Jurnal Manajemen Dinamis

https://journalversa.com/s/index.php/jmd

Vol 6, No. 4, Desember 2024

ANALYSIS OF PLANTATION RESOURCE MANAGEMENT FROM AN ENVIRONMENTAL PRESPECTIVE: STUDY OF PALM OIL PLANTATION MANAGEMENT IN INDONESIA AND COCOA PLANTATION IN GHANA

Agnesia Putri[1], Achmad Husen[2], I Made Astra[3]

[1,2,3]Universitas Negeri Jakarta

E-mail : agnessputry@gmail.com[1], ahusen@unj.ac.id[2]

ABSTRACT

The sustainable management of plantation resources requires an integrated approach that balances economic, social, and environmental dimensions. This study investigates how sustainable management can be applied in the plantation sector and explores the main challenges in its implementation. Based on theories of natural resource management and agribusiness, sustainable practices must go beyond physical resource management—such as land and water—and also address the welfare of farmers and local communities. Community involvement in decision-making is essential to achieving sustainability, ensuring that the benefits of environmentally friendly practices, such as precision agriculture and agroforestry, are shared equitably. While these technologies can improve productivity and reduce environmental impacts, challenges remain, particularly in balancing economic growth with environmental conservation. The adoption of green technologies is often hindered by financial constraints and limited technical knowledge, especially for smallholder farmers. Moreover, effective government policies are critical in providing the necessary support and incentives for the adoption of sustainable practices, including the protection of forested areas and promoting organic inputs. Collaboration among the government, private sector, and local communities is key to overcoming these barriers. Sustainable plantation management not only enhances economic outputs, such as increased exports and rural employment, but also safeguards environmental resources, ensuring their availability for future generations. By integrating technological innovations and aligning them with social and economic factors, this approach can create a long-term solution that supports both economic development and environmental preservation, as emphasized in the theories of sustainable resource management and agribusiness.

Keywords: *Sustainable Plantation Management, Resource Management, Environmental Conservation, Green Technology, Agroforestry, Precision Agriculture, Community Involvement, Government Policy.*

ABSTRAK

Pengelolaan sumber daya perkebunan yang berkelanjutan memerlukan pendekatan terpadu yang menyeimbangkan dimensi ekonomi, sosial, dan lingkungan. Studi ini menyelidiki

bagaimana manajemen berkelanjutan dapat diterapkan di sektor perkebunan dan mengeksplorasi tantangan utama dalam penerapannya. Berdasarkan teori pengelolaan sumber daya alam dan agribisnis, praktik berkelanjutan harus melampaui pengelolaan sumber daya fisik—seperti tanah dan air—dan juga memperhatikan kesejahteraan petani dan masyarakat lokal. Keterlibatan masyarakat dalam pengambilan keputusan sangat penting untuk mencapai keberlanjutan, memastikan bahwa manfaat dari praktik ramah lingkungan, seperti pertanian presisi dan wanatani, dibagikan secara adil. Meskipun teknologi ini dapat meningkatkan produktivitas dan mengurangi dampak lingkungan, masih terdapat tantangan, khususnya dalam menyeimbangkan pertumbuhan ekonomi dengan pelestarian lingkungan. Penerapan teknologi ramah lingkungan seringkali terhambat oleh kendala keuangan dan terbatasnya pengetahuan teknis, terutama bagi petani kecil. Selain itu, kebijakan pemerintah yang efektif sangat penting dalam memberikan dukungan dan insentif yang diperlukan untuk penerapan praktik berkelanjutan, termasuk perlindungan kawasan hutan dan peningkatan masukan organik. Kolaborasi antara pemerintah, sektor swasta, dan masyarakat lokal merupakan kunci untuk mengatasi hambatan-hambatan ini. Pengelolaan perkebunan yang berkelanjutan tidak hanya meningkatkan keluaran ekonomi, seperti peningkatan ekspor dan lapangan kerja di pedesaan, namun juga menjaga sumber daya lingkungan, memastikan ketersediaannya untuk generasi mendatang. Dengan mengintegrasikan inovasi teknologi dan menyelaraskannya dengan faktor sosial dan ekonomi, pendekatan ini dapat menciptakan solusi jangka panjang yang mendukung pembangunan ekonomi dan pelestarian lingkungan, sebagaimana ditekankan dalam teori pengelolaan sumber daya berkelanjutan dan agribisnis.

