



# Environmental Vulnerability in Food Estate Policy in Central Kalimantan: Political Ecology Review

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**Abstract:** This study aims to analyze the implementation of Indonesia's food estate policy in Central Kalimantan and assess its ecological and social implications from a political ecology perspective. Using a qualitative case study design, data were collected through documentary analysis of policy documents, official government reports, scientific publications, and media coverage. The study examines power relations among the state, corporations, and local communities to understand how governance arrangements shape policy outcomes. The findings reveal that the food estate program operates within an unequal power structure that prioritizes state and corporate interests over local livelihoods. Policy implementation has generated significant ecological vulnerabilities, including deforestation, peatland degradation, disruption of hydrological systems, and increased risks of long-term environmental crises. Social impacts are also evident in the marginalization of indigenous peoples and smallholder farmers due to limited participation, reduced land access, and inequitable benefit distribution. These results indicate that the food estate policy functions not merely as a technocratic strategy for food security but as a political arena that redistributes environmental risks and socio-economic burdens toward local communities. The study highlights the need for governance reforms that integrate ecological sustainability, social justice, participatory decision-making, and recognition of local knowledge to ensure more equitable and sustainable agricultural development.

**Keywords:** Food Estate, Political Ecology, Ecological Vulnerability, Environmental Degradation

## Introduction

Food security is a national strategic agenda consistently pursued by the Indonesian government to ensure long-term food availability, affordability, and stability (Abdulgani & Savitri, 2025). Within this framework, the food estate policy was developed as a large-scale agricultural development approach aimed at increasing national food production through land clearing and intensification in various regions, particularly outside Java (Marwanto & Pangestu, 2021). Globally, large-scale agricultural models are often positioned as a response to the threat of food crises, climate change, and population growth (Salahudin et al, 2025). However, studies show that large-scale agricultural projects often have significant ecological consequences, especially when implemented in vulnerable ecosystems such as peatlands and tropical forests (McCarthy & Sitorus, 2025). Agricultural expansion based on large projects is also widely associated with deforestation, land degradation, biodiversity loss, and increased carbon emissions (Rozenblatt-Rosen et al, 2020). In the Southeast Asian

context, similar policies often face the problem of weak integration between food policies and environmental protection policies (Liu et al, 2024).

In Indonesia, the implementation of the food estate policy since 2020 in several regions such as Central Kalimantan, North Sumatra, and Papua has sparked academic and public debate regarding environmental sustainability (Fadillah et al, 2021). One of the main locations for this program's development is Central Kalimantan Province, specifically Kapuas and Pulang Pisau Regencies, which are designated as part of the National Strategic Project. Food estate development in these regions focuses on rice, corn, and cassava through agricultural mechanization and large-scale land clearing in the former Peatland Project (PLG) area (Istani et al, 2025) (Lasminingrat & Efriza, 2020). The government views this program as a long-term solution to anticipate the risk of a global food crisis, maintain price stability, and meet the growing national food demand (Wijerathna-Yapa & Pathirana, 2022). However, various studies indicate that the implementation of food estates in Central Kalimantan has the potential to increase environmental vulnerability due to peatland clearing, changes in water management, and weak environmental carrying capacity assessments in policy planning (Merten et al, 2021) (Nuraisyah et al, 2025). Data from the Ministry of Environment and Forestry (KLHK) in 2021 even shows that approximately 34,000 hectares of food estate land are located in areas with high levels of ecological vulnerability, particularly in peat ecosystems (Elshad et al, 2024).

These issues demonstrate that food estate policies cannot be understood solely as neutral, technocratic policies. From a political ecology perspective, environmental and food policies are always closely linked to the distribution of power, economic interests, and the political processes that surround them (Sihidi et al, 2024) (Sihidi et al, 2026) (Sihidi, Romadhan, et al, 2025) (Sihidi, Salahudin, et al, 2025). The political ecology analytical framework developed by Bryant & Bailey (1997) emphasizes that natural resource management often reflects unequal power relations between the state, corporations, and local communities. In this context, food estate policies can be understood as a political arena in which the interests of the state and powerful economic actors dominate over those of ecological sustainability and social justice (Hendra & Ismunarta, 2024a). Thus, food estate programs not only result in increased food production but also shape the unequal distribution of environmental benefits and risks at the local level.

Previous studies have shown that the food estate project in Central Kalimantan has complex socio-ecological impacts. Large-scale peatland clearing has the potential to trigger land degradation, changes in hydrological systems, loss of biodiversity, and increase the risk of land fires. Socially, this policy often leads to the marginalization of indigenous communities and local farmers due to minimal participation in the planning process and reduced access to productive land (Fadillah et al, 2021). These conditions demonstrate that the success of the food estate program is determined not only by the technical aspects of production, but also by how power relations, governance, and political-economic interests operate within it. Therefore, an analytical approach is needed that can interpret food policy as a political process fraught with interests, rather than simply as a typical agricultural development policy.

Based on this context, this study attempts to analyze the environmental vulnerabilities that arise in the implementation of the food estate policy in Indonesia, particularly in Central Kalimantan. The approach used is political ecology, as formulated by Bryant & Bailey (1997), which emphasizes the importance of examining the relationship between development policies, the distribution of power, and their impact on socio-ecological conditions. This study views the food estate policy as a policy fraught with political-economic interests and potentially resulting in unequal distribution of environmental benefits and risks. Therefore, this study aims to demonstrate that environmental issues in the food estate program cannot be separated from power structures, state-centric development patterns, and the lack of recognition of local community knowledge and interests.

Through secondary data-based analysis of policy documents, official reports, scientific articles, and media publications, this study seeks to uncover how food estate policies are designed and implemented, and how they contribute to increasing ecological vulnerability in their development areas. This study is expected to contribute to academic discourse on the relationship between food policy and environmental sustainability in Indonesia. Furthermore, this research is also expected to provide an argumentative basis for the need to review food estate policies to be more sensitive to aspects of social justice, ecological sustainability, and the protection of local community rights.

## **Methodology**

This study employed a descriptive qualitative method with a literature review approach that relied entirely on secondary data. This method was chosen because the study aimed to critically analyze food estate policies and their impact on environmental vulnerability based on various existing studies and reports, without conducting primary data collection in the field. The research data were obtained from various relevant secondary sources, including scientific journal articles, books, official government reports, policy documents, research institution publications, non-governmental organization reports, and credible media coverage. All data sources were selected based on the criteria of thematic relevance, publisher credibility, and direct relevance to the study's focus on food estate policies in Indonesia.

