

FROM HUMAN ECOLOGY TO POLITICAL ECOLOGY: COMMERCIALIZATION OF URBAN AGRICULTURE IN BANDUNG, INDONESIA

Kinanti Indah Safitri^{1}, Amir Syamsuadi¹*

¹ Department of Government Studies, Faculty of Psychology and Social Politics,
Universitas Abdurrah

* Corresponding author: kinanti.indahsafitri@univrab.ac.id

Abstract *Urban agriculture has commonly been analyzed through a human ecology perspective emphasizing its role in food security, resource efficiency and environmental sustainability. However, this approach remains limited in explaining how commercialization transforms urban agriculture into a space shaped by economic and political dynamics. This study aims to examine the shift from a human ecology to a political ecology perspective in understanding the commercialization of urban agriculture in Bandung, Indonesia. This research employs a qualitative case study approach, using in-depth interviews with 25 informants, including urban farmers, government representatives, and private sector actors, complemented by secondary data from various sources. Data were analyzed using thematic analysis to identify patterns related to ecological practices, commercialization processes, and power relations. The findings reveal that urban agriculture in Bandung has transitioned from subsistence-oriented and ecologically grounded practices toward market-driven systems integrated into global supply chains. This transformation is characterized by the emergence of unequal power relations, reduced farmer autonomy, environmental degradation, and the erosion of local ecological knowledge. In conclusion, while human ecology explains the adaptive origins of urban agriculture, political ecology provides a more comprehensive framework to understand its contemporary dynamics. A balanced approach is needed to align economic development with environmental sustainability and social equity.*

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1. Introduction

The human ecology perspective emerged from cultural anthropology to examine the existence of communities within unique ecosystems (Poston et al., 2019). An ecosystem provides services to the social system through the flow of materials, energy, and information to meet human needs. These ecosystem services include water, food, clothing materials, construction materials, and various other human necessities (Hawley, 2017). Materials, energy, and information flow from the social system back to the ecosystem because of human activities that

impact ecological conditions. These activities, in turn, affect ecosystem stability, particularly when humans begin to exploit resources intensively (Marten, 2010). The large-scale use of resources generates diverse environmental consequences that ultimately lead to ecosystem destabilization (Cabrales, 2023). Within human ecology, Malthusian concepts are widely adopted to explain ecosystem destabilization through the relationship between population growth and resource scarcity (Siegel, 2019). However, some scholars argue that ecosystem destabilization is not solely a consequence of population growth, but is also shaped by power dynamics, state policies, and global market interventions (Abdoellah, 2020). Therefore, human ecology-based explanations tend to have limitations in capturing the socio-political dimensions that structure human–environment relations.

In response to these limitations, the political ecology perspective emerged in the 1970s as a critique of neo-Malthusian approaches (Benjaminsen & Svarstad, 2019). This perspective emphasizes that environmental issues cannot be separated from power relations, resource distribution, and political-economic interests operating from local to global scales. Thus, political ecology offers a more comprehensive analytical framework to understand how certain actors control, access, and utilize environmental resources (Robbins, 2020). Nevertheless, in the context of urban agriculture, most studies still tend to frame this phenomenon within a human ecology perspective, particularly in relation to food security, resource efficiency, and environmental sustainability (Ferreira et al., 2018; Opitz et al., 2016). Urban agriculture is often viewed as an ecological solution to urbanization pressures and land scarcity, as well as an adaptive strategy for urban communities to meet their food needs (De Zeeuw et al., 2011). However, this approach has not fully explained how commercialization processes transform urban agriculture into an arena of economic and political contestation.

