

Research article

From Farmland to Housing: Assessing the Consequences of Agricultural Land Conversion for Farmers' Welfare and Food Security

Lalu Teguh Suganda^{1,*}, Jawoto Sih Setyono²

¹ Master Program in Urban and Regional Planning, Universitas Diponegoro, Semarang, Indonesia; ² Department of Urban and Regional Planning, Universitas Diponegoro, Semarang, Indonesia.

^{*} Correspondence: laluteguh.suganda@students.undip.ac.id

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Abstract

Rapid conversion of agricultural land into housing challenges rural livelihoods and food security in many developing countries; however, its implications for agrarian injustice remain underexplored. This study investigates how unjust agricultural land conversion affects farmers' welfare and household food insecurity in Kediri Subdistrict, West Lombok, Indonesia. Unjust agricultural land conversion relates to unequal land governance, weak spatial planning enforcement, and socioeconomic effects on smallholders. A convergent mixed-method approach is used to integrate multitemporal spatial analysis using Geographic Information Systems, household survey data from 100 farmers, qualitative interviews, and logistic regression modeling based on the Food Insecurity Experience Scale. The results reveal a substantial transformation of rural landscapes, with approximately 31% of productive agricultural land converted into housing between 2012 and 2024. This process undermines farmers' livelihoods and intensifies food insecurity across availability, accessibility, and utilization dimensions. Logistic regression identified housing-driven land conversion as the strongest predictor of worsening food insecurity. Older and less-educated farmers exhibited significantly higher vulnerability. The findings demonstrate that farmland conversion is a physical land-use change and structural driver of food insecurity through land dispossession, livelihood erosion, and reduced household resilience. This study clarifies that unjust conversion reflects rapid land transformation driven by housing development, weak spatial planning control, and unequal effects on smallholders who experience livelihood loss without adequate protection or compensation. These findings highlight the need to strengthen spatial planning enforcement, protect sustainable agricultural land, and promote more inclusive land governance to safeguard rural livelihoods and food security.

Keywords: agricultural land conversion; land use change; food insecurity; farmers' livelihoods; spatial planning; rural Indonesia.

1. Introduction

Food is a fundamental element of human well-being and sustainable development (Tian & Henseler, 2025). As the global population is projected to reach 9 billion by 2050 (UN, 2022), the demand for food will continue to increase significantly. Furthermore, the agricultural sector is facing growing structural pressures, including declining agricultural labor, climate change, and decreasing productive farmland (Gibson, 2012). In many developing countries, including Indonesia, these challenges are closely linked to the rapid conversion of agricultural land for non-agricultural uses (Abubakar *et al.*, 2026). The conversion of agricultural land for non-agricultural purposes has emerged as a significant economic influence in developing countries (Zhang *et al.*, 2023). Although it can potentially enhance economic growth, the conversion of agricultural land has significant negative effects, particularly on farm productivity and food safety (Yazdanpanah *et al.*, 2025).

In this study, the unjust conversion of agricultural land refers to the transformation of productive farmland for non-agricultural uses that disproportionately disadvantages smallholder farmers. This injustice is reflected in weak spatial planning enforcement, unequal land governance, and a lack of adequate protection or compensation for farmers who have lost productive land (Li *et al.*, 2024). Rather than being a neutral process of land-use change, the conversion of agricultural land often reflects power imbalances between farmers, land developers, and urban expansion interests. This presents significant challenges in securing food supply and accommodating the space requirements of an expanding population (Hussain *et al.*, 2025).

Previous studies have examined the conversion of agricultural land and its impact on food production, rural livelihoods, and economic development (Rustiadi *et al.*, 2021; Zhang *et al.*, 2023). However, most have focused primarily on land-use change or agricultural productivity, whereas limited research has explicitly linked farmland conversion to household-level food insecurity and the erosion of farmers' livelihood resilience. Moreover, the concept of unjust land conversion remains underexplored in empirical research, particularly in the context of rapidly urbanizing rural areas in Indonesia.



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Indonesia, an agrarian country, is experiencing increasing pressure on agricultural land owing to population growth and rapid housing expansion. According to agricultural land statistics from the Ministry of Agriculture of the Republic of Indonesia (2020), the total agricultural land area in West Lombok District declined significantly from 17,306 ha in 2015 to 15,004 ha in 2019. In contrast, data derived from the “Food Security and Vulnerability Atlas of West Lombok District” Barat (2024) indicate a slight increase in agricultural land area in Kediri Subdistrict, West Lombok, from 1,421 ha in 2021 to 1,426 ha in 2024. This discrepancy highlights the limitation of relying solely on aggregate land statistics and underscores the need for integrated analyses that combine spatial land-use changes with the socioeconomic impact at the household level. Therefore, this study aims to bridge this gap by examining not only the extent of the conversion of agricultural land but also its implications for farmers’ welfare and food insecurity. By focusing on Kediri Subdistrict, West Lombok, as a localized case, this study aims to determine whether seemingly stable land availability masks the underlying processes of the unjust conversion of agricultural land disproportionately affecting smallholder farmers.

The conversion of agricultural land for housing has broader consequences than the loss of physical farmland (Li *et al.*, 2024). When farmers lose land access, they lose income, employment security, and the ability to produce food for their households. This can shift farmers from food producers to market-dependent consumers, thereby increasing their exposure to price volatility and economic uncertainty. Consequently, the conversion of agricultural land may generate hidden forms of food insecurity, even in regions not classified as severely food insecure.

Despite rising food demand driven by population growth, agricultural land continues to diminish, creating a structural contradiction between food needs and production capacity (Harini *et al.*, 2012; Ivanka *et al.*, 2024). Moreover, landowners’ decisions to sell or convert agricultural land are often driven by short-term economic incentives rather than long-term food system sustainability (Beckers *et al.*, 2020). This market-driven logic reinforces inequality because land is redirected from food production to profit-oriented development, whereas farmers who are central to food systems are marginalized and deprived of their productive base (Giller *et al.*, 2021). Consequently, unjust land conversion represents not only a spatial transformation but also a redistribution of economic and food system power away from agricultural communities.

Although several studies have discussed the relationship between the conversion of agricultural land and rural livelihoods, the interrelationships among unjust land conversion, farmers’ welfare, and household food insecurity have not been sufficiently examined. In particular, empirical evidence at the local level combining spatial analysis of land-use change with household-level data on food insecurity and livelihood resilience remains limited. This reflects an important research gap, particularly in rapidly growing rural areas, where housing expansion is accelerating the loss of productive farmland.

This study addresses this gap by analyzing how the unjust conversion of agricultural land into housing affects farmers’ welfare and contributes to food insecurity in Kediri Subdistrict, West Lombok District, Indonesia. By integrating spatial analysis using a Geographic Information System (GIS) with farmers’ survey and interview data, this study provides a more comprehensive understanding of how land-use change affects farmers’ livelihoods and food security. The findings are expected to contribute to the literature on agrarian justice and land governance, as well as inform policy strategies aimed at protecting agricultural land, strengthening farmers’ livelihoods, and ensuring long-term food security.

2. Literature Review and Conceptual Framework

Unjust land conversion refers to the inequitable transformation of land use, typically involving a shift from productive agricultural land to housing, commercial, or industrial purposes without adequate compensation, meaningful consent, or proper consideration of environmental and social consequences (Aini *et al.*, 2024). Such processes are often characterized by imbalanced power relations and weak governance, resulting in the displacement of local communities, declining food security, and intensified socioeconomic inequality, particularly in developing regions (Li *et al.*, 2024; Yuspin *et al.*, 2020). Saqib *et al.* (2024) found that agricultural land is a crucial resource for farming and that any change in its use can lead to considerable adverse effects on the area available for cultivation. In Indonesia, this injustice is closely linked to the national land governance framework. Although Basic Agrarian Law (UUPA) No. 5/1960 affirms that land has a social function and must be used for the greatest benefit to people, in practice, land conversion is often driven by market-oriented development agendas. Unjust land conversion has led many farmers to lose their primary livelihoods, resulting in food insecurity, community disintegration, and declining welfare among farming families (Ahmad *et al.*, 2021; Aini *et al.*, 2024).

