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Community Gardens in Transitioning Cities: Co-creating Spatio-Temporal Practices of Commoning in Brussels and Kraków

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PhD dissertation conducted under the supervision of
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Kraków 2025

Acknowledgement

This dissertation was carried out at the Jagiellonian University in Kraków and at the University of Mons. I am deeply grateful to my supervisor, Dr hab. Jarosław Działek, for his guidance, trust, and intellectual generosity throughout every stage of this work. I also warmly thank my co-supervisor, Dr Kristel Mazy, for her support, encouragement, and sharp insights, which consistently helped me deepen my reflections. I extend my appreciation to the Doctoral School of Social Sciences and the Institute of Geography and Spatial Management at the Jagiellonian University, as well as the Faculty of Architecture and Urban Planning at UMONS, for offering institutional and financial support, and for providing an intellectually rich and supportive research environment.

This thesis would not have been possible without the many individuals and collectives who shared their knowledge, time, and spaces with me. I owe sincere thanks to the gardeners (especially from Gray-Moineaux, Fruits-Dupuis, Pychogród, and Salwator), activists, public officials, and NGO members in Brussels and Kraków who participated in this research. I am especially grateful to Le Début des Haricots in Brussels for generously inviting me into their practices and reflections. I also want to thank Michał and Zofia, not only for their inspiring commitment to urban commons on campus, but also for believing in my work and giving me the floor to experiment. Their trust and solidarity were essential.

To my family and friends, thank you for walking this journey with me. To my brother Sacha, for his creative perspective and unwavering encouragement. To Pénélope, for her sisterhood, deep kindness, and presence. To Furkan, my life partner, for his emotional support, care, and faith in me during both fieldwork and writing. To all my girlfriends, for their endless support, humour, and grounding presence. I am also grateful to the teachers, mentors, and administrative staff who helped me navigate this long process. And finally, to all the people I encountered along the way, those who opened their gardens, shared their stories, and shaped my thinking, thank you for making this project what it became.

This dissertation is as much theirs as it is mine.

Table of content

Abstract (in English)

Title: Community Gardens in Transitioning Cities: Co-creating Spatio-Temporal Practices of Commoning in Brussels and Kraków.

This dissertation examines the role of community gardens as socio-ecological infrastructures and commons in urban contexts undergoing socio-ecological transition. Community gardens are conceptualized as “natural third places”, informal, inclusive gathering spaces that foster connections across diverse social groups through collective gadening practices, and that function as urban commons under collective stewardship. The research adopts an interpretive, mixed-methods design, combining participatory mapping, ethnographic fieldwork, and comparative case studies in Krakow and Brussels.

Key findings indicate that governance structure critically influences outcomes: bottom-up, community-led management is associated with higher gardener satisfaction and ecological performance. Participation exhibits distinct temporalities, ranging from intermittent engagement to long-term stable involvement, highlighting the need for adaptive coordination. Co-creation processes emerged as crucial mechanisms for linking collective action with institutional learning in these shared spaces. Community gardens consistently cultivate social capital (bonding, bridging, and linking), enhancing psychological well-being, and promoting inclusive social networks. Together, these socio-ecological functions position community gardens as adaptive urban infrastructures integrating ecosystem services with social cohesion, thereby strengthening the resilience of urban socio-ecological systems.

Overall, this work enriches conceptual and practical understandings of urban green spaces by linking governance analysis with the framework of socio-ecological infrastructure. It advances urban sustainability research by showing how community-managed green spaces, through co-creative practices, serve as multi-scalar agents of inclusive, resilient urban transition. However, the analysis also critically acknowledges that community gardens are not a universal remedy: without supportive policy frameworks and inclusive governance, they may face resource constraints and social exclusion that potentially reproduce existing inequalities.

Abstract (in Polish)

Tytuł: Ogrody społeczne w miastach w okresie transformacji: współtworzenie praktyk wspólnotowych w ujęciu przestrzenno-czasowym w Brukseli i Krakowie.

Niniejsza rozprawa analizuje rolę ogrodów społecznych jako infrastruktury społeczno-ekologicznej oraz dóbr wspólnych w ośrodkach miejskich przechodzących transformację społeczno-ekologiczną. Ogrody społeczne są konceptualizowane jako „naturalne trzecie miejsca": nieformalne, inkluzywne przestrzenie spotkań, sprzyjające budowaniu więzi między zróżnicowanymi grupami społecznymi poprzez wspólne praktyki ogrodnicze, a jednocześnie funkcjonujące jako dobra wspólne zarządzane kolektywnie. Badanie opiera się na interpretatywnym, mieszanym podejściu metodologicznym, łączącym kartowanie partycypacyjne, badania etnograficzne i porównawcze studia przypadków w Brukseli i Krakowie.

Uzyskane wyniki podkreślają znaczenie struktur zarządzania: oddolne, prowadzone przez społeczność modele wiążą się z wyższym poziomem satysfakcji uczestników oraz lepszymi efektami ekologicznymi. Formy uczestnictwa przybierają różne ramy czasowe, od zaangażowania okazjonalnego po długoterminowe i stabilne, co podkreśla potrzebę adaptacyjnej koordynacji. Procesy współtworzenia okazują się kluczowymi mechanizmami łączenia działań zbiorowych z uczeniem się instytucjonalnym w tych wspólnych przestrzeniach. Ogrody społeczne konsekwentnie wzmacniają kapitał społeczny, poprawiają dobrostan psychiczny oraz wspierają inkluzywne sieci społeczne. Łącznie te funkcje społeczno-ekologiczne pozycjonują ogrody społeczne jako adaptacyjną infrastrukturę miejską: integrują one usługi ekosystemowe ze spójnością społeczną, wzmacniając tym samym odporność miejskich systemów społeczno-ekologicznych.

W ujęciu całościowym praca ta wzbogaca koncepcyjne i praktyczne rozumienie miejskich terenów zielonych, łącząc analizę struktur zarządzania z ramami infrastruktury społeczno-ekologicznej. Wnosi wkład do badań nad zrównoważonym rozwojem miast, ukazując, w jaki sposób obszary zielone zarządzane przez społeczności mogą działać, poprzez praktyki współtworzenia, jako wielopoziomowi agenci inkluzywnej i odpornej transformacji miejskiej. Jednocześnie praca ta w sposób krytyczny zauważa, że ogrody społeczne nie stanowią rozwiązania uniwersalnego: bez odpowiednich ram politycznych i włączającego zarządzania mogą napotykać na ograniczenia w dostępie do zasobów oraz prowadzić do wykluczenia, reprodukując istniejące nierówności.

Abstract (in French)

Titre: Les jardins communautaires dans les villes en transition : co-création spatio-temporelle des pratiques de mise en commun à Bruxelles et Cracovie.

Cette thèse examine le rôle des jardins communautaires en tant qu'infrastructures socio-écologiques et de biens communs dans des contextes urbains en transition. Les jardins communautaires y sont conceptualisés comme des « tiers-lieux naturels » : des espaces de rencontre informels et inclusifs favorisant les liens entre des groupes sociaux diversifiés par le biais de pratiques de jardinage collectives, et agissant comme des communs urbains sous une gouvernance partagée. L'étude adopte une approche interprétative et mixte, combinant cartographie participative, travail de terrain ethnographique et études de cas comparatives à Bruxelles et Cracovie.

Nos résultats mettent en évidence l'importance des structures de gouvernance : une gestion ascendante, menée par la communauté, est associée à une plus grande satisfaction des jardiniers et à de meilleures performances écologiques. Par ailleurs, les formes de participation suivent des temporalités variées, allant d'implications ponctuelles à des engagements stables sur le long terme, soulignant la nécessité d'une coordination adaptative. Les processus de co-création apparaissent comme des leviers essentiels pour articuler action collective et apprentissage institutionnel dans ces espaces partagés. Les jardins communautaires cultivent systématiquement un capital social, améliorent le bien-être psychologique et favorisent des réseaux sociaux inclusifs. Ensemble, ces fonctions socio-écologiques positionnent les jardins communautaires comme des infrastructures urbaines adaptatives : ils intègrent services écosystémiques et cohésion sociale, renforçant ainsi la résilience des systèmes socio-écologiques urbains.

Dans son ensemble, ce travail enrichit la compréhension conceptuelle et pratique des espaces verts urbains en articulant une analyse de la gouvernance dans le cadre des infrastructures socio-écologiques. Il fait progresser la recherche sur la durabilité urbaine en montrant comment les espaces verts autogérés par les communautés, à travers des pratiques de co-création, agissent comme des agents à multi-échelles d'une transition urbaine inclusive et résiliente. Toutefois, notre analyse reconnaît également que les jardins communautaires ne constituent pas une solution universelle : sans des politiques de soutien et une gouvernance inclusive, ils peuvent potentiellement faire face à des contraintes de ressources et à des formes d'exclusion, reproduisant les inégalités déjà existantes.

List of Papers included in the Dissertation

Paper 1: Téoule F., (2025), Community gardens as natural third places: a conceptual framework. Accepted for publication in Contemporary Social Science.

Paper 2: Téoule, F. (2025). E-participation in mapping and typology development: community gardens in Krakow and Brussels. *Planning Practice & Research*, 1-25. https://doi.org/10.1080/02697459.2025.2547215.

Paper 3: Téoule F., Mazy K., (2025), Temporalities of urban commons: Case study of community gardens, manuscript submitted to Local Environment.

Paper 4: Téoule, F. (2025). Governance models and the socio-ecological role of community gardens in post-socialist Krakow. *Regional Science Policy & Practice, 17*(10), 100243. https://doi.org/10.1016/j.rspp.2025.10024.

The full versions of all research papers included in this dissertation are presented in Part II.

RADA DYSCYPLINY
GEOGRAFIA SPOŁECZNO-EKONOMICZNA
I GOSPODARKA PRZESTRZENNA

Annex 2

Declaration of personal contribution to the co-authored work submitted within the PhD dissertation of Mr./Ms. Fanny Téoule

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Conceptual development ..... 30 %
Literature research ..... 5 %
Research design ..... 5 %
Data collection ..... 0 %
Data analysis ..... 10 %
Presentation of results ..... 0 %
    Map design ..... 0 %
    Figures design ..... 0 %
    Table design ..... 0 %
Interpretation & discussion of results ..... 10 %
Manuscript preparation ..... 10 %
Other ..... %

16.10.2025.....
Date *Signature*

PART I: Synthesis Report

Chapter I: Literature review & Conceptual framing

1. Introduction and overview: Cities in transition, community gardens as a lens

This introductory section serves a dual purpose. First, it situates the research within wider debates on socio-ecological transitions and the challenges facing contemporary European cities. Second, it provides an overview of the thesis as a whole: outlining its conceptual framing, comparative rationale, methodological design, and main contributions, and introducing the structure that connects the four articles. In this way, the introduction contextualizes the study and functions as a roadmap, clarifying how the investigation unfolds and how the thesis contributes to ongoing debates in urban studies, human geography, and political ecology.

Cities across Europe face mounting climate, social, and institutional challenges that undermine conventional modes of urban governance. Climate-related hazards (heatwaves, storms, floods, etc.) are already inflicting severe losses to people, ecosystems, infrastructure and human well-being (Seneviratne et al., 2021). At the same time, rapid socio-economic change has been accompanied by rising inequality and concerns about eroding public trust. For example, Eurofound (2018) noted that in recent decades roughly half of European countries experienced a net decline in public trust in national institutions. These converging risks (climatic, social, and political) create pervasive uncertainty about the future of cities. In response, scholars in sustainability transitions and urban studies have increasingly invoked the idea of a socio-ecological transition, emphasizing the need for systemic change rather than incremental fixes. Social-ecological transitions are understood as non-linear, contested processes that reconfigure relations among nature, governance, and everyday life (Brand, 2016; Bulkeley, 2015; Frantzeskaki et al., 2025). In this view, the shift goes beyond technical upgrades (such as renewable energy) and requires institutional innovation, collective learning, and new social imaginaries of nature and citizenship (Schneidewind et al., 2016; Frantzeskaki et al., 2025). For example, Wachsmuth and Angelo (2018) show that urban sustainability policies often blend "green" (nature-based) and "gray" (technological) solutions in ways that reinforce existing inequalities, highlighting how cities must challenge long-established ideologies of nature. Likewise, other transition scholars argue that urban change involves experimentation with new governance forms and cultural practices across multiple scales (Avelino et al., 2019; Frantzeskaki et al., 2025).

This thesis engages these debates through a situated study of community gardens as "laboratories" of urban sustainability. In this study, community gardens are defined as shared urban green spaces where local residents collectively manage and cultivate plants for food, recreation, education, and social activities. They often arise on underutilized land (vacant lots, park edges, schoolyards, rooftops) and are managed by community members for multiple social and ecological purposes (Kwartnik-Pruc & Droj, 2023). Such gardens, known as "ogrody społeczne" in Polish or "jardins collectifs" in French, contrast with traditional allotment gardens ("ogrody działkowe" in Polish), which consist of individually managed plots leased to households. Community gardens emphasize collective use and shared decision-making, whereas allotment gardens involve private plots within a larger leased area, with gardeners independently choosing what to grow. This distinction clarifies that our analysis focuses on community-managed, collectively governed urban gardens, rather than on plot-based allotments.

Moving beyond their conventional framing as amenities or food production sites, the community gardens investigated here are understood as socio-ecological infrastructures, hybrid spaces where people and ecosystems co-produce new ways of urban living. Within these gardens, human and non-human actors interact in ways that shape resource use, social relations, and ecological functions. This framing draws on scholarship on coupled human-environment systems (Ostrom, 1990) and urban commons (Foster & Iaione, 2015). We adopt a standard definition of a social-ecological system (SES): a dynamic integration of ecological subsystems (such as biodiversity and nutrient flows) with social subsystems (institutions, user groups, and norms) (Petrosillo et al., 2015). In this context, community gardens function as socio-ecological infrastructures insofar as they operate like semi-formal urban networks: they are infrastructural in that they comprise managed assemblages (e.g. garden beds, composting tools, water systems, and volunteer networks) that channel and regulate flows of material (e.g. food, water) and immaterial (e.g. knowledge, trust) resources through the urban fabric. This aligns with recent urban studies that conceptualize community gardens as “hybrid social-ecological hubs” or as infrastructures delivering ecosystem services (Clarke et al. 2019, Kanosvamhira, 2024). Morever, the notion of commoning processes refers to the social practices through which communities collectively create, use, and maintain shared resources. Following Foster and Iaione (2015), we consider the building and maintenance of a community garden to be acts of commoning because they generate both tangible resources (green space, food) and intangible ones (social ties, mutual trust, a sense of security and belonging). This perspective extends Ostrom’s SES framework (1990) by highlighting how community gardens operate as

infrastructural interfaces where ecological dynamics (such as pollination, soil health, and biodiversity) are interwoven with collective governance and place-making. Empirically, the thesis finds that community gardens enact both ecological functions and collective agency. Barthel et al. (2010, p. 256) describe urban gardens as sites of "social-ecological memory," where communities manage green spaces and learn from ecological rhythms. They argue that such spaces function as "urban green commons," contributing to urban resilience by pooling ecological knowledge and social cooperation. In this sense, community gardens provide a rich analytical terrain for studying the tensions and collaborations involved when citizens, NGOs, and public institutions co-produce urban nature (Barthel et al., 2010).

More than studying community gardens in isolation, this research uses them as a lens on broader processes of socio-ecological change. Its main aim is to uncover how community gardens, as socio-ecological infrastructures, can inform more inclusive and adaptive forms of urban governance that remain underexplored in existing scholarship. We investigate how diverse actors (residents, municipal agencies, non-profit organizations, grassroots groups) together contest, adapt, and sustain urban commons through situated action. Gardens thus become a prism for seeing how urban nature is mobilized, inhabited, and governed in transition. We compare two contrasting European cities to answer this question. Brussels (Belgium) is characterized by a complex multi-level governance system**:** the Brussels-Capital Region shares competencies with 19 separate municipalities, and many powers overlap with federal and surrounding regional authorities. Indeed, the OECD notes that "while on paper" the Brussels Region has extensive competencies, "in practice most of them are shared with other levels of government" (OECD, 2024, p. 13). This institutional plurality creates both opportunities for collaboration and persistent coordination challenges. By contrast, Kraków (Poland) has a different historical legacy: its urban form still bears the imprint of socialist-era planning and rapidly shifting demographics. As Hirt (2013) and Ferenčuhová & Gentile (2017) observe, post-socialist cities like Kraków remain shaped by centralized planning legacies and evolving (often contested) imaginaries of public space. In Kraków today, community gardens are emerging within this context: a heritage of allotment gardens persists, even as new forms of community gardening take root amidst changing expectations about nature and participation.

Methodologically**,** this study adopts a mixed-methods, comparative case design. The quantitative component here is primarily documentary*:* we compiled an extensive database of planning documents, city reports, NGO publications, and online content (including community garden websites and social-media pages) in both cities. These data supported development of a typology of community garden and an online survey to map them. In tandem, the qualitative

component employed ethnographic and participatory methods. Fieldwork (from 2021 to 2024) included go-along and semi-structured interviews, participatory mapping and co-design workshops, and action-research activities. Interviewees included gardeners, municipal officers, NGO leaders, and residents. We also held multiple co-design sessions with stakeholders in Kraków. This rich dataset allows triangulation across sources: for example, survey and document review provided contextual and quantitative grounding, while interviews and workshops revealed lived experiences and community dynamics.

The analysis is guided by a comparative case study framework that balances within-case depth with cross-case synthesis. Following Bartlett and Vavrus (2017), we treat comparison as multi-axial: we examine each city (Brussels vs. Kraków) in its own right, but we also look horizontally (comparing how similar or not processes unfold across cities), vertically (considering influences from local to national scales), and transversally (tracing changes over time). In this way, the study maintains sensitivity to local context while identifying broader patterns. Overall, the interdisciplinary contribution of this thesis lies in conceptualizing community gardens as relational, temporal, and contested infrastructures. Drawing on geography, anthropology, political ecology, and environmental studies, we argue that community gardens are co-constructed through governance dynamics, daily practices, and overlapping timeframes.

The key contributions can be summarized as follows: the thesis demonstrates that community gardens operate as natural third places and socio-ecological infrastructures that foster conviviality, ecological care, and civic innovation (Paper 1); it develops and applies a participatory mapping and typology that reveals how governance legacies and spatial contexts shape community gardening in Brussels and Kraków (Paper 2); it shows how temporal practices and short-term actions underpin resilience and adaptive capacity in the everyday life of community gardens in Brussels (Paper 3); and it highlights how governance models (bottom-up, top-down, and hybrid) condition inclusivity, ecological adaptability, and sustainability in Kraków post-socialist contexts (Paper 4).

To clarify the overall structure of the report: this first chapter introduces the conceptual foundations, comparative framework, and methodology of the research (Chapter 1); the second chapter presents the four research articles in sequence (Chapter 2); and the third chapter synthesizes their findings, reflects on methodological and theoretical implications, and outlines directions for policy and future research (Chapter 3).

By rooting our inquiry in the lived experiences of community garden practitioners, this thesis aims for a nuanced understanding of urban nature as a zone of negotiation and innovation.

Crucially, we avoid romanticizing community gardens as idyllic refuges. Instead, we show them as urban commons in the making, where conflicts and cooperation coexist. These gardens evolve through multiple, overlapping timeframes: seasonal growing cycles, shifts in political regimes, and institutional learning. At the same time, people form affective attachments to these places, giving rise to strong emotional bonds (sense of community, identity, care for non-human life) that are negotiated alongside formal rules. Overall, the thesis shows how community gardens become sites of situated sustainability, not fixed but dynamic, contested arenas where future urban trajectories are co-authored. In doing so, the study contributes to broader theoretical debates on environmental justice, co-creation, urban commons, and natural third places, offering an integrative framework that connects socio-ecological practice with contemporary transitions in urban governance.

2. Literature review: Interdisciplinary root

This literature review establishes the theoretical framework for analyzing community gardens as socio-ecological laboratories in cities undergoing transition. Drawing on human geography, political ecology, urban anthropology, and planning theory, it integrates four main conceptual strands: urban commons and commoning; co-creation and participatory urbanism; natural third places and affective urbanism; and socio-ecological infrastructure in urban political ecology. Together, these concepts demonstrate how community gardens operate as relational infrastructures, spaces where governance, care, ecological knowledge, and collective experimentation intersect.

2.1. Urban commons and commoning practices

The revival of the commons concept responds to contemporary ecological and governance challenges. Garrett Hardin's "tragedy of the commons" thesis (1968) argued that shared resources are doomed without state or market control, but Elinor Ostrom (1990, 2010) demonstrated that communities can self-organize to manage common-pool resources sustainably under appropriate institutional conditions (Hardin, 1968; Ostrom, 1990, 2010). Ostrom's work laid the foundation for understanding commons as dynamic systems rooted in collective agency, adaptable rules, and social learning. Subsequent scholarship has extended the concept to include not only material resources (land, water, green space) but also the everyday social practices that produce and sustain them (Linebaugh, 2008; Stavrides, 2016). The terms "urban commons" and "commoning" emphasize this relational dimension,

highlighting negotiation, cooperation, and embedded social ties in urban life (Gibson-Graham et. al., 2006; Harvey, 2012; De Angelis, 2017). In this perspective, commons involve collective use and shared access, co-responsibility, shared temporality, and affective connections among participants.

Community gardens have increasingly been theorized as urban commons, spaces where ecological, social, and political processes intersect and where residents collectively steward shared resources (Gibson-Graham et. al., 2006; Eizenberg, 2012; Ponstingel, 2023). Rather than being inherently harmonious, these commons require negotiation, cooperation, and ongoing maintenance (Eizenberg, 2012). They exemplify how residents can collectively claim and transform urban space for mutual benefit. In Brussels, for example, grassroots initiatives like Gray-Moineaux and Fruits-Dupuis demonstrate commoning in action, as neighborhood volunteers jointly tend plots, share harvests, and experiment with horizontal governance (Paper 3). In Kraków, community gardening similarly reflects the city's post-socialist context: decades of centralized planning and civic distrust can challenge collective action, but new ecological concerns and grassroots mobilization are fostering emergent forms of commoning (Czepczyński, 2016; Ferenčuhová, 2016) (Paper 4). By analyzing governance arrangements, interdependencies, and the interplay between formal institutions and informal practices in community gardens, this research contributes to the expanding literature on urban commons, especially in under-explored post-socialist contexts (Mokras-Grabowska, 2020; Dymek et al., 2021). It sheds light on how collective urban stewardship is forged and negotiated under diverse institutional conditions.

2.2. Co-creation and participatory urbanism

Co-creation has gained traction as an alternative to top-down, technocratic planning. Rooted in design theory and collaborative governance, co-creation refers to processes where diverse stakeholders (residents, experts, institutions) jointly define problems, generate ideas, and implement solutions (Manzini, 2015; Voorberg et al., 2014). Unlike earlier models of participation (Arnstein, 1969) or collaborative governance (Ansell & Gash, 2008), co-creation emphasizes open-ended experimentation, situated learning, and mutual adaptation. In sustainability and transition studies, co-creation is increasingly seen as a vehicle for systemic change driven by local innovation (Nevens et al., 2013; Frantzeskaki et al., 2025). It disrupts linear planning by linking knowledge production with practice and by encouraging iterative, inclusive engagement.

Methodologically, this thesis embeds co-creation in the research process. Participatory mapping (Paper 2) and co-design workshops (Paper 4) were employed as tools to engage community garden members and stakeholders. In both cities, community gardens practitioners co-designed digitally the participatory mapping of their own gardens (Paper 2). In Kraków specifically, the co-design of the Jagiellonian University (JU) Campus community garden brought together students, faculty, the municipal Greenery Authority, and nearby residents, illustrating how hybrid governance can integrate institutional legitimacy with grassroots input (Paper 4). These co-creative methods shaped the research outcomes by fostering ownership and shared understanding among participants.

Analytically, co-creation highlights how governance emerges from formal institutions and affective and symbolic processes. The JU Campus community garden (Paper 4) illustrates a hybrid governance model: university support provided legitimacy and resources, while grassroots volunteers infused energy and everyday stewardship. Importantly, co-creation can reproduce power imbalances or serve as tokenistic engagement if not carefully managed (Purcell, 2009; Cociña, 2022). For instance, critics warn that co-creative planning often fails to cede real power, offering only an illusion of inclusion that maintains the status quo (Arnstein, 1969; Purcell, 2009). Such participatory initiatives risk being co-opted by powerful actors, what Cooke and Kothari (2001) term the “tyranny” of participation, if underlying inequalities are not addressed. Without sustained facilitation and attention to equity, co-design initiatives may falter or be appropriated for institutional branding rather than genuine empowerment.

2.3. Natural third places and affective urbanism

Sociologist Ray Oldenburg (1991) originally defined "third places" as everyday informal gathering spots outside home (first place) and work (second place), such as cafes, churches, or community centers. Third places are characterized by neutrality, accessibility, routine social encounters, and a spirit of equal footing among participants; they foster conviviality, belonging, and civic life (Oldenburg, 1991). Recent scholarship has extended the third-place concept to include green and hybrid spaces, sometimes called by practitioners "natural third places", where urban nature blends with social interaction (Jennings, 2019; Kanosvamhira, 2024). Public parks, greenways, and community gardens can serve as natural third places, offering restorative environments for casual sociability. These spaces are especially valuable in cities where formal amenities are scarce or socially segmented, as they provide inclusive venues for informal gathering and community building (Paper 1).

This thesis examines community gardens through the lens of natural third places to foreground their affective, symbolic, and temporal dimensions. Beyond food production or governance, gardens are places of storytelling, ritual, and sensory experience. For example, community gardeners from our case study establish shared rhythms and seasonal rituals in their plots, fostering informal learning and bonding (Paper 3). These qualities reflect what Lefebvre (2004) calls the "rhythmanalysis" of everyday life: community gardens tune participants into seasonal cycles and communal routines. Gardeners in Kraków and Brussels often described their spaces as "*places to be*," not merely places to do; they emphasized emotional attachment, friendship, and respite as core values of the garden experience. This perspective resonates with the study of affective urbanism**,** which highlights care, maintenance, and emotional labor as key dimensions of making meaningful space (Milligan et al., 2004; Power & Williams, 2020). By extending Oldenburg's concept (1991) into the realm of urban nature, the analysis expands the vocabulary for green space: community gardens are understood as socio-ecological infrastructure, and as socially reproductive practices rich in relational and emotional value.

2.4. Socio-ecological infrastructures and urban political ecology

The notion of socio-ecological infrastructure has gained traction in urban studies as a way to rethink green (and blue) spaces as both material systems and social constructs. These hybrid infrastructures deliver ecological functions (habitat support, water retention) alongside social services (community participation, education, care) and cultural ecosystem services (Derek et al., 2025), woven together by broader political-economic systems (Ernstson, 2013; Latham & Layton, 2019). For instance, Ernstson (2013) frames urban ecosystems as co-produced by networks of people and nature, highlighting how collective action in gardens generates ecosystem services for the city. Urban Political Ecology (UPE) provides a critical lens on these infrastructures. UPE scholars argue that "urban nature is made" through political decisions, economic logics, labor, and cultural meanings (Heynen, Kaika & Swyngedouw, 2006). From this view, infrastructures are inherently political: they reflect and reproduce power asymmetries and social inequalities, even as they may become sites of resistance and alternative futures (Graham & Marvin, 2001; Lawhon et al., 2023).

In this thesis, community gardens are approached as socio-ecological infrastructures that can disrupt dominant urban logics. They are embedded in formal systems of land use, waste management, and biodiversity planning, yet they often arise informally through civic initiative. For example, Paper 4 shows how the JU Campus community garden emerged through co-

creation as a alternative infrastructure: an everyday assemblage where material flows (compost, rainwater) and social relations are re-patterned through gardening practice (Paper 4). This approach emphasizes the temporal and embodied labor of infrastructure. Gardening involves daily care, seasonal cycles, and ongoing maintenance, in contrast to one-off engineering projects. In this sense, as Simone (2004) observes in other contexts, "people are infrastructure", community gardeners themselves become carriers of adaptive capacity and ecological stewardship.

By aligning with calls to broaden the concept of infrastructure beyond physical assets (Silver, 2014; Große, 2023; Lawhon et al., 2023) this research contributes to debates on urban resilience and socio-ecological transition. It frames community gardens as infrastructures that are at once functional and symbolic, material and affective, resilient yet contingent. In doing so, it offers a grounded perspective on how cities might be remade through everyday acts of ecological and social negotiation, rather than only through top-down projects.

3. Research framework

This third part sets out the conceptual and analytical framework that structures the thesis. It clarifies how the research engages with existing debates, identifies the gaps it seeks to address, and specifies the contributions it makes to scholarship and practice. The section unfolds in four steps: it first situates the study within ongoing debates and highlights research gaps (3.1), then formulates the research questions guiding the inquiry (3.2), reflects on positionality and epistemological commitments (3.3), and finally explains the comparative rationale and case selection of Brussels and Kraków (3.4). Together, these elements establish the intellectual foundations of the thesis.

3.1. Research gaps and contributions

Although scholarship on urban commons, socio-ecological infrastructure, and participatory governance has grown in the past decade, key issues remain underexplored, especially concerning community gardens in cities facing institutional and socio-environmental transition. First, most studies treat community gardens as sites of food production, urban greening, or civic engagement, but fewer examine them as hybrid socio-ecological infrastructures and as natural third places (Guitart et al., 2012; Huq & Deacon, 2025). In this thesis, we build on an emerging view of green spaces as multifunctional infrastructures. For example, recent work on Polish allotment gardens highlights that, beyond their economic and

leisure roles, gardens are increasingly valued as community, social, ecological, and even creative spaces (Mokras-Grabowska, 2020). Likewise, policy initiatives by Poland's Allotment Gardens Association stress preserving gardens as "productive and living spaces" for leisure and social integration for recognizing their infrastructural role in the city. By framing gardens as infrastructures of transition, we show they support care work, communal rituals, and a sense of belonging through everyday practices. This builds on Oldenburg's (1991) notion of third places and recent studies showing that community gardens can function as third places with a communal purpose that is inclusive across diverse neighborhoods (Dolley, 2019). In our research (Paper 1), community gardens emerge not only as cultivation plots but as dense relational ecologies: sites where reciprocal care and social ties develop across social differences, anchoring social reproduction and local identity in otherwise fragmented cities. In other words, community gardens become natural third places, blending ecological activity with convivial public life (Dolley, 2019).

Second, we identify a gap in urban commons scholarship**.** The literature on urban commoning has largely focused on Western Europe and North America (Blomley 2008, Foster & Iaione 2015), reflecting more stable institutional contexts and strong civic traditions. Blomley (2008) observed that, at the time, only about 1.2% of commons research explicitly addressed urban settings, highlighting the marginalization of the urban commons within the broader literature. Additionally, to balance the Western bias, we examine commoning in a post-socialist context. In cities like Kraków, legacies of centralized socialist planning and weak civil society mean that collective projects face different challenges (Ferenčuhová, 2017). For example, planning efforts in Poland have sometimes threatened existing allotments and new development plans have proposed liquidating urban garden sites for housing (Mokras-Grabowska, 2020). At the same time, grassroots actors (e.g. the Polish Allotment Gardens Association) work vigorously to redefine gardens as public resources. Mokras-Grabowska (2020, p. 245) documents how these civic programs "redefine and change the perception of [allotment gardens] in Poland" and aim to strengthen their social and infrastructural roles. By studying Kraków as a case, this thesis shows how commons emerge (or fail to emerge) under conditions of institutional fragility. This extends critiques like Ferenčuhová's (2017), which call for decentering urban theory by including Eastern European experiences. Together, our findings fill a geographic gap: they demonstrate that, under post-socialist conditions of low initial trust and top-down governance, community gardens require new understandings of collective action and commons management (papers 2-4), rather than uncritical transfer of Western models.

Third, we address a gap in participatory governance research. Many studies praise participatory or co-creative planning, but in practice such initiatives are often short-lived or tokenistic (Arnstein 1969, Cociña et al., 2022). For instance, Cociña et al. (2022) argue that conventional participation often fails to change power structures, remaining as a "blind spot" unless embedded in broader political struggles. In our research we respond by implementing embedded co-design and action-research with garden stakeholders. Papers 2 and 4 use methods like participatory mapping and sustained co-design. This allows us to document how institutional context conditions participatory processes. The Brussels-Kraków comparison shows that Brussels' multi-level governance (and relatively strong NGOs) can sustain some community garden collaborations over time (Paper 3), whereas Kraków's centralized system and more volatile resource flows often interrupt or co-opt garden projects (Paper 4). This analysis illustrates how institutional culture, power dynamics, and temporal rhythms shape the inclusivity and continuity of co-creation (Cociña et al., 2022). Overall, our approach sheds new light on participatory mechanisms within community-level initiatives like community gardens, an aspect rarely examined in urban governance research (Rosol, 2010).

Fourth, the thesis tackles a gap at the interface of ecology and planning. Urban policy increasingly calls for bridging ecological systems with spatial governance, but practical frameworks remain scarce. In the words of Erixon-Aalto et al. (2018, p.1), "social-ecological knowledge must be better integrated in urban planning and design projects" to promote sustainability, yet this integration has proven challenging. Our contribution is to analyze how everyday green infrastructures, community gardens, perform such integration. Specifically, we examine how these gardens link land management, biodiversity goals, and citizen stewardship. For example, we trace how plantings and soil practices advance urban ecological objectives, while governance structures determine whether these ecological functions are supported or undermined. By situating community gardens within both ecological networks and planning systems, we show how they can serve as plot of care-based urban greening (Paper 1-4). In doing so, we draw on theories of care (Puig de la Bellacasa, 2017) to interpret community gardening as a practice of multi-species solidarity. This goes beyond technocratic greening, it portrays community gardens as negotiated, context-sensitive transformations of urban nature.

These analyses lead to four concrete contributions. Empirically, the thesis provides a comparative analysis of community garden governance in two very different cities (Brussels and Kraków), highlighting post-socialist dynamics and multi-level governance effects. Conceptually, it offers an integrated framework connecting theories of the commons, urban infrastructure, care, and participatory action; in this framework, community gardens are

positioned as natural third places and infrastructures of transition. Methodologically, the work advances participatory urban research by deploying long-term, embedded action-research; it critically reflects on power, temporality, and epistemology in co-creation (moving beyond one-off participatory mapping to sustained engagement). Finally, politically and practically, the thesis shows how community gardens can serve as sites of civic ecological experimentation. It demonstrates how action-research can inform context-sensitive urban transitions, revealing both the potentials and limits of community gardens as transformative infrastructure.

3.2. Research aim

This thesis investigates how community gardens in transitioning cities function as situated socio-ecological infrastructures where nature, governance, and urban life are continuously renegotiated. Accordingly, the main research aim is to examine how community gardens operate as socio-ecological infrastructures in transitional cities, and to identify what governance arrangements, spatial strategies, and everyday practices shape their emergence, sustainability, and inclusivity.The overarching research question is therefore twofold: **How do community gardens operate as socio-ecological infrastructures in cities undergoing transition, and what governance arrangements, spatial strategies, and everyday practices shape their emergence, sustainability, and inclusivity?**

To answer this, we develop four interrelated research questions, each explored in an article (Table 1). The first question asks: How do community gardens function as natural third places, and how do these locally rooted practices (both generative and contested) inform evolving notions of place and socio-ecological transformation in contemporary cities? Drawing on Oldenburg's (1991) concept of third places and recent reinterpretations in urban design, Paper 1, a conceptual contribuation based on structured literature review, investigates informal conviviality, care, experimentation and ecological engagement in community gardens.

The second question is: How can participatory mapping and typology development improve spatial understanding and stakeholder engagement in community gardening, and how do governance frameworks, planning regimes, and heritage discourses affect garden emergence and management? In Paper 2, we use participatory tools including co-created digital maps to engage practitioners. We examine Brussels and Kraków to see how different institutional contexts shape community garden projects (e.g. Brussels' municipal greening plans vs. Kraków's heritage and development policies). We also reflect on how digital and co-creative methods mediate between diverse expectations and concrete constraints.

The third question focuses on resilience: How do short-term, targeted garden actions contribute to long-term resilience, and what factors enable or hinder sustained engagement over time? Paper 3 examines Brussels case studies to trace how ephemeral events (every-day practices, seasonal workshops, rapid interventions) affect a garden's adaptive capacity. We look at seasonal rhythms, volunteer turnover, funding flows, and shifting land tenure as key dynamics. By studying community gardens' adaptive cycles, we show that sustainability often depends on flexibility and the ability to learn from short-term projects.

Finally, the fourth question addresses governance models: How do different governance approaches (bottom-up, top-down, hybrid) influence the inclusivity, ecological adaptability, and sustainability of community gardens in Kraków's post-socialist context? Paper 4 analyzes multiple garden governance cases in Kraków. In post-socialist Kraków, this means considering factors like state support legacies and changing civic activism. For instance, top-down initiatives may provide resources but limit community autonomy, while purely volunteer models may struggle with stability.

Table 1 summarizes these sub-questions alongside the focus of each paper. Together, they form a multi-scalar, empirically grounded inquiry into community gardens as infrastructures of transition. The thesis examines how ecological care, civic agency, spatial co-creation, and governance modes interact, sometimes harmoniously, sometimes in tension, to determine urban nature's place in times of environmental uncertainty and institutional change.

Table 1: Summary of thesis sub-questions and paper focus.

Research Question	Papers	Emprirical Focus
RQ1: How do community gardens function as natural third places, contributing to evolving notions of place and socio-ecological transformation?	**1**	Conceptual framework of community gardens as natural third places
RQ2: How do participatory mapping and typology tools enhance spatial understanding and stakeholder engagement in garden planning?	**2**	Comparative participatory mapping and typology of community gardens in Brussels and Kraków (spatial distribution, governance, functions)
RQ3: How do short-term, targeted actions contribute to the resilience of community gardens, and what factors enable or hinder their long-term sustainability?	**3**	Longitudinal ethnographic of two case studies in Brussels exploring seasonal/social dynamics and adaptive practices
RQ4: How do different governance models influence inclusivity, ecological adaptability, and sustainability of community gardens in Kraków?	**4**	Comparative case study of three Kraków gardens (bottom-up, top-down, hybrid) examining governance outcomes

Source: Own study.

Each question connects to the gaps identified above (Part 3.1). In combination, they provide a coherent framework for analyzing community gardens as living infrastructures: from the role of place-making (Paper 1) to participatory tools and governance contexts (Paper 2), to temporal resilience (Paper 3), and finally to institutional models in a specific political context (Paper 4).

3.3. Positionality and epistemological anchors

The author approached this research from a reflexive, constructivist-interpretivist standpoint. The inquiry emphasizes situated knowledge: understanding urban community gardens through the specific perspectives and experiences of those involved (Haraway, 1988). In this view, objectivity arises from acknowledging one's positionality and the partial, embodied nature of all knowledge rather than from a detached perspective. Consistent with Flyvbjerg's (2006) argument, the study values concrete, context-dependent knowledge over abstract universals: each community garden is analyzed in its socio-cultural context, and insights are built from in-depth case understanding. This interpretivist paradigm (Sandercock, 2003; Simone, 2010; Puig de la Bellacasa, 2017) allows the research to treat community garden practices as co-constructed realities. It privileges learning from garden users' own meanings and relations (Kindon et al., 2007; Cahill, 2007) rather than imposing external benchmarks. In this sense, the study is aligned with the ethos of relational comparative urbanism*:* cities (and community gardens) are seen as linked through wider flows, and urban diversity is examined through each case's "everyday projects" (Simone, 2010).

Importantly, the researcher's own position and language skills shaped the process. The author is fluent in English and French (facilitating fieldwork in Brussels) but does not speak Polish. During Kraków fieldwork, the author relied on bilingual collaborators for informal translation and cultural interpretation, ensuring that Polish-speaking participants could fully engage. Institutional embeddedness aided this work: through formal affiliations (for example, joint appointments or partnerships with local universities and NGOs in Brussels and Kraków), the author gained community trust, logistical support, and exposure to local norms. In practice this meant co-attending meetings with Polish colleagues, using English or French in encounter with international staff, and sometimes employing digital translators for community garden interviews. These strategies acknowledged cultural differences while keeping participants central to knowledge production.

Reflexivity was practiced continuously. The author maintained a detailed field journal (recording observations, personal impressions, and methodological decisions) and held regular

debriefing sessions with supervisors and collaborators in both countries. These discussions foregrounded power relations and researcher bias, echoing participatory action research principles that research creates "spaces for reflexivity" about the researcher's own positionality (Kindon et al., 2007). For example, early drafts of interview questions and workshop activities were reviewed with local partners to check for cultural assumptions. In line with Cahill (2007) and Kindon et al. (2007), the author treated knowledge as co-produced: participants and local co-researchers were invited to critique findings and even reshape analytical categories. In all these practices, reflexivity functioned as an ongoing dialogue between the researcher's interpretations and participants' perspectives.

3.4. Comparative rationale and case selection: Brussels and Kraków

This study uses a relational comparative urbanism framework (Ward, 2009; Robinson, 2010) to examine community gardens (Paper 1-4). In this view, cities are not compared as isolated "units" with one trump city, but rather in terms of the relations and flows connecting them (Robinson, 2010). The analysis was never about pitting Brussels against Kraków, but about learning from difference: how do community gardens evolve within two distinct European contexts? As Ward (2009) emphasizes, a relational-comparative approach "recognize[s] both the territorial and the relational histories and geographies" of cities. Brussels and Kraków were not pre-selected as an "obvious pair" or because one is superior; instead, they emerged through research networks and practical opportunities, offering complementary insights (e.g. an EU capital city versus a post-socialist regional city). Neither serves as a normative benchmark. Rather, following Robinson (2006, 2010), they are treated as "ordinary cities" each with lessons to offer the other, as when comparing institutional support for urban agriculture or participatory governance across different settings.

Fieldwork included five community gardens in total (Table 2). In Kraków the focus was on three sites: JU Campus Garden, Pychogród, and Salwator (Figure 1) and in Brussels on two: Gray-Moineaux and Fruits-Dupuis (Figure 2). These cases were identified through partner networks. For example, the author collaborated with a Brussels urban agriculture NGO that connected to Gray-Moineaux and Fruits-Dupuis, and with Kraków researchers who introduced the other sites. Each garden was chosen for its particular community dynamics and institutional setting, rather than to rank Brussels vs. Kraków. Together, they illustrate how gardeners in different regulatory, cultural, and political contexts co-create space (Table 2). This mixed selection facilitates inter-contextual comparison: by analyzing similar phenomena (community

gardening) in two distinct European urban milieus, the study can highlight broader patterns without assuming one city as the standard (Ward, 2009; Robinson, 2010).