The data analysis process was carried out through systematic stages including literature collection, source selection, thematic grouping, and critical interpretation. The collected data were categorized into several main themes, such as the ecological impact of food estate policies, the socio-economic dynamics of affected communities, and power relations in food and environmental governance. The analysis was conducted using the political ecology framework as formulated by Bryant & Bailey (1997) to understand the relationship between policies, political-economic interests, and environmental vulnerability. To maintain the validity and reliability of the findings, this study applied source triangulation techniques by comparing various information from different types of documents, so that the resulting analysis is comprehensive, critical, and based on accountable secondary evidence.

## Result and Discussion

### Food Estate Policy in Political Ecology

Indonesia's food estate policy cannot be understood solely as a technocratic response to the threat of a national food crisis. Research findings indicate that from its inception, the food estate policy has been fraught with political and economic interests, and embedded in the logic of extractive development based on large-scale land ownership. From a political ecology perspective (Bryant & Bailey, 1997), environmental and natural resource management policies consistently reflect an unequal distribution of power between the state, corporations, and local communities. Therefore, the food estate can be understood as a political arena in which the state facilitates the interests of powerful actors at the expense of ecological sustainability and the rights of local communities (Hendra & Ismunarta, 2024a). This policy, therefore, is not simply a matter of increasing food production but also a manifestation of power relations in natural resource governance.

Analysis of policy documents shows that the state positions food estates as a national strategic project (PSN) embedded within the logic of food security and economic nationalism (Guillaumie et al, 2025). The narrative of a global food crisis is used as political legitimacy to accelerate large-scale land clearing, particularly in areas with vulnerable ecosystems such as peatlands in Central Kalimantan. However, this policy framing tends to ignore the ecological character of the region and the historical failure of similar projects, such as the Peatland Project (PLG) during the New Order era (Puspitaloka et al, 2020). This policy pattern demonstrates that ecological considerations are often subordinated to short-term political-economic interests. Consequently, food estate policies are more oriented toward accelerating production than toward sustainable environmental protection.

From an ecological perspective, the implementation of food estates has had a significant impact on environmental degradation, particularly through the conversion of forests, peatlands, and customary territories into large-scale food production areas. Research findings indicate an increased risk of ecosystem damage, such as decreased soil quality, loss of biodiversity, and increased vulnerability to long-term ecological crises. Massive land-use changes also have the potential to disrupt hydrological balance and increase the risk of land fires in peat areas. Within the framework of political ecology, this condition is understood as a consequence of the state prioritizing productivity and economic growth over ecological sustainability (Gaudart & Aldrin Pasha, 2024). Thus, the environmental issues that arise are not simply a side effect of policy, but rather an inherent part of the dominant development orientation.

From a socio-political perspective, the food estate policy also produces distributional injustice and triggers agrarian conflicts at the local level. Research findings show that local communities, particularly smallholder farmers and indigenous communities, often lose access to land and livelihoods due to non-participatory licensing processes. The discourse of food security is used as political legitimacy to normalize land grabbing, so that emerging conflicts are not understood as policy failures but rather as logical consequences of development dynamics (Dialektika et al, 2022). This process demonstrates how policies claimed to be in the national interest can actually neglect the interests of vulnerable groups

at the local level. In many cases, affected communities lack adequate space to voice objections or influence policy direction.

Within the framework of political ecology (Bryant & Bailey, 1997), the neglect of local community voices demonstrates how local ecological knowledge is marginalized in favor of centralized state development rationales. Long-standing community-level environmental knowledge and practices are often deemed irrelevant to large-scale food production targets. Consequently, food estate policies emphasize a top-down, technocratic approach, ignoring the specific socio-ecological contexts of each region. These findings emphasize that food estate policies are not neutral policy instruments based solely on technical considerations, but are shaped through a political process fraught with vested interests (López-García et al, 2024). Power relations between the state, corporations, and communities are key determinants of policy direction and impact.

Furthermore, the emphasis on food security logic and national production targets serves as a legitimizing framework that allows the state to ignore more contextual ecological and social considerations (Sarjito, 2022). Food estate policies are presented as the sole solution to food problems, thus often marginalizing criticism of their environmental impacts. From a political ecology perspective, this situation demonstrates how national food policy becomes a space for the articulation of power, where the interests of the state and dominant economic actors are prioritized over ecosystem sustainability and the interests of local communities (Surbakti et al, 2023). As a result, environmental problems arising from food estate implementation are often treated as technical issues, rather than structural ones.

This analytical framework is crucial for understanding that environmental issues in food estates are not policy anomalies, but rather inherent in the design and political orientation of food development itself (Kato et al, 2022). As long as national food policy remains dominated by the logic of economic growth and production expansion, ecological and social vulnerabilities will continue to recur across implementation areas. Therefore, the findings of this study emphasize that evaluations of food estates cannot be limited to the technical aspects of production but must also address the underlying political-economic dimensions. Therefore, a political ecology approach provides a relevant analytical framework for revealing that food estate policies are products of power configurations that directly impact environmental sustainability and social justice.

The food estate program in Central Kalimantan was designed from the outset as a centralized development project directly controlled by the central government. At the President's direction, several strategic ministries, such as the Ministry of Defense, the Ministry of Agriculture, and the Ministry of Public Works and Public Housing, were positioned as key actors in managing this area. The program's initial plan included the development of strategic food crops such as rice, cassava, corn, and other commodities deemed suitable for the land's potential (Hunter, 2022). The establishment of the food estate as part of the National Strategic Program (PSN) in 2020 further emphasized the policy's position within the broader framework of the national food security agenda. The development area is focused on Kapuas and Pulang Pisau Regencies, with a target area of

approximately 165,000–180,000 hectares (Ayelazuno et al, 2025), making it one of the most ambitious large-scale agricultural projects in Indonesia.

The food estate policy in Central Kalimantan can be understood as a concrete manifestation of a state-centric development approach due to the strong state dominance in all planning and program implementation processes (Silaban, 2025). The state establishes a relatively uniform food production model in terms of crop types, planting patterns, and management systems, without fully considering the diverse socio-ecological conditions of peatlands and local livelihood systems (Mahardika et al, 2024). This uniformity reflects a centralized development logic, in which local spaces are engineered to fit national targets, rather than the other way around. Within this framework, Central Kalimantan is often treated as an "empty space" ready to be integrated into national projects, even though the region has long been socially and ecologically inhabited and managed by local communities (Tiswoko et al, 2024). This perspective demonstrates how development policies tend to ignore social and ecological realities that have already been established at the local level.

