in Sweden, reflecting both historical traditions and emerging trends, further accrued classifications of community gardens types in Sweden is recommended.

5.2 Social Cohesion and Community Gardens

The results confirm that community gardens significantly contribute to social cohesion by fostering stronger relationships among participants. The study found that the most reported social benefits were strengthening neighbourhood relationships and enhancing a sense of community. These findings align with community gardens that function as “third spaces” (Larson & Giritli Nygren, 2024) strengthen social cohesion through place attachment (Scannell & Gifford, 2010) and fostering social interactions and shared activities, they enhance neighbourhood bonds and a sense of belonging (Veen et al., 2015).

Moreover, participants acknowledged friendships formed in community gardens, which aligned with research highlighting strong social bonding as a central function of community gardens (Firth et al., 2011). Nevertheless, statistical

analysis showed that the perceived importance of these friendships was not significantly higher than a neutral value. One possible explanation is that Swedish community gardens may serve more as places for collective work and social engagement rather than deep personal bonding.

Furthermore, both literature review and survey analysis identified that community gardens support social capital, particularly through networking and sharing of skills (Tsounis & Xanthopoulou, 2024). The majority of participants reported gaining social contacts and collaborating with others, demonstrating how these spaces facilitate social interactions that extend beyond gardening. The statistical analysis also showed significant perceived importance of the skills and resources gained in community gardening events. These findings correspond with the social capital framework proposed by Putnam (1995), emphasizing that networks, norms, and trust enable cooperation for mutual benefit, which in the Swedish context of community gardens are considered important.

Although this paper does not aim to examine the primary social groups involved in community gardening, the findings suggest a possible gendered pattern, with women more frequently involved in gardening, aligning with the historical image of Swedish women's involvement in gardening since the early 20th century. Olausson (2015) notes a rise in women pursuing gardening as their main occupation between 1910 and 1950. Additionally, community gardens appear to attract middle- to older-aged individuals, serving as a space for working professionals seeking a weekend hobby and retirees looking for social engagement.

Despite their social benefits, community gardens in Sweden face several challenges that impact their success. The qualitative findings reveal key themes of social aspects that contribute to their effectiveness, aligning with the pyramid of social key for grades success i.e. the literature review results (see Figure 8). A major concern identified was the need to expand gardens in low-income areas, aligning with the location factor (see Figure 8). Many respondents highlighted the scarcity of community gardens in economically disadvantaged neighborhoods,

despite their potential to improve food security, social cohesion, and environmental awareness. This aligns with previous research indicating that urban gardening initiatives often disproportionately benefit middle-class participants (Bonow & Normak, 2018). Furthermore, accessibility for marginalized groups, including people with disabilities, was another key theme linked to the design factor (see Figure 8). Respondents stressed the importance of inclusive infrastructure, mobility-friendly pathways, and thoughtful layouts. The qualitative analysis emphasized that community gardens were also recognized as social hubs, aligning with the diverse initiatives factor (see Figure 8). Participants emphasized the importance of gardening courses, mentorship programs, and social events. These activities not only improve community gardening but also foster stronger community bonds.

Finally, concerns about fair leadership and governance were closely tied to the management factor (see Figure 8). Respondents criticized hierarchical structures in some gardens, where decision-making is dominated by a small group. Additionally, stronger municipal involvement was advocated, including financial support, dedicated coordinators, and policies that recognize urban agriculture's value. This supports findings by Ding, et al. (2020), emphasizing that fair and transparent governance structures are crucial for maximizing social capital in community gardens. In conclusion, these results emphasize community gardens' role in fostering social cohesion; they need to be well social-oriented by ensuring the main key social factors for success (see Figure8) i.e. strategic location, design principles, diverse activities and initiatives and transparent management.

5.3 Community Gardens and Local Biodiversity

Both the literature review and survey findings highlight the significant role community gardens play in fostering local biodiversity at both human and non-human levels.

At the individual/human level, participants expressed positive emotional experiences and attitudes toward community gardens in Sweden, emphasizing a

sense of natural connectedness and appreciation for aesthetics. These perceptions align closely with the National Research Council's (1999) and SLU CBM understanding of biodiversity as encompassing not only biological dimensions but also intrinsic and cultural values. The visual richness offered by diverse plant and animal life in gardens, not only supports species diversity (Stork, 2009) but also enhances the garden's aesthetic appeal, reinforcing a human sense of connection to nature (Sato et al., 2021).