In recent decades, urban agriculture in developing countries has undergone significant transformation alongside its increasing integration into market mechanisms and global supply chains (Abdoellah, Suparman, Safitri, Mubarak, et al., 2023; Safitri et al., 2025). This process of commercialization not only affects production patterns but also reshapes social relations among farmers, the state, and market actors (Safitri, Abdoellah, Gunawan, & Suparman, 2022). In this context, urban agriculture no longer functions solely as a subsistence strategy or an environmental conservation practice but has increasingly become part of an economic system oriented toward capital accumulation. However, there remains a gap in the literature that explicitly examines the shift from a human ecology perspective to a political ecology framework in understanding the commercialization of urban agriculture, particularly in developing countries such as Indonesia. Therefore, this study aims to fill this gap by analyzing how urban agriculture in Bandung has transformed from an ecologically grounded practice into one increasingly shaped by power relations and market dynamics. Based on this background, the research questions addressed in this paper are: (1) how the human ecology perspective explains the phenomenon of urban agriculture in Indonesia, and (2) how commercialization drives a shift toward a political ecology perspective in analyzing the dynamics of urban agriculture in Indonesia.

2. Method

This study adopts a qualitative research approach using a case study design (Creswell & Creswell, 2017) specifically an intrinsic case study aimed at gaining an in-depth understanding of a particular phenomenon within its real-life context. This approach is appropriate as the study focuses on the transformation of urban agriculture in Bandung from a human ecology

perspective toward a political ecology framework without attempting to generalize findings across different cases. The case study design enables the exploration of complex interactions between ecological practices, market dynamics, and power relations embedded in urban agricultural systems.

The research was conducted in the Greater Bandung area (Bandung Raya), Indonesia, which includes both urban and peri-urban zones such as Bandung City, Lembang, Cimendan, and Ciwidey. This area was selected due to its dynamic development of urban agriculture, particularly its integration with commercial agricultural activities and export-oriented production systems. Bandung represents a relevant case for examining the shift from subsistence-oriented and ecologically grounded practices toward market-driven agricultural systems influenced by broader political-economic forces.

Data collection involved both primary and secondary sources to ensure a comprehensive understanding of the research problem. Primary data were obtained through in-depth, semi-structured interviews with 25 informants who were selected based on their active involvement and strategic roles in urban agriculture. The informants consisted of urban farmers, local government representatives, and private sector actors particularly those engaged in agricultural export activities. A purposive sampling strategy was applied to ensure that the selected participants possessed relevant knowledge and experience related to the research topic. Interviews were conducted directly in the field to capture contextual insights and lived experiences.

In addition to primary data, this study also utilized secondary data from academic publications, government reports, NGO documents, statistical databases, and online media sources. Social media platforms were also examined to capture contemporary practices, interactions and narratives related to urban agriculture. The use of multiple data sources allowed for a more comprehensive understanding of the phenomenon.

Data were analyzed using thematic analysis (Miles et al., 2018) to identify recurring patterns and key themes related to ecological practices, commercialization processes, and power relations. The analysis involved several stages, including data transcription, coding, categorization, and interpretation. Interview transcripts and secondary data were systematically coded to identify significant concepts which were then grouped into broader analytical themes. These themes were interpreted within the frameworks of human ecology and political ecology to explain the transformation of urban agriculture in the study area.

To enhance the credibility and trustworthiness of the findings, data triangulation was applied by cross-checking information from interviews, documents, and media sources. Prolonged engagement with the data and iterative analysis were also conducted to ensure consistency and depth in interpretation. Furthermore, this study adheres to ethical research principles, where all informants participated voluntarily and were informed about the purpose of the study. The confidentiality and anonymity of participants were maintained throughout the research process.

3. Results and Discussion

3.1 Urban Agriculture Based on Human Ecology

The emergence of urban agriculture from a human ecology perspective can be understood as a response to the increasing demand for food among urban populations. When contextualized within Malthusian theory, this phenomenon reflects the imbalance between rapid population growth and limited resource availability particularly in urban areas (Ridwan & Ismail, 2025). In

Bandung, this condition has been evident in the rapid urban expansion and population growth which have significantly increased pressure on urban food systems.



Diagram 1. Population of Bandung City Based on The Statistic National Agency, 2017-2024

As one of the major urban centers in Indonesia, Bandung has experienced continuous urbanization resulting in a growing demand for food, land, and energy (Abdoellah et al., 2023). However, the city functions primarily as a consumption center, relying heavily on resource flows from rural hinterlands (Nuraeni et al., 2017). This creates an ecological imbalance, where urban areas consume more resources than they regenerate (Edwards et al., 2014). At the same time, rural areas surrounding Bandung face challenges such as land degradation and declining agricultural labor, particularly due to the decreasing interest of younger generations in farming.