Research findings indicate that food estate policies are implemented through a state-centric development approach, in which the state plays a dominant role in determining locations, project design, and implementing actors (Fahmid et al, 2022a). The central government, through technical ministries and State-Owned Enterprises (SOEs), is the primary policy driver, while regional governments and local communities have very limited participation (Uda et al, 2020). This pattern demonstrates how the state does not fully function as a mediator of public interests, but rather as an actor reorganizing spatial control for the benefit of elite national development (Puspitaloka et al, 2021). This dominant state role makes the policy formulation process more top-down, often marginalizing the aspirations and needs of local communities. As a result, food estate policies reflect macro-development interests rather than the real needs of grassroots communities.

From a political ecology perspective, this situation reflects a form of state-led enclosure, namely the process of taking over people's living space through legally valid policy instruments. Land previously managed subsistently by local communities is redefined as "idle land" or "unproductive land," thus paving the way for state and corporate intervention (Yuwati et al, 2021). This redefinition process is not merely technical-administrative but also carries a strong political dimension as it determines who has the right to access and control agrarian resources (RS Tulis et al, 2024). Through this mechanism, agrarian space previously under the control of local communities is gradually transferred to large-scale food production schemes controlled by the state and dominant economic actors. Thus, the food estate policy functions as a legal instrument for reorganizing land ownership and use structures.

As a consequence, the food estate policy not only impacts changes in land tenure patterns but also influences the configuration of power relations between the state, economic actors, and local communities (Abiwodo & Marlen, 2021). Spatial planning implemented through state policy instruments tends to limit local communities' negotiation space in determining the direction of their living space utilization (Mathys et al, 2023). In this context, the management of agrarian space through food estates reflects a development

model that positions the state as the primary decision-maker, while local communities are more often the recipients of policy (Tornaghi & Dehaene, 2020). These unequal power relations have the potential to weaken communities' capacity to maintain access to the resources that have long been the basis of their livelihoods. As a result, programs claimed to improve welfare can actually create new forms of social vulnerability.

This state-centric development approach has implications for strengthening development orientations focused on production expansion, while simultaneously increasing the potential for social and ecological vulnerability in food estate development areas (Fahmid et al, 2022b). When the state monopolizes authority in defining food problems and policy solutions, agrarian space is reduced to mere objects of production that can be technocratically regulated (Leach et al, 2020a). This reduction ignores the fact that local communities' living spaces not only have economic value but also contain complex social, cultural, and ecological meanings. Therefore, food estate policies demonstrate how highly centralized development can create tensions between national targets and local sustainability. These findings confirm that without a shift in development paradigms to a more participatory and contextualized one, the state-centric development model in food estates has the potential to continue reproducing vulnerability at the community and environmental levels.

### **Marginalization of Indigenous Communities**

The food estate project in Central Kalimantan began rolling out in mid-2020 as part of the National Strategic Program established by the central government to improve food security, with a primary focus on rice in Kapuas and Pulang Pisau Regencies and cassava in Gunung Mas Regency (Usop, 2023). This location was determined despite the fact that most of the projected area consists of peatland and forest that has been managed by local communities, particularly the Dayak indigenous community, through diversified and sustainable agricultural systems (Dwi Agustini Herawati et al, 2025). In the Pangkoh Hulu food estate area, for example, the conversion of peatland into rice fields on a scale of several hectares was carried out between 2020 and 2021. This process sparked controversy because the land was cleared and distributed to farmer groups without adequate and fair consultation mechanisms, and significant differences in land distribution among beneficiaries were found. This situation indicates that from the outset, the implementation of the food estate has ignored the principle of community participation that should be the basis of land-based development policies.

The implementation of the food estate policy in Central Kalimantan takes place within a development framework that tends to ignore local ecological knowledge and land management practices of the Dayak community, which have been formed through a long historical process (Oemar Atallah & Rayi Kharisma Rajib, 2024). Traditional agricultural systems practiced by local communities, such as shifting cultivation based on land rotation, natural soil fertility restoration, and adaptation to peatland characteristics, are perceived by the state as unproductive and inconsistent with modern agricultural logic (Nowysz et al, 2022). Consequently, these practices are subordinated to the intensive and mechanistic

agricultural model promoted through national policy. From a political ecology perspective, this condition reflects a form of epistemic marginalization, namely the process by which technocratic and scientific knowledge institutionalized by the state dominates, while simultaneously marginalizing local, contextual and experience-based knowledge (Ilieva et al, 2022). The dominance of this technocratic perspective results in the food estate policy not being built on a deep understanding of local socio-ecological realities.

At the planning stage, concrete forms of neglect of indigenous communities are reflected in their minimal involvement in site determination, peatland water management design, and selection of superior commodities (Nurleni et al, 2024). The policy socialization process is more informative and administrative, rather than deliberative, thus positioning communities only as objects receiving decisions, rather than as subjects actively involved in policy formulation. Local ecological knowledge of the Dayak community, such as shifting cultivation practices based on land rotation, natural soil fertility restoration, and adaptation to peatland hydrological characteristics, is not used as a basis for policy development (Dwi Agustini Herawati et al, 2025). These practices are perceived by the state as unproductive and inconsistent with the logic of modern agriculture, which emphasizes intensification, mechanization, and monoculture. Consequently, at the implementation stage, the intensive agricultural model implemented through food estates replaces local land management systems, while subordinating indigenous knowledge to a technocratic, state-controlled framework (Mishra et al, 2021).

The government's response to protests and criticisms from indigenous communities and civil society organizations has tended to be defensive and technocratic. Central and regional governments have emphasized the narrative of national food security, technical infrastructure improvements, and limited productivity evaluations, without fundamentally changing the participatory planning approach. Criticisms from indigenous communities and NGOs have generally been met with claims that the program will continue to be technically refined, while the policy framework for the food estate as a national strategic project remains intact (Husnatarina et al, 2025b) (Nurleni et al, 2024). This pattern of response suggests that the government prioritizes project sustainability over accommodating demands for more equitable policy changes for local communities. Thus, the space for substantive dialogue between the state and affected communities is increasingly limited.