This connection often fosters intrinsic appreciation of biodiversity, valuing nature's contribution to people (Díaz et al., 2018; University of Gothenburg, 2018) and ecosystem cultural services (SLU CBM, 2025) and encouraging environmental stewardship, a concept grounded in ethical respect for nature (Leopold, 1949/2013). Participants' expressed concerns, such as stress over seasonal gardening responsibilities, reflect a deep commitment to environmental care. These gardening practices go beyond simple cultivation; they embody personal values and a land ethic that promotes responsible and reciprocal relationships with the natural world. As Leopold (1949/2013) articulated, such ethics nurture a sense of interconnectedness and moral responsibility toward the environment. Moreover, participants' suggestions and appreciation for biodiversity-enhancing features indicate a heightened environmental awareness and active engagement with ecological sustainability.

At the environmental level, community gardens emerge as ecologically significant spaces that support urban biodiversity through habitat provision, species diversity, and sustainable land use practices. The findings from both the literature review and the empirical survey reinforce the role of these gardens as vital ecological spots embedded within urban landscapes.

The literature provides strong evidence that community gardens can function as **biodiversity hotspots,** highlighting the capacity of such urban spaces to conserve threatened flora (Egerer et al., 2024; Seitz et al., 2021; Klepacki & Kujawska, 2018; Segar et al., 2022). Community gardens also contribute to **functional biodiversity** by offering nesting sites, and refuge for pollinators. Egerer et al.

(2024) noted that 40% of Berlin's wild bee species and several Red List insects were found in community gardens, showing their importance for pollinator conservation. These findings align with the National Research Council's (1999) framing of biodiversity as having instrumental (e.g., provision of ecosystem services). These findings underscore the ecological function of community gardens as "novel ecosystems" (Seitz et al., 2021), bridging biodiversity conservation with food production.

Findings from this study's survey echoed these themes. Participants demonstrated a high level of awareness and appreciation for biodiversity-enhancing features such as pollinator-friendly flowers, birdhouses, insect hotels, and wildlife. They even suggested further features such as bats and hedgehogs habitats. This reflects a growing recognition of gardens not just as food-producing sites, but as carefully managed habitats. These practices align with Stork's (2009) emphasis on biodiversity as species richness and ecological function, and with Swingland's (2013) understanding of biodiversity as encompassing genetic, species, and ecosystem levels.

Moreover, the widespread use of organic and permaculture practices among participants suggests a shift toward ecologically sustainable gardening. Such methods reduce reliance on synthetic chemicals, thereby preserving soil health, minimizing pollution, and supporting invertebrate populations critical for ecosystem services like pollination and decomposition (Verma et al., 2024; Francini et al., 2022).. These practices align with Lim (2016), who found that Swedish community gardens widely adopt sustainable practices. Many follow a chemical-free approach, composting, homemade pesticides and seed-saving are very common (Lim, 2016). These sustainable practices preserve the biological cultural heritage and ecosystem services (SLU CBM, 2009, 2025).

The Swedish context also adds a culturally relevant layer to biodiversity. As highlighted by Ouis and Lisberg Jensen (2009), the inclusion of exotic plant species by immigrant gardeners (e.g., coriander, fenugreek, squash) has contributed to the biocultural diversity of urban gardens. While exotic, these

plants are carefully selected for their cultural significance and edibility and are not typically invasive. The empirical data further emphasized this method of blending both native and non- native plants within Swedish community gardens. This supports a more inclusive interpretation of biodiversity, where cultural identity and ecological stewardship coexist (Swingland, 2013).

Qualitative analysis of the participants' responses emphasized the importance of adapting community gardening to climate change through sustainable practices, extended growing seasons, and climate-smart crops. Showing strong demand for integrating community gardens into urban planning, with calls for more land allocation and municipal support to meet the growing interest. While digitalization and smart gardening received less emphasis, some participants acknowledged the potential benefits of technology, such as gardening apps and digital tools, to enhance learning and efficiency.

In conclusion, community gardens in Sweden contribute meaningfully to local biodiversity at the environmental level. They support native and adapted species, enhance ecological networks, and foster sustainable urban ecosystems. By integrating ecological principles with cultural and social values, these gardens exemplify how biodiversity conservation can be embedded into everyday urban life and landscape. Their ecological roles ranging from habitat creation to species conservation and environmental education, position them as key assets in efforts to "bring nature back into cities" (Mata et al., 2020), offering scalable solutions for biodiversity and climate resilience.