In response to these conditions, urban agriculture in Bandung began to develop as a localized strategy to support food availability and reduce dependence on external supply chains. Early forms of urban agriculture were primarily small-scale and subsistence-oriented, utilizing available spaces such as home gardens, vacant land, and community-managed plots. These practices were often initiated by urban residents, including migrants with agricultural backgrounds, who adapted their rural farming knowledge to urban conditions.



Figure 1. Hydroponic Instalation in Bandung City

Urban agriculture also emerged as a coping mechanism for vulnerable urban populations, particularly those with limited access to stable employment. During periods of economic instability such as the monetary crisis, urban communities increasingly relied on small-scale food production to maintain household food security (Lynch, 2005). At a deeper level, this phenomenon illustrates how marginalized urban groups engage in forms of everyday resilience by transforming underutilized or informal spaces such as vacant lots, riverbanks, and residential

yards into productive landscapes. These practices represent a reconfiguration of urban ecological systems driven by necessity where access to food and income is secured through localized knowledge, social networks, and low-cost technologies. Urban agriculture embodies a form of grassroots adaptation that is deeply embedded in the lived realities of urban inequality.

From a human ecology perspective, these practices demonstrate an effort to rebalance the flow of materials, energy and resources within the urban ecosystem. Urban agriculture contributes to reducing pressure on rural areas by enabling cities to partially fulfill their own food needs (Tacoli, 1998). In addition, it supports more efficient resource use through the recycling of organic waste into productive inputs such as compost, thereby addressing urban environmental problems related to waste management (De Zeeuw, 2004; Dobeles & Zvirbule, 2020; Krikser et al., 2016; Omondi et al., 2017).

Furthermore, the development of urban agriculture in Bandung is also associated with a growing awareness of environmental sustainability and food safety among urban residents. In response to increasing concerns over the health risks associated with chemically intensive agriculture, some urban farmers have adopted organic and environmentally friendly farming practices. These include minimizing the use of synthetic fertilizers and pesticides, utilizing composted organic waste, and implementing closed-loop production systems that recycle nutrients within the urban ecosystem. Such practices not only aim to produce safer and healthier food for urban consumers but also seek to restore ecological balance within increasingly degraded urban environments.

This trend reflects a strong ecological orientation within urban agriculture, where the relationship between humans and the environment is consciously managed to support long-term sustainability. From a human ecology perspective, these practices can be understood as efforts to realign socio-ecological interactions by reducing environmental externalities and enhancing the regenerative capacity of urban ecosystems. Urban farmers act as key agents in promoting environmentally responsible production while simultaneously addressing food security concerns at the household and community levels. The development of urban agriculture in Bandung when viewed through a human ecology perspective can be understood as an adaptive and functional response to urban resource constraints, food insecurity, and environmental challenges.

One case is the existence of urban farming business group. Urban farming business group in Bandung is committed to maintaining local food security by being inclusive of goods deposited from producers using organic and environmentally friendly production methods. To ensure that every producer partner who works with them uses organic and environmentally friendly methods, the organizer will conduct a survey directly to the land and production site to ensure the process of making sterile products from hazardous materials. The manager said that it is quite difficult to get a network of producers who apply organic products because not all producers pay attention to the principles of organic and environmentally friendly.



Figure 2 The Product of Urban Farming Business Group

The role of urban business groups highlights how urban communities actively reorganize ecological processes to sustain their livelihoods and improve resource efficiency. These groups do not merely engage in food production but also develop adaptive strategies by optimizing limited urban resources such as land, water, and organic waste through innovative practices including hydroponics, vertical farming, and integrated waste management systems. In this sense, urban agriculture reflects a form of socio-ecological adaptation in which communities respond to environmental constraints while simultaneously creating new economic opportunities.