The conversion of agricultural land into housing affects food availability, thereby indirectly affecting food stability, access, and utilization, regardless of the scale of the changes (Coulibaly & Li, 2020; Ivanka *et al.*, 2024). Consequently, land conversion is not only a land-use issue but also a justice issue because it redistributes resources away from food producers and toward capital-intensive sectors. This process deepens socioeconomic inequality, erodes farmers' welfare, and weakens local food systems. Thus, within the framework adopted from Drammeh *et al.* (2019), food insecurity is conceptualized through three interrelated dimensions: availability, accessibility, and utilization (Figure 1). Unjust land conversion is a structural driver that reduces farmers' access to productive assets, undermines household livelihood strategies, and ultimately intensifies food insecurity. Therefore, from this perspective, protecting agricultural land is not only an environmental or economic necessity but also a moral and political obligation to safeguard farmers' rights, livelihoods, and food security.

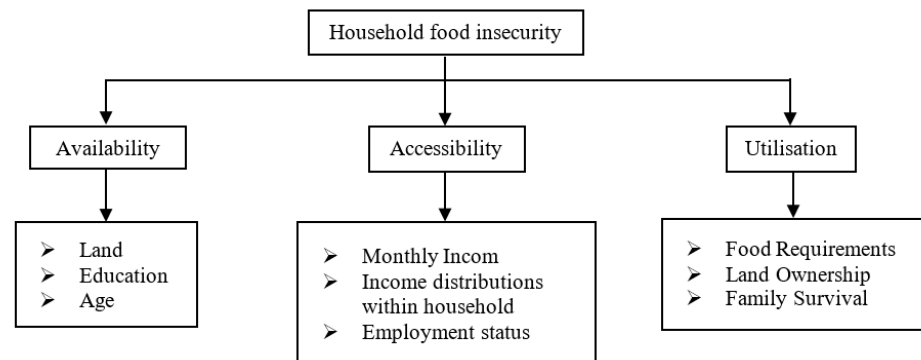


Figure 1. Conceptual model of household food insecurity (adapted from Drammeh *et al.*, 2019).

This injustice operates as a cross-cutting driver that reduces farmers' access to productive land, weakens their livelihoods, and intensifies food insecurity (Li *et al.*, 2024). Unjust land conversion directly diminishes food availability by eliminating farmland, and farmers' limited education and advanced age further restrict their adaptability. Furthermore, land loss undermines economic accessibility by reducing household income, increasing unemployment, and destabilizing income distribution within families (Stringer *et al.*, 2020; Zakari *et al.*, 2022). These pressures also weaken food utilization because declining land ownership and income constrain households' ability to meet nutritional requirements and adopt sustainable survival strategies. Thus, this framework demonstrates that the unjust conversion of agricultural land constitutes a structural link connecting land dispossession, declining farmer welfare, and household food insecurity.

3. Methods

3.1. Study Area

This study was conducted in Kediri Subdistrict, West Lombok District, West Nusa Tenggara Province, Indonesia (Figure 2). Based on the "Food Security and Vulnerability Atlas" published by the Food Security Agency of the West Lombok District, Barat (2024), the Kediri Subdistrict, West Lombok, is classified into priority categories 4 and 5, indicating low-to-moderate levels of food security. According to the "Productive Rice Field Area for Food Security 2015" report, Kediri Subdistrict, West Lombok, has approximately 1,398 ha of agricultural land that is projected to be designated as Sustainable Food Agricultural Land (LP2B) covering 1,338 ha by 2030 (Tajidan *et al.*, 2022). The Regional Spatial Plan (RTRW) formally defines LP2B as protected agricultural land intended to prevent conversion to non-agricultural uses. These conditions are critical in the context of ongoing agricultural land conversion because the reduction of productive farmland may further weaken local food systems and increase household dependence on market-based food access (Table 1). Consequently, even moderate food insecurity may mask the deeper structural risks associated with declining agricultural livelihoods and limited resilience among smallholder farmers (Hatlebakk, 2025).

Table 1. Conversion of agricultural land to housing areas in Kediri Subdistrict, West Lombok, 2012–2024.

Year	Agricultural Land (Ha)	Housing Land (Ha)
2012	1.425	10
2017	1.296	129
2022	1.113	312
2024	983	442
Total		893

Source: Research Analysis, 2024

Table 1 shows a consistent trend of land conversion, with agricultural land decreasing from 1,425 ha in 2012 to 983 ha in 2024 and housing land increasing from 10 ha to 442 ha during the same period. This indicates that approximately 31% of the total initial agricultural land has been converted into housing areas in the last decade, confirming the significant pressure urbanization exerts on the local food production system. However, this study was unable to find detailed spatial data indicating the exact location and boundaries of LP2B-designated areas within Kediri Subdistrict, West Lombok. Consequently, the spatial overlap between observed land conversion and protected agricultural zones could not be directly assessed. This limitation restricts the quantitative evaluation of the extent to which land conversion occurs in LP2B areas. Despite this constraint, the discrepancy between planned agricultural land protection and observed patterns of land conversion suggests potential inconsistencies between spatial planning policies and their implementation. Future research should incorporate detailed RTRW and LP2B spatial datasets to enable more precise spatial analysis, including overlay mapping and quantification of land conversion in protected zones.

