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Sustainable Food Forest Innovation: Integration of Agroforestry, Smart Technology, and Community Empowerment to Realize Food Security and Environmental Sustainability

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Abstract
Background. Climate change, land degradation, reduced biodiversity, and rising food needs are strategic challenges for developing sustainable food systems. One innovative approach with the potential to address these challenges is developing food forests by integrating agroforestry principles, smart agricultural technology, and community empowerment.
Objectives. This article analyzes food forest innovation, identifies the technological and institutional components that support its implementation, and develops a conceptual model for sustainable food forest development.
Methods. The research used an integrative literature review approach with thematic synthesis of agroforestry literature on food security, landscape ecology, digital agriculture, and community development.
Results. The conceptual synthesis shows that food forest innovation can be developed through five main dimensions: diversification of productive vegetation, agroforest-based ecosystem management, application of digital technology, strengthening community institutions, and developing a circular economy. Integrating these five dimensions can increase diversification of food sources, improve ecological functions, open local economic opportunities, and strengthen food systems' resilience to environmental change.
Conclusion. The article's novelty lies in the Smart Community-Based Food Forest framework, which connects ecological, technological, social, and economic innovations into one adaptive management system. This article provides a conceptual foundation for developing food forests as a strategy for food security, land rehabilitation, and sustainable regional development.

Keywords: food forests, agroforestry innovation, food security, smart agriculture, circular economy, environmental sustainability.

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INTRODUCTION

Food security is a strategic issue in global development, closely linked to population growth, climate change, limited land resources, and environmental degradation. Conventional food production systems that rely on monoculture cultivation and intensive use of external inputs can increase productivity under certain conditions but can also strain soil quality, water resources, and biodiversity. In this context, it is necessary to innovate food production systems that are not only oriented towards increasing agricultural yields, but also paying attention to ecosystem balance and community welfare. One increasingly relevant alternative is developing food forests, multistrata vegetation-based food production systems that integrate trees, fruit plants, food crops, medicinal plants, and other biological components into a productive ecosystem.

Food forests adopt the structure and function of natural forest ecosystems while still meeting the needs of human food production. This approach is closely related to agroforestry, permaculture, and regenerative agriculture. In its development, food forests are seen not only as a system of plant cultivation but also as a socio-ecological innovation that integrates food production, natural resource conservation, community economics, and sustainable landscape management.

In Indonesia, food forests have development opportunities through yards, mixed gardens, community agricultural land, critical land suitable for productive rehabilitation, and social forestry areas, in accordance with applicable management provisions. Technological developments such as the Internet of Things (IoT), artificial intelligence, geographic information systems (GIS), and remote sensing also create opportunities to transform conventional food forests into smart food forest systems.

State of the Art

Agroforestry studies show that integrating trees with agricultural components can support production diversification and provide a variety of ecosystem services. Jose (2009) discusses agroforestry's role in biodiversity conservation and ecosystem service provision, while Mbow et al. (2014) highlight its relevance to food security and climate change adaptation in Africa. Garrity et al. (2010) developed the idea of evergreen agriculture as an approach to integrating trees in agricultural production systems to improve productivity and sustainability. On the technological side, Wolfert et al. (2017) explain the potential of big data in developing smart agriculture by using data to support decision-making. The literature provides a foundation for food forest innovation. However, a more targeted synthesis is needed to connect

ecological functions, digital technologies, community governance, and business models in the context of food forests.

Research Gap

This article identifies four conceptual gaps that warrant further exploration.

1. Technology integration gap: the use of digital technology in multistrata food forest management still requires a model that takes into account the complexity of vegetation and the limitations of community resources.
2. Institutional gaps: the linkages between food forest management, community participation, and the distribution of economic benefits have not been fully articulated in a single operational framework.
3. Sustainability measurement gap: indicators that combine food productivity, biodiversity, soil conditions, resource efficiency, and community welfare are needed.
4. Implementation model gap: the stages of food forest implementation are needed that can be adjusted to the ecological, social, and economic characteristics of the region.

This gap forms the basis for the research framework, not a claim that previous studies have not addressed these aspects.