However, this sustainability-oriented narrative requires further critical examination. The adoption of organic practices is not solely driven by ecological awareness but is also increasingly shaped by market dynamics that assign higher economic value to “organic” and “safe” food products. As demand for healthier food rises, organic agriculture becomes commodified, transforming sustainability into a marketable attribute rather than purely an ecological commitment. This shift raises important questions regarding who benefits from the commercialization of organic products and whether small-scale urban farmers can fully capture the added value generated by such practices. The growing commercialization of urban agriculture introduces new forms of dependency on market demand, standardization, and external actors such as corporations and state institutions. As a result, the transformation of urban agriculture cannot be fully understood without considering how these economic and political forces reconfigure social relations and reshape the control over urban ecological resources. However, while this perspective effectively explains the ecological and adaptive dimensions of urban agriculture, it remains limited in addressing the broader economic and political dynamics that increasingly shape its development. In practice, urban agriculture is not only driven by local adaptive needs but is also embedded within wider market structures, policy frameworks, and power relations that influence access to resources, production decisions, and distribution channels.

3.2 Urban Agriculture Based on Political Ecology

While urban agriculture in Bandung initially emerged as an environmentally oriented and subsistence-based practice, its development has increasingly been shaped by broader processes of modernization and commercialization (Safitri et al., 2022). Historically, agricultural activities were closely associated with ecological functions and subsistence needs (Giraldo, 2019). However, over time, the expansion of market mechanisms and economic rationality has transformed agriculture into a profit-oriented activity (Giraldo, 2019; Hall, 2015). This

transformation reflects a broader shift in human civilization where agricultural practices are rationalized and integrated into systems of economic production aimed at maximizing efficiency and profit (Hall et al., 2015)

This condition illustrates a key limitation of the human ecology perspective which tends to emphasize ecological balance but provides limited explanation of how power and economic forces shape environmental practices. As a response to these limitations, the political ecology perspective emerges as a more comprehensive framework focusing on how political, economic, and institutional dynamics influence the management and control of natural resources (Bailey & Bryant, 2005; Carr, 2015; Peet et al., 2010).

In the context of developing countries including Indonesia, the orientation of the state in managing natural resources is often closely linked to broader development agendas. When economic growth and capital accumulation become primary objectives, market-based logic becomes deeply embedded in various sectors including agriculture. This process reflects the expansion of capitalist systems, which increasingly separate humans from their ecological relationships and reframe nature as a commodity to be exploited for economic gain.

The emergence of commercialization in urban agriculture in Bandung can be understood as part of this broader process of commodification. Agricultural production is no longer solely oriented toward fulfilling household needs but is increasingly directed toward market demand, including export markets. The Indonesian government plays a significant role in regulating and promoting horticultural exports, as stipulated in Law No. 13 of 2010, particularly Article 87, which governs the export of horticultural products. This regulation emphasizes the fulfillment of quality standards and food safety requirements, which are further elaborated through ministerial regulations. It also mandates both central and local governments to actively support and facilitate the export of horticultural commodities.

Government-led export promotion efforts have begun to yield tangible outcomes. Agricultural products from peri-urban farmers in Greater Bandung have increasingly entered international market circuits. This development is further supported by interview findings with a packaging manager from a vegetable company that markets green bean products sourced from its partner farmers. The company acts as a supplier to an export firm that regularly ships Kenyan green beans to countries such as Singapore, Hong Kong, and Brunei. As stated by the informant:

Exports to Singapore, Brunei, and Hong Kong are carried out through collaboration with farmers. The demand is mainly for premium Kenyan green beans, which are not always suitable for greenhouse cultivation. Therefore, due to certain constraints in our own production capacity, we rely on partnerships with farmers. In fact, most of the exported products come from farmers rather than being entirely produced by our company.

These findings indicate that certain urban agricultural products have successfully penetrated international markets, although this remains limited to specific commodities, particularly premium Kenyan green beans. Therefore, data on the increasing value of agricultural exports in Indonesia indicate a growing integration of agriculture into global trade systems. The total export value of crops and livestock products in Indonesia reached USD 49.86 billion in 2024, reflecting an increase of 3.34% compared to USD 48.25 billion in 2023. This marks a recovery following a period of decline. According to FAOSTAT data, Indonesia's agricultural export value has grown substantially over the long term, increasing by more than 108 times since 1961. The lowest recorded value occurred in 1967, at USD 337.8 million, while the highest was achieved in 2022, when exports peaked at USD 57.34 billion.