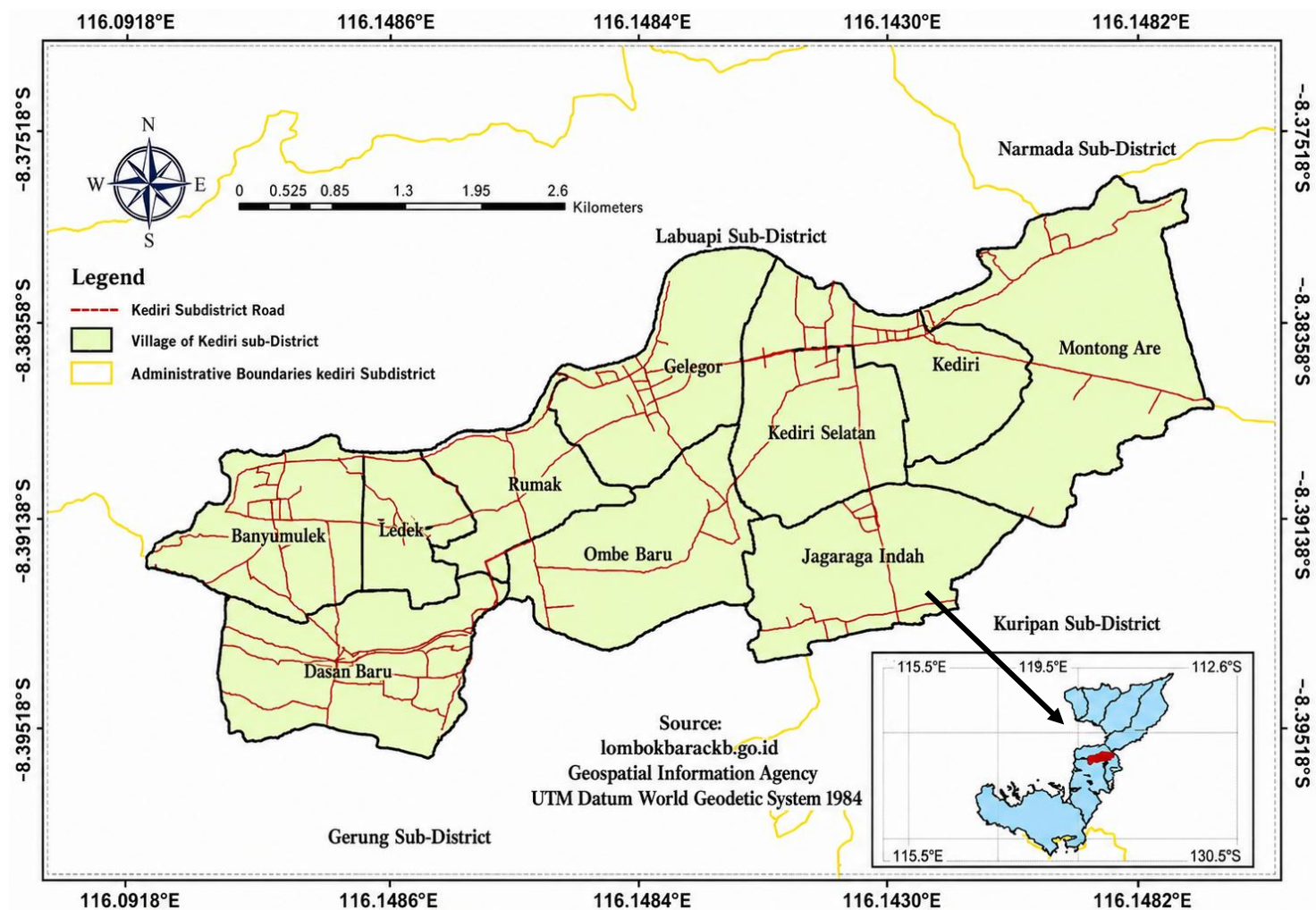


Figure 2. Map of Kediri Subdistrict, West Lombok District.

3.2. Research Design and Data Collection

This study used a convergent mixed-method design in which quantitative and qualitative data were collected simultaneously in a single research phase. This approach enables the integration of numerical trends with contextual explanations, thereby providing a more comprehensive understanding of complex socio-spatial processes, such as the conversion of agricultural land and its impact on farmers' welfare and food insecurity.

The use of a mixed-method strategy is particularly relevant in this study because the phenomenon under investigation involves measurable changes (e.g., land-use dynamics and food insecurity indicators) and subjective dimensions (e.g., farmers' perceptions and experiences). Respondents were selected using a probability proportional to size sampling technique (Yansaneh, 2005), allowing each village to be proportionally represented according to its population size to ensure representativeness at the village level. The total sample size of 100 respondents was determined

using Yamane's formula (Equation 1), which is a widely applied approach for estimating representative samples in survey-based research with known population sizes (Sathyanarayana *et al.*, 2024). Table 2 presents the distribution of respondents across villages.

$$n = \frac{N}{(1 + (N \times e^2))} \quad (1)$$

Where:

n: represents the sample size;

N: is the total population;

e: is the margin of error.

A margin of error of 10% was applied, resulting in a minimum sample size of 99.77, which was rounded to 100 respondents. Although a 5% margin of error is typically recommended for confirmatory social research, the use of a 10% margin in this study reflects a deliberate methodological trade-off between statistical precision and practical feasibility.

Table 2. Distribution of respondents by village.

No	Research Area	Total Population	Sample Size
1	Village Dasan Baru	4.407	24
2	Village Banyumulek	9.025	20
3	Village Rumak	5.957	13
4	Village Gelogor	7.643	17
5	Village Kediri Selatan	7.233	10
6	Village Kediri	10.176	16
Total		44.432	100

Source: Central Statistics Agency of West Lombok District, 2024.

Several considerations support the use of a 10% margin of error in this context. First, this study focuses on capturing relational dynamics and underlying mechanisms rather than exact prevalence rates. Second, field constraints, including limited access to respondents, time, and financial resources, necessitate a pragmatic sampling strategy. Third, the relatively homogeneous socio-economic characteristics of farmers in the study area helped reduce variability, thereby partially mitigating the impact of a larger margin of error on analytical reliability. However, this study is not intended to produce highly precise population estimates. Instead, it adopts an exploratory and diagnostic approach aimed at identifying general patterns and structural relationships (Jebb *et al.*, 2016) among the conversion of agricultural land, farmers' welfare, and food insecurity.

Six of the ten villages in Kediri Subdistrict, West Lombok, were selected using purposive criteria based on (1) the intensity conversion of agricultural land to housing and (2) dominance of agricultural livelihoods among residents. These criteria were applied to ensure that the study captured the areas that were most exposed to development pressure and land-use transformation. The selected villages included Dasan Baru, Banyumulek, Rumak, Gelogor, Kediri Selatan, and Kediri. However, this purposive selection focused on villages experiencing relatively high levels of land conversion, which may bias the findings toward more severe cases of land-use change. Therefore, the results should not be interpreted as statistically representative of all villages in Kediri Subdistrict, West Lombok. Instead, this study adopts an analytical generalization approach, aiming to generate insights that are transferable to similar rural contexts characterized by rapid land conversion and weak land governance.

Spatial analysis of land-use change was conducted using historical Google Earth imagery from 2012, 2017, 2022, and 2024, with an approximate spatial resolution of 0.5–1 meter. Visual interpretation techniques, including on-screen digitization and temporal comparison within GIS, were applied to identify patterns in the conversion of agricultural land into housing. However, reliance on Google Earth imagery and visual interpretation has several limitations. Small-scale or incremental land-use changes, particularly in fragmented agricultural areas, may not be fully detected. Furthermore, interpretation accuracy depends on image quality, temporal consistency, and analyst judgment. The spatial findings were cross-validated using field observations, interview data, and secondary information from local government agencies to mitigate these limitations. This triangulation approach enhances the reliability of land-use classification and ensures that spatial patterns reflect actual conditions. Quantitative, qualitative, and spatial data were integrated using a convergent mixed-method strategy. Quantitative results provide measurable patterns, whereas qualitative and spatial findings offer contextual explanations and validation. This integrated approach strengthens the robustness of the analysis by linking statistical trends with empirical field evidence (Banawa, 2025), thereby providing a more comprehensive understanding of how agricultural land conversion affects farmers' welfare and food insecurity.

3.3. Data Analysis Methods

The main focus of this study was to examine the impact of the unjust conversion of agricultural land on availability, accessibility, and utilization. Unjust land conversion can be understood as a structural driver that reduces farmers' access to productive assets, undermines household livelihood strategies, and ultimately intensifies food insecurity. Food insecurity was measured using the Food Insecurity Experience Scale Survey Module developed by the Food and Agriculture Organization (FAO, 2016). This instrument is widely used to monitor progress toward Sustainable Development Goal 2, which aims to eliminate global hunger.

Farmers were asked to report their food availability experiences before and after converting agricultural land into housing. Based on FAO guidelines, each affirmative response was assigned a value of 1, whereas negative responses were assigned a value of 0, resulting in a raw score ranging from 0 to 8. A score of 0 indicates food security, whereas a score of 1 or higher reflects some level of food insecurity. Scores of 4 or above indicate moderate-to-severe food insecurity, with scores of 7 or 8 representing severe conditions.

The impact of land conversion on food insecurity was assessed by comparing the post- and pre-conversion scores of each farmer. A positive difference between these scores indicates increased food insecurity following land conversion. For analytical purposes, this difference was transformed into a binary dependent variable, where a value of "1" indicates a deterioration in food security (difference ≥ 1), and "0" otherwise. Given the binary nature of the dependent variables, "availability, accessibility, and utilization," a logistic regression (logit) model was employed to examine the relationship between land conversion and the outcomes (Table 3). Three separate logit models were estimated: Model 1 for availability, Model 2 for accessibility, and Model 3 for utilization.

Table 3. Model specifications.