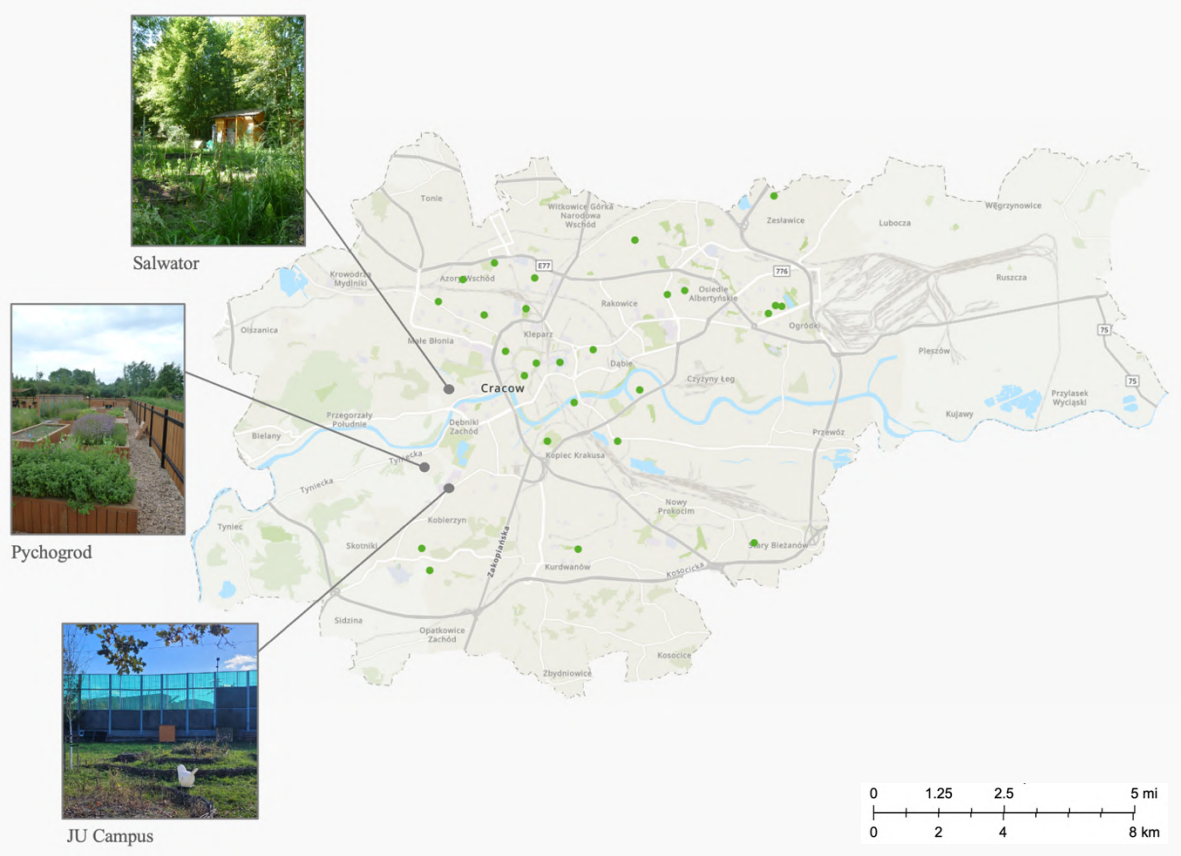

Figure 1: Case studies (JU Campus Garden, Pychogród, and Salwator) selected in Kraków (Paper 4). Source : own study.

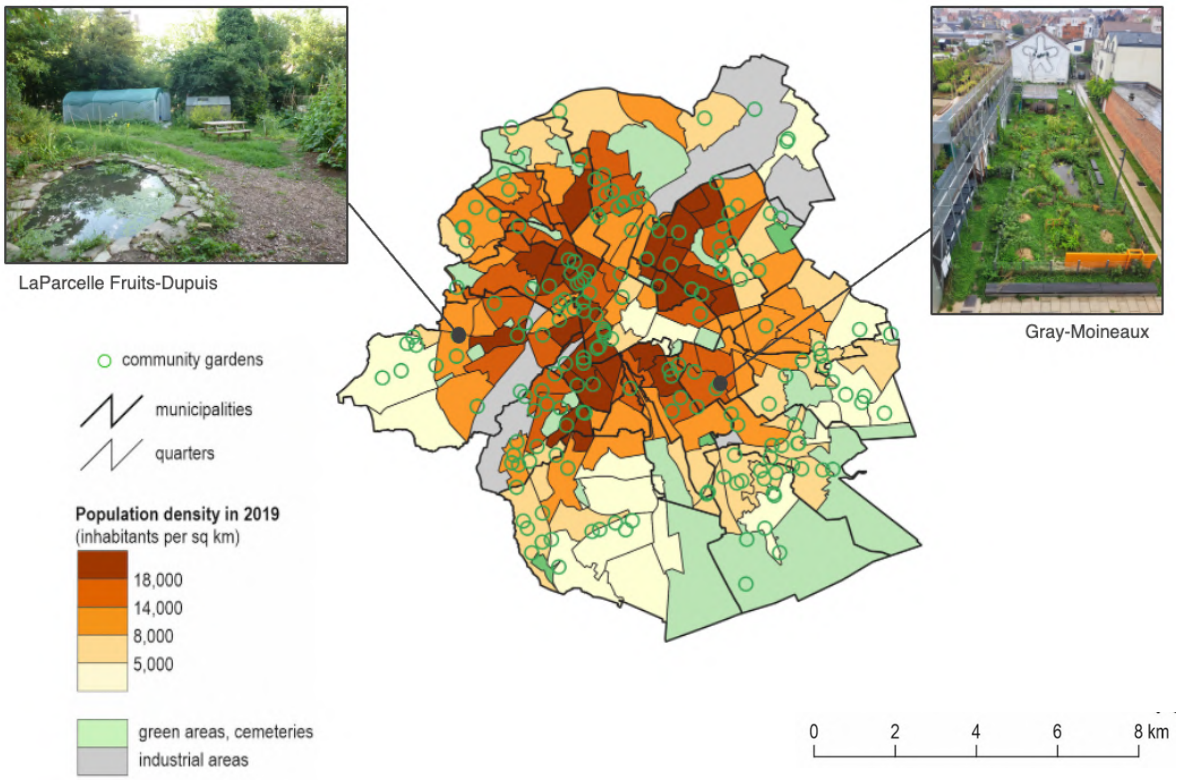

Figure 2: Case studies (Gray-Moineaux and Fruits-Dupuis) selected in Brussels (Paper 3).

Source : own study.

Within each city, the author's institutional affiliations and embedded collaborations proved enabling. For instance, presenting preliminary findings in Kraków at a workshop hosted by JU helped garner participant feedback and recruit volunteers. Similarly, connections in Brussels allowed interviews with city officials and attendance at multi-stakeholder meetings. Overall, the author's dual connectivity (academic and activist networks in both countries) helped navigate cultural differences and situate the research within each city's discourse, all while maintaining an explicitly comparative lens. Finally, this comparative project aligns with a relational urbanism outlook by placing cities and community gardens as nodes in wider networks. In practice, this meant avoiding any imposition of a single "best practice" standard. The result is a comparative analysis sensitive to scale and difference, offering insight into how each city's approach to urban gardening emerges from its unique and connected urban fabric (Ward, 2009; Robinson, 2010; Simone, 2010).

Table 2: Comparative overview of Brussels and Kraków in relation to community gardens (information collected across Papers 1-4).

Dimension	Brussels	Kraków
Governance structure	Multiscalar governance (regional and municipal authorities, active civil society, and grassroots initiatives).	Historically centralized governance (socialist legacy); hybrid public-community models now emerging in specific contexts.
Planning legacies	Decentralized planning with layered responsibilities across regional and municipal levels.	Centralized planning legacy from the socialist era; planning still largely top-down, with gradual decentralization reforms.
Civic engagement	Established associative life, multicultural activism, and a strong NGO sector facilitating participation.	Developing civic networks and participatory culture, still consolidating after decades of limited civil society under socialism.
Policy framing of community gardens	Frequently mobilized as tools for social cohesion, environmental education, and participatory innovation.	Slowly gaining visibility and policy integration; mentioned in sustainability and climate strategies but still peripheral.
Institutional support	Access to regional and municipal funding (e.g., Inspirons le Quartier grants), participatory planning tools, and NGO facilitation.	Limited formal support (no dedicated municipal program until recently); targeted support in specific cases (e.g., Pychogród pilot project, JU campus garden collaborations).
Field sites studied	Gray-Moineaux (Ixelles) and Fruits-Dupuis (Anderlecht): resident-initiated, later supported by institutions.	JU Campus Garden (co-designed with students, staff, residents), Pychogród (municipality-supported pilot), Salwator (grassroots initiative).

Source : own study.

4. Methodology

This fourth part details the methodological architecture of the thesis. It explains how different research strategies were mobilized to investigate community gardens as socio-ecological infrastructures and commons across Brussels and Kraków. The section outlines the overall epistemological stance and the rationale for adopting an interpretive, mixed-methods approach, before describing the specific methods used in each of the four articles. It also reflects on issues of integration, reflexivity, and positionality, clarifying how the research design balanced breadth and depth, and how methodological choices were guided by both theoretical commitments and practical constraints. In doing so, this part establishes the coherence and rigor of the empirical inquiry that underpins the thesis's analytical and conceptual contributions.

4.1. Methodological overview

The research unfolds through four linked articles, each using methods appropriate to its questions while collectively reflecting an interpretive, pragmatic design. Across the thesis, an interpretive mixed-methods stance was adopted. This means qualitative and quantitative tools were combined to generate rich, contextualized insights (Creswell, 2014; Bryman, 2016). The overall epistemology is grounded in relational comparative urbanism (Robinson, 2010) (Part 3.4): by studying Brussels and Kraków side by side, the research recognizes that each context is unique yet connected to broader socio-political and ecological transformations. A pragmatic ethos guided method choice (Morgan, 2016): methods were chosen for what they could reveal, and not to fit a single paradigm. At the same time, participatory and co-creative principles ran through the design (Greenwood & Levin, 2007); for example, community members helped to map gardens and co-design workshops shaped a community garden's plans (Paper 2). The research was therefore both analytical and action-oriented: it sought to understand community gardens while also engaging with their practices and governance in real time.

In total, approximately 215 community gardens were identified across both cities, around 198 in Brussels (monitored until December 2023) and 17 in Kraków (monitored until February 2024), through desk research, NGO databases, and participatory mapping (Paper 2). From this wider inventory, five gardens were selected for in-depth study: Gray-Moineaux and Fruits-Dupuis in Brussels, and Salwator, Pychogród, and the JU Campus Garden in Kraków. These cases were purposefully chosen to represent distinct governance types (grassroots, municipal, and hybrid) or socio-demographic disparties and to enable cross-contextual comparison of participatory and ecological dynamics.

Fieldwork was conducted between 2021 and 2024, following an iterative structure that moved from conceptual framing to comparative mapping and, finally, to embedded ethnographic case studies. Specifically:

1. 2021-2022: desk research, literature review, and conceptual framing (Paper 1);
2. 2022-2024: participatory mapping, online survey, and interviews for the comparative typology (Paper 2);
3. 2022-2024: longitudinal ethnographic fieldwork, go-along interviews, and co-design workshops for the Brussels and Kraków case studies (Papers 3-4).

Across all field sites, 67 semi-structured and go-along interviews were conducted. In Brussels (Paper 3), 42 interviews were carried out with gardeners, local residents, NGOs, and municipal representatives. In Kraków (Paper 4), 25 interviews were conducted with gardeners,

ZZM officials, neighborhood representatives, and university staff involved in the JU Campus Garden. These interview numbers vary between articles because of differing site characteristics and methodological objectives: Paper 3 focused on in-depth temporal ethnography, while Paper 4 employed a multi-site comparative approach complemented by co-design workshops and action-research sessions.

In chronological terms, data analysis and writing proceeded in parallel with the fieldwork phases (2021-2024). Data from the initial desk research and literature review (2021-2022) were analyzed in late 2022 and formed the basis of Paper 1, with its manuscript drafted by early 2023. Likewise, the participatory mapping and survey data collected in 2022-2024 were processed through early 2024 to construct the comparative typology in Paper 2. Concurrent ethnographic fieldwork (2022-2024) yielded qualitative data for Papers 3 and 4: insights from the Brussels sites were systematically coded throughout 2023, allowing Paper 3 to be drafted by mid-2024, while findings from the Kraków gardens were analyzed in 2023-2024, enabling Paper 4 to be drafted by beginning 2025. These timelines illustrate how analysis and writing for each article were sequenced to build on earlier findings.

In practice, the four articles proceeded roughly in sequence: Paper 1 establishes a conceptual framework, Paper 2 develops a comparative typology, and Papers 3 and 4 delve into in-depth case studies. Table 3 summarizes each article's focus and methodological tools. These papers were built on one another, with insights from earlier phases guiding later fieldwork.

Table 3. Empirical focus and methodological tools for each article of the thesis.

Article	Empirical focus	Methods
1	Conceptual framework for "natural third places" (community gardens as socio-ecological gathering spaces).	Structured literature review of academic and policy sources (thematic synthesis).
2	Spatial distribution, governance and functions of community gardens in Brussels and Kraków. Development of a comparative typology.	Iterative mixed-methods: desk research to compile community garden inventory (~215 sites); stakeholder surveys (quantitative profiles); digital participatory mapping (e-mapping platform Umap) to validate locations; field observation to verify sites; and semi-structured interviews to add qualitative depth (n=15). Data from these methods were triangulated for accuracy (Bryman, 2016; Creswell, 2014).
3	Longitudinal ethnographic case study of two community gardens in Brussels, focusing on seasonal and social dynamics (temporalities of the commons).	Longitudinal ethnography (2022-2024): repeated site visits across weeks, participant observation, and visual documentation (photography, mapping). In-depth interviews included both go-along interviews (n = 42) (Kusenbach, 2003), and semi-structured interviews on their experiences. Qualitative data were coded thematically (Braun & Clarke, 2006) to reveal everyday practices and changes over time.
4	Comparative case study of three Kraków community gardens, each exemplifying different governance: grassroots bottom-up, municipal top-down, and a hybrid co-created project.	Comparative qualitative case study (2022-2024) (Gerring, 2007). Each site was studied via extended ethnographic observation (daily routines, communal meetings), supplemented by semi-structured and go-along interviews with gardeners, officials, and residents (n = 25). The hybrid (university) garden also featured co-design workshops with stakeholders (Sanders & Stappers, 2008) and participatory action research activities (Greenwood & Levin, 2007) to iteratively shape the project. Visual documentation (plans, photos) and reflexive field notes captured socio-ecological interactions. Data from interviews and observation were analyzed interpretively (Braun & Clarke, 2006) to compare inclusivity and ecological practices under each governance model.

Source : own study.

4.2. Methodological integration and reflexivity

Across these articles, triangulation and reflexivity were key. Multiple methods were explicitly combined within and across papers to strengthen validity (Creswell, 2014). For example, in Paper 2 the initial community garden inventory was cross-checked through e-participatory mapping, surveys and follow-up interviews. Surveys provided quantitative summaries of garden size, governance, and users, but these were complemented by field visits and interviews that resolved ambiguities (Bryman, 2016). In the case studies (Papers 3-4), interview narratives were cross-validated against observations and visual records. In short,

where one method provided only a partial perspective or raised interpretive questions, another could fill the gap or offer clarification, a practice aligned with case-study rigor (Merriam & Tisdell, 2016).

Methodological transparency was maintained by careful documentation. Detailed field notes and transcripts were stored, and decisions (e.g. themes coding, case comparison) were logged. In each article, the research design is explicitly linked to epistemology. For instance, the case studies follow Merriam & Tisdell's (2016) guidelines for qualitative case research, emphasizing context-rich description and meaning-making. Throughout the fieldwork the researcher kept a reflexive diary, used to record observations, emotional responses, and methodological decisions. Positionality was explicitly considered: the researcher's multilingual background (English and French fluency, limited Polish) required collaboration with bilingual facilitators in Kraków to ensure full participant inclusion. The author's dual embeddedness in academic and community networks (e.g. NGOs in Brussels, the JU Campus Garden collective in Kraków) enabled access but also required continuous reflection on power dynamics and potential bias. These reflexive practices echo qualitative good practice (Lincoln & Guba, 1985), ensuring that interpretations remained grounded in participants' perspectives.

The sequencing of studies followed a coherent logic. We began with a broad conceptual exploration (Paper 1), identifying key concepts that would frame all empirical work. Next, Paper 2 conducted a comparative survey and mapping in both cities, which guided site selection for in-depth research. Building on this, papers 3 and 4 engaged in immersive fieldwork at specific community gardens. This progression, from conceptualization to mapping to case studies, mirrors an iterative "zooming in" approach often recommended in mixed-methods planning (Creswell, 2014). At each step, emerging findings informed the next phase (e.g., typologies from Paper 2 suggested which types of community gardens to study ethnographically). Together, this design resembles the "patchwork ethnography" approach (Watanabe et al., 2020), where episodic field engagements across sites are woven into a larger comparative narrative. Differences in sample size or methods between the Brussels and Kraków studies reflect intentional adaptation to context rather than inconsistency, depth in one city complemented breadth in the other. And finally, we openly acknowledge limitations and measures to address them (Chapter 3, Part 1.) By combining multiple lenses (quantitative counts, qualitative stories, and participatory inputs), the overall thesis presents a triangulated, contextualized understanding of community gardens (Ernstson, 2013).

5. Interconnection between papers

This thesis (2021-2025) adopts an interpretivist, pragmatist approach (Creswell, 2014; Merriam & Tisdell, 2016) and a relational-comparative urbanism framework. Brussels and Kraków are viewed as interconnected contexts offering complementary insights into community gardening. Chapter 2 thus comprises four sequential and interlinked articles. Each paper builds on the previous one: first developing conceptual framework, then gathering empirical data, then delving into in-depth case studies, and finally integrating all findings across both cities.

The first article is conceptual. It uses a structured literature review to formalize community gardens as "natural third places" that blend green infrastructure with informal social gathering. By analyzing academic and policy sources, Paper 1 identifies core themes of place-making, care work, experiment and shows that community gardens function as affective, inclusive spaces (Oldenburg, 1991; Dolley, 2019). This theoretical framing establishes a vocabulary of socio-ecological infrastructure that guides the empirical studies.

The second article implements a mixed-methods, participatory comparison in both cities. Using e-participatory mapping alongside surveys and interviews, it develops a typology of Brussels and Kraków community gardens based on their emergence (grassroots vs. institutional), governance model, spatial context, and functions. Importantly, gardeners in each city co-designed the mapping exercise, which ensured that local knowledge informed the data. The resulting typology reveals, for instance, that Brussels tends to have bottom-up, community-led gardens, whereas Kraków more often involves hybrid institutional support. In effect, Paper 2 tests the concepts from Paper 1 against real-world data, producing a comparative snapshot that informs the case studies to follow.

The third and fourth articles are qualitative case studies that explore temporal and governance dimensions, respectively. Paper 3 (Brussels) examines two community gardens through ethnographic observation and semi-structured and go-along interviews. It traces how short-term, seasonal activities (workshops, planting events) accumulate into long-term resilience of the garden commons. The analysis uses thematic coding (Braun & Clarke, 2006; Merriam & Tisdell, 2016) to identify patterns in how everyday community practices and environmental stewardship sustain the community gardens' adaptive capacity. Paper 4 (Kraków) examines three community gardens exemplifying different governance models (bottom-up, top-down, and hybrid). It employs ethnography, go-along interviews, co-design workshops, and action-research methods to investigate how institutional arrangements affect

inclusivity, care practices, and ecological outcomes. For example, one case (the JU Campus garden) was co-created by students, faculty, the municipal green agency, and residents, yielding a hybrid governance model. Both case studies interpret participants' experiences to understand the socio-political conditions of community gardening in each city.

Finally, a comparative integration and triangulation step synthesizes all findings. By juxtaposing results across papers and contexts, the thesis highlights commonalities (e.g. community gardens as sites of care and resilience) and differences (e.g. policy support levels) without assuming either city is normative. In practice, this means revisiting the typology and case-study data to see how the conceptual themes of Paper 1 and the patterns from Paper 2 resonate or diverge in each setting. This cumulation is facilitated by the mixed-methods, co-creative design (Creswell, 2014) of the research: the participatory tools used in Paper 2 and Paper 4 fostered reflexive comparison, and the interpretive coding in Papers 3-4 was guided by the earlier theoretical insights.

Overall, the thesis architecture (Figure 3) is both sequential and cumulative. Each stage informs the next: the conceptual framework of Paper 1 sets up the categories used in Paper 2's comparative mapping; Paper 2 then directs attention to particular dynamics (spatial distribution, governance types) that become the focus of Papers 3 and 4; and finally, all insights are woven together in Chapter 3. This progression, along with an embedded comparative case strategy, ensures that multiple methods and epistemologies work together.

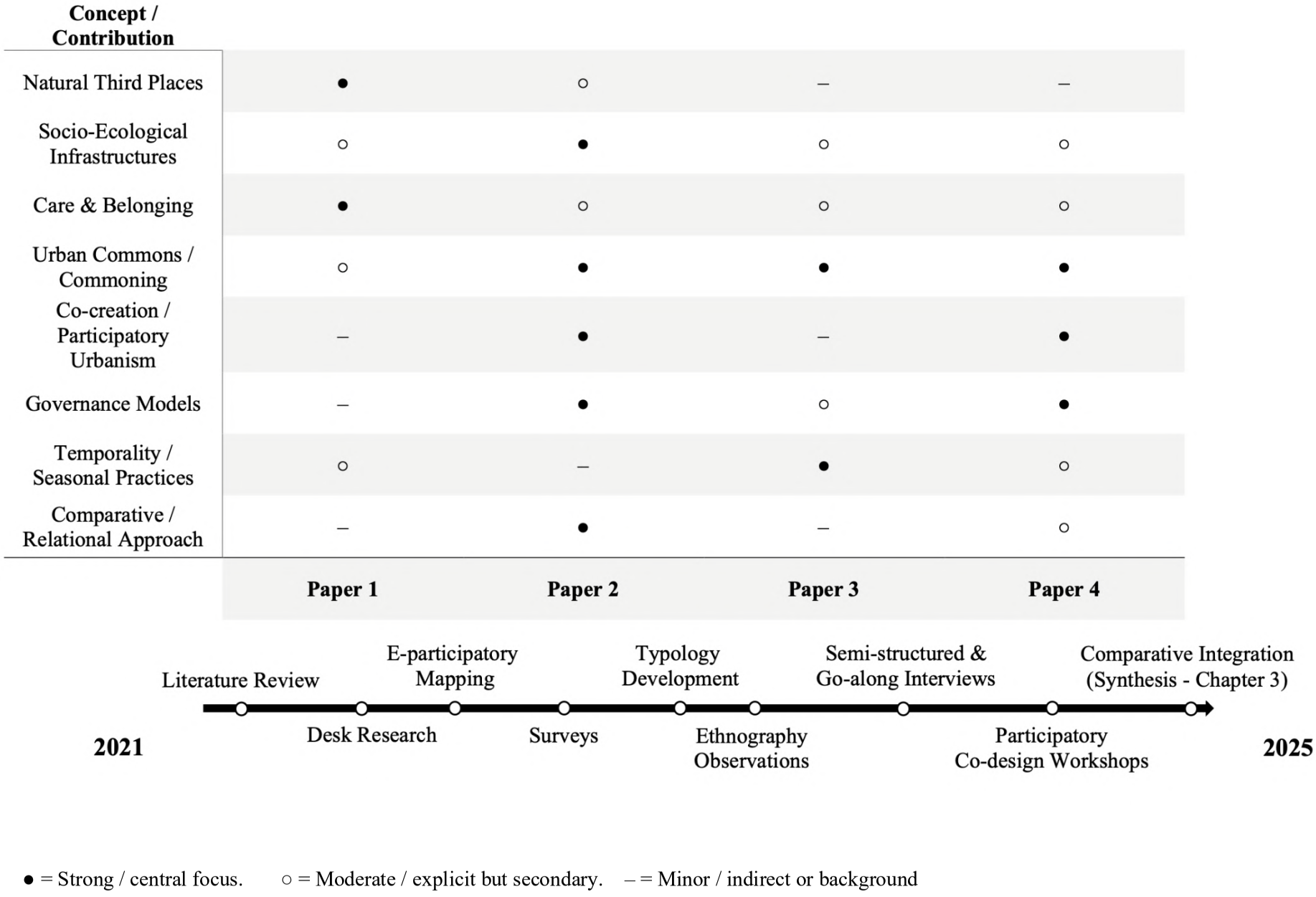

Figure 3: Integrated overview of thesis architecture (information collected across Papers 1-4). Source: own study.

Chapter II: The four research papers

1. Paper 1: Community gardens as natural third places: A conceptual framework

Status: Contemporary Social Science, Accepted for publication.

This paper proposes a new conceptual lens by formalizing natural third places, spaces where social interaction and ecological functions intersect, using community gardens as a primary example. It argues that while traditional third-place theory emphasizes sociability and civic exchange, it has largely overlooked ecological dynamics. Through a structured literature review of academic studies, policy documents, and case examples, the article synthesizes insights from place-making, commons theory, and urban ecology. Methodologically, it employs a systematic literature-based approach to build an analytical framework.

The main contribution is conceptual: it defines natural third places and positions community gardens at this intersection of social and environmental domains. By doing so, it enriches debates on urban place-making and socio-ecological transitions, showing how community gardens foster social cohesion, environmental awareness, and innovative civic practices. Within the dissertation on community garden as socio-ecological infrastructures and urban commons, this article provides the theoretical underpinning that frames community gardens not only as green spaces, but as hybrid social-ecological hubs. It lays a conceptual foundation for viewing gardens as natural third places, thereby connecting the social-network role of community gardens to their environmental and commons dimensions.

2. Paper 2: E-participatory mapping and typology development: Community gardens in Kraków and Brussels

Status: Planning Practice & Research, Published.

The second article reports a comparative empirical study of community gardens in a post-socialist city (Kraków) and a Western European city (Brussels). It examines how community gardens emerge, are governed, and perform socio-ecological functions in these contrasting contexts.

The study uses a multi-method, participatory approach: it integrates digital participatory mapping, surveys, and qualitative interviews. This methodology improves spatial accuracy (resolving discrepancies between official records and on-the-ground realities) by engaging local stakeholders in data collection.

The author develops a community garden typology with four dimensions (emergence reason, governance model, spatial setting, and function) that captures the diversity of community gardens initiatives. Key empirical findings are that Brussels's gardens tend to be bottom-up and cluster in denser, lower-income neighborhoods, whereas Kraków's are more often hybrid projects supported by municipal agencies.

Conceptually, the article contributes a novel framework for understanding community gardens across socio-political contexts and demonstrates the value of e-participatory mapping for inclusive planning. In the dissertation's broader framework, this work grounds the discussion of community gardens in concrete case studies: it shows how governance legacies and local contexts shape these urban commons, and how community knowledge can inform resilient urban planning. It thus links the theoretical ideas of the thesis with comparative empirical evidence, highlighting context-specific adaptations of socio-ecological infrastructures.

3. Paper 3: Temporalities of urban commons: Case study of community gardens

Status: Local Environment, submitted.

The third article explores time as a critical dimension of community gardens conceived as urban commons. Focusing on two Brussels community gardens, it asks how short-term, participatory activities accumulate into longer-term resilience. The study adopts a qualitative case-study design, combining ethnography, semi-structured interviews, seasonal observations and spatial mapping. By tracking planting sessions, workshops, and temporary installations across seasons, the research reveals how community gardens co-produce sustainability through adaptive use of time.

The findings highlight tensions between grassroots initiative and institutional support, as well as the importance of intergenerational renewal for community garden continuity. Crucially, the study reframes community gardens as "dynamic, evolving commons" embedded in shifting urban landscapes. Conceptually, it contributes a temporal perspective to urban commons theory: community gardens are shown to be living systems whose resilience depends on an interplay of short-term events and long-term commitments.

This advances the thesis by emphasizing that community gardens function as socio-ecological infrastructures in space and over time, serving as experimental labs of urban resilience where communities and policies interact iteratively. The article thus situates the community gardens' evolution within broader processes of adaptation and governance, reinforcing their role as commons that must be understood in temporal cycles.

4. Paper 4: Governance models and the socio-ecological role of community gardens in post-socialist Kraków

Status: Planning Practice and Research, Published, Open access.

Téoule, F. (2025). Governance models and the socio-ecological role of community gardens in post-socialist Krakow. *Regional Science Policy & Practice, 17*(10), 100243. https://doi.org/10.1016/j.rspp.2025.100243

The fourth article presents a comparative analysis of three Kraków community gardens under different governance regimes (bottom-up, top-down, hybrid). It examines how these models influence inclusivity, ecological adaptability and long-term sustainability of the community gardens. The research employs a qualitative case-study design: ethnographic observation, semi-structured and go-along interviews, participatory workshops, and action-research activities. The goal was to understand how decision-making structures mediate community dynamics and environmental practices.

One key finding is that governance models are key determinants of the community gardens transformative potential as socio-ecological infrastructures. For example, the bottom-up community garden fostered strong community learning but struggled with volunteer turnover, while the top-down community garden secured resources yet suffered from limited local ownership. The hybrid model combined strengths of both, illustrating the role of collaborative governance.

By analyzing these cases in Kraków's post-socialist context, the article contributes to understanding how legacy of centralized planning and trust deficits affect urban commons. It underscores that effective, context-sensitive governance is crucial for community gardens to fulfil their promise of socio-ecological transformation. In the dissertation's broader framework, this piece ties together themes of governance and commons: it shows how community gardens function as coupled social-ecological systems in the city, and how adaptive, participatory governance can anchor them as lasting urban commons and green infrastructure.

Chapter III: General discussion and conclusion

1. Cross-cutting findings and synthesis

This study portrays community gardens as relational urban commons, collectively managed green spaces that enable communal cultivation, ecological care, and social exchange. They function as socio-ecological infrastructures, bridging ecological processes and social practices. This framing clarifies: What community gardens are (collaborative sites of socio-ecological interaction) and how they operate (as hybrid infrastructures of urban sustainability). The research questions were designed to explore these dimensions, providing a clear link between the identified gaps and our findings. In synthesis, the empirical results are interpreted in light of this definition: we examine how community gardens (as defined) serve as infrastructural nodes in transitioning cities and how governance arrangements, spatial contexts, and everyday practices shape their functioning. In both Brussels and Kraków, community gardens supply tangible ecosystem services (habitat, soil health, microclimate regulation) alongside social goods (environmental education, community cohesion, care). They function as intentional urban commons: shared green resources managed collectively by residents (via volunteering, rule-setting and shared labor). In effect, community gardens are socio-ecological commons, sites where ecological processes and social relations are deeply intertwined and co-managed. These infrastructures bridge past and future urban imaginaries: for example, Kraków's post-socialist planning legacy creates a "transitional environment" where new community gardens negotiate shifting notions of public space, while Brussels' 2016 Good Food Strategy formalizes community gardens into the city-region's adaptive infrastructure (targeting 30% local vegetable production by 2035).

Community gardens also serve as natural third places in the city. Drawing on Oldenburg's concept (1991), third places are neutral, accessible gathering spots for informal socializing. Our analysis shows community gardens extend this idea into urban nature. Gardeners describe them as "places to be" for friendship, respite and belonging. By hosting storytelling, seasonal practices and shared harvests, community gardens synchronize people with Lefebvre's notion (2004) of urban "rhythmanalysis". These practices manifest commoning: collaborative processes of negotiating, caring for, and jointly maintaining shared space. As one Brussels gardener noted, managing the plot was about "*building community*" (LaParcelle Fruits-Dupuis). Neighborhood volunteers together constructed beds, shared tools

and harvests, and set planting rules. In both cities our cases thus instantiate Harvey's (2012) right to the city: community gardens enable residents to claim a voice in shaping public space.

A key insight is the importance of temporality in community garden sustainability. Community gardens operate on multiple time scales, so aligning short-term actions with long-term rhythms is crucial. Drawing on Crang et al. (2001) and Edensor (2010), our data show that everyday routines and seasonal cycles structure community garden life: short-lived events (workshops, pop-up plantings, festivals) build trust and social capital that support long-term continuity. For example, Brussels community gardens host annual planting festivals and youth programs that layer experience and visibility over time. This points to a form of temporal governance: planners and communities coordinating actions across ecological seasons and civic calendars. In Brussels, comparing an older garden (Gray-Moineaux, est. 2007) and a newer one (Fruits-Dupuis, est. 2021) highlighted how evolving management practices affect resilience. In Kraków, a bottom-up garden (Salwator) struggled with funding while a top-down one (Pychogród) felt rigid; a hybrid university campus community garden combined stable resources with community autonomy. Thus, mixing temporal scales of support (e.g. academic semesters, municipal budgeting cycles) appears to produce both stability and innovation.

Across sites, collaborative governance was critical. Consistent with Ansell and Gash's framework (2008), diverse actor networks (residents, NGOs, municipal agencies, universities) balanced flexibility and stability. In Kraków, the municipal Green Board (ZZM) formally coordinates some community gardens (Paper 4): it provides land, tools and water in exchange for official agreements, securing resources but introducing bureaucracy. An official noted that community gardens let the city "*improve green space and get citizens to manage it, for free*" (ZZM). In Brussels, by contrast, most community gardens grew from civil society with city oversight, such as regional policies like the Good Food Strategy that offers direct support. In both contexts, participatory processes (co-design workshops, mapping) lent community gardens local legitimacy and shared ownership. However, formal backing can dilute volunteer agency unless carefully managed (Eizenberg, 2012). Bridging grassroots groups and institutions thus requires trust-building and clear rules, as found in our data.

The synthesis also highlights risks of co-optation and gentrification. Urban greening projects in transitioning neighborhoods may inadvertently raise property values and exclude low-income residents (Checker, 2011; Anguelovski et al., 2018). In one Brussels case near a redevelopment project, gardeners feared real-estate interest. In Kraków, planners eyed a successful community garden as a model for upscale districts. These align with "green gentrification" ideas (Checker, 2011; Anguelovski et al., 2018). To counter this, community

gardens should explicitly incorporate equity goals (reserving plots for disadvantaged groups or partnering with affordable-housing advocates). Integrating social justice aims is needed to prevent gardens from reinforcing existing inequalities.

Finally, the local policy context influences community gardens' roles. Brussels has explicitly integrated urban gardening into planning: the Good Food Strategy (2016) sets ambitious local food targets, reflecting a "city-region food systems" approach. In Kraków, the city's green-space plan (ZZM, 2022) formally recognizes community gardens as part of sustainable urban management. These government programs illustrate two styles: Brussels tends to enable community gardens through grants and education, whereas Kraków structures them via formal agreements and oversight. Both are policy responses to each city's transition challenges (climate change, social fragmentation, post-industrial shifts) and position community gardens as infrastructures of urban transition.

Overall, the cross-paper synthesis shows that community gardens are socio-ecological commons requiring context-sensitive, collaborative governance. They operate as natural third places and living commons, embedding care and community into city life. They span temporal scales (from seasonal rituals to decades-long networks) and thus demand governance attentive to timing. Crucially, each theoretical lens (third place, commoning, socio-ecological infrastructure, temporal governance) is evidenced by our cases. By linking empirical patterns from Brussels and Kraków with these concepts, we provide an integrated account of how community gardens can catalyse socio-ecological transformation in transitioning cities.

2. Methodological reflections and limitations

This study employed a mixed-method, iterative design to answer its interdisciplinary questions. The four articles used complementary methods (conceptual synthesis; e-participatory mapping and survey; ethnography; comparative case study) that reinforced one another. Combining qualitative and quantitative data across scales enhanced validity through triangulation. For example, city-wide participatory mapping (Paper 2) yielded quantitative-spatial insights on 200+ community gardens, while ethnographic case studies (Papers 3-4) provided in-depth context on everyday practices and governance. Findings from one strand informed the others: a pattern of bottom-up governance in Brussels seen in the survey was explained through case interviews, and novel ethnographic themes (e.g. intergenerational knowledge transfer) helped interpret the mapping data. This iterative interplay of methods provided both breadth and depth in understanding the community gardens.

However, each method had known biases. The e-participatory mapping improved engagement and data accuracy, but introduced a digital divide: participants with internet access and mapping literacy were over-represented. Community gardens with well-networked members were more likely to appear on the map, while others remained underrepresented. We mitigated this through field visits and interviews, but some coverage gaps likely remain. Similarly, the volunteer survey risked self-selection bias: highly engaged gardeners tended to respond more. As Fowler (2013) notes, such samples often reflect motivated subgroups rather than the broader population. Indeed, survey respondents in Kraków were mainly leaders, and overall response rates were modest. We therefore treated survey results as indicative trends guiding qualitative follow-up, not as statistically representative estimates. These methodological limitations are acknowledged in interpreting the findings.

Language and positionality also posed challenges (Chapter 1, Part 3.3). Research spanned Polish, French/Dutch and English contexts, requiring careful translation and cultural sensitivity. We followed best practices for cross-language qualitative research (Squires, 2009) by triangulating translations with native speakers. Positional reflexivity was built into the design (Finlay, 2002): as a Western European researcher working in a post-socialist city, the author remained aware of outsider bias. Prolonged field engagement, collaborative workshops and guidance from local experts (co-supervisors and community stakeholders) helped counterbalance potential misinterpretations and power asymmetries.

The comparative case approach brought both insights and limits. Studying five community gardens across two different cities allowed us to draw contrasts in governance and temporal dynamics. Yet case studies yield analytical rather than statistical generalizations. The findings are transferable to similar transitional contexts (e.g. other post-socialist or rapidly changing European cities) but not universally prescriptive. Other community gardens in Brussels or Kraków might operate differently. Moreover, while the Brussels ethnography spanned an active season and the Kraków study engaged stakeholders in real-time co-design, the overall timeframe of the research was limited to the period possible within the PhD research (2021-2025). Claims about long-term resilience depend on triangulating historical data (founding dates, records) and participant recollections, rather than actual multi-decade observation. As Yin (2014) notes, longitudinal studies would be needed to substantiate resilience trajectories over time.

Integrating the four articles into a coherent thesis also required methodological coherence. Each paper had its own focus, so we harmonized terminology and cross-referenced findings through iterative coding. Concepts that emerged in one study (e.g. socio-ecological

infrastructure, natural third place, temporality of commoning) were compared and consolidated across cases. This process resembles a thematic synthesis across multiple case studies (Thomas & Harden, 2008). Ensuring consistent framing prevented siloing of results and strengthened the overall narrative. In effect, the synthesis phase treated the collective papers as interconnected parts of a mixed-methods whole.

Finally, the action-research elements in the Kraków co-design (Paper 4) introduced both opportunities and caveats. Engaging community garden stakeholders in participatory design deepened insight and directly produced community benefits, consistent with co-production principles (Hirsch et al., 2000; Reason & Bradbury, 2001). However, action research blurs the line between observer and participant. Researcher involvement (facilitating workshops and co-implementing ideas) means the study shaped the process as well as observed it. This dual role reduces detachment (Brydon-Miller et al., 2003). We explicitly acknowledge this in our reflexivity: the knowledge generated is partial, situated and co-created with participants. Such transparency does not undermine validity; instead, it situates the findings as grounded in real-world practice, in line with the epistemologies of participatory research (Lincoln & Guba, 1985; Haraway, 1988).

Overall, rigorous triangulation and reflexive practice underpinned this research. Throughout, an iterative, reflexive orientation (Reason & Bradbury, 2001; Finlay, 2002) guided the work, ensuring transparency and scholarly rigor in the complex task of examining community gardens as socio-ecological phenomena.

3. Policy and practice implications

Our findings suggest that community gardens should be strategically recognized within urban planning and governance frameworks, yet supported with context-sensitive flexibility. They should be framed not as fixed planning instruments but as evolving commons, supported by eneabling policies rather than rigid regulation. In doing so, cities can combine the stability of institutional support with the creativity of grassroots innovation. Drawing on the four articles, we offer concrete recommendations for urban policy and practice. All recommendations follow directly from the thesis findings and are supported by the suggested literature.

The findings indicate that community gardens need to be treated as a legitimate component of urban land-use strategy, though not all should be formalized. Rather than emerging ad hoc, community gardens should be mapped and supported as key elements of socio-ecological infrastructure, while still leaving room for spontaneous or experimental

initiatives that emerge organically from residents. For example, Codato et al. (2024) argue that community gardens should be included within urban planning to achieve broader sustainability goals. Our mapping (Paper 2) likewise showed spatial clustering in under-served neighborhoods, implying inequitable access. To correct this, planners can use participatory GIS and multi-criteria site-selection (Codato et al., 2024) to identify community garden locations that maximize social and ecological benefits. Likewise, Bieri et al. (2024) note growing demand (e.g. during COVID-19) and call for including gardens in sustainable urban planning so that open space is used for well-being and resilience. Thus, local governments should formally recognize community gardens in zoning and masters plans, while also preserving informal, bottom-up spaces that operate outside official programs. Using tools like participatory mapping and spatial analysis (Paper 2) can help prioritize sites in high-need areas. Spatial-optimization models should be applied to avoid clustering and to distribute gardens fairly (Huq & Deacon, 2025). In practice, this means balancing planned and spontaneous communty gardens within green infrastructure networks, ensuring that policies do not suppress grassroots emergence. For instance, while including them in "green belt" or open-space policies may protect land, planners must remain aware that community gardens are not automatically biodiversity-friendly, intensive cultivation or pesticide use can degrade local ecosystems if unmanaged (Tassin de Montaigu & Goulson, 2023). Urban policies should therefore encourage organic or low-impact practices and monitor ecological outcomes alongside social benefits.

The thesis found that governance models critically shape community garden success (Paper 4). However, no single model universally outperforms others. Purely bottom-up projects can struggle for resources and longevity, while purely top-down initiatives may lack community ownership. In some contexts, hybrid models combining both can balance stability and autonomy; in others, strong grassroots leadership or targeted municipal programs may work best. Jacob and Rocha (2021) show that administrative support (by city agencies) paired with community programs fosters the creation and maintenance of community gardening. Similarly, Carrad et al. (2023) report that Australian local governments act as gatekeepers but only as "facilitators" with variable support; they recommend clear policies and less red tape. In Stockholm, Bonow and Normark (2018) found that fragmented, "ad hoc governance" led to slow growth of community gardens, and they suggest providing facilitators, long-term land leases, and resources to boost stability. Municipalities should therefore develop explicit community garden programs (bylaws, guidance documents, dedicated staff) that define roles and procedures, while still leaving flexibility for local adaptation. Funding support (grants, in-kind assistance) should be routinely available. For example, Carrad et al. (2023) recommend

allocating ongoing funding for edible gardens at the community level. Coordination across departments (e.g. planning, environment, social services) is vital: policies must be clear and comprehensive, minimizing bureaucratic barriers. Ultimately, cities should aim to act as partners and enablers, rather than regulators, providing resources, training, and platforms for self-organization.

