WASS
Waste, Society, and Sustainability
WASS 1(2): 100–111
ISSN 3062-8202

Institute for Advanced Science, Social and Sustainable Future
MORALITY BEFORE KNOWLEDGE

Economic valuation of ecosystem services in urban agriculture through willingness to pay and its implications in indonesia (a literature review in several countries)

Assyifa Fauzia[1]*
[1] *Department of Environmental Science, Faculty of Environmental Science, Universitas Indonesia, Central Jakarta City, Jakarta 10430, Indonesia.*
*Correspondence: assyifa.fauzia21@ui.ac.id

Received Date: July 20, 2024 Revised Date: July 30, 2024 Accepted Date: August 31, 2024

ABSTRACT

Background: Urban agriculture plays a crucial role in mitigating urban environmental degradation by providing ecosystem services. Understanding consumers' willingness to pay (WTP) in urban agriculture planning offers insights into individual preferences and values, which can guide policies that promote sustainable urban agriculture. Existing research across various locations, including Spain, Norway, the United States, Nigeria, and Sri Lanka, highlights the diversity of societal values and preferences regarding urban agriculture. **Methods**: This study employs economic valuation of ecosystem services through the WTP method, focusing on evaluating the value of ecosystem services, socio-economic factors, and household WTP in the context of sustainable urban agriculture planning. The research synthesizes findings from previous studies and integrates theoretical components relevant to urban agricultural ecosystems. **Findings:** The analysis reveals significant variability in WTP among different demographics, indicating that socio-economic factors significantly influence consumers' perceptions of urban agriculture's value. The results suggest a positive correlation between ecosystem services provided by urban agriculture and overall community well-being, emphasizing the necessity for tailored policies to enhance sustainability in this sector. **Conclusion**: The study concludes that urban agriculture not only serves as a provider of ecosystem services but also positively impacts community welfare. Understanding societal preferences and values can aid in designing effective urban agricultural solutions. **Novelty/Originality of this article:** This research introduces an innovative approach by applying the WTP method to evaluate urban agriculture's ecosystem services, contributing unique insights into the relationship between consumer preferences and urban sustainability efforts, which have not been thoroughly explored in previous studies.

KEYWORDS: urban agriculture; willingness to pay (WTP); ecosystem services; economic valuation.

1. Introduction

Ecosystem services (ES) refer to ecological characteristics, functions, or processes that directly or indirectly support human well-being by offering benefits derived from functioning ecosystems, often termed as "natural capital" (Kubiszewski et al., 2017). Over half the world's population resides in urban areas (52%), and by 2050, two-thirds are projected to be urban dwellers, predominantly in developing regions (Miller & Spoolman, 2016). Urban concentration facilitates economic efficiency and increases demand for

Cite This Article:
Fauzia, A. (2024). Economic valuation of ecosystem services in urban agriculture through willingness to pay and its implications in indonesia (a literature review in several countries). *Waste, Society, and Sustainability, 1*(2), 100-111. https://doi.org/10.61511/wass.v1i2.2024.1272

accessible public facilities and services. However, while urbanization is a defining feature of human development, it also presents enduring global issues, such as population growth, food security challenges, and climate change (Baker et al., 2023; Nikologianni et al., 2022; Tacoli, 2017).

An environmentally conscious development approach emphasizes natural resources as foundational to environmental structuring, allowing natural functions to be adapted and enhanced to meet diverse needs (Yayasan Keanekaragaman Hayati Indonesia, 2020). Urban agriculture has increasingly emerged as a key strategy in developing countries to address urban poverty and enhance urban residents' well-being (Orsini et al., 2013). Urban farming relies on and enhances local resources to meet community needs, providing diverse ecosystem services and contributing to ecological and social sustainability. Environmentally friendly urban agriculture practices bring multiple benefits (Fauzi et al., 2016).

Urban agriculture plays an ecological role by reducing pollution within supply chains, facilitating recycling, and enabling energy synergies for sustainable food production. It serves as a model for sustainable farming practices (Kumar et al., 2023; Valley & Wittman, 2019) and acts as an urban buffer, regulating microclimates and mitigating the urban heat island effect (Octarino, 2023; Sharifi & Lehmann, 2015). Moreover, urban farming supports natural water cycles to reduce flood risks (Ebissa & Desta, 2022), conserves urban green spaces (Sarjan et al., 2022), and preserves biodiversity (Lin et al., 2015). The ecosystem services concept highlights human dependence on ecological systems, fostering greater interest in biodiversity conservation. Urban agriculture benefits from ecosystem services while also providing them, as human intervention often enhances its productivity and ecosystem functions (Halperin et al., 2023). This paper explores urban agriculture's role in mitigating urban environmental damage through economic valuation of ecosystem services using the WTP approach.