Kata Kunci: Pengelolaan Perkebunan Berkelanjutan, Pengelolaan Sumber Daya, Konservasi Lingkungan, Teknologi Ramah Lingkungan, Agroforestri, Pertanian Presisi, Keterlibatan Masyarakat, Kebijakan Pemerintah.

INTRODUCTION

A. Background

The sustainable management of natural resources (SDA) is essential in the context of economic and social development in Indonesian society. Article 32 of the 1945 Constitution emphasizes that the state plays a role in managing natural resources for the greatest benefit of the people's welfare (N. Hidayati, 2019). In this context, the plantation sector becomes a strategic one because it significantly contributes to the economy by providing for society's needs, both in terms of food supply and as export commodities.

Plantations, which include various crops such as oil palm, rubber, coffee, and tea, have great potential to improve people's welfare, especially in meeting daily needs. The plantation sector in Indonesia plays a strategic role in the national economy. Not only is it a key driver of rural economic growth, but it also significantly contributes to the national Gross Domestic Product (GDP). Data from the Central Bureau of Statistics (BPS) show that in 2022, the agricultural sector—which includes plantations—contributed around 13% to Indonesia's GDP. Plantations produce various leading commodities such as palm oil, coffee, cocoa, rubber, and tea, which are the backbone of exports and provide substantial foreign exchange for the country. This sector is also a source of employment for millions of

people, especially in rural areas, and supports the economic welfare of many farming households (KLHK, 2020).

However, despite its significant economic contributions, the plantation sector also faces major challenges related to environmental impacts. Land clearing for plantations often involves environmentally unfriendly practices, such as large-scale deforestation, which reduces biodiversity and damages rich tropical forest ecosystems. A report from the World Wildlife Fund (WWF) shows that Indonesia is one of the countries with the highest deforestation rates in the world. Every year, Indonesia loses about 1.5 million hectares of forest, much of it due to plantation expansion, especially for palm oil (WWF, 2020). The loss of primary forests threatens the sustainability of natural ecosystems, causes the extinction of flora and fauna species, and disrupts the hydrological cycle, which is crucial for environmental balance.

The common practice of land clearing through burning not only damages soil structure but is also a major cause of uncontrollable forest fires. These fires not only destroy forest areas but also produce significant greenhouse gas (GHG) emissions, contributing to global warming and climate change. According to the Ministry of Environment and Forestry (KLHK), forest fires related to plantation land clearing have significantly increased carbon emissions, making Indonesia one of the largest contributors of GHG emissions from land and forestry sectors (KLHK, 2020).

In addition to deforestation, the excessive use of pesticides and chemical fertilizers is another major problem in unsustainable plantation management. The uncontrolled use of chemicals can lead to soil quality degradation, long-term loss of fertility, and water resource contamination. This pollution impacts surrounding communities, especially those who rely on water sources for daily needs, and threatens aquatic ecosystems as toxic agricultural waste slowly enters irrigation channels.

In addressing these challenges, it is essential to formulate more sustainable approaches to plantation resource management. Sustainable management aims to create a balance between economic needs and environmental preservation. By integrating environmentally friendly technologies, agroecological approaches, and policies that support sustainable farming, the plantation sector can continue to contribute to economic growth without sacrificing vital natural ecosystems and by adhering to sustainability principles.