This neglect of local knowledge not only impacts cultural aspects but also reinforces unequal power relations in the control and management of natural resources. This situation simultaneously increases the ecological vulnerability of peatlands and deepens the socio-economic marginalization of indigenous Dayak communities (Silvianingsih et al, 2021). Damage to peatland hydrological function, for example, increases the region's vulnerability to land fires during the dry season and flooding during the rainy season, directly threatening the livelihoods of Dayak communities who depend on the stability of local ecosystems (McDonagh & Tuulentie, 2020). These impacts demonstrate that changes in land management through food estates are not simply a matter of food production but also concern the sustainability of local livelihood systems. Therefore, policies that are insensitive

to the local context have the potential to create new socio-ecological crises at the community level.

In this context, environmental vulnerability and resource conflicts cannot be understood solely as the result of natural factors or technical failures in land management. Rather, they are a product of unequal power relations in the control and management of natural resources, where the state and dominant economic actors have greater authority in determining the direction of spatial use (Taufik et al, 2020). The food estate policy places indigenous communities in an increasingly vulnerable position because their living space is redefined based on national interests without considering historical rights and traditional management practices. Thus, this program not only reproduces ecological injustice but also deepens the socio-economic marginalization of local communities through the neglect of land management knowledge and practices that have been proven adaptive to local environmental conditions (Krisnadi & Wijanarko, 2024b). These findings confirm that the success of food policy is inextricably linked to respect for indigenous peoples' rights and the sustainability of local ecosystems.

### **Corporate Involvement and the Distribution of Ecological Risks in Food Production**

The involvement of State-Owned Enterprises (SOEs), private corporations, and military institutions in food estate policies demonstrates that food production is positioned as a strategic state project involving the apparatus of power (Applegate et al, 2022). In Central Kalimantan, this actor configuration forms a large-scale agricultural model integrated with national economic interests and the food security agenda (Uli Arta Trisnawati, 2025). From a political ecology perspective, this policy is implemented through power relations that transcend technical agronomic considerations, with capital accumulation and territorial control as key elements (Marwanto & Pangestu, 2021b). The role of military institutions in project operations, mentoring, and security reinforces the top-down approach and limits the participation of non-state actors (Leach et al, 2020b) (Mohylnyi et al, 2022).

The production orientation born of this state-corporate-military configuration increases pressure on peat ecosystems (Pînzariu, 2025). When production falls short of targets, policies tend to encourage expansion of planted areas and intensification of inputs, rather than evaluating ecological and social suitability (Ma et al, 2022). This pattern aligns with findings that land-based projects in Southeast Asia often fail ecologically due to the dominance of technocratic approaches that ignore local dynamics (Hidayana, 2021). Thus, food production becomes an arena for contestation between state and capital interests, with serious implications for ecological sustainability and the bargaining power of local communities (Lindberg Bromley & von Uexkull, 2025) (Yopiannor et al, 2024).

The emphasis on quantitative targets reinforces intensification tendencies that are out of sync with the characteristics of peat ecosystems (Alisya Rahma Saebani & Irwan Triadi, 2024). Production failures are more often responded to through land expansion and increased inputs, rather than through fundamental corrections to management models (Marchetti et al, 2020). Ecological failures are then reduced to technical issues deemed resolvable with larger, more centralized interventions (Cheevapattananuwong et al, 2020).

Consequently, local communities' bargaining power is increasingly narrowed as the dominance of state and corporate actors increases (Hidayat et al, 2023).

Research findings indicate that the environmental impacts of food estates are not experienced proportionally by all actors (Ayu, 2022a). The state gains political benefits through the legitimacy of the food security narrative, while state-owned enterprises (SOEs) and corporations gain access to strategic land and projects (Siborutorop, 2023). In Central Kalimantan, SOE involvement is manifested through the roles of ID FOOD, PT Sang Hyang Seri, PT Pertani, and support from PT Pupuk Indonesia in providing production facilities (Nuraisyah et al, 2025) (Silaban, 2025). Conversely, local communities face environmental degradation, reduced agrarian access, and an increased risk of ecological disasters on peatlands (Ayu, 2022a) (Maskun et al, 2021).

Ecological damage is reflected in forest conversion and peat degradation due to large-scale land clearing (Maskun et al, 2021). The loss of natural vegetation disrupts peat's function as a water and carbon reservoir, thereby weakening environmental carrying capacity (Ayu, 2022b). Hydrological changes increase seasonal flooding and reduce the soil's ability to regulate water flow (Yeny et al, 2022). Furthermore, peat drainage through canals increases the risk of land fires and the release of carbon emissions (Hajad et al, 2025). From a political ecology perspective, this situation represents environmental injustice because vulnerable groups bear the greatest impact (Hendra & Ismunarta, 2024b).

Food estates present a resilience paradox, as they are promoted as a food solution but actually weaken local ecological and social resilience (R. Tulis et al, 2024). This ecological risk imbalance is related to governance dominated by a state-centric approach, where location and commodity decisions are determined by the central government (Widianto et al, 2024). State-owned enterprises (SOEs) act as instruments of the state, while regional governments and local communities have limited influence (Saebani & Triadi, 2024). Within a political ecology framework, this pattern reinforces vertical power relations that position the state and economic actors as the primary controllers of natural resources (Ramadhan et al, 2024).

Weak environmental accountability mechanisms further exacerbate this inequality. Ecological damage is often not accompanied by clear accountability because projects are run by various state institutions and corporations with a non-transparent division of roles (Elshad et al, 2024). This situation creates a space of policy impunity where ecological failures are not addressed with adequate structural corrections (Hajad et al, 2025). Thus, the unequal distribution of ecological risks in the food estate project in Central Kalimantan is a direct consequence of a political-economic configuration that prioritizes state and corporate interests over environmental sustainability and social justice (Yeny et al, 2022).

## Conclusion

This study shows that the food estate policy in Central Kalimantan functions not merely as a food security initiative but as a political instrument shaped by the economic interests of the state and dominant corporations, resulting in unequal control over land and natural resources. Using a political ecology perspective, the findings reveal that the program

prioritizes productivity and growth over ecological sustainability and social justice, producing an uneven distribution of benefits and risks in which profits are largely concentrated among state and corporate actors while local communities bear disproportionate social and environmental burdens. Environmentally, peatland conversion has generated land degradation, hydrological disruption, biodiversity loss, and increased fire risks, while socially it has reduced indigenous peoples' land access and weakened their bargaining power. These conditions confirm that food estates operate as arenas of power contestation rather than neutral development policies.