2. Methods

This research employs a systematic literature review to gather and interpret data relevant to the economic valuation of urban farming ecosystem services through the willingness-to-pay (WTP) method. Literature searches were conducted using databases such as Google Scholar, Remote-lib search, and Mendeley Search to obtain reputable sources. Keywords like "willingness to pay," "economic valuation," "urban farming," "urban agriculture," and "ecosystem services" were used to focus on studies from 2015 to 2023. This timeframe includes the rapid growth period from 2015 to 2021 when studies on urban agriculture saw significant increases in publication volume, particularly with 79 articles published in 2020 alone (Yan et al., 2022). Extending the search to 2023 was intended to increase the dataset's comprehensiveness by incorporating the most recent developments.

Each selected article underwent quality assessment based on Bano and Zowghi's (2015) independent quality criteria. These criteria evaluated research objectives' clarity, data collection methods, support from existing literature, consistency of research design, fulfillment of research questions, and completeness of the research approach. Articles covering WTP-based economic valuations were selected, focusing on comparative analyses between studies from various countries, such as those from Spain, Norway, the United States, Nigeria, and Sri Lanka. This comparative approach allows for a nuanced understanding of the WTP method's implications on urban farming ecosystem services across different geographic and socio-economic contexts, and its potential applications within the Indonesian urban agricultural landscape.

3. Results and Discussion

This section discusses the literature review results on the economic valuation of urban agriculture ecosystem services using the WTP method. The discussion includes several

topics: urban agriculture as an ecosystem service provider, ecosystem service valuation through WTP, comparative analysis of articles on WTP for urban agriculture ecosystem services across countries, and implications of WTP for urban agricultural ecosystem services in Indonesia.

3.1 Urban agriculture as an ecosystem service provider

The provision of ecosystem services by natural capital underpins life on Earth and is essential to human quality of life and the global economic function (Miller & Spoolman, 2018). Urban ecosystems act as a central link between humans and nature, meeting the high demand for ecosystem services but also producing considerable environmental threats (Shao et al., 2022). Agriculture functions as both a producer and recipient of ecosystem benefits, as it generates and depends on ecosystem support primarily facilitated through human intervention (Halperin et al., 2023). Ecosystem services, including provisioning, regulating, sociocultural, and supporting functions, are fundamental to human health and well-being (Mulya et al., 2023).

Urban agriculture pertains to activities within or on the outskirts of cities that involve the cultivation, processing, and distribution of a range of food and non-food products. This sector primarily uses human and material resources, products, and services available within urban spaces (Tapia et al., 2021; Zheng & Chou, 2023). Essentially, urban agriculture utilizes and enhances local resources to meet the evolving needs of local residents, providing services that fulfill multiple objectives and functions (FAO & RUAF, 2022). Today, urban agriculture takes various forms, such as the use of private gardens for vegetable growing, as well as integrating green spaces into private development plans, which can sometimes lead to "green stealth" — a form of spatial exclusion through privatizing these green areas (Audate et al., 2022).

The forms of urban agriculture described in various studies vary widely across countries and authors. The observed forms depend on several factors, including contextual background (urban, territorial, political, economic, social, etc.), stakeholder involvement (whether professional, non-professional, individual, family, etc.), available land area, technical tools used (whether advanced or replicable), production goals (for food, economic, or social purposes), and distribution methods (for self-consumption, donation, sharing, or sale) (Royer et al., 2023; Gisclard & Richard, 2018). Common forms of urban agriculture include private garden farming (Chandra & Diehl, 2019), community gardens (Dorr et al., 2023), green open spaces (Zheng & Chou, 2023), and land allocated specifically for urban farming (Gulyas & Edmondson, 2021).

Urban agriculture also expands the availability of urban green open spaces by integrating them with a variety of ecosystem services. This practice often utilizes underused spaces, such as schoolyards, playgrounds, roadsides, riverbanks, vacant lots, rooftops, and existing green spaces. Such initiatives reintroduce natural elements and their benefits into built environments, especially in situations where space for parks and green areas is limited. These efforts also enable local communities to engage with nature directly, without lengthy and complex land acquisition or rezoning processes (Mabon et al., 2022).

3.2 Economic valuation of ecosystem services (willingness to pay method)

Quantifying social demand is a key element guiding stakeholders in the development of community gardens designated for urban agriculture on public land. Economic valuation methods facilitate the estimation of demand for urban agriculture, reflecting the anticipated benefits of these agroecosystems and identifying the factors influencing demand (Scott et al., 2018). The Contingent Valuation Method (CVM) is one approach that provides economic value to non-use benefits associated with goods not commonly traded in markets (Nur-Shafiza et al., 2023). The concept of Willingness to Pay (WTP), or reservation price, defined as the maximum amount a consumer is willing to spend for a product or service, is

particularly useful for capturing individual-level information (Le Gall-Ely, 2009). WTP analysis assesses the maximum value a consumer is willing to pay (Hadhi & Mukhamad, 2014). Using CVM, quantitative analysis calculates the average maximum WTP that consumers are prepared to pay (Riana et al., 2019).