Variable	Model 1	Model 2	Model 3
Dependent	Availability (1,0)	Accessibility (1,0)	Utilization (1,0)
Model specification	$\gamma_{i1}^* = \beta X_i' + \gamma_{i1}$	$\gamma_{i2}^* = \beta X_i' + \gamma_{i2}$	$\gamma_{i3}^* = \beta X_i' + \gamma_{i3}$

In the model specification, the latent variable γ_i^* represents the unobserved propensity of farmer i to experience adverse outcomes (i.e., availability, accessibility, and utilization) owing to land conversion. The observed binary variable γ_i takes the value of 1 if $\gamma_i^* \geq 0$, indicating a negative impact, and 0 otherwise. The vector X_i includes farmers' socioeconomic characteristics that influence these outcomes, while β represents the estimated coefficients and ε_i denotes the error term. The estimated coefficients from the logit model indicate the direction of relationships but do not directly reflect the magnitude of the effects (Zeng, 2024). Odds ratios (ORs) were calculated to provide a more interpretable measure of how the unjust conversion of agricultural land into housing affects food availability, which indirectly affects farmers' food stability, access, and utilization.

4. Results and Discussion

4.1. Respondent Characteristics

Respondent characteristics provide important insights into farmers' backgrounds (Sarie *et al.*, 2023). Age is a relevant attribute that may influence how agricultural land conversion affects farmers' welfare. Male farmers accounted for more than half of the respondents. Income, another key determinant, was classified into two categories based on the regional minimum wage (UMR). Farmers earning below IDR 2,500,000 per month were categorized as low-income, whereas those earning above this threshold were classified as high-income. The descriptive statistics indicated that more than half of the respondents fell into the low-income category, suggesting generally vulnerable economic conditions among farming households. Education level was grouped into three categories: low (primary school), medium (junior and senior high school), and high (bachelor's degree). The distribution showed that more than one-fifth of the farmers had a low education level, while approximately two-fifths had attained higher education, indicating varying levels of human capital among respondents.

The conversion of agricultural land in the study area has occurred primarily for three purposes: (1) business capital, (2) infrastructure development, and (3) housing development. Accordingly, the variable representing the purpose of land conversion was categorized into these three groups. More than half of the respondents reported that their land had been acquired by real estate developers, making housing development the dominant driver of land conversion. The land conversion

proceeds for business capital were the second most common reason (Table 4). Recent policy shifts in Indonesia, particularly those related to the implementation of Sustainable Agricultural Land Protection and National Strategic Projects, have influenced land-use dynamics (SPI, 2020). In several cases, farmers reported having limited bargaining power to resist the sale of their land. Consequently, more than three-fifths of the respondents indicated that they experienced negative changes in their livelihoods following the conversion of agricultural land.

Table 4. Respondent characteristics

Characteristics	Frequency
Gender	
Male	71%
Female	29%
Age	
20–29 Years	22%
30–39 Years	26%
40–49 Years	21%
50–59 Years	15%
> 60 Years	16%
Highest Education	
No School	8%
Primary School	17%
Junior High School	16%
Senior High School	38%
Bachelor's Degree	21%
Monthly Income	
< Rp.500.000	5%
Rp.500.000–Rp.1.000.000	26%
Rp.1.000.000–Rp.3.000.000	43%
Rp.3.000.000–Rp.4.000.000	14%
> Rp.5.000.000	12%
Reasons for Land Conversion (c)	
Business capital	31%
Infrastructure development	15%
Housing development	54%

Source: Questionnaire Survey, 2024

4.2. Spatial Dynamics Conversion of Agricultural Land to Housing

This study indicates that the conversion of agricultural land into housing in Kediri Subdistrict, West Lombok District, was initially relatively low, with only one housing unit recorded in 2012. However, housing development increased rapidly between 2017 and 2024, reaching 27 housing complexes, as illustrated in Figures 3–6. Spatial analysis shows that the total area of housing development expanded from approximately 129 ha in 2017 to 312 ha in 2022, and further increased to 442 ha in 2024. This expansion corresponds to a substantial reduction in productive agricultural land, posing long-term risks to local food security (Cao & Wang, 2025).

According to the “Productive Rice Field Area for Food Security 2015” report, Kediri Subdistrict, West Lombok, has approximately 1,398 ha of agricultural land, which is projected to be designated as LP2B covering 1,338 ha by 2030 (Tajidan *et al.*, 2022). LP2B is formally defined within the RTRW as protected agricultural land intended to prevent conversion to non-agricultural uses. These conditions become critical in the context of the ongoing conversion of agricultural land because reductions in productive farmland may further weaken local food systems and increase household dependence on market-based food access (Figures 3–6).

Figures 3–6 show a consistent trend in land conversion, with agricultural land decreasing from 1,425 ha in 2012 to 983 ha in 2024, whereas housing land increased from 10 ha to 442 ha during the same period. This indicates that approximately 31% of the initial agricultural land was converted into housing areas in the last decade, confirming the significant pressure of urbanization on the local food production system. However, detailed spatial data indicating the exact location and boundaries of LP2B-designated areas within Kediri Subdistrict, West Lombok, could not be located. Consequently, the spatial overlap between the observed land conversion and protected agricultural zones could not be directly assessed. This limitation restricts the ability to quantitatively evaluate the extent to which land conversion occurs in LP2B areas.

Despite this constraint, the discrepancy between planned agricultural land protection and observed patterns of land conversion suggests potential inconsistencies between what spatial planning policies state and how they are implemented. Future research should incorporate detailed RTRW and LP2B spatial datasets to enable more precise spatial analysis, including overlay mapping and

quantification of land conversion within protected zones. In 2012, housing development was relatively limited and spatially concentrated at a specific location, primarily within established settlement clusters. Agricultural land still dominated the landscape, particularly in the central and southern areas of the subdistrict, indicating a predominantly agrarian land-use structure.

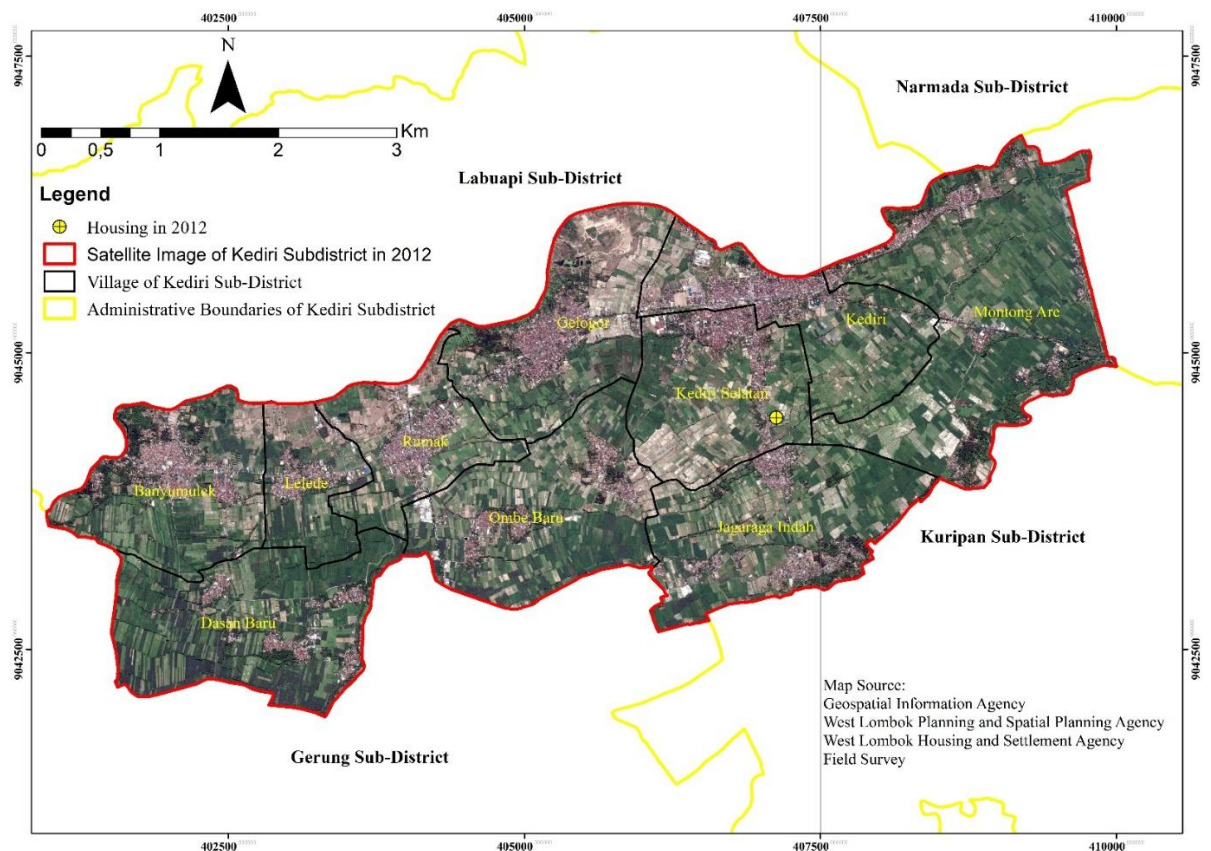


Figure 3. Map of Kediri Subdistrict, West Lombok District, showing housing locations in 2012.