Research Novelty

The novelty proposed in this article is the development of a conceptual model of Smart Community-Based Food Forest (SCBFF), which is a food forest management approach that integrates five dimensions of innovation:

1. Ecological innovation through multistrata vegetation systems and biodiversity conservation.
2. Technological innovation through IoT, GIS, remote sensing, and data analytics.
3. Social innovation through institutions and community participation.
4. Economic innovation through product diversification and the circular economy.
5. Governance innovation through a monitoring and evaluation system based on sustainability indicators.

Its conceptual contribution lies in the interconnectedness of these five dimensions in adaptive decision-making systems. This claim of novelty still needs to be tested through systematic literature search and empirical validation.

Research Objectives

This research aims to examine the principles and potential of food forest innovation, identify supporting technologies and institutions, formulate a community-based smart food forest integration model, and develop sustainability evaluation indicators for future field research.

METHODS

This research is designed as a conceptual study based on an integrative literature review.

Research Approach

An integrative literature review is used to connect concepts from various disciplines, namely agroforestry, ecology, food security, digital agriculture, environmental economics, and community development.

Data Source

Planned literature sources include scientific journal articles, academic books, and publications of international institutions such as FAO and agroforestry research institutes.The search can be done through Scopus, Web of Science, Google Scholar, and other scientific databases using a combination of keywords: food forest, forest garden, agroforestry innovation, smart agriculture, food security, and community-based forest management. Data from Saladara Cirebon Food Forest.

Analytical Techniques

The analysis follows four stages: identifying relevant literature, grouping themes, synthesizing relationships between concepts, and preparing conceptual models. To ensure scientific transparency, subsequent research implementation should document the search date, number of articles found, inclusion-exclusion criteria, and results of the literature quality assessment. Methodological note: This article is a draft conceptual study. This article does not claim that systematic searches, field data collection, or statistical testing have been conducted.

DISCUSSION

Basic Concepts of Food Forest Innovation

Food forests are a multistrata ecosystem-based food production system that integrates woody and non-timber plants to produce a variety of food products and environmental services. Figure 1 shows the Saladara Cirebon Food Forest.





Figure 1. Saladara Cirebon Food Forest

Conceptually, food forests can be developed in several vegetation layers, ranging from tall canopy trees and medium-sized fruit trees to shrubs, herbaceous plants, ground cover plants, vines, and tubers. These structures allow more diverse use of vertical and horizontal space. However, species selection must consider competition for light, water, and nutrients so that plant integration does not actually reduce productivity.

Ecological and Agroforestry Innovation

Ecological innovation is the main foundation of food forest development. Applications include species diversification, organic matter management, soil and water conservation, and integrated control of plant pests. A well-designed agroforestry system can support nutrient cycles, provide habitat for beneficial organisms, and reduce dependence on some external inputs. In the Indonesian context, suitable plant types include moringa, jackfruit, breadfruit, bananas, avocados, spice crops, tubers, and various local food crops. Their composition needs to be adjusted to climate, elevation, soil characteristics, food needs, and community economic value.

Smart Food Forest Technology Innovation

Digital technology can strengthen food forest development by supporting environmental monitoring and decision-making, as shown in Table 1. Technology use should consider investment costs, connectivity, user capabilities, and maintenance needs. Not all locations require high automation; simple, easy-to-maintain technology may be more appropriate.

Social Innovation and Community Empowerment

Community involvement in planning, planting, maintenance, harvesting, and benefit distribution strongly influences the success of food forest development. The community-based management model can involve farmer groups, farmer women's groups, village governments, cooperatives, universities, and business actors. Community participation can also strengthen the use of local knowledge about food crop types, seasonal patterns, conservation techniques, and natural resource management. Key considerations include the certainty of land management rights, benefit-sharing agreements, representation of vulnerable groups, and conflict-resolution mechanisms.

Table 1. Smart Food Forest Technology Innovation

Technology	Main functions	Potential benefits
IoT and soil sensors	Monitor humidity and microclimate conditions	Supports irrigation efficiency
GIS	Mapping land and crop zoning	Spatial planning supports
Remote sensing	Observing changes in vegetation cover	Supports landscape monitoring
Artificial Intelligence	Analyze environmental and production data	Supports predictions and recommendations
Digital platform	Record harvest and distribution	Improve product traceability

Circular Economy Innovation

Food forests can be developed into a local economic system that produces various commodities, such as fruits, vegetables, spices, processed foods, and plant seeds. The circular economy is applied through organic residues used as compost or mulch, crop processing to reduce food loss, and the development of local supply chains. Product diversification can reduce people's income dependence on one commodity. However, its economic feasibility still requires an analysis of costs, productivity, market access, and business risks.