Diagram 2. Indonesia's Agricultural Export Value (Faostat Data, 2024)

This trend has encouraged the development of export-oriented agricultural practices in peri-urban areas surrounding Bandung. Due to limited land availability and high land values in the urban core, urban farmers expand their activities into peri-urban regions such as Lembang, Banjaran, Cimenyan, and Ciwidey. These areas become important sites for large-scale agricultural production aimed at meeting export demand. At the same time, agricultural methods commonly associated with urban farming, such as hydroponics and greenhouse systems, are increasingly adopted in these peri-urban production systems to enhance productivity and efficiency. This indicates a transfer of knowledge and technology from small-scale urban practices to industrial-scale agriculture.



Figure 3. Hydroponics System in Multinational Company

Within this system, farmers are increasingly integrated into complex market networks involving exporters, government institutions, and certification bodies. To participate in export markets, farmers must comply with various requirements including quality standards, certification processes, and production targets. These requirements are often determined by external actors, limiting farmers' autonomy in decision-making. Farmers are required to produce specific commodities based on market demand, leading to the adoption of monoculture systems that prioritize quantity and uniformity over ecological diversity.

The phenomenon of affective deterritorialization ultimately has adverse consequences for both the environment and human well-being. In the context of urban agriculture, farmers are increasingly shaped by prevailing market mechanisms. As a result, they are compelled to adopt monoculture cropping patterns. Crop diversity is no longer a primary consideration in

commercial agricultural production, as farmers cultivate specific commodities not to meet household food needs, but primarily for market sale. Income generated from market-oriented agriculture is perceived as more reliable in ensuring economic well-being compared to subsistence-based farming practices.

This condition reflects the emergence of unequal power relations within the agricultural system. Exporters and market intermediaries hold significant control over pricing, quality standards, and market access, while farmers are positioned as producers with limited bargaining power. In many cases, farmers must rely on networks and associations to access markets and those who do not meet the required criteria are excluded from participation. This creates new forms of inequality among farmers, where only those with sufficient capital, land, and social connections can benefit from commercialization.

Moreover, the contractual arrangements between farmers and exporters often place farmers in vulnerable positions. Farmers are required to meet specific production quotas, and failure to meet these requirements can result in economic losses. Agricultural products that do not meet export standards are rejected and must be sold in local markets at lower prices. This creates economic uncertainty and reinforces farmers' dependence on market actors.

The influence of market dynamics is also evident in the determination of crop selection. Farmers tend to cultivate commodities with high market demand and price fluctuations, such as chili, onions, and other horticultural products. This market-driven orientation shifts agricultural practices away from subsistence and ecological considerations toward profit maximization. As a result, biodiversity is reduced, and farming systems become more vulnerable to environmental and economic shocks.

In addition to economic impacts, commercialization also has significant environmental consequences. The intensification of agricultural production often leads to increased use of chemical inputs, including synthetic fertilizers and pesticides to achieve higher yields. Over time, this practice can degrade soil quality, increase pollution, and reduce the ecological sustainability of agricultural systems. This contradicts the initial purpose of urban agriculture as an environmentally friendly practice.



Figure 4. Waste of Inputs in Irrigation Sites

Furthermore, the expansion of agricultural activities into peri-urban areas contributes to increasing competition over land resources. In some cases, this process is linked to broader issues of land control and land acquisition where agricultural expansion intersects with infrastructure development and urban growth. These dynamics create potential conflicts over land ownership and access and cause land degradation. There is a case in which one of the farmer

informants in this study applied a raised-bed (*bedeng*) technique on land with a slope exceeding 30°. However, this practice was not accompanied by efforts to plant perennial or deep-rooted vegetation. As shown in Figure 5, the land is not interspersed with protective vegetation cover.



Figure 5. Land without vegetation cover

The documentation shows a lack of perennial plants surrounding the cultivated area. Although some banana trees were planted, these do not function as strong vegetation capable of effectively preventing soil erosion. Meanwhile, sloped land without adequate vegetative barriers, combined with high rainfall intensity has the potential to degrade land quality (Senoaji et al., 2019). In fact, urban farmers in the North Bandung Area possess local ecological knowledge in land management which if preserved, could serve as an alternative solution to environmental problems, particularly land degradation. One example can be found in the community of Padasuka, Cimenyan District, Bandung Regency where land use is traditionally divided into three zones.