This approach emphasizes the importance of long-term sustainability in plantation management. One solution is to reduce reliance on destructive land-clearing methods and shift to more environmentally friendly cultivation techniques, such as agroforestry, which allows for crop diversification among forest trees without deforestation. Additionally, the use of organic fertilizers and natural pesticides can minimize negative impacts on soil and water while improving the quality of agricultural products. However, unsustainable management can lead to environmental damage, social conflict, and a decline in the quality of life for communities. Therefore, it is crucial to explore the relationship between sustainable SDA management in the plantation sector and its impact on community welfare (Anggraini, 2021).

At the same time, government policies must also support the transition to sustainable farming by providing incentives to farmers who adopt environmentally friendly practices and tightening regulations on companies engaging in illegal deforestation. Collaboration between the government, the private sector, and civil society is essential to achieving plantation management that is not only economically productive but also environmentally responsible.

In other practices, Indonesia's plantation system often contributes to large-scale deforestation. Since 2020, more than half of the natural forests destroyed in Mayawana concessions were located on carbon-rich peatlands, and by 2023, the percentage of deforestation in peat areas increased to over 80% of the total deforestation that year (Nusantara Atlas (nusantara-atlas.org)). Peatland clearing for industrial pulpwood plantations releases large amounts of carbon dioxide (CO2). Therefore, this form of land-use change is a major contributor to greenhouse gases (GHG). This contradicts the concept of sustainable development, which requires not only economic fulfillment from plantation production but also environmentally sustainable practices, not just based on immediate needs. The practice of palm oil plantations is closely related to sustainability

B. Problem Formulation

1. How can plantation resource management be carried out sustainably?
2. What are the main challenges in implementing sustainable management in the plantation sector?
3. How can the management of oil palm plantations, as a case study, be implemented sustainably?

C. Research Objectives

1. To analyze plantation resource management from an environmental perspective.
2. To identify best practices in environmentally friendly plantation management.
3. To provide recommendations for stakeholders in the plantation sector.
4. To offer recommendations for addressing challenges in implementing sustainable practices.
5. To examine the issues of oil palm plantation practices from the perspective of sustainable development.

D. Research Benefits

1. Short-Term Benefits:

a. **Increased awareness among the public and farmers**: This research can directly enhance farmers' and the public's knowledge about the importance of environmentally friendly plantation resource management, encouraging behavior change in plantation cultivation practices in Indonesia.

b. **Reference for stakeholders**: The research findings can be used by policymakers, companies, and organizations to design programs that support sustainable plantation practices.

c. **Implementation of environmentally friendly technologies**: The recommendations produced can

promote the adoption of better and eco-friendly technologies and agricultural methods, such as the use of organic fertilizers or agroecological techniques.

2. Long-Term Benefits:

a. **Environmental sustainability and ecosystem preservation**: In the long term, the implementation of sustainable plantation management will help reduce deforestation, maintain soil quality, and protect biodiversity.

b. **Increased productivity and economic gains**: Sustainable practices can improve plantation productivity, maintain long-term soil fertility, and provide stable economic benefits for farmers and plantation companies.

Support for policies and regulations: This research can serve as a basis for developing policies and regulations that more effectively support environmental conservation and social welfare in the plantation sector

RESEARCH METHODS

1. Type of Research

This study employs a qualitative descriptive method to describe plantation resource management from an environmental perspective. This method was chosen because it allows for an in-depth analysis of complex phenomena, such as the environmental impacts of plantation practices and the challenges faced in implementing sustainable management. The qualitative approach will explore current plantation practices and identify the barriers and opportunities that arise in the process of sustainable management.

2. Data Sources

The data sources used in this research consist of secondary data, including books, scientific articles, and journals relevant to the topic of plantation resource management and the environment. Journals such as *Agricultural Systems*, *International Journal of Agricultural Sustainability*, and *Journal of Environmental Management* will serve as primary references for data collection. Additionally, this study will also utilize reports from research institutions and environmental organizations focused on sustainable agriculture and its impact on ecosystems.