Based on these findings, more equitable governance reforms are necessary, including stricter environmental safeguards, protection and restoration of peat ecosystems, recognition of customary land rights, transparent decision-making processes, and meaningful community participation in planning and implementation. Strengthening accountability mechanisms and independent monitoring is also essential to ensure that food security objectives do not compromise socio-ecological sustainability. This study is limited by its qualitative single-case design and reliance on documentary sources, which may restrict the generalizability of the results. Therefore, future research should employ comparative and mixed-method approaches across multiple food estate sites and incorporate quantitative environmental and socio-economic indicators to more rigorously assess long-term governance effectiveness and policy impacts.

## References

- Abdulgani, F., & Savitri, L. A. (2025). State, Capital and Coercion in Indonesia's Food Estates. *Journal of Agrarian Change*, 25(4), e70031. <https://doi.org/10.1111/joac.70031>
- Abiwodo, A., & Marlen, D. (2021). Food Estate Management as Global Food Crisis Prevention Through the Implementation of the BNI Tani Card Program at Pulang Pisau. *Budapest International Research and Critics Institute (BIRCI-Journal): Humanities and Social Sciences*, 4(2), 3136–3152. <https://doi.org/10.33258/birci.v4i2.2035>
- Applegate, G., Freeman, B., Tular, B., Sitadevi, L., & Jessup, T. C. (2022). Application of agroforestry business models to tropical peatland restoration. *Ambio*, 51(4), 863–874. <https://doi.org/10.1007/s13280-021-01595-x>
- Ayelazuno, J., Against, M. A.-S. C. in the M. F., & 2025, undefined. (2025). State-Centric Theories of the Galamsey Menace. *Springer*, 47–68. [https://doi.org/10.1007/978-3-031-82673-3\\_3](https://doi.org/10.1007/978-3-031-82673-3_3)
- Ayu, K. P. (2022a). Kebijakan Perubahan Lahan Dalam Pembangunan Food Estate Di Kalimantan Tengah. *Journal Ilmu Sosial, Politik Dan Pemerintahan*. <https://doi.org/10.37304/jispar.v11i1.4203>
- Bryant, R. L. & Bailey, S. (1997). *Third World political ecology*. 237.
- Cheevapattananuwong, P., Baldwin, C., Lathouras, A., & Ike, N. (2020). Social capital in community organizing for land protection and food security. *Land*, 9(3). <https://doi.org/10.3390/land9030069>

- Dialektika, J. S., Fahira, P. A., Farikhah, J. A., Laula Nafila, A., Adjipersadani, G., Mikhael, P., Nugroho, P., & Mubah, A. S. (2022). Comparative analysis of President Susilo Bambang Yudhoyono and Joko Widodo's food estate policies as a national food securitization attempts. *DIALEKTIKA*, 17 (2) 2022. <https://doi.org/10.20473/jsd.v17i2.2022.195-206>
- Herawati, D. A., Risdhianto, A. & Saptono, E. (2025). Swasembada Pangan sebagai Pilar Strategis Ketahanan Nasional di Indonesia dalam Perspektif Manajemen Pertahanan. *KREATIF: Jurnal Pengabdian Masyarakat Nusantara*, 5(3), 140–152. <https://doi.org/10.55606/kreatif.v5i3.7959>
- Elshad, J., Pangestu, P., & Habib, S. (2024). Climate change impacts of forest conversion: Study on forest conversion for food estate (National Food Granary Program) in Central Kalimantan. *Interaction, Community Engagement, and Social Environment*, 2(1), 92–106. <https://doi.org/10.61511/ICESE.V2I1.2024.419>
- Fadillah, A. N., Sisgianto, & Mohammad Jafar Loilatu. (2021). The Urgency of Food Estate for National Food Security in The Middle of The COVID-19 Pandemic. *Journal of Government and Political Issues*, 1(1), 35–44. <https://doi.org/10.53341/jgpi.v1i1.8>
- Fahmid, I. M., Wahyudi, Agustian, A., Aldillah, R., & Gunawan, E. (2022a). The Potential Swamp Land Development to Support Food Estates Programmes in Central Kalimantan, Indonesia. *Environment and Urbanization ASIA*, 13(1), 44–55. <https://doi.org/10.1177/09754253221078178>
- Fahmid, I. M., Wahyudi, Agustian, A., Aldillah, R., & Gunawan, E. (2022b). The Potential Swamp Land Development to Support Food Estates Programmes in Central Kalimantan, Indonesia. *Environment and Urbanization ASIA*, 13(1), 44–55. <https://doi.org/10.1177/09754253221078178>
- Gaudart, A. R., & Aldrin Pasha, J. (2024). Dynamics between Actors and Interest Groups in an Environmental Politics Perspective: Case Study of Food Estate Development in Kalimantan. *Jurnal Ilmu Sosial Dan Pendidikan (JISIP)*, 8(1), 2598–9944. <https://doi.org/10.58258/jisip.v7i1.6476/http>
- Guillaumie, L., Kamgang, S. É., Brotherton, M. C., & Boiral, O. (2025). Achieving Sustainable Development Goals Through the Governance of Local Food Systems in Western Countries: A Realist Synthesis. *Environmental Policy and Governance*, 35(3), 488–504. <https://doi.org/10.1002/EET.2153>
- Hajad, V., Yanda, S., Ikhsan, I., & Herizal, H. (2025). Food Estate Dan Governmentality: Kekuasaan Negara Dalam Membentuk Subjektivitas Petani. *JDP (JURNAL DINAMIKA PEMERINTAHAN)*, 8(02), 562–588. <https://doi.org/10.36341/JDP.V8I02.6372>
- Hendra, A., & Ismunarta, I. (2024a). Collaborative Governance in Ecological Politics: Non-Governmental Organization Influence and Strategies in Food Estates Program in Central Kalimantan. *Politicon: Jurnal Ilmu Politik*, 6(2), 235–255. <https://doi.org/10.15575/POLITICON.V6I2.38052>

