International Journal of Sustainable Development and Planning
Vol. 16, No. 4, August, 2021, pp. 683-692
Journal homepage: http://iieta.org/journals/ijsdp

Development of Superior Plantation Commodities Based on Sustainable Development

Almasdi Syahza[1*], Djaimi Bakce[2], Mitri Irianti[3], Brilliant Asmit[4], Besri Nasrul[5]

[1] Institute for Research and Community Service (LPPM), Universitas Riau, Pekanbaru 28293, Indonesia
[2] Center for Agricultural and Rural Development Studies, Universitas Riau, Pekanbaru 28293, Indonesia
[3] Physics Education Program, Universitas Riau, Pekanbaru 28293, Indonesia
[4] Economic Education Program, Universitas Riau, Pekanbaru 28293, Indonesia
[5] Faculty of Agriculture, Universitas Riau, Pekanbaru 28293, Indonesia

Corresponding Author Email: almasdi.syahza@lecturer.unri.ac.id

https://doi.org/10.18280/ijsdp.160408

Received: 26 February 2021
Accepted: 7 June 2021

Keywords:
economic innovation, superior commodities, rural economy, sustainable development goals (SDGs)

ABSTRACT

Riau is an Indonesian province known for its large plantations. The plantation business makes the most significant contribution to the fiscal revenues of the province. This paper aims to innovate rural economy through the sustainable development of superior commodities in the plantation sub-sector of agriculture. Specifically, multi-criteria analysis (MCA) was performed to determine the superior commodities in each locality. The results show that the superior commodities include palm oil, rubber, coconut, cocoa, coffee, and sago. The development of these commodities could boost farmers' income with the added value of planation products. On this basis, the fair use of land for all categories was highlighted from social, economic, and environmental perspectives, and recognized as essential to the development of sustainable plantations, which are integral to rural economy and land sustainability. The proposed development strategy for superior commodities in plantation is in line with the sustainable development goals (SDGs) in Riau Province, Indonesia.

1. INTRODUCTION

Long-term national policy on agriculture is the foundation for development programs, especially those in rural areas. In Indonesia, the agricultural sector consists of large state/private plantations, and smallholder production. The large plantations tend to focus on important export commodities like palm oil and rubber. However, the development of these commodities in Indonesia is far from optimal. There are various technical problems and constraints: (1) decreasing planting and harvesting area, (2) low productivity, (3) inadequate facilities and infrastructure, (4) low application of plantation technology, (5) limited downstream industry and marketing, and (6) the lack of proper attitudes, behaviors, and skills of farmers. Other problems have also emerged, such as the limited access to capital, and the low human resource capacity for farmers.

Riau is one of the Indonesian provinces that rely heavily on agriculture, particularly the plantation sub-sector. Located in the tropics, this province can grow and develop some commodities efficiently. The superior commodities are oil palm, rubber, coconut, cocoa, coffee, sago, etc. The oil palm stands out from these commodities for its rapid growth.

In fact, Indonesia is an agricultural country. The oil palm plantations across the country produce vegetable oil and staples. These commodities both provide a source of energy, and bring an added economic value. Therefore, the county has a good potential of meeting the growing energy demand. However, it is currently difficult to tap the potential, due to the obstacles in processing palm oil biodiesel into a widely used fuel. In the future, the processing is expected to be made very cost-effective, thanks to technological breakthroughs [1].

The boom of oil palm in Indonesia is accompanied by the loss of biodiversity (e.g., deforestation), ecologically fragile areas (e.g., peatlands), increasing social conflicts, and many other problems [2]. In the meantime, oil palm development indeed creates many employment and income opportunities. In the long run, the trade in the plantation subsector is expected to boost the national income [3]. Furthermore, oil palm plantations also provide a source of income to the local community. Thanks to these plantations, large and small farmers have a stable income stream, and the country obtains more fiscal revenues [4]. To sum up, the sub-sector of plantation supports the livelihoods of rural communities, contributes to the national economy, and safeguards the market security better than other crops [5].

Many have closely studied the best practices for the integration between commodity development and natural resource conservation in Indonesia. The integration strategy for coffee commodities is to improve the certification mechanism, that for cocoa is to expand somatic embryogenesis (SE) nurseries and sustainability-based certification, and that for rubber commodities is to combine clonal-based development with forest protection [6].

Ecologically, plantations are bound to cause the decline and loss of biodiversity and ecosystem services. Rapid changes in land use are taking place in Indonesia, due to the rapid expansion of the palm oil industry. The progressive loss of forest cover that ensues has a major impact on biodiversity and global carbon emissions [7]. Compared to forests, oil palm plantations have a great negative impact on ecosystem functions. Some of these functions are lost globally, such as

gas and climate regulation, as well as habitat and nursery maintenance [8]. Clearing forest areas threatens the survival of mammal and bird species. The priorities for biodiversity conservation vary with the taxa and criteria used. Government regulations and private interventions are necessary to protect the biodiversity of ecosystems from being damaged by the expansion of oil palm plantations [9], and curb the uncontrolled land clearing for plantations, which threatens the very existence of key species [10].

With the aid of efficient processing technology, the development of oil palm plantations can reduce the exploitation of non-renewable natural resources [1]. Moreover, oil palm is a plant requiring lots of water, with limited purification ecosystem services [11]. Socially, oil palm development provides job and business opportunities, improves the economic state of the community, and increases purchasing power and demand in rural areas [12]. Despite slowing down, the expansion of oil palm plantations occupies more and more land, which adversely affects the functions and services of natural forest ecosystems [13]. Community rights are often neglected as the land is converted to plantations under the past social land tenure [14]. Formally, forestland is encroached to satisfy the economic needs of the community fields and gardens, leading to conflicts over land ownership. That is why the plantation land remains poorly administered [15].