3. Data Collection Techniques

Data collection techniques include literature review and document analysis. The literature review aims to gather information from various academic sources to obtain a comprehensive understanding of sustainable plantation resource management. Document analysis will evaluate the policies and practices that have been implemented in Indonesia's plantation sector, including reviews of regulations, management standards, and sustainability reports from companies or relevant institutions. This allows the research to assess the alignment between theory and practice in plantation resource management

RESULTS AND DISCUSSION

A. Definition of Plantation Resources

a. Definition and Scope

Plantation resources encompass all elements necessary for the sustainability of plantation crop cultivation, from land and water to agricultural inputs such as fertilizers and pesticides. The scope of plantation

resource management is not limited to physical aspects alone but also includes social and economic dimensions (Ali, 2024). It is emphasized that the success of plantation resource management largely depends on the well-being of farmers and local communities. Social welfare plays a crucial role in achieving sustainable management, where communities are involved in decision-making and benefit economically from environmentally friendly and sustainable plantation practices.

b. Role in the Economy and Environment

In the economic context, plantation resources play a strategic role in the national economy. For instance, plantation commodities such as palm oil, coffee, and cocoa make significant contributions to Indonesia's export revenues. Additionally, this sector is a major source of employment in rural areas. However, improper management of plantation resources can lead to various environmental issues, such as water pollution, soil degradation, and loss of biodiversity (Suharto, 2021). Therefore, sustainable management is essential to ensure that the economic growth generated by this sector does not come at the expense of environmental conservation.

B. Natural Resource Management Theory

a. The Concept of Sustainability in Resource Management

The concept of sustainability in natural resource management involves balancing economic, social, and environmental aspects. Sustainable resource management must engage communities in the decision-making process and consider the long-term impacts of plantation activities. It emphasizes that the involvement of local communities is a key factor in achieving sustainability, especially in maintaining the balance between resource utilization and environmental conservation (Budi S., 2018).

b. Approach to Sustainable Management

The importance of using environmentally friendly technologies as part of sustainable management cannot be overstated. Technologies such as precision farming, agroforestry, and soil and water conservation practices can be applied to increase agricultural productivity while minimizing negative environmental impacts. Government policies that support sustainable practices, such as incentives for green technology adoption and protection of forest areas, are crucial. This approach prioritizes innovation and adaptation to climate change and socio-economic conditions to achieve long-term sustainability goals.

The use of agricultural support tools is also important. The application of fertilizers, which are considered key to maximizing plantation yields, must be managed with precision. Monitoring soil nutrient conditions and implementing effective irrigation systems are also part of Sustainable Management in plantation systems (Ali, 2024). Attention should be paid to avoiding excessive use of chemical fertilizers, focusing not only on maximum yields but also on the sustainability of existing soil nutrients.

C. Plantation Agribusiness Practices

a. Management in Agribusiness

Good management in agribusiness is key to improving the efficiency and productivity of plantations. However, the biggest challenge in this sector is ensuring that the practices implemented are not only economically profitable but also environmentally friendly. Unsustainable practices can lead to land degradation and reduce the quality of plantation yields. Therefore, management focused on sustainability is crucial not only to preserve ecosystems but also to ensure the sustainable availability of resources for future generations (Ramakrishnan, 2024).

b. Strategies and Best Practices

One strategy that can support sustainable plantation resource management is the use of environmentally friendly technologies, such as organic fertilizers and natural pesticides. In addition, cooperation between various stakeholders, including the government, private sector, and community, plays a vital role in creating a more effective and sustainable management system. This collaboration is essential to ensure that sustainable practices are widely adopted and provide both economic and environmental benefits to all stakeholders (Ayompe, 2024). Journals like *Agricultural Systems* and the *International Journal of Agricultural Sustainability* also highlight the importance of policy and technological innovation in accelerating the adoption of sustainable agribusiness practices.

