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Optimizing Oil Palm Plantation Land in an Effort to Increase Productivity in Pandeglang Regency, Banten Province

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Abstract

This study aims to map the productivity of oil palm plantations in Pandeglang Regency in 2023. The methods that used including GIS (Geographic Information System) analysis and a descriptive-quantitative approach. The research methods include GIS analysis to visualize and analyze spatial data, and a descriptive-quantitative approach to evaluate productivity levels based on available data. The GIS analysis stages include collecting spatial data from official sources like BPS and Department of Agriculture, processing the data using software such as ArcGIS, and field validation to ensure the data accuracy. Data that have been collected includes oil palm plantation area, administrative boundaries, and oil palm production data. From this research show productivity levels in various regions of Pandeglang Regency. The resulting productivity distribution map identifies areas with high and low production levels, providing important insights for decision-making. This research is expected to provide recommendations for increasing production efficiency and yields, such as improving cultivation techniques and resource management. With this approach, it is hoped that oil palm plantation productivity can be increased sustainably.

Keywords: *Mapping, Modeling, Geographic Information System (GIS), Plantation, Palm Oil, Regional Potential.*

Introduction

Pandeglang Regency has significant potential in the plantation sector, but productivity varies significantly across regions. The region's vast area and diverse environmental characteristics influence plantation productivity. The potential for oil palm plantations in this region is a leading sector that can support the local economy. However, challenges such as suboptimal cultivation techniques, limited access to resources, and varying soil conditions are major obstacles to achieving maximum productivity.

Pandeglang Regency was chosen as the focus of this research because it has been designated an Agropolitan Area. The development of Pandeglang Regency is directed towards agricultural activities. The economy of this regency is also dominated by the agricultural sector. Plantations are one of the largest producers within the agricultural sector, with four main commodities: coconut, palm oil, coffee, rubber, and cloves.

The oil palm plantation sector in Pandeglang, like many other regions in Indonesia, is a vital part of the economy. In terms of economic scale, oil palm plantations in Pandeglang play a significant role in providing employment, increasing farmers' incomes, and contributing to the country's foreign exchange through exports. The potential of oil palm plantations in Pandeglang Regency needs to be reassessed to determine their productivity so that they can be further developed.

Problem Formulation

The problem in this Research is:

1. How is the productivity of oil palm plantations in Pandeglang Regency?
2. How is the productivity mapping of oil palm plantations in Pandeglang Regency?

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Problem Solving Approach

Based on the problem above, the problem solving approach is to use the research methods of quantitative and qualitative by implementing Geographic Information Systems (GIS) to map the productivity of oil palm plantations.

State Of The Art

Mapping of oil palm plantations has not been widely found in previous research. The focus of oil palm plantations is crucial for identifying and mapping to provide more strategic development policy recommendations. This research also builds on previous research on land suitability in Pandeglang Regency for oil palm plantations.

Literature Review

Oil palm plantation productivity is a crucial indicator for assessing the efficiency and sustainability of the tropical agribusiness sector. A study by Purba et al. (2021) emphasized that productivity is influenced by cultivation techniques, fertilization, and plant age. Meanwhile, Herdiansyah et al. (2020) showed that farmer behavior and land management also determine yields, particularly on a small-scale basis.

In a spatial context, Murphy et al. (2021) review global challenges in palm oil production, including the impacts of climate change and land degradation, and the need for superior varieties that are resistant to extreme conditions. Siregar et al. (2022) integrate satellite imagery and GIS to map productivity zones and identify priority areas for intervention

Productivity level classification is generally divided into:

1. High: >20 ton/ha/year
2. Medium: 15–20 ton/ha/year
3. Low: <15 ton/ha/year

This scale has been used in various studies, such as Dewi et al. (2021) and GAPKI (2023), to assess plantation performance and design production improvement strategies. Efforts to increase productivity are also discussed by Masitah et al. (2022), who highlight the importance of technical training, land intensification, and institutional support. Zen et al. (2024) add that increasing*Oil Extraction Rate* (OER) through processing technology can reduce environmental impacts and increase production efficiency.

International study by Chew et al. (2021) and Khatiwada et al. (2021) shows that increasing productivity doesn't always through land expansion, but rather through intensification and re-planting technology-based.