- Hendra, A., & Ismunarta, I. (2024b). Collaborative Governance in Ecological Politics: Non-Governmental Organization Influence and Strategies in Food Estates Program in Central Kalimantan. *Politicon : Jurnal Ilmu Politik*. <https://doi.org/10.15575/politicon.v6i2.38052>
- Hidayana, D., Prihantoro, M., & R Saragih, H. J. (2021). The Role Of The Indonesian Ministry Of Defense Against Threats To The Agricultural Sector From A Non-Military Defense Perspective. *7(3)*, 2549–9459. <https://doi.org/10.33172/jp.v7i3>
- Hidayat, D. C., Mizuno, K., Said, C. A. A., & Herdiansyah, H. (2023). Implementation Framework for Transformation of Peat Ecosystems to Support Food Security. *Agriculture (Switzerland)*, *13(2)*. <https://doi.org/10.3390/agriculture13020459>
- Hunter, D. (2022). Moving beyond State-Centrism in International Environmental Law. *Environmental Policy and Law*, *52(3–4)*, 201–212. <https://doi.org/10.3233/EPL-219031>
- Husnatarina, F., Ompusunggu, D., Rakhmawati, D., Suherman, S., Nasrida, M. F., & Simbolon, T. R. (2025a). Sustainability of Jokowi and Prabowo’s Food Estate Program. *Journal La Sociale*, *6(4)*, 1248–1258. <https://doi.org/10.37899/JOURNAL-LA-SOCIALE.V6I4.1861>
- Husnatarina, F., Ompusunggu, D., Rakhmawati, D., Suherman, S., Nasrida, M. F., & Simbolon, T. R. (2025b). Sustainability of Jokowi and Prabowo’s Food Estate Program. *Journal La Sociale*, *6(4)*, 1248–1258. <https://doi.org/10.37899/journal-la-sociale.v6i4.1861>
- Ilieva, R. T., Cohen, N., Israel, M., Specht, K., Fox-Kämper, R., Fargue-Lelièvre, A., Poniży, L., Schoen, V., Caputo, S., Kirby, C. K., Goldstein, B., Newell, J. P., & Blythe, C. (2022). The Socio-Cultural Benefits of Urban Agriculture: A Review of the Literature. In *Land* (Vol. 11, Issue 5). MDPI. <https://doi.org/10.3390/land11050622>
- Istani, I., Absori, A., Dimiyati, K., Wardiono, K., Budiono, A., & Achmadi, A. (2025). Food Estate Management System and Policies in Pulang Pisau and Kapuas Regencies, Central Kalimantan Province, Indonesia. *WSEAS Transactions on Environment and Development*, *21*, 19–27. <https://doi.org/10.37394/232015.2025.21.2>
- Kato, K. Y. M., Delgado, N. G., & Romano, J. O. (2022). Territorial Approach and Rural Development Challenges: Governance, State and Territorial Markets. *Sustainability (Switzerland)*, *14(12)*. <https://doi.org/10.3390/su14127105>
- Krisnadi, L. A., & Wijanarko, A. F. (2024a). Epistemicide in The Indonesian Food Estate Project in a Critical Approach of Boaventura de Sousa Santos. *Digital Press Social Sciences and Humanities*, *11*, 00008. <https://doi.org/10.29037/digitalpress.411460>
- Krisnadi, L. A., & Wijanarko, A. F. (2024b). Epistemicide in The Indonesian Food Estate Project in a Critical Approach of Boaventura de Sousa Santos. *Digital Press Social Sciences and Humanities*, *11*, 00008. <https://doi.org/10.29037/digitalpress.411460>
- Lasminingrat, L., & Efriza, E. (2020). The Development Of National Food Estate: The Indonesian Food Crisis Anticipation Strategy. *Jurnal Pertahanan Dan Bela Negara*, *10(3)*, 229–248. <https://doi.org/10.33172/JPBH.V10I3.1110>

- Leach, M., Nisbett, N., Cabral, L., Harris, J., Hossain, N., & Thompson, J. (2020a). Food politics and development. *World Development*, 134, 105024. <https://doi.org/10.1016/J.WORLDDEV.2020.105024>
- Lindberg Bromley, S., & von Uexkull, N. (2025). UN peacekeeping presence and local food security outcomes. *Conflict Management and Peace Science*, 42(2), 168–189. <https://doi.org/10.1177/07388942241237727>
- Liu, T., Melot, R., & Wallet, F. (2024). Integrating land and food policy to transform territorial food systems in the context of coexisting agri-food models: Case studies in France. *Elementa*, 12(1), 295–308. <https://doi.org/10.1525/elementa.2023.00063>
- López-García, D., Cruz-Maceín, J. L., & DiPaula, M. (2024). Agri vs. food? Perceptions of local policymakers on agro-food policies from a multilevel approach. *Frontiers in Sustainable Food Systems*, 8, 1399746. <https://doi.org/10.3389/FSUFS.2024.1399746/BIBTEX>
- Mahardika, O., Azkar, N., & Sopiana, Y. (2024). Socio-Cultural Issues In Agricultural Modernization: A Case Study of the Food Estate Program in Pulang Pisau Regency. *International Journal of Multidisciplinary Approach Research and Science*, 2(02), 837–843. <https://doi.org/10.59653/ijmars.v2i02.757>
- Marchetti, L., Cattivelli, V., Coccozza, C., Salbitano, F., & Marchetti, M. (2020). Beyond sustainability in food systems: Perspectives from agroecology and social innovation. *Sustainability (Switzerland)*, 12(18). <https://doi.org/10.3390/su12187524>
- Marwanto, S., & Pangestu, F. (2021a). Food Estate Program in Central Kalimantan Province as An Integrated and Sustainable Solution for Food Security in Indonesia. *IOP Conference Series: Earth and Environmental Science*, 794(1), 012068. <https://doi.org/10.1088/1755-1315/794/1/012068>
- Marwanto, S., & Pangestu, F. (2021b). Food Estate Program in Central Kalimantan Province as An Integrated and Sustainable Solution for Food Security in Indonesia. *IOP Conference Series: Earth and Environmental Science*, 794(1), 012068. <https://doi.org/10.1088/1755-1315/794/1/012068>
- Maskun, Napang, M., Nur, S., Bachril, S., & Mukarramah, N. Al. (2021). Detrimental impact of Indonesian food estate policy: Conflict of norms, destruction of protected forest, and its implication to the climate change. *IOP Conference Series: Earth and Environmental Science*, 824. <https://doi.org/10.1088/1755-1315/824/1/012097>
- Mathys, A., Van Vianen, J., & Rowland, D. (2023). (2023). Participatory mapping of ecosystem services across a gradient of agricultural intensification in West Kalimantan, Indonesia. <https://doi.org/10.3929/ethz-b-000588212>
- McCarthy, J. F., & Sitorus, H. (2025). In the kitchen of Indonesia's oil palm complex: life making, climate precarity and nutritional insecurity in plantation landscapes. *Globalizations*. <https://doi.org/10.1080/14747731.2025.2553934>
- McDonagh, J., & Tuulentie, S. (2020). Sharing Knowledge for Land Use Management: Decision-Making and Expertise in Europe's Northern Periphery. *Sharing Knowledge for Land Use Management: Decision-Making and Expertise in Europe's Northern Periphery*, 1–180. <https://doi.org/10.4337/9781789901894>