Discussion

a. Sustainable Management of Plantation Resources

Sustainable management of plantation resources requires a balance between economic, social, and environmental aspects. As outlined in the literature review, plantation resources encompass various critical elements, ranging from land and water to agricultural inputs such as fertilizers and pesticides. To achieve sustainability, management must consider not only the physical aspects but also the social and economic well-being of surrounding communities.

The success of sustainable plantation resource management heavily relies on the active participation of local communities in decision-making processes. Community involvement not only encourages the efficient use of resources but also ensures that they derive economic benefits from sustainable plantation practices. This supports the concept of sustainability, which emphasizes a balance between economic growth and environmental preservation.

In an economic context, the plantation sector, including commodities like palm oil, coffee, and cocoa, contributes significantly to national income and provides substantial employment opportunities. However, if management is not conducted sustainably, this sector has the potential to cause various environmental problems, such as water pollution and soil degradation. Therefore, sustainable management must be implemented by utilizing environmentally friendly technologies, such as agroforestry and precision farming, to enhance productivity without damaging ecosystems.

Additionally, the government plays a crucial role through policies that support environmentally friendly practices, including incentives for green technology and the protection of forest areas. This aligns with the sustainable management approach, which focuses on adapting to climate change and socio-economic conditions to achieve long-term sustainability.

b. Case Study of the Plantation Sector in Indonesia, Specifically Palm Oil Plantations as a Major Cause of Deforestation

One of the largest plantation industries in Indonesia is the palm oil plantation sector. Data shows that the area of palm oil plantations in Indonesia reached 15.38 million hectares in 2022, marking one of the highest records in more than five decades. This area has seen an average growth rate of 1.8% over the past five years. In terms of ownership, the majority of palm oil plantations are owned by large private estates (PBS), covering 8.4 million hectares in 2022. Smallholder plantations (PR) accounted for 6.37 million hectares, while state-owned plantations (PBN) were the smallest, with only 598,781 hectares. These palm oil plantations are spread across 34 provinces in Indonesia, with Riau Province having the largest area of palm oil plantations, covering 2.99 million hectares in 2022, or 19.50% of the total palm oil area in the country (Record High: Indonesia's Palm Oil Area Reaches 15.38 million Hectares in 2022).

However, with the significant size of palm oil plantations in Indonesia comes complex environmental issues related to their impact. Beyond the deforestation caused by converting peatlands or forest areas into palm oil plantations, other concerns have arisen, such as the drastic reduction in biodiversity in affected areas. This issue will be discussed further by presenting findings from other research studies.

Environmental activists have raised concerns about palm oil plantations, specifically highlighting the environmental challenges associated with their management in Indonesia. NGOs like WALHI (Indonesian Forum for the Environment), Sawit Watch, and Greenpeace have uncovered alarming facts about the environmental issues linked to palm oil plantations, as documented in several articles released by Greenpeace.

One of the common practices in Indonesia's plantation system is its significant contribution to deforestation. Since 2020, more than half of the natural forest destroyed in the Mayawana concessions occurred on carbon-rich peatlands, and by 2023, deforestation in peat areas had increased to over 80% of the total deforestation for that year (Nusantara Atlas (nusantara-atlas.org)). Clearing peatlands for industrial pulpwood plantations releases large amounts of carbon dioxide (CO2), making land-use changes a major contributor to greenhouse gas (GHG) emissions. This directly contradicts the concept of sustainable development, which requires not only economic production from plantations but also environmentally sustainable practices that go beyond meeting immediate needs. The management of palm oil plantations is therefore closely tied to the issue of sustainability.