Sustainable development offers an ecological, economic, and social balance with high conservation value [16]. Sustainable economy aims to balance the use of natural resources for mutual needs [17]. Even with maximum conservation efforts, it is difficult to restore conditions to normal [18]. The right effort is to aid the community, making the members willing to pay for environmental restoration services. The environmental value can be characterized by deriving the water consumption from the willingness to pays (WTP), using the equilibrium equations. The WTP reflects the ability of the community to pay (beneficiaries) [19]. Environmental problems are inseparable from plantation development. The environment is a strategic issue that calls for the sustainable development of economy, society, and environment. Comprehensive planning is required to realize sustainable development [20]. The plantation business depends on land, which is an area of the earth surface covering all components of the biosphere that functions to support human life [21].

Humans can benefit from the natural processes in an ecosystem through ecosystem management [22]. There are three types of ecological services, namely, the regulatory, cultural, and non-material supports originating from human-ecosystem interactions [23]. Currently, ecosystem services result in conflicts between users, under the constraints of resource utilization and population growth [24]. Changes in land use for food needs, coupled with heavy human intervention, impose a burden on the environment. Farmers and hunter-gatherers directly exploit and obtain benefits from ecosystem services, while urban residents prioritize non-ecosystem services in the form of socio-economics, although they, too, rely on ecosystems [25].

To reform Indonesian agriculture, an important strategy is to nurture a long-term operational development concept called policy reform framework. Further, superior and competitive technologies should be provided to modernize agriculture from the ecological and sustainable perspective, e.g., realizing the bio-industrial agriculture [26]. Syuaib suggested that agricultural development in Indonesia has led to significant changes in the agricultural production system. Facing the dual demands of productivity growth and environmental conservation, an action strategy is needed to improve and popularize sustainable agricultural practices [27]. The moratorium policy fails to improve forest governance in Indonesia, but hinders the economic growth for the plantation industry. The national plantation business is threatened by land legality, extensification, and intensification of smallholders. Law enforcement of the moratorium policy is needed to increase the productivity of smallholder plantations [28].

Focusing on the complex problems above, this paper aims to promote regional economic innovation through the sustainable development of superior plantation commodities. To optimize plantation development, a plantation-based area model was presented both regionally and nationally, in the form of design documents and instruments for the development of national superior plantation commodities at the provincial level. The model was supported by information and analysis of the following aspects: identifying potential plantation areas in Riau, generating strategies for developing these locations, and recommendations for rural innovation in accelerating an economy based on superior plantation commodities, both regionally and nationally.

2. RESEARCH METHODS

This research was conducted in Riau Province, Indonesia. Both primary and secondary data were adopted to prepare the plantation-based area development models. The primary data were collected through field surveys, including observations, verification of secondary data, and interviews with related stakeholders. The secondary data were extracted from the reports released by government agencies. The data processing and analysis were carried out with full consideration of resources, social economy, spatial planning, and plantation environment. The analysis covers the following phases: (1) determining the base commodities, (2) ranking of superior commodities, (3) ranking of regencies/cities as plantation locations, (4) assessing these locations, (5) determining the direction of policies, strategies, and developmental programs. The final results were formulated into dimensions of size and target that describe the determinants of sustainable development for plantations.

To obtain the public opinions about the superior commodity in a region, a questionnaire was prepared based on research needs. The data were collected through rapid rural appraisal (RRA) [29, 30], a participatory approach to acquire and assess general information in a short time. Through the RRA, information was collected in line with the research objectives.

The superior planation commodities in the province and their development on regency/city scale were determined/evaluated through a multi-criteria analysis (MCA). During the MCA, four criteria were weighed to represent the current conditions and future trends of plantation commodities in regencies/cities, and provinces [31, 32]: (1) land suitability; (2) location quotient (LQ) production; (3) planting area; (4) production. Table 1 lists the weights of the four criteria. The MCA mainly targets the commodities specified in national and provincial policies, namely, oil palm, rubber, coconut, cocoa, coffee, and sago.

The decision-making aims to identify and select the best alternatives, in the light of different factors and the

expectations of the decision-maker. Every decision was made in a specific environment, and defined as a collection of information, alternatives, values, and preferences available during this process [33].

In addition, an LQ analysis was carried out to determine the production centers and development potentials of superior commodities. The LQ [34] can be calculated by:

$$LQ = \frac{Si/Ni}{S/N} = \frac{Si/S}{Ni/N}$$

where, S_i is the ratio of area to production of commodity i in each regency; S is the ratio of area to commodity production in the province; N_i is the ratio of area to production of commodity i in the province; N is the ratio of area to commodity production in the province. The commodities with an LQ>1 were considered superior commodities.

The research data were obtained from the following sources: (1) the maps released by Indonesian Ministry of Agriculture on the potential development of national and provincial plantation areas; (2) the Central Bureau of Statistics (BPS) of Riau Province and its regencies/cities; (3) the long-term regional development plan (RPJPD) of Riau Province 2005-2025; (4) in-depth interviews and focus-group discussions (FGDs) with farmers, farmer groups, agricultural officers, district and village officials/leaders, and other relevant parties; (5) field observations; 6) geospatial systems.

Considering the objectives of rural economic innovation models, our analytical framework was designed based on the identified superior commodities, which focuses on: (1) the superior commodities to be developed in each regency/city; (2) the opportunities for future plantation development; (3) the problems and strategic issues in plantation development; (4) mapping of plantation areas.

Our sustainable plantation development model was established based on the basic features of plantation in all regencies/cities in Riau, which are strongly influenced by agroecosystems and the dominance of smallholders in plantation business. The established model is closely related to factors like resources, social economy, spatial planning, and the environment, and aligned with the goals of sustainable development.

Table 1. Multi-criteria analysis for the determination of each main plantation commodity in each regency/city

No	District/ City	Weight Value Criteria (%)				Total Weight (%)
		Land Suitability	Location Quotient	Growth of Planted area	Production growth	
1	Region 1	Land Suitability Weight (30%)	Production LQ weight (20%)	Weight Planted area (30%)	Production Weight (20%)	Weights per district
2	Region 2	Land Suitability Weight (30%)	Production LQ weight (20%)	Weight Planted area (30%)	Production Weight (20%)	Weight per district
..	……	……	……	……	……	……
n	Region n	Land Suitability Weight (30%)	Production LQ weight (20%)	Weight Planted area (30%)	Production Weight (20%)	Weight per district

Description: If the total weighted value of a commodity in a regency/city is more than 75 percent, then the commodity is proposed as a national superior plantation commodity developed in that district/city. If the total weight is 50-74 percent, then the commodity is proposed as a superior provincial plantation commodity that can be developed in the district/city.