- Merten, J., Nielsen, J. Ø., Rosyani, & Faust, H. (2021). Climate change mitigation on tropical peatlands: A triple burden for smallholder farmers in Indonesia. *Global Environmental Change*, 71, 102388. <https://doi.org/10.1016/j.GLOENVCHA.2021.102388>
- Mishra, S., Page, S. E., Cobb, A. R., Lee, J. S. H., Jovani-Sancho, A. J., Sjögersten, S., Jaya, A., Aswandi, & Wardle, D. A. (2021). Degradation of Southeast Asian tropical peatlands and integrated strategies for their better management and restoration. *Journal of Applied Ecology*, 58(7), 1370–1387. <https://doi.org/10.1111/1365-2664.13905>
- Mohylnyi, O., Patyka, N., Kucher, A., Krupin, V., Siedlecka, A., & Wysokiński, M. (2022). Features of Agrarian Sector Deregulation in the Context of Martial Law: Shocks in Food Security. *Sustainability (Switzerland)*, 14(20). <https://doi.org/10.3390/su142012979>
- Nowysz, A., Mazur, Ł., Vaverková, M. D., Koda, E., & Winkler, J. (2022). Urban Agriculture as an Alternative Source of Food and Water Security in Today's Sustainable Cities. In *International Journal of Environmental Research and Public Health* (Vol. 19, Issue 23). MDPI. <https://doi.org/10.3390/ijerph192315597>
- Nuraisyah, T. K., Khalila, K., Rasyidian, S., Putri, R., Nisa, N. A., & Qulbi, S. H. (2025). Perkembangan Food Estate di Indonesia: Analisis Peluang, Tantangan, dan Ancaman secara Domestik serta Global. *Jurnal Syntax Admiration*, 6(2), 1099–1115. <https://doi.org/10.46799/JSA.V6I2.2110>
- Nurleni, E., Dubut, D., & Sumandie, E. (2024). Cultural Mechanisms of Local Community towards the Food-Based Development in Indonesia (Case of Food Estate Program in Pulang Pisau Regency, Central Kalimantan). *Journal of Global Innovations in Agricultural Sciences*, 12(4), 1199–1206. <https://doi.org/10.22194/JGIAS/24.1437>
- Oemar Atallah, & Rayi Kharisma Rajib. (2024). Implementasi Food Estate Sebagai Tantangan Menjaga Ketahanan Pangan Dan Melestarikan Lingkungan. *Jurnal Ilmiah Penelitian Mahasiswa*, 2(3), 72–80. <https://doi.org/10.61722/jipm.v2i3.57>
- Pînzariu, S. (2025). The Impact of Armed Conflicts on Military Food Security. *Scientific Bulletin*, 30(1), 110–114. <https://doi.org/10.2478/BSAFT-2025-0013>
- Puspitaloka, D., Kim, Y. S., Purnomo, H., & Fulé, P. Z. (2020). Defining ecological restoration of peatlands in Central Kalimantan, Indonesia. *Restoration Ecology*, 28(2), 435–446. <https://doi.org/10.1111/REC.13097>
- Puspitaloka, D., Kim, Y. S., Purnomo, H., & Fulé, P. Z. (2021). Analysis of challenges, costs, and governance alternative for peatland restoration in Central Kalimantan, Indonesia. *Trees, Forests and People*, 6. <https://doi.org/10.1016/j.tfp.2021.100131>
- Ramadhan, T., Brutu, S., Romantika, D., Gultom, L. H., Sembiring, T., Andini, P., Joy, D., Sembiring, G. R., & Sitepu, E. M. R. (2024). Juridical Review of Food Estate Project Land Clearing Against Environmental Damage Judging from Government Regulation No. 23 of 2021 concerning Forestry Implementation. *QISTINA: Jurnal Multidisiplin Indonesia*. <https://doi.org/10.57235/qistina.v3i1.2377>
- Rozenblatt-Rosen, O., Regev, A., Oberdoerffer, P., Nawy, T., Hupalowska, A., Rood, J. E., Ashenberg, O., Cerami, E., Coffey, R. J., Demir, E., Ding, L., Esplin, E. D., Ford, J. M., Goecks, J., Ghosh, S., Gray, J. W., Guinney, J., Hanlon, S. E., Hughes, S. K., ... Zhuang,