Smart Community-Based Food Forest Conceptual Model

The SCBFF model connects land resources, five dimensions of innovation, adaptive management mechanisms, and sustainability outcomes, as shown in Figure 2.

The model places adaptive governance as a link between innovation and development outcomes. Monitoring data is used to evaluate performance, improve crop composition, regulate resource use, and adjust marketing strategies.

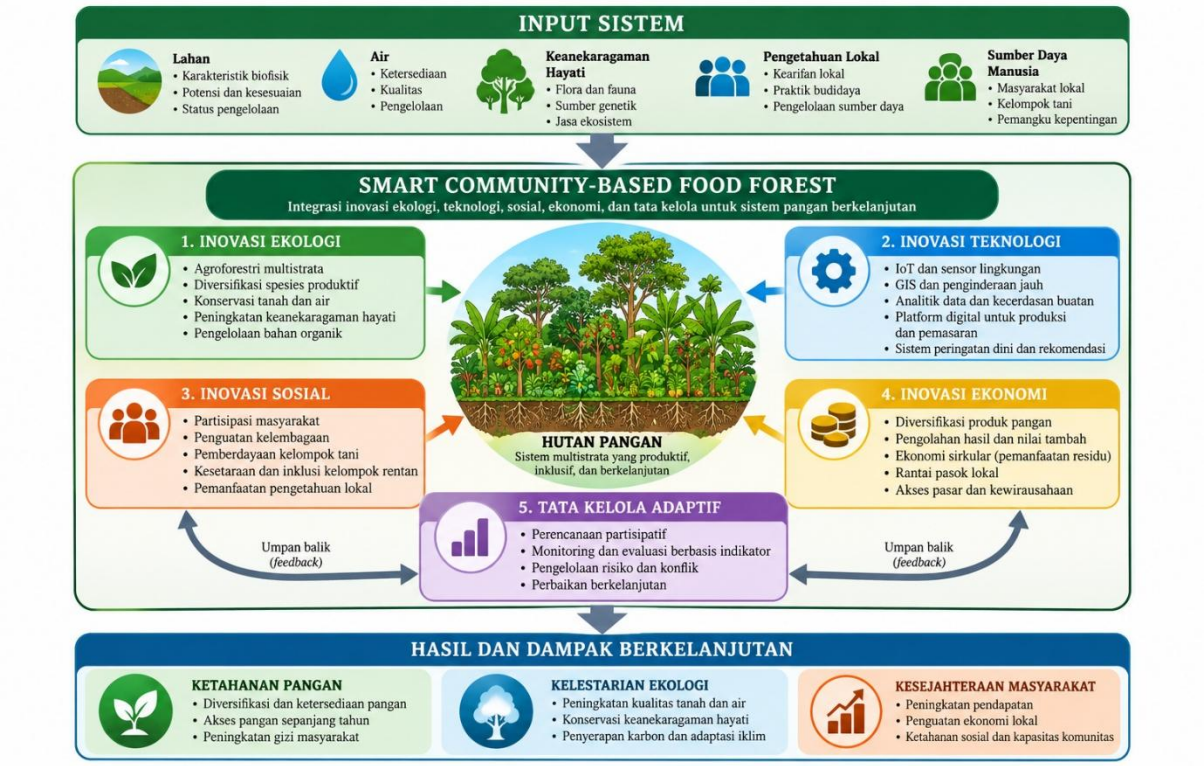


Figure 2. Conceptual framework for sustainable food forest innovation

Sustainability Evaluation Indicators

Measuring the success of food forests requires a multidimensional approach is shown in Table 2.

Table 2. Sustainability Evaluation Indicators

Dimensions	Proposed indicators
Food	Diversity of food produced, crop yield, seasonal availability
Ecology	Species richness, vegetation cover, soil organic carbon
Technology	Monitoring accuracy, data utilization, water use efficiency
Social	Community participation, equitable distribution of benefits, institutional capacity
Economy	Net income, product value-added, business feasibility
Governance	Management plan compliance, frequency of evaluation, conflict resolution

The indicators are still proposed and require validation through expert assessment, field testing, and sensitivity analysis.