3. RESULTS

To spur the economy in rural areas, the government should develop local superior commodities. Superior plantation commodities should be in line with the strategic values to be developed in an area, such as physical values like soil and climate, as well as socioeconomic and institutional values like technology mastery, human resources, infrastructure, and socio-cultural conditions.

The development of superior plantation commodities was integrated into the whole spectrum of agribusiness system in the form of processing and marketing. From the upstream to the downstream of the system, the superior commodities were omnipresent, bringing more economic income and employment opportunities to local people. Then, the local economy will grow faster, as most of the added values of agribusiness benefit the locals. Rekiso pointed out the positive and cumulative relationship between industrialization and regional economic integration. Therefore, a superior commodity processing industry is necessary to spur the regional economy [35].

The contribution of agricultural sectors (e.g., food crops, fisheries, plantations, livestock, and forestry) can be enhanced by increasing the following factors: (1) the availability and diversity of quality food; (2) the intensity of land use and input technology; (3) the farmer exchange rate (NTP); (4) the agricultural and plantation information systems and data; (5) the role of the private sector and associations in the quality and productivity of agriculture and plantations; (6) the developmental quality of irrigation/swamp networks, drainage, riverbanks, and coastlines. Arifin discovered that the stages of competitiveness and sustainability vary with commodities, and put forward two suggestions: (1) strengthening the competitiveness and sustainability of commodities, such as the inclusiveness of small farmers and small-scale processors; (2) mitigating the impact of commodity development on natural resources [6].

3.1 Land use

Riau Province covers an area of 9,012,875.96 ha. Referring to the regional regulation in the *Riau Province Spatial Plan*, the land can be divided into seven categories: (1) 628.636,00 ha (6,96%) of nature reserve forests; (2) 208.910,00 ha (2,31%) of forest protection areas; (3) 2.952.179,00 ha (32,67%) of limited production areas; (4) 1.638.519,00 ha (18,13%) of forest production areas; (5) 1.769.966,27 ha (19,59%) of convertible forest production areas; (6) 1.719.364,73 ha (19,03%) of other uses (APL); (7) 119,260.00 ha (1.32%) of water bodies.

According to the *Decree of the Minister of Environment and Forestry* (SK.9246/MENLHK-PHPL/KPHP/HPL.0/12/2018), the utilization of production forests is not burdened with permits in Riau Province if the utilization involves 0 ha of natural forest, less than 2,740 ha of industrial forest/community forest plantations, less than 685,315 ha of

village forest/community forest areas, and less than 24,195 ha ecosystem restoration areas. The area of each case is presented in Figure 1.

The APL covers the if development of the agricultural sector. However, the APL has the potential to trigger regional social conflicts. The areas allocated for community management tend to be used for oil palm or mining plantations. Brad et al. demonstrated that the exponential growth of oil palm production has made Indonesia world's largest producer of vegetable oils [36, 37]. The development of plantation crops on forest borders contributes immensely to land conversion and deforestation, and signifies the conversion of forest to rubber plantations [38]. With a long development history in Riau, rubber and its derivatives are expected to stimulate regional economy and promote employment, which helps to increase income and alleviate poverty [39]. The expansion of plantations has led to the shrinkage of natural forest, making it harder to extract forest products. However, the natural forest has not been harvested in the production of ecosystem services [40].

3.2 Superior commodity areas

Gap analysis was conducted to determine the actual land and potential land allocated for plantation development, under the following constraints: (1) suspension of land allocation permits for natural forest and peat; (2) exclusion of the protected peat area from the determination of superior plantation commodities. Combined with the spatial allocation pattern in the *Riau Province Spatial Plan*, the development of plantation areas was designed in view of the following factors: the levels of land suitability, the support for production factors, and the systems of agricultural institutions and agribusiness.

The data on land availability were juxtaposed with those on actual land and potential land allocated for plantation development, the allocation of existing site which has been utilized, and the allocation of land per regency/city available for development as plantations. The result was called the level of land availability or the gap factor. Table 2 presents the results of the land availability analysis in Riau Province. Figure 2 provides the location map.

Spatial analysis shows that around 3.59% of land is still available for plantation development. Based on the gap value of each regency/city, the land availabilities of Meranti Islands and Rokan Hilir were 14.73% and 10.31%, respectively, roughly the same as those of Bengkalis, Pelalawan, Indragiri Hilir, Kampar, and Rokan Hulu. These availabilities were utilized and developed, under the assumption that the land functions do not change other than being used as a plantation. According to Tavares et al., the importance of public policies, which take the form of planning and regulatory instruments, is closely related to local communities, agriculture, and forest resources. The land management and forest preservation should provide greater benefits to the communities [41]. Yanti et al. held that, socially, forests strengthen community relations, increase their participation in forest management, create jobs, and maintain local wisdom and institutions [42]. Land use is a form of power competition between stakeholders. Therefore, land use governance must be improved to involve high-level stakeholders, who can control the use of natural resources [43].