Measuring WTP enables the creation of demand curves based on price, allowing for pricing strategies that maximize profit margins. When prices can be adjusted, knowing WTP provides an opportunity to optimize sales volumes and profit margins. Understanding the factors that influence WTP can guide strategies to increase WTP and present opportunities to boost sales volumes at specific price points or, if feasible, adjust prices (Le Gall-Ely, 2009). The average maximum WTP is often calculated using bidding games, a technique within the CVM framework. WTP aggregation, reflecting the total WTP value consumers are willing to pay, is obtained by multiplying the average WTP by the number of consumers who are willing to pay that amount (Lorentziadis, 2016).

As Le Gall-Ely (2009) notes, studying WTP is particularly valuable because it enables the summing of consumers who are willing to pay a given price, Q(CAP=p)Q(CAP = p)Q(CAP=p), or higher prices, Q(CAP>p)Q(CAP > p)Q(CAP>p), thus helping to determine the quantity, qqq, purchased at that sale price: q(p)=Q(CAP=p)+∑Q(CAP>p)q(p) = Q(CAP = p) + \sum Q(CAP > p)q(p)=Q(CAP=p)+∑Q(CAP>p). Beginning with the cumulative number of consumers willing to pay a specified price or more, the demand law as a function of price and the revealed price elasticity enables setting prices that may maximize revenue, profit, or market share. Different prices will then be established depending on each specific goal.

3.3 Comparative analysis of studies

This sub-section provides a comparison of studies that have applied the economic valuation of ecosystem services using the Willingness to Pay (WTP) method across several countries. The articles reviewed include those by Albaladejo-García et al. (2021) from Spain, Gustavsen et al. (2022) from Norway, Printezis & Grebitus (2020) from the United States, Okon et al. (2018) from Nigeria, and Ayoni et al. (2022) from Sri Lanka.

3.3.1 WTP for urban agriculture in degraded agroecosystems in Spain

Albaladejo-García et al. (2021) conducted a study in public urban gardens designated for urban agriculture in Murcia, a southeastern city in Spain, where most of these gardens are managed by the Environmental Department of the Murcia City Council, spanning an area of 17,800 square meters. This research quantified ecosystem service values economically, also examining the socio-economic and spatial characteristics impacting these values. The study aimed to evaluate the establishment of urban agriculture spaces in degraded agroecosystems located on the outskirts of Murcia.

As a case study, a degraded peri-urban agroecosystem was selected, with a restoration project planned to create space for urban agriculture. Various analytical methods, including the Contingent Valuation Method (CVM), Analytic Hierarchy Process (AHP), and hot spot analysis, were combined to integrate community preferences for ecosystem services with spatial factors in demand analysis. A survey was conducted to establish WTP for urban agriculture and identify the factors influencing public assessment.

The socio-economic assessment of the urban garden project in the degraded agroecosystem proved to be insightful, providing valuable data not emphasized in previous economic valuation studies. This research may assist urban planners in understanding resident preferences better, thus enabling decisions that optimize social welfare through urban agriculture initiatives. Residents rated urban agriculture highly for its contributions to provisioning services, followed by regulatory and cultural services.

Designing plans for urban green infrastructure provision requires detailed knowledge of the ecosystem services offered by each type of facility to ensure optimal ecosystem service delivery in line with social preferences. This study represents a pioneering approach

to assessing such development plans, as it takes into account the primary ecosystem service categories. Improved knowledge of preferences and the provision of specific ecosystem services can enhance urban planning. Spatial dimensions, a novel aspect of this study, are particularly relevant in urban agriculture planning since proximity to the garden area and prior exposure to urban agriculture both influence residents' evaluations of these initiatives.

3.3.2 WTP for vertical farming and aquaponics in community gardens in Norway

The study by Gustavsen et al. (2022) in Oslo, Norway, applied the Contingent Valuation Method (CVM) to assess public WTP for four types of urban agriculture, including both non-commercial urban community gardens and commercially-oriented methods like aquaponics and vertical farming. The CVM approach was used to gain insights into public attitudes and the community's willingness to pay to support various urban farming types in Oslo.

CVM surveys gathered responses regarding food consumption, attitudes, socio-economic factors, and the willingness to support urban agriculture expansion in Oslo. With varying payment sizes, researchers tracked the demand curve for urban agriculture and estimated the average WTP. However, one limitation of this method is that responses reflect stated rather than observed preferences.