Policy must also ensure that community gardens serve diverse communities equitably. Our study showed that community gardens in Brussels tended to cluster in denser, lower-income areas (Paper 2), raising both opportunities and challenges. The literature warns that location strongly influences who participates: Butterfield (2023) emphasizes that garden placement and framing affect inclusivity. He argues for optimizing inclusion and representation in community garden design so that disadvantage is addressed. Likewise, systematic reviews note that community gardens are often less accessible to marginalized groups unless planners consciously address equity. Thus, new community gardens should be sited in neighborhoods lacking green space or fresh food access (Bieri et al., 2024). Capacity-building programs (workshops, translated materials, youth outreach) should accompany community gardens to engage under-represented groups. Participation barriers (high membership fees or exclusive management structures) must be removed (Butterfield, 2023). Cities can adopt outreach and frame theese gardens around local needs (e.g. language, cultural practices) to broaden appeal. These steps draw on Papers 3 and 4 findings about intergenerational renewal and diversified governance: inclusive, community-driven garden models build social capital and ensure that they are truly natural third places open to all members (Article 1).

Finally, community gardens must be sustained over time and integrated into resilience planning. Paper 3 emphasized temporal cycles and the need for "long-term commitments" (following natural rythyms of each season, nurturing new volunteers) for community garden continuity. Policymakers should therefore embed them into urban resilience and adaptation strategies. Shimpo (2024) found that during crises (COVID-19 in Tokyo) stable, socially integrated community gardens provided daily purpose and well-being, calling for their inclusion in city planning. Likewise, Bieri et al. (2024) note that heightened demand during the pandemic underscores gardens' role in crisis-response (mental health, social cohesion) and argues for planning them as essential green infrastructure. Thus, city plans and climate adaptation policies should explicitly recognize community gardens as long-term assets. This means securing permanent or multi-year land tenure (e.g. public land reserved for gardening) ensuring continuity of support, and aligning them with seasonal and social rhythms rather than short-term funding cycles. Governments can include community gardens in sustainability

indicators (e.g. through green-space targets). In practice, local agencies might offer multi-year grants or partner gardens with schools and NGOs to ensure intergenerational transfer (teaching gardening skills to youth). Such measures prevent the “stop-start” cycle we observed and align with calls to institutionalize community gardens as part of adaptative urban commons and socio-ecological networks.

In all cases, the evidence emphasizes careful, context-sensitive implementation. Recommendations are grounded in the thesis’s empirical findings (for Kraków and Brussels) and supported by peer-reviewed studies. By combining planned and spontaneous approaches, ensuring governance diversity, and embedding ecological care within social equity goals, policymakers can harness community gardens as multifunctional, adaptative and just urban infrastructures (Bonow & Normark, 2018; Carrad et al., 2023; Codato et al., 2024; Huq & Deacon, 2025).

4. Future research directions

Future studies should look beyond Western and post-socialist Europe to community garden initiatives in Latin America, Africa, and Asia. For example, urban gardening in São Paulo has been driven by grassroots "right-to-the-city" activism aiming at food justice in low-income neighborhoods (Visoni & Nagib, 2019) and in Havana the state-supported "organopónico" farms supply over half the city’s vegetables (McNamara, 2017). Similar dynamics occur in Cape Town, where formal land tenure for community gardens is scarce; researchers recommend supporting perceived or de facto land access to sustain community farms there (Kanosvamhira & Tevera, 2023). Engaging with literature on food sovereignty and land justice is critical, recent reviews of Latin American urban agriculture show how community gardens serve as food systems in crisis contexts (e.g. economic collapse, forced migration) and are linked to agroecological movements (Visoni & Nagib, 2019; Castellarini, 2022). Comparative work should also cover Asian contexts (e.g. informal "guerilla" gardens in India or post-disaster vegetable plots) and African cities (e.g. Accra’s peri-urban farms or Nairobi slum gardening), learning from fields like environmental justice.

The temporal evolution of community gardens warrants long-term study. Methodologically, future research could adopt ethnographic or mixed methods to follow community gardens across years or decades. Precedents exist: for example, scholars have tracked the life-cycle of allotment sites in Europe over decades, or conducted repeated field observations of a neighborhood garden to see how participation waxes and wanes with seasons

and economic conditions. An analog is climate-adaptation studies that revisit community schemes post-disaster (Elmqvist et al., 2016). We recommend systematic "garden demography": panel interviews with founders and users, sequential mapping of community garden expansions/contractions, or annual surveys of soil and produce, similar to the participatory mapping we used in Paper 2. These methods make clear both feasibility (many NGOs already monitor sites) and challenges (e.g. volunteer dropout and funding changes over time). Such longitudinal work has been done in part: one study of inner-city community garden in Brussels (Gray-Moineaux) showed how gardeners turnover and shifting support influenced community garden survival. Future projects should build on these precedents and note challenges like researcher continuity, attribute change causally, and secure funding for multi-year fieldwork.

To compare community gardens, future work should adopt both ecological and social indicators. Empirically, studies have measured plant and pollinator species richness, bird counts, or carbon sequestration in community gardens. For instance, Jha et al. (2023) found that urban plots can achieve "multiple synergies", meaning high food output did not trade off against biodiversity. Other metrics include soil quality (nutrients, contamination) and microclimate variables (ambient temperature or humidity under shade vs. bare ground). On the social side, metrics include number of active members, hours volunteered, or diversity of participants. Health-related outcomes can be tracked via surveys of physical activity or mental well-being: for example, a Philadelphia trial of vacant-lot greening showed dramatic reductions in self-reported depression (-41.5% overall, -68.7% in low-income neighborhoods) (South et al., 2018). Community outcomes such as trust or cohesion can be measured by social-network analysis or validated scales: systematic reviews have reported positive psychosocial outcomes of gardening, including greater fruit/vegetable intake and neighborhood attachment (Hume et al., 2022). Importantly, researchers have noted measurement challenges: Branas et al. (2018) warn that heavily vegetated lots can inadvertently create hiding spots for crime, complicating safety assessments. Thus, a robust metric suite would track both benefits (biodiversity, harvest weight, self-rated health) and potential disamenities (vector incidence, trespassing rates), as well as documenting methods (e.g. sampling protocols). A comparative framework might integrate remote-sensing with on-the-ground audits and community surveys.

Future work should engage urban commons theory and documented cases of community garden management. For example, Ostrom's (1990) design principles provide a template for evaluating community garden governance. Empirical studies reinforce this: Rosol (2010) and others find that when citizen participation is high (as in bottom-up community gardens),

inclusion and monitoring rules tend to develop informally, whereas top-down community gardens often rely on municipal regulations. Our own case studies showed this clearly: one bottom-up Kraków community garden (Salwator) encouraged "strong community learning" but struggled with volunteer turnover, while a top-down site (Pychogród) secured resources but had "limited local ownership"; a hybrid model (JU campus garden) combined both strengths. Future research should cite classic cases (e.g. Eizenberg, 2012, on New York gardens; Rosol, 2010 on Berlin) and newer ones (e.g. Foster & Iaione, 2015 on city-as-commons) to deepen this analysis. Within community gardens, internal power relations warrant focus. Feminist urbanism reminds us that issues of gender, race, and class shape who feels welcome and who leads in a garden. For example, Foster & Iaione (2015, p. 302) note that commoning produces "mutual aid, neighborliness, fellowship, and ... trust", but these benefits depend on inclusive participation. Researchers should therefore include questions about representation on committees, decision-making fairness, and care roles (e.g. who does the routine maintenance or seed saving). Longitudinal ethnographies or surveys with a gender/class lens can reveal these dynamics.

Finally, community gardens' roles under disturbance deserve more study. The COVID-19 pandemic and climate extremes have spotlighted green infrastructure as resilience hubs. For instance, access to green spaces was associated with lower stress and enhanced social support during lockdowns, and gardeners became more motivated to cultivate despite receiving fewer benefits (Tuominen et al., 2024). More systematically, researchers should examine how community gardens fared during events like heatwaves, floods, or the pandemic. Using an urban political ecology lens, one can frame community gardens as sites of care in crisis: they are places where communities self-organize to care for each other and the environment (Tronto, 2020). The literature shows that urban green commons can buffer shocks by sustaining social networks and "community resilience" (Foster & Iaione, 2015; Tuominen et al., 2024). Future work should cite COVID-era case studies and climate adaptation research (e.g. on using gardens for heat relief or stormwater management) to suggest how community gardens might be integrated into official resilience planning. This includes documenting how community gardens adapted operations (e.g. social distancing vs. communal tending) and mobilized support (e.g. food donations). Clarifying the political ecology angle means interrogating who benefits from community garden based care: who gets access to shared harvests or communal spaces during emergencies, and how resource flows (water, plants, labor) are sustained. Such analysis can draw on concepts of environmental justice and care ethics to better understand community gardens as mutual aid infrastructure in crisis.

5. Concluding thoughts

The evidence from our four articles, and the wider literature, suggests that community gardens can foster strong social-ecological benefits, but only under certain conditions. For example, Paper 1 coined the term "natural third places" to highlight how community gardens can bridge sociability and ecology. As such, community gardens often do build social capital: they have been shown to generate mutual trust, fellowship, a sense of security within communities (Foster et al, 2015). This thesis's findings align with that: the bottom-up community garden in Kraków (Salawator) produced strong community learning among diverse volunteers (Paper 4). Moreover, community gardens can incubate innovation. Paper 1 argued that community gardens encourage "innovative civic practices" and ecological awareness, a claim borne out when we observed gardeners experimenting with new crops or negotiating shared compost strategies. Overall, our data support the idea that community gardens can be spaces of collaboration and creativity.

However, our conclusions also acknowledge limits. The benefits of a community garden depend on its social context. For instance, Paper 4 showed that a top-down, municipally run community garden (Pychogród) could supply resources but often failed to build the same sense of ownership, and thus trust, as a grassroots project. Likewise, while some articles claim community gardens unambiguously "build trust", our ethnography found that trust grew more slowly and unevenly: new members often needed months to feel integrated. We thus want to avoid overstatement. Instead, we anchor claims in our findings: for example, rather than saying gardens "always" create community, we note that in Paper 2 Brussels's some community gardens clustered in multicultural and low-income neighborhood to became hubs of cultural exchange, whereas in Kraków community gardens were more mixed in function.

In conclusion, the thesis affirms that community gardens can function as adaptive socio-ecological commons and contribute to urban well-being, but the evidence must speak for itself. As other studies have found, "community gardening was associated with higher fruit and vegetable intake [and] positive psychosocial and community outcomes" (Hume et al., 2022, p.1). Our interviews and observations echo this cautiously: participants reported feeling more connected to nature, peaceful and more engaged, but also noted challenges of coordination and time. By citing concrete results from each paper, we show that claims like "gardens build trust" or "incubate innovation" are grounded in data (e.g. shifts in survey scores, repeated quotes from gardeners, and observed practices). Future readers should take home the nuanced message:

community gardens hold great promise as green commons, but realizing their full potential requires attention to context, governance, and the hard work of commonin

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PART II: Articles

Paper 1:

Téoule F., (2025), Community gardens as natural third places: a conceptual framework.

Status: Accepted for publication in Contemporary Social Science

Decision Letter (RSOC-2025-0077.R1)

From: d.g.bailey@bham.ac.uk

To: fanny.teoule@doctoral.uj.edu.pl

CC:

Subject: Contemporary Social Science - Decision on Manuscript ID RSOC-2025-0077.R1

Body: 27-Oct-2025

Dear Miss Teoule:

Ref: Community gardens as natural third places: a conceptual framework

Thank you for submitting the paper that is referenced above. We have now considered it and taken into account the comments of internationally renowned referees. In the light of these comments we are happy to accept your paper in its current form for publication in Contemporary Social Science . It will now be forwarded to the publisher for copy editing and typesetting. The reviewer comments are included at the bottom of this letter.

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Thank you for your contribution to Contemporary Social Science and we look forward to receiving further submissions from you.

With all good wishes,

With kind regards,

David

_____

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Community gardens as natural third places: a conceptual framework

Abstract
Amid global climate and biodiversity crises, urban communities, particularly in Europe, are seeking integrative socio-ecological solutions. This paper examines two key concepts for reimagining urban communal spaces: community gardens and third places. We introduce the concept of natural third places, defined as hybrid urban commons that merge informal community social functions with ecological engagement, exemplified by community gardens. This conceptual framework extends third place theory by integrating environmental dimensions and spatial justice considerations, broadening the understanding of inclusive, sustainable urban commons. The study articulates how natural third places facilitate socio-ecological transitions and contribute to more equitable, resilient urban futures.

Keywords: community gardens, third places, natural third places, socio-ecological transitions.

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INTRODUCTION

The world's cities are confronting converging environmental and social crises. Rapid urbanization, climate change, and biodiversity loss are straining urban life and amplifying inequalities. Extreme climate-related events (from heatwaves to floods) have become more frequent, underscoring the urgency of developing sustainable, community-centered responses in cities (Huq & Deacon, 2025). In parallel, the COVID-19 pandemic has illuminated the importance of local social infrastructure: when lockdowns closed cafés, libraries, and other gathering spots, communities felt the loss of these informal meeting places, and many turned to outdoor green spaces for relief (Luo et al. 2021). In this context, there is a growing need to rethink the relationship between urban society and the environment and to foster spaces that simultaneously build social cohesion and ecological resilience. This paper responds by examining two interrelated concepts: community gardens (CGs) and third places (TPs), as grassroots innovations driving socio-ecological transitions. We propose a new theoretical framing of CGs as "natural third places," arguing that these community-managed green spaces function as critical informal public places for urban social life and sustainability. Below, we clarify these key concepts and outline the theoretical and methodological framework guiding our inquiry.

We define CGs as shared urban green spaces where local residents collectively engage in gardening and social activities. They often emerge on underutilized land (vacant lots, park corners, schoolyards) and are managed by community members for growing food or flowers, recreation, education, and neighborhood beautification (Clarke et al. 2018). Beyond food production, CGs provide important venues for social interaction, cultural exchange, and connection to nature within the city (Okvaut & Zauta, 2011). A rich body of literature documents the benefits of CGs , including improved mental and physical health, stress reduction, environmental learning, and stronger social bonds among participants (Okvaut & Zauta, 2011, Clarke et al. 2018; Luo et al. 2021). For example, during the COVID-19 pandemic, residents increasingly used CGs and other local green spaces as safe outlets to cope with stress and maintain social ties outdoors (Luo et al. 2021). In this way, CGs serve not only as sites of urban agriculture but as neighborhood social hubs.

The concept of TP comes from urban sociology. Ray Oldenburg (1991) famously described TPs as the informal public gathering spaces that are neither home (the "first" place) nor workplace (the "second" place), but are essential for community life (Oldenburg, 1991). Classic

examples of TPs include cafes, bars, teahouses, barber shops, libraries, and other "hangouts" where people regularly meet casually for conversation and companionship. Oldenburg emphasized that true TPs are accessible, welcoming, and neutral grounds that foster social equality and civic engagement by bringing diverse people together in a playful, relaxed atmosphere (Oldenburg, 1991). Key characteristics include accessibility (ideally walking distance in one's neighborhood), regular clientele (familiar faces and "regulars"), a neutral and unpretentious setting, and conversation as the main activity. These spaces are seen as the "living room" of society, anchors of community where social networks form and a sense of belonging is built. In recent years, scholars and practitioners have expanded Oldenburg's idea, noting that TPs do not need to be indoors or commercial; parks, gardens, and other green spaces can also function as open-air TPs that bring people together around leisure and nature. Indeed, urban green spaces are increasingly recognized as green TPs that promote community connectedness alongside environmental benefits (Du et al, 2023; Valentim et al, 2025)

Bridging these concepts, CGs can be understood as TPs in a natural setting. Recent studies explicitly identify CGs as exemplars of TPs, highlighting their role in fostering inclusive social interaction, trust, and mutual aid among neighbors (Kanosvamhira, 2024; Tchekemian, 2024; Valentim et al, 2025). For instance, Valentim et al. (2025) observe that urban CGs serve as vital social spaces, informal gathering spots that function as TPs, by connecting people across demographics and enhancing well-being. Similarly, case studies from diverse cities find that CGs often become neighborhood "hangouts" where friendships are formed, knowledge is exchanged, and community identity grows (Kanosvamhira, 2024; Zhuang & Lok, 2025). However, the term "natural third place" (NTP) has not yet been formally defined in the scholarly literature. We introduce NTP to denote a sub-category of TPs that are characterized by a predominantly natural, green environment and community-driven ethos. In other words, a NTP is "a social environment separate from home and work where community life happens within a natural setting" (Sustainability Directory, 2025). These are public spaces, open to all, inviting regular informal encounters within greenery . Classic TP qualities (accessibility, informality, social mixing) are present, enhanced by the restorative and inclusive power of nature. Examples include CGs, urban farms, pocket parks with communal seating, or a neighborhood orchard, not just green landscapes, but true social hubs where people gather in an organically convivial atmosphere. The "natural" in NTP thus refers both to the physical setting (vegetated, outdoor space) and the often organic, bottom-up manner in which these places emerge and operate. By explicitly defining CGs as NTP, we aim to highlight how they

simultaneously fulfill a social function (as TPs) and an ecological function (as green urban infrastructure). This novel concept helps fill a gap in existing research: while CG studies document social benefits and TP theory extols informal community venues, there has been little theoretical integration of the two. Recognizing CGs as NTP positions them at the intersection of social and environmental domains, which is especially pertinent given current urban challenges.

Our analysis is grounded in two complementary social theories that illuminate the dynamics of place-based community initiatives: Henri Lefebvre's theory of the production of space and Anthony Giddens' structuration theory (structure-agency dynamics). Lefebvre's perspective, articulated in The Production of Space (1991), insists that space is not merely a neutral backdrop for social processes but is actively produced and shaped by those processes. From this viewpoint, a CG is far more than a physical plot of urban land; it is a social space created by the interactions, practices, and meanings that people attach to it. Lefebvre's conceptual triad of spatial production (spatial practices, representations of space, and representational spaces) offers a lens to examine CGs at multiple levels (Lefebvre, 1991). The daily routines of gardening and gathering (spatial practices) gradually transform an idle lot into a community node; the way planners or authorities perceive and map these gardens (representations of space) might differ from how gardeners and neighbors experience and imagine the garden as a lived place imbued with identity and fellowship (representational space). In short, Lefebvre's theory sensitizes us to the bottom-up production of urban space: CGs exemplify how citizens can appropriate and recreate urban space for collective purposes, challenging purely top-down or commodified uses of land. This spatial-production lens aligns well with the idea of TPs, which are often informal, improvisational spaces born of community initiative rather than formal design.

At the same time, Giddens' structuration theory provides a valuable framework for understanding how CGs emerge and persist through the interplay of human agency and social structure. According to Giddens (1984), social life is a recursive process: individuals (agents) create and reproduce social structures through their actions, even as those structures constrain and enable future actions. In the context of CGs, agency can be seen in the grassroots actions of residents who organize a garden (planting, negotiating rules, fundraising, hosting events) while structure appears in the form of institutional contexts like land tenure systems, municipal policies, or cultural norms about public space. A CG's existence often depends on navigating

structural factors (obtaining permission from the city, accessing resources through networks or nonprofits) while also harnessing the creativity and commitment of local volunteers. Structuration theory reminds us that community initiatives are shaped by, but also can reshape, the broader social structures around them. For example, a garden may start as an informal act of agency (neighbors guerrilla-gardening a vacant lot) and over time lead to structural changes such as new city support programs or zoning adjustments for urban agriculture. In this paper, we pay close attention to this duality of structure and agency: how the intentional actions of community members (agency) produce a new shared space, and how existing structural conditions (economic inequalities, urban land markets, governance frameworks) influence which spaces become gardens and who participates. This approach is informed by Giddens' concept of locales, the specific places where social interaction is constituted. Giddens notes that analyzing the "time-space coordination of social activities means studying the contextual features of locales through which actors move in their daily paths" (Giddens,1984). In other words, CGs can be studied as locales in which daily social life unfolds, situated within broader patterns of movement and time use in the city. Here we also draw on Torsten Hägerstrand's time-geography (Hägerstrand, 1970) to explicitly consider temporal-spatial constraints on urban interactions. Hägerstrand's framework introduces the idea of individual "time-space paths" and "time-space prisms," illustrating how people's opportunities to meet are bounded by schedules, distances, and mobility. Applying this to CGs, we acknowledge that these gardens operate at particular times (e.g. weekend mornings, after-work hours) and in certain locations (often within residential neighborhoods), which structure who can be present and when. The rhythms of daily life and the geography of the city thus critically shape participation in NTP. By integrating Giddens and Hägerstrand, we recognize that CGs as TPs exist within the flow of urban routines: they may become regular stops in residents' daily trajectories, offering a "time-space niche" for social interaction that other environments (like workplaces or commercial spaces) do not provide. This theoretical grounding in spatial production, structure-agency interplay, and time-space dynamics ensures that our analysis goes beyond anecdotal descriptions but instead, we interpret CGs as socially produced places embedded in structural context and temporal patterns.

Conceptualizing CGs as NTPs is not only a theoretical exercise; it directly speaks to pressing contemporary issues. Modern cities are experiencing what some have called a "fragmentation of urban public space," where opportunities for face-to-face social mixing are diminishing due to privatization, digital substitution, and socio-spatial segregation. In this climate, TPs provide

a crucial antidote to isolation and polarization by nurturing everyday sociability (Oldenburg & Brissett, 1982). CGs, in particular, offer neutral ground that bridges social divides: young and old, longtime locals and newcomers, people of different cultures and classes can bond over the shared activity of gardening and a common stake in a piece of urban nature. Moreover, these NTP contribute tangible solutions to urban sustainability challenges. Studies have shown that CGs enhance urban resilience by improving local food security, offering cooling green refuge in overheated neighborhoods, and strengthening social networks that are vital during crises (Clarke et al. 2018; Huq & Deacon, 2025). For example, a recent systematic review found that CGs significantly impact food access, climate adaptation, and community well-being, and notably, research interest in community gardening spiked during the COVID-19 pandemic as their value became more evident (Huq & Deacon, 2025). Cities like New York, Toronto, and Berlin have documented how gardens serve as community anchors during extreme events, providing shade and cooling during heatwaves, spaces for mutual aid distribution during pandemics, and even emotional support after natural disasters (Chan et al., 2015; Lal, 2020). In the post-COVID urban context, where many are seeking reconnection and outdoor engagement, CGs stand out as accessible TPs that are outdoors and thus inherently safer in public health terms (Clarke et al. 2018). Residents increasingly recognize the mental health benefits of green TPs, as gardening and casual socializing in these spaces alleviate loneliness and stress heightened by the pandemic (Luo et al. 2021). Additionally, with climate change bringing more frequent extreme weather, CGs can bolster climate resilience at the neighborhood scale, for instance, by mitigating urban heat island effects through vegetation and by fostering a culture of local self-reliance and knowledge-sharing on sustainability practices (Clarke et al. 2018). In light of global calls for societal transitions toward sustainability, including grassroots initiatives in climate action and disaster preparedness, CGs exemplify a practical, citizen-led approach to building more resilient and cohesive communities. They are living laboratories of socio-ecological transition: small in scale, but scalable in impact and rich in lessons about how communities can transform their environment and social relations in tandem. By situating CGs within the TPs framework, our study underscores their significance as urban green infrastructure, and as social infrastructure for healing and transforming urban life (Klinenberg, 2018). Framing CGs as NTPs shines a light on their dual role addressing contemporary environmental crises and social challenges: from climate adaptation and food security to post-pandemic social recovery and the rebuilding of inclusive public life in fragmented cities.

To develop the conceptual arguments in this paper, we conducted a structured literature review of scholarly and grey literature on CGs, TPs, and related concepts. A structured review is an appropriate methodological choice for our objectives because it combines systematic techniques for searching and screening literature with a flexible, integrative analysis of broad topics (Snyder, 2019). Unlike a full systematic review that aims for exhaustive coverage of a narrowly defined question, a structured (or "semi-systematic") review allows us to map out and synthesize interdisciplinary knowledge on an emerging concept while maintaining rigor and transparency in the process. We followed clearly defined inclusion criteria and search strategies to ensure a comprehensive yet focused collection of sources. First, we identified key databases likely to contain relevant research: Scopus, Web of Science, and Google Scholar for academic literature, as well as specialized repositories for urban studies and sociology. We limited our search primarily to publications in English from approximately 2000 to 2023, reasoning that the past two decades cover the flourishing of CGs research and contemporary urban theory, while also including earlier foundational works (e.g. Jacobs, 1961, Hägerstrand, 1970; Giddens,1984; Oldenburg, 1989; Lefebvre, 1991) for theoretical context. Our search keywords combined terms related to CGs (e.g. "community garden," "urban gardening," "allotment gardens," "urban agriculture") with terms related to TPs and social space (e.g. "third place," "informal public space," "social cohesion," "public gathering space," "urban commons"). We also included keywords to capture the sustainability transition context (e.g. "socio-ecological transition," "urban resilience," "green infrastructure," "post-COVID"). These searches were supplemented by reviewing reference lists of key papers (snowballing) and including pertinent grey literature and reports (for example, municipal documents on CG programs, NGO reports on urban green space, and online essays by practitioners) to ensure practical insights were considered alongside academic findings.

All identified sources were then screened in a stepwise manner: we first filtered by titles and abstracts to exclude off-topic works (for instance, studies purely about horticultural techniques or unrelated uses of "third place" terminology). We included studies that provided empirical or theoretical insight on the social functions of CGs, the characteristics or impacts of TPs, or the interaction of community spaces with urban environmental and social challenges. Both quantitative and qualitative studies were included, as well as literature reviews and conceptual papers. After preliminary selection, we evaluated full texts of the remaining sources to confirm relevance and quality. In total, our review encompasses around 35 studies on CGs (including prior systematic reviews such as Guitart et al., 2012) and 25 studies TPs and related social

infrastructure, along with several cross-cutting works bridging urban greening and community development. We then employed thematic coding to organize the literature's findings and concepts. Key themes that emerged include: the social benefits and functions of CGs (e.g. social inclusion, health, civic empowerment), the defining attributes of TPs (e.g. neutrality, regulars, playfulness), the spatial and temporal dimensions of community interactions, and the role of community-led spaces in addressing contemporary crises (climate adaptation, pandemic recovery, etc.). We paid special attention to identifying where the literatures on CGs and TPs intersect or diverge. This structured analytic approach allowed us to identify gaps, notably the lack of explicit conceptual linking of green spaces with TP theory, which our concept of NTP seeks to fill. By articulating our search and analysis process, we also provide transparency and replicability; our goal is that future researchers can build on this framework to further investigate NTP.

The remainder of this paper is organized as follows. In Section 1, we review the literature on CGs in urban environments, charting their historical emergence and the multiple roles they play in socio-ecological transitions (social, political, environmental, and economic). We draw on both academic studies and practice-based publications to paint a comprehensive picture of contemporary community gardening movements. Section 2 examines the concept of TP and related notions of informal public space, distilling the core characteristics of TP from Oldenburg's classic work and subsequent research. We highlight various types of TP identified in the literature and discuss how they contribute to urban social life. In Section 3, we synthesize the two strands by introducing and elaborating the concept of NTP. We argue that CGs constitute a distinct subset of TPs, and we detail the defining features, opportunities, and challenges of NTP as gleaned from the literature (for example, how they foster both social bonding and ecological awareness). We also consider any observable differences between NTP and more "traditional" TP, as well as the implications of this concept for urban theory. Finally, Section 4 concludes the paper by summarizing the key insights and discussing practical implications. We emphasize why recognizing CGs as NTP matters for urban policy (e.g., planning and supporting such spaces in city design) and community practice (e.g., empowerment and inclusion strategies). We also identify areas for future research, such as comparative studies of natural vs. commercial TPs, or deeper investigation into the long-term impacts of CGs on urban resilience.

1. COMMUNITY GARDEN IN SOCIO-ECOLOGICAL TRANSITIONS

CGs are a distinct form of urban green space that have played evolving roles in cities' socio-ecological transformations. To enhance conceptual clarity, it is crucial to distinguish CGs from related urban gardening practices such as allotment gardens, victory gardens, kitchen gardens, and public parks. CGs are typically defined as collectively managed plots in urban areas where residents cooperatively grow plants (often vegetables and fruits) and sharethe harvest and also the space as a social resource. This contrasts with allotment gardens, where individuals or families tend separate plots within a larger garden site (a model common in Europe since the 19th century), or kitchen gardens, which are private household food gardens. Victory gardens (or "war gardens") were an emergency response during World Wars I and II (millions of Americans, Britons, and others grew vegetables in yards and parks to support the home front) but were typically short-term and individually managed (Drescher, 2001). Unlike urban parks designed primarily for recreation or ornamentation, CGs emphasize participatory cultivation and often food production. In short, CGs are "collectively managed urban agriculture", nested within the broader category of urban and peri-urban agriculture (UPA) (Rao et al., 2022). UPA encompasses "horticultural, agricultural, and farming activities carried out on small plots of land in and around urban centres" (Rao et al., 2022), including home gardens, allotments, rooftop farms, and CGs. Recent research positions CGs as a key subset of UPA, contributing to all three pillars of sustainability (environmental, economic, and social). For example, urban agriculture initiatives like CGs can enhance ecosystem services, food security, often foster social cohesion and empower communities by enabling bottom-up innovation (Langemeyer et al., 2021). In this way, CGs are defined by their physical form (gardening on urban land), and by their collective, community-driven ethos that differentiates them from more individualistic or top-down forms of urban greening.

Historically, the emergence of CGs has unfolded through several phases, each tied to specific socio-ecological contexts and often distinct from the Eurocentric or Americentric narratives that dominate the literature (Guitart et al., 2012). Early antecedents can be traced to the allotment garden movements in industrializing Europe in the 19th and early 20th centuries. Allotment gardens (e.g. Schreber gardens in Germany, jardin ouvriers in France, allotments in Britain) were created to provide urban workers and the poor with access to land for food and healthy recreation (Crouch, 1989; Baudelet-Stelmacher, 2018). These were usually sanctioned by governments or charities, with plots leased to individuals. During and after the World Wars,

crisis gardening efforts proliferated: in addition to victory gardens in the US and UK, many European cities expanded allotments to fight wartime hunger. For instance, Figure 1 illustrates how wartime victory gardens (1914-1918 and 1939-1945) prompted a surge in urban food production, albeit temporarily. After World War II, the trajectory of allotment gardening diverged geographically. In Western Europe and North America, improved economic conditions led to a decline in allotment usage in the post-war decades, as food scarcity waned and recreational uses of urban land changed ((Crouch, 1989; Baudelet-Stelmacher, 2018; Poniży et al, 2021). By contrast, in Eastern Europe and other socialist contexts, allotment gardens greatly expanded from the 1950s-1980s as vital supplements to state food systems (Schmelzkopf, 1995; Ferris et al., 2001; Baudry, 2010; Poniży et al, 2021). These socialist allotments functioned as semi-collective spaces under state oversight, differing from both Western allotments and the more informally organized CGs that would rise elsewhere. Notably, allotment gardening's persistence in the Eastern Bloc reflected an implicit socio-ecological transition: urban populations collectively coped with material scarcity by reverting to local food cultivation, building a form of urban resilience long before that term gained currency. Scholarly analyses have begun to document these historical phases, for instance Poniży et al. (2021) detail how allotment gardens under socialism were geared toward "edible plants to cope with chronic food shortages" despite their recreational veneer. Such cases underscore that urban gardening has not been monolithic globally; it has served varied purposes from subsistence to leisure, and its prevalence has waxed or waned with socio-economic transitions.

CGs in the contemporary sense began to emerge more explicitly in the late 20th century, often as grassroots responses to urban crises and as alternatives to traditional allotments. In the United States, the modern CG movement is commonly dated to the 1970s, when citizens in disinvested inner-city neighborhoods (like New York City's Lower East Side) started reclaiming vacant lots and derelict land to create shared gardens. These initiatives were typically bottom-up: for example, New York's Green Guerrillas and other activist groups illicitly planted and cleaned up abandoned parcels, spurring the city's first generation of CGs. This wave of urban gardening was born not of government sponsorship but out of residents' desperation and creativity amid urban decline (Mitchell, 1995; Francis, 2003; Lawson, 2005; Purcell & Tyman, 2014; Poniży et al, 2021) . Scholars have noted that "the diverse patchwork of over 800 CGs that took root in New York since the 1970s [was] born not out of government support, but rather its absence" (Staeheli et al., 2002, as cited in Purcell & Tyman, 2014) . Similar trends occurred in other cities across North America and Western Europe during the 1980s and 1990s, where CGs

became tools for urban revitalization, food justice, and neighborhood empowerment in the face of neoliberal disinvestment. In the UK, for instance, “community allotments” and city farms grew in popularity alongside a broader environmental movement. Meanwhile, younger generations began gravitating toward the more collective ethos of CGs. Traditional allotment societies often had aging membership and barriers to entry (long waiting lists, fees, rules), pushing younger or less-resourced urbanites toward informal CG projects. Studies in Europe confirm this demographic shift: in Poland and Germany the average age of allotment plot-holders is around retirement (Poniży et al, 2021). CGs thus signaled a conceptual shift from the individualistic, often apolitical cultivation of allotments to a more collective, civically engaged practice imbued with goals of social inclusion and urban re-appropriation of neglected space.

Community gardening practices (even if not always labeled as such) exist worldwide and have taken on unique forms in the Global South, Asia, and Oceania. For example, many rapidly growing African cities have long traditions of urban agriculture out of necessity: in cities like Nairobi and Lagos, thousands of residents grow food on roadside verges, vacant plots, and community sites to supplement their diets and incomes (Mbiba, 1995; Hovorka et al., 2009). In Latin America, urban CGs often intertwine with social movements around land rights and food sovereignty: Havana’s organopónicos (urban organic gardens) famously emerged during the 1990s Special Period, illustrating how a severe economic crisis spurred a transition to local self-provisioning (Górna & Górny, 2020). In South Africa’s townships, as another case, CGs in places like Cape Town’s Cape Flats are primarily driven by a need for food security but also serve broader social purposes (Kanosvamhira, 2024). Studies note that even when food production is the main objective in these contexts, gardens become hubs for community learning, solidarity, and healing in communities fractured by apartheid’s legacy (Kanosvamhira, 2024). Across the Global South, then, CG soften function as informal safety nets and spaces of empowerment, helping urban residents navigate the stresses of poverty, unemployment, and inadequate food access. At the same time, there is increasing interest in formalizing and studying these efforts. Rao et al. (2022) found that literature on urban agriculture has been heavily skewed to temperate Global North cities, with far fewer studies on African and Asian cities. This geographic bias is gradually being addressed as scholars recognize that the “15 fastest-growing cities” are now in Africa and that UPA (including CGs) may play a critical role in the sustainability and resilience of these rapidly urbanizing areas (Rao et al., 2022).

Type of garden	Period & Context	Socio-ecological transition role
Allotment gardens (Europe)	Began in 19th-century industrial Europe; expanded in early 20th century and socialist Eastern Europe.	Integrated nature into industrial cities; improved worker nutrition and well-being (early urban sustainability effort). Under socialism, alleviated food shortages (informal food system).
Victory gardens (War gardens)	WWI and WWII in North America, Europe; also Depression-era relief gardens (1930s).	Short-term transition of ornamental or idle urban land to food production in crises; boosted wartime resilience and civic morale. Demonstrated capacity of cities to supply food in emergencies.
Community gardens (First wave)	Late 1960s-1980s, North America and Western Europe; grassroot responses to urban disinvestment (e.g. inner-city neighborhoods).	Bottom-up urban regeneration: reappropriation of vacant lots for green space and food. Pioneered urban sustainability transitions by addressing urban blight, food insecurity, and social fragmentation. Influenced policy toward community-led development.
Contemporary urban community gardens & Urban agriculture	1990s-present, global spread (North and South). Often supported by NGOs or city programs; tied to sustainability, health, and resilience agendas.	Part of socio-ecological transformation toward sustainable cities (local food production, biodiversity, climate adaptation). Serve as "living labs" for environmental education, social innovation, and building community resilience (e.g. to economic crises or climate events).

Table 1. Evolution of urban gardening types, their historical context, and their roles in socio-ecological transitions (Source: Author).

The urban socio-spatial theory lens further deepens our understanding of CGs' transformative role. CGs are frequently cited as examples of urban residents reclaiming space for use-value rather than exchange-value, reclaiming vacant land for community use instead of profit-driven development (Calvet-Mir & March, 2017). This aligns with Henri Lefebvre's ideas of the right to the city and the production of social space. Indeed, the conflict between community gardeners and city authorities is often a contest of values: the use value of green commons vs. the exchange value of real estate (Schmelzkopf, 1995). The very act of starting a CG on an abandoned lot can be seen as what Lefebvre called a "trial by space", a test of whose vision for the city will prevail (Lefebvre, 1991). It is also a form of collective action: neighbors organizing to improve their environment and asserting their collective right to shape urban space. Recent scholarship explicitly frames CGs as a new kind of urban commons, requiring collective governance and cooperation (Eizenberg, 2012; Rogge & Theesfeld, 2018). Nettle (2014) describes community gardening as a social movement and highlights the tactics of

collective action gardeners use to achieve social change. They also resonate with broader transition theories in the socio-ecological realm: CGs can be viewed as grassroots innovations (Seyfang & Smith, 2007) that prefigure sustainable urban futures by building community resilience at the local level. For instance, after disasters like Hurricane Katrina or the COVID-19 pandemic, CGs have been noted to bolster recovery and food security, acting as nodes of resilience, providing social "insurance" value, preserving practices and knowledge that enhance a city's capacity to absorb shocks (Langemeyer et al., 2021). Thus, whether in routine times or crises, CGs contribute to socio-ecological transitions by reconnecting urban populations with ecological practices, shortening food circuits, and strengthening social fabrics.

Building on these insights, the following section turns to the concept of TPs, a cornerstone in urban sociology that illuminates how spaces of informal encounter and social interaction sustain community life. By further situating CGs within this broader theoretical lineage (Section 3), we can better understand how they operate as ecological infrastructures and social anchors in the everyday fabric of urban life.

2. THIRD PLACES

TP are informal, semi-public spaces that facilitate regular social interaction outside of home (the first place) and work (the second place). The concept was introduced by sociologist Ray Oldenburg (1989), who observed the erosion of public gathering spots in car-centric, suburbanizing America. Oldenburg defined TPs as neutral ground where individuals can gather voluntarily, on equal footing, regardless of social or economic status. Classic examples include neighborhood cafés, pubs, and other inexpensive, accessible locales that invite conviviality (Oldenburg, 1991; Jeffres, 2009). These venues provide a "home away from home" atmosphere that fosters casual conversation, community ties, and a sense of belonging. Subsequent scholars have echoed these defining features: accessibility (easy to reach and enter), inclusivity (welcoming to diverse groups), and an emphasis on social interaction over commercial or private functions (Table 2). Urbanist William Whyte (1980), for instance, noted that successful public spaces encourage chance encounters by offering comfortable design and flexible use, underscoring that openness and spontaneity are key to a thriving TPs.

Characteristics of TPs	Description
Informality	Informal spaces where individuals can be themselves.
Accessibility	Easily accessible and open to everyone.
Regularity	Places visited regularly, fostering familiarity.
Low-key	Low-pressure environments where people can relax.
Multi-purpose	Venues for various activities, e.g., socializing or reading.
Good food and drink	Often serve food and drinks, contributing to the atmosphere.
A level of sociability	Lively places for social interactions.
Neutral ground	Unassociated with specific groups, open to all.
Democratic spaces	Equal footing for people of diverse backgrounds.
A source of community	Fostering social connections and a sense of belonging.

Table 2: Key characteristics of Third Places as defined by Ray Oldenburg (1989) (Source: Author)

Oldenburg's work provided the foundational definition of TPs, later research expanded the conceptualization of what constitutes a TP and how such spaces function in different contexts. Some scholars conceptualize a TP as a social configuration or network of interactions embedded in space and time, drawing on Norbert Elias's notion of figuration (1990). From this perspective, a TP is not merely a physical locale but an organized set of interrelationships among people, situated in a particular setting and moment (Rampa, 2015). This theoretical lens widens the scope beyond Oldenburg's cafés and taverns, allowing researchers to consider any environment, physical or virtual, that sustains informal communal ties.

Over the past few decades, the TPs concept has evolved in tandem with societal and technological change. Researchers from various fields (urban planning, anthropology, public health, etc.) have examined TPs across a broader range of environments. Importantly, contemporary TPs are no longer limited to the traditional small-scale venues of Oldenburg's era. New organizational dynamics have emerged as TPs adapt to changing work patterns, lifestyles, and technologies. For example, the rise of "hybrid" spaces blending work and leisure is notable: coffee shops now double as remote offices with Wi-Fi, and dedicated coworking spaces have proliferated as communal workplaces for freelancers and teleworkers. These work-oriented TPs reflect a shift in organizational model (often privately operated or membership-based) yet they strive to maintain the open, community-centric ethos of a TPs (Rampa, 2015). Likewise, the digital revolution has given birth to virtual TPs, from online forums to social media communities, which serve similar functions of socializing and networking beyond

physical constraints. Even in physical terms, TPs today appear in diverse cultural and geographic contexts: studies document TP analogues in settings ranging from Japanese cities (e.g. manga cafés contributing to community well-being) to post-socialist Europe (e.g. libraries and museums acting as community hubs). Moreover, TP-like activities can begin informally, such as a neighborhood pop-up event or community garden, and later become established fixtures of local social infrastructure. Through this broad evolution, the core idea endures: TPs are associated with positive outcomes like stronger social connectedness, improved mental health, and greater community resilience. Empirical research supports these benefits, for instance, communities with more accessible TPs report higher social cohesion and quality of life (Jeffres, 2009). At the same time, the growing institutional interest in TPs (by policymakers, developers, and organizations) has sparked debate about preserving their original character. Observers caution that as cities deliberately create or co-opt TPs (e.g. government-funded innovation labs or commercial "community spaces"), there is a risk of drifting toward exclusive, productivity-focused venues that cater to specific elites, thus undermining the egalitarian, grassroots spirit of true TPs. Maintaining the balance between organic community ambiance and formal organizational goals is an ongoing challenge in the evolution of the TP concept (Rampa, 2015; Levy-Waitz, 2018).