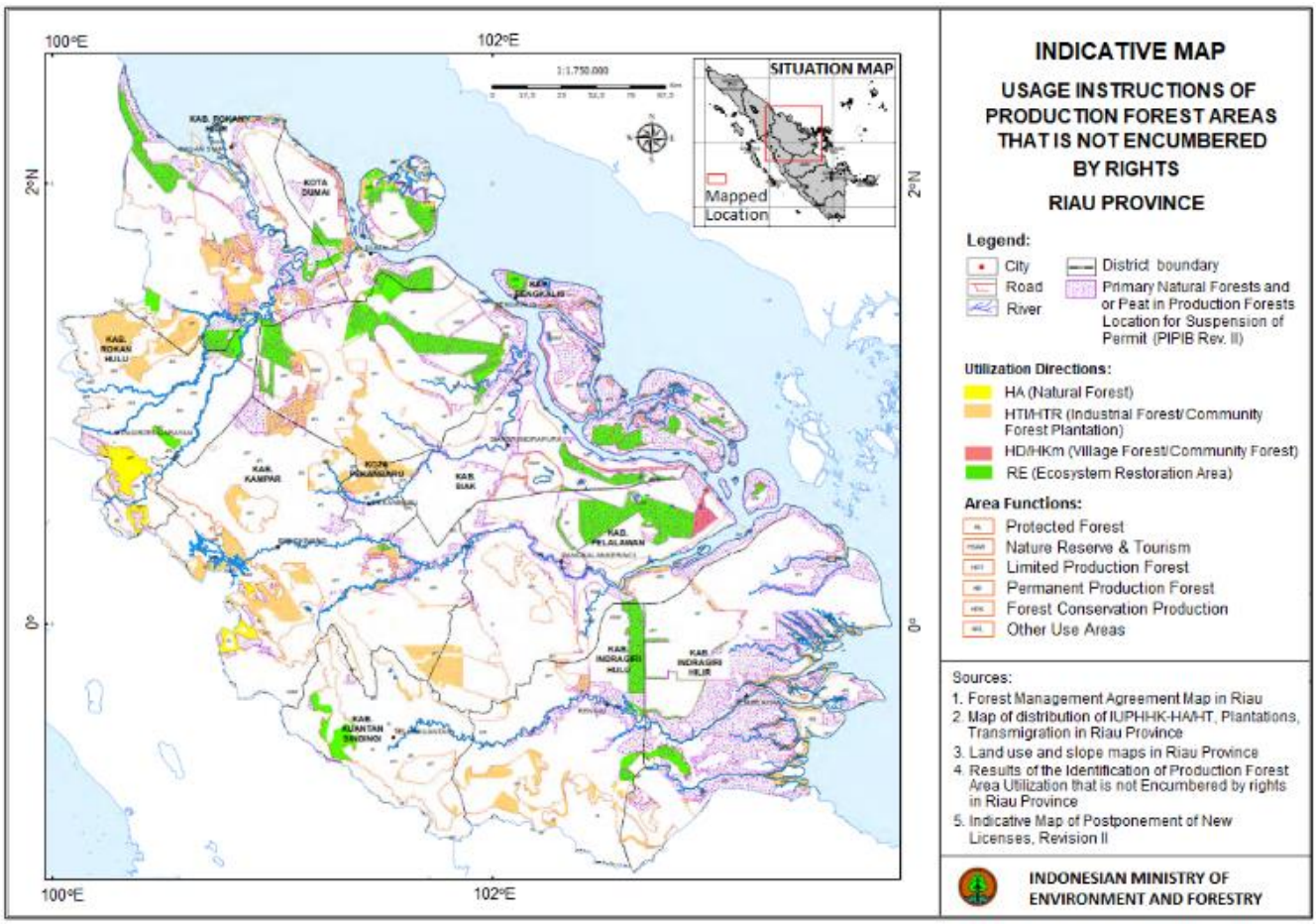

Figure 1. Map of area distribution in the production forest of Riau province

Table 2. Gap or plantation land availability in Riau province

No	Regency / City	Available Land (ha)	Land Allocation (Spatial Pattern)		Gap	
			Area (ha)	%	Area (ha)	%
1	Kampar	432.610,55	426.232,73	16,37	6.377,82	1,47
2	Rokan Hulu	304.167,27	300.857,41	11,56	3.309,86	1,09
3	Pelalawan	355.931,21	339.391,53	13,04	16.539,68	4,65
4	Indragiri Hulu	174.591,49	174.321,43	6,70	270,06	0,15
5	Kuantan Singingi	122.102,06	121.843,65	4,68	258,41	0,21
6	Bengkalis	178.571,81	168.786,33	6,48	9.785,48	5,48
7	Rokan Hilir	294.252,26	263.908,88	10,14	30.343,38	10,31
8	Dumai	8.455,51	8.430,31	0,32	25,20	0,30
9	Siak	222.420,54	222.049,50	8,53	371,04	0,17
10	Indragiri Hilir	524.795,90	506.491,50	19,46	18.304,40	3,49
11	Pekanbaru	4.251,71	4.251,71	0,16	0,00	0,00
12	Meranti Islands	77.918,63	66.440,78	2,55	11.477,85	14,73
	Total Area	2.700.068,94	2.603.005,76	100,00	97.063,18	3,59