Through CVM, the researchers presented payment cards to a representative sample of Oslo's residents, asking their willingness to increase annual taxes to fund the four types of urban agriculture (community gardens for general public use, community gardens for educational and work training purposes, vertical farming, and aquaponics). Estimated tax increases ranged between 6.8 million and 9.3 million Euros for the four urban agriculture types. They found a significant positive association between "environmentally-friendly behavior" and "willingness to support urban agriculture." Notably, gender differences or the impacts of COVID-19 did not significantly affect WTP

Among respondents, urban agriculture for educational purposes was the most popular. The average WTP for allocating urban spaces for community gardens ranked second, while technical solutions like vertical farming and aquaponics run by commercial enterprises had the lowest support. The authors speculate that environmental attitudes and interest in urban agriculture will grow in the future. Norway's government and Oslo's City Council have launched strategies supporting non-commercial urban agriculture and existing business development measures.

According to Oslo's strategic documents, no increase in public funding for urban agriculture is planned over the next five years, aligning with the policy to avoid substituting private sector contributions with public funds. This may, however, conflict with the strategy's goal to develop urban agriculture. The authors suggest that urban agriculture budgets should, at a minimum, grow at a rate aligned with general agricultural policy. Farmer associations often negotiate successfully for additional subsidies, and urban agriculture organizations might similarly benefit from enhanced negotiation power.

3.3.3 WTP for food supply from urban agriculture among millennial students in the United States

Printezis and Grebitus (2020) conducted a study in the United States using two online Choice Experiments (CE) to investigate millennial college students' preferences and WTP for food products, both fresh and processed, sold by urban farms. The study also examined the influence of competing sales venues and attributes such as organic labels on preferences and WTP for urban farm products. The research contributes to understanding millennials' preferences for urban farm food products, farmers' market items, and grocery store goods. Specifically, the authors focused on millennials' WTP for processed and unprocessed foods,

taking into account potential interactions between local and organic labels, as well as between sales venues and product labels.

Results from the two online CEs showed that college-aged millennials were willing to pay more for locally sourced foods, although positive WTP for local products was not specific to urban farm sales venues. While urban farms may have an advantage selling local foods, the study found no significant positive WTP for foods sold directly at urban farms. Millennials did not prefer direct-to-consumer channels over grocery stores for local food purchases; in fact, WTP decreased for processed foods labeled as local and sold at farmers' markets and urban farms. This may stem from a perception that such venues target price-sensitive consumers or require less financial input since production, processing, and sales are centralized. A negative WTP for local tomato sauce sold at farmers' markets or urban farms could also reflect expectations that processed local foods in these markets should be more affordable. Discounts on organic tomatoes and sauces at farmers' markets may indicate consumers' belief that these markets lack premium branding found in grocery stores.

Millennials in this study showed a positive WTP for organic items produced by urban farms. Consequently, selling organic products could be economically beneficial for urban farms. Farmers producing organic items may benefit from adding labels indicating local production, as positive WTP was observed for such products, making these labels valuable marketing tools even if price premiums are not feasible.

These findings may assist producers of fresh and processed goods, retailers, and stakeholders interested in promoting urban agriculture sales. The authors found that millennial college students did not exhibit a strong preference for urban farms as distributors over grocery stores and were not willing to pay a premium. Conversely, they were willing to pay less for products sold by urban farms. Additionally, the study noted lower preferences and WTP for local products sold at farmers' markets, while urban farm products were not affected by their local label. Nevertheless, travel distance could become a barrier for urban farms selling products on or near their sites if locations are remote. Bringing products closer to customers or offering enhanced shopping experiences, such as holiday light displays or corn mazes, could help urban farms overcome travel barriers.

3.3.4 WTP for household waste recycling and urban agriculture in Nigeria

Okon et al. (2018) investigated the factors influencing the willingness to pay (WTP) for urban waste recycling for agriculture by urban farming households in Akwa Ibom State, Nigeria. The research involved a survey with cross-sectional data from 90 randomly selected urban farming households across three major cities in Akwa Ibom State, which was analyzed using descriptive statistics and Tobit regression. Joint efforts to manage waste and repurpose it for agriculture would require significant policy changes and infrastructure investment. Policymakers have identified the need to recycle urban waste rich in nitrogen, phosphorus, and potassium to enrich and support urban agriculture as a priority. This study addresses urban farmers' WTP for adopting organic fertilizers and using recycled urban waste.

Data were analyzed with descriptive statistics such as averages and standard deviations, as well as inferential statistics, particularly Tobit regression models. Socio-economic factors influencing respondents' WTP for recycling or reusing organic waste for farming were determined through the Tobit model with maximum likelihood estimation. Ordinary Least Squares (OLS) proved inefficient and inconsistent due to the model's intolerance for zero values in the error term. Key findings include significant impacts of age, education, monthly expenditure, land acquisition method, and household size on urban farmers' WTP for waste recycling in the study area.