Method

Research Stages

This research used quantitative and qualitative methods, implementing a Geographic Information System (GIS) as the data processor. The research stages were as follows:

1. Collection of spatial data from official sources such as BPS and the Agriculture Service of Pandeglang Regency, Banten Province.
2. Data processing using software such as ArcGIS.
3. Field validation to ensure data accuracy.

Data collection was conducted by integrating various information sources, including satellite imagery, statistical data, and field surveys. This process ensured that the data used in the analysis was highly accurate and relevant to the research objectives.

Research Location

This research was conducted within Pandeglang Regency, Banten Province. The focus on Pandeglang Regency is a follow-up to previous research on Land Suitability in Banten Province, and Pandeglang Regency is a regency with high land suitability for plantations (oil palm).

Data Collection Technique

The data obtained in this study is divided into two, namely:

1. Primary Data

Primary data sources were obtained from Google Maps and other map sites, in the form of spatial data for the Pandeglang Regency area.

2. Secondary Data

Secondary data sources in this study include oil palm plantation data and oil palm plantation area data from BPS and the Department of Agriculture.

Analysis Technique

The analytical techniques used in this study were GIS analysis and quantitative descriptive analysis. GIS analysis was conducted using software such as ArcGIS to visualize spatial data and map productivity. A descriptive-quantitative approach was used to evaluate palm oil production data in tons/hectare. By combining these two techniques, the study can provide comprehensive insights into the productivity of oil palm plantations in Pandeglang Regency in the current year.

Research Implementation Results

Identification of Oil Palm Plantation Productivity in Pandeglang Regency

Palm oil plantation productivity is determined by calculating production data (tons) compared to land area (ha) in a given region. The most recent production and land data were obtained in 2024 from Statistics Indonesia (BPS), specifically from the Pandeglang Regency in Figures 2024 document. The following data was obtained:

Based on Table 1, data obtained from the Pandeglang Regency in Figures 2024 document published by BPS, the identification of oil palm plantation productivity in Pandeglang Regency shows that most sub-districts are still in the low productivity category, namely below 10 tons per hectare. Productivity calculations are carried out by dividing total oil palm production (in tons) by the land area (in hectares) in each sub-district. Sub-districts such as Cimanggu, Cibaliung, Cibitung, Cikeusik, and Angsana have productivity in the range of 0.43–0.59 tons/ha, far from the high productivity category set at 20–35 tons/ha. This indicates that oil palm productivity in this region is still very low and not optimal. Some sub-districts even show productivity values approaching zero, such as Picung (0.034 tons/ha) and Koroncong (0.002 tons/ha), indicating major constraints in land use or plantation management. Many sub-districts, such as Sobang and Panimbang, also have no production data at all despite having land, or only record production without including land area, such as Saketi and Cigeulis. This makes it impossible to accurately calculate their productivity. This could be due to several factors, such as low harvest intensity, limited agricultural technology, or the possibility of land conversion to other crops. This lack of data integration adds to the challenge of comprehensive productivity analysis.

Tabel 1. The Productivity of Palm Oil (ton/ha) in Pandeglang Regency

No.	Subdistrict	Wide	Production (ton)	Productivity
		2023	2023	
1	Well			
2	Cimanggu	305,25	147,5	0,483
3	Cibaliung	89,15	38,419	0,431
4	Cibitung	169,84	100,715	0,593
5	Cikeusik	459,9	220,7	0,480
6	Cigeulis		0,81	
7	Panimbang	48,2		0
8	Sobang	499,3		0
9	Munjul	493,3	93	0,189
10	Angsana	127	55,6	0,438
11	Sindangresmi	223,5	80,172	0,359
12	Picung	503,35	17,1	0,034
13	Bojong	87,5	30,056	0,343

14	Saketi		31,7	
15	Cisata			
16	Pagelaran			
17	Patia	3,25		0
18	Sukaresmi			
19	Labuan			
20	Carita			
21	Jiput			
22	Cikedal			
23	Menes			
24	Pulosari			
25	Mandalawangi			
26	Cinamuk			
27	Cipeucang	1,3	0	0
28	Banjar			
29	Kaduhejo	3	0	0
30	Mekarjaya	3,25	19,2	5,908
31	Pandeglang	27,5	0	0
32	Majasari			
33	Cadasari	3,3	0	0
34	Karangtanjung			
35	Koroncong	12	0,03	0,002

Source: Central Statistic Agency, 2024.