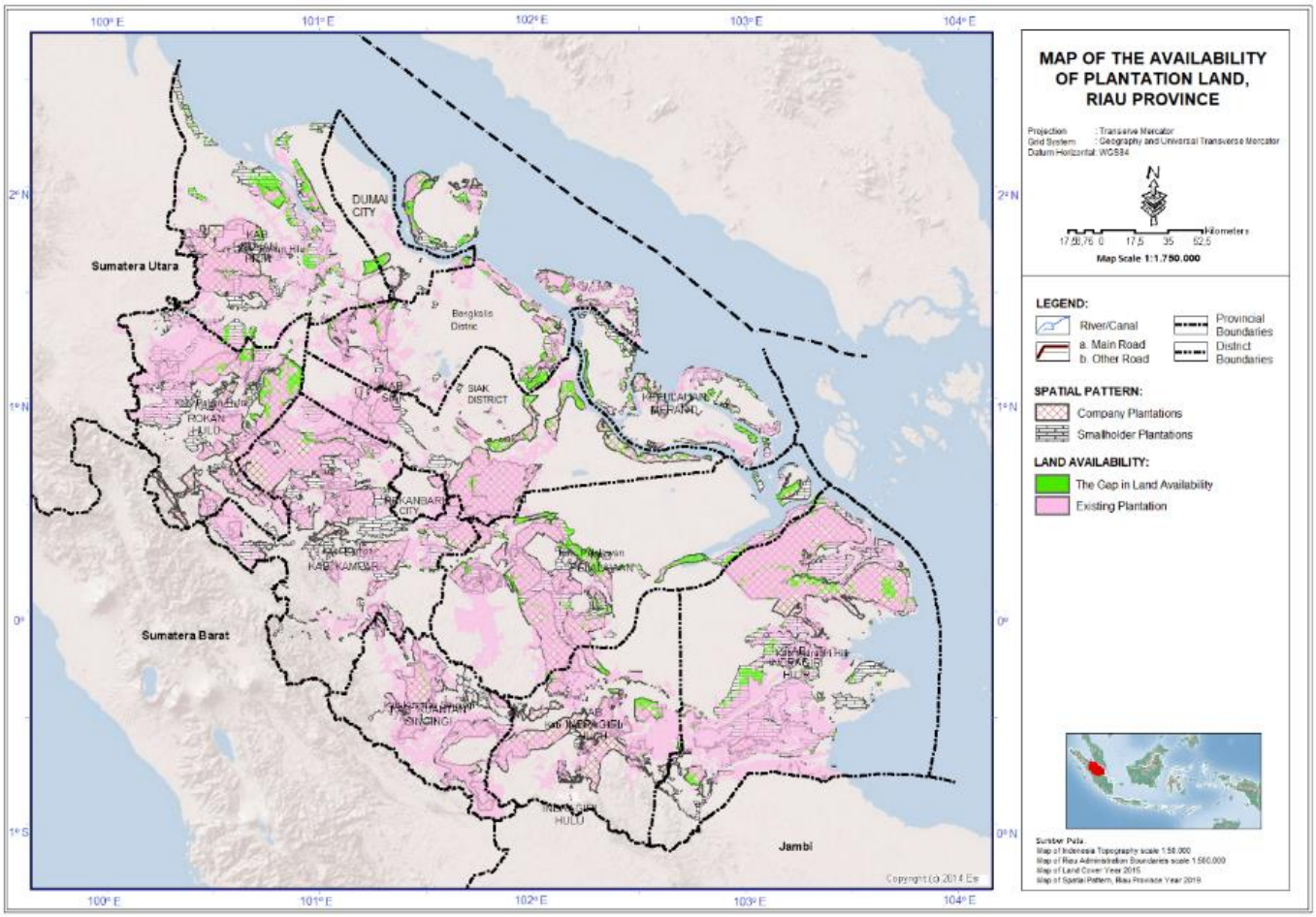

Figure 2. Map of availability of plantation land in Riau province

3.3 MCA

The six superior plantation commodities in Riau Province were subjected to the MCA to determine the regence/city suitable for developing each superior commodity [30]. As mentioned before, the MCA adopts four criteria: land suitability, production LQ, area, and production. These criteria were weighed as shown in Table 3. The MCA results lay the basis for determining the superior commodities feasible to be developed in potential areas. The selected commodities had been cultivated by local farmers, as the result of the FGDs with regional stakeholders.

The maximum total weighted value was set to 100%. If the weighted value was greater than 75%, then a commodity was considered a national superior commodity developed in the regency/city. If the weighted value fell between 50%-74%, then the commodity was considered a provincial superior commodity developed in the regency/city.

As national commodities, oil palm is developed in five areas, and rubber, in four areas, especially in high-slope or hilly areas. Meanwhile, the rubber in coastal areas is the provincial superior commodity. Coconut, coffee, and sago are predominantly developed in coastal areas, namely, Indragiri Hilir and Meranti Islands. Moreover, provincial superior commodities are almost evenly developed in each district, because these plants were cultivated by locals before the emergence of oil palm and cacao. The national superior commodities developed in regencies/cities contributed greatly

to the economy, both regionally and nationally.

Also, oil palm and rubber remained strategic commodities on national and regional scales. Afriyanti et al. showed that sustainable development has penetrated the oil palm plantations in Kalimantan and Sumatra. The potential yield of palm oil is much higher than that of other plantations. Mineral soils are the potential areas for oil palm plantations, excluding those on the peatlands [44]. Coconut could only be developed in Indragiri Hilir and Meranti Islands (coastal wetlands). Coconut, sago, and Liberika coffee are paludiculture crops. Tan et al. believed that paludiculture or wet agriculture is an alternative to sustainable land use on peatlands. Vegetation for paludiculture should be obtained from native species. Paludiculture in the tropics is heavily influenced by socio-economic factors [45].

3.4 Rural economic innovation

Through the MCA, the development areas were determined for the six superior plantation commodities in Riau Province, from the aspects of policy, land suitability, etc. Table 4 lists the locations of the areas for the superior national and provincial plantation commodities. The blue boxes indicate the areas of superior national commodities, while the green boxes indicate the areas of superior provincial commodities. Rubber is the commodity with the largest development area in Riau Province, followed in turn by oil palm, cocoa, rubber, coffee, and sago.

Commodities marked with **Q**, **R**, **Y**, and **Z** mean the corresponding areas require special attention. **Q** suggests that the corresponding commodity is developed in an area by policy, but not sufficiently superior, as reflected by the MCA; the area should make more efforts to develop these commodities. **R** suggests that the commodity has an edge in the area, and is eligible to become a superior national commodity; **Y** suggests that the commodity has an edge in the area, and is eligible to become a superior provincial commodity; **Z** suggests that the commodity has been designated as a superior provincial commodity, but fails to meet the criteria in the MCA.

Table 3. Multi-criteria analysis for superior commodities

No	Regency / City	Criteria Weight Value (%)					
		Oil Palm	Rubber	Coconut	Cacao	Coffee	Sago
1	Kampar	36,83	98,49	30,46	54,24	37,19	0,00
2	Rokan Hulu	83,50	81,26	47,04	52,11	54,21	0,00
3	Pelalawan	76,86	81,28	44,06	63,03	100,00	37,85
4	Indragiri Hulu	34,88	59,06	28,51	87,83	46,34	0,00
5	Kuantan Singingi	41,81	98,95	30,49	52,76	30,42	0,00
6	Bengkalis	76,47	60,54	40,92	16,67	34,63	34,26
7	Rokan Hilir	80,98	68,00	48,76	77,85	37,12	0,00
8	Dumai	69,24	63,96	37,20	47,56	30,27	0,00
9	Siak	83,20	62,79	37,27	48,54	35,32	52,07
10	Indragiri Hilir	46,77	68,88	100,00	100,00	85,54	70,25
11	Pekanbaru	40,21	60,74	40,01	30,21	0,00	0,00
12	Meranti Islands	0,00	49,10	79,27	0,00	100,00	100,00