Education-based WTP differences suggest a need for awareness campaigns to increase farmers' understanding of organic fertilizers' benefits and the potential risks of unmanaged urban waste. Additionally, younger individuals should be encouraged to acquire urban land

and consider farming careers, as older generations are less inclined to pay for waste recycling. This research can aid policymakers in estimating the government subsidies and public education required for urban waste recycling implementation in the study area. The authors advocate establishing centers of excellence in urban waste recycling and management in Akwa Ibom State.

3.3.5 WTP for urban agriculture practices in Sri Lanka

Ayoni et al. (2022) conducted research to estimate the willingness to pay (WTP) and socio-economic benefits of urban agriculture practices using Choice Experiments (CE) in Colombo, Sri Lanka's most urbanized district. Rapid urbanization in Colombo has created negative externalities. The lack of socio-economic benefits, aside from harvests, to mitigate urbanization's adverse effects, presents a gap in sustainable solutions development. The study evaluated urban residents' preferences for urban agriculture practices (commodities) regarding associated socio-economic benefits (attributes). This objective was achieved through surveys to estimate respondents' relative valuation of socio-economic attributes. WTP assessments for policy-relevant attributes required distinct evaluations for each attribute. The resulting WTP values were calculated using econometric models, and the socio-economic benefits of urban agriculture practices were analyzed.

Measuring WTP for urban residents ranged from lower to higher attribute levels. CE proved more appropriate in this context compared to the Contingent Valuation Method (CVM). The CE's ability to estimate marginal changes by adjusting attribute levels enabled an analysis of the commodity's total value. Respondents' WTP for additional benefits from urban agriculture improvements was quantifiable, given land limitations and limited modern technology knowledge. There was an exception among non-practitioners regarding agriculture benefits and user-friendly landscaping. Considered benefits included food cost reduction, food security and safety, nutritional security, personal well-being, improved yield through user-friendly farming, and mitigation of urbanization's adverse impacts.

The study focused on preference variations rather than their causes, identifying significant variations in all cases between non-practitioners' preferences and nutritional value for urban agriculture practitioners. The findings suggest an opportunity to explore sources of population preference heterogeneity, such as socio-demographic factors. Socio-economic benefits of urban agriculture generate an estimated welfare of USD 136,400 per urban farming community in Colombo. The study shows high WTP for additional benefits from urban agriculture, presenting an option for charging fees to urban residents for access.

In conclusion, urban agriculture programs can be effectively guided by promotion, targeting youth and underprivileged non-farming segments while disseminating knowledge on vertical farming for social housing and modern settlements. The CE findings strongly support the hypothesis that urban agriculture contributes positively to practitioners' utility. This positive impact is also perceived to benefit non-practitioners in urban areas. Numerous urban agriculture qualities are beneficial, underscoring the importance of urban agriculture in counteracting urbanization's adverse effects.

3.4 Implications of willingness to pay for urban agriculture ecosystem services in Indonesia

The Willingness to Pay (WTP) for ecosystem services provided by urban agriculture in Indonesia carries significant implications, both environmentally and socio-economically. WTP is a critical element in planning urban agriculture on public land in Indonesia. As a concept, WTP reflects the maximum price consumers are willing to pay to support a given service or product, offering detailed insight into individual preferences and values. WTP analysis determines the highest amount consumers are willing to spend, allowing the demand curve to be calculated and providing a basis for setting optimal pricing. Aggregated WTP, representing the total consumer WTP value, offers an overview of the financial support the community is willing to provide for urban agriculture.

Urban agriculture in Indonesia functions not only as an ecosystem service provider but also as a creator of green open spaces that contribute to public health and well-being. Urban agriculture practices facilitate the reintegration of natural elements into built environments, even when land availability is limited. Consequently, WTP for ecosystem services from urban agriculture indicates community recognition of the economic and social value of these efforts, establishing a foundation for policies that support sustainable urban agriculture in Indonesia.

Several examples illustrate WTP applications within Indonesia's agricultural sector. Riana et al. (2019) conducted a study at two Gelael Signature supermarket locations in Semarang to assess WTP for organic rice and the factors influencing consumer decisions. Results showed that among the 100 participants, approximately 88% were willing to pay a premium for organic rice. Factors influencing this decision included monthly income, price, and brand. This research provides insights into the organic rice market in Indonesia and suggests ways to enhance its distribution. Another study by Hadhi and Mukhamad (2014) examined the characteristics of organic vegetable consumers, the extent they were willing to pay, and the factors influencing their choices. Findings revealed that average WTP was approximately IDR 18,738 for cabbage, IDR 30,048 for lettuce, IDR 40,250 for broccoli, IDR 24,368 for pak choi, and IDR 19,820 for carrots. Attitudes and perceived barriers significantly impacted payment decisions, while economic status was less influential.