In a study conducted in Terantang Manuk Village, Pelalawan Islands, Riau, the expansion of palm oil plantations has caused alarming environmental problems. The

damage goes beyond harming soil elements and has reached the level of ecological degradation. One of the most significant impacts is the decline in biodiversity, where 53% of the 47 types of fruit previously found in the area have become extinct, and 45% have seen a reduction in population, with only 4% still surviving. In addition to fruit, 52% of local vegetable varieties have declined, and 2% of the 68 types of fish in the area have gone extinct, while 39% of the 23 types of game animals have also disappeared (Suryadi, 2020). The expansion of palm oil plantations is not just about deforestation but encompasses many harmful aspects. Another notable issue is the low involvement of the local community, with only 17% participation in managing the palm oil plantations in Terantang Manuk Village, Pelalawan Regency, Riau.

Another important finding is the drastic change in land cover. In 1990, only 45.14 hectares of forest remained from the original 3,250 hectares, with palm oil plantations dominating 3,912.9 hectares by 2019 (Suryadi, 2020). This indicates complex ecological damage in the area. The first issue is the **depletion of water resources**: 44% of respondents indicated a decrease in groundwater quality, requiring wells to be dug deeper. The second issue is **water pollution**: 22% of respondents reported water contamination due to the use of fertilizers and pesticides. Lastly, there is the **decline in wildlife populations**: 34% of respondents noted a decrease in local wildlife, including fish in nearby rivers.

These issues have resulted in external costs, such as healthcare expenses amounting to IDR 11,667,500/year due to pollution that affects residents' health. Additionally, water replacement costs reached IDR 134,526,933/year because of the need to find alternative clean water sources due to pollution. This research concludes that while the expansion of palm oil plantations brings economic benefits, it also causes complex and significant environmental issues (Rany Utami, 2017).

c. Main Challenges in Implementing Sustainable Management in the Plantation Sector

Although the concept of sustainability in plantation resource management seems ideal, its implementation faces several challenges. The first challenge is balancing economic and environmental interests. Agribusiness practices that focus on economic gains tend to overlook negative environmental impacts, such as land degradation and biodiversity loss. This requires better management in agribusiness to integrate environmentally friendly practices. In particular, palm oil plantation practices that cause deforestation in Indonesia do not align with the concept of sustainable development. According to Greenpeace, deforestation, defined as the permanent conversion of forested areas to non-forested land, poses a significant threat to the environment, wildlife, nature, and climate. In Indonesia, deforestation is closely linked to the pulp and palm oil industries, which have devastated forests in Sumatra and Kalimantan and triggered fires over 22 million hectares from 2000 to 2002. Greenpeace data also shows that from 2021 to 2023, natural forests in Indonesia were deforested by the pulp and palm oil industries, further destroying forests in Sumatra and Kalimantan and contributing to

forest fires over 22 million hectares from 2000 to 2022.

The second challenge is the adoption of environmentally friendly technologies. Technologies such as organic fertilizers and natural pesticides can help maintain sustainability, but the initial costs and lack of technical knowledge often hinder small farmers from adopting these practices. Therefore, collaboration between the government, private sector, and communities is needed to provide adequate incentives and training to accelerate the adoption of green technologies.

The third challenge is the role of government policy. Policies that do not support sustainability or are overly focused on short-term economic growth can slow down the implementation of sustainable management. Thus, more proactive policies are needed to support technological innovation and provide incentives for sustainable practices.

The best strategy to address these challenges is to enhance cross-sector collaboration, including partnerships with research institutions and local communities, to create effective resource management systems. Journals like *Agricultural Systems* and the *International Journal of Agricultural Sustainability* emphasize the importance of collaboration and innovation in creating a more sustainable agribusiness system.

d. Sustainable Plantations

It would be incomplete to only provide case studies of how plantation systems in Indonesia are not yet sustainable. In contrast, another study on cocoa plantations in Ghana uses a landscape approach to address deforestation caused by commodity production. The cocoa production program in Ghana, known as the REDD+ Cocoa Forest Program (GCFRP), aims to reduce deforestation through climate-smart cocoa within landscapes that are jointly managed with the community. This study discusses a complex, multi-level ecological perspective to analyze institutional innovations using an integrated approach that can be applied (S. van der Haar, 2023). Several important points that can be drawn from this study are:

a) **Integrated Landscape Approach**: Sustainable plantations must be managed by considering various land uses and environmental, social, and economic interests through multi-stakeholder planning and negotiation. This approach allows for synergy between economic objectives (commodity production) and environmental goals (deforestation reduction).