5.4 Limitation

Some limitations must be considered when interpreting the all previous findings. The study focused exclusively on community gardens in urban settings, excluding larger-scale initiatives such as forest gardens. The public survey primarily reached organizations already engaged in gardening, but a considerable number of responses were incomplete and had to be excluded, limiting the dataset and generalization. Future studies could benefit from more targeted approaches, such

as direct engagement with individual gardeners through workshops or structured interviews, to capture a broader range of experiences. Additionally, while this study provides a snapshot of the relationship between gardening and social cohesion, longitudinal research would be necessary to track how these dynamics evolve over time. Experimental studies comparing different garden management models could also offer valuable insights into optimizing both social and ecological benefits. Finally, I acknowledged using of an AI tool in some sections to refine language and finalize the texts. While this supported language improvement and concentrate summarization of additional literature, particularly in biodiversity review, it may have limited the deep critical reflection.

6. Recommendation

This study highlights the crucial role of community gardens as socio-ecological spaces and provides key recommendations for municipalities and urban planners to enhance their success. To support both socially-oriented and biodiversity-focused community gardens, clear guidelines should be developed that prioritize both practical and theoretical aspects:

1. **Integrated planning and location:** Community gardens should be integrated into urban planning, strategically placed on development land to ensure accessibility, equitable distribution, and proximity to residential areas.
2. **Sustainable design and management:** Implementing fair, transparent governance structures and diverse initiatives can enhance community engagement, longevity and long-term viability.
3. **Ecological gardening practices:** Encouraging organic horticulture, integrated pest management, and water conservation practices through policy incentives and educational programs.
4. **Collaborative approaches:** Strengthening partnerships between municipalities, community groups, NGOs and gardeners to balance top-down support (e.g., municipal funding, support) with bottom-up initiatives (e.g., resident-led projects, knowledge-sharing programs).
5. **Future studies** should examine community gardens as hybrid socio-ecological systems, emphasizing feedback loops between ecological stewardship and social interaction.

6. **Integrating biocultural diversity theoretical frameworks** may help explain how immigrant and cultural practices contribute to biodiversity through plant selection and gardening traditions.

By adopting these strategies and theories-based approach, stakeholders can ensure that community gardens contribute to urban sustainability, biodiversity conservation, and stronger social cohesion.

7. Conclusion

Community gardens serve as vital spaces that significantly enhance both social cohesion and local biodiversity. This thesis demonstrates that, particularly within the Swedish context, these gardens are instrumental in fostering stronger community relationships, building social networks, and promoting collaborative engagement, effectively acting as "third spaces" that strengthen a sense of belonging and social capital among diverse groups. At the same time, they play a vital ecological role by offering habitat for pollinators, preserving plant diversity, and encouraging sustainable gardening practices such as composting, organic cultivation, and permaculture. The integration of native and culturally meaningful exotic plant species further reflects the gardens' biocultural value. The results also reveal a need for policy support, equitable land access, and inclusive management models to ensure the long-term viability and land tenure of these spaces. As well as educational outreach, and municipal collaboration in reinforcing both social and ecological outcomes.

As a final take-home massage, community gardens are more than spaces for cultivation, they are living laboratories of social resilience and ecological care. They hold untapped potential to weave together community building and biodiversity restoration in increasingly urbanized settings. As cities grow, integrating these spaces into planning and policy will be essential not just for greener landscapes, but for more connected, cohesive, and sustainable communities.

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Popular science summary

As urbanization increases and cities grow more crowded, social bonds tend to weaken, green spaces vanish, and biodiversity declines. However, research increasingly highlights the multiple roles community gardens play in urban environments. These gardens act as hubs for community engagement, cultural exchange, and social justice—making them ideal platforms for eco-social work. This study explores how community gardens can enhance social cohesion and support local biodiversity, with a focus on Sweden.

How the Study Was Done

This research combines a literature review with an online survey. The study defines "community gardens" and provides historical and cultural context. The literature review identifies six common types found in Sweden, showing how gardens' purposes and names vary across countries. Community gardens are framed as "third spaces" welcoming places that foster social cohesion by building individual place attachment and strengthening collective social capital. The review also examines how gardens support biodiversity by enhancing connectedness to the nature and environmental values. Additionally, community gardens are habitats for wildlife, including pollinators and native plants. The survey got 61 valid responses and all came from individuals involved in community gardening across Sweden. The questionnaire included multiple-choice and open-ended questions covering social experiences, gardening practices, plant choices, and attitudes toward biodiversity.