Given the expanding spectrum of TPs, scholars have proposed typologies to classify their various forms and functions. Establishing a typology clarifies the concept's breadth and aids in identifying where new sub-categories, such as NTP, might fit within the larger landscape. Table 3 outlines a synthesized classification based on prior models (e.g., Rampa, 2015; Lorre, 2018) and recent literature. In general, TPs can be grouped into several often overlapping categories:

- Cultural TPs: Spaces primarily dedicated to arts, culture, and creative expression that also foster social mixing. These include community art centers, music venues, or repurposed industrial sites turned into cultural hubs. Such places often intertwine creative practice with community engagement, exemplified by art collectives in converted warehouses or even emergent cultural scenes (e.g. hip-hop music venues doubling as social hangouts). They help construct shared cultural identity and innovation networks (Duffour, 2001; Kniaź, 2017).
- Educational TPs: Environments that support informal learning and skill-sharing outside formal institutions. Public libraries and museums are classic examples, as they provide an intermediate space between home and school for education, leisure, and civic interaction (Murzyn-Kupisz & Działek, 2015). Even maker spaces or adult learning circles can serve

as educational TPs. In modern contexts, online platforms for collaborative learning or creativity (e.g. coding clubs, forums) also function as TPs for knowledge exchange (Yen et al., 2017).

- Work-Oriented TPs: Often termed "third workplaces," these cater to the need for flexible work and collaboration outside the traditional office. They range from coffee shops with free Wi-Fi and co-working offices, to business lounges and telecenters. Such spaces are typically privately operated but open to the public or members, blurring the line between public and private realms. They have gained prominence with the rise of the gig economy and remote work, offering social contact and networking alongside functional workspace (Rampa, 2015).
- A subtype of work-oriented TPs focused on innovation, fabrication, and technology. These include makerspaces, hackerspaces, and fab labs (collaborative workshops equipped with tools for making and learning). Often founded by grassroots tech communities, maker hubs exemplify the TP ethos by encouraging knowledge sharing, creativity, and peer-to-peer support (Bruns, 2007; Gauntlett, 2011). They illustrate how TPs can also be sites of productive activity (e.g. coding, crafting, prototyping) without losing their communal character.

Type of TPs	**Description**	**Examples**
Cultural	Spaces that facilitate creative practices and the construction of cultural identity, often in industrial wastelands, squats, or multidisciplinary projects.	Rap music, art squats, multidisciplinary projects.
Educational	Locations complementing formal education, serving as intermediaries between home and school.	Libraries, museums, virtual learning platforms
Workplace	Fragmented facilities accommodating workers, in response to the changing nature of work and gig economy; flexible working environments.	Coworking spaces, cafés, telecenters
Innovative hubs	Physical spaces where technology (but not necessarily) and innovation enthusiasts collaborate on projects, share resources, and learn from one another.	Makerspaces, hackerspaces, fablab

Table 3: Typology of Third Places (Source: Author).

It is important to note that real-world TPs frequently bridge these categories. For instance, a single venue might combine cultural and educational roles (a gallery that hosts lectures and neighborhood meetings), or serve both leisure and work functions on different days. Many TPs also involve a mix of public and private ownership or sponsorship: a city government might provide a community center space, while volunteers or entrepreneurs animate it with TPs dynamics (Levy-Waitz, 2018). The flexible use and adaptive nature of these spaces are

precisely what grant TPs their resilience and broad appeal (Jeffres, 2009). Each type, however, shares the fundamental trait of cultivating informal social interaction and community bonds in an accessible setting.

As urban social spaces diversify, scholars have begun to identify gaps in TP theory regarding green or nature-integrated community sites. Traditional TP research has largely focused on built environments (cafés, bars, malls), yet natural settings like parks or CGs can equally facilitate social cohesion. Studies show that exposure to nature in communal contexts can act as a social catalyst, strengthening neighborhood ties and well-being (Jennings, 2019; Haase, 2022). Recognizing this synergy between sociability and nature, we posit the need for a new sub-category of TPs. In the next section, we introduce the concept of NTP which merges the social functions of TPs with the ecological and restorative benefits of green spaces, a fusion exemplified by CGs as living laboratories of socio-ecological engagement.

3. NATURAL THIRD PLACES

Building on the previous discussions of CGs and TPs, we define NTP as community-managed green spaces (exemplified by CGs) that function as TPs in the Oldenburgian sense while also embedding socio-ecological values. TPs refer to informal public gathering settings separate from home and work, characterized by neutral ground, regular visitors, inclusive ambience and the fostering of community ties (Oldenburg, 1999). CGs share many of these social qualities, they are neighborhood hubs where residents gather voluntarily and informally, but they introduce a natural element into the TP concept. Integrating nature into daily communal life creates a socio-natural space that blurs the line between social and ecological systems in the city (Eizenberg, 2012). This hybrid character is central to NTPs, aligning them with socio-ecological transition goals by simultaneously fostering community and environmental stewardship (Jennings, 2019; Kingsley et al., 2019). In effect, CGs as NTPs become *"*hybrid spaces*"* of social and natural engagement, expanding the scope of traditional TP theory into the realm of urban sustainability.

Viewing CGs through a TP lens reveals both commonalities with traditional TPs and distinctive features. In conventional CGs, the primary focus is often on horticulture or food production for a defined group of members, whereas as TPs they are conceived as more open, inclusive social environments for the broader community. Table 4 below contrasts traditional CGs with CGs

understood as TPs across key dimensions (social, economic, spatial, and ecological) highlighting how the NTP framing extends the role of CGs beyond gardening.

Dimension	**Traditional CG**	**CG as TPs**
Social	Primarily engages a core group of gardeners; social interaction is a by-product of tending plots and often limited to members.	Serves as a neutral gathering ground for the wider community, fostering informal interactions, intergenerational contact, and social inclusion (Oldenburg, 1991; Firth et al., 2011). Deliberate efforts (e.g., open gates, community events) welcome diverse participants beyond the gardeners themselves, aligning with the *"*leveling" effect of TPs (Sennett, 1973).
Economic	Provides produce for personal use or local sale; economic impact is limited to gardeners' savings and small-scale surplus sharing.	Contributes to local resilience and mutual aid economies: improves food security, develops skills, and sometimes incubates micro-ventures (e.g., seed exchanges, compost co-ops) that benefit the neighborhood (Phillips, 2010; Rivas-Aceves & Schmidt, 2022). Emphasis on volunteerism and sharing exemplifies non-monetary value creation (Rosol, 2012), although heavy reliance on unpaid labor can raise concerns about sustainability and equity.
Spatial/ Governance	Often a fenced or semi-private parcel allocated for gardening; governance is informal or limited to members. Land tenure is frequently precarious (temporary leases or permissive occupancy).	Functions as an open community space integrated into the neighborhood fabric. Participatory governance is emphasized: residents co-design and co-manage the space (Petrescu et al., 2016), exemplifying co-construction of the commons. This collaborative stewardship challenges conventional property regimes by asserting a community "right to the city" (Lefebvre, 1968; Staeheli et al., 2002). Deliberate design interventions (e.g., adding benches, shade, bulletin boards) make the garden inviting as a public place rather than exclusive territory (Whyte, 1980).
Ecological/ Educational	Focus on cultivating plants and providing urban green space; environmental benefits (urban greening, biodiversity) are incidental and	Serves as a living laboratory for urban sustainability and environmental learning. Participants and visitors gain hands-on ecological education by engaging in gardening, composting, and habitat creation (Kingsley et al., 2019; Laigle, 2013). The deep human-nature connection cultivated in these spaces reinforces pro-environmental behaviors and community-based resource management

	educational aspects are informal.	(Ostrom, 1990; Eizenberg, 2012), positioning the garden as an urban commons for shared ecological stewardship.

Table 4: Key dimensions differentiating traditional community gardens from community gardens as natural third places (Source: Author).

As the table 4 suggests, conceiving CGs as NTPs broadens their purpose and audience while addressing previous conceptual gaps. Socially, a NTP emphasizes inclusivity and everyday sociability: it is "neutral ground" open to all, not only to those tending plots (Oldenburg, 1991). Empirical studies show that when CGs operate as open TPs, they can strengthen trust, social cohesion, and sense of belonging among diverse neighbors (Ohmer et al., 2009; Firth et al., 2011). At the same time, we caution against romanticizing these spaces as inherently harmonious. Like other TPs, they are not immune to exclusion or conflict. For instance, volunteer-run gardens might inadvertently cater to those with more free time or similar cultural backgrounds, potentially alienating others, a dynamic noted in critical studies of community gardening as a neoliberal strategy reliant on middle-class volunteerism (Rosol, 2012). Power imbalances can surface in decision-making, and some "community" gardens may actually reproduce social exclusivity (Eizenberg, 2012). Acknowledging these challenges, our NTP framework stresses continuous reflexivity and outreach. Garden-TPs must actively work to maintain the *"*leveling" ethos of TPs (Sennett, 1973), for example, by rotating leadership, soliciting input from underrepresented groups, and programming activities that appeal across age, class, and culture, so that they truly function as open commons rather than closed clubs.

Economically, treating CGs as TPs highlights their contributions to community resilience and local livelihoods beyond what a traditional garden model might acknowledge. These spaces provide tangible benefits like fresh produce, but equally important are the intangible assets they generate: new knowledge, social capital, and a culture of sharing (Rivas-Aceves & Schmidt, 2022). Participants collectively learn and practice resourcefulness, for example, saving seeds, bartering excess crops, or teaching each other DIY skills; which builds capacity to withstand economic or environmental stresses at the community level. Such grassroots resilience aligns with the idea of *"*resourcefulness*"* as opposed to top-down "resilience" (Derickson & MacKinnon, 2015). However, resilience is not an unqualified good: as Derickson & MacKinnon (2015) argue, simply celebrating community resilience can depoliticize hardship and shift burdens onto civil society. We therefore frame the economic dimension of NTPs as commons-based resilience (Petrescu et al., 2016), wherein communities collectively create new

economic circuits (e.g. tool libraries, seed sharing workshop) while also advocating for structural support (access to land, funding). In practice, some CGs have successfully partnered with municipalities or nonprofits (through grants, produce donations, etc.), demonstrating that NTPs can be leveraged to tackle poverty and food insecurity when linked with institutional support (Rivas-Aceves & Schmidt, 2022). The economic role of NTPs is thus twofold: they provide micro-level benefits (personal savings, entrepreneurship opportunities, job skills) and embody alternative economic principles (cooperation, commons) that challenge the purely market-driven use of urban space (Bollier, 2007).

Spatial and governance considerations are especially salient for NTPs, given that many CGs occupy contested urban spaces. Unlike purpose-built parks or plazas, CGs often emerge in vacant lots, derelict plots or other interstitial spaces not initially intended for public gathering. In Western cities, this means they frequently exist under uncertain legal conditions, for example, a CG might be tolerated on municipal land without formal protection, or operate through a short-term lease on private land (Lawson, 2005; Schmelzkopf, 1995). Recognizing a CG as a TP underscores the need to secure its tenure and integrate it into urban planning frameworks, rather than treating it as an interim use. History has shown that without legal safeguards, even long-standing community gardens can be threatened by development or municipal policy shifts (Schmelzkopf, 1995). Conflicts in New York City and elsewhere highlight how the "commons" logic of CGs (shared public benefit from idle land) often clashes with traditional property rights regimes (Staeheli et al., 2002). For instance, Blomley (2008) describes how gardeners negotiate property boundaries and challenge the notion that unused land must be commodified. NTPs thus invite innovative governance arrangements. Many cities have begun to formalize support (e.g., land trusts, garden licensing programs, participatory budgeting for community spaces) to protect such gardens as commons. Indeed, the participatory governance inherent in NTPs, where local volunteers, associations, and sometimes officials co-manage the space; exemplifies co-production of public space (Petrescu et al., 2016). This approach can institutionalize CGs as part of the urban commons without stripping them of their grassroots character. For example, some municipalities in Europe designate CGs as public amenities co-run with citizen groups, blending bottom-up and top-down governance (Eizenberg, 2012). Additionally, deliberate design and planning choices can reinforce the spatial openness of these TPs. Research on public space design shows that small interventions like transparent fencing, welcoming signage, seating areas, and visible pathways can make an enormous difference in inviting broader community use (Whyte, 1980). Our analysis found that

CGs explicitly conceived as TPs tended to incorporate such features, as opposed to gardens focused only on production which might prioritize allotment layout over social space.

The ecological and educational roles of NTPs further distinguish them from other kinds of TPs. Oldenburg's TP concept was rooted in social interaction and conviviality, largely in built settings like cafés or barber shops. CGs, by contrast, introduce an environmental dynamic: they are sites where people interact with each other and with urban nature. In NTPs, environmental stewardship and learning are explicit objectives alongside social cohesion. CGs functioning as TPs often host workshops, school visits, or public demonstrations on topics such as composting, pollinator gardening, or climate adaptation, effectively turning these sites into informal open-air classrooms (Kingsley et al., 2019). This aligns with the notion of the city as a living laboratory for sustainability transitions (Audet et al., 2019), where citizens collectively experiment with greener lifestyles and share practical ecological knowledge. Crucially, the learning that occurs in NTPs is experiential and dialogic: instead of top-down instruction, knowledge is co-produced through hands-on activities and peer exchange (Laigle, 2013). Such participatory education fosters what sociologists term ecological citizenship, as individuals develop a sense of responsibility and agency in addressing environmental issues at the local level (Wonjin et al., 2021). However, even this laudable educational aspect demands a critical perspective. We note that not all community members may have equal ability to engage with garden-based education: barriers like time, physical accessibility, or cultural relevance can limit who benefits. Successful NTPs therefore implement inclusive practices: for example, some gardens schedule events on weekends or after work hours to accommodate different work schedules, provide raised beds and path surfaces to include people with disabilities, and offer multilingual signage or programming in diverse languages to reach immigrant communities. Projects like the Art Garden Ganja[1], which combines art and ecology in Azerbaijan, or Matsegården Stigsbo[2] in Sweden, which integrates cultural activities on a farm, show how broadening the focus beyond gardening per se can draw in new participants and strengthen community buy-in.

Beyond CGs, the concept of NTPs can encompass a broader spectrum of grassroots green spaces where social and ecological objectives consciously intersect. We emphasize that NTP is a flexible category that includes, but is not limited to, CGs. For instance, occupied or reclaimed

[1] Art Garden Ganja, https://www.instagram.com/artgardenganja/?hl=en, accessed in 2025.
[2] Matsesgarden Stigsbo, https://www.visitdalarna.se/en/matsesgarden-stigsbo-korda-art-motion, accessed in 2025.

spaces known as ZADs[3] (*Zones à Défendre*, "Zones to Defend") in France exemplify radical NTPs: these are spaces where environmental protest and communal living merge, such as the famous Notre-Dame-des-Landes ZAD which evolved into a self-organized zone combining farming, education, and political activism. While more contentious than a typical urban garden, a ZAD functions as a TP for its participants (a site of solidarity, shared meals, debate, and collective experimentation) and as a manifestation of the urban (or in this case, semi-rural) commons being directly defended by citizens (McKay, 2011). Other innovative examples include participatory biology labs and "green" makerspaces (e.g., the BlueCity Lab[4] in Rotterdam or the Green Fab Lab[5] in Barcelona), which operate at the intersection of community, technology, and ecology. These labs invite residents to collaborate on sustainable technologies (like circular economy experiments or urban farming research) in a social setting, essentially creating TPs oriented around ecological innovation. They illustrate how the NTP concept can extend into domains of urban experimentation and "do-it-together" science. Even cultural venues with strong ecological components, for example, a community-run nature interpretation center or an art space focused on environmental themes, can be analyzed as NTP if they deliberately cultivate open, participatory atmospheres and connect people to nature. What unites these varied cases with CGs is a common ethos of co-creation and shared benefit: they are public-spirited, hybrid spaces managed by communities to produce both social connection and environmental value. They align with the idea of urban commons where citizens collectively manage a resource or space for mutual gain (Ostrom, 1990; Bollier, 2007). No scholarly typology TPs to date has explicitly highlighted these "socio-ecological" TPs; our contribution is to foreground them and argue for their relevance in understanding urban transformations.

CONCLUSION

This paper set out to synthesize insights from urban geography, TP theory, and socio-ecological systems to conceptualize CGs as NTP. By integrating these perspectives, we introduced a novel framework that views CGs as spaces simultaneously fostering informal social ties and environmental stewardship in cities. In doing so, we extend Oldenburg's TP concept beyond traditional venues (cafés, libraries, etc.) into the realm of urban green commons (Oldenburg, 1991). This theoretical contribution expands the *TP* literature by illuminating a socio-

[3] ZAD, https://zad.nadir.org/?lang=en, accessed in 2025.
[4] BlueCity Lab, https://www.bluecitylab.nl, accessed in 2025.
[5] Green Fab Lab, https://greenfablab.org/about/, accessed in 2025.

environmental dimension: CGs emerge as hybrid social-natural sites that nurture community cohesion **and** ecological resilience (Valentim et al, 2025). In essence, *NTP* bridge the gap between social urban infrastructure and urban sustainability transitions, offering a holistic lens to understand the role of community-driven green spaces in contemporary cities (Neville, 2020).

Findings from the structured literature review underscore that CGs indeed fulfill the dual role of social hubs and environmental assets. On the social side, CGs reduce isolation and strengthen neighborhood bonds, functioning much like classic TPs that cultivate local social capital and a sense of belonging (Ohmer et al., 2009; Poljak Istenič et al., 2023). Participants in community gardening projects often report enhanced trust, community engagement, and collective efficacy, affirming the capacity of these spaces to act as inclusive forums for informal sociability and mutual support (Valentim et al, 2025). At the same time, CGs promote eco-responsible practices and urban greening, for example, converting vacant lots into productive landscapes, encouraging composting, and supporting biodiversity. Such grassroots initiatives contribute to broader socio-ecological transitions by fostering environmental awareness and sustainable habits at the community level (Audet et al., 2019; Neville, 2020). By bridging community development and environmental stewardship, CGs exemplify *NTP* that generate co-benefits: they not only provide informal gathering places, but also serve as catalysts for urban sustainability and resilience. This synthesis of the literature reinforces our framework's premise that the social and environmental functions of CGs are deeply interwoven. It advances knowledge on *NTP* by clearly illustrating how the convivial atmosphere of a TP can be married to the greening and adaptive capacity of urban nature (Poljak Istenič et al., 2023).

Notwithstanding these contributions, we must acknowledge several limitations of our approach. First, the study relied on a *structured literature review* rather than a fully systematic or meta-analytic review. This structured approach, while suitable for exploring an emergent conceptual convergence, did not attempt an exhaustive coverage of all possible sources. Instead, it focused on integrating diverse interdisciplinary literature to build our framework. As a result, there is a risk of selection bias, and some relevant works may have been omitted. A more strictly systematic review might yield different emphases, but was beyond our scope given the exploratory, heuristic aim of this research. Second, our analysis is inherently conceptual and qualitative**:** we did not collect new empirical data or conduct fieldwork to validate the *NTP* concept. The arguments and framework proposed are grounded in existing studies and theory,

but their practical impact remains to be tested. This lack of empirical validation means our conclusions should be seen as *propositions* to inform future investigation, rather than definitive empirical generalizations. Third, the scope of our synthesis was purposefully narrowed to the socio-environmental functions of CGs, and we did not delve into important operational dimensions. For instance, issues of governance, organizational structure, and financing in CGs, which certainly influence their longevity and inclusivity, are not addressed in our review. These managerial and economic aspects (e.g. how gardens secure resources or navigate institutional support) lie outside our focus, even though they are noted in literature as significant for TPs and community spaces (Phillips, 2010). Recognizing these gaps, we concede that our conceptual framework provides only a partial view, and the NTP idea would benefit from further examination that incorporates these practical realities.

Building on these insights and limitations, we propose several directions for future research and practice**.** Empirical studies are needed to apply and test the NTP framework in varied urban contexts. Comparative case studies could investigate CGs in different cities and cultures to see how the TPs characteristics manifest across contexts, for example, contrasting Western European cases with those in postsocialist cities or the Global South (Poljak Istenič et al., 2023). Such cross-contextual research would illuminate how socio-cultural, economic, or policy differences shape the role of CGs as TPs. Another promising avenue is to explore the integration of NTPs into urban policy and planning**.** City planners and policymakers might examine ways to support CGs as part of social infrastructure and green infrastructure strategies. This includes considering CGs in urban development plans, providing institutional support or land access, and recognizing their contributions to public health and climate resilience. Prior work has suggested bringing food and gardening spaces onto the urban policy agenda (Pothukuchi & Kaufman, 1999), and our framework reinforces that idea with a socio-ecological twist. Future research could evaluate existing policy models (for instance, municipal CGs programs or urban agriculture ordinances) to identify how embracing the TP concept might enhance community engagement and sustainability outcomes. Additionally, scholars may extend the concept of NTP beyond CGs to other types of green commons or hybrid spaces (e.g. urban farms, pocket parks, or green coworking hubs), assessing whether similar social-environmental dynamics occur there. Finally, addressing the noted gaps, further studies should examine the organizational and financial dimensions of CGs as community spaces, for example, how management practices or funding models impact their social inclusivity and ecological functionality. Such inquiries would not only strengthen the theoretical model but also provide

practical guidance for communities and organizations seeking to establish or sustain these gardens.

In conclusion, conceptualizing CGs as NTPs offers a richer understanding of how informal public spaces and nature intersect to support urban life. This article has advanced the discourse by clearly articulating the socio-environmental significance of CGs, showing that they are more than leisure or aesthetic amenities, but key nodes of social interaction, cultural expression, and ecological learning in the city. By naming and framing CGs as NTPs, we invite urban geographers, sociologists, and planners to recognize these sites as integral to the urban fabric: places where community bonds and environmental stewardship coalesce. This perspective paves the way for more nuanced research and action on urban sustainability. Ultimately, embracing the concept of NTPs can help scholars and practitioners alike to reimagine and leverage CGs as catalysts for more inclusive, resilient, and sustainable urban futures.

STATEMENTS

Disclosure of interest statement

The author declares no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Data availability statement

No new data were created or analyzed in this study. Data sharing is not applicable to this article.

Funding statement

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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Paper 2:

Téoule, F. (2025). E-participation in mapping and typology development: community gardens in Krakow and Brussels. *Planning Practice & Research*, 1-25. https://doi.org/10.1080/02697459.2025.2547215.

Status: Published.

E-participation in mapping and typology development: Community gardens in Krakow and Brussels

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Abstract
This study investigates the emergence, governance, spatial distribution, and multifunctional roles of community gardens in Krakow and Brussels using a multi-method, participatory approach. By integrating digital participatory mapping, surveys, and qualitative interviews, the research develops a typology that categorizes community gardens based on their emergence reasons, governance models, location characteristics, and socio-ecological functions. The study highlights the adaptive and context-specific nature of community gardens, emphasizing the influence of local socio-political contexts, governance structures, and demographic factors on their development.
E-participatory mapping proved essential in resolving discrepancies between official records and on-the-ground realities, capturing dynamic changes and user-driven modifications in community garden locations and functions. Among the key findings, the study reveals that in Brussels, bottom-up governance models dominate but often face sustainability challenges, while in Krakow, hybrid models involving municipal support are more common. Spatially, gardens in Brussels cluster in medium to high-density, lower-income areas. In Krakow, they are concentrated in high-density neighborhoods with diverse housing typologies.
The typology not only provides a conceptual framework for understanding community gardens but also serves as a practical tool for urban planners and policymakers to prioritize case studies, allocate resources, and design targeted interventions.
This research contributes to participatory urban planning by demonstrating how local knowledge can be harnessed to develop sustainable green spaces tailored to diverse urban contexts. By addressing gaps in typology development and participatory mapping methodologies, the study offers valuable insights into how community gardens can be integrated into resilient urban development strategies.

Keywords
Community gardens, Digital participatory mapping, Urban typologies, Socio-ecological transitions, Europe.

1. INTRODUCTION

Contemporary cities face increasing pressures due to rapid urbanization, land-use conflicts, and shifting socio-economic dynamics (Han et al., 2018). As space becomes limited and populations grow, issues like food security, social equity, environmental sustainability, and public health converge, creating complex challenges in urban environments (Roberts & Shackleton, 2018). Within this context, community gardens (CGs), often developed as grassroots initiatives aimed at addressing a range of interconnected urban concerns (Senes et al., 2016). While CGs are often lauded for their manifold benefits, significant gaps persist in understanding how governance frameworks, cultural heritage, and spatial planning intricately shape their emergence and management. This study advances beyond existing literature by offering a direct comparative analysis of CGs in a Western European city (Brussels) and a post-socialist city (Krakow), highlighting how socio-political legacies and urban development trajectories differently influence CG formation, governance, and spatial patterns. Moreover, the role of digital participatory mapping remains underexplored, particularly in its capacity to enhance spatial accuracy and stakeholder engagement. In this study, digital participatory mapping is defined as a collaborative cartographic approach that enables residents and stakeholders to contribute spatial data and contextual insights via digital platforms (Cochrane & Corbett, 2020). Addressing these knowledge gaps is essential for informing urban planning policies that aim for long-term community resilience and inclusive urban development.

The evolution of CGs in different urban contexts reflects varied socio-political, cultural, and spatial influences. In Western Europe, cities like Brussels have witnessed CGs flourish primarily through grassroots environmental activism, aligning with formal sustainability agendas (Cahn et al. 2018, Mercier, 2018). Conversely, post-socialist cities such as Krakow

exhibit a reorientation of traditional allotment gardens, influenced by heritage conservation and urban redevelopment processes (Mokras-Grabowska, 2020; Tomczyk & Basińska, 2022). Despite these contextual differences, both cities present opportunities to investigate how digital participatory mapping can serve as a methodological tool for fostering inclusive urban planning. This study thus engages with existing literature to critically assess the methodological, socio-spatial, and governance aspects of CGs, ensuring a nuanced, context-sensitive understanding of these urban phenomena.

To develop a robust typology of CGs, insights from existing literature on urban agriculture and sustainability were instrumental. This typology is structured around four interrelated dimensions that capture the socio-spatial diversity and adaptive nature of community gardens. First, emergence reasons reflect motivations such as environmental concerns, social inclusion, food security, and cultural or economic drivers, which vary according to local socio-political contexts. Second, governance structures encompass top-down, bottom-up, and hybrid models, illustrating the diverse forms of stakeholder engagement and institutional support shaping CG operations. Third, location factors address spatial distribution, accessibility, and integration with broader urban planning strategies, revealing how physical settings influence the functions and sustainability of CGs. Lastly, functions encompass multiple roles, including food production, environmental stewardship, education, and social integration, highlighting the multifunctional contributions of CGs to urban resilience. By clearly operationalizing these dimensions, the typology not only synthesizes existing literature but also provides a novel framework for comparative analysis across divergent urban contexts.

By comparing these two cities, this research aims to: (1) examine how digital participatory mapping, as both a methodological and empowerment tool, enhances spatial understanding and stakeholder engagement; (2) build a comparative typology that reflects the socio-spatial diversity, governance models, and adaptive functional of CGs in contrasting contexts; and (3) examine how governance frameworks, spatial planning, and cultural heritage influence the emergence and management of CGs. The study's findings will provide actionable recommendations for integrating CGs into broader urban planning frameworks. These recommendations aim to help urban policymakers, planners, and community organizations design CG projects that support social inclusion, environmental sustainability, and long-term community resilience.

2. LITEERATURE REVIEW

The evolution of CGs provides valuable context for understanding their current roles. European gardening traditions, particularly allotment gardens, have long contributed to urban resilience by supporting food production and recreational needs. However, these traditions vary across the continent due to diverse geographical, historical, social, cultural, economic, and political contexts. For example, Poland and Belgium, two countries from which the case studies in this paper are drawn, exemplify distinct approaches to urban gardening. In both contexts, allotment gardens emerged as early responses to food insecurity and industrial urbanization, particularly gaining traction in the early 20th century. However, it was after WWII and especially during the post-socialist transformation in Poland that major divergences occurred (Bell et al., 2016, Bellows, 2010). In Poland, Rodzinne Ogrody Działkowe (Family Allotment Gardens) were established during the interwar period to address food shortages and offered green recreational spaces amid rapid urbanization (Mokras-Grabowska, 2020). These roles became even more pronounced during the communist period. Following the systemic transformation of 1989, the function of these

spaces shifted significantly from subsistence gardening to more multifunctional uses, including leisure, ecological education, and civic engagement (Bellows, 2010; Bell et al., 2016). More recently, a growing body of scholars has begun to examine the rise of CGs in post-socialist Poland. These CGs, distinct from traditional allotments, have emerged primarily since the 2010s and are often associated with grassroots environmental activism, participatory governance, and urban regeneration projects (Barszczewska-Woszczyk, 2020; Maćkiewicz & Jeziorek, 2024). For instance, studies in Warsaw, Krakow, and Poznań highlight the role of CGs in fostering social cohesion, offering inclusive green infrastructure, and responding to the densification of post-socialist housing estates (Wojcieszak-Zbierska, 2024; Rancew-Sikora et al., 2025). These works emphasize that CGs in Poland are shaped not only by civic initiative but also by partnerships with cultural institutions and local governments, often operating in tension between bottom-up ideals and top-down frameworks (Maćkiewicz & Jeziorek, 2024). In Belgium, early 20th-century philanthropic gardening efforts aimed to alleviate poverty and improve public health, forming the foundation for contemporary CG movements in Brussels (Cahn et al. 2018, Mercier, 2018). The evolution of community gardens there was later reinforced by environmental movements and migrant-led initiatives, especially from the late 1990s onwards (Certomà & Notteboom, 2015).

For clarity, this study defines allotment gardens as formally regulated parcels of land allocated to individuals or families for food cultivation, often supported by national or municipal frameworks. In contrast, CGs refer to collectively managed urban spaces where diverse stakeholders collaborate on cultivation, social interaction, and environmental stewardship, usually with an emphasis on shared governance, education, and inclusivity (Guitart et al., 2012; Bell et al., 2016; Kwartnik-Pruc & Droj, 2023). These conceptual

distinctions are key in understanding both the governance models and the spatial logic of urban gardening.

Meanwhile, in North America, CGs emerged in response to urban poverty and food insecurity in the late 19th century, experiencing renewed momentum in the 1970s due to rising environmental activism and community-based efforts (Lawson, 2005). These different historical trajectories reflect the influence of local socio-political factors and highlight the need for comparative studies to understand how CGs are established and adapted across regions (Fox-Kämper et al., 2017; Djokić et al., 2018).

Although previous studies highlight CGs' ability to foster social cohesion, environmental awareness, and local food security (Blair, 2009; Hagey et al., 2013; Wakefield et al., 2007; Langemeyer et al., 2017), knowledge gaps remain. Many studies focus on the benefits of CGs but offer limited insight into how governance structures, property rights, and cultural values influence their spatial distribution and sustainability in urban planning contexts (Fox-Kämper et al., 2017; Deep, 2023). Several recent publications explicitly address CG development in post-socialist cities, highlighting how post-communist transitions have shaped civic engagement, land-use policy, and institutional relationships in urban gardening (Škamlová et al., 2020; Slavuj Borčić et al., 2016). These works emphasize region-specific constraints, such as weak tenure security, inconsistent municipal support, and contested public space, that distinguish the CG experience in Central and Eastern Europe (CEE) from its Western counterparts. This study addresses a knowledge gap (Miles, 2017) by investigating CG typologies in two distinct national contexts, post-socialist Krakow and Western European Brussels, uncovering patterns that are underexplored in comparative studies.

In terms of methodological approaches in urban studies, participatory mapping has emerged as a powerful tool for incorporating community-driven knowledge into urban planning, spatial analysis, and decision-making processes (Cochrane & Corbett 2020, 2006; Narbaitz Sarsura, 2024). It enables stakeholders, including local residents, to map and identify key spatial issues such as access to public spaces, resource distribution, and community assets (Laituri et al., 2023). In particular, **e**-participatory mapping has gained prominence as digital tools and Geographic Information Systems (GIS) facilitate broader participation and data collection in urban planning, disaster management, and neighborhood regeneration (Pánek 2018; Rawat &Yusuf, 2020). By engaging diverse participants, including marginalized groups, e-participatory mapping ensures more inclusive planning outcomes and fosters spatial accuracy (Weyer et al. 2019, Akmentina, 2022). However, despite its extensive use in urban planning, its application in urban agriculture and CG research remains limited (Ramos et al., 2019; Codato et al., 2024; Gemperle; 2024). Studies in urban farming contexts often focus on traditional participatory techniques such as in-person workshops or interviews, with few employing digital mappings to integrate community perspectives systematically (Guitart et al., 2012).

This study addresses this methodological gap (Miles, 2017) by applying e-participatory mapping to CG research, specifically engaging CG practitioners: users with unique hands-on knowledge of land use, social interactions, and local environmental management. Unlike general participatory mapping, which typically involves non-specialized community members, this approach draws on the expertise of CG practitioners to enrich spatial data. By combining e-participatory mapping with complementary methods, including desk research, surveys, and semi-structured interviews, this research evaluates the effectiveness of this approach in capturing dynamic spatial and functional data about CGs. Furthermore, this

method assesses whether digital mapping, when used alongside other techniques, improves spatial accuracy and fosters stakeholder engagement in CG planning and development.

Finally, typologies of CGs are another key focus of this study. Research has highlighted CGs' multifunctional roles in addressing food security (Hagey et al., 2013), promoting environmental education (Blair, 2009), fostering social cohesion (Wakefield et al., 2007), and mitigating urban challenges such as the heat island effect (Langemeyer et al., 2017). CGs also contribute to local economies by supporting small-scale food production and neighborhood revitalization (Burley et al., 2011). Existing typologies typically classify CGs based on governance models, garden size, or primary functions (Bell et al., 2016; Firth et al., 2011, Guitart et al., 2012). However, these frameworks often lack a cross-regional dimension, particularly in the context of comparative studies between post-socialist cities in CEE and Western European cities. As such, this study addresses a population gap (Miles, 2017) by comparing CG typologies between Krakow and Brussels, analyzing how governance models, socio-political contexts, and location-specific drivers influence CG development and operation.

Drawing on theoretical and empirical insights, the typology framework used in this study examines four key dimensions:

- Emergence reasons: Understanding why CGs are established is essential for grasping their evolving roles in urban environments. Motivations can range from addressing environmental concerns, such as biodiversity preservation and climate resilience, to fulfilling social needs like community building and providing accessible green spaces (Veen et al. 2015; Kingsley et al., 2019). In some cases, food security and economic drivers also play significant roles, especially in lower-income

neighborhoods where fresh produce may be scarce (Burley et al., 2011). The initial motivations behind CG creation influence their design, stakeholder involvement, and long-term sustainability.

- Governance structures: Governance models critically impact how CGs are managed, sustained, and integrated into broader urban planning frameworks. These structures can range from top-down municipal programs, where city authorities lead garden development, to bottom-up community initiatives driven by local residents (Zhang et al., 2022; Faehnle, 2014, Derlukiewicz et al. 2021). Hybrid models that combine both approaches also exist, allowing for shared decision-making and resource allocation (Beavin et al., 2022). Analyzing governance structures provides insights into power dynamics, stakeholder responsibilities, and the level of community engagement.
- Location factors: The spatial distribution of CGs significantly influences their accessibility, functions, and alignment with urban development goals (Fox-Kämper et al., 2017; Benis et al., 2018). Factors such as proximity to residential areas, availability of underutilized land, and integration within existing green networks affect the role CGs play in urban ecosystems. In dense urban settings like Brussels, CGs may occupy unconventional spaces such as rooftops or courtyards.
- Functions: CGs serve multiple, evolving roles that extend beyond their original purposes. Many gardens promote food production and environmental stewardship through biodiversity conservation and pollution mitigation (Wakefield et al., 2007; Langemeyer et al., 2017). Social integration is another critical function, as CGs provide spaces for community interaction, cultural expression, and educational activities (Corkery, 2004; Lloyd & Paige, 2022). In some cases, CGs support artistic or political activities, reflecting broader social movements or community identities

(Salwa, 2022). By examining the diverse functions of CGs, this study reveals how these spaces adapt to changing community needs and environmental challenges.

These typologies aim to provide a comprehensive framework that not only captures the socio-spatial diversity of CGs but also highlights their adaptive roles in response to evolving urban challenges. However, given the diversity of CG development across different contexts, further refinement of these typologies is necessary, as certain dimensions, particularly related to post-socialist transitions, remain underdeveloped in the literature.

This study's comparative approach is well-suited to uncovering these gaps, identified above. By analyzing CGs in Krakow, a post-socialist city with a strong allotment garden tradition undergoing redefinition amid urban growth and heritage preservation (Mokras-Grabowska, 2020; Tomczyk & Basińska, 2022), and Brussels, a multicultural Western European city driven by grassroots environmental activism (Cahn et al. 2018, Mercier, 2018), the research examines how socio-political and historical contexts shape CG emergence, governance, and sustainability.

By comparing these two cities, this research aims thus to:

- Assess the effectiveness of digital participatory mapping in improving spatial accuracy and fostering stakeholder engagement.
- Develop a comparative typology of CGs, highlighting their socio-spatial diversity, governance models, and multifunctional contributions.
- Examine how governance frameworks, spatial planning, and cultural heritage influence the emergence and management of CGs.

The study's findings will provide actionable recommendations for integrating CGs into broader urban planning frameworks. They aim to help urban policymakers, planners, and community organizations design CG projects that support social inclusion, environmental sustainability, and long-term community resilience.

3. RESEARCH DESIGN

This study employed a mixed-methods approach to investigate the spatial distribution, governance structures, and multifunctional roles of CGs in Krakow and Brussels. Combining desk research, surveys, participatory mapping, field observations, and semi-structured interviews, the methodology reconciled inconsistencies in official records, engaged local stakeholders in data validation, and generated both quantitative and qualitative insights. These methods were carefully selected and iteratively refined to meet the study's objectives, following established practices in urban research (Creswell, 2014; Bryman, 2016). The iterative nature of the research, illustrated in Figure 1, reflects the feedback loops between stages, ensuring data accuracy and contextual depth while accommodating the evolving nature of CGs. To address potential biases associated with low survey response rates, additional qualitative interviews and iterative mapping consultations were used as mitigation strategies to validate and enrich the data.

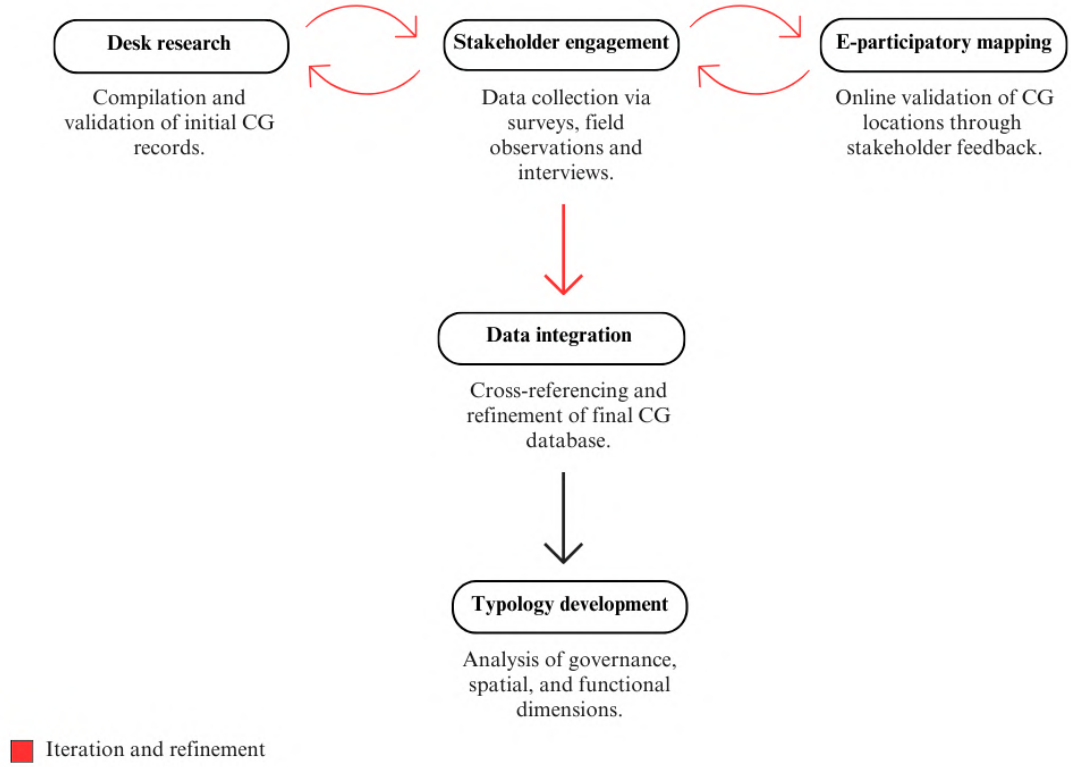

Figure 1: Iterative methodology cycle for understanding community gardens in Krakow and Brussels (author, 2025)

3.1. Desk research and preliminary CGs identification

The research began with desk-based reviews of official records and supplementary sources to compile an initial inventory of CGs in both cities. In Krakow, primary data were retrieved from the municipal website of Zarząd Zieleni Miejskiej (ZZM), which listed 19 active gardens (ZZM Krakow, 2024). This dataset was cross-referenced with local news articles, neighborhood association records, and social media platforms maintained by gardening groups (e.g Wyborcza.pl, 2023). Similarly, in Brussels, the initial database was drawn from Environnement.brussels and supplemented by district-level registers, listing 204 gardens

updated in 2018[6] (environnement.brussels) and expert-developed map from 2012 (nobohan.be)[7].

Initial comparisons revealed inconsistencies: figures ranged from 16 to 20 gardens in Krakow and from 176 to 204 in Brussels. To resolve these discrepancies, we engaged in a validation exercise by cross-referencing official records with data from local NGOs, informal community networks, and direct consultations with garden coordinators. In Krakow, where data collection concluded in February 2024, one site was confirmed inactive, and another one was classified as allotment garden, reducing the final operational count to 17. In Brussels, data collection ended in December 2023, during which we confirmed that four gardens were under development, and two were recently closed, resulting in 198 active sites. Stakeholder follow-ups addressed cases where gardens remained listed despite their closure, ensuring that the dataset was accurate and current.