Description:

Superior national plantation commodity that was developed in the regency

Superior provincial plantation commodity that was developed in regency areas

Table 4. Location of Riau province's superior commodity development area

No	Regency/City	Superior plantation commodities					
		Oil Palm	Rubber	Coconut	Cacao	Coffee	Sago
1	Kampar	**Q**	**P**	-	**X**	-	-
2	Rokan Hulu	**P**	**R**	-	**X**	**Y**	-
3	Pelalawan	**P**	**R**	**Z**	**X**	**R**	-
4	Indragiri Hulu	**Z**	**X**	-	**R**	-	-
5	Kuantan Singingi	**Z**	**P**	-	**X**	-	-
6	Bengkalis	**P**	**X**	**Z**	-	-	-
7	Rokan Hilir	**P**	**X**	-	**R**	-	-
8	Dumai	**P**	**Y**	-	-	-	-
9	Siak	**P**	**X**	-	-	-	**Y**
10	Indragiri Hilir	**Z**	**Y**	**R**	**R**	**R**	**X**
11	Pekanbaru	-	**Y**	-	-	-	-
12	Meranti Islands	-	**Z**	**R**	-	**R**	**R**

P	The superior national plantation commodity area determined by the Ministry of Agriculture, in accordance with the results of the *Multi-Criteria Analysis*
Q	The superior national plantation commodity area determined by the Ministry of Agriculture, however, the results of the *Multi-Criteria Analysis* did not yet meet the criteria
R	The superior national plantation commodity area based on the results of the *Multi-Criteria Analysis*
X	The superior provincial plantation commodity areas defined by the Province, based on the results of the *Multi-Criteria Analysis*, meet the criteria
Y	The superior provincial plantation commodity areas were not determined by the province, however, based on the results of the *Multi-Criteria Analysis*, it met the criteria
Z	The superior provincial plantation commodity areas was determined by the Province

The commodities not recognized as national or provincial superior commodities were considered regency/city superior commodities. These commodities are supported by programs and funds from the corresponding regencies/cities. The information on such commodities were collected through FGDs with relevant agencies (Table 5).

According to the information in Table 5, it is recommended to maintain oil palm as a regional superior commodity, except in Meranti Islands and Pekanbaru. The recommendation is based on the multiplier effect of oil palm development on regional economy. Rubber should be treated as a regional commodity in Riau, except in Dumai, Pekanbaru, and Indragiri Hilir. This recommendation was made in the light of farming habits, land suitability, and area-specific superiority. In general, coconut commodity should be developed in coastal areas like Pelalawan, Bengkalis, Indragiri Hilir, and Meranti Islands. The coffee commodity cultivated in coastal areas is a type of Liberika coffee. The sago commodity, as a specific wetland plant, was recommended to two regencies, namely, Indragiri Hilir, and Meranti Islands.

Integrated management of natural resources opens a path towards poverty alleviation. The results of agricultural research should be implemented in rural areas to increase rural prosperity, and mitigate an array of problems in rural areas. Prioritizing local commodities as regional superior ones offers a good strategy of poverty reduction [46]. According to Syahza et al., most plants cultivated by locals on peatland are oil palm, rubber, coconut, coffee, and areca nut, and those on wetlands are sago. The utilization of peatlands is mainly bottlenecked by the lack of community participation in policy development [47]. Inspired by Jacobson et al., the role of tribal groups in traditional communities determines the success of forest management. These groups can overcome past governance barriers through their sovereign authority and rich expertise and knowledge of forestry. This concept serves as a tool for reforming the rigid forest management institutions [48].

The recognition and involvement of various social groups not only bring competing interests, but also provide valuable policies, institutions, and investments to increase the value of land use. These contribute immensely to the understanding of smallholder participation in land-use change and tenure [49]. The sustainable plantation, integral to rural economic growth, offers an opportunity to understand the superior plantation commodities. The development of such commodities needs a fair use of land in social, economic, and environmental aspects [50]. Regarding plantation development, the top priority should be given to the control of open land erosion. Special counseling needs to be carried out to all landowners on how to conserve soil [51]. Widiati et al. proved that the standard dimensions of sustainable development can improve the achievement level of oil palm farming by 82.43%, laying the basis for performance improvement through standard management [52]. Syahza and Asmit demonstrated that oil palm farming increased the welfare of rural communities, exerting a multiplier effect on the regional economy [53].

Table 5. Superior commodities of regencies/cities in Riau Province based on the results of *multi-criteria analysis*

No	Regency / City	Superior Plantation Commodities					
		Oil Palm	Rubber	Coconut	Cacao	Coffee	Sago
1	Kampar	✓	✓				
2	Rokan Hulu	✓	✓				
3	Pelalawan	✓	✓	✓	✓	✓	
4	Indragiri Hulu	✓	✓		✓		
5	Kuantan Singingi	✓	✓				
6	Bengkalis	✓	✓	✓			
7	Rokan Hilir	✓	✓				
8	Dumai	✓					
9	Siak	✓	✓				
10	Indragiri Hilir	✓		✓	✓	✓	✓
11	Pekanbaru						
12	Meranti Islands		✓	✓		✓	✓

4. CONCLUSIONS

The integrated management of resources is an effort to accelerate rural economy. Prioritizing local commodities as superior provides a way to reduce poverty. The development of regional superior commodities is a small-scale strategy for agricultural development, which takes account of regional conditions. Since the ancient times, the local farmers have been sticking to the management standards for sustainable development in agricultural activities. In line with the SDGs of Riau Province, superior plantation commodities can be developed by providing financing chances and opening investment opportunities.

The provincial policy-makers are advised to highlight the regional strengths for the development of designated superior commodities, including oil palm, rubber, coconut, cocoa, coffee, and sago. The development of the superior commodities could contribute to the economy, both regionally and nationally. Therefore, government policies should be guided by commodity-based regional development.

This paper provides a reference for those interested in agricultural development, especially in rural areas. The results can be applied by agribusiness actors and researchers to boost the added value of agriculture, and increase the income of small farmers in rural areas. However, our research is limited in terms of the superior commodities that contribute to the economy both regionally and nationally. Further research will focus on the structure and institutions of the agricultural sector, especially the superior commodities, in Indonesia.