Key Findings

- The most common types of community gardens are residential gardens and allotments, rooted in Swedish gardening traditions. Emerging forms of community gardens include entrepreneurial market gardens and pocket parks.
- Community gardens strengthen neighborhood relationships. Participants reported increased connection, sharing resources, produce, and gardening advice. Participants also rated their skill-sharing and learning opportunities through their participation on community gardens as significantly important.
- Most gardeners followed sustainable methods like organic and permaculture, while avoiding harmful chemicals. A wide variety of plants were grown—both native and non-native—reflecting Sweden's growing cultural diversity.
- Key features such as pollinator-friendly flowers, shaded areas, and beehives were highly valued for supporting local biodiversity and wildlife habitats.
- Interest in adopting new technologies (e.g., mobile apps, smart watering systems, or robotic weeders) was notably low.
- Participants called for greater municipal assistance, more land access, especially in low-income areas, and improved inclusivity and accessibility for all abilities.

Conclusion: What Can We Learn?

Community gardens help build stronger, more connected communities while supporting local biodiversity. They reduce isolation, promote cultural exchange, and provide habitats for wildlife. As cities grow, including community gardens in urban planning offers a simple, sustainable way to create stronger social cohesion and contribute to biodiversity conservation.

Appendix 1

Survey

After choosing the language of survey (e.g. Swedish, English), the consent will appear with Yes/No availability choice before starting. The terms and consent text is:
“ This questionnaire is part of a master’s thesis in Outdoor Environments for Health and Well-being at the Swedish University of Agricultural Sciences (SLU). The data collected will be analyzed for educational purposes to better understand the social-ecological role of community gardens. All responses are anonymous, and the data will be stored for six months in compliance with GDPR regulations and SLU's research ethics guidelines. The questionnaire of 18 questions, estimated time 10 minutes to end”

The survey questions:

Q1: Gender

Female/ Male / Other

Q3: How old are you?

18-24 / 25-34 / 35-44 / 45-54 / 55–64 / 65 and older

Q3: What is your profession?

Student (e.g., high school, university, or vocational training)
Employed (full-time, permanent or temporary)
Employed (part-time, permanent or temporary)
Self-employed or freelancer
Unemployed
Retired
Homemaker or caregiver
Other (please specify):

Q4:What type of community gardens do you usually visit? (Please select all that apply)

Allotments (Koloniträdgårdar)
School gardens (Skolträdgårdar,)
Therapy gardens (Terapiträdgårdar)
Neighbourhood gardens (Innergårdar)
Residential gardens (Privata trädgårdar)
Entrepreneurial market gardens (Naturträdgårdar, Fritidsträdgårdar)
Other (please specify):

Q5: What feelings do you typically experience when spending time in community gardens? Please describe

Q6: What type of activities do you prefer to participate in at community gardens?

Gardening activities
Social events
Both gardening and social events
Other (please specify):

Q7:What social benefits have you experienced from participating in community gardens? (Please select all that apply)

Building social networks
Developing friendships
Strengthening neighbourhood relationships
Enhancing sense of community
Other (please specify):

Q8: Have you gained any of the resources below during your social participation in community gardens? (Please select all that apply)

Learnings opportunities such as courses
Skills development such as workshops
Social contacts such as being member in some associations and/or facebook or social media groups
Collaborating with others on shared products
Other (please specify):

Q9: If you have formed friendships through your participation in community gardens, how important are these relationships to your social life?

1=Not important to 7=Very important

Q10: If you have gained skills and learning opportunities through your. participation in community gardens, how important are these to you?

1=Not important to 7=Very important

Q11: How often do you participate in community gardening activities?

1=Never t0 7=Often
(if the answer is 1 the questionnaire will end at this point)

Q12: What types of plants do you typically grow in the garden?

Food crops (e.g., vegetables, fruits)
Flowers & Herbs
All of them

Q13: Which types of plants do you prefer to grow?

Native plants
Plants from other countries
Both local and non-native species

Q14: What habitat features do you think are important in community. gardens? (Please select all that apply)

Water sources (e.g., ponds, fountains)
Insect hotels
Bird feeding stations or birdhouses

Beehives
Build small brush piles for habitat
Pollinator-friendly flowers (to attract bees, butterflies, and other beneficial insects.)
Shaded seating areas, acessible pathways (to relax and socialize comfortably & to ensure inclusivity for individuals of all abilities)
Other (please specify):

Q15: What gardening practices do you follow?

Organic Gardening: Growing plants without using chemicals, using natural ways to keep the soil healthy.
Traditional Ornamental Gardening: Planting flowers and plants mainly for decoration and beauty.
Permaculture: A way of gardening that works with nature to create sustainable, self-supporting gardens.
Other (please specify)

Q16: Do you use pesticides or other chemical products to kill insects or weeds?