- X. (2020). The Human Tumor Atlas Network: Charting Tumor Transitions across Space and Time at Single-Cell Resolution. *Cell*, 181(2), 236–249. <https://doi.org/10.1016/J.CELL.2020.03.053>
- Saebani, A. R., & Triadi, I. (2024). Analisis Terhadap Proyek Food Estate dalam Penggunaan Lahan Hutan dan Ketahanan Pangan Ditinjau dari Perspektif Hukum Lingkungan. *Deposisi: Jurnal Publikasi Ilmu Hukum*, 2(3), 65–74. <https://doi.org/10.59581/DEPOSISI.V2I3.3674>
- Sarjito, A. (2022). The Role of The Ministry of Defense in Ensuring Food Security for State Defense. *Journal of Governance*, 7(3). <https://doi.org/10.31506/jog.v7i3.14607>
- Siborutorop, J. (2023). An Analysis of Indonesia's National Food Estate Programme from a Food Sovereignty-based Perspective. *Jurnal Politik Indonesia (Indonesian Journal of Politics)*, 9(2), 92–102. <https://doi.org/10.20473/JPI.V9I2.44430>
- Silaban, R. (2025). Seeking Indonesia's Food System Concept: Drawing Lessons from Food Estate Project. *International Journal of Innovative Research in Multidisciplinary Education*, 4(02). <https://doi.org/10.58806/ijirme.2025.v4i2n09>
- Sihidi, I. T., Romadhan, A. A., Kamil, M., & Febriana, N. N. (2024). Green Politics in the Political Agenda and Village Development Policies in Batu City. *Journal of Ecohumanism*, 4(1). <https://doi.org/10.62754/joe.v4i1.5169>
- Sihidi, I. T., Romadhan, A. A., Kamil, M., & Salahudin. (2025). A Bibliometrics Analysis of Green Politics: Insights and Implications. *International Journal of Environmental Impacts*, 8(1), 71–79. <https://doi.org/10.18280/ijei.080108>
- Sihidi, I. T., Salahudin, Galang, J., Suhemarmanto, D. F., & Widodo, E. R. P. (2025). How Smart Farming Encourages Agricultural Transformation: Evidences from Budi Cakap ' s Innovation in Pasuruan How Smart Farming Encourages Agricultural Transformation: Evidences from Budi Cakap ' s Innovation in Pasuruan. *IOP Conference Series: Earth and Environmental Science*. <https://doi.org/10.1088/1755-1315/1475/1/012018>
- Sihidi, I. T., Salahudin, Kamil, M., Romadhon, A. A., & Galang, J. T. (2026). Development of Indonesia's New Capital: Challenges to Green Economy. In *Shaping Green and Inclusive Economies Through Innovative Entrepreneurship* (p. 24). <https://doi.org/10.4018/979-8-3373-1097-8.ch006>
- Silvianingsih, Y. A., Hairiah, K., Suprayogo, D., & van Noordwijk, M. (2021). Kaleka agroforest in central kalimantan (Indonesia): Soil quality, hydrological protection of adjacent peatlands, and sustainability. *Land*, 10(8). <https://doi.org/10.3390/land10080856>
- Surbakti, A. M., Rafli Gebrena, M., & Jannah, L. M. (2023). Inefektivitas Program Food Estate Kabupaten Gunung Mas: Sebuah Analisis Diagram Pohon.
- Taufik, M., Minasny, B., Mcbratney, A. B., Van Dam, J. C., Jones, P. D., & Van Lanen, H. A. J. (2020). Human-induced changes in Indonesian peatlands increase drought severity. *Environmental Research Letters*, 15(8). <https://doi.org/10.1088/1748-9326/ab96d4>

- Tiswoko, A. P., Subejo, & Sudrajat. (2024). Public Perception of the Food Estate Program of Cassava Cultivation as a Strategic Logistic Reserve in Realizing Regional Food Security in Gunung Mas Regency, Central Kalimantan. *EVOLUTIONARY STUDIES IN IMAGINATIVE CULTURE*, 8, 808–848. <https://doi.org/10.70082/ESICULTURE.VI.1082>
- Tornaghi, C., & Dehaene, M. (2020). The prefigurative power of urban political agroecology: rethinking the urbanisms of agroecological transitions for food system transformation. *Agroecology and Sustainable Food Systems*, 44(5), 594–610. <https://doi.org/10.1080/21683565.2019.1680593>
- Tulis, R. S., Pramusinto, A., Subarsono, A., & Kusumasari, B. (2024). The Impact of Food Estate Policy Implementation on Local Economy and Community Welfare in Central Kalimantan: Post-Implementation Review. *IOP Conference Series: Earth and Environmental Science*, 1421(1), 012028. <https://doi.org/10.1088/1755-1315/1421/1/012028>
- Uda, S. K., Schouten, G., & Hein, L. (2020). The institutional fit of peatland governance in Indonesia. *Land Use Policy*, 99. <https://doi.org/10.1016/j.landusepol.2018.03.031>
- Uli Arta Trisnawati. (2025). Kekerasan Simbolik Negara Atas Nama Food Estate Dalam Konteks Demokrasi. *Al-Hayat: Natural Sciences, Health & Environment Journal*, 3(1). <https://doi.org/10.47467/alhayat.v3i1.8532>
- Usop, S. R. (2023). Farmers' Cultural Flexibility in Food Estate Development Corporate Based in Central Kalimantan. *The Innovation of Social Studies Journal*, 4(2), 165. <https://doi.org/10.20527/issj.v4i2.7841>
- Widianto, A., Perguna, L., Fatanti, M., Alam, M., & Perdana, D. (2024). Food Estate in Transmigrant Society, Central Borneo: Blessed or Curse? *IOP Conference Series: Earth and Environmental Science*, 1291. <https://doi.org/10.1088/1755-1315/1291/1/012004>
- Wijerathna-Yapa, A., & Pathirana, R. (2022). Sustainable Agro-Food Systems for Addressing Climate Change and Food Security. In *Agriculture (Switzerland)* (Vol. 12, Issue 10). MDPI. <https://doi.org/10.3390/agriculture12101554>
- Yeny, I., Garsetiasih, R., Suharti, S., Gunawan, H., Sawitri, R., Karlina, E., Narendra, B., Surati, Ekawati, S., Djaenudin, D., Rachmanadi, D., Heriyanto, N., Sylviani, & Takandjandji, M. (2022). Examining the Socio-Economic and Natural Resource Risks of Food Estate Development on Peatlands: A Strategy for Economic Recovery and Natural Resource Sustainability. *Sustainability*. <https://doi.org/10.3390/su14073961>
- Yopiannor, F. Z., Gani, A. Y. A., Mindarti, L. I., & Rozikin, M. (2024). Agenda Setting for Food Estate Policy in Multiple Stream Frameworks (MSF) Perspective: Case in Central Kalimantan, Indonesia. *Journal of Management World*, 2024(4), 524–532. <https://doi.org/10.53935/JOMW.V2024I4.451>

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Yuwati, T. W., Rachmanadi, D., Pratiwi, Turjaman, M., Indrajaya, Y., Nugroho, H. Y. S. H., Qirom, M. A., Narendra, B. H., Winarno, B., Lestari, S., Santosa, P. B., Adi, R. N., Savitri, E., Putra, P. B., Wahyuningtyas, R. S., Prayudyaningsih, R., Halwany, W., Nasrul, B., Bastoni, & Mendham, D. (2021). Restoration of degraded tropical peatland in indonesia: A review. In *Land* (Vol. 10, Issue 11). MDPI. <https://doi.org/10.3390/land10111170>