b) **Climate-Smart Cocoa**: This program aims to combine cocoa production with environmental conservation practices. Farmers are incentivized to adopt agroforestry systems, where shade trees are planted to help with carbon sequestration, enhance climate resilience, and sustainably increase cocoa productivity.

c) **Institutional Innovation**: The GCFRP creates institutional mechanisms that support community-based land-use planning and more equitable natural resource management. This approach includes sharing the benefits of timber with communities that contribute to forest conservation around them.

d) **Policy and Implementation Challenges**: While the program is

promising, challenges exist in reforming tree ownership rights and profit-sharing from timber. Changes in tree rights policies and stronger economic incentives for farmers are key to ensuring the sustainability of this program.

In discussing ecological approaches, it is important to consider this perspective to gain a sustainable viewpoint. Applying this perspective reveals the concept of agroforestry within cocoa plantations. Several key points discussed include reducing deforestation and land degradation through integrated landscapes. The agroforestry principle involves allowing natural canopy trees or replanting shade trees to enhance biodiversity and preserve forest ecosystem functions. A well-maintained forest ecosystem can provide other benefits, such as carbon storage, increased biodiversity, and improved soil quality. Another positive outcome is the ecosystem's resilience to climate change due to carbon absorption and soil quality improvements. In this way, sustainable plantation principles can be effectively implemented through sustainable natural resource management

CONCLUSIONS AND RECOMMENDATIONS

The sustainable management of plantation resources requires the application of sustainability concepts that consider economic, social, and environmental aspects. Based on the theories outlined in the literature review, sustainability can be achieved through the active participation of local communities, the use of environmentally friendly technologies, and government policies that support sustainable practices. Well-managed plantation resources can provide significant economic benefits, such as increased income and job opportunities, without sacrificing environmental preservation.

However, the main challenge in implementing sustainable management is ensuring a balance between economic growth and environmental conservation. Additionally, the adoption of eco-friendly technologies and proactive policy support are key factors for successful management. Therefore, collaboration between the government, private sector, and communities is needed to overcome existing barriers and ensure the creation of a sustainable plantation system.

Theories of Natural Resource Management and Agribusiness Management emphasize that environmentally friendly technologies, such as agroforestry and precision farming, along with incentive policies for green technology, are solutions that can be adopted to maximize plantation potential without harming the environment. This approach not only supports the welfare of farmers and local communities but also ensures the continuity of resources for future generations, in line with sustainability principles.

DAFTAR PUSTAKA

Ali, E. S. (2024). **Manajemen Perkebunan**. Eurika Media Aksara.

Anggraini, R. (2021). **"Analisis Dampak Lingkungan dari Ekspansi Perkebunan".** Jurnal Analisis Lingkungan, 9(1), 67-78.

Anugrah, A. R. S. (2023). **Sinkronisasi Kebijakan Kelapa Sawit**

Berkelanjutan. ***Jurnal Kebijakan Publik*****, 14(3)**. Diakses dari https://jkp.ejournal.unri.ac.id

Apdini, T., van Middelaar, C. E., & Oosting, S. J. (2024). **Developing sustainable dairy farms in the tropics: From policy to practice**.

Ayompe, L. M., Schaafsma, M., & Egoh, B. N. (2021). **Towards sustainable palm oil production: The positive and negative impacts on ecosystem services and human wellbeing**.

Budi, S., & Santoso, H. (2018). **Pengelolaan Sumber Daya Alam Berkelanjutan: Teori dan Praktik.** Penerbit Universitas Indonesia.

Datta, P., Behera, B., Timsina, J., & Rahut, D. B. (2024**). Achieving sustainable development through agriculture-forestry-livestock nexus in Bangladesh: Synergies and trade-offs**..