Yes No

Q17: With the availability of new gardening technologies like smart app systems, smart watering systems, and Tertill weeding robots, would you be interested in using these innovations in your gardening?

1=I would not to 7=I would

Q18: What ideas do you have to make gardening practices better in community gardens ? Please describe

Links

Here are links to some facebook group pages and organizations involved in the survey

- Kolonilottsliv https://www.facebook.com/groups/615110288666681
- Trädgårdsvänner https://www.facebook.com/groups/840550525995988
- Odla ihop https://www.facebook.com/OdlaIhop
- Fritidisodling Riksorgansition (FOR) https://www.facebook.com/fritidsodlare
- FOR publications on instagram https://www.instagram.com/p/DFgAAb8sTXg/?hl=en

Poster

COMMUNITY GARDENS

The Role of Community Gardens in Enhancing Social Cohesion & Addressing Local Biodiversity

SUMMARY

This study examines the dual role of community gardens in fostering social cohesion and supporting local biodiversity. The study focus particularly on Sweden and combined a literature review with an online survey.

Types of Gardens: The study identifies six common types of community gardens in Sweden.
Social Cohesion: Community gardens strengthen social bonds, facilitate skill-sharing, and enhance social capital, though challenges like accessibility, expansion in low-income areas, and governance issues remain.
Biodiversity Contribution: They contribute to local biodiversity by providing pollinator habitats, encouraging organic practices, and integrating climate adaptation strategies.

THIRD SPACES

According to Larson and Giritli Nygren (2024), community gardens are conceptualized as a "third space" that strengthens neighborhood relationships, fosters a sense of belonging, and enhances place attachment, while also building social capital within communities.

FLORA & FAUNA

According to Egerer et al. (2024), community gardens are considered a natural matrix that contributes to local biodiversity by serving as a refuge for flora and fauna, providing habitats for pollinators, and promoting land ethics and environmental stewardship among individuals.

AI- generated image based on the prompt: 'Community garden in the Swedish context with some people socializing and some bees and/or butterflies" Instructions by Sarah Saleh 2025

Pollinator-friendly flowers were identified as the most essential habitat feature, with 93% of survey participants prioritizing them. Here, a honeybee is seen foraging on blue bugle. This highlights how community gardens boost biodiversity.

Photo: Jenny Svennås-Gillner, 2013 SLU Media Bank

Allotment type is favored by 44% of participants; 25% garden ornamentally, and 27% grow only food. Here's an example of an allotment prepared for both ornamental gardening and vegetable cultivation, with a greenhouse.

Photo: Sarah Saleh 2025, Stensökolonisterna, Nacka

Type "known in Swedish"	Participation groups	Organization/ Intiatives	Primary purpose
Plot gardens or allotments "koloniträdgårdar"	Urban residents Families	Municipalities	Food production Recreation
School gardens "skolträdgårdar"	Students Teachers	Municipalities Institutional initiatives	Gardening activities Educational purposes Recreational purposes School kitchen
Healing or therapy gardens "terapiträdgårdar"	Patients Instructors Landscape architects	Educational institutes Hospitals	Rehabilitation Skills sharing
Neighbourhood gardens "innergårdar"	Residents Families	Housing agencies	Gardening Socializing Beautification
Residential gardens "privata trädgårdar"	Residents Families	Individuals Owners Tenants	Gardening Socializing Beautification
Entrepreneurial market gardens "naturträdgårdar, fritidsträdgårdar"	Different participants	Different initiatives	Income improvement Sustainability Self-reliance

Table. Common types of community gardens in Sweden

RESULTS

Types of Gardens:
- Residential gardens are the most popular type.
- Allotment gardens are also common, reflecting a strong Swedish tradition.
- Entrepreneurial market gardens are an emerging trend.

Social Benefits:
- Strengthened neighborhood relationships are the main social benefit from gardens participation.
- A stronger sense of community is frequently reported.
- Learning opportunities and skill development through participation in community gardens is considered highly important.

Gardening Practices & Plant Diversity:
- Common methods include organic gardening, permaculture, and ornamental gardening.
- 98% of participants avoid using pesticides.
- Gardens host a wide variety of vegetables, fruits, flowers, and herbs, both native and non-native species.

Biodiversity Features & Tech Adoption Trends:
- Pollinator-friendly flowers and shaded seating with accessible paths are highly valued.
- Low interest in smart gardening technologies such as apps, smart watering systems, and weeding robots.

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