4. Conclusions

Urban agriculture has become a vital contributor to environmental services and ecosystem support in urban settings by utilizing various land types, including schoolyards, playgrounds, and vacant lots. This practice not only expands green open spaces but also sustainably integrates ecosystem services. The diverse forms of urban agriculture, involving multiple stakeholders and utilizing local resources, provide solutions without requiring extensive land acquisition processes. This approach functions as an ecosystem service provider and creates green spaces that positively impact public health and well-being.

Consumer Willingness to Pay (WTP) is a crucial element in urban agriculture planning in Indonesia. The WTP concept offers deep insights into individual preferences and values, enabling the development of policies that support sustainable urban agriculture. WTP reflects societal recognition of urban agriculture's economic and social value, which provides ecosystem services and fosters environmental sustainability despite limited land availability.

Research conducted in various locations—such as the outskirts of Murcia, Spain, Oslo, Norway, and the United States—has explored critical aspects of urban agriculture. These studies emphasize the economic valuation of ecosystem services, socio-economic characteristics, and community preferences, supporting sustainable urban agriculture planning. In Akwa Ibom, Nigeria, other research focused on the factors influencing urban farming households' WTP for recycling waste, with implications for planning awareness campaigns and encouraging youth engagement in urban farming. Research in Colombo, Sri Lanka, evaluated urban residents' preferences and WTP for urban agriculture practices and socio-economic benefits, demonstrating that WTP for additional benefits from improved urban agriculture can guide promotional efforts targeting young and lower-income non-farming segments.

Urban agriculture plays an essential role as an ecosystem service provider and contributor to community well-being. The use of the WTP method in research and planning is an effective tool for understanding consumer preferences, supporting urban agriculture sustainability, and designing policies relevant to stakeholders.

Acknowledgement
The author would like to express my gratitude to all those who contributed to the completion of this research. Special thanks to my colleagues for their support and valuable insights throughout the study.

Author Contribution
The author is responsible for all aspects of this work, including the conception and design of the study, data collection, analysis and interpretation of data, drafting and revising the manuscript, and final approval of the version to be published.

Funding
This research received no external funding.

Ethical Review Board Statement
Not available.

Informed Consent Statement
Not available.

Data Availability Statement
Not available.

Conflicts of Interest
The authors declare no conflict of interest.

References
Albaladejo-García, J. A., Alcon, F., & Martínez-Paz, J. M. (2021). Economic valuation of allotment gardens in peri-urban degraded agroecosystems: The role of citizens' preferences in spatial planning. *Sustainable Cities and Society*, 68. https://doi.org/10.1016/j.scs.2021.102771

Audate, P. P., Cloutier, G., & Lebel, A. (2022). Role of urban agriculture in the space-to-place transformation: Case study in two deprived neighborhoods, Haiti. *Cities*, 12. https://doi.org/10.1016/j.cities.2022.103726

Ayoni, V. D. N., Ramli, N. N., Shamsudin, M. N., & Hadi, A. H. I. A. (2022). Urban agriculture and policy: Mitigating urban negative externalities. *Urban Forestry and Urban Greening*, 75. https://doi.org/10.1016/j.ufug.2022.127710

Baker, E., Bezner Kerr, R., Deryng, D., Farrell, A., Gurney-Smith, H., & Thornton, P. (2023). Mixed farming systems: potentials and barriers for climate change adaptation in food systems. *Current Opinion in Environmental Sustainability*, 62. https://doi.org/10.1016/j.cosust.2023.101270

Bano, M., & Zowghi, D. (2015). A systematic review on the relationship between user involvement and system success. *Information and Software Technology*, 58, 148–169. https://doi.org/10.1016/j.infsof.2014.06.011

Chandra, A. J., & Diehl, J. A. (2019). Urban agriculture, food security, and development policies in Jakarta: A case study of farming communities at Kalideres – Cengkareng district, West Jakarta. *Land Use Policy*, 89. https://doi.org/10.1016/j.landusepol.2019.104211

Dorr, E., Goldstein, B., Aubry, C., Gabrielle, B., & Horvath, A. (2023). Best practices for consistent and reliable life cycle assessments of urban agriculture. *Journal of Cleaner Production*, 419. https://doi.org/10.1016/j.jclepro.2023.138010

Ebissa, G., & Desta, H. (2022). Review of urban agriculture as a strategy for building a water resilient city. *City and Environment Interactions*, 14. https://doi.org/10.1016/j.cacint.2022.100081