ACKNOWLEDGMENT

This research was funded by the Directorate of Research and Community Service (DRPM), through the Riau University Research and Community Service Institute (LPPM) Contract number 205/SP2H/AAMD/LT/DRPM/2020

REFERENCES

[1] Faizal, M., Ateeb, S. (2018). Energy, economic and environmental impact of palm oil biodiesel in Malaysia. Journal of Mechanical Engineering Research and Developments, 41(3): 24-26. https://doi.org/10.26480/jmerd.03.2018.24.26

[2] Budidarsono, S., Susanti, A., Zoomers, A. (2013). Oil palm plantations in Indonesia: the implications for migration, settlement/resettlement and local economic development. Economy, Environment and Sustainability, 173-193. https://doi.org/10.5772/53586

[3] Aghsilni, A., Sentosa, S.U., Syofyan, E. (2019). Analysis of international trade in Indonesian: Plantation sub-sector commodities. Advances in Economics, Business and Management Research, 64: 186-195. https://doi.org/10.2991/piceeba2-18.2019.123

[4] Pacheco, P, Gnych, S, Dermawan, A, Komarudin, H., Okarda, B. (2017). The palm oil global value chain: Implications for economic growth and social and environmental sustainability. Working Paper 220. Bogor, Indonesia: CIFOR. https://doi.org/10.17528/cifor/006405

[5] Syahza, A., Bakce, D., Irianti, M., Asmit, B. (2020). Potential development of leading commodities in coastal areas Riau, Indonesia. Journal of Applied Sciences, 20(5): 173-181. https://doi.org/10.3923/jas.2020.173.181

[6] Arifin, B. (2013). On the competitiveness and sustainability of the Indonesian agricultural export commodities. ASEAN Journal of Economics, Management and Accounting, 1(1): 81-100.

[7] Sumarga, E., Hein, L. (2014). Mapping ecosystem services for land use planning, the case of Central Kalimantan. Environmental Management, 54: 84-97. https://doi.org/10.1007/s00267-014-0282-2

[8] Dislich, C., Alexander, C.K., Jan, S., Yael, K., Katrin, M.M. (2015). Ecosystem functions of oil palm plantations - a review. EFForTS Discussion Paper Series 16. https://www.econstor.eu/handle/10419/117328.

[9] Vijay, V., Pimm, S.L., Jenkins. C.N., Smith, S.J. (2016). The impacts of oil palm on recent deforestation and biodiversity loss. PLoS ONE, 11(7): e0159668. https://doi.org/10.1371/journal.pone.0159668

[10] Curtsdotter, A., Banks, H.T., Banks, J.E., Jonsson, M., Jonsson, T., Laubmeier, A.N., Traugott, M., Bommarco, R. (2019). Ecosystem function in predator-prey foodwebs – confronting dynamic models with empirical data. Journal of Animal Ecology, 88: 196-210. https://doi.org/10.1111/1365-2656.12892

[11] Malghan, D. (2011). A dimensionally consistent aggregation framework for biophysical metrics. Ecological Economics, 70(5): 900-909. https://doi.org/10.1016/j.ecolecon.2010.12.015

[12] Syahza, A., Asmit, B. (2019). Development of palm oil sector and future challenge in Riau Province, Indonesia. Journal of Science and Technology Policy Management, 11(2): 149-170. https://doi.org/10.1108/JSTPM-07-2018-0073

[13] Sharma, S., Baral, H., Pacheco., P., Laumonier, Y. (2017). Assessing impacts on ecosystem services under various plausible oil palm expansion scenarios in Central Kalimantan, Indonesia. Center for International Forestry Research (CIFOR), 176: 1-8. https://doi.org/10.17528/cifor/006479

[14] Gellert, P.K. (2015). Palm oil expansion in Indonesia: Land grabbing as accumulation by dispossession. States and Citizens: Accommodation, Facilitation and Resistance to Globalization (Current Perspectives in Social Theory), 34: 65-99. https://doi.org/10.1108/S0278-120420150000034004

[15] Harun, M.K., Dwiprabowo, H. (2014). Model resolusi konflik lahan di kesatuan pemangkuan hutan produksi model Banjar. Jurnal Penelitian Sosial dan Ekonomi Kehutanan, 11(4): 265-280.

[16] Sharma, S.K., Baral, H., Laumonier, Y., Okarda, B., Komarudin, H., Purnomo, H., Pacheco, P. (2019). Ecosystem services under future oil palm expansion scenarios in West Kalimantan, Indonesia. Ecosystem Services, 39(C): 100978. https://doi.org/10.1016/j.ecoser.2019.100978

[17] Pittock, J., Cork, S., Maynard, S. (2012). The state of the application of ecosystems services in Australia. Ecosystem Services, 1: 111-120. https://doi.org/10.1016/j.ecoser.2012.07.010

[18] Asaleye, A.J., Alege, P.O., Lawal, A.I., Popoola, O., Ogundipe, A.A. (2020). Cash crops financing, agricultural performance and sustainability: Evidence from Nigeria. African Journal of Economic and Management Studies, 11(3): 481-503. https://doi.org/10.1108/AJEMS-03-2019-0110

[19] Kenter, J.O., Hyde, T., Christie, M., Fazey, I., (2011). The importance of deliberation in valuing ecosystem services in developing countries-evidence from the Solomon Islands. Global Environmental Change: Human and Policy Dimensions, 21(2): 505-521. https://doi.org/10.1016/j.gloenvcha.2011.01.001

[20] Kusumaningrum, M.E., Juliani, T., Amri, K., Silamon, M.A. (2020). Sustainable development issue in the relocation policy at Peterongan market, Semarang city. Journal of Environmental Science and Sustainable Development, 3(1). https://doi.org/10.7454/jessd.v3i1.1038

[21] Ritohardoyo, S., Sadali, M. (2017). Kesesuaian Keberadaan Rumah Tidak Layak Huni (Rtlh) Terhadap Tata Ruang Wilayah Di Kota Yogyakarta. Tataloka, 19(4): 291-305. https://doi.org/10.14710/tataloka.19.4.291-305