Steep slopes are planted with bamboo and other deep-rooted trees that function to prevent soil erosion, a practice known as *lereng diawian*. Flat areas are allocated for settlements, referred to as *dataran diimahan*. Meanwhile, lower-lying areas are utilized as ponds for water storage and fish cultivation, known as *legok dibalongan*. If such locally embedded zoning practices were incorporated into spatial planning policies in Bandung, both the urban core and peri-urban areas could be better organized in accordance with their physical and topographical conditions, thereby minimizing environmental degradation. Areas that should function as conservation zones would be less likely to be converted into resorts or real estate developments.

However, this local wisdom is increasingly eroded by market pressures that compel farmers to prioritize agricultural practices aligned with market standards and demands. The study also highlights the presence of “invisible power” in shaping urban agricultural systems. Power is not always exercised through direct control but rather through policies, market mechanisms, and institutional arrangements that subtly influence farmers’ decisions (Bailey & Bryant, 2005). Government policies promoting export-oriented agriculture, certification systems, and global market standards all contribute to structuring the behavior of farmers (Otto, J., & Mutersbaugh, 2015). These forms of power operate indirectly yet have significant impacts on how resources are accessed and controlled.

Therefore, the development of urban agriculture in Bandung demonstrates a clear shift from an ecologically oriented practice toward a system increasingly shaped by commercialization, market forces, and power relations. While human ecology provides a useful framework for understanding the initial emergence of urban agriculture, it is insufficient to explain the complexities introduced by market integration. Political ecology, therefore, offers a more comprehensive perspective for understanding how economic interests, power structures, and institutional dynamics reshape urban agricultural systems and produce new forms of inequality and environmental challenges.

3.3 Implications of Commercialization on Environmental Sustainability and Social Relations

The increasing commercialization of urban agriculture in Bandung has generated significant implications in environmental sustainability and social relations among farmers. These implications reflect the complex interaction between ecological processes and market-driven agricultural practices, which are central to the political ecology perspective.

From an environmental standpoint, the shift toward market-oriented production has led to the intensification of agricultural practices. Farmers are increasingly required to meet production targets in terms of quantity, quality, and continuity of supply, particularly within market systems that prioritize efficiency, uniformity, and reliability. These pressures are often embedded in terms of contractual arrangements and supply chain requirements, leaving farmers with limited flexibility in determining their own production strategies. Therefore, many adopt more intensive farming techniques including the increased use of chemical fertilizers, pesticides, and high-yield inputs to stabilize output and comply with market standards.

While such practices may enhance productivity in the short term, they generate significant ecological trade-offs that undermine the long-term sustainability of urban agricultural systems. The continuous application of synthetic inputs can lead to soil degradation, nutrient imbalances, and a decline in soil biodiversity ultimately reducing the regenerative capacity of the land. In addition, the runoff of chemical residues contributes to water contamination affecting both surface and groundwater systems, while also posing risks to human health in densely populated urban environments. These environmental impacts are particularly critical in urban and peri-urban areas, where ecological systems are already under pressure from land conversion, pollution, and infrastructural development.

Beyond these immediate ecological consequences, the intensification process also reflects a deeper transformation in the human–environment relationship. Agricultural practices become increasingly oriented toward maximizing output rather than maintaining ecological balance, signaling a shift from adaptive resource management to extractive production systems. This transformation aligns with broader processes of commodification where nature is treated primarily as a means of generating economic value rather than as a system requiring stewardship and regeneration. As a result, ecological considerations are often subordinated to market imperatives, leading to the erosion of sustainable farming principles that initially underpinned urban agriculture. In addition, the expansion of agricultural activities into sloped and environmentally sensitive areas further exacerbates ecological vulnerability. As observed in several cases, farming practices on steep land without adequate conservation measures increase the risk of soil erosion and land degradation. This condition is often driven by economic necessity and market demand, which push farmers to maximize land use regardless of ecological constraints. Consequently, environmental considerations tend to be subordinated to production

and profit objectives.