Additionally, during the desk research phase, a comprehensive dataset was compiled for each identified community garden, encompassing the following information: Geographical coordinates, Name, Contact information, Location, District name and type (e.g., center, suburb), including demographic variables, Position (e.g., rooftop, park, courtyard, wasteland), Area (in square meters), Year of establishment, Operational status since 2013 (closed: Yes or No), Ownership type (e.g., municipality, lender, housing community,

[6] The environmental map of Brussels used in this study is available online and can be accessed through Brussels Environment's interactive map platform (2018): https://geodata.environnement.brussels/client/view/9c49fffb-1a01-4b15-954e-9c8bc9558216.

[7] The map of community gardens in Brussels can be accessed online via the interactive platform provided by Nobohan (2012): https://www.nobohan.be/webmaps/potagers/map.html.

common), Involved parties (e.g., schools, municipality, social entrepreneurs, citizens), Practitioners (e.g., producer, citizen, activist, consumer, entrepreneur, volunteer), Accessibility (e.g., open, closed, opening hours), Perceived as temporary (Yes or No), Functions (e.g., cultivation, recreation, education, therapy, artistic, socialization/integration), Facilities (e.g., compost, greenhouse, water source, eco-hotel, fences, gate, tool shed), Governance structure (e.g., top-down, bottom-up), Land use status (e.g., illegal, legal, building zone), Emergence reasons (motivations). This detailed dataset provided a foundational understanding of each garden's characteristics, informing subsequent phases of the research.

3.2 Survey design and administration

Following the desk research, structured surveys were distributed to individuals or groups responsible for overseeing each garden. The survey included 18 questions designed to gather data on garden size, governance structures, funding mechanisms, primary functions, and challenges (Table 1). The questions were tailored to reflect collective operational realities rather than individual opinions, aligning with the participatory nature of the research.

Category	Survey questions
General information	1. What is the name of your community garden?
	2. Who created your community garden and when?
	3. Who currently manages your community garden?
	4. Why was your community garden created?
	5. What is its location? (Provide the full address, including postal code)
Spatial characteristics	6. Where is it situated? (e.g. wasteland, in a courtyard, on rooftops, etc.)
	7. What is its surface area? (in square metres)
Land ownership and support	8. Who owns the land? (e.g. private owner, public, association, etc.)
	9. Has your garden received any subsidies? (e.g., municipal financial support)
	10. Have you collaborated with other community gardens or participated in similar initiatives or events?
Accessibility and users	11. Is your garden accessible and open to everyone? (e.g., Yes, but only from 10 AM to 10 PM)
	12. Who has access to the garden? (e.g. gardeners, citizens, students, etc.)
	13. How many people visit the garden? (e.g., 20 per day, 20 per week)
Garden activities and features	14. What activities take place in the garden? (e.g. art workshops, educational workshops, gardening, etc.)
	15. What features can be found in your community garden? (e.g. raised beds, open soil, water collectors, etc.)
Challenges and future plans	16. Have you encountered any issues during the creation or maintenance of your garden?
	17. Do you perceive the community garden as a temporary space?
	18. What are your future plans for the community garden?

Table 1: Surveys questions used for the study (author, 2023)

To improve response rates, surveys were administered in Polish (Krakow) and French (Brussels). In Krakow, 17 verified gardens received the survey, with 6 complete responses returned (a 35% response rate). In Brussels, surveys were sent to representatives of 198 gardens, yielding 55 submissions, 40 of which were complete (a 20% effective response rate after accounting for duplicates and partial responses). While these rates are typical of participatory urban research (Cochrane, 2020), we acknowledge this limitation and

addressed it by conducting complementary fieldwork and follow-up interviews. The responses provided sufficient diversity to identify common patterns in governance, spatial characteristics, and community challenges across both cities.

Survey data directly informed the next research stages. Responses regarding garden size, user numbers, and organizational structures guided the participatory mapping phase, while governance and funding insights contextualized field observations and semi-structured interviews.

3.3. E-participatory mapping

The participatory mapping phase was conducted online, making use of e-participatory mapping method that allowed stakeholders to contribute remotely. This approach aligns with established principles of participatory mapping, emphasizing community collaboration while leveraging digital tools for spatial representation and stakeholder feedback (Rawat & Yusuf, 2020). We used the open-source Umap platform, based on Leaflet.js, which allowed participants to annotate spatial data directly via an interactive interface accessible without login or special software. The tool is mobile-friendly and respects GDPR by avoiding IP tracking.

Participants, particularly those who had completed the survey, were invited to review and annotate maps online. They provided corrections, clarifications, and updates about other CGs to ensure the spatial data accurately reflected active gardens. Iterative feedback was a key feature of this process. For example, stakeholders highlighted issues such as gardens that had been decommissioned or newly established sites that had not been captured in the initial records. One Brussels organizer commented, "*We realized our collective actually*

manages multiple plots, not just the single site listed," highlighting how group discussions and digital review clarified organizational boundaries.

In Krakow, initial records included allotment gardens, some of which were later reclassified based on stakeholder input. In Brussels, participants confirmed the closure of two gardens listed as active in official documents and identified four under development. The final maps integrated this feedback, producing a dynamic and up-to-date representation of CGs, reflecting their evolving nature and user-driven modifications.

To ensure ethical standards, informed consent was obtained at the beginning of all survey and mapping communications. Mapping contributors were informed of the non-commercial research purpose and the anonymized nature of their input. No personally identifiable information was published, and all digital participation was voluntary.

This e-participatory mapping process proved essential for bridging gaps in desk research, resolving inconsistencies, and ensuring that the spatial data captured nuanced on-the-ground realities.

3.4. Field observations and semi-structured interviews

Field observations and semi-structured interviews provided qualitative depth to the quantitative and spatial data. Site visits focused on physical layouts, accessibility, community interactions, and infrastructure, revealing features often omitted from official documentation, such as informal gathering areas, shared tool storage, and on-site composting.

A total of eleven semi-structured interviews, seven in Brussels and four in Krakow, were conducted with garden coordinators, practitioners, and representatives of municipal or green management organizations. In Brussels, interviews included members of Collectif Ipé, local NGO, who provided insights into the citywide coordination of community-led green spaces. In Krakow, In Krakow, interviews were conducted not only with community garden organizers but also with managers of allotment gardens, as these spaces remain highly visible and relevant in the city's post-socialist urban green infrastructure. The inclusion of allotment managers aimed to contextualize the transition and coexistence between historical allotment systems and emerging community gardens, offering comparative insight into governance models, land-use conflicts, and cultural perceptions of urban gardening.

Interview questions were partially derived from survey responses to maintain consistency while allowing for the exploration of emergent themes. Topics included governance models, funding challenges, volunteer coordination, and land-use negotiations with municipal authorities. Although efforts to engage municipal officials were limited, practitioners' insights effectively bridged this gap by highlighting discrepancies between policy intentions and on-the-ground realities.

3.5. Data integration and analysis

The final phase of the methodology involved integrating data from desk research, surveys, e-participatory mapping, field observations, and interviews into a unified case-study database (Bryman, 2016). Cross-referencing and triangulating findings helped resolve

discrepancies. For example, when survey responses diverged from official records, follow-up inquiries clarified inconsistencies.

To develop a robust typology of CGs, insights from existing literature on urban agriculture and sustainability were instrumental; focusing on four key dimensions: (1) emergence reasons, including environmental concerns, social needs, and cultural or economic drivers; (2) governance structures, encompassing top-down, bottom-up, and hybrid models; (3) location factors, such as spatial distribution, accessibility, and alignment with urban planning goals; and (4) functions, covering food production, environmental stewardship, and social integration. This typology provides a comprehensive and context-sensitive framework to capture the diversity of CG development and operational models in different urban settings. By integrating empirical data and theoretical insights, the typology aids in understanding CGs as dynamic interventions that adapt to shifting socio-ecological demands and governance arrangements, contributing to practical urban planning and policy recommendations.

4. FINDINGS

4.1. Spatial distribution and participatory mapping analysis

The spatial distribution of CGs in Krakow and Brussels reveals how historical development, socio-economic dynamics, and urban planning strategies shape their establishment and evolution. By integrating e-participatory mapping with quantitative spatial data, this study refined official datasets, identified discrepancies, and captured essential details about CG locations and their multifunctional roles. This iterative mapping process not only enhanced spatial accuracy but also fostered stakeholder engagement by incorporating local

practitioners' knowledge. The mapping outcomes are central to understanding the emergence of CGs, their socio-spatial diversity, and their role in broader urban contexts.

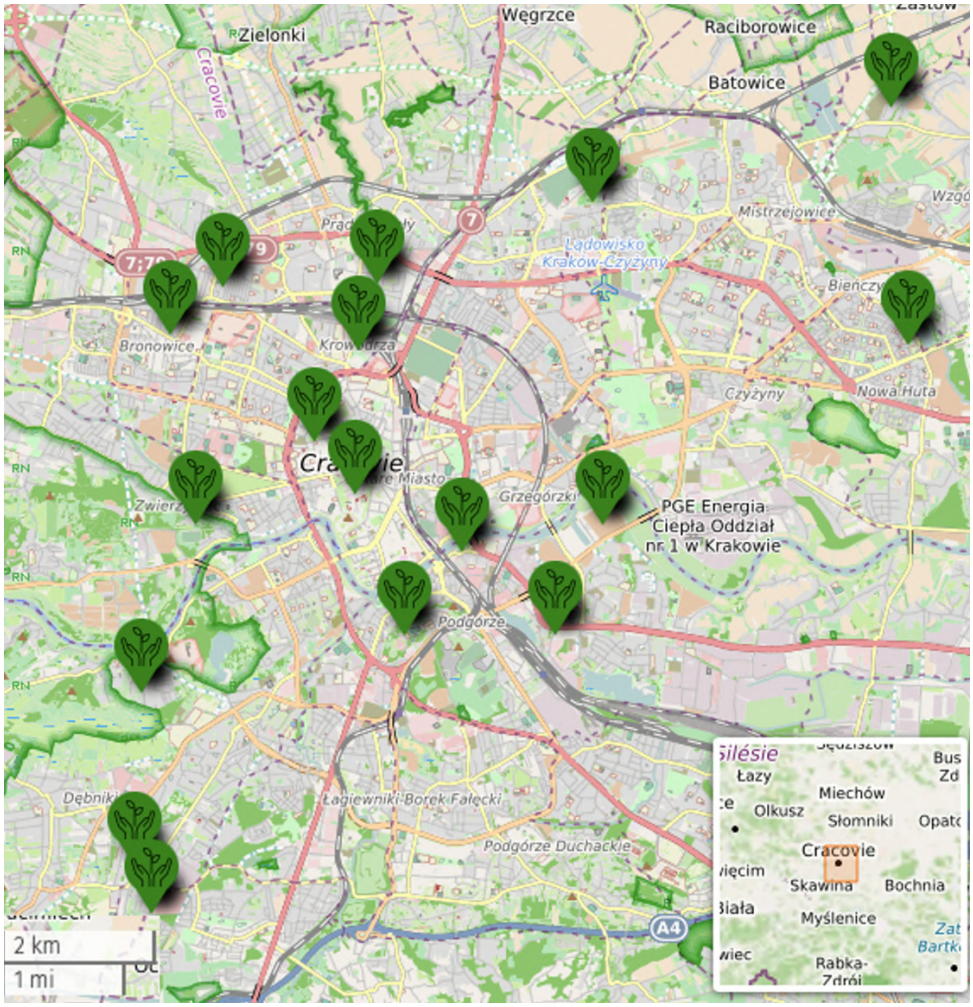

Figure 2. View of online tool used for e-participatory mapping of community gardens in Krakow (Source: Own study[8], 2024)

[8] Interactive participatory maps of community gardens in Brussels and Krakow were developed using Umap, an open-source tool based on OpenStreetMap. These publicly accessible maps support the spatial analysis of governance models and stakeholder engagement. The map of Krakow is accessible at http://u.osmfr.org/m/882202/

In Krakow, the digital participatory mapping validated the existence of 17 active CGs after correcting two misclassified sites from initial records (Figure 2). Many of these gardens emerged from the reorientation of traditional allotment garden practices, evolving into contemporary community gardens that integrate nature into urban settings.

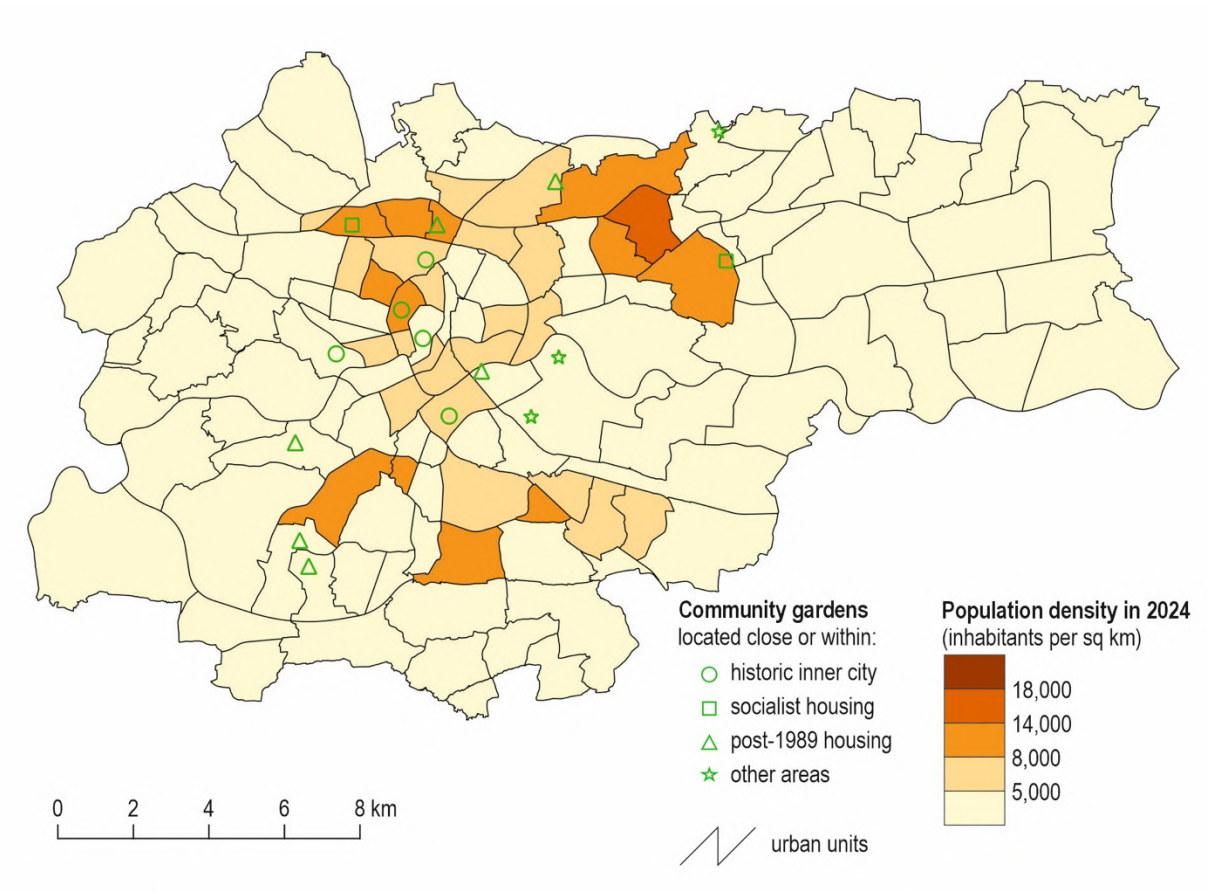

Figure 3: Spatial distribution of community gardens in Krakow by population density and housing typology

(Population density by hexagon (inhabitants per km²) and CG location by urban area type: historic inner city, socialist housing, post-1989 housing, and other zones.)

(Source: Own study based on Krakow Urban System of Spatial Information, 2025. Urban System of Spatial Information[9],)

[9] Accessed in October 2024 at https://msip.krakow.pl/

These CGs are distributed across three key urban contexts: historic inner-city neighborhoods, socialist-era housing estates and post-1989 housing developments (Figure 3). Four CGs within Krakow's dense historic core (e.g., Salwator CG) operate in areas where heritage conservation intersects with urban growth. These CGs have adapted over time, transitioning from food production spaces to multifunctional hubs offering social, educational, and cultural programs. In post-1989 urbanised areas, CGs like Macierzanki or Pychogród, address a lack of green spaces resulting from rapid housing development. They often serve as hubs for neighborhood interactions, reflecting residents' grassroots responses to urban expansion. Conversely, CGs in socialist era, in neighborhoods such as Nowa Huta, CGs like Teatralny CG, housing estates occupy repurposed communal spaces initially planned under centralized state control. These gardens represent a shift toward locally driven initiatives, where residents reclaim underutilized land for community-oriented uses.

Most CGs are concentrated near high-density residential zones (Figure 3), aligning with Krakow's strategy of integrating green infrastructure into its urban regeneration efforts (ZZM, 2024). This distribution demonstrates how CGs serve as tools for addressing urban renewal and promoting sustainable community engagement. Unlike in Brussels, where income distribution data were available for analysis, such detailed socio-economic data for Krakow were unavailable, limiting the ability to directly assess how CG locations correlate with income levels. However, the spatial placement of CGs near key residential areas suggests their role in catering to diverse urban communities and supporting inclusive urban development.

Figure 4: View of online tool used for e-participatory mapping of community gardens in Brussels (Source: Own study[10], 2024)

In Brussels, the initial listing of 204 CGs was refined to 198 thanks to digital participatory mapping, which identified six inactive or under-development sites (Figure 4).

CGs in Brussels are distributed across neighborhoods with varying socio-economic profiles, reflecting their responsiveness to local community needs (Figure 5). In lower-income districts, CGs address food insecurity, mitigate social isolation, and foster community building. One practitioner emphasized that "*the garden brings neighbors together in a building where many live alone*," highlighting the role of CGs in creating inclusive, shared spaces.

[10] The digital participative map of Brussels is accessible at http://u.osmfr.org/m/860548/

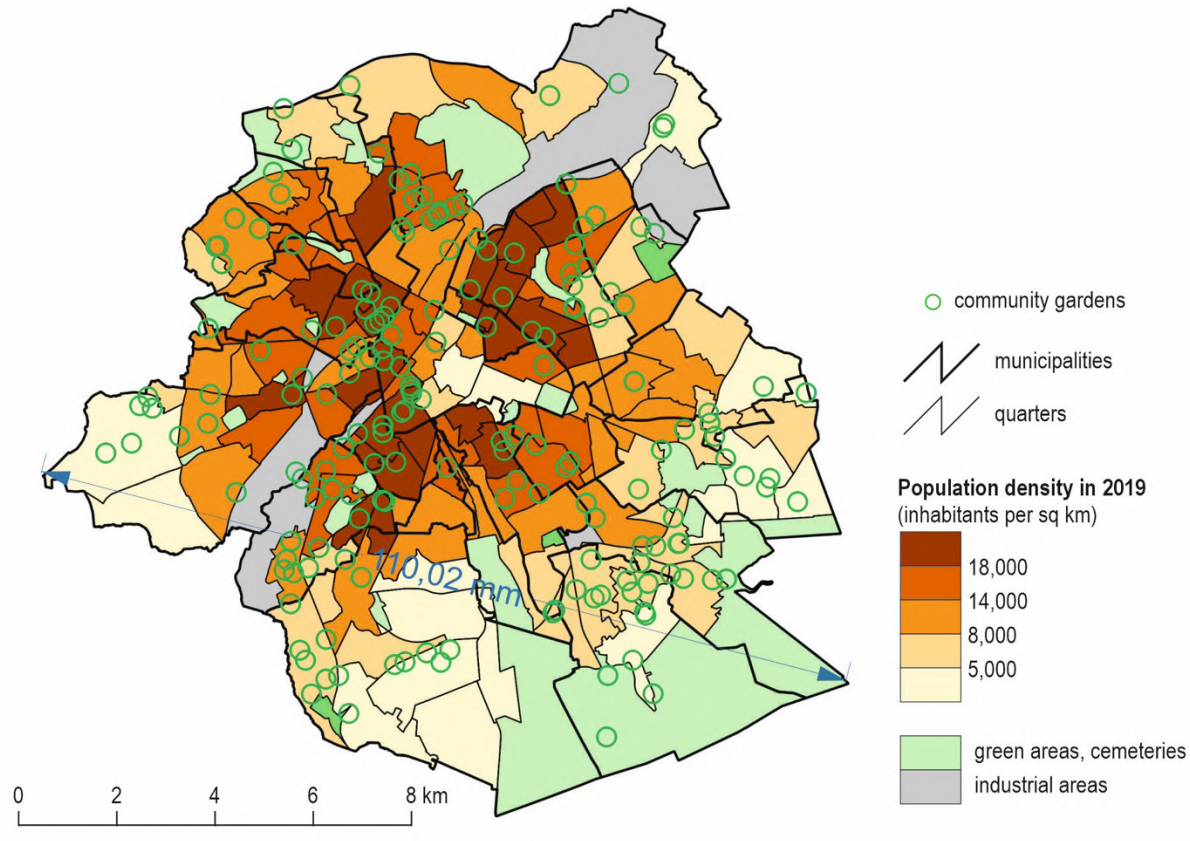

Figure 5: Spatial distribution of community gardens in Brussels by population density (*Population density by quarter in inhabitants per km². Community garden locations overlaid. Green and industrial areas shown for reference.)*

(Source: Own study based on Monitoring des Quartiers[11], 2025)

[11] Accessed in October 2024, https://monitoringdesquartiers.brussels/

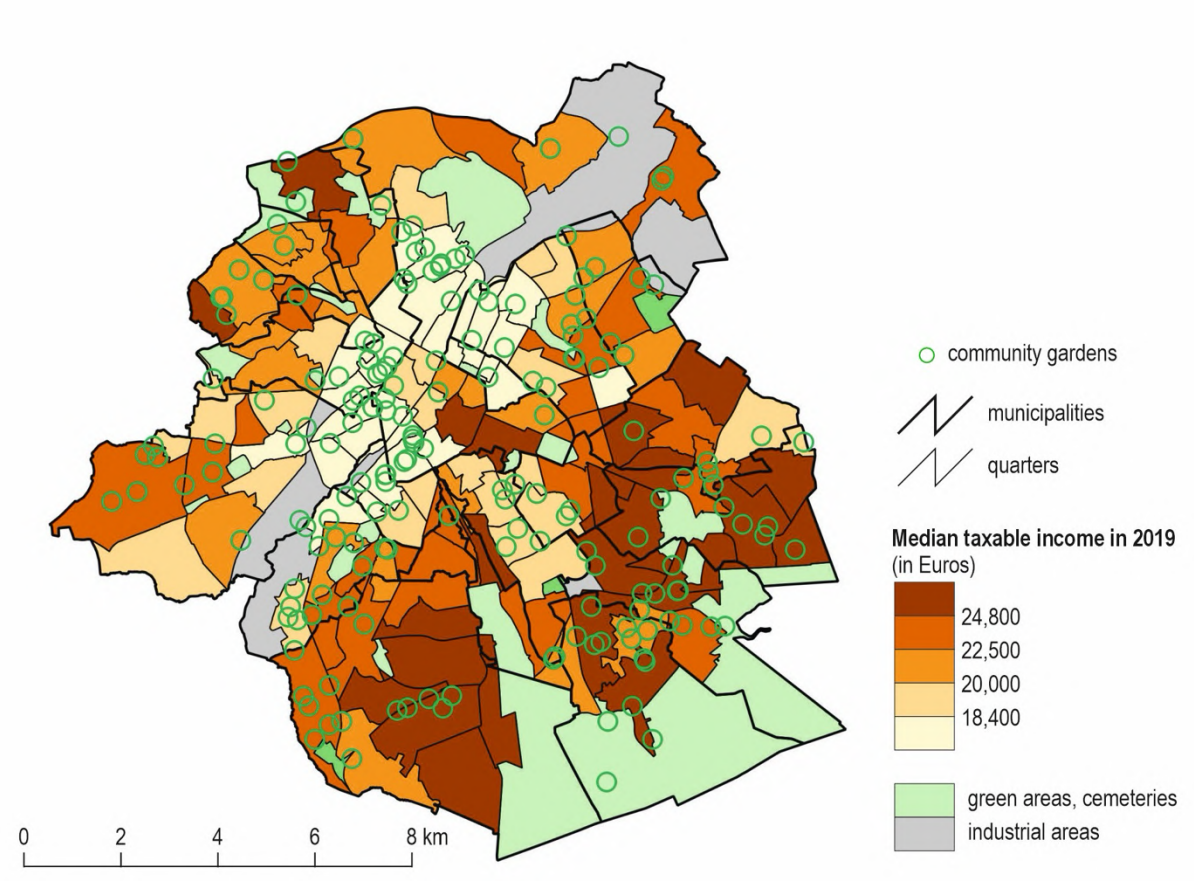

Figure 6: Spatial distribution of community gardens in Brussels by median taxable income (*Median taxable income by quarter in Euros. Community garden locations overlaid. Green and industrial areas shown for reference).*

(Source: Own study based on Monitoring des Quartiers[12], 2025)

[12] Accessed in October 2024, https://monitoringdesquartiers.brussels/

In wealthier areas, CGs focus more on educational and recreational activities, such as biodiversity workshops and sustainable gardening programs. These spaces often collaborate with schools and local organizations, demonstrating the city's tradition of using community gardens to support broader educational and ecological goals. Figure 6 depicts how CGs cluster in high-density, mixed-income neighborhoods, showcasing their multifunctional nature and adaptability. This uncovers important distinctions between single-purpose food production sites and multi-use hubs that combine social, ecological, and educational activities.

The comparison of CG distribution in Krakow and Brussels reveals key differences rooted in their respective historical legacies and governance frameworks. In Krakow, the distribution reflects a post-socialist urban landscape where hybrid governance models facilitate municipal support for integrating CGs into city planning. By contrast, Brussels demonstrates a more bottom-up approach, with CGs emerging through grassroots initiatives that address diverse socio-economic challenges.

Overall, e-participatory mapping not only improved spatial data accuracy but also revealed how CGs serve multifunctional roles and adapt to various socio-economic contexts. These findings underscore the importance of flexible governance models and participatory approaches in fostering resilient, inclusive urban green spaces.

4.2. Typologies of community gardens

This section analyzes four key dimensions that shape the development and operation of CGs in Krakow and Brussels: emergence reasons, governance structures, location factors, and

functions. By examining these dimensions, the analysis highlights how socio-economic, cultural, and spatial contexts influence the diversity of CGs.

A. Emergence reasons

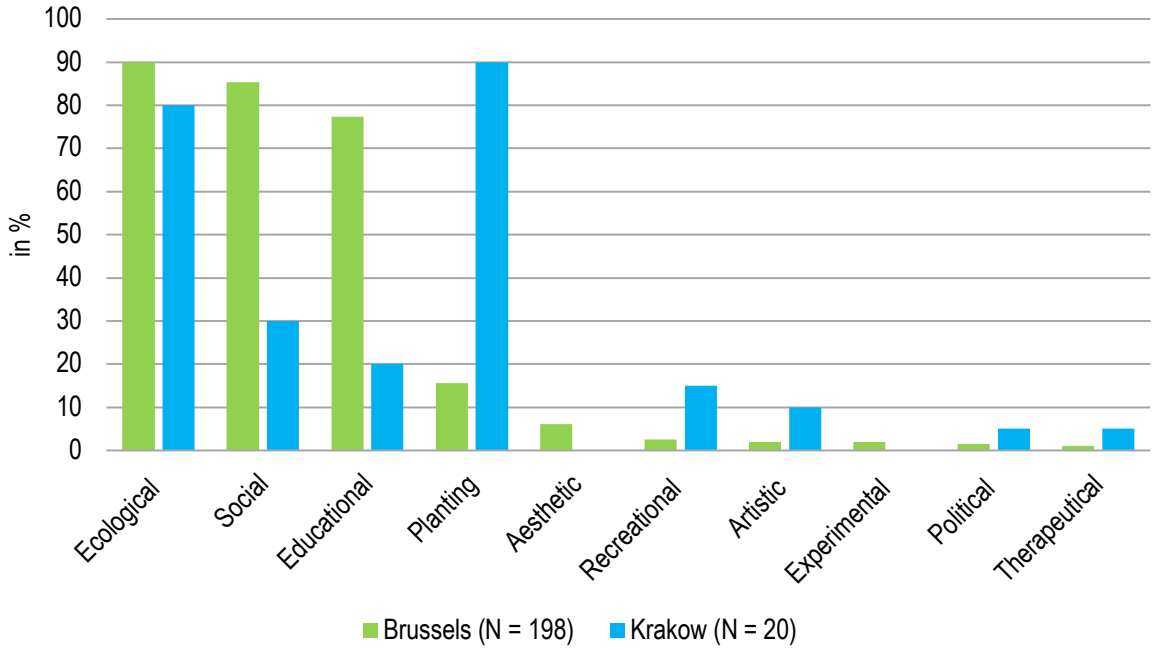

Figure 7. Emergence reasons CGs in Brussels and Krakow (in %).

(Source: Own study, 2024)

The motivations for establishing community gardens in Brussels and Krakow (figure 7) reflect both institutional objectives and grassroots initiatives, shaped by their unique urban contexts. In Brussels, ecological priorities dominate, with 90% of surveyed gardens citing goals such as biodiversity enhancement, climate resilience, and environmental stewardship. Social motivations are equally significant, with 85% of gardens emphasizing the need to provide accessible green spaces in dense urban areas where private gardens are rare. Education is another prominent driver, as over three-quarters of respondents highlighted the importance of ecological learning delivered through structured programs and pedagogical gardens. Additional catalysts, such as artistic expression, recreation, and political

engagement, further underscore the multifaceted nature of CGs in the city (Cahn et al. 2018, Mercier, 2018).

Krakow's gardens demonstrate similarly diverse motivations but with a distinct emphasis on horticultural traditions. Nearly all CGs in Krakow prioritize planting and cultivation, blending older allotment practices with community-oriented goals. Six gardens identified social aspirations, emphasizing collective work and socialization, while four cited educational objectives aimed at youth engagement and ecological awareness. Some projects also reflect unique aims, including therapeutic uses, art-based installations, and platforms for political activism. One participant explained, "*Our group started primarily as a way to learn about organic growing, but we quickly realized we also needed a place where people could gather, especially families with children."* These findings, based on surveys, interview data and institutional analysis, suggest that while ecological, social and educational motivations are common to CGs in both cities, their institutional integration differs. In Brussels, CGs are often supported by policy instruments such as regional grants (e.g., 'Inspire the Neighborhood') and integrated into urban green space planning (Certomà & Notteboom, 2015; Beavin et al., 2022). In Krakow, by contrast, several gardens emerged from informal or grassroots initiatives with limited initial support and often evolved from or alongside traditional allotment practices (Mokras-Grabowska, 2020; Kwartnik-Pruc & Droj, 2023).

Although reorientations of allotment gardening have occurred elsewhere in Europe (e.g., Denmark or the UK), studies suggest that in CEE cities, this reorientation is often shaped by specific historical legacies of land use, privatization, and transitional governance (Bellows, 2010; Djokić et al. 2018). Thus, in the Polish case, this path dependency helps explain how

CGs continue to draw on both grassroots experimentation and the physical infrastructure or spatial logic of former allotment sites.

B. Governance structure

The governance arrangements of CGs in Brussels and Krakow reflect varied balances between grassroots initiatives and institutional support. In Brussels, 60% of surveyed gardens operate under bottom-up models, where residents initiate and manage projects independently. These efforts are often supported by intermittent municipal or regional funding programs, such as "Inspire the Neighborhood" by Brussels Environment, which provides grants and technical assistance. Non-governmental organizations, such as "Le début des haricots," also play a vital role in coordinating projects and offering resources. However, participants reported challenges, including reliance on external funding and difficulties sustaining momentum once initial grants expire. One respondent noted, "*Our garden depends on volunteers, but when funding runs out, it's hard to maintain enthusiasm*." This strong bottom-up orientation illustrates Brussels' broader planning ethos, which encourages civic initiatives while avoiding full municipal control. While empowering, this model may lead to fragmented support across districts, inconsistent long-term planning, and reliance on volunteer burnout or project fatigue. Interviews revealed that although gardens often begin informally, formalization through NGO partnerships or limited subsidies is necessary to ensure land tenure and infrastructure.

In Krakow, governance structures demonstrate a hybrid model. Fifty-five percent of surveyed gardens were initiated by local residents who later sought assistance from Zarząd Zieleni Miejskiej (ZZM), the city's green management body. This collaboration results in

shared governance, with communities retaining decision-making power while benefiting from municipal support for land access, materials, and training programs. Meanwhile, 35% of gardens were established directly by ZZM, reflecting a top-down model. Although this approach ensures alignment with broader urban planning objectives, it risks lower levels of community ownership if not managed collaboratively. Approximately 10% of gardens provided insufficient data to classify their governance, indicating the need for further research into less formalized arrangements.

This hybrid dynamic in Krakow reflects a transition from the top-down legacy of allotment garden regulation toward more participatory modes. ZZM's role as both facilitator and regulator has led to a dual track: some gardens are embedded in city greening programs (e.g., pocket parks), while others emerge more organically but later require formal recognition. This can create tensions, particularly around access to public resources or recognition of informal groups, yet it also enables alignment between local knowledge and municipal strategy.

Comparatively, the key distinction lies in the sequencing and source of institutional engagement: in Brussels, citizen initiatives lead and institutions follow selectively; in Krakow, institutions often initiate or formalize community initiatives. While both approaches offer benefits, autonomy in Brussels and policy integration in Krakow, they also face challenges: governance fragmentation versus bureaucratic rigidity. These findings align with studies suggesting that successful urban greening often depends on structured institutional support for grassroots initiatives, balancing autonomy with sustainable resource allocation (Faehnle 2014; Derlukiewicz et al. 2021). The evidence here reinforces the importance of co-production frameworks, particularly where land-use and civic engagement goals intersect.

C. Location factors

The spatial distribution of CGs in Brussels and Krakow (figure 8) reflects their respective urban contexts, land-use strategies, and planning incentives. Research on urban greening interventions (Wong et al. 2003; Benis et al. 2018) underscores the value of utilizing diverse spaces, from parks to rooftops, to mitigate urban heat, enhance biodiversity, and foster social interaction. In Brussels, CGs are dispersed across courtyards (39%), wasteland sites (22%), and municipal parks (18%), with additional sites found on rooftops, streets, and unconventional locations such as roundabouts. This wide geographic spread illustrates the city's dense urban fabric and proactive search for creative infill opportunities, particularly in older neighborhoods where vacant lots or shared courtyards are often the only viable options. For example, one garden organizer described transforming an underused courtyard into a communal space that now hosts both ecological workshops and social events.

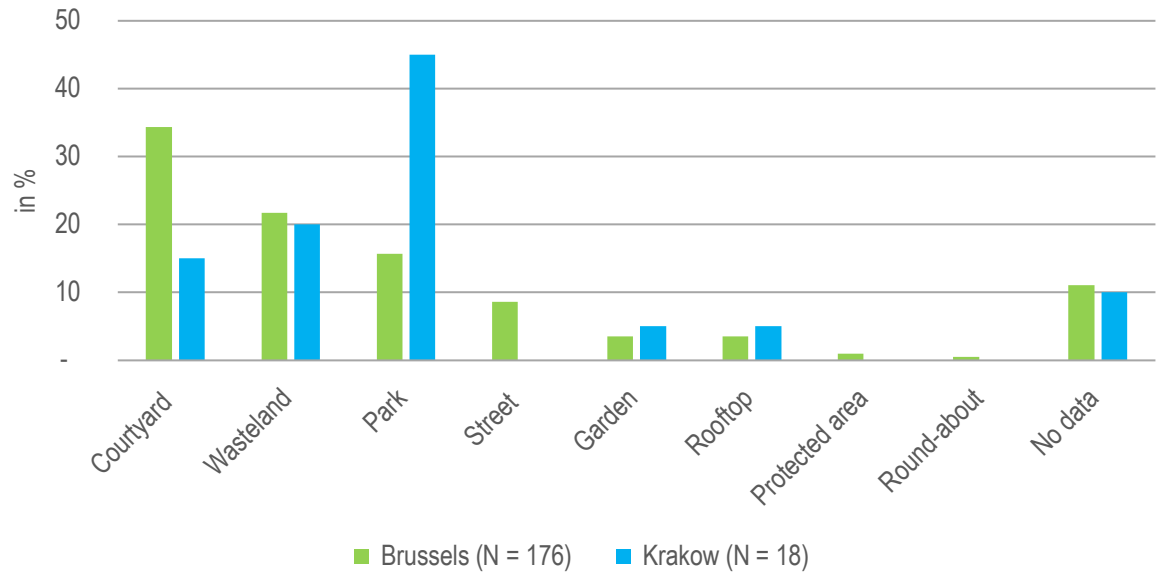

Figure 8. Location factors of CGs In Brussels and Krakow. (Source: Own study, 2024)

Krakow's gardens, by contrast, are predominantly located in public parks, which account for 45% of surveyed sites. This reflects municipal efforts to integrate CGs into park redevelopment projects, often led by ZZM. Other locations include wasteland parcels and private courtyards, though these are less common. The emphasis on park-based gardens suggests a strategic approach to enhance community engagement through public green spaces. As one gardener noted, "*We repurposed an underutilized park corner, working with ZZM to secure permits and build some gardening beds for workshops*." Only one of Krakow's CGs is located on rooftops, likely due to differences in building stock and urban density compared to Brussels. These patterns reveal how land availability, municipal priorities, and local activism shape the spatial distribution of CGs in each city.

D. Functions

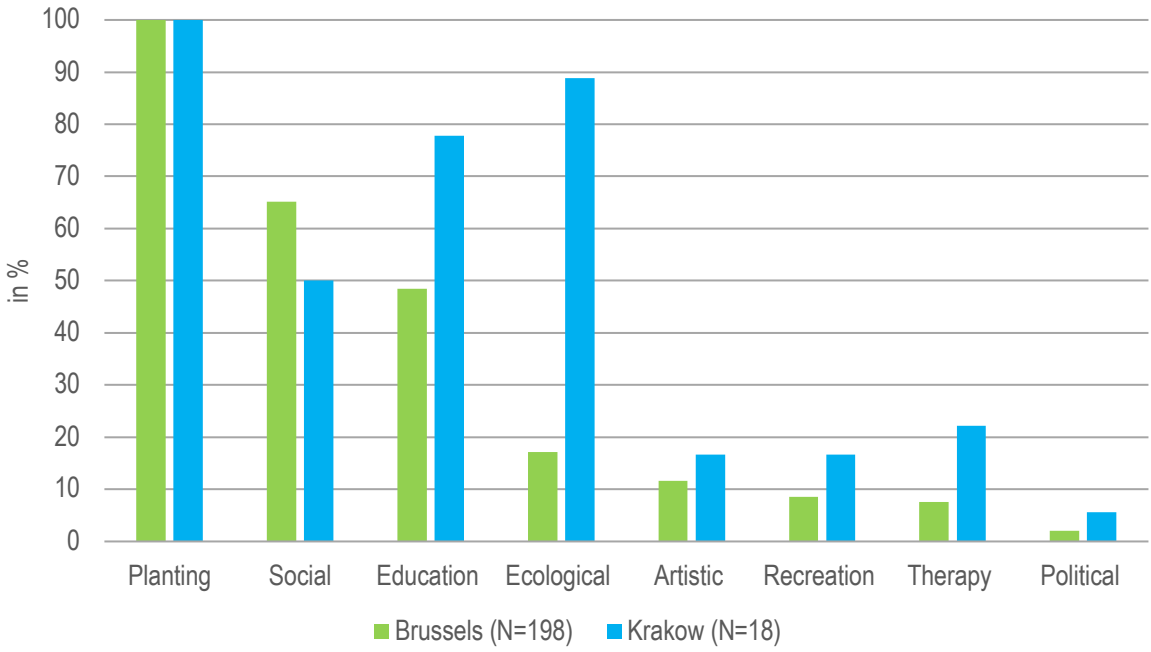

Figure 9. Functions of CGs in Brussels and Krakow. (Source: Own study, 2024)

The functions of CGs in Brussels and Krakow (Figure 9) reflect their adaptability to local needs, often exceeding their original goals to address broader community aspirations. Planting and

cultivation here refers to the shared practice of growing edible or ornamental plants, central to all CGs and forming the basis for broader social, educational, and ecological functions. In Brussels, 65% of gardens prioritize social cohesion, hosting collective workdays, open-door workshops, and cultural events that bridge linguistic and ethnic divides. Educational initiatives are prominent in half of the gardens, often through partnerships with schools or structured programs on composting, organic farming, and climate adaptation. One practitioner emphasized, "*Art and gardening go hand in hand here. We've hosted painting workshops and small exhibitions alongside the planting beds*."

In Krakow, ecological goals dominate, reflecting the city's transformation from a post-socialist allotment tradition to a broader community gardening culture. Nearly all surveyed gardens cited biodiversity conservation, pollution mitigation, or aesthetic improvements as primary objectives. Social cohesion also ranks highly, with about half of the gardens serving as gathering points for neighborhood interactions. Educational initiatives, while less institutionalized than in Brussels, are growing in prominence, with several projects partnering with schools and NGOs to teach urban farming and waste reduction. One unique example is a predominantly female-led garden that integrates ecofeminist perspectives, demonstrating how CGs can serve as platforms for social and political activism.

These findings align with existing research indicating that CGs rarely serve static purposes but instead evolve in response to changing community needs and external conditions (Wakefield et al. 2007; Hagey et al. 2013). The multifunctional nature of CGs underscores their potential to address diverse urban challenges, from fostering social inclusion to advancing ecological sustainability. However, their success often hinges on adaptive governance and sustained

community engagement, particularly in dynamic urban environments like Brussels and Krakow.

6. DISCUSSION

The findings highlight how different socio-political, historical, and urban contexts influence the emergence, management, and adaptation of CGs. However, while both Krakow and Brussels present distinct trajectories, their governance models are not mutually exclusive; rather, they illustrate different points on a continuum of institutionalization. In Krakow, CGs often evolve from regulated allotment traditions toward more community-oriented forms, while in Brussels, grassroots gardens gradually seek formalization and municipal support. These pathways are shaped by historical legacies, such as post-socialist land use in Krakow and liberal planning frameworks in Brussels, and socio-political cultures of civic engagement and state intervention. These findings confirm prior research indicating that governance models, particularly hybrid or well-supported bottom-up approaches, can play a crucial role in shaping the sustainability and long-term functionality of CGs, while top-down models may be less effective if not coupled with active community participation (Zhang et al., 2022; Fox-Kämper et al., 2018).