[22] Howe, C., Helen, S., Vira, B., Mace, G.M. (2014). Creating win-wins from trade-offs? Ecosystem services for human well-being: A meta-analysis of ecosystem service trade-offs and synergies in the real world. Global Environmental Change, 28: 263-275. https://doi.org/10.1016/j.gloenvcha.2014.07.005

[23] Fish, R., Church, A., Winter, M. (2016). Conceptualising cultural ecosystem services: A novel framework for research and critical engagement. Ecosystem Services, 21: 208-217. https://doi.org/10.1016/j.ecoser.2016.09.002

[24] Cumming, G.S., Buerkert, A., Hoffmann, E., Schlecht, E., Taubadel, S.C., Tscharntke, T. (2014). Implications of agricultural transitions and urbanization for ecosystem services. Nature, 515: 50-57. https://doi.org/10.1038/nature13945

[25] Dickinson, D.C., Hobbs, R.J. (2017). Cultural ecosystem services: Characteristics, challenges and lessons for urban green space research. Ecosystem Services, 25: 179-194. https://doi.org/10.1016/j.ecoser.2017.04.014

[26] Pasandaran, E., Rachmat, M., Mardianto, S., Salim, H.P.,

Hendriadi, A. (2014). Reformasi Kebijakan Menuju Transformasi Pembangunan Pertanian, Badan Penelitian dan Pengembangan Pertanian. IAARD PRESS. https://www.litbang.pertanian.go.id/buku/reformasi-kebijakan-menuju/.
[27] Syuaib, M.F. (2016). Sustainable agriculture in Indonesia: Facts and challenges to keep growing in harmony with environment. Agricultural Engineering International: CIGR Journal, 18(2): 170-184. https://cigrjournal.org/index.php/Ejounral/article/view/3747.
[28] Suroso, A.I., Pahan, I., Maesaroh, S.S. (2020). New plantation moratorium policy and smallholders palm oil rejuvenation for increasing productivity of Indonesian palm oil. Journal Manajemen & Agribisnis, 17(2): 138-152. https://doi.org/10.17358/jma.17.2.138
[29] Alam, A, Ihsan, S. (2012). Role of participatory rural appraisal in community development. International Journal of Academic Research in Business and Social Sciences, 2(8): 25-38. http://hrmars.com/admin/pics/963.pdf
[30] McCracken, J.A, Pretty, J.N., Conway, G.R. (1988). An introduction to rapid rural appraisal for agricultural development. International Inst. for Environment and Development, London, UK.
[31] Sheppard, S.R., Meitner, M. (2005). Using multi-criteria analysis and visualisation for sustainable forest management planning with stakeholder groups. Forest Ecology and Management, 207(1-2): 171-187. https://doi.org/10.1016/j.foreco.2004.10.032
[32] Mateo, J.R.S.C. (2012). Multi-criteria analysis. In: Multi Criteria Analysis in the Renewable Energy Industry. Green Energy and Technology. Springer, London. https://doi.org/10.1007/978-1-4471-2346-0_2
[33] Sadras, V.O., Cassman, K., Grassini, P., Bastiaanssen, W.G.M., Laborte, A.G., Milne, A.E., Steduto, P. (2015). Yield Gap Analysis of Field Crops: Methods and Case Studies.
[34] Xu, N., Cheng, Y., Xu, X. (2018). Using location quotients to determine public–natural space spatial patterns: A Zurich model. Sustainability, 10(10): 3462. https://doi.org/10.3390/su10103462
[35] Rekiso, Z.S. (2017). Rethinking regional economic integration in Africa as if industrialization mattered. Structural Change and Economic Dynamics, 43: 87-98. https://doi.org/10.1016/j.strueco.2017.10.001
[36] Syahza, A., Irianti, M. (2021). Formulation of control strategy on the environmental impact potential as a result of the development of palm oil plantation. Journal of Science and Technology Policy Management, 12(1): 106-116. https://doi.org/10.1108/JSTPM-06-2019-0059
[37] Brad, A., Schaffartzik, A., Pichler, M., Plank, C. (2015). Contested territorialization and biophysical expansion of oil palm plantations in Indonesia. Geoforum, 64: 100-111. https://doi.org/10.1016/j.geoforum.2015.06.007
[38] Junquera, V., Meyfroidt, P., Sun, Z., Latthachack, P., Regamey, A.G. (2020). From global drivers to local land-use change: Understanding the northern Laos rubber boom. Environmental Science & Policy, 109: 103-115. https://doi.org/10.1016/j.envsci.2020.04.013
[39] Syahza, A., Backe, D., Asmit, B. (2018). Natural rubber institutional arrangement in efforts to accelerate rural economic development in the province of Riau. International Journal of Law and Management, 60(6): 1509-1521. https://doi.org/10.1108/IJLMA-10-2017-0257
[40] Heilmayr, R. (2014). Conservation through intensification? The effects of plantations on natural forests. Ecological Economics, 105: 204-210. https://doi.org/10.1016/j.ecolecon.2014.06.008
[41] Tavares, A.O., Monteiro, M., Vargas, M.A., Pato, R.L., Serra, R. (2014). Land use change and forest routing in a rural context: The relevance of the community-based management and planning framework. Applied Geography, 52: 153-171. https://doi.org/10.1016/j.apgeog.2014.05.008
[42] Yanti, R., Syahza, A., Hidir, A., Suwondo, S. (2018). The communication model of forest management based on environmental awareness. Management of Environmental Quality, 29(6): 1093-1109. https://doi.org/10.1108/MEQ-02-2018-0028
[43] Juniyanti, L., Purnomo, H., Kartodihardjo, H., Prasetyo, L.B., Pambudi, S.E. (2021). Powerful actors and their networks in land use contestation for oil palm and industrial tree plantations in Riau. Forest Policy and Economics, 129(102512). https://doi.org/10.1016/j.forpol.2021.102512
[44] Afriyanti, D., Kroeze, C., Saad, A. (2016). Indonesia palm oil production without deforestation and peat conversion by 2050. Science of The Total Environment, 557-558: 562-570. https://doi.org/10.1016/