FAO & RUAF. (2022). Urban and peri-urban agriculture sourcebook. In *Urban and peri-urban agriculture sourcebook*. FAO. https://doi.org/10.4060/cb9722en

Fauzi, A. R., Ichniarsyah, A. N., & *Agustin*, H. (2016). Urban Agricuture : Urgency, Role, and Best Practice. *Jurnal Agroteknologi*, *10*(01), 49–62. https://jagt.jurnal.unej.ac.id/index.php/jagt/article/view/4339

Gisclard, M., & Richard, R. (2018). L ' agriculture urbaine comme opportunité de construction politique: Réflexions à partir des jardins de l'Hevsel à Diyarbakır. In *Les jardins de l'Hevsel, paradis intranquilles.* Institut français d'études anatoliennes.

Gulyas, B. Z., & Edmondson, J. L. (2021). Increasing city resilience through urban agriculture: Challenges and solutions in the global north. *Sustainability (Switzerland)*, *13*(3), 1–19. https://doi.org/10.3390/su13031465

Gustavsen, G. W., Berglann, H., Jenssen, E., Kårstad, S., & Rodriguez, D. G. P. (2022). The Value of Urban Farming in Oslo, Norway: Community Gardens, Aquaponics and Vertical Farming. *International Journal on Food System Dynamics*, *13*(1), 17–29. https://doi.org/10.18461/ijfsd.v13i1.A2

Hadhi, P. L., & Mukhamad, N. (2014). Analisis Kesediaan Membayar (Willingness to Pay) Sayuran Organik dan Faktor-Faktor Yang Mempengaruhinya. *Jurnal Manajemen Dan Organisasi*, *5*(5), 1–14.

Halperin, S., Castro, A. J., Quintas-Soriano, C., & Brandt, J. S. (2023). Assessing high quality agricultural lands through the ecosystem services lens: Insights from a rapidly urbanizing agricultural region in the western United States. *Agriculture, Ecosystems and Environment*, *349*. https://doi.org/10.1016/j.agee.2023.108435

Kubiszewski, I., Costanza, R., Anderson, S., & Sutton, P. (2017). The future value of ecosystem services: Global scenarios and national implications. *Ecosystem Services*, 26, 289–301. https://doi.org/10.1016/J.ECOSER.2017.05.004

Kumar, A., Mangla, S. K., & Kumar, P. (2023). An integrated literature review on sustainable food supply chains: Exploring research themes and future directions. *Science of the Total Environment*, *821*. https://doi.org/10.1016/j.scitotenv.2022.153411

Le Gall-Ely, M. (2009). Definition, Measurement and Determinants of the Consumer's Willingness to Pay: A Critical Synthesis and Avenues for Further Research. *Recherche et Applications En Marketing (English Edition*), *24*(2), 91–112. https://doi.org/10.1177/205157070902400205

Lin, B. B., Philpott, S. M., & Jha, S. (2015). The future of urban agriculture and biodiversity-ecosystem services: Challenges and next steps. *Basic and Applied Ecology*, *16*(3), 189–201. https://doi.org/10.1016/j.baae.2015.01.005

Lorentziadis, P. L. (2016). Optimal bidding in auctions from a game theory perspective. *European Journal of Operational Research, 248*(2), 347–371. https://doi.org/10.1016/j.ejor.2015.08.012

Miller, G. T., & Spoolman, S. E. (2016). *Environmental Science (Fifteenth).* Cengage Learning.

Miller, G. T., & Spoolman, S. E. (2018). *Living in Environment (Nineteenth)*. Cengage Learning.

Mulya, S. P., Putro, H. P. H., & Hudalah, D. (2023). Review of peri-urban agriculture as a regional ecosystem service. *Geography and Sustainability*, *4*(3), 244–254. https://doi.org/10.1016/j.geosus.2023.06.001

Nikologianni, A., Betta, A., Andreola, M., Pianegonda, A., Battistel, G. A., Ternell, A., & Gretter, A. (2022). Urban Farming Models, Ecosystems and Climate Change Adaptation in Urban Environments: The Case of SATURN Pan European Programme. *Athens Journal of Sciences*, *9*(1), 9–24. https://doi.org/10.30958/ajs.9-1-1

Nur-Shafiza, M., Syamsul-Herman, M., & Wan-Norhidayah, W. (2023). Contingent Valuation Method for Urban Green Space: Case of Bukit Kiara, Kuala Lumpur, Malaysia. *Journal of Tropical Forest Science*, *35*(1), 20–27. https://doi.org/10.26525/jtfs2023.35.1.20

Octarino, C. N. (2023). Efektivitas Pertanian Perkotaan (Urban Farming) dalam Mitigasi Urban Heat Island di Kawasan Perkotaan. *ATRIUM: Jurnal Arsitektur*, *8*(3), 189–198. https://doi.org/10.21460/atrium.v8i3.200