The typology developed in this study serves as a strategic framework for observing and categorizing CGs, allowing researchers and urban planners to target specific cases for in-depth investigation. By classifying CGs based on emergence reasons, governance structures, spatial distribution, and functions, the typology aids in identifying key differences and commonalities across urban contexts. For example, gardens with hybrid governance models in socio-economically disadvantaged areas may require different interventions compared to grassroots-driven gardens in high-density neighborhoods. These distinctions are particularly relevant in post-socialist cities where formal planning cultures coexist with informal civic practices, and

where CGs may be tied to residual perceptions of allotment gardens or resistance to institutional control. These results extend previous typology-based studies (Firth et al. 2011; Guitart et al., 2012; Rogge & Theesfeld, 2018; Anderson et al. 2019; Jansma & Veen, 2024) by incorporating a cross-regional comparative dimension, offering insights into how CGs adapt differently in post-socialist and Western European contexts. While developed in the European context, this typology is adaptable to cities in the Global South, where informal land tenure, high-density conditions, and community reliance on food production present similar governance challenges. Future research could test this typology in cities undergoing rapid urban expansion or conflict-driven restructuring. This typology is not static; it is adaptable to different cities and scalable, making it a valuable tool for urban planners seeking to prioritize interventions and allocate resources effectively.

The comparative analysis underscores the importance of context-specific governance structures supporting earlier studies that emphasize the need for flexible governance models (Faehnle, 2014). Krakow's hybrid approach offers lessons on how municipal involvement can support community efforts, while ensuring alignment with broader urban planning goals. Conversely, while Brussels highlights the potential of citizen-driven models in adapting CG functions to diverse urban needs as also demonstrated in studies of grassroots urban movements (Derlukiewicz et al., 2021). However, each model faces constraints: in Krakow, some residents reported frustration over bureaucratic delays or limited co-decision opportunities, while in Brussels, bottom-up gardens frequently cited financial precarity and volunteer fatigue. The study's findings suggest that balancing grassroots participation with institutional support can provide sustainable frameworks for CG development across various socio-political contexts.

E-participatory mapping played a central role in the methodological framework, enhancing spatial accuracy and resolving discrepancies in official records by integrating practitioner feedback. The iterative process revealed temporal changes, such as newly established gardens and inactive sites, emphasizing the dynamic nature of CGs. This finding is consistent with studies on participatory GIS applications in urban planning (Cochrane, 2020), which highlight the value of engaging local stakeholders to capture continuously changing spatial data. Moreover, while Codato (2024) and Gemperle (2024) primarily focused on traditional participatory methods, this study expands their work by demonstrating the effectiveness of digital participatory mapping in CG contexts. Nonetheless, this method presents limitations. Uneven stakeholder engagement, shaped by digital literacy, time availability, or language, may skew spatial feedback toward more organized or digitally connected groups. In areas with lower engagement, such as under-resourced neighborhoods, gardens may remain unmapped or misrepresented. Future research should incorporate longitudinal studies and follow-up mapping exercises to better capture changes over time, especially as CGs adapt to shifting socio-economic conditions or new environmental pressures. Studies in urban agriculture suggest that mapping outcomes improve when supported by continuous collaboration among researchers, local organizations, and policymakers (Ramos et al., 2019).

The integration of survey data and qualitative interviews provided further depth, uncovering governance challenges, socio-spatial dynamics, and stakeholder experiences that would be difficult to observe through mapping alone. While the surveys were valuable for gathering quantitative insights, they were also constrained by incomplete responses and a limited respondent base, especially in Krakow. These limitations, compounded by language diversity and informal structures, made direct field observations and interviews crucial for data validation. Expanding the socio-economic data collected during surveys, such as neighborhood

stability and income levels, would further refine the typology and improve its applicability across diverse contexts.

The findings provide practical suggestions for policymakers and urban planners. E-participatory mapping could be institutionalized as part of urban green space monitoring systems to enable real-time updates on CG locations, functions, and status. This would help cities identify emerging CGs, monitor their development, and ensure they meet evolving community needs. To achieve this, municipal departments could integrate mapping tools such as Umap into existing open-data platforms. Coordinating with local NGOs or garden federations may enhance outreach, while hosting annual "mapping weeks" or linking participation to small grants could incentivize contributions. These could include training sessions, user-friendly mapping platforms, or incentives to encourage long-term participation, ensuring that practitioners contribute continuously to the accuracy and comprehensiveness of CG data.

The typology developed here can guide resource allocation by prioritizing CGs that address key socio-ecological goals, such as biodiversity conservation or food security in underserved areas. Integrating CGs into broader green infrastructure plans would enhance their contributions to urban resilience, particularly in cities facing rapid urbanization or socio-economic transitions. For example, Langemeyer et al. (2017) and Wakefield et al. (2007) emphasized CGs' role in ecological and social sustainability, and this study builds on their findings by highlighting how CGs can adapt across cities with distinct urban planning frameworks. Moreover, the findings extend the work of Blair (2009) by showing that CGs are not limited to food production but can evolve into multifunctional hubs serving educational, ecological, and cultural purposes.

7. CONCLUSION

In conclusion, this study demonstrates the value of context-sensitive, participatory, and mixed-method approaches to understanding community gardens in complex urban environments. It contributes to ongoing debates on how CGs can be sustained through adaptive governance, responsive planning, and digital tools. While the comparative focus on Brussels and Krakow sheds light on contrasting trajectories, the analytical frameworks developed here can inform future research and practice in a variety of contexts, including Global South cities facing similar constraints around land, participation, and institutional capacity. Strengthening links between civil society and planning institutions remains central to unlocking the full potential of CGs as catalysts for socio-ecological transformation.

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Acknowledgments

I would like to express my sincere gratitude to all the community garden practitioners, municipal representatives, and local organizations in Brussels and Krakow who participated in this study. Their willingness to share insights and experiences made this research possible. I am also thankful for the guidance and support provided by my supervisors at Jagiellonian University and the Université de Mons.

Declaration of Interest Statement

The author declares that there are no conflicts of interest relevant to this research. No financial or personal relationships have influenced the research, analysis, or conclusions presented in this manuscript.

Paper 3:

Téoule F., Mazy K., (2025), Temporalities of urban commons: Case study of community gardens.

Status: Manuscrit submitted to Local Environment.

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TEMPORALITIES OF URBAN COMMONS: CASE STUDY OF COMMUNITY GARDENS

ABSTRACT

This study explores how community gardens (CGs) adapt to urban pressures through short-term, participatory actions that accumulate into long-term resilience. Using qualitative methods such as interviews, ethnography, spatial mapping; this research compares two Brussels CGs, revealing how governance, seasonal rhythms, spatial configurations, and knowledge exchange co-produce sustainability. Findings highlight the tensions between grassroots agency and institutional support, and the importance of generational renewal for continued viability. This temporal perspective reframes CGs as dynamic, evolving commons embedded in shifting urban landscapes. The study offers practical insights for policy and planning, advocating for flexible governance that balances inclusivity with ecological stewardship.

KEYWORDS

Community garden, Urban common, Adaptative governance, Urban resilience, Brussels

INTRODUCTION

Rapid urbanization has intensified environmental pressures on cities, contributing to biodiversity loss, pollution, and urban heat island effects (Elmqvist et al., 2015). Among urban interventions addressing these challenges, community gardens (CGs) stand out as dynamic solutions, fostering ecological restoration, social cohesion, and participatory governance (Anguelovski, 2014; Bendt et al., 2013). While their immediate benefits, such as green space provision and urban food production, are widely recognized, ensuring their long-term sustainability requires evolving engagement strategies and adaptive governance mechanisms that responds to shifting urban realities.

As potential urban commons, CGs have been framed as merging collective governance and community-building to promote social equity and ecological sustainability (Ostrom, 1990; Foster & Iaione, 2016).

Their governance varies across institutional frameworks, community capacities, and urban policies (Colding & Barthel, 2013; Eizenberg, 2012). Adopting a temporal perspective, this study examines CGs as dynamic ecosystems shaped by seasonal cycles, urban transformation, and fluctuating participation (Edensor, 2010; Konijnendijk et al., 2013).

Short-term actions within CGs - such as planting sessions, workshops, and temporary spatial interventions like mobile raised beds, pop-up green installations, and biodiversity experiments - enhance biodiversity, environmental knowledge, and social networks (Feinberg, 2020; Roberts et al., 2018). These gardens provide essential ecosystem services, including carbon sequestration, water retention, and pollination, supporting climate adaptation (Ellison et al., 2021; Haase et al., 2017). However, the way in which these targeted actions consolidate over time to produce enduring impacts remains insufficiently explored. The challenge lies in understanding how they accumulate, adapt, and interact with broader governance frameworks to sustain CGs over time.

This study explores these dynamics through two cases in Brussels: Gray-Moineaux in Ixelles and LaParcelle Fruits-Dupuis in Anderlecht. These sites, selected for their contrasting socio-demographic contexts and governance trajectories, illustrate how CGs evolve. Gray-Moineaux (est. 2007) demonstrates how established gardens integrate within policy frameworks, while LaParcelle Fruits-Dupuis (est. 2021) represents a grassroots response to urban expansion. By contrasting these cases, the research sheds light on how governance scale, community initiative, and policy integration influence the long-term resilience of CGs.

The study addresses the central research question: How do short-term, targeted actions contribute to CG resilience? A corollary question follows: What conditions enable long-term commitment necessary for CGs to persist? The hypothesis posits that CG sustainability depends on their ability to adapt through a continuous interplay of temporary interventions, governance adjustments, and evolving spatial configurations. To explore these dynamics, this research uses a qualitative case study design (Merriam, 2009) and combines semi-structured interviews with gardeners, municipal officials, and NGOs; ethnographic observations of seasonal practices and governance interactions; field mapping of physical and infrastructural changes; visual documentation of ecological and participatory shifts; and thematic coding to identify patterns in governance, spatial adaptation, and community participation (Seidman, 2013; Emerson et al., 2011; Crang & Graham, 2007; Rose, 2016; Braun & Clarke, 2006).

By emphasizing the temporal and adaptative dimensions of community-based green space governance, this study contributes to urban research by emphasizing the temporal dimensions of participatory green space governance. Findings highlight the importance of adaptability, seasonal cycles, and governance models in sustaining CGs amid urbanization pressures. Moreover, the research positions CGs as situated laboratories of urban resilience, where iterative short-term actions shape long-term sustainability outcomes through continuous negotiation between communities, policies, and ecological processes.

LITERATURE REVIEW

Community gardens as urban commons

CGs play a vital role in urban landscapes, where they can function as commons: spaces where residents collectively manage land, grow food, and foster social connections (Guitart et al., 2012; Eizenberg, 2012). While the concept of the commons traditionally refers to rural resources (Ostrom, 1990), its urban adaptation emphasizes communal stewardship of shared spaces (Hess & Ostrom, 2007; Foster & Iaione, 2016; Rogge, & Theesfeld, 2018). The French concept of jardins partagés exemplifies CGs as platforms for citizen participation and collaborative urban transformation (Sachse, 2020). However, the degree to which these spaces truly operate as collective commons can vary: some CGs foster rich collaborative governance, while others remain more individualistic, reflecting diverse levels of cohabitation and cooperation.

Beyond green infrastructure, CGs negotiate between civic engagement and urban policies, where informal initiatives interact with institutional frameworks (Certomà, 2011; Colding et al., 2013). They act as catalysts for alternative urban practices, reinforcing local food systems and collective agency (Camps-Calvet et al., 2015; Orsini et al., 2013). Their role aligns with Lefebvre's (1968) "right to the city", enabling residents to reclaim public space and reshape urban environments (Harvey, 2012; Tornaghi, 2014).

Urban commoning processes further illustrate how residents collaboratively produce and manage shared resources in response to socio-economic and environmental challenges (Linebaugh, 2008; Huron, 2015; Pikner, 2018). In Finland and Estonia, collective gardening has mediated between institutional governance and grassroots initiatives, balancing contestation and collaboration (Pikner, 2018). However, CGs face challenges such as insecure land tenure, institutional pressures, and urban development threats (Rosol, 2010; Eizenberg, 2012). Ensuring their long-term viability requires navigating the delicate balance between grassroots autonomy and institutional engagement (Carmona et al., 2010). Despite increasing research on CG governance, the specific mechanisms through short-term activities shape enduring impacts remains underexplored (Edensor, 2010; Dombroski & Diprose, 2016).

Short-term actions as pathways to long-term outcomes

Examining CGs through a temporal lens reveals their adaptability and sustainability. Crang's (2001) concept of "timespace" underscores the intertwined nature of temporal and spatial dynamics in social practices. CGs function within seasonal cycles, daily routines, organizational shifts, and long-term transformations, shaping both governance structures and ecological resilience (Edensor, 2010).

Short-term activities - such as planting sessions, workshops, and community events - though often perceived as temporary, accumulate over time and constitute foundational steps in long-term transitions

(Dombroski & Diprose, 2016; Guitart et al., 2013). They foster social capital, trust, and collective identity, which are essential for CG sustainability (Feinberg, 2020; Roberts et al., 2018).
Moreover, temporary commoning practices enhance urban resilience, particularly in post-disaster recovery, where gardens serve as spaces for community-led regeneration (Dombroski & Diprose, 2016; Tornaghi, 2014). Pikner (2018) argues that short-term interventions can influence policy-making, yet the extent to which these practices evolve into institutionalization or spatially embedded forms remains a critical gap in current research.

Experimental practices and innovative governance

CGs function as urban laboratories, testing alternative governance models and adaptive environmental management techniques (Follmann, 2014; Certomà, 2011; Torre et al., 2016). Through participatory decision-making and informal rule-setting, gardeners develop context-specific solutions to challenges such as biodiversity conservation, soil health, and resource management (Roberts et al., 2018; Guitart et al., 2013).
Trial-and-error experimentation fosters urban sustainability by integrating water-saving techniques, organic farming, and permaculture into community knowledge (Orsini et al., 2013; Dorr et al., 2023). The iterative nature of these practices strengthens urban commons resilience, enabling continuous adaptation through knowledge transfer across networks (Feinberg et al., 2020).
CGs also challenge urban governance by proposing alternative land-use strategies and models of participatory urbanism (Foster & Iaione, 2016; Moragues-Faus & Marsden, 2017). Collaboration with municipal authorities can provide stability and resources but raises concerns over co-optation, as institutional engagement may impose regulatory constraints and dilute grassroots autonomy (Sachse, 2020; Pikner, 2018). Critically engaging these governance tensions isessential for understanding how CGs ca, preserve their transformative capacity while operating within formal urban structures (Rosol, 2010; McClintock, 2014).

Balance between grassroots initiatives and institutional support

The relationship between grassroots initiatives and institutional support in CGs is complex. While partnerships provide resources and legitimacy, they can also shift decision-making power away from community actors, challenging autonomy (Eizenberg, 2012; Rosol, 2010). Sachse (2020) highlights contrasting approaches: in France, formal support provides stability but limits grassroots independence, whereas in Italy, informal governance fosters flexibility and resilience amid political shifts.
This tension is particularly relevant in environmental gentrification, where green initiatives risk increasing property values and accelerating displacement pressures (Checker, 2011; Anguelovski, 2014). To counteract these risks, CGs must integrate immediate actions into broader strategies for social

equity, urban resilience, and community empowerment (Feinberg, 2020; Paquot, 2006). The "We Garden" initiative in Shenzhen illustrates how mediated governance models can align community participation with sustainable urban management, ensuring both continuity and community control in socio-ecological transitions (Zheng et al., 2022).

Research question

Although existing literature acknowledges CGs' role in social cohesion and ecological sustainability, the cumulative impact of temporary collective actions on long-term governance and spatial transformations has received limited attention, a gap clearly identified in the above literature review. This study asks: How do short-term, targeted actions contribute to CG resilience? Building upon this, it further explores: What conditions enable, and which hinder, the long-term commitment necessary for CGs to persist?

The hypothesis posits that CG sustainability is linked to their adaptive capacity - their ability to respond to seasonal shifts, governance challenges, and urban transformations. However, this adaptability also introduces tensions, as shifts in governance models and resource availability can alter community values.

METHODOLOGY

Research design

This study employs a qualitative research design to explore how CGs function as urban commons, emphasizing their adaptive governance, social organization, and ecological resilience. A qualitative approach is particularly suited for capturing the temporality of collective action and the evolving relationship between short-term interventions and long-term transformations (Merriam, 2009). This design enables a nuanced understanding of CGs as evolving socio-ecological systems shaped by ongoing negotiation, experimentation, and community participation.

Given that the two selected gardens - Gray-Moineaux (est. 2007) and LaParcelle Fruits-Dupuis (est. 2021) - are at different stages of development, a comparative case study offers an opportunity to examine temporal variation and institutional embedding. The study examines how initiatives taken at different moments (e.g., land reclamation, governance models, and seasonal activities) contribute to their sustainability and integration within urban planning frameworks.

Case study selection

Figure 1: Distribution of CGs in Brussels against population density
(Source: Own study, 2024, population density based on data provided by Monitoring des Quartiers, https://monitoringdesquartiers.brussels/)

A spatial analysis of CGs distribution in Brussels (Figure 1) reveals a strong correlation between urban density and the concentration of CGs across neighborhoods. The city hosts 204 documented CGs, predominantly located in medium- to high-density areas, where limited private green spaces increase the demand for shared urban commons. The spatial location of the two selected gardens illustrates how CGs emerge in response to specific demographic and environmental pressures within the urban fabric.

The selection of Gray-Moineaux and LaParcelle Fruits-Dupuis was guided by two key comparative factors:

- Socio-demographic and spatial context: On one hand, Ixelles (Gray-Moineaux) is a high-density area with strong institutional engagement in urban greening. On the other hand, Anderlecht (LaParcelle Fruits-Dupuis) is more diverse, with fewer green spaces per capita and a greater reliance on informal governance.
- Comparative temporalities: Gray-Moineaux provides insights into long-term sustainability challenges, policy integration, and land tenure negotiations. In turn, LaParcelle Fruits-Dupuis illustrates early-stage governance formation, experimentation, and initial community mobilization.

This contrast enables the analysis of both mature and emerging governance models, offering a layered understanding of CG development across time and space.

Data collection methods

To examine the temporal evolution of CGs, a multi-method qualitative approach was used, ensuring data triangulation for reliability and validity (Denzin, 1978). Findings were cross-validated across methods and case studies.

a. Semi-structured interviews (n =42)

A total of 42 interviews were conducted with key stakeholders: 24 gardeners, 1 municipal official, 2 NGO representatives and urban planners, and 15 local residents. Interviews explored engagement strategies, institutional interactions, and long-term sustainability perceptions. Sessions lasted 45-90 minutes, conducted in French, transcribed, and translated into English for analysis. This method enabled participants to reflect on both daily routines and strategic shifts in garden governance, offering layered narratives on collective action.

b. Go-along interviews

Go-along interviews, primarily with gardeners, documented real-time interactions with CG spaces. By accompanying participants in tasks such as planting, watering, and organizing community events, this method provided firsthand insights into decision-making, governance practices, and site usage. It allowed the researcher to access experiential and embodied knowledge, often absent from formal interviews.

c. Ethnographic observation

Ethnographic fieldwork, spanning May-October 2023, captured seasonal rhythms, governance dynamics, and participatory trends through weekly site visits. Observational logs documented participation levels, decision-making, infrastructure changes, and adaptive responses to external pressures. Participation in governance meetings further revealed negotiations of roles and collective management strategies. These immersive observations facilitated a longitudinal reading of participation, illuminating both continuity and rupture in everyday practices.

d. Visual documentation and mapping

Historical imagery (2007-2023) and over 150 photographs tracked spatial transformations, activity zones, and ecological interventions. Visual mapping, complemented by go-along interviews, analyzed internal spatial configurations, contested spaces, and patterns of expansion or reorganization. This visual data grounded the analysis of spatial politics and ecological change in material evidence.

Analytical framework

Findings were structured through systematic coding (Braun & Clarke, 2006) applied to interviews, observations, and visual data. The thematic categories were selected based on:

- Empirical recurrence: Themes emerged from stakeholder accounts regarding CG evolution and governance.
- Theoretical anchoring: Categories align with urban commons theory (Ostrom, 1990), adaptive governance (Barthel et al., 2013), and socio-ecological resilience (Ahern, 2011).
- Comparative relevance: The framework facilitates structured comparison between Gray-Moineaux and LaParcelle Fruits-Dupuis.

This hybrid framework allowed for both inductive and theory-driven interpretation, supporting a nuanced cross-case synthesis.

Methodological considerations

The methodology accounted for the unique historical and social contexts of each CG, ensuring analyses were contextually grounded. Ethical considerations were central to the study; all interviewees were anonymized, with personal identifiers removed from transcripts. Participants were categorized by role (e.g., gardener, municipal official, NGO representative) to maintain confidentiality while preserving the integrity of their perspectives. Informed consent was obtained, ensuring voluntary participation and the right to withdraw at any stage.

The study acknowledges its interpretive limitations, particularly regarding translation, selective memory, and the variability of participation over time. However, triangulation and prolonged engagement mitigate these risks, enhancing the robustness of the findings.

TEMPORALITIES UNDER PLAY

The findings are structured around the temporal dynamics of CGs, illustrating how short-term actions contribute to long-term transformations. As urban commons, these gardens evolve across multiple timeframes, shaped by seasonality, governance adaptation, and land-use policies. This perspective highlights CGs not only as spatial interventions but as dynamic temporal processes where collective action unfolds through layered rhythms.

The analytical framework (Table 1) categorizes these dynamics into six interrelated themes, derived from discourse analysis of fieldwork data and cross-referenced with existing literature. These themes span immediate actions to structural transformations and provide a structured lens for understanding CG sustainability. By aligning empirical findings with theoretical insights, the framework demonstrates how time operates as a critical dimension in shaping governance, engagement, and spatial resilience.

The first dimension, “Reclaiming,” examines how communities repurpose urban wastelands, highlighting land tenure conflicts and grassroots mobilization. “Experimentation and adaptation” focus on the role of iterative learning in governance and ecological practices, where trial-and-error strategies enable continuous improvement. “Seasonal rhythms and community engagement” address how cyclical participation patterns influence both community cohesion and ecological sustainability. The study further underscores “Knowledge exchange and social capital”, emphasizing the intergenerational and intercultural transmission of gardening practices that reinforce collective resilience. “Balancing grassroots agency with institutional support” explores the tensions that emerge when municipal partnerships provide stability yet impose regulatory constraints that can limit grassroots autonomy. Finally, “Spatial dynamics” highlight the evolving physical and accessibility-related transformations of urban gardens, reflecting how spatial configurations impact long-term viability and engagement.

Thematic category	Temporal scale	Key processes	Empirical evidence	Theoretical relevance
Reclaiming	Long-term (decades)	Land tenure conflicts, urban policy shifts, grassroots mobilization	Struggles over land use, transformation of wastelands, municipal negotiations	Urban commons theory (Ostrom, 1990); Spatial justice (Anguelovski, 2014)
Experimentation and adaptation	Short- to medium-term (months–years)	Governance innovations, ecological trial-and-error, participatory decision-making	Adoption of permaculture, water management techniques, self-organized governance structures	Adaptive governance (Colding & Barthel, 2017); Urban resilience (Ahern, 2011)
Seasonal rhythms and community engagement	Cyclical (annual, seasonal)	Community involvement fluctuations, seasonal adaptation of gardening practices	Increased participation in spring/summer, indoor winter workshops, fluctuations in volunteer engagement	Temporal ecologies (Dennis & James, 2018); Urban seasonality (Edensor, 2010)
Knowledge exchange and social capital	Intergenerational & ongoing	Informal learning, mentorship, intergenerational and intercultural exchange	Transmission of traditional gardening practices, mentorship programs, cultural diversity in gardening techniques	Social capital (Putnam, 2000); Learning communities (Wakefield et al., 2007)
Balancing grassroots agency with institutional support	Institutional (years, project-based cycles)	Policy integration, co-optation risks, municipal support vs. autonomy	Conflicts over municipal regulations, NGO collaborations, shifts in governance structure	Co-production of urban space (Rosol, 2010); State-community partnerships (Foster & Iaione, 2016)
The spatial dynamics	Spatial-temporal (flexible use over time)	Urban integration, accessibility, contested space dynamics	Fencing policies, accessibility constraints, urban redevelopment impacts	Public space governance (Krasny & Tidball, 2015); Negotiation of commons (Eizenberg, 2012)

Table 1: Analytical framework of the temporal dynamics of CGs (Authors, 2025)

This thematic structure clarifies how CGs evolve over time, linking short-term interventions to broader socio-ecological transformations. It offers not only an interpretative model but also a practical tool for identifying where and how interventions can be most effective. By demonstrating the interplay between

different temporalities - daily practices, seasonal cycles, and institutional timelines - the findings reveal the mechanisms through which CGs persist, adapt, and embed themselves in the urban fabric.

Reclaiming: The challenge of urban transformation

CGs have emerged in response to urban transformation, reclaiming spaces once marginalized, underutilized, or threatened by speculative development (Eizenberg, 2012; McClintock, 2014). Their establishment results from both grassroots mobilization and institutional frameworks, shaping their long-term viability. This section explores how Gray-Moineaux and LaParcelle Fruits-Dupuis CGs assert spatial agency by transforming neglected land into multifunctional commons, revealing the socio-political dynamics that condition their emergence and endurance.

a. Reclaiming abandoned spaces

Both gardens originated in areas excluded from formal urban planning priorities. Gray-Moineaux, founded in 2007 on a 500 m² lot in the Maelbeek Valley, faced challenges such as soil contamination, invasive species, and urban debris. Its transformation was initiated by local residents and activists and later formalized through the Début des Haricots, an association advocating for sustainable urban agriculture (UA). Through sustained mobilization and negotiations, the garden moved from informal occupation to semi-institutionalized recognition, securing temporary land-use agreements, integrating permaculture and agroecological practices to rehabilitate the soil and engage the community. This trajectory illustrates UA not only as an ecological restoration practice but as a strategic socio-political intervention that redefines the value and use of urban land (McClintock, 2014; Demailly & Darly, 2017). Similarly, LaParcelle Fruits-Dupuis, reclaimed in 2021 from a 2,765 m² wasteland, was initially overrun with brambles and neglected vegetation. As one gardener recalled, "*We had to remove brambles taller than us*[13]". The physical and emotional effort invested by residents underscores the transformative power of grassroots initiatives in reintegrating neglected spaces into the urban fabric. This transformation speaks not only to material restoration but also to the affective labor embedded in collective reclamation Both gardens serve as examples of how urban greening efforts counteract the encroachment of development projects (Anguelovski, 2014).

[13] Original quote in French: « *On a dû enlever des ronces plus grandes que nous* ». Translation by the author.

Figure 2: Before/ after of LaParcelle Fruits-Dupuis (left) and Gray-Moineaux (right) gardens (Source: Gardeners (top – used with permission) and author (bottom))

b. Resilience against external pressures

The resilience of both gardens amidst urban pressures highlights the role of community mobilization and strategic partnerships. Although Gray-Moineaux was initially founded under a temporary agreement, it was demolished in 2018 as part of an urban renewal project in Ixelles. However, its legacy was partially safeguarded through its integration into the Brussels Good Food Strategy (2019), which signaled institutional recognition of CGs' broader socio-ecological contributions, including food sovereignty and ecological planning (Bruxelles Environnement, 2019). This case demonstrate how urban gardens can operate within, and sometimes resist, neoliberal development frameworks, by reframing themselves as strategic assets within sustainability agendas (Demailly & Darly, 2017).

Similarly, LaParcelle Fruits-Dupuis leveraged environmental NGO support, particularly from Natagora - an organization dedicated to protecting biodiversity in Wallonia and Brussels - to obtain a "nature network" label, securing a three-year lease amid pressures for redevelopment. One gardener emphasized the importance of advocacy, stating, «*We had to show that this space was important for the community*"[14]. This illustrates how grassroots actors strategically mobilize alliances and narratives to gain legitimacy and negotiate space in competitive urban spaces. These cases reflect a broader paradox in neoliberal urban governance: while grassroots movements increasingly rely on state partnerships for

[14] Original quote in French: *« Nous devions montrer que cet espace était important pour la communauté »*

land security and funding, these same relationships may compromise organizational flexibility and long-term autonomy (Rosol, 2010). The transformation of both gardens was not solely ecological but deeply political, driven by collective action that extended beyond ecological concerns, shaped by a broader desire to establish lasting urban commons. One gardener from LaParcelle Fruits-Dupuis reflected, "*What will I leave behind?*"[15], expressing a desire to create a lasting contribution amid urbanization pressures. This sentiment underscores how CGs become embedded with personal and collective aspirations, constructing new narratives of urban space as sites of identity, memory and empowerment.

Experimentation and adaptation: balancing short-term flexibility with long-term resilience

Urban CGs function as dynamic spaces of experimentation, where short-term adjustments in gardening techniques, infrastructure, and governance shape long-term ecological and social resilience. These gardens continuously adapt to urban environmental shifts, seasonal variations, and evolving community needs, refining not only cultivation methods but also governance structures and social interactions.

a. Gardening techniques and infrastructure evolution

Both gardens illustrate how localized experimentation fosters site-specific ecological strategies. In Gray-Moineaux, sustainable practices such as permaculture and organic farming have evolved through iterative testing. Before its renewal, the garden implemented rainwater harvesting systems as part of a broader ecological innovation model. Over time, its infrastructure expanded to include a biodiversity pond and a spiral aromatic garden, reinforcing ecological resilience (Fig. 3). These infrastructural additions are not merely functional; they represent an incremental layering of knowledge and care, grounded in community-driven experimentation. Such practices highlight a commitment to sustainability and bottom-up solutions, where short-term trials foster collaboration and adaptation to urban pressures (Barthel et al., 2013; Colding, 2013). However, the garden's transition into municipal oversight raises critical questions about the durability of grassroots ecological interventions once institutionalized, and whether experimental logics are retained in formal planning.

[15] « *Qu'est-ce que je vais laisser derrière moi* »

Figure 3: Biodiversity pond and spiral aromatic garden at Gray-Moineaux
(Source: author)

Similarly, LaParcelle Fruits-Dupuis has engaged in experimental infrastructure projects, including a chicken coop, a mandala plantation (Fig. 4), and bean plantations. By 2023, the garden expanded its experimental scope through collaborations with the Pulses Increase EU project and the implementation of a seed exchange program. These initiatives exemplify how grassroots experimentation can scale up through connection with broader knowledge networks, transforming local trials into distributed learning systems. They align with the concept of urban gardens as "living laboratories" where trial-and-error processes shape long-term sustainability strategies (Colding & Barthel, 2017). Such examples reveal the permeability between micro-level innovation and macro-level sustainability agendas.

Figure 4: Mandala plantation at LaParcelle Fruits-Dupuis
(Source: gardener – used with permission)

b. Adaptive governance and the integration of experimentation

The ability of CGs to self-organize, respond to external pressures, and sustain participation relies on adaptive governance - a balance between structured frameworks and flexible decision-making that enables continuous learning. Governance in this context is not a fixed structure but a living process, evolving through experimentation, feedback, and collective reflection. Gray-Moineaux operates through decentralized governance, where participatory workshops on waste management, composting, and ecological practices create a community-driven feedback loop. Ethnographic fieldwork revealed that these workshops not only enhance environmental practices but also sustain engagement. One participant noted, "*Workshops allow us to decide together how to improve the garden*"[16]. Such processes reflect a form of embedded co-learning, where knowledge is produced through doing, observing, and discussing in collective spaces, and crucially, they require continuous organizational effort to maintain and adapt these practices over the long term.

LaParcelle Fruits-Dupuis similarly reflects an ongoing process of trial and error in governance. The introduction of the Assemblée Générale (General Assembly) in 2022 (Fig.5) aimed to establish a more inclusive management system. A gardener explained, *"We learned to organize our meetings so that everyone could participate*"[17]. This bottom-up evolution of governance illustrates how democratic routines are cultivated over time, not imposed from above but iteratively co-designed. This resonates with participatory research findings, which highlight the role of environmental learning and social cohesion in public-access CGs (Bendt et al., 2013). By fostering collective responsibility and experimentation, both gardens have established governance models that allow for continuous adaptation. Their resilience lies not in permanence but in the capacity to evolve, accommodating new challenges and ideas without losing core values. As gardeners refine planting methods, infrastructure, and decision making processes, they contribute to a collective knowledge base that enhances long-term resilience and embeds adaptability into everyday practice.

Seasonal rhythms and community engagement: cyclical participation

CGs function within cyclical temporalities, shaped by seasonal rhythms, ecological processes, and fluctuating participation levels. These cycles influence both horticultural practices and social interactions, structuring engagement throughout the year. Unlike conventional green spaces, CGs require continuous labor and re-engagement, making seasonality a critical factor in their long-term resilience. This section examines how Gray-Moineaux and LaParcelle Fruits-Dupuis navigate seasonal fluctuations through adaptive gardening techniques and participatory strategies (Fig. 5).

[16] Original quote in French: *« Ces ateliers nous permettent de décider ensemble comment améliorer le jardin »*

[17] « *Nous avons appris à organiser nos réunions pour que tout le monde puisse participer »*

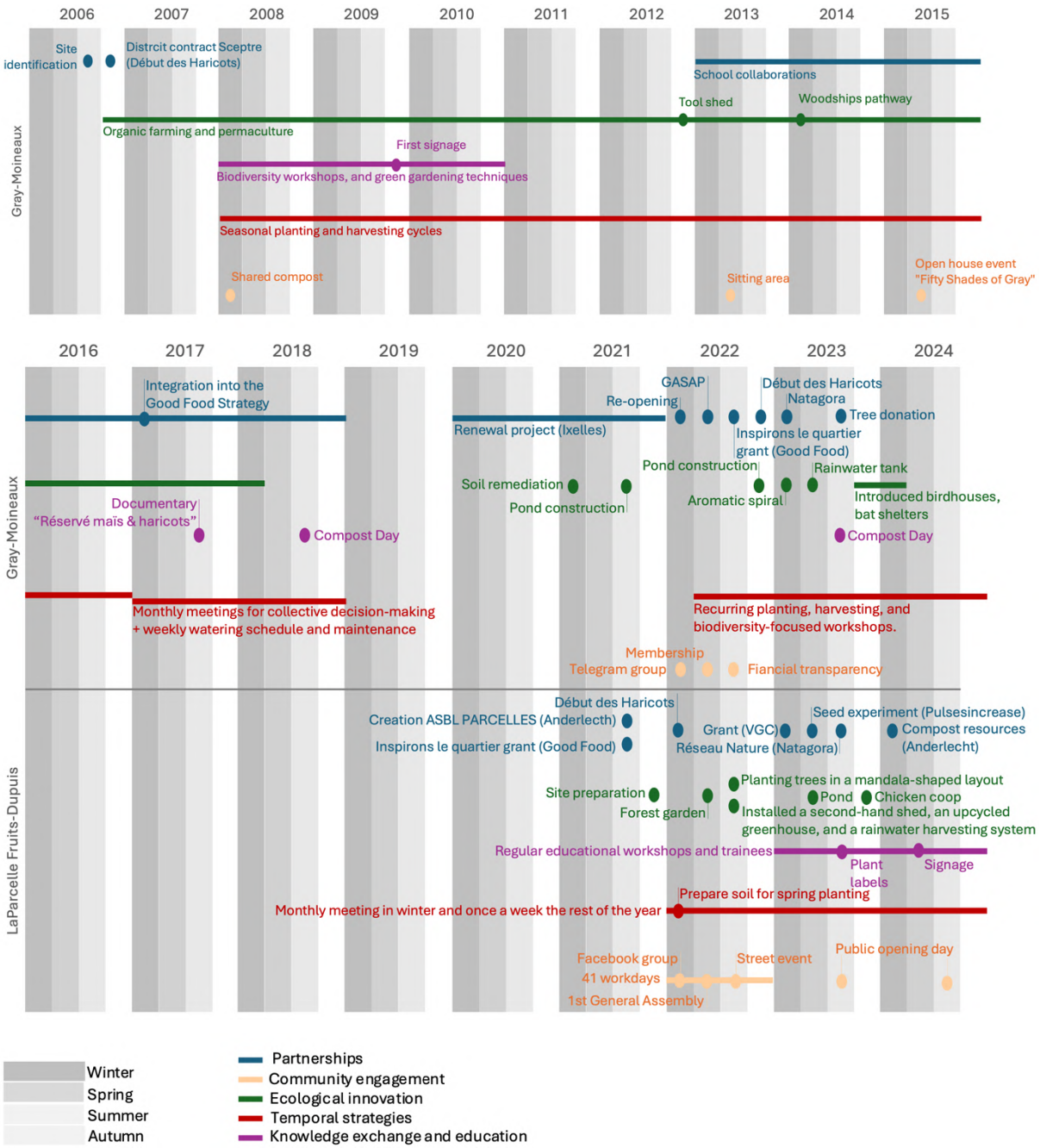

Figure 5: Timeline illustrating the seasonal variations in engagement and key activities within the Gray-Moineaux and LaParcelle Fruits-Dupuis CGs from their establishment to the present. (Source: Author, data were derived from semi-structured interviews with stakeholders, ethnographic observations, and in-depth archival research).

a. Seasonal rhythms and ecological impact

Long-term ecological sustainability in CGs depends on their ability to adapt to natural cycles, ensuring soil fertility, biodiversity conservation, and resource management. Both gardens illustrate how seasonal rhythm's structure horticultural activities, ecological learning, and transformation.

At Gray-Moineaux, cyclical practices such as spring planting, summer harvesting, and autumn composting ensure continuous involvement and ecological maintenance. These repeated actions foster an embedded form of environmental knowledge, rooted in practice and tuned to the rhythms of nature.

They transform the garden into a dynamic space of learning and co-creation, aligning with iterative processes in adaptive urban socio-ecological systems (Dennis & James, 2018).

Similarly, LaParcelle Fruits-Dupuis relies on seasonal planting cycles, including fruit tree planting in 2022 and spring planting events in 2023, to promote biodiversity and sustainability. These events mark key seasonal milestones that both structure the gardening calendar and activate community engagement. As one gardener observed, "*Observing what grows in the garden connects us to nature*"[18], illustrating how civic greening initiatives foster environmental learning (Bendt et al., 2013).

Unpredictable ecological occurrences further demonstrate gardening's adaptive nature. One gardener at Gray-Moineaux recalled, "*We discovered potatoes that grew on their own; it was a surprise*"[19]. Such moments of spontaneous growth create shared narrative collective adaptability, reinforcing CGs' role as resilient urban spaces, particularly in times of crisis (Bieri et al., 2024).

b. Cyclical participation as a mechanism for social cohesion

Sustaining collective energy is essential for CGs to remain functional, particularly given the seasonal nature of gardening activities. Both Gray-Moineaux and LaParcelle Fruits-Dupuis demonstrate how structured, recurring events maintain engagement and strengthen social cohesion. Seasonality thus becomes not only a rhythm of nature but a rhythm of community life.

Seasonal activities such as planting workshops, harvest festivals, and open-house events serve as regular community touchpoints, fostering a sense of shared purpose and belonging. At Gray-Moineaux, the "Fifty Shades of Gray" open house provides an opportunity to celebrate achievements, reflect on challenges, and plan future projects, reinforcing collective ownership and commitment (Fig. 5). Similarly, LaParcelle Fruits-Dupuis sustains enthusiasm through seasonal planting and harvest celebrations, ensuring consistent participation (Fig. 5). These seasonal rituals anchor participation in meaningful moments, reinforcing CGs as socially embedded emotionally resonant spaces (Eizenberg, 2012).

However, seasonal fluctuations, such as reduced winter activity, require innovative strategies to maintain momentum. Both gardens mitigate lower participation in colder months by hosting indoor workshops and planning sessions, ensuring the garden remains a focal point for the community year-round. As one gardener at Gray-Moineaux noted, "*In winter, it was a bit more complicated because it's dark at 5 PM"* [20] . This highlights the need for temporal governance – structures that anticipate and accommodate seasonal drop-offs while keeping social ties active. By adapting to changing social and environmental conditions, CGs ensure their long-term relevance across different timeframes. Their resilience lies not in uniform activity but in their capacity to modulate engagement across the seasons, maintaining continuity through variation.

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[18] *« Observer ce qui pousse dans le jardin nous connecte à la nature »*

[19] *« On a découvert des patates qui poussaient toutes seules ; c'était une surprise »*

[20] **«** *En hiver, c'était un peu plus compliqué car à 17h il fait nuit »*

Knowledge exchange and social capital: enhancing collective resilience

Beyond their ecological function, CGs serve as hubs of social interaction, cultural transmission, and intergenerational learning, fostering long-term community resilience. They operate as spaces of informal education, where knowledge-sharing sustains collective action. These forms of learning are embedded in everyday activities, where hands-on experimentation, dialogue, and observation coalesce into shared knowledge. However, knowledge transmission and social cohesion are not static; they evolve in response to demographic shifts, institutional influences, and changing participation patterns. This section examines how Gray-Moineaux and LaParcelle Fruits-Dupuis function as dynamic spaces of social learning, exploring intergenerational knowledge transfer, cross-cultural exchanges, and emerging challenges to social capital formation.

a. Knowledge sharing and intergenerational connections

Both gardens demonstrate the critical role of intergenerational knowledge transfer in strengthening community resilience. At Gray-Moineaux, prior to its renewal, collaboration with schools positioned it as an outdoor learning space, embedding ecological stewardship into early education. Today, workshops on biodiversity and sustainable gardening continue this legacy, offering platforms for experienced gardeners to share traditional ecological knowledge with newcomers. One participant remarked, "*We chose together (the planting) but since he knows a bit more*,"[21] highlighting the reciprocal learning central to these exchanges (Urueta-Ortiz, 2016; Armstrong, 2000). These interactions underscore the horizontal nature of learning within CGs, where knowledge is co-produced rather than unidirectionally transmitted.