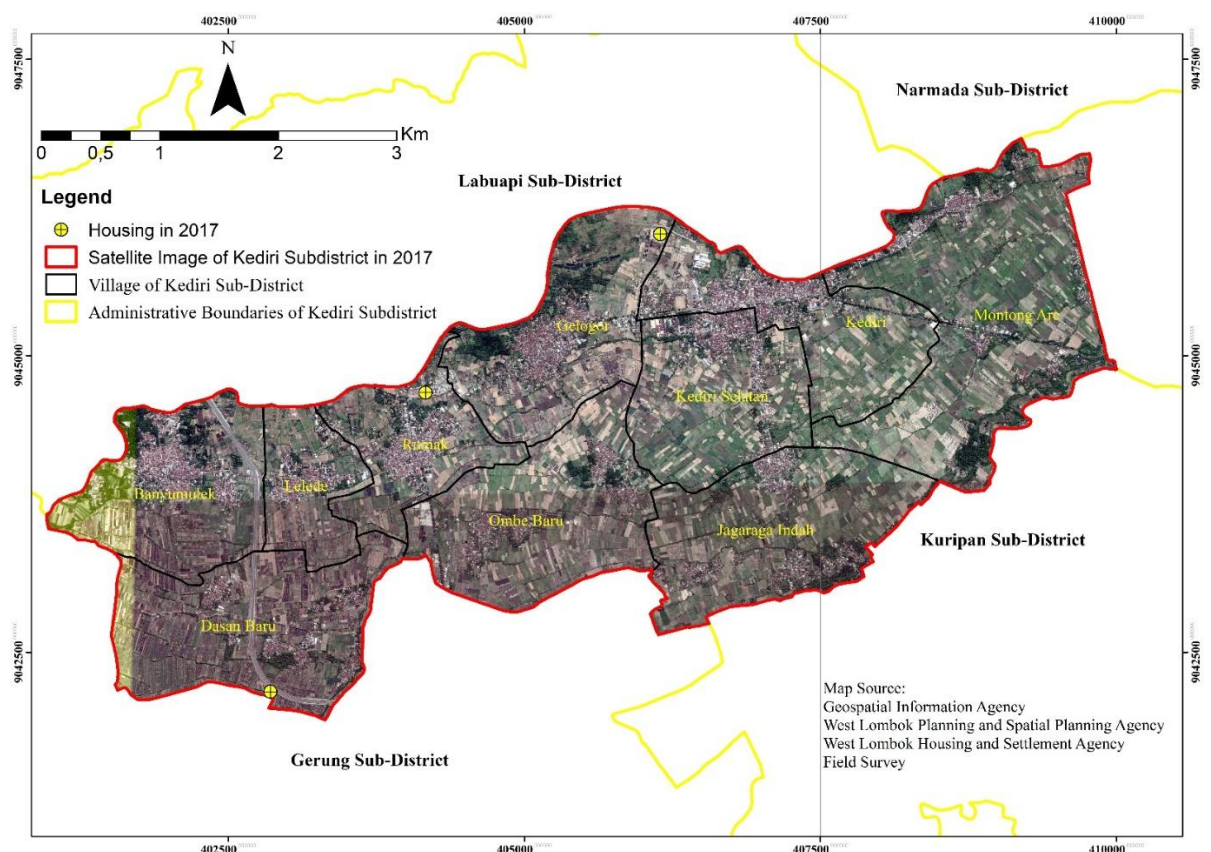


Figure 4. Map of Kediri Subdistrict, West Lombok District, showing housing growth in 2017.

By 2017, the pattern of housing expansion began to intensify and spread outward from existing settlements. New housing developments emerged along transportation corridors and peri-urban zones, suggesting the influence of accessibility and infrastructure in shaping land-use change. This period marks the early stage of the more dispersed and incremental conversion of agricultural land. These dynamics illustrate how infrastructure development catalyzes land conversion (Ram-melt, 2018). Similar patterns have been widely documented internationally, with improved accessibility and transportation networks significantly accelerating farmland loss (Song *et al.*, 2016).

A more pronounced transformation occurred in 2022, when housing development became significantly more extensive and spatially distributed. The emergence of multiple new housing points indicates accelerated land conversion, particularly in areas previously characterized by contiguous agricultural parcels. This pattern reflects increasing development pressure and a shift toward more fragmented agricultural landscapes.

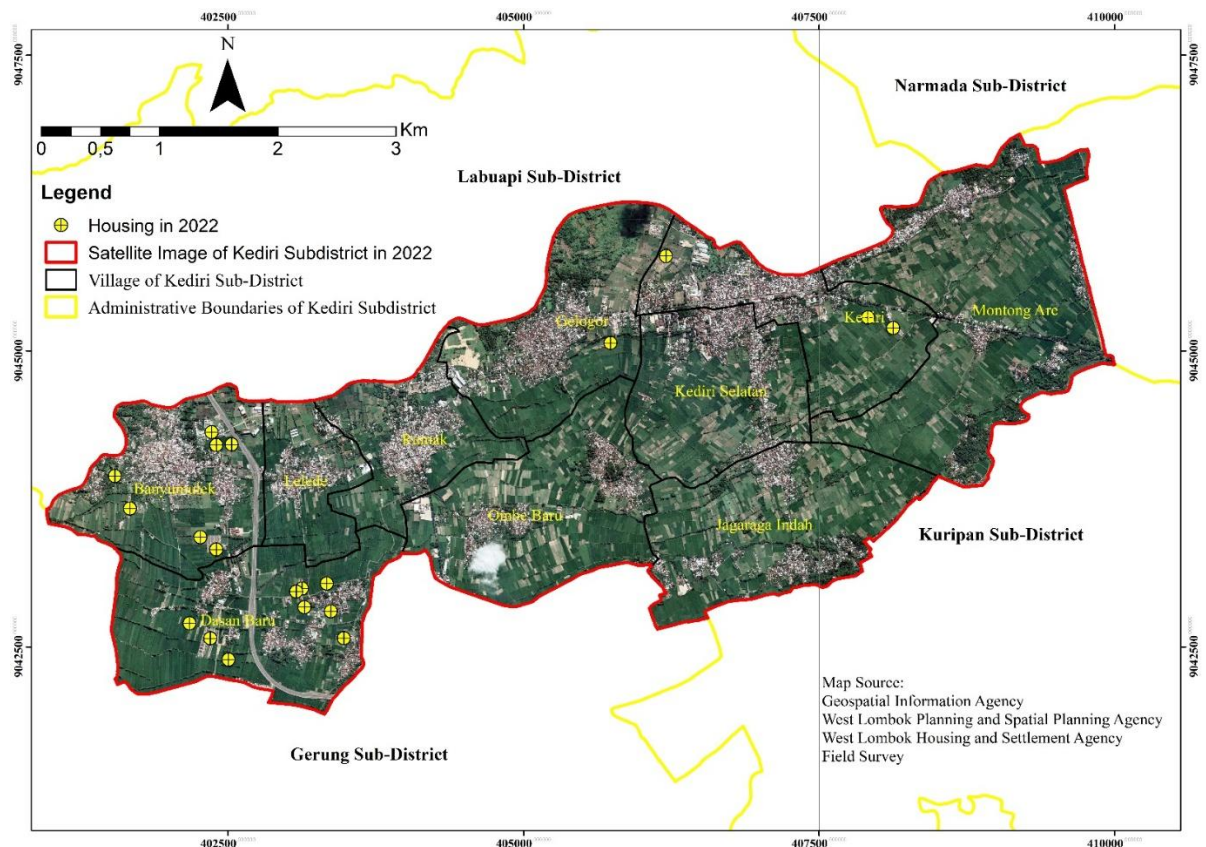


Figure 5. Map of Kediri Subdistrict, West Lombok District, showing housing growth in 2022.