Implementation Strategy for Food Forests in Indonesia

The development of food forests can be carried out in stages, starting from the identification of biophysical and socio-economic conditions of the region. The next stage is the preparation of multistrata vegetation design, the establishment of management institutions, the provision of seeds, planting, and maintenance. Digital technology can be applied gradually based on the needs and capabilities of the community. Furthermore, the development of product processing and marketing is carried out to strengthen economic value. In state forest areas, implementation must follow the applicable licensing and management provisions. The development of food forests should also not be used as an excuse to replace natural forests that have high conservation value with production gardens.

Research Implications

Theoretically, the SCBFF model offers an integrative framework for analyzing the relationship between ecosystem function, technology utilization, institutional capacity, and economic outcomes in food forest development. Practically, this framework can serve as a basis for preparing food forest pilot programs by local governments, village governments, farmer groups, educational institutions, and community organizations. From a policy perspective, such approaches can support local food security planning, appropriate productive land rehabilitation, village economic strengthening, and climate change adaptation. Follow-up research should examine relationships among variables in the model through case studies, field experiments, or longitudinal studies to empirically assess productivity, ecological sustainability, and economic benefits.

State of the Art: Sustainable Food Forest Innovation

Evolution of Food Forest and Agroforestry Research

Sustainable food production systems have increasingly shifted from conventional agricultural intensification to ecologically integrated approaches that combine food production, biodiversity conservation, climate change adaptation, and socioeconomic resilience. Within

this transition, food forests have emerged as a promising application of agroforestry principles, characterized by the integration of perennial trees, shrubs, herbaceous plants, climbing species, and root crops into vertically structured and multifunctional production systems.

Early agroforestry research established the scientific foundation for understanding interactions among trees, agricultural crops, soil resources, and ecosystem processes. Nair (1993) conceptualized agroforestry as a dynamic land-use system integrating woody perennials with agricultural components to generate ecological and socioeconomic benefits.

Jose (2009) subsequently emphasized the contribution of agroforestry systems to ecosystem services, including biodiversity conservation, soil improvement, carbon sequestration, and environmental regulation. These findings established agroforestry as an important approach to reconciling agricultural productivity with ecological sustainability. Garrity et al. (2010) further introduced the concept of evergreen agriculture, demonstrating how integrating trees into agricultural landscapes could support soil fertility improvement, sustainable production, and resilience in smallholder farming systems. However, food forests differ from broader agroforestry systems in their deliberate emphasis on multilayer vegetation structures, edible biodiversity, perennial food production, and ecological interactions that resemble natural forest ecosystems. Consequently, the contemporary food forest concept extends beyond conventional agroforestry by integrating ecological design, diversified food production, community participation, and regenerative land management.

Food Forests, Biodiversity, and Ecosystem Services

Recent developments in agroforestry research have increasingly emphasized multifunctional landscapes that simultaneously support agricultural production and ecosystem conservation. Mbow et al. (2014) identified agroforestry as a potentially important strategy for addressing food insecurity and climate change through diversified production, improved ecological resilience, and enhanced adaptation capacity. Likewise, Torralba et al. (2016) demonstrated through a meta-analysis that European agroforestry systems can positively influence biodiversity and ecosystem service provision, although the magnitude of these effects varies according to management practices and environmental conditions. These findings suggest that diversified vegetation structures can provide ecological advantages compared with certain simplified agricultural systems. Food forests potentially contribute to these objectives through the integration of complementary plant species, organic matter recycling, soil cover management, and habitat provision for beneficial organisms. Nevertheless, ecological benefits

cannot be assumed to occur uniformly across all food forest configurations. Differences in plant composition, planting density, water availability, soil conditions, and management intensity may influence ecological performance and agricultural productivity. Therefore, current research increasingly requires multidimensional evaluation frameworks capable of measuring both productive and ecological outcomes.