At the same time, the erosion of local ecological knowledge represents another critical implication of commercialization. Traditional land management practices, such as the zoning system observed in communities like Padasuka, have historically played an important role in maintaining ecological balance. However, these practices are increasingly marginalized as farmers are compelled to adopt standardized production systems that prioritize efficiency and uniformity over sustainability. This shift reflects a broader transformation in which locally embedded knowledge systems are displaced by externally driven market logics (Giraldo, 2019).

Beyond environmental impacts, commercialization also reshapes social relations among farmers. Previously, agricultural practices were often characterized by cooperation, knowledge sharing, and community-based resource management. However, the integration into competitive market systems has altered these dynamics. Farmers are increasingly positioned as individual economic actors competing for market access, contracts, and profit opportunities.

This shift contributes to the fragmentation of social relations and weakens collective forms of organization. In some cases, farmers become dependent on specific buyers or intermediaries, creating asymmetric relationships that limit their bargaining power. Those who can access market networks benefit from higher incomes, while others are excluded, leading to growing inequality within farming communities. Furthermore, the role of social networks becomes increasingly important in determining access to market opportunities. Farmers with stronger connections to exporters, government programs, or agricultural associations are more likely to succeed in commercial agriculture. This reinforces existing social hierarchies and creates barriers for small-scale or less-connected farmers.

Therefore, the implications of commercialization in urban agriculture extend beyond economic transformation, affecting both environmental sustainability and social structures. The findings suggest that while commercialization may provide economic opportunities, it also introduces new challenges including ecological degradation, loss of local knowledge, and increasing social inequality. These dynamics highlight the importance of adopting a more balanced approach that integrates economic objectives with ecological sustainability and social equity in the development of urban agriculture.

4. Conclusion

This study demonstrates that urban agriculture in Bandung has undergone a significant transformation from an ecologically grounded practice as explained by the human ecology perspective, toward a system increasingly shaped by commercialization, as captured by the political ecology framework. Initially, urban agriculture emerged as an adaptive response to urban challenges, including population growth, food insecurity, and limited access to resources. Within the human ecology perspective, these practices functioned to rebalance resource flows, enhance food availability, and promote environmentally sustainable behaviors through small-scale, subsistence-oriented farming.

However, this perspective is insufficient to explain the contemporary dynamics of urban agriculture, particularly as it becomes more deeply integrated into market systems. The findings reveal that commercialization has reoriented urban agriculture toward profit-driven production, linking local farming practices to broader national and global market structures. This shift has led to the expansion of export-oriented agriculture, the adoption of standardized production systems, and the increasing involvement of external actors such as exporters, government institutions, and certification bodies.

From a political ecology perspective, these transformations are not merely economic but are deeply embedded in power relations that shape access to resources, decision-making processes, and the distribution of benefits. Farmers are increasingly positioned within unequal systems where their autonomy is constrained by market demands, production standards, and contractual arrangements. As a result, commercialization generates new forms of social inequality, favoring those with greater capital, land, and social networks while marginalizing smaller or less-connected farmers.

In addition, the study highlights significant environmental implications. The intensification of agricultural practices, driven by market pressures, contributes to soil degradation, increased chemical use, and the exploitation of ecologically sensitive areas. At the same time, local ecological knowledge and traditional land management practices are being eroded, replaced by standardized approaches that prioritize efficiency and uniformity over sustainability.

Furthermore, commercialization reshapes social relations within farming communities, shifting them from cooperative and community-based systems toward more competitive and individualized structures. This transformation weakens social cohesion and reinforces dependency on market intermediaries, thereby deepening existing vulnerabilities. This study underscores the importance of moving beyond a purely ecological understanding of urban agriculture toward a more integrated analytical framework that incorporates political, economic, and institutional dimensions. While commercialization offers opportunities for economic growth and income generation, it also introduces complex challenges related to environmental sustainability and social equity. Therefore, a balanced approach is needed one that aligns market development with ecological conservation and inclusive social policies to ensure that urban agriculture contributes not only to economic objectives but also to long-term sustainability and justice.

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