The spatial distribution of new housing developments revealed that agricultural land had been progressively diminished and subdivided by 2024, particularly in villages such as Dasan Baru, Banyumulek, and Kediri Selatan, where development pressure was most intense. Housing development became increasingly clustered while simultaneously expanding across a wider geographic area, reflecting a dual process of densification within existing built-up areas and outward urban expansion into previously productive farmland. From a socio-spatial perspective, this process reflects a form of spatial injustice in which farming communities experience a disproportionate loss of access to productive land resources, despite the formal existence of regulatory frameworks intended to safeguard agricultural areas (Syaban & Opoku, 2024).

More broadly, the multi-temporal spatial analysis demonstrates a clear and consistent trajectory of land-use transformation driven primarily by housing development. The observed pattern signifies a gradual transition from a predominantly agrarian landscape toward a more urbanized and heterogeneous land-use system. This has far-reaching implications, extending beyond land cover changes to affect the socioeconomic foundations of rural communities. The decline in contiguous agricultural land not only constrains food production capacity but also accelerates the erosion of traditional livelihood systems, thereby increasing farmers' dependence on non-agricultural income sources.

The growing fragmentation of agricultural land also weakens local food systems by disrupting production networks, increasing transaction costs, and reducing resilience to external shocks

(Aslam & Fazal, 2025). These dynamics are critical in rapidly urbanizing rural areas, where the loss of productive land interacts with limited institutional capacity and inadequate policy enforcement. Consequently, the conversion of agricultural land should be viewed not only as a physical or economic process but also as a complex socio-spatial transformation with significant implications for agricultural sustainability, rural livelihoods, and long-term food insecurity.

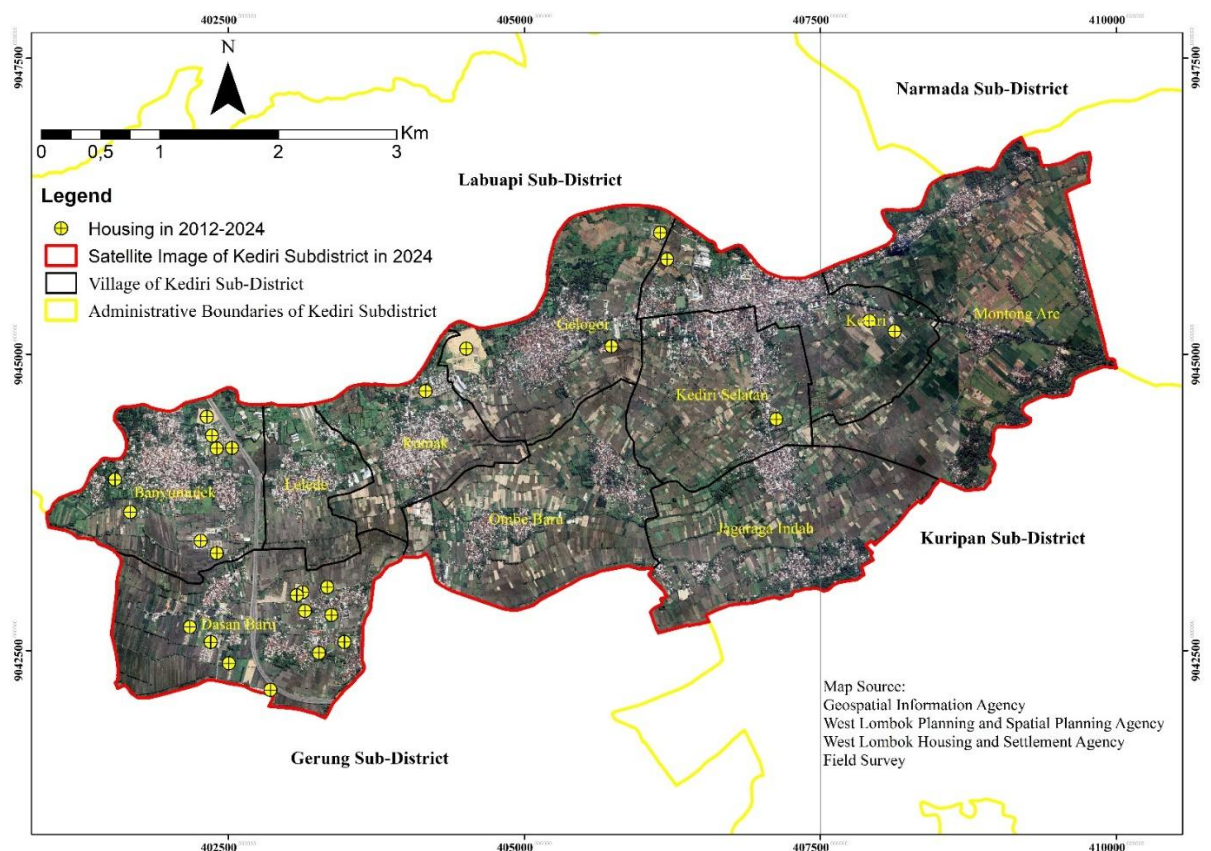


Figure 6. Map of Kediri Subdistrict, West Lombok District, showing housing growth from 2012 to 2024.

4.3. Consequences of the Conversion of Agricultural Land to Housing

Figure 7 illustrates the changes in the proportion of farmers who experienced food insecurity before and after the conversion of agricultural land. The results show a clear and consistent increase across all categories of food insecurity following land conversion (Figure 7). Before land conversion, approximately 29% of farmers reported experiencing food insecurity, whereas the majority (approximately 71%) indicated no significant issues with food security. However, after land conversion, the proportion of farmers affected by food insecurity sharply increased to approximately 82%, indicating a substantial deterioration in food security conditions. This represents an increase of more than 50 percentage points, suggesting that land conversion plays a critical role in exacerbating food insecurity at the household level. These results suggest that land conversion contributes to the worsening of farmers' food insecurity, particularly in rural areas where livelihoods are highly dependent on agriculture. One respondent (48 years old, farmer in Banyuwulek Village) explained that agricultural land served not only as a source of income but also as a form of social security:

"In the past, agricultural land was our main asset. If we faced financial problems, we could still survive because we had land. We grew rice, vegetables, and sometimes corn. Food was never a problem because we produced it ourselves."

This statement reflects a transition from subsistence-based food production to market dependency, increasing farmers' vulnerability to price fluctuations and income instability. Another respondent highlighted the decline in income stability following land conversion (farmer, Rumak Village):

"After the land was sold, I no longer had a steady income. I tried working in construction, but the job is not permanent. Sometimes there is income, sometimes there is none."

The proportion of farmers experiencing severe food insecurity increased from approximately 25% before conversion to approximately 78% after conversion. This finding highlights a significant intensification of food insecurity, suggesting that the impact of land conversion extends beyond

marginal effects and contributes to deeper structural vulnerability among farming households. The loss of productive land reduces farmers' capacity to produce food and increases their reliance on market-based food access, thereby increasing their vulnerability to economic shocks. This trend is consistent with evidence from developing countries, where rural communities are often disproportionately affected by poverty and food insecurity (FAO, 2000). This reflects the direct link between land loss and declining food availability at the household level. In addition, respondents reported that unstable income following land conversion exacerbated their vulnerability to food insecurity. As a farmer group leader in Dasan Baru (40 years old) explained:

"After selling the land, I worked as a daily laborer, but the income is uncertain. Sometimes I earn money, but sometimes I don't. When there is no income, it becomes difficult to buy enough food."