Okon, U. E., Nkeme, K. K., Essien, U. A., Solomon, E. U., & Solomon, U. U. (2018). Urban Farmers' Willingness to Pay and Utilize Urban Waste for Agriculture in Akwa Ibom State, Nigeria. *American Journal of Environmental Protection*, 6(2), 50–53. https://doi.org/10.12691/env-6-2-4

Orsini, F., Kahane, R., Nono-Womdim, R., & Gianquinto, G. (2013). Urban agriculture in the developing world: A review. *Agronomy for Sustainable Development*, *33*(4), 695–720. https://doi.org/10.1007/s13593-013-0143-z

Printezis, I., & Grebitus, C. (2020). *College-Age Millennials' Preferences for Food Supplied by Urban Agriculture. Frontiers in Sustainable Food Systems*, *4*. https://doi.org/10.3389/fsufs.2020.00048

Riana, E. T., Mukson, M., & Roessali, W. (2019). Analisis Kesediaan Membayar (Willingness To Pay) Konsumen Terhadap Berbagai Jenis Beras Organik di Kota Semarang (Kasus Di Pasar Modern Gelael Signature). *Jurnal Ekonomi Pertanian Dan Agribisnis*, *3*(4), 689–700. https://doi.org/10.21776/ub.jepa.2019.003.04.4

Royer, H., Yengue, J. L., & Bech, N. (2023). Urban agriculture and its biodiversity: What is it and what lives in it? *Agriculture, Ecosystems and Environment*, *346*. https://doi.org/10.1016/j.agee.2023.108342

Sarjan, M., Fauzi, M. T., & Thei, R. S. P. (2022). Introduction of Integrated Pest Management Practices in Urban Farming in Mataram City During the Covid-19 Pandemic. Unram *Journal of Community Service*, *3*(3), 85–91. https://doi.org/10.29303/ujcs.v3i3.192

Scott, A., Dean, A., Barry, V., & Kotter, R. (2018). Places of urban disorder? Exposing the hidden nature and values of an English private urban allotment landscape. *Landscape and Urban Planning*, *169*, 185–198. https://doi.org/10.1016/j.landurbplan.2017.09.004

Shao, Y., Zhou, Z., Chen, H., Zhang, F., Cui, Y., & Zhou, Z. (2022). The potential of urban family vertical farming: A pilot study of Shanghai. *Sustainable Production and Consumption*, *34*, 586–599. https://doi.org/10.1016/j.spc.2022.10.011

Sharifi, E., & Lehmann, S. (2015). Correlation analysis of surface temperature of rooftops, streetscapes and urban heat island effect: Case study of central Sydney. *Journal of Urban and Environmental Engineering*, *9*, 3–11. https://doi.org/10.4090/juee.2015.v9n1.003011

Tacoli, C. (2017). Urban poverty, food security and climate change Policy pointers. *International Institute for Environment and Development*, 5. http://www.jstor.org/stable/resrep01511

Tapia, C., Randall, L., Wang, S., & Aguiar Borges, L. (2021). Monitoring the contribution of urban agriculture to urban sustainability: an indicator-based framework. *Sustainable Cities and Society*, *74*, 103130. https://doi.org/10.1016/j.scs.2021.103130

Valley, W., & Wittman, H. (2019). Beyond feeding the city: The multifunctionality of urban farming in Vancouver, BC. *City, Culture and Society*, *16*, 36–44. https://doi.org/10.1016/j.ccs.2018.03.004

Yan, D., Liu, L., Liu, X., & Zhang, M. (2022). Global Trends in Urban Agriculture Research: A Pathway toward Urban Resilience and Sustainability. *Land*, *11*, 1–17. https://doi.org/10.3390/land11010117

Yayasan Keanekaragaman Hayati Indonesia. (2020). Sustainable Development: Pembangunan Berkelanjutan: Towards Indonesia Takeoff 2045. *In 90 Tahun Prof. Emil Salim, Pembangunan Berkelanjutan: Menuju Indonesia Tinggal Landas 2045.*

Zheng, Z. W., & Chou, R. J. (2023). The impact and future of edible landscapes on sustainable urban development: A systematic review of the literature. *Urban Forestry and Urban Greening*, *84*, 127930. https://doi.org/10.1016/j.ufug.2023.127930

Biographies of Author

Assyifa Fauzia, Department of Environmental Science, Faculty of Environmental Science, Universitas Indonesia.

- Email: assyifa.fauzia21@ui.ac.id
- ORCID: N/A
- Web of Science ResearcherID: N/A
- Scopus Author ID: N/A
- Homepage: N/A