The calculation results show that only one sub-district, Mekarjaya Sub-district, has very high productivity, with 5,908 tons/ha. Although this value is still far below the high standard according to the category classification, this value likely reflects the mismatch between the very small land area (3.25 ha) and the relatively large production figure (19.2 tons), resulting in high productivity. However, due to the limited land area, its contribution to the district's total production remains small. Overall, this identification reveals significant challenges in increasing the efficiency and effectiveness of oil palm cultivation in Pandeglang Regency. Targeted policies and technological interventions are needed to increase productivity across all sub-districts so that this commodity can become a mainstay sector for the regional economy.

Mapping of Oil Palm Plantation Productivity in Pandeglang Regency

Based on data reviewed from BPS documents and the results of calculations of oil palm plantation productivity in each sub-district in Pandeglang Regency, the results show that in general, oil palm productivity is still relatively low. Calculations using the ratio between production volume and land area in each sub-district show that no region reaches the high productivity category (≥20 tons/ha/year). In fact, the majority of sub-districts with land and production data only achieve productivity figures below 1 ton/ha/year, far from the ideal productivity threshold. This indicates that oil palm cultivation efforts in Pandeglang have not produced optimal results, both in terms of cultivation techniques, land management, and other supporting factors such as infrastructure and access to agricultural technology. The following map is a mapping of productivity in Pandeglang Regency.

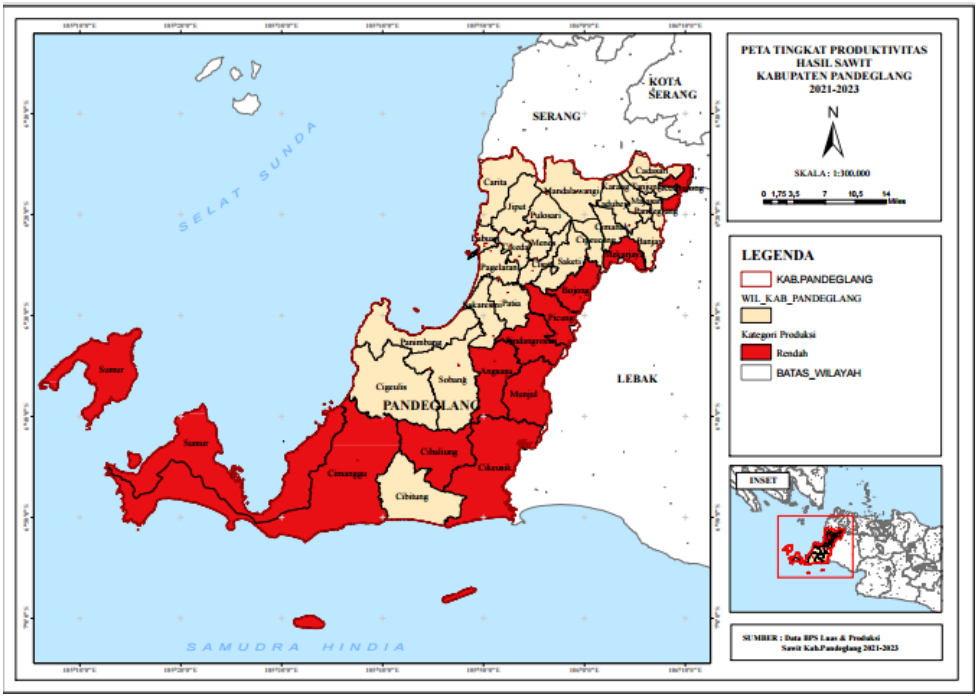

Figure 1. Map of Palm Oil Productivity in Pandeglang Regency

The map in Figure 1 shows all areas with recorded palm oil production activities categorized in red for low productivity, indicating very minimal production compared to the available land area. This map presents a spatial distribution, demonstrating that although oil palm is spread across many sub-districts such as Cimanggu, Cibaliung, Cibitung, Cikeusik, and others, the level of success is uneven, and the majority are still far from optimal potential. Therefore, the map serves not only as a visualization tool but also as a basis for evaluation and agricultural policy intervention.

Conclusion

Identification of oil palm plantation productivity in Pandeglang Regency in recent last years indicates the low utilization of oil palm land. Therefore, optimizing existing land is still possible, even through interventions on unproductive land. This provides the basis for further research on oil palm plantation development, including land cover planning.

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