These findings align with those of Alisha (2024), indicating that land conversion has significant adverse effects on farmers' food security and livelihood sustainability. Kebede *et al.* (2023) showed that farmers who retain access to agricultural land tend to exhibit higher levels of food security than those who lose their land. Moreover, land conversion has been associated with increasing food insecurity among rural farming populations, reinforcing the argument that such processes can exacerbate existing socioeconomic vulnerabilities (Hatab *et al.*, 2019). Overall, these results demonstrate that the conversion of agricultural land is strongly associated with the incidence and severity of food insecurity, reinforcing the argument that land loss undermines household resilience and increases dependence on unstable market-based food systems.

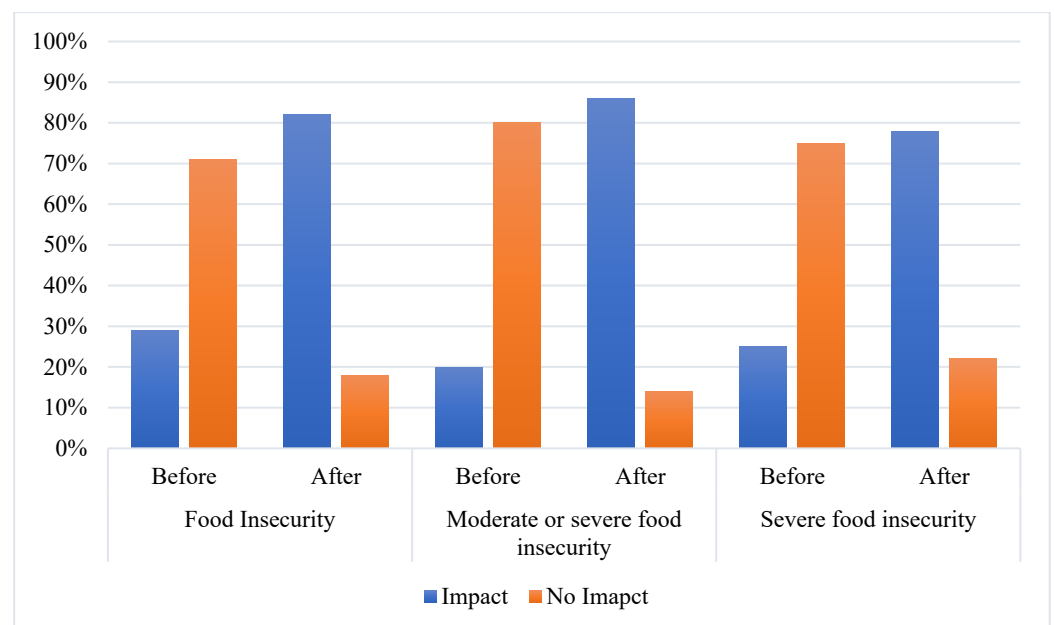


Figure 7. Consequences of the conversion of agricultural land for food insecurity of the farmers' community.

4.4. Determinants of Food Availability, Accessibility, and Utilization

The results of the logistic regression model provide robust evidence that several socioeconomic factors significantly influence the impact of agricultural land conversion on farmers' food insecurity. The overall model is statistically significant (LR $\chi^2 = 107.231$; $p < 0.001$), indicating that the selected explanatory variables jointly contribute to explaining variations in food insecurity outcomes among farmers. Age emerges as a significant determinant, with a negative coefficient ($\beta = -1.250$) and an odds ratio of 0.29. This suggests that younger farmers are substantially less likely to experience food insecurity than older farmers. Thus, an increase in age is associated with a higher probability of adverse food security outcomes. This finding reflects differences in adaptive capacity, in which younger farmers tend to have greater physical ability, mobility, and access to alternative livelihood opportunities, enabling them to cope better with the impact of land conversion.

Education plays a critical role in shaping vulnerability. Farmers with low and medium education levels exhibit positive coefficients ($\beta = 1.081$ and $\beta = 0.903$) and relatively high odds ratios (2.94 and 2.46, respectively). These results indicate that farmers with lower educational attainment are significantly more likely to experience food insecurity than those with a higher education. This pattern underscores the importance of human capital because education enhances farmers' ability to access information, diversify income sources, and adapt to structural changes following land conversion (Table 5).

Table 5. Factors that influence conversion of agricultural land on food insecurity.

Variables	B	Std. errs.	Odd ratios
Age	-1.250	0.431	0.29
Last education (a)			
Low	1.081	0.452	2.94
Medium	0.903	0.341	2.46
Monthly Income (b)			
Low	0.009	0.041	1.01
Medium	-0.345	0.432	0.71
Reasons for land conversion (c)			
Business capital	-0.413	0.120	0.66
Infrastructure development	-0.392	0.135	0.67
Housing development	1.543	0.612	4.67
LR chi ²			107.231
Probability > chi ²			0.000
Log likelihood			678.965

In contrast, monthly income shows a relatively weak and statistically less pronounced effect. Despite a marginally positive relationship between low-income farmers and food insecurity (OR = 1.01), medium-income farmers exhibit a lower likelihood (OR = 0.71). These mixed results suggest that income alone may not fully capture household vulnerability, particularly in rural contexts where subsistence production plays a crucial role in food security. Therefore, land loss may have a more direct impact than income fluctuations because it affects production and purchasing power simultaneously.

The differential effects observed across the “reasons for land conversion” variable further illustrate the structural nature of food insecurity. Conversion driven by housing development shows a strong positive association with food insecurity ($\beta = 1.543$; OR = 4.67), indicating that farmers affected by housing expansion are significantly more likely to experience worsening food security conditions. This finding suggests that housing-related land conversion tends to be permanent and transformative, often leading to a complete loss of agricultural livelihoods. In contrast, land conversion for business capital (OR = 0.66) or infrastructure development (OR = 0.67) is associated with a lower likelihood of food insecurity. These forms of conversion may provide short-term financial benefits or improve accessibility, partially offsetting their negative impact. In terms of availability, land conversion directly reduces local food production capacity by decreasing the amount of productive farmland available to farmers. This decline undermines the balance between the food supply and demand at the local level. The odds ratio shows that farmers who experience land conversion are more likely to experience decreased food availability than those who do not. The interview data further corroborate these spatial patterns. A female respondent from Kediri Selatan explained:

"We rarely feel completely starving, but we often reduce meal portions or skip meals. Sometimes we eat only once or twice a day because our income is not fixed anymore."

Overall, the model highlights that the impact of the conversion of agricultural land on food insecurity is not uniform but mediated by demographic characteristics, human capital, and the underlying drivers of land-use change. Among these risk factors, housing-driven conversion emerges as the most critical, reinforcing the argument that rapid housing expansion in peri-urban areas significantly threatens farmers' livelihoods and food security. It simultaneously reduces food availability, constrains economic access, and undermines food utilization, thereby reinforcing a cycle of vulnerability among farmers.

These findings emphasize the need for more targeted policy interventions that consider not only the extent of land conversion but also the socioeconomic conditions of affected farmers. The loss of agricultural land constrains household food production, which is subsequently compounded by declining purchasing power, thereby cumulatively shaping food consumption and utilization. Accordingly, the utilization dimension can be understood as a secondary outcome that reflects the cascading effects arising from structural disruptions in food availability and accessibility, rather than as an isolated or independent impact.