Food Forests and Sustainable Food Security

The relationship between agroforestry and food security has become an important research priority, particularly in regions experiencing climate variability, land degradation, and nutritional vulnerability. Diversified agroforestry systems may contribute to food security by providing multiple food commodities, reducing dependence on individual crops, and supporting more diversified household diets. Food forests can potentially produce fruits, vegetables, nuts, spices, medicinal plants, and other edible products throughout different harvesting seasons. Such diversification is relevant to the four dimensions of food security: food availability, accessibility, utilization, and stability. However, increasing the diversity of edible species does not automatically guarantee improved household nutrition or equitable access to food. These outcomes also depend on production volumes, dietary preferences, market structures, land tenure, household income, and food distribution mechanisms. Accordingly, food forest innovation should be evaluated not only through agricultural productivity but also through nutritional diversity, seasonal food availability, economic accessibility, and community resilience.

Recent Advances in Food Forest Research (2025–2026)

Recent scientific publications have significantly advanced the understanding of food forests as multifunctional agricultural systems. Thwaites et al. (2025), through a systematic quantitative literature review of urban food forests, identified their potential contributions to biodiversity conservation, ecosystem services, and community-oriented food systems. The authors also highlighted the importance of species selection, local community preferences, quantitative performance assessment, and integration into local policy frameworks. Knook et al. (2025) conducted a systematic scoping review of temperate food forests, examining their establishment, management challenges, potential benefits, and integration of Indigenous knowledge. The study identified important research priorities concerning mature food forests, harvesting practices, revenue models, and locally grounded knowledge systems. More recently,

Roodhof et al. (2026) reviewed 50 empirical publications on temperate food forestry and organized the literature into nine interconnected research themes. Their findings identified three major research-gap clusters involving food production, multifunctionality, and knowledge legitimization. They recommended longitudinal research, larger samples, standardized assessments, and transdisciplinary collaboration. These publications demonstrate that food forest research is moving beyond conceptual advocacy toward empirical assessment of ecological performance, economic viability, social processes, and management practices. Nevertheless, the evidence remains uneven, particularly across geographic regions and stages of food forest maturity.

Smart Technologies and Digital Innovation

The integration of digital technologies represents another potential development in food forest management. Wolfert et al. (2017) established the relevance of big data in smart farming, particularly for integrating agricultural information and supporting data-driven decisions. In food forest systems, technologies such as the Internet of Things (IoT), Geographic Information Systems (GIS), remote sensing, and artificial intelligence could support environmental monitoring, species mapping, irrigation planning, production forecasting, and adaptive management. However, transferring smart farming technologies from conventional agricultural settings into multilayer food forests requires careful consideration of heterogeneous vegetation, canopy interference, species interactions, and spatial variability. Importantly, the feasibility of these technologies does not establish their effectiveness in food forests. Their practical value requires testing under real management conditions, including assessments of cost, accessibility, technical reliability, and farmer adoption.

Community Empowerment and Socioeconomic Innovation

The social dimension of food forest development is increasingly recognized as an important component of sustainability. Community-based food forests may provide opportunities for participatory land management, local food production, environmental education, and the development of small-scale enterprises. The review by Roodhof et al. (2026) emphasized the importance of knowledge co-creation, value creation, management motivations, and broader transition processes. These findings reinforce the need to investigate food forests as socioecological systems rather than solely agricultural production arrangements. Similarly, Jung and Vendrametto (2025) reviewed connections between agroforestry, food security, public

health, and environmental sustainability, identifying the importance of understanding interactions and trade-offs across these domains. For community-based food forests, socioeconomic innovation should therefore incorporate participatory decision-making, equitable benefit distribution, local entrepreneurship, and institutional capacity development.

Critical Assessment of Existing Evidence

Although agroforestry research provides substantial evidence of environmental benefits, findings are not universally consistent. Torralba et al. (2016) found an overall positive but context-dependent effect of European agroforestry on biodiversity and ecosystem services. Conversely, a subsequent meta-analysis reported no unequivocal overall biodiversity advantage across European agroforestry systems, while identifying benefits for certain practices and comparison conditions. This evidence highlights the importance of distinguishing potential benefits from empirically demonstrated outcomes. Consequently, future food forest research should investigate ecological trade-offs, production efficiency, economic feasibility, and social equity through comparable indicators and context-specific evaluation.

Comparative Analysis of Previous Studies

Table 3. Comparative synthesis of previous studies and the proposed research contribution.