Similarly, LaParcelle Fruits-Dupuis integrates children into seasonal activities, such as planting and harvesting, fostering intergenerational bonds. One gardener observed, "*We have children who come with their parents*,"[22] emphasizing how these activities transmit sustainable practices across generations (Bieri et al., 2024). This participatory exposure to gardening at a young age contributes to cultivating environmental awareness and collective responsibility. However, some gardeners at LaParcelle Fruits-Dupuis expressed concern over limited youth involvement, with one participant noting, *"Few young people seem to be involved*"[23]. This lack of youth presence signals a potential discontinuity in knowledge transmission and raises questions about the long-term renewal of collective practices. Research on CGs suggests that youth-specific programs and targeted outreach can bridge this gap (Wakefield et al., 2007; Armstrong, 2000). Without such efforts, gardens risk becoming socially fragmented, where knowledge

[21] *« On a choisi ensemble (les plantations), mais vu qu'il s'y connait un peu plus »*
[22] *« On a des enfants qui viennent avec leurs parents »*
[23] *« Peu de jeunes semblent s'y impliquer »*

remains concentrated within specific age groups rather than shared across generations. The challenge, then, is not only to preserve knowledge but to actively regenerate it across demographic boundaries.

b. Cross-cultural exchange and social networks

Beyond intergenerational learning, both gardens foster cross-cultural knowledge exchange. Gray-Moineaux, situated near Brussels' European district, has become a multicultural hub, where interactions between gardeners from diverse backgrounds broaden ecological knowledge. Ethnographic observations revealed dialogues between local gardeners and expatriates, such as an Italian participant sharing traditional seed-saving techniques. These cross-cultural interactions enrich the knowledge base if the garden and cultivate respect through shared ecological practices (Bieri et al., 2024; Armstrong, 2000). LaParcelle Fruits-Dupuis demonstrates similar dynamics, collaborating with the Pulses Increase EU project to introduce experimental planting methods. This partnership illustrates how CGs operate at the intersection of local action and translocal innovation, integrating external expertise into grassroots experimentation. Communal meals and gatherings further strengthen these ties, providing opportunities for gardeners to share expertise, personal narratives, and cultural traditions. One gardener emphasized, "*The meetings are always followed by a potluck"*[24], illustrating how such events integrate collective memory and cultural continuity into the garden's social fabric. These shared rituals transform CGs into social ecosystems where food, stories, and traditions build emotional bonds and collective identity (Wakefield et al., 2007; Armstrong, 2000).

However, at Gray-Moineaux, social interactions have shifted, with some gardeners expressing concerns over growing individualization. One participant noted, *"Now the other comes only to pick up their vegetables... that's not the point of a community garden"*[25]. This reflects a drift from relational engagement to transactional use, potentially weakening the community fabric that sustains CGs over time. While CGs enhance social cohesion, sustaining cross-cultural networks requires continuous outreach and participation renewal, particularly within shifting urban populations (Wakefield et al., 2007; Bieri et al., 2024). Maintaining collective energy thus depends on active social infrastructure, rituals, events, and communication practices that reinforce the garden's role as a shared commons.

Balancing grassroots agency with institutional support: Bureaucratic constraints

The governance of CGs involves a delicate balance between grassroots autonomy and institutional support, shaping their long-term viability and impact (Fig. 6, 7). Navigating this balance reveals the dual role of institutions as both enablers and potential constraints in the life cycle of CGs. This section examines the challenges and strategies used by Gray-Moineaux and LaParcelle Fruits-Dupuis to

[24] *« Les rencontres sont toujours suivi d'une auberge espagnole »*

[25] **«** *Maintenant il vient juste chercher ses légumes… ce n'est pas ça le but d'un jardin collectif »*

navigate institutional frameworks, weighing the trade-offs between community-driven governance and external partnerships.

a. Institutional support and bureaucratic constraints

Institutional support provides resources and legitimacy to CGs, as exemplified by Gray-Moineaux's integration into the Brussels Good Food Strategy in 2019, which secured funding and infrastructural support (Bruxelles Environnement, 2019) (Fig. 6). Under neoliberal urban frameworks, governments increasingly position CGs as grassroots providers of sustainability outcomes, effectively outsourcing responsibilities once held by public institutions (Rosol, 2010; Cumbers, 2018). However, such partnerships also introduce challenges. Aligning CG activities with urban policies can lead to bureaucratic delays and conflicts with grassroots priorities. One gardener expressed frustration: *"It's sometimes complicated to meet the city's requirements without losing our community spirit"*[26]. This quote captures a broader concern: that institutional integration can erode the informal culture of CGs, replacing flexibility with compliance. These tensions prompted some members to temporarily shift focus to other spaces, such as Gray-Couronne, highlighting the risk of eroding CGs' democratic and participatory ethos under formal governance structures (Eizenberg, 2012) (Fig. 6). Another gardener noted, *"Bureaucracy forces us to structure more, but we don't want to become a rigid organization"*[27] reflecting a broader tension between maintaining community values and complying with institutional expectations. Such comments expose the emotional and organizational costs of formalization - where the drive for legitimacy may come at the expense of spontaneity and inclusion. The formalization of grassroots initiatives often shifts priorities, potentially transforming them into bureaucratic entities aligned more with policy agendas than community-driven missions (McClintock, 2013; Ghose et al., 2014).

LaParcelle Fruits-Dupuis faces similar challenges. To establish the garden through a communal contract with Anderlecht, gardeners created the "Collectif Parcelles", allowing them to navigate bureaucratic constraints while preserving their community-oriented approach (Fig. 5). Supported by the Good Food Strategy, the garden secured a three-year agreement with the municipality, aligning with broader urban policies while maintaining grassroots autonomy (Fig. 7). Its partnership with the Flemish Community Commission and Anderlecht municipality illustrates the strategic potential of institutional alliances - when paired with community-led governance. However, the garden remains committed to prioritizing community needs over external mandates. Collaborations with Le Début des Haricots and Natagora illustrate a strategy of diversifying support to mitigate external pressures, such as potential housing developments threatening the site (Fig. 5, 7). Ethnographic observations revealed that gardeners

[26] *« C'est parfois compliqué de suivre les exigences de la ville sans perdre notre esprit communautaire »*

[27] *« La bureaucratie nous oblige à structurer davantage, mais nous ne voulons pas devenir une organisation rigide »*

proactively engage institutions but as not as passive but as skilled negotiators, leveraging partnerships to secure land tenure without compromising grassroots values (Barron, 2016; Ghose et al., 2014).

b. Evolving governance structures and the sustainability of collective action

Temporary governance mechanisms - such as workshops, planting events, and volunteer coordination - often evolve into formalized structures, linking short-term activities to long-term sustainability (Fig. 5). These micro-practices accumulate over time, gradually shaping more stable organizational forms. Gray-Moineaux, for example, introduced membership systems, financial transparency measures, and digital communication tools to enhance organizational stability. However, the shift toward structured governance raises concerns about retaining collective energy and volunteer engagement. One gardener remarked, "*It's difficult to keep people over the long term*"[28] reflecting how administrative burdens and personal constraints impact participation. While digital tools like Telegram improved coordination, they also introduce form of "soft formalization" - increasing efficiency but potentially narrowing the modes of participation. These challenges mirror broader community-driven environmental projects, where formalization can sometimes hinder grassroots engagement (Eizenberg, 2012).

LaParcelle Fruits-Dupuis addresses this challenge through a decentralized governance model, ensuring that administrative responsibilities do not fall on a single group. The creation of a "groupe pilote" to handle bureaucratic tasks, combined with smaller working groups, allows members with varying expertise and availability to remain engaged. One gardener explained, *" We try to communicate as much as possible, so they know what we're doing"*[29]*,* underscoring the role of transparency and communication in sustaining participation (Armstrong, 2000). This modular governance structure diffuses responsibility and fosters inclusivity, without abandoning the informal spirit that defines CGs. The use of WhatsApp, Facebook, and physical task boards enhances coordination, ensuring members stay informed and actively involved. These digital tools align with broader trends in participatory urban governance, where online platforms support decision-making while preserving informal community networks (Ghose et al., 2014). However, even decentralized governance structures risk formalizing interactions, potentially reducing spontaneous exchanges that are central to fostering social cohesion (Eizenberg, 2012). The challenge, therefore, is not to reject structure but to design governance systems that preserve adaptability, trust, and relational engagement.

The spatial dynamics of community gardens: Creating hybrid spaces

CGs function as hybrid spaces, blending ecological functions, social interactions, and urban infrastructure. Their spatial organization influences long-term viability, shaping accessibility,

[28] *"C'est difficile de tenir les gens sur le long terme"*

[29] *« On essaie de communiquer le plus possible pour qu'ils sachent ce qu'on fait »*

integration within the urban landscape, and seasonal adaptability. As such, CGs are not only ecological interventions but spatial strategies that negotiate land use, participation, and visibility within evolving urban fabrics. This section examines the evolving physical and spatial characteristics of Gray-Moineaux and LaParcelle Fruits-Dupuis, focusing on layout, urban integration, accessibility, and temporal use.

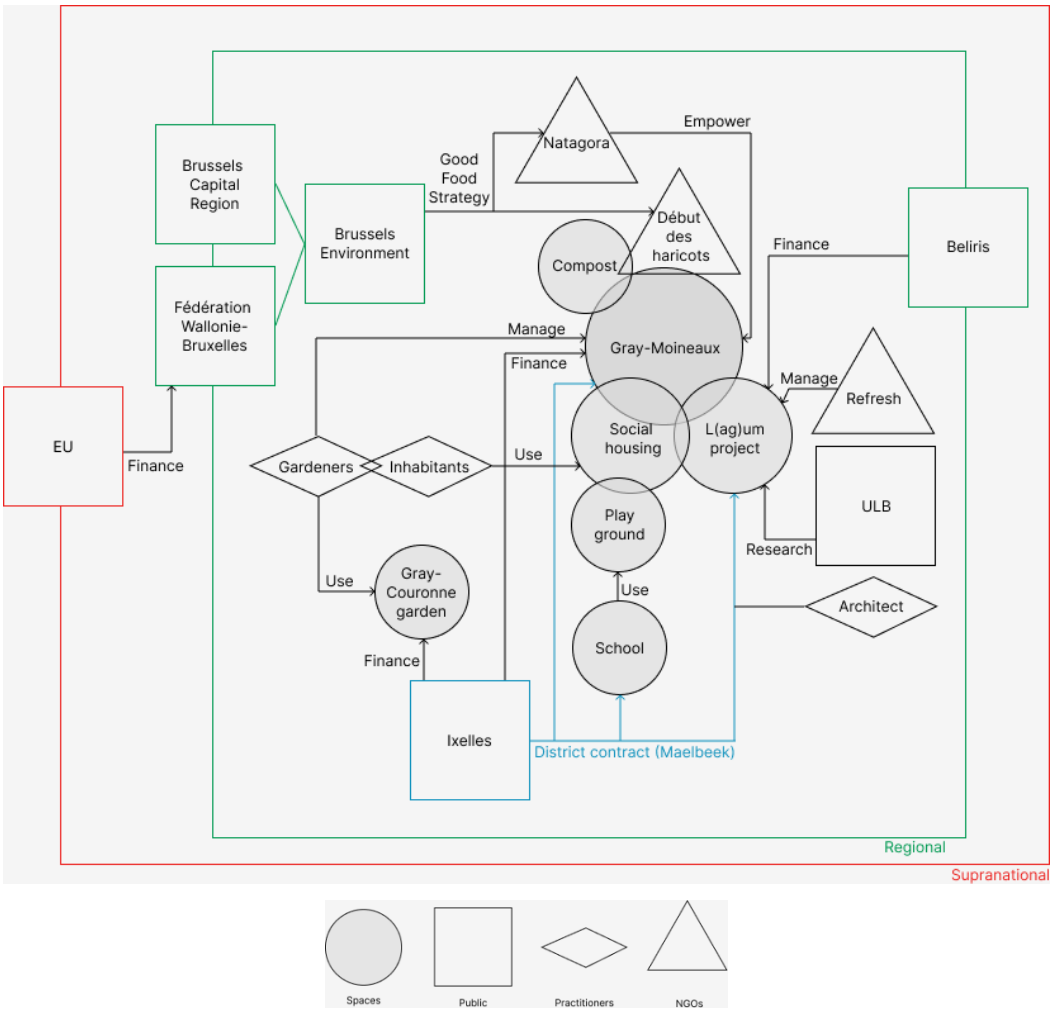

Figure 6: Stakeholder network in Gray-Moineaux (Source: author)

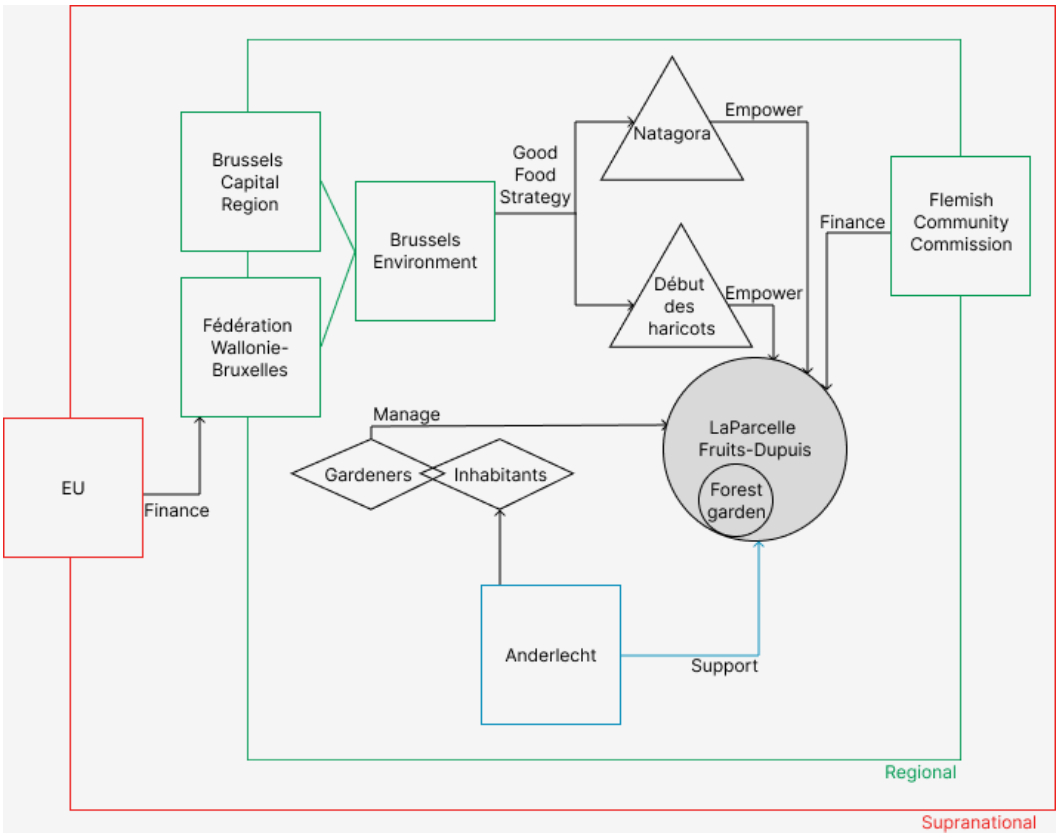

Figure 7: Stakeholder network in LaParcelle Fruits-Dupuis (Source: author)

a. Spatial transformation and accessibility

Both gardens exemplify how spatial transformation is essential to CG functionality and longevity. Initially perceived as wastelands, these spaces evolved into multifunctional areas through collective action and adaptive design, balancing community needs, environmental constraints, and urban development pressures.

At Gray-Moineaux, the spatial layout shifted from an isolated, enclosed space to an open, integrated urban landscape. Initially restricted by fencing, limited access inhibited broader community interaction. However, following a renewal project that introduced social housing, a rooftop agriculture garden, and a playground, the garden's borders were opened, increasing community involvement (Fig. 5, 6). Seating areas, pathways, and shared composting bins further solidified its role as a multifunctional public space, supporting educational workshops, social events, and urban agriculture (Fig. 5, 6). However, this openness raised concerns about security and ecological protection. One gardener noted, "*Children and dogs come in and damage our plants*"[30], highlighting the tension between fostering inclusivity and safeguarding ecological integrity - a recurring dilemma in the governance of urban commons, where access must be balanced with care and stewardship (Glover et al., 2005; Alaimo et al., 2010).

By contrast, LaParcelle Fruits-Dupuis maintains a closed-off spatial configuration, with high fences limiting access to members and scheduled events. This approach has enabled focused ecological

[30] *« Les enfants et les chiens entrent et endommagent nos plantes »*

interventions but constrained spontaneous community engagement. In interviews with residents, one participant remarked, "*I thought that it was still a wasteland*"[31], reflecting how restricted access affects public perception. Gardeners explained that fencing serves a dual function - protecting biodiversity zones such as the forest garden, while also preserving the privacy and integrity of cultivated areas. One gardener noted, "*The fence allows us to work without interruption and protect biodiversity*"[32]. This illustrates how enclosure becomes both a protective and political strategy, shaping the visibility and permeability of CGs within their neighborhoods. While this structured approach supports permaculture, biodiversity, and collaborative projects, it also raises questions about inclusivity. This case highlights how spatial boundaries are not neutral but actively co-produce social inclusion, ecological priorities, and urban narratives.

Both CGs are also embedded within multiscale networks, engaging at neighborhood, district, city, regional, national, and EU levels (Fig 6, 7). These connections facilitate knowledge exchange, policy advocacy, and financial support, ensuring their integration into broader urban greening and sustainability agendas. Their spatial position is not only physical but institutional, mapping local practices onto regional strategies and transnational frameworks. Participation in municipal food strategies, environmental NGOs, and EU-wide ecological projects positions them within a wider framework of urban resilience and governance, linking local community actions to broader territorial and institutional dynamics.

b. Temporal use of space

The seasonal nature of CGs significantly influences spatial organization, as different areas gain prominence throughout the year. In both gardens spatial use follows an ecological rhythm, where temporal cycles dictate activity zones and reconfigure movement patterns.

At Gray-Moineaux, seasonal cycles define the use of space, with planting areas activated in spring and summer, while autumn and winter months focus on composting, soil regeneration, and community events (Fig. 5). Ethnographic observations revealed how gardeners adjust tasks seasonally, redistributing labor and resources based on climate and daylight availability. This cyclical repurposing of space enables continuity in engagement and reinforces ecological resilience through seasonal care routines.

Similarly, LaParcelle Fruits-Dupuis follows a structured division of space, where specific zones shift in prominence depending on the time of year. For example, the forest garden and biodiversity areas are central in spring and summer, while winter is dedicated to soil health, composting, and planning future cultivation cycles (Fig. 5, 7). One gardener explained, "*In winter, we focus on planning and maintaining infrastructure*"[33],highlighting how seasonal transitions are actively managed rather than passive

[31] *« Je pensais que c'était toujours une friche »*

[32] *« La clôture nous permet de travailler sans interruption et de protéger la biodiversité »*

[33] *« En hiver, nous nous concentrons sur la planification et l'entretien des infrastructures »*

dormancy periods. This spatial-temporal orchestration reflects a proactive engagement with environmental cycles, turning "off-seasons" into productive planning periods.

Rather than experiencing seasonal inactivity, both gardens strategically leverage these transitions to reinforce long-term sustainability. Their spatial adaptability is key to sustaining relevance, allowing CGs to function as active commons year-round despite climatic or participation fluctuations. The ability to reallocate resources, adjust labor distribution, and organize activities around environmental constraints illustrates how CGs function as resilient urban commons. This adaptability ensures their continued role as dynamic public spaces, bridging ecological cycles with social practices. By synchronizing garden rhythms with urban lifestyles, these spaces transcend their horticultural functions and emerge as lasting community infrastructures, alive with seasonal, social, and spatial meaning.

DISCUSSION

This study explored the conditions enabling long-term commitment in CGs, focusing on Gray-Moineaux and LaParcelle Fruits-Dupuis in Brussels. Through a qualitative case study approach, including interviews, ethnographic observations, and spatial analysis, we examined how short-term actions shape broader governance, social, and spatial structures, contributing to CG sustainability. Findings reveal that cumulative and adaptative of micro-scale interventions plays a pivotal role in generating long-term resilience, positioning CGs as dynamic commons rather than fixed entities.

Adaptive governance

Results highlight the significance of adaptive governance in sustaining CGs (Rosol, 2010; Eizenberg, 2012). Both gardens negotiated between grassroots autonomy and institutional frameworks to secure land and resources while preserving collective identity. This balancing act produced varied governance trajectories: Gray-Moineaux, through structured decision-making and formalized coordination; LaParcelle Fruits-Dupuis, via decentralized models that emphasized flexibility. Their integration into the Brussels Good Food Strategy (Bruxelles Environnement, 2019) provided support but also introduced bureaucratic constraints. The tensions observed reflect broader challenges in co-producing sustainability between civic actors and public institutions, where formal support can inadvertently reshape grassroots priorities (Barron, 2017; Wakefield et al., 2007).

Temporality of engagement

The study underscores the role of seasonal rhythms in structuring participation. Gardening cycles create a temporal framework that fosters engagement while mitigating burnout through rotational participation (Colding & Barthel, 2017). These recurring cycles stabilize community dynamics and anchor shared rituals within the gardening calendar. Seasonal events, such as planting sessions and harvest festivals, reinforce community bonds. However, winter months pose challenges, requiring alternative strategies

like indoor workshops and planning meetings to sustain momentum (McClintock, 2014; Bendt et al., 2013). These adaptive responses emphasize the importance of temporal flexibility, not only in ecological terms but in organizing participation across fluctuating conditions.

Spatial strategies

Spatial flexibility influences long-term usability and engagement. Gray-Moineaux's transition from an enclosed space to an open, integrated landscape increased accessibility but also raised challenges in managing ecological integrity. Conversely, LaParcelle Fruits-Dupuis maintained controlled access, protecting biodiversity while limiting spontaneous participation. These divergent strategies reveal spatial trade-offs between inclusivity and ecological protection, suggesting that spatial governance is a core component of CG resilience. Field mapping revealed that diverse configurations - such as communal areas, planting zones, and adaptable infrastructure - enhance usability and sustained participation (Rosol, 2010; Krasny & Tidball, 2015). In both cases, spatial design shaped who could engage, how, and when, embedding socio-ecological values into physical form.

Knowledge exchange

Intergenerational knowledge transmission emerged as essential for sustaining CGs. Participants valued learning about sustainable gardening, permaculture, and biodiversity conservation, fostering strong social networks (Bieri et al., 2024; Wakefield et al., 2007). These informal learning exchanges functioned as a form of community memory, reinforcing resilience through shared practices. However, attracting younger participants remains a challenge, raising concerns about generational renewal. Like findings in urban greening projects, targeted outreach - through partnerships with schools and youth-oriented workshops - could enhance long-term engagement (Barron, 2017; Pudup, 2008). Without such renewal, CGs risk consolidating social capital without regenerating it, limiting their future adaptability.

CONCLUSION

This study demonstrates that long-term CG sustainability results from interconnected governance, seasonal participation, spatial adaptability, and social cohesion, reinforcing one another over time. Rather than isolated variables, these dimensions operate as a system of interdependencies that sustain CGs as resilient socio-ecological infrastructures. While previous research has examined governance structures or ecological benefits independently, this study highlights how short-term, adaptive interventions accumulate to create resilience, framing CGs as fluid, evolving commons rather than static spaces.

A key contribution is its temporal perspective, emphasizing how governance shifts, seasonal engagement, and spatial modifications interact to sustain CGs. This focus on temporal layering - linking the immediate with the enduring - offers a fresh lens for understanding commons-based urban resilience.

Institutional support offers stability but may impose constraints on grassroots agency. Seasonal fluctuations require adaptive participation strategies, while generational renewal remains a pressing concern, necessitating structured efforts to involve younger participants.

These insights inform urban planning and policy, advocating for:

- Adaptive governance models that balance institutional support with grassroots agency,
- Spatial strategies that enhance accessibility while preserving ecological integrity,
- Participatory frameworks that embed CGs within broader sustainability agendas.

Practically, this suggests that support mechanisms must go beyond funding and land access, offering flexibility in governance and space-making that reflects the lived rhythms of CG communities

Future research should explore how policy environments and land tenure structures influence CG longevity, while longitudinal studies could provide deeper insights into how these spaces continuously evolve amid shifting socio-economic and environmental conditions. Further inquiry into the co-production of commons across time, scale, and institutional layers would help clarify how CGs contribute not only to urban sustainability but to democratic urban governance.

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Paper 4:

Téoule, F. (2025). Governance models and the socio-ecological role of community gardens in post-socialist Krakow. *Regional Science Policy & Practice, 17*(10), 100243. https://doi.org/10.1016/j.rspp.2025.10024.

Status: Published

Regional Science Policy & Practice 17 (2025) 100243

Contents lists available at ScienceDirect

Regional Science Policy & Practice

journal homepage: www.sciencedirect.com/journal/regional-science-policy-and-practice

Governance models and the socio-ecological role of community gardens in post-socialist Krakow

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ARTICLE INFO

Keywords:
Community gardens
Governance models
Socio-ecological infrastructure
Postsocialist, urbanism
Urban food systems

ABSTRACT

Community gardens are increasingly recognized as critical nodes for socio-ecological learning and innovation, particularly in post-socialist cities navigating historical legacies and contemporary urban challenges. This study investigates how governance models -bottom-up, top-down, and hybrid - influence the inclusivity, ecological adaptability, and long-term sustainability of community gardens in Krakow, Poland. Drawing on qualitative research conducted across three distinct sites - a grassroots initiative (Salwator), a municipally-led project (Pychogród), and a hybrid model (Jagiellonian University Campus) - this paper explores the interplay between governance arrangements and socio-ecological outcomes. Ethnographic observations, semi-structured interviews, co-design workshops, and action research were employed to capture governance dynamics and the evolving role of gardens as transformative infrastructures. Findings reveal that grassroots initiatives foster strong community ownership and flexible ecological practices, yet face challenges related to resource instability and volunteer fatigue. Conversely, top-down models provide structural security and institutional support but risk alienating participants by limiting local agency. Hybrid approaches, exemplified by the Jagiellonian University Campus garden, blend institutional legitimacy with participatory processes, fostering inclusive decision-making and ecological experimentation, although they grapple with sustaining engagement amidst transient populations. The results underscore the necessity of adaptive governance frameworks that balance institutional support with community agency, particularly in post-socialist urban contexts characterized by fragmented social trust and uneven civic engagement. By conceptualizing community gardens as socio-ecological infrastructures, this study contributes to understanding how urban food systems can integrate sustainability goals with local cultural and environmental specificities. The findings offer actionable insights for policymakers, urban planners, and practitioners aiming to harness the transformative potential of community gardens to address broader sustainability challenges.

Introduction

Cities, as pivotal nodes within local and global food systems, are uniquely positioned to drive transitions toward sustainability. They concentrate resources, infrastructure, and diverse communities, providing fertile ground for innovative food initiatives. In recent years, urban agriculture has garnered attention for its capacity to influence dietary patterns, improve ecological resilience, and foster social cohesion (Morgan and Sonnino, 2010; WinklerPrins, 2017). Among its various forms, community gardens stand out as integrated spaces where food production, environmental stewardship, and civic participation converge (Guitart et al., 2012). This study builds on the special issue's concern with urban food challenges by exploring how community gardens, as embedded urban practices, contribute to sustainability transitions in a post-socialist context.

Krakow, a historically significant and rapidly evolving city in southern Poland, offers a compelling site for exploring this inquiry. More than three decades after the collapse of state socialism, the city's urban fabric remains shaped by centralized planning legacies, shifting demographic profiles, and evolving imaginaries of public space (Hirt, 2012; Ferenčuhová, 2016). Within this transitional environment, community gardening has evolved beyond subsistence-oriented allotments. Today, such gardens are increasingly understood as socio-ecological infrastructures, settings where citizens, institutions, and policies converge to negotiate inclusion, ecological adaptability, and long-term sustainability (Barthel, Parker and Ernstson, 2015; Mokras-Grabowska, 2021).

While community gardens are well established as sites of food

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https://doi.org/10.1016/j.rspp.2025.100243
Received 30 December 2024; Received in revised form 9 August 2025; Accepted 13 August 2025
Available online 16 August 2025

production, ecological resilience, and social learning, their potential to advance sustainability depends significantly on how they are governed. In post-socialist cities like Krakow, governance takes multiple forms: from grassroots mobilisation to municipal initiatives and collaborative arrangements. These configurations emerge in response to persistent institutional legacies and evolving civic practices (Colding and Barthel, 2013). Yet, little is known about how these governance models influence inclusivity, ecological adaptation, and the capacity to anchor long-term transformations. To address this gap, this paper asks: *How do governance models (bottom-up, top-down, and hybrid) shape the inclusivity, ecological adaptability, and sustainability of community gardens in Krakow, as they evolve into transformative socio-ecological infrastructures responding to the cultural, political, and environmental challenges of post-socialist urban change?*

The study employs a comparative, qualitative research design encompassing three community gardens in Krakow, each representing a distinct governance model: a grassroots bottom-up initiative, a municipally supported top-down structure, and a hybrid arrangement blending institutional support with community participation. Using ethnographic observation, semi-structured and go-along interviews, co-design workshops, and action research, the study triangulates data to examine governance negotiations, everyday practices and socio-ecological interactions (Kusenbach, 2003; Sanders and Stappers, 2008; Dymek et al., 2021).

This paper is structured as follows: the next section presents the literature on urban sustainability, governance, and post-socialist urban change. Section three outlines the methodological framework and criteria for case selection, data collection, and analysis. The fourth section presents the research findings around three interconnected themes: (a) the influence of governance on inclusivity; (b) ecological adaptability and ecological practices; and (c) conditions for long-term sustainability. The fifth section discusses broader implications for post-socialist cities and global urban food system governance, while the conclusion reflects on the potential of community gardens to act as transformative socio-ecological infrastructures.

By examining the interaction of governance models with socio-cultural transformations, and environmental conditions, this study contributes to understanding how cities navigating post-socialist transitions can harness community gardens to advance urban sustainability. It highlights that while community gardens hold significant promise as arenas of socio-ecological learning and innovation, realizing the transformative potential of this space depends on governance frameworks that are adaptive, participatory and context-sensitive. The findings are relevant to policymakers, urban planners, researchers, and practitioners seeking to integrate community gardens into boarder sustainability agendas, particularly in cities shaped by post-socialist trajectories.

Literature review

Historical development of community gardens

Community gardens, broadly understood as collectively managed urban green spaces where residents cultivate plants for various social, ecological, and cultural purposes, have a long and multifaceted history. Their conceptual roots are often traced to nineteenth-century Europe and North America, where industrialization, urbanization, and socio-economic inequalities prompted the creation of allotment gardens, victory gardens, and school gardens as pragmatic responses to urban poverty, public health concerns, and wartime food shortages (Lawson, 2005; Bell et al., 2016). Notably, such practices were not confined to the West; collective urban gardening traditions have long existed in parts of Africa, Asia, and Latin America, often linked to colonial policies or subsistence needs (WinklerPrins, 2017). Recent research highlights how community gardens in the Global South, such as in Cape Town, function not only as sources of food and green space but also as vehicles for environmental justice, fostering ecological stewardship, knowledge exchange, and the revitalization of neglected urban areas (Jorgensen, 1989). By the late twentieth century, cities across the Global South were witnessing a proliferation of community gardens as grassroots responses to urban food insecurity and the paucity of green space. For instance, during Cuba's economic crisis in the 1990s, Havana's residents famously converted vacant lots into urban organic gardens (es. *organopónicos*) to bolster local food supply, a case that illustrates the global reach of community gardening ideals (WinklerPrins, 2017). Over time, these initiatives took on more diverse functions, evolving into places for community-building, social learning, environmental stewardship, and civic engagement (Smith & Kurtz, 2003; Barthel, Parker and Ernstson, 2015).

In Western Europe and North America, community gardens benefited from a variety of influences: grassroots activism, urban social movements emphasizing social justice and environmental quality, and policy frameworks supporting public participation in urban planning. In many cases, they emerged as bottom-up responses to market-driven development, environmental degradation, and spatial inequalities (Smith & Kurtz, 2003; Guitart, Pickering and Byrne, 2012). As a result, the concept of community gardens took on a flexible character, accommodating a wide range of objectives, from improving neighborhood cohesion to experimenting with sustainable food systems.

These notions gradually spread to Central and Eastern Europe (CEE), including Poland, where the post-1989 political and economic transformations opened the urban fabric to new forms of civic participation (Hirt, 2012; Czepczyński, 2008). However, the region's gardening traditions predate the global community garden discourse by over a century, taking shape through allotment gardens (pol. *ogródki działkowe*) deeply ingrained in the urban landscape as semi-private, household-level plots focused on subsistence and recreation (Szczepańska et al., 2021; Dymek et al., 2021; Djokić et al., 2018; Bański, Czapiewski, 2015; Mokras-Grabowska, 2021). Under state socialism, allotment gardens provided families with supplemental food and green refuges amid highly regulated urban environments (Mincyte, 2009; Dymek et al., 2021; Hlavaček et al., 2016). The post-socialist transition brought both challenges and opportunities. Economic liberalization and urban market pressures led to spatial reorganization and redevelopment, which, in turn, threatened traditional allotments (Dymek et al., 2021; Becker, 2018; Szczepańska et al., 2021). As highlighted in studies of Poznań and Warsaw, allotment gardens were increasingly viewed as remnants of an outdated past, often threatened by investment pressures and spatial reorganization (Dymek et al., 2021; Hlavaček et al., 2016). However, this period also opened spaces for civic engagement and introduced new models of collective urban gardening influenced by global discourses of sustainability, participatory planning, and localism (Bell et al., 2016; Prové et al., 2016) (Fig. 1).

In cities like Krakow, one can thus encounter a hybrid legacy. On one hand, there is the long-standing tradition of allotment gardening, historically individualized and shaped by a period of top-down state management. On the other hand, emerging initiatives reflect newer, community-driven experiments that emphasize collective governance, environmental education, and cultural exchange (Łabędź, 2017; Krzysztonek, 2014; Dudzic-Gyurkovich, 2021, Becker, 2018). This reflects a broader trend of urban reorganization seen in CEE cities like Prague and Budapest, where community gardens are increasingly recognized for their social, ecological, and cultural functions (Djokić et al., 2018; Szczepańska et al., 2021).

This convergence of historical and contemporary influences makes it essential to clarify how to define "community gardens" in this study. While acknowledging the layered cultural significance of traditional allotments, we adopt a definition that highlights collective governance and shared decision-making processes aimed at producing socio-ecological benefits. Specifically, we define community gardens as urban green spaces cultivated and managed by a collective of local stakeholders who engage in deliberative processes, share responsibilities and resources, and align their gardening activities with broader

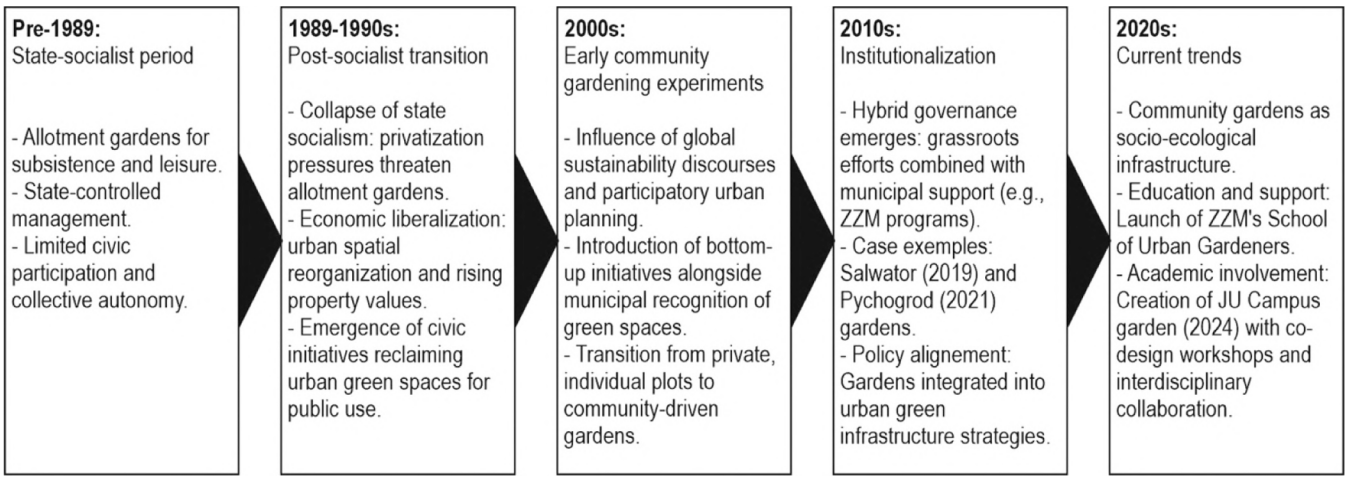

Fig. 1. Timeline of Krakow's community gardens (Source: author).

environmental, social, and cultural objectives (Beilin & Hunter, 2011).

Governance models in urban green spaces

Urban governance literature highlights the significance of decision-making structures, ranging from bottom-up and top-down models to various hybrids, in shaping the inclusivity, durability, and ecological performance of community gardens (Ansell and Gash, 2007; Guitart, Pickering and Byrne, 2012). Bottom-up approaches emphasize community initiative, local knowledge, and participatory processes. They can bolster place-based identities and rapidly adapt to changing conditions but may face limited resources and inconsistent participation if not anchored by supportive institutions (Guitart et al., 2012). This aligns with recent shifts in regional science, which increasingly acknowledge the role of small-scale, community-based initiatives in shaping urban quality of life and resilience (Chen and Schintler, 2023). One might also note that community gardens' longevity is intertwined with urban land dynamics: amid rapid city growth, unprotected grassroots gardens are vulnerable to redevelopment, reflecting broader spatial inequalities in green space access (Rosol, 2010; Haase et al., 2017). In Poland, grassroots urban movements have begun to play a more prominent role, particularly in cities like Krakow, where residents organize to protect green spaces and engage in bottom-up revitalization projects (Łabędź, 2017), often driven by concerns over privatization and loss of public accessibility (Krzysztonek, 2014).

By contrast, top-down governance, often led by municipal authorities, provides formal land tenure security, administrative support, and policy integration. This stability can ensure that community gardens are recognized within broader urban planning agendas (Beilin & Hunter, 2011; Bell et al., 2016). However, top-down interventions may risk marginalizing local voices and failing to reflect the nuanced interests and cultural practices of garden users. Studies on Warsaw and Poznań highlight how top-down approaches can provide stability (e.g., land tenure security) but risk excluding community perspectives and local priorities (Szczepańska et al., 2021; Dymek et al., 2021). In post-socialist contexts like Krakow, historical legacies of centralized authority often result in uneven trust between citizens and institutions (Czepczyński, 2008). Krzysztonek (2014) highlights how urban elites in Krakow, while acknowledging civic movements, often prioritize market-oriented development agendas, limiting grassroots influence in urban decision-making. Yet, research suggests that cities offering attractive public amenities, such as parks, gardens, and leisure spaces, may experience stronger growth and be more successful in attracting skilled residents (Carlino and Saiz, 2019).

In response, hybrid governance models have emerged as a strategy to balance institutional stability with grassroots innovation. These models involve partnerships among civic groups, municipal departments, non-governmental organizations, and even private stakeholders (Ansell and Gash, 2007). As observed in Poznań, partnerships between local authorities, NGOs, and garden users can address land security issues while promoting ecological and social sustainability (Dymek et al., 2021; Hlavaček et al., 2016). While promising, these models must address power imbalances, divergent priorities, and uneven capacities to manage shared resources. For example, the governance of urban agriculture in Warsaw reveals the challenges of reconciling community-driven practices with formal policies aimed at land management and food security (Prové et al., 2016). The interplay of bottom-up mobilization and top-down policies in Krakow underscores the potential for hybrid governance to support community gardens. The historical advocation from civic groups for participatory urban governance reveals opportunities to integrate community-led initiatives into broader sustainability agendas. Hybrid models in Krakow must address barriers such as institutional inertia, land ownership disputes, and fragmented civic networks (Becker, 2018; Hlavaček et al., 2016; Krzysztonek, 2014). Insights from recent studies in the Global South, such as ecotourism projects in rural Uzbekistan, demonstrate how local environmental initiatives, when coupled with inclusive governance, can generate social and economic benefits, strengthening local employment and livelihoods (Abdurakhmanova and Ahrorov, 2025).

Community gardens as socio-ecological infrastructures

Conceptualizing community gardens as socio-ecological infrastructures places them at the intersection of ecological processes and human agency. Beyond their provisioning functions, such as food production, they contribute to soil remediation, biodiversity enhancement, and urban microclimate regulation (Harris, 2009; Barthel et al., 2015). For example, studies highlight that well-maintained allotment gardens in Poland can serve as vital components of urban green infrastructure systems, enhancing ecological resilience and environmental quality (Klepacki & Kujawska, 2018). Also, gardens in CEE cities like Belgrade demonstrate how informal gardening practices contribute to urban greenery and ecological restoration, even in unregulated contexts (Djokić et al., 2018).

Equally significant are their social dimensions. Community gardens facilitate collective learning, cultural exchange, and the development of social capital, as participants experiment with horticultural practices, share resources, and forge inclusive local identities (Wakefield et al., 2007). Similar trends have been noted in Warsaw, where younger generations are increasingly engaging in allotment gardening for recreation and environmental education (Szczepańska et al., 2021; Dymek et al., 2021). These infrastructural qualities depend on governance

frameworks that encourage long-term stability with adaptability. By linking local knowledge with formal policy support, well-managed gardens can enhance a city's broader green infrastructure network, bolstering resilience against environmental pressures such as climate change or urban heat islands. However, scholars caution that if such urban greening initiatives are not inclusive, community gardens may inadvertently reinforce social inequalities rather than alleviate them (Haase et al., 2017). For instance, recent scholarship emphasizes the strategic importance of allotment gardens in urban green space systems, demonstrating how careful classification and planning, aligned with governance models, can integrate gardens into citywide sustainable development strategies (Dymek, Wilkaniec, Bednorz and Szczepańska, 2021). Thus, effective governance arrangements are a cornerstone in ensuring that gardens function as enduring socio-ecological nodes rather than transient experiments.

Post-socialist urban transformations

The post-socialist transition in Central and Eastern European cities provides a complex backdrop for examining community garden governance. Decades of centralized control established a pattern of top-down management and limited citizen participation, while simultaneously fostering the ability of citizens to provide themselves and their immediate networks with a degree of self-sufficiency. However, this self-sufficiency was predominantly confined to close family, friends, and neighborhood connections, reflecting the low levels of bridging social capital that characterize post-communist societies (Czapiński, 2010; Lasinska, 2013). In Poland, for instance, the density of social networks and levels of social trust remain relatively low compared to Western European countries, a legacy of the limited existence of independent civic associations under communism and the resulting "middle range social vacuum" (Nowak, 1979; Murzyn-Kupisz and Działek, 2013). This vacuum constrained broader civic engagement and reinforced reliance on personal networks, often explained as an adaptation to the shortages and centralized control of the centrally planned economy (Kolankiewicz, 1996; Rose, 2000). After the political changes of the early 1990s, new opportunities emerged for civic engagement, yet these were accompanied by market pressures, shifting policy frameworks, and uneven legacies of trust in public institutions (Hirt, 2012; Czepczyński, 2008).