4.5. Discussion

The findings of this study provide strong empirical evidence that the conversion of agricultural land to housing is a critical structural driver of food insecurity in peri-urban rural areas. According to Bonye *et al.* (2021), smallholder farmers rely heavily on natural resources for subsistence and income generation. By integrating spatial analysis, quantitative modeling, and qualitative insights, this study's results demonstrate that land conversion is not only a physical transformation of land

use but also a multidimensional process that reshapes livelihood systems, weakens local food production capacity, and increases farmers' vulnerability. In line with Tufa and Megento (2022), the loss of productive assets significantly reduces livelihood resilience and limits adaptation strategies. This confirms that land conversion has multidimensional consequences, extending beyond economic income to the long-term sustainability of the food system.

Spatial analysis reveals a clear accelerating trajectory of agricultural land loss, with approximately 31% of farmland being converted into housing areas between 2012 and 2024. This pattern reflects the broader processes of peri-urbanization, in which agricultural landscapes are progressively absorbed into expanding urban systems. This finding is consistent with that of Zhang *et al.* (2023), who reported that farmland loss in rapidly urbanizing regions leads to a measurable decline in local food production capacity and increased dependency on external food systems. Such dynamics have been widely documented in high-impact studies, which show that urban expansion often leads to the irreversible loss of productive land and fragmentation of agricultural systems, thereby undermining long-term food security (D'Amour *et al.*, 2017; Sheng *et al.*, 2025). In the context of Kediri Subdistrict, West Lombok, this transformation is particularly concerning, considering the area's role as a key agricultural zone and designation under the LP2B policy framework. The observed discrepancy between planned land protection and actual land conversion suggests a gap between policy design and implementation, reflecting a challenge frequently reported in developing countries where land governance institutions remain relatively weak (Laksana, 2020).

The quantitative results, particularly those of the logistic regression analysis, confirm that land conversion significantly affects all three dimensions of food insecurity: availability, accessibility, and utilization. In this study, availability emerged as the most directly affected dimension because the loss of agricultural land reduced household-level food production. From a food sovereignty perspective, diminishing farmer control over land reduces community autonomy in determining food production systems (Levien, 2012). This reduction subsequently constrains accessibility by increasing dependence on market-based food systems while influencing utilization through changes in dietary quality and consumption patterns. The statistically significant model (LR $\chi^2 = 107.231$; $p < 0.001$) indicates that these relationships are not random but reflect systematic structural changes driven by land conversion.

The magnitude of these effects varied across socioeconomic groups. Older farmers and those with lower educational levels were significantly more vulnerable to food insecurity, highlighting disparities in adaptive capacity. This finding is consistent with those of recent studies in the rural development literature showing the crucial role of human capital in enabling households to diversify their income sources and respond to economic shocks (Rusere *et al.*, 2025; Siri & Combarry, 2025). In contrast, income alone appears to have relatively weak explanatory power, suggesting that access to productive assets, particularly land, remains a fundamental determinant of food security in agrarian contexts. This supports the argument that land is not only an economic resource but also a form of social security that provides resilience against uncertainty (Ranucci *et al.*, 2025).

This study highlights that the drivers of land conversion significantly shape food insecurity outcomes. Housing development-driven conversion exhibited the strongest negative effect (OR = 4.67), indicating a substantially higher likelihood of food insecurity than other forms of land conversion. This suggests that housing expansion tends to be permanent and disruptive, often resulting in the complete loss of agricultural livelihoods. Contrary to the common assumption that housing development stimulates broad-based local prosperity (Ashaye, 2024; TAPERA, 2023), this study shows that benefits are unevenly distributed, while former landholders face long-term economic precarity. In contrast, conversion for infrastructure development or business capital has a relatively lower impact, possibly because of the compensatory benefits associated with improved accessibility or temporary financial gains. These findings are consistent with recent evidence emphasizing that not all land-use changes have uniform effects, with their impact depending on the nature, scale, and institutional context of the transformation (Bikis *et al.*, 2025).

The concentration of land conversion in specific villages, particularly those under high development pressure, suggests that the burden of urban expansion is unevenly distributed. Farming communities bear disproportionate costs in terms of lost livelihoods and reduced access to productive resources, whereas external actors, such as real estate developers, often capture the benefits. This reflects a broader pattern of unequal resource allocation and governance failure, as highlighted in recent urban and regional studies (Jacobs, 2024). Farmers who previously relied on their land for food production now face unstable incomes and increased exposure to price volatility. This shift significantly heightens vulnerability, particularly during periods of economic uncertainty. The

sharp increase in severe food insecurity from approximately 25% before conversion to 78% after conversion illustrates that the impact is not marginal but represents a profound deterioration in household resilience. Such patterns are consistent with global evidence that land dispossession and livelihood disruption are closely linked to rising food insecurity in rural communities (Li *et al.*, 2024; Sundaram, 2024).

Overall, this study contributes to the literature by demonstrating that the conversion of agricultural land operates as a systemic driver of food insecurity through interconnected pathways affecting availability, accessibility, and utilization. Efforts to address food insecurity in rapidly urbanizing rural areas should not focus solely on income support or food distribution programs and must prioritize the protection of productive agricultural land. Strengthening the implementation of LP2B policies, improving land governance, and enhancing farmers' adaptive capacity through education and livelihood diversification are essential strategies for mitigating the adverse impact of land conversion. Without such interventions, the continued loss of agricultural land will likely exacerbate structural vulnerabilities and undermine long-term food security in similar contexts.

4. Conclusion

This study demonstrates that the conversion of agricultural land into housing in Kediri Subdistrict, West Lombok, Indonesia, is not only a land-use transformation process but also a structural driver of rural vulnerability that undermines farmers' livelihood resilience and intensifies food insecurity. By integrating spatial analysis, farmer survey data, and qualitative evidence, this study shows that rapid housing expansion has substantially reduced productive farmland, weakened farmers' livelihoods, and changed many smallholder farmers from food producers into market-dependent consumers exposed to growing economic risks. The findings confirm that the impact of land conversion extends across the three interconnected dimensions of food insecurity, availability, accessibility, and utilization, with food availability and accessibility being the most severely affected. Although the composite food security index suggests moderate resilience, disaggregated evidence reveals hidden vulnerabilities, particularly among older farmers and those with lower educational attainment. Accordingly, this study demonstrates that food insecurity may intensify even in areas not formally categorized as highly food insecure, indicating that conventional aggregate indicators may obscure deeper structural risks.

A key contribution of this study lies in clarifying the concept of unjust conversion of agricultural land as a form of spatial and agrarian injustice shaped by weak land governance, inadequate spatial planning enforcement, and unequal distribution of development burdens. The findings show that housing-driven land conversion disproportionately imposes livelihood losses on smallholder farmers, whereas the benefits are largely captured by external development interests. This highlights that farmland conversion should be understood not only as a threat to agricultural sustainability but also as a governance and justice issue with direct implications for rural welfare and food system resilience.

This study contributes to the literature by demonstrating that land conversion generates hidden pathways to food insecurity through interconnected socio-spatial mechanisms linking land dispossession, livelihood erosion, and declining household resilience. These findings extend existing debates on agrarian change by showing that the consequences of farmland conversion cannot be adequately understood solely through productivity loss but must also be examined through the lens of food security and agrarian justice. From a policy perspective, the results highlight the urgency of strengthening the implementation of sustainable agricultural land protection policies (LP2B), improving spatial planning enforcement, and promoting more inclusive land governance to protect smallholder farmers from disproportionate displacement. Policy responses should move beyond compensatory approaches and prioritize safeguarding productive farmland to support livelihood diversification and enhance farmers' adaptive capacity to sustain long-term food security in rapidly urbanizing rural regions. Although this study provides crucial empirical insights, the absence of detailed spatial data on LP2B boundaries and its localized case study scope create limitations. Future research could conduct comparative analyses across rapidly urbanizing rural regions and examine how institutional arrangements mediate the relationships between land conversion, agrarian justice, and food security outcomes. Nevertheless, this study highlights that protecting agricultural land is not only critical for sustaining food production but also essential for safeguarding rural livelihoods and advancing a more just and resilient food system.

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Conflict of interest

All authors declare that they have no conflict of interest.

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