Authors	Research focus	Main contribution	Remaining opportunity
Jose (2009)	Agroforestry and ecosystem services	Ecological foundation of agroforestry	Food forest-specific integration
Garrity et al. (2010)	Evergreen agriculture	Integration of trees into productive landscapes	Digital and institutional integration
Mbow et al. (2014)	Agroforestry and climate resilience	Food security and adaptation linkages	Integrated community-level assessment
Torralba et al. (2016)	Agroforestry meta-analysis	Context-dependent ecosystem benefits	Long-term food forest assessment
Wolfert et al. (2017)	Big data in smart farming	Data-driven agricultural management	Adaptation to multilayer food forests
Thwaites et al. (2025)	Urban food forests	Ecosystem and community benefits	Quantitative assessment and policy integration
Knook et al. (2025)	Temperate food forest review	Establishment and management research agenda	Mature systems and revenue models
Jung & Vendrametto (2025)	Agroforestry, food security, and health	Integration of food, health, and environmental dimensions	Operational evaluation of trade-offs

Roodhof et al. (2026)	Empirical food forestry research	Nine-theme framework and research priorities	Longitudinal and transdisciplinary validation
Proposed study	Smart Community-Based Food Forest	Integrated ecological, technological, social, economic, and governance framework	Empirical validation of the proposed model

The identified opportunities are interpretive research directions, not necessarily limitations stated by each original author, is shown in Table 3.

Research Gap and Proposed Novelty

Based on the reviewed literature, the proposed study identifies four interconnected research gaps.

First, existing research has established important ecological and socioeconomic dimensions of agroforestry and food forests, but further investigation is needed into how these dimensions can be operationally integrated with digital technologies.

Second, recent reviews have identified limitations in empirical assessments of food forest productivity, multifunctionality, and long-term performance, particularly across diverse geographic contexts.

Third, community participation and knowledge co-creation are recognized as relevant dimensions, but their interactions with digital decision support, economic value creation, and adaptive governance require further evaluation.

Fourth, a context-sensitive evaluation framework is needed to measure food security, ecological performance, socioeconomic outcomes, and governance effectiveness simultaneously.

Mutia & Astriani (2022) asserted that forest regions may be utilized for food estate initiatives, as outlined in Ministerial Regulation Number 7 of 2021 via the forest area framework for food security. This research employs a normative legal methodology by analyzing diverse secondary data related to food estate initiatives and forest regions. Designated forest reserves and/or managed timberlands may be utilized in forest area initiatives aimed at ensuring food security. Nevertheless, the Government must establish explicit limitations concerning the utilization of safeguarded forest regions that are not operationally protected within this food security initiative, as there are concerns about potential repercussions on the genuinely protected forest areas, given the substantial land requirements of this

agricultural project. The Government must also take into account existing usage rights to prevent conflicts among rights holders.

Kadir et al. (2024) conducted a study on the communal forest in Lanna Village, Parangloe District, Gowa Regency, which encompasses two agroforestry models: the mixed agroforestry model and the coffee agroforestry model. In the mixed agroforestry system, there exists a total of 34 plant species, with 9% (32 varieties) classified as food crops and 6% (2 varieties) as non-food crops. In the agroforestry system for coffee, there are four species, with 67% classified as food crops and 33% as non-food. The edible components of plants encompass stems, leaves, flowers, hearts (such as bananas), fruits, rhizomes, shoots, and seeds. The technique for employing or handling these plant components involves cooking, mashing, and direct consumption without any processing. The mixed agroforestry system exhibits a potential of 32 varieties (94%) of food crops at a density of 338 individuals per hectare, whereas the coffee agroforestry system comprises 4 varieties (67%) of food crops with a density of 518 individuals per hectare. The community utilizes all of these agricultural products for everyday requirements or for commerce.