In Poland, allotment gardens historically served as semi-private refuges of food production and leisure, and functioning as a de facto local sharing economy particularly during periods of scarcity (Bański, Czapiewski, 2015; Mokras-Grabowska, 2021). Over time, some of these spaces have evolved, at least temporarily, into more publicly accessible community gardens that emphasize collective benefits, environmental stewardship, and cultural integration, reflecting changing urban realities and social aspirations. Community gardens provide an inclusive alternative, particularly for marginalized groups or residents facing spatial exclusion (Becker, 2018; Djokić et al., 2018) (Fig. 1).

The transformation of allotment gardens into community-focused sites resonates with broader transitions in urban governance. Scholars have pointed out how strategic planning can incorporate these green spaces into citywide sustainability frameworks (Bell et al., 2016; Dymek et al., 2021). Yet, the pace and depth of this integration vary, influenced by historical path-dependencies, socio-economic stratification, and disparities in municipal capacity. In Krakow, for example, the interplay between a culturally rich urban environment,[1] a dynamic academic population,[2] and shifting environmental attitudes[3] offers fertile ground for exploring how governance models shape the trajectories of community gardens.

Challenges and opportunities in community garden governance

A central challenge for community gardens, especially in post-socialist settings, lies in ensuring secure land tenure and stable funding mechanisms. Rapid urbanization, rising property values, and competition for central urban parcels can threaten the continuity of gardens (Beilin & Hunter, 2011; Dymek et al., 2021; Becker, 2018). Specifically in Krakow, securing long-term land tenure and institutional support is challenging amid rising property values and competing development priorities (Krzysztonek, 2014). Overcoming these challenges often requires forging durable partnerships between community groups and public or private entities, as limited institutional support, unclear regulations, and weak coordination between stakeholders undermine the long-term sustainability of gardens (Hlavaček et al., 2016; Becker, 2018). Hybrid governance models, combining local initiative with institutional support, may facilitate negotiations over land use, resource allocation, and long-term maintenance, helping gardens weather the fluctuations of urban policies and market forces.

The evolving nature of these governance models also presents opportunities. When effectively implemented, they can enhance inclusivity by involving multiple stakeholders, diverse cultural groups, different age cohorts, and various socio-economic segments, thereby enriching the social fabric of neighborhoods and strengthening community social capital. As Dymek et al. (2021) illustrate in the case of Poznań, the purposeful classification and planning of allotment gardens based on their ecological and social functions has helped align them with municipal sustainability goals. Applied to Krakow, similar strategies could integrate community gardens more systematically into the city's green infrastructure network, bolstering both ecological resilience and reinforcing local ownership.

Theoretical gaps and research contribution

While the conceptual origins of community gardens and their global diffusion have been explored, more nuanced research is needed on how these concepts are locally adapted and redefined locally, particularly in post-socialist contexts. The layers of historical allotment use, evolving civic cultures, and contemporary environmental imperatives demand careful, context-sensitive inquiry (Hirt, 2012; Czepczyński, 2008). By investigating the governance models of community gardens in Krakow, this study aims to offer insights into how global ideas are localized, how historical legacies interact with emerging frameworks, and how

[1] Krakow is former capital of Poland and European Capital of Culture 2000 as well as a city rich in UNESCO World Heritage Sites.

[2] With one of the oldest universities in the world, Jagiellonian University established in 1364 as well as over 20 other Higher Education Institutions.

[3] The city was a finalist in European Green Capital competition 2023 (EC, 2023), participates in the European knowledge and innovation community working to build a zero-emission Europe (Climate-KIC, 2023) and is a member of the EU's Mission of "100 Climate-Neutral and Smart Cities by 2030" (Krakow.pl 2023a). In 2022 the recommendations of the Krakow Citizens Panel regarding climate change and city's climate neutrality were handed over to the president of the city (Krakow.pl 2023b), and in 2023 the Krakow Climate Education Center was opened (Krakow.pl 2023c).

community gardens can become more resilient and inclusive socio-ecological infrastructures.

This study therefore asks: In what ways do different governance models (bottom-up, top-down, and hybrid) influence the inclusivity, ecological adaptability, and long-term sustainability of community gardens in Kraków, particularly as these spaces take on transformative socio-ecological roles in navigating the cultural, political, and environmental challenges of post-socialist urban transformation?

Methodology

Case study selection and contextualization

This study employed a comparative, qualitative research design to examine how differing governance models influence co-creation processes and socio-ecological outcomes in community gardens in Krakow, Poland. Drawing on an approach common in urban studies, the research integrated multiple qualitative methods and case studies to capture both the complexity of governance arrangements and the situated nature of community gardening practices (Lawson, 2005; Bell et al., 2016). From the 21 community gardens mapped and monitored[4] in 2024, as part of an earlier participatory typology-building effort, three gardens were selected for deeper exploration. These cases were chosen based on both analytical contrast and the high degree of responsiveness and engagement from participants during the previous research phase. The selection aimed to encompass varying degrees of institutional involvement and community agency (Fig. 2): (1) the Salwator garden, a bottom-up initiative; (2) the Pychogród garden, a more top-down, municipally supported endeavor; and (3) an emergent hybrid model at the JU Campus, where co-design workshops and action research activities informed garden development.

This tripartite typology, bottom-up, top-down, and hybrid, draws on governance theory distinguishing between citizen-led, institutionally-managed, and collaborative forms of collective action. In this study, "bottom-up" refers to gardens initiated and governed autonomously by residents; "top-down" describes gardens organized by municipal or institutional actors; while "hybrid" denotes co-management involving both grassroots stakeholders and formal institutions.

The broader socio-political context in which the research was conducted is also noteworthy. Between 2022 and 2024, Poland experienced heightened political conservatism, growing institutional centralization, and the social impacts of the war in neighbouring Ukraine, including an influx of refugees and increased military visibility. While these developments did not directly impact the selected gardens, they heightened the relevance of autonomous, resilient, and inclusive civic initiatives. Additionally, the aftermath of the COVID-19 pandemic significantly shaped public interaction with urban green spaces. As demand for outdoor space and local food production surged, the price and scarcity of allotment gardens increased in many cities, including Kraków, pushing more residents toward community garden initiatives as accessible, collectively governed alternatives (Lin et al., 2021; Bristowe and Heckert, 2023). This contextual framing, coupled with the three contrasting governance models, enabled an in-depth, theoretically grounded comparison of how governance arrangements affect co-creation dynamics and socio-ecological functions.

This tripartite case selection facilitated an in-depth, context-sensitive comparison. Ethnographic observation, semi-structured and go-along interviews, participatory co-design workshops, and action research were combined to yield a rich, triangulated dataset. These methods were specifically chosen to capture multi-scalar interactions and co-creation processes in governance. For example, go-along interviews were selected to spatialize narratives of participants, while participatory workshops allowed stakeholders to co-design governance frameworks in situ. The application of these methods aligned with each governance type: co-design was employed in the hybrid JU Campus garden, where governance structures were still forming, while ethnography and interviews were prioritized in the already operational Salwator and Pychogród gardens. By integrating these methods and perspectives, the analysis could illuminate how historically rooted practices, evolving policy frameworks, and emergent civic imaginaries intersect in the governance of urban green spaces (Pink, 2007; Sanders and Stappers, 2008).

The case studies were chosen based on theoretical and empirical considerations. The Salwator garden, initiated by local residents without formal institutional mandates, exemplifies a bottom-up governance model rooted in flexible decision-making, cultural expressions, and adaptive organizational forms. In contrast, the Pychogród garden, founded with municipal support, represents a top-down model characterized by structured oversight, resource stability, and alignment with city-level ecological strategies (Colding and Barthel, 2013). Both gardens reflect Krakow's post-socialist urban context, shaped by shifting civic landscapes, policy experimentation, and the evolving role of green spaces (Hirt, 2012; Mokras-Grabowska, 2020).

The JU Campus garden introduced a hybrid model, shaped through transdisciplinary workshops and action research involving faculty, students, the Municipal Greenery Authority (ZZM), and neighborhood residents. This integration of academic, civic, and environmental actors embodied a co-creation ethos, blending institutional support with grassroots input (Lang et al., 2012; Polk, 2015). Notably, this initiative was embedded in an academic curriculum, enabling students and researchers to collaborate as part of an applied sustainability learning process.

Data collection methods

- Ethnographic observation: Prolonged ethnographic fieldwork was conducted at the Salwator and Pychogród gardens over multiple seasons over one year, with a particular focus on a regular daily meeting over two months in summer 2023. Observations focused on daily routines, spatial configurations, informal decision-making episodes, conflict resolution and maintenance activities (Jorgensen, 1989; Pink, 2013). Detailed field notes documented the interplay of social relations, horticultural practices, and governance structures, generating insights into the embodied and relational dimensions of community gardening (Rosol, 2010). This method enabled a deep understanding of how governance is enacted through everyday practices, and how authority and inclusion are negotiated informally.
- Semi-structured and go-along interviews: Interviews were conducted with a purposive sample of approximately 25 participants, including gardeners (11), official from the municipal Greenery Authority (ZZM) (1), NGO representatives (1), and local residents of the surrounded neighborhood (14). Semi-structured interviews allowed participants to articulate their experiences, motivations, and long-term visions, while go-along interviews, conducted in situ, enabled respondents to narrate their engagement with garden spaces as they moved through them (Kvale and Brinkmann, 2009; Kusenbach, 2003; Brinkmann, 2018). These spatially contextual interviews revealed how people interpreted and influenced garden governance in real time. Interviews were held in English, with careful attention to linguistic nuances and cultural references to ensure accurate interpretation (Temple and Young, 2004). When necessary, Polish

[4] This study builds on a previous phase of research by the author involving the participatory mapping and typology development of 21 community gardens in Kraków. That exploratory survey, conducted in 2024 through e-mapping, interviews, and on-site observations, informed the selection of the three case studies presented here. While the current paper focuses specifically on governance and co-creation dynamics, it forms part of a broader, multi-phase project on community gardens in post-socialist urban contexts (Teoule, 2025).

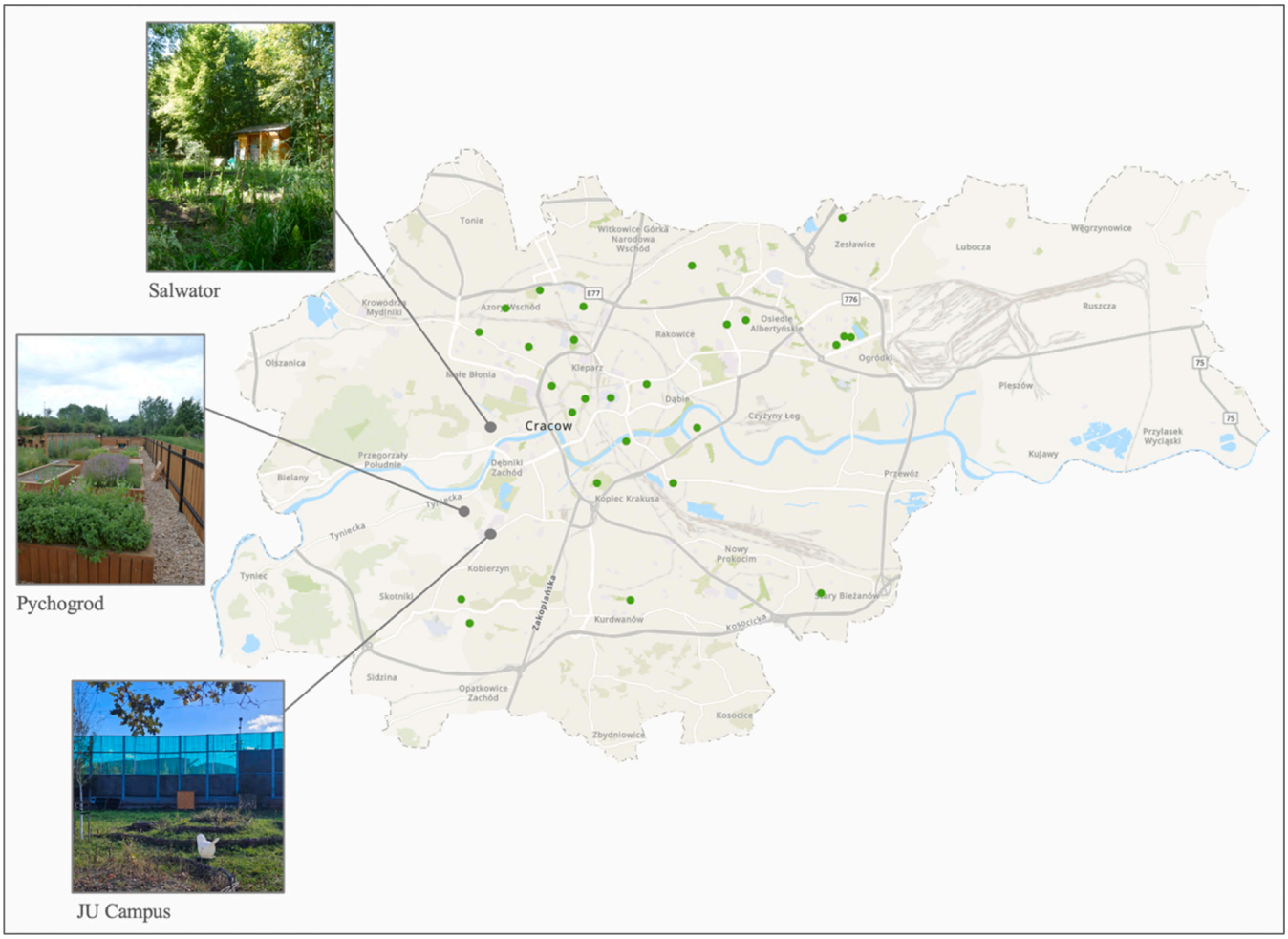

Fig. 2. Distribution of community gardens in Krakow in 2024 and case studies selected.
Source: Own study

terms and translated excerpts were used to ensure clarity and respect for original meanings.

- Workshops and co-design methods at the Jagiellonian University campus garden:
- Co-design methods were here applied exclusively and developed during the research period within an academic setting. This context enabled co-design to serve both as a governance tool and a research method. At the university campus site, participatory workshops facilitated collaborative design processes. Participants worked with maps, sketches, and visualization exercises, proposing spatial layouts and planting schemes (Sanders and Stappers, 2008; Hou, 2013). The workshops, held in English and Polish, brought together stakeholders with differing expertise, urban ecologists, gardeners, community organizers, students, and university staff, to co-create a governance framework aligned with both ecological resilience and social inclusion. Detailed documentation, including audio recordings, photographs, and annotated designs, captured the evolution of participants' ideas and the negotiation of diverse priorities (Brand and Rocchi, 2011). The co-design process also fostered reflexive engagement with the role of knowledge, inclusion, and institutional constraints, making it both a method and an object of study.
- Action research integration: The action research component underpinned the co-creation process at the university garden, linking scholarly inquiry with practical, iterative interventions (Bradbury, 2008; Greenwood, Levin, 2007). The research team organized thematic sessions and public events, such as workshops on soil health, biodiversity, and cultural activities for children and adults, that simultaneously generated empirical data and contributed to the garden's establishment. This integration aligns with the "living lab" approach to sustainability transitions, in which the research site functions as both an experimental space and a mechanism for community engagement (Wittmayer and Schäpke, 2014; Voytenko et al., 2016; Działek et al., 2025).

Researcher positionality

This research was conducted by a sole author, resident of Kraków, Poland, during the study period. The researcher's outsider status (as a non-Polish citizen) and insider experience (as a local resident) together shaped the perspective brought to the field. Living in Kraków provided the researcher with everyday exposure to the city's culture, public spaces, and community life, helping to build rapport with garden participants and an intuitive understanding of local urban issues. However, the researcher is not fluent in Polish; to navigate this, interviews were primarily conducted in English, and when language barriers arose, ad-hoc translation support was used or bilingual participants stepped in to translate key points. All documents and communications (e.g., city regulations, garden rules, online forum posts) in Polish were translated to English, and care was taken to cross-verify translations for accuracy. The researcher acknowledges the risk of ethnocentrism and bias, given a Western European background studying a post-socialist context; this was mitigated through a reflexive, embedded ethnographic stance, for example, by spending long periods participating in garden activities without imposing external frameworks, listening to local interpretations

of governance before forming conclusions, and engaging in regular self-reflection and peer debriefings about one's own assumptions. By explicitly stating this positionality, we underscore that the findings emerge from an interpretive process influenced by the researcher's identity, and we have taken steps to ensure that local voices and meanings remain central in that process.

Ethical considerations

The study followed established ethical guidelines and received approval from the university ethics committee. All participants were informed of the aims, methods, and voluntary nature of the study and gave informed consent before interviews or workshop participation. Anonymization protocols were strictly followed: all names were replaced with pseudonyms, identifying details were removed, and audio recordings were securely stored. Participants had the opportunity to ask for clarifications; some received short reports on preliminary findings via email, fostering transparency and reciprocity. These steps were especially important given the participatory nature of the research and the personal or political sensitivity of certain discussions.

In line with ethical research standards for community-based and participatory studies, detailed socio-demographic data were not collected from individual participants. Given the small scale and visibility of the gardening communities involved, doing so could have compromised participant anonymity and trust. Instead, contextual information was developed through prolonged field observation, informal conversations, and repeated interactions. This allowed for the identification of general user profiles (e.g., students) and socio-spatial characteristics, providing meaningful site-level understanding while prioritizing ethical integrity and participant safety.

Data analysis

Interviews, workshop transcripts, and field notes were analyzed using thematic coding to systematically interpret the data. A preliminary codebook was developed based on the literature and our research questions, incorporating both theory-informed codes (e.g., "decision-making process", "conflict resolution", "stakeholder roles") and case-specific themes (e.g."bottom-up initiative" or "top-down policy"). Using this codebook as a guide, the researcher first deductively coded the transcripts to identify segments related to these a priori themes. Subsequently, an inductive coding phase was carried out in which emergent patterns were identified and incorporated, allowing new codes to be created for ideas that repeatedly appeared in participants' narratives (for example, an unforeseen emphasis on personal well-being benefits or interactions with city officials might arise and warrant a new code).

Key concepts such as "inclusivity," "co-creation," and "environmental stewardship" were operationalized through observable practices and narrative cues. Inclusivity was assessed not through demographic variables, excluded for ethical reasons, but through relational, spatial, and procedural indicators. Relational inclusivity involved the observed or reported integration of newcomers and less-vocal members; spatial inclusivity referred to how accessible and inviting the physical garden layout was to diverse publics; and procedural inclusivity was interpreted through the diversity of actor participation in planning or decision-making (Arnstein, 1969; Rosol, 2010). Furthermore, environmental stewardship was coded through maintenance practices, biodiversity concerns, and expressions of care for non-human life. Finally, co-creation process was evaluated based on instances where governance structures or physical designs were visibly shaped through collective input, negotiation, or iteration across actor groups (Polk, 2015; Lang et al., 2012).

The analysis was primarily done by the sole author, steps were taken to enhance reliability: the researcher iteratively recoded the data after a four weeks' interval to check for consistency, and any ambiguities or borderline cases were discussed with academic peers to reach interpretative consensus. For instance, segments expressing frustration with design constraints were discussed in relation to both spatial layout and perceived lack of agency and were assigned multiple codes where relevant. This reflexive review process supported consistency and interpretive depth.

Data triangulation was achieved by systematically comparing themes across ethnographic observation, interviews, and workshop materials. Rather than weighting sources a priori, each method was analyzed for its unique contributions to the research questions. For instance, field notes often revealed informal dynamics and embodied practices; interviews captured individual experiences and perceptions; and workshops illuminated collective visions and negotiation processes. Divergences across data types were retained and analyzed to expose tensions and plural perspectives within governance configurations.

All coded data were then synthesized by theme, and the relationships between themes were mapped out (using narrative summaries) to build a coherent picture of how governance models correspond with various social and ecological outcomes in the gardens. Themes were further analyzed in relation to the governance typology, allowing for cross-case comparison of co-creation dynamics across bottom-up, top-down, and hybrid configurations.

Results

Municipal-led initiatives and historical legacies

The governance of community gardens in Kraków reflects enduring post-socialist legacies, notably the persistence of centralized management structures despite formal decentralization reforms since the 1990s (Hirt, 2012; Czepczyński, 2008; Mokras-Grabowska, 2021). Although local authorities were empowered during the transition to a market economy, municipal approaches to civic engagement have remained cautious, shaped by inherited top-down planning traditions (Rosol, 2010; Szczepańska et al., 2021). Zarząd Zieleni Miejskiej (ZZM), the municipal green space management authority, plays a central role in orchestrating community garden development through formalized programs. Unlike in many Western European cities where community gardens frequently arise organically from grassroots movements advocating for the "right to the city" (Lefebvre, 1968; Rosol, 2010), Kraków's community gardens are predominantly initiatives spearheaded by municipal agencies (Ferenčuhová, 2016; own study, 2024).

ZZM provides institutional guidance through tools, consultations, and training programs while facilitating essential infrastructure such as tree care, tool rental, and access to land. Importantly, this support is conditional upon the signing of agreements that outline the "rights and duties" of garden leaders and participants, emphasizing a structured partnership model (Fig. 3). Such conditions reflect ZZM's dual aim of promoting environmental management while maintaining oversight, highlighting both the opportunities and constraints within Kraków's municipal-led community garden initiatives.

This municipal dominance is evident in the strategic objectives articulated by ZZM officials, who view community gardens not only as spaces for urban greening but also as instruments for social management and civic engagement. As one municipal representative explained, "*It's also a great way to get the citizens to manage our green spaces, for free,*" highlighting a dual agenda of environmental improvement and cost-efficient maintenance (Mokras-Grabowska, 2021). This perspective aligns with neoliberal governance practices where public participation is encouraged within the confines of state-defined roles, thereby maintaining institutional control while promoting a veneer of community involvement (Ferenčuhová, 2016; Woźniak, 2019).

Moreover, the historical context of post-socialist urban transformation in Kraków reveals a tension between inherited bureaucratic structures and emerging civic initiatives. The transition period saw local authorities grappling with new responsibilities and limited resources,

Fig. 3. ZZM Support strategy for community gardens in Kraków. (Source: Zarząd Zieleni Miejskiej, ZZM, 2022)

leading to an incremental shift towards participatory governance. However, without a robust tradition of grassroots activism or strong civil society networks, municipal-led initiatives often lack the depth of community ownership and long-term sustainability seen in more organically developed community gardens elsewhere (Colding and Barthel, 2013). This is further complicated by the uneven distribution of resources and support, which can reinforce existing socio-economic disparities and limit broader civic engagement (Dudzic-Gyurkovich, 2021).

The institutional frameworks established by ZZM also reflect a pragmatic adaptation to Kraków's unique socio-political landscape. By implementing standardized guidelines, offering workshops, and running leader training programs, ZZM attempts to replicate successful community garden models while ensuring alignment with broader municipal policies on urban sustainability and green infrastructure (Colding and Barthel, 2013). However, this approach can inadvertently stifle local innovation and limit the potential for gardens to serve as true socio-ecological space that empower residents beyond their designated roles (Barthel, Parker and Ernstson, 2015).

Balancing autonomy and institutionalization

While municipalities often set the overarching framework, some community gardens have emerged through grassroots efforts. A notable example is the Salwator garden, founded in 2019 (Fig. 1) as a resident-led initiative. This garden grew from the collective motivation of local residents seeking to bring positive change to their urban environment. After identifying an abandoned plot of land spanning 24–28 acres in the Zwierzyniec district, near the Salwatorski cemetery, the group approached municipal authorities for support. To their surprise, the administration responded favorably. As one gardener explained during an in-depth interview, "*I asked the municipality about a free spot, and they responded positively*," highlighting the collaborative attitude of local authorities towards community-led initiatives. The Salwator garden exemplifies how grassroots initiatives can spark urban greening projects even within a governance system traditionally dominated by top-down processes. Initially, the garden operated autonomously, with residents

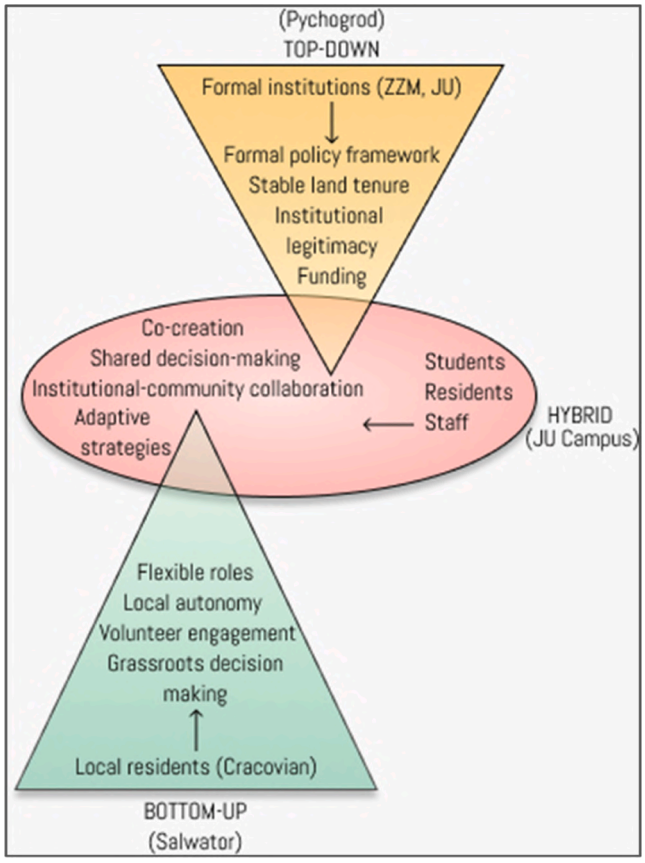

Fig. 4. Governance structure diagram for Krakow's community gardens. (Source: author)

managing and designing their plots without strict oversight. This freedom fostered a strong sense of ownership and community engagement (Barthel, Parker and Ernstson, 2015; Dymek et al., 2021) (Fig. 4). However, the trajectory of Salwator garden also illustrates the complexities inherent in maintaining grassroots autonomy when interfacing with institutional frameworks. As the garden gained visibility and demonstrated successful outcomes, ZZM incorporated it into a broader municipal pilot program[5] aimed at testing new urban greening strategies. This integration brought both benefits and challenges. On one hand, municipal support provided additional resources, such as funding for infrastructure improvements and access to expert advice on sustainable practices. On the other hand, the formalization of Salwator into a pilot project introduced new layers of oversight and standardization, which sometimes conflicted with the residents' original vision and autonomous management style (Ferenčuhová & Gentile, 2016; Rosol, 2010). The hybrid governance of Salwator garden demonstrates both the potential and challenges of blending grassroots innovation with institutional frameworks. While municipal involvement can offer stability and resources, it can also impose restrictions that hinder community creativity. Such tensions reflect broader patterns in post-socialist urban settings, where civic activism and established institutions often negotiate shared governance models rather than adhering strictly to top-down or bottom-up approaches (Colding and Barthel, 2013).

[5] Gardeniser is a European initiative that facilitates the exchange of best practices among professionals and volunteers involved in urban community gardening. The project aims to enhance participants' competencies and provide insights into existing methodologies within the context of European urban community gardens. For more information, visit here https://www.replaynet.eu/en/gardeniserplus

A contrasting dynamic emerges in the Pychogród garden, which was established in 2021 (Fig. 1) under the direct supervision of ZZM, followed a fully institutionalized process. Covering 200–300 square meters, the garden was part of Pychowice neighborhood renewal project aimed at revitalizing a meadow near a Natura 2000 protected site. From the outset, municipal authorities established clear rules, secure land tenure, and an organized planting schedule. As one participant shared, "*The city organized the first planting days. It felt reassuring to have their support.*" This approach aligns with findings that top-down governance can mitigate risks such as land appropriation and vandalism. (Becker, Kunze, 2014; Dymek et al., 2021) (Fig. 4). However, the formalized structure came with limitations. The municipality's strong presence restricted opportunities for participants to experiment or take full ownership of the space. One participant remarked during a go-along interview "*I wouldn't have built the beds like this, we don't have enough space for planting, we can't change the structure now*". As a result, the garden lacked the adaptive, innovative energy observed in more autonomous cases like Salwator. This statement reflects a broader issue in top-down models where formal support does not always translate into deep, sustained community engagement.

The JU Campus garden, created in 2024 (Fig. 1), also in the Dębniki district, provides a more balanced hybrid model that integrates institutional legitimacy with participatory processes. The garden's establishment began through co-design workshops involving university faculty, students, ZZM representative and nearby residents. Although situated on university land, the garden was designed to remain partially accessible to the public and intentionally engaged neighborhood residents, particularly through open events and collaborative gardening sessions. This accessibility ensured that diverse perspectives shaped the space. A participant commented, *"The workshops were great because everyone could contribute, and bring a multiplicity of visions."* By facilitating deliberative processes, JU community garden avoided the pitfalls of rigid institutional control while retaining the organizational benefits of top-down support (Fig. 4). However, hybrid models are not without challenges, especially in settings where participants may rotate frequently, such as university campuses.

Inclusivity, social trust, and the limitation of engagement

The inclusivity of Kraków's community gardens is shaped by the interplay between governance models, socio-economic disparities, and the city's post-socialist legacy of fragmented social trust. Under socialism, collective initiatives in Poland were largely state-driven, creating a lingering ambivalence toward civic participation in public projects (Ferenčuhová, 2016; Dudzic-Gyurkovich, 2021). This historical backdrop influences current levels of trust and engagement, which vary depending on how gardens are governed.

Bottom-up gardens like Salwator have demonstrated a capacity for inclusivity by lowering barriers to entry. Interviews revealed that many participants were drawn to the garden due to its openness and lack of formalized rules. One gardener explained, "*I found out about the garden through friends on Facebook. I just showed up one day, and they welcomed me immediately*." The absence of rigid structures allowed a diverse set of individuals, including those unable to access formal allotments due to economic or bureaucratic constraints, to engage in gardening, especially in post-pandemic context. However, while grassroots gardens reduce structural barriers, their inclusivity is often limited by informal social norms and volunteer burnout. Ethnographic observations highlighted that younger participants (under 18) and men were less likely to engage at the outset, with a gardener noting, "*My husband only comes when there is heavy stuff to carry*." This gendered division of labor reflects broader societal patterns and highlights the need for strategies to diversify involvement intentionally.

By contrast, top-down community gardens like Pychogród, while initially providing a stable legal and structural foundation, often struggle to foster deep, sustained community involvement. Municipal outreach efforts have largely relied on formal channels, such as public meetings or call-for-volunteer programs, which fail to engage residents who are less attuned to institutional communications. One resident from the neighborhood remarked, "*Most people in the neighborhood didn't even know this garden existed until last month*." This visibility gap underscores the limitations of top-down approaches when local and cultural engagement strategies are lacking. Moreover, institutional facilitation can sometimes create a passive dynamic, where participants feel like caretakers rather than co-creators of the space, reducing their sense of agency and attachment. Taken together, the Salwator and Pychogród cases illustrate opposite ends of the inclusivity spectrum, one emphasizing open, informal access with limited structural support, and the other offering institutional stability but limited participatory depth. This contrast sets the stage for the third case, the JU Campus garden, which was intentionally developed as a hybrid model designed to bridge these gaps.

By combining elements of top-down and bottom-up governance, the JU garden enables a comparative analysis of how structured participatory tools can actively cultivate inclusivity through shared ownership and dialogue. The use of mind-mapping techniques (Fig. 5) allowed for a structured yet flexible approach to integrating diverse perspectives. By visually organizing ideas and identifying shared priorities, mind-mapping facilitated open dialogue. This method not only democratized the planning process by ensuring that participants could contribute on equal footing regardless of expertise but also revealed synergies between institutional goals and community needs. Such an approach enabled the creation of a shared vision for the garden that balanced ecological priorities with social functions like gathering spaces and educational areas. Early workshops were instrumental in broadening participation by engaging a mix of students, faculty, municipal actors, and local residents. As one participant noted, "*The workshops feel like we really contribute to something bigger*." Multilingual communication and collaboration with different faculties and disciplines further expanded the garden's reach, attracting international students, often underrepresented in civic initiatives.

Nevertheless, field observations revealed challenges in sustaining inclusivity over time. The transient nature of student populations created turnover, disrupting the continuity of engagement and leaving gaps in leadership. One participant explained, "*The motivation from students is great, but when they leave, it feels like starting over again*."

A common limitation across all governance models is the persistence of social and economic inequalities, which influence who engages with community gardens and how. Interviews across sites highlighted that community gardens, despite being publicly accessible, remain largely self-selective spaces. Residents with limited time, financial pressures, or lack of gardening knowledge were often excluded, either because they perceived the garden as requiring expertise or because they felt they had little to contribute. "*I would like to join, but I know nothing about gardening, I don't want to make mistakes*," shared one resident near Pychogród garden. These barriers reflect a broader need for governance frameworks that integrate accessible educational programs, mentorship, and tailored outreach strategies to demystify participation and make gardens welcoming to all residents.

Finally, trust, both among participants and between residents and institutions, emerges as a critical factor for inclusivity. Grassroots gardens tend to build trust through informal social connections, while top-down models often need to overcome skepticism toward municipal actors. Hybrid models like the JU community garden show promise in building trust by facilitating inclusive processes from the outset, yet their success hinges on consistent institutional commitment and mechanisms to retain local ownership. Without sustained outreach, transparent communication, and adaptive leadership structures, even participatory spaces risk reverting to exclusionary or temporary initiatives.

Fig. 5. Examples of mind-maps designed for the JU Campus garden.
(Source: Workshops outputs Author, 2023)

Ecological dimensions and knowledge exchange

The ecological dimension of community gardens in Kraków reveals both their potential to contribute to urban sustainability and the challenges of ensuring long-term ecological adaptability. These gardens are not merely spaces for cultivation but dynamic platforms where ecological knowledge is produced, shared, and mobilized in ways that reflect governance structures and the socio-environmental conditions of the city.

Bottom-up models, such as the Salwator garden, showcase a strong

Salwator: 1.Vandalism, 2. Water collector, 3. Compost
Pychógrod: 1. Rules, 2. Compost, 3. Water collector, 4. Beds
JU Campus: 1.Spiral beds, 2. Seed exchange, 3. Compost

Fig. 6. Ecological features of community gardens.
(Source: Ethnographic observations, author, 2023)

inclination toward grassroots experimentation with sustainable practices, including composting, organic cultivation, and adaptive planting strategies. Participants actively tested methods suited to Kraków's local environmental pressures, such as contaminated soils, seasonal variability, and water scarcity (Fig. 6). As one gardener explained during a go-along interview, "*We started composting because we realized it's not only good for the soil but also reduces waste. Everyone can come and use it.*" This hands-on experimentation reflects the potential of bottom-up governance to generate localized, flexible solutions that respond directly to ecological realities. Moreover, the transfer of skills and knowledge, both tacit and explicit, within these gardens fosters a progressive, community-led process of urban ecological learning. However, reliance on volunteer labor and personal initiative also exposes these gardens to vulnerabilities. Challenges like vandalism (Fig. 6), uneven participation, and seasonal neglect limit their capacity to consistently maintain ecological functions. This fragility reflects findings from Barthel et al. (2015) and Colding and Barthel (2013), who emphasize the need for supportive structures to sustain community-led environmental stewardship over time.

In contrast, top-down models, exemplified by the Pychogród garden, initially benefit from structured ecological frameworks provided by the municipality, such as organized planting sessions, pre-selected plant varieties, small compost, and basic infrastructure like raised beds or pathways (Fig. 6). These efforts ensure an immediate, visible transformation of neglected urban spaces into functional green areas. The community garden has also been built with a kindergarten area, showcasing the multi-functional intent. However, long-term ecological adaptability is often limited due to the rigid, prescriptive nature of such initiatives (Fig. 6). As one gardener remarked, "*We received clear instructions, but when problems came up, we had to figure it out ourselves.*" This observation highlights a recurring issue: municipal frameworks prioritize establishment but neglect ongoing ecological mentoring and adaptive problem-solving, leaving participants unprepared to address emerging challenges independently. Such gaps align with broader patterns observed in post-socialist cities, where institutional actors often focus on visible outcomes but overlook the need for sustained ecological education and capacity building (Mokras-Grabowska, 2021; Haase et al., 2013).

Hybrid models, as seen in the JU Campus garden, attempt to bridge the strengths of top-down guidance and bottom-up creativity. The co-design workshops emphasized sustainability from the outset, incorporating expert knowledge on ecological design, native species selection, and composting systems (Fig. 6). One participant described the process: "*They explained why certain plants are more suitable for Polish weather*". This blend of institutional input and community participation enabled the garden to address local environmental challenges while fostering participants' ecological literacy. The JU garden also benefitted from knowledge exchanges with other community gardens, such as the nearby Macierzanki garden, which provided seeds and advice on organic methods (Fig. 6). These inter-garden networks reflect what Barthel et al. (2015) describe as "knowledge commons", shared repositories of ecological know-how that strengthen resilience through collective learning. Nevertheless, despite its strengths, the JU garden highlights key challenges for hybrid governance. Many participants, particularly first-time gardeners, reported uncertainties about implementing ecological practices in the absence of ongoing mentorship. "*We started composting, but sometimes we weren't sure if we were doing it right,*" admitted one student gardener. This gap underscores the importance of sustained education and iterative learning processes. Programs like ZZM's "School of Urban Gardeners" demonstrate the potential for formalized training initiatives to complement hybrid governance models, equipping participants with the skills and confidence to manage ecological systems effectively (Colding and Barthel, 2013; Dymek et al., 2021).

Discussion and conclusions

This study has explored how governance frameworks (bottom-up, top-down, and hybrid) influence the inclusivity, ecological adaptability, and long-term sustainability of community gardens in a post-socialist city. By drawing on ethnographic observations, semi-structured and go-along interviews, participatory workshops, and action research, this analysis reveals that governance models are not neutral structures but key determinants of the gardens' transformative potential as socio-ecological infrastructures. Community gardens in Kraków function as coupled socio-ecological systems: the way they are governed profoundly shapes both community dynamics and ecological performance (Ostrom, 2009; Barthel, Parker, and Ernstson, 2015). Social benefits (e.g., cohesion, learning, inclusion) and ecological benefits (e.g., biodiversity, resilience, ecosystem services) are codependent, with governance models mediating the strength of this interdependence (Lynch, 1981; Rosol, 2010).

The Salwator garden illustrated how bottom-up governance can foster deep engagement, experimentation, and responsiveness to local ecological challenges. Participants emphasized autonomy and informal decision-making, crafting adaptive practices for waste, planting, and water management. However, the model's fragility was visible in its dependence on volunteers, limited inclusivity, and lack of long-term support structures (Hirt, 2012; Mokras-Grabowska, 2021). These findings resonate with broader post-socialist urban literature on the precarity of grassroots initiatives within historically centralized planning contexts (Dudzic-Gyurkovich, 2021).

In contrast, the Pychogród garden reflected the advantages of top-down governance, particularly in securing land tenure and municipal support (Dymek et al., 2021). City-led coordination by ZZM ensured material infrastructure and regulatory clarity, creating stable conditions for garden development. However, institutional control also created barriers to ownership, with many participants expressing limited agency or a sense of detachment from garden governance (Becker, Kunze, 2014). The initiative struggled to reach marginalized groups and activate broader civic engagement, shortcomings also identified in other top-down models in CEE (Ferenčuhová, 2016).

The hybrid model at the JU Campus garden offered a middle ground. It combined academic and municipal legitimacy with participatory design, enabling diverse stakeholders, including students and inhabitants, to co-create the garden's governance and design. This model exemplifies collaborative governance (Ansell and Gash, 2007) and engaged both grassroots energy and formal resources. While challenges emerged, such as volunteer turnover among transient student populations and the need for stable facilitation, the garden illustrated how institutional frameworks can empower, rather than constrain, collective agency (Sanders and Stappers, 2008; Barthel et al., 2015).

Across all cases, the study affirms that governance models interact dynamically with Kraków's socio-political context, particularly its post-socialist legacies. Years of centralized control have shaped civic distrust and uneven participation, making trust-building and inclusion particularly vital for bottom-up and hybrid models (Czepczyński, 2008; Rosol, 2010). Yet, despite structural constraints, these gardens are becoming important spaces of socio-ecological experimentation and deliberative democracy. They offer avenues for rebuilding local agency, fostering environmental stewardship, and cultivating shared urban imaginaries.

The findings contribute to broader theoretical discussions in urban and environmental governance. Collaborative governance theory (Ansell and Gash, 2007) provides a useful lens to understand the processes of negotiation, trust-building, and shared rule-making seen in hybrid models. Simultaneously, the socio-ecological systems framework helps reveal how governance arrangements mediate feedback loops between human actors and ecological conditions. Gardens function as commons (Barthel et al., 2015), requiring co-management, clear rules, and context-sensitive coordination. The Kraków case also underscores the value of co-creation in sustainability transitions, highlighting how

experimental, transdisciplinary methods can generate both social and ecological resilience.

While the study offers rich insights, several limitations must be acknowledged. First, the small number of case studies (three) and their inherent contextual specificities limit the generalizability of findings. These cases were selected for their contrasting governance configurations and levels of accessibility, but they do not encompass the full diversity of community gardens in Kraków or other post-socialist cities. Second, although the study employed mixed qualitative methods to enhance triangulation and depth, the sampling strategy focused on active participants and did not systematically capture socio-demographic diversity. This approach may have introduced selection bias, and future research should aim to include more comprehensive demographic data where ethically and practically feasible.

These limitations also open avenues for future investigation. Comparative studies across cities and governance models, especially those integrating ecological indicators and long-term institutional trajectories, would enhance understanding of how inclusivity, stewardship, and co-creation unfold across scales. Additionally, longitudinal research could better track how participation and governance structures evolve, particularly in relation to volunteer turnover, seasonal rhythms, and shifting policy frameworks.

To translate these insights into policy and practice, we argue that governance frameworks for urban gardens must be flexible, inclusive, and adaptive. First, outreach strategies should be prioritized to engage underrepresented groups, including elderly residents, migrants, and those unfamiliar with gardening, through multilingual communication, local partnerships, and accessible public events. Second, stable resource allocation is crucial: small grants, infrastructural support, and technical mentoring can significantly enhance long-term viability and ecological performance. Third, feedback mechanisms should be institutionalized through participatory planning tools, such as co-design workshops and rotating leadership structures, to ensure responsiveness and shared accountability. These recommendations are globally relevant. In both post-socialist and non-post-socialist cities, community gardens can serve as laboratories of adaptive governance and sustainability innovation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgements

I sincerely thank my academic advisors for their guidance and feedback, the community gardeners and participants in Krakow for sharing their experiences, and the municipal officials who provided essential insights. This research was supported by the Institute of Geography and Spatial Management, Doctoral School of Social Sciences of Jagiellonian University in Krakow.

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