Fitria, N., & Suryadi, D. (2019). **"Penerapan Teknologi Ramah Lingkungan dalam Pengelolaan Perkebunan."** Jurnal Teknologi Pertanian, 10(3), 112-120.

Food and Agriculture Organization (FAO). (2019). **The State of the World's Forests 2018: Forests and Sustainable Cities**.

Global Environment Facility (GEF). (2019). **Sustainable Land Management in Indonesia: A Review of Progress and Opportunities.**

Hidayati, N. (2019). **Praktik Pertanian Berkelanjutan di Indonesia**. Penerbit Alfabeta.

International Union for Conservation of Nature (IUCN). (2021). **Guidelines for Sustainable Palm Oil Production**.

Kementerian Lingkungan Hidup dan Kehutanan Republik Indonesia. (2020). **Rencana Aksi Nasional Pengelolaan Sumber Daya Alam Berkelanjutan.**

Kusnadi, J., & Setiawan, B. (2020). **"Dampak Perubahan Iklim terhadap Produktivitas Perkebunan di Indonesia."** Jurnal Ilmu Pertanian, 15(2), 123-135.

Lestari, D. (2020**). "Keterkaitan antara Praktik Pertanian Berkelanjutan dan Keberlanjutan Ekosistem."** Jurnal Ekologi, 11(2), 85-97.

Mitchell, B., dkk. (2010). **Pengelolaan Sumberdaya Lingkungan**. Yogyakarta: Gadjah Mada University Press.

Nugroho, A. (2020**). "Kendala dalam Implementasi Praktik Pertanian Berkelanjutan di Sektor Perkebunan."** Jurnal Pertanian Berkelanjutan, 5(2), 45-55.

Rahman, A. (2017). **Agroekologi: Konsep dan Aplikasi dalam Pertanian Berkelanjutan**. Penerbit IPB Press.

Ramakrishnan, R., & Rajendrakumar, S. (2024). **Regional sustainability of the Kattunayakan tribe in Kerala, India through the enhancement of agricultural, livestock, and livelihood options.**

Retrieved from https://www.sciencedirect.com/science/article/abs/pii/S0308521X24000799#preview-section-snippets

Sari, R. (2021**). "Pengelolaan Limbah Perkebunan dan Implikasinya terhadap Lingkungan."** Jurnal Lingkungan dan Pembangunan, 12(1), 45-58.

Suharto, P. (2021). **"Dampak Sosial Ekonomi dari Pengelolaan Perkebunan yang Tidak Berkelanjutan."** Jurnal Sosial Ekonomi Pertanian, 15(1), 99-110.

Suryadi. (2020). **Ekspansi Perkebunan Kelapa Sawit: Persoalan Sosial, Ekonomi, dan Lingkungan Hidup (Studi Kasus Kab. Pelalawan, Riau)**. *Jurnal Ilmu Lingkungan*, 2020.

Utami, R. (2017). **Dampak Ekonomi dan Lingkungan Ekspansi Perkebunan Kelapa Sawit (Studi Kasus: Desa Penyabungan, Kecamatan Merlung, Kabupaten Tanjung Jabung Barat, Jambi)**. *Jurnal Ilmu Pertanian Indonesia (JIPI)*, Agustus 2017

van der Haar, S. (2023). **Climate-smart cocoa in forest landscapes: Lessons from institutional innovations in Ghana. *Land Use Policy***. Diakses dari www.elsevier.com/locate/landusepol

World Wildlife Fund (WWF). (2020). **Palm Oil Buyers Scorecard: Assessing the Progress of Palm Oil Buyers.**

Yusuf, M., & Rahmawati, A. (2018). **"Peran Komunitas dalam Pengelolaan Sumber Daya Perkebunan Berkelanjutan."** Jurnal Pembangunan Masyarakat, 7(3), 201-210.