Shofiyah and Hakim (2020) asserted that agricultural plants flourishing in woodlands and communal gardens are vital assets in the food security initiatives of coastal populations residing near woods. Irundu & Fatmawati (2019) discovered that the capacity of community woods in Paku Village to fulfilll nutritional requirements may yield 46.01% of food products, comprising 12 varieties of food, according to the agroforestry model. Prominent varieties of food include sugar palm (Arenga pinnata), cocoa (Theobroma cacao), and mango (Mangifera indica). Syofiarti (2024) asserted that MHA forest regions are subjects of food estate development; nevertheless, there are no protective measures in place for MHA within the food estate-related regulations. Consequently, this affects the government's capriciousness in allocating customary woodland regions for agricultural estate expansion. Consequently, based on these findings, the government, as a policy architect, must ensure that any developmental initiatives aimed at enhancing the populace's welfare do not infringe with the rights safeguarded by the constitution, especially those of MHA.

Dako et al. (2019) demonstrated that the daily food consumption per family differed between villages, with an average intake of 0.86 kg of rice, 0.83 kg of corn, 0.25 kg of cassava, 0.28 kg of sweet potatoes, 0.10 kg of green beans, and 0.09 kg of tourism nuts. The daily per capita consumption of rice was 0.18 kg, corn 0.17 kg, cassava 0.05 kg, sweet potatoes 0.06 kg, green beans 0.02 kg, and nuts 0.01 kg. The proportion of families that utilized the specific food

combinations during cooking included corn rice (BJ) at 12.46%, sweet potato rice (BJU) at 60.05%, corn sweet potato rice (BJUK) at 24.92%, corn bean rice (BJK) at 1.41%, and sweet potato (BU) at 1.13%. This amalgamation of dietary habits indicated that families endeavored to uphold food resilience inside their households and, more generally, within society. Aldila et al. (2024) discovered that the community, encompassing LMDH in Candisari village, Lamongan Regency, has not extensively diversified items derived from corn. This arises from the community's deficiency of information and expertise about maize-based food innovation, leading individuals to prefer selling corn straight to intermediaries for financial survival. The primary objective of this program is to furnish LMDH with a method for utilizing sweet corn in the Candisari Village region to transform it into commercially viable food items employing basic technologies. This serves as the foundation for social engagement initiatives and the utilization of corn processing conducted in Candisari Village, Sambeng District, Lamongan Regency. The outcome of the socialization is an enhancement of communal expertise and abilities in the creation of corn pudding processing and product promotion.

Rahutomo and colleagues (2023) declared a 500,000-hectare agricultural estate in Kalimantan. In 2020, the Covid-19 epidemic brought the matter of food security to prominence once more. This essay examines the historical analysis of food estate discourse by the government and juxtaposes it with a critical evaluation of food concepts in Indonesia, the execution of food estates, and food security through a literature survey. Adha et al. (2019) indicate that the dietary consumption pattern aligns with the Hope Food Pattern (PPH) score of 97.8, signifying that households have assured access to a balanced and sufficient array of food items, significantly influenced by age, income, and expenditure characteristics, while the impact of educational characteristics is notably substantial. The attributes of family dependents, employment type, and farming experience do not significantly influence the food consumption habits of agricultural households near forested regions. Rahmi et al. (2020) collected information regarding the varieties of plants utilized as sustenance by the local populace near the Lingkar Indah Village forest in the Sayan District of Melawi Regency. The research was conducted in Lingkar Indah Village for a duration of 4 weeks in the field. The employed methods are survey and observation utilizing direct interview approaches. The method of purposive sampling. A total of 104 plant species utilized as sustenance by the community were documented, encompassing 48 recognized families. The consumption of plants as food primarily derives from tree forms (49 species), with fruits being the predominant food source (58 species), and the most utilized element being the fruit itself (75 species). The predominant

processing method is direct consumption, with bay leaf (Syzygium polyanthum Wight) exhibiting the greatest Use Value (UV) of 0.7, while the Anacardiaceae family holds the highest Family Importance Value (FIV) at 36.84%.

CONCLUSION

Food forest innovation is a potential approach in the development of sustainable food systems that integrates food production, ecosystem conservation, technology utilization, and community empowerment. This article proposes a Smart Community-Based Food Forest model consisting of five main dimensions, namely ecological, technological, social, economic, and adaptive governance innovations. The model provides a conceptual framework for the development of food forests that are productive, inclusive, and responsive to environmental change. The main contribution of the article lies in the preparation of integrative models as well as multidimensional evaluation indicators that can be used as a basis for empirical research. Further development is needed to validate the model on various regional characteristics and measure its contribution to food security, environmental sustainability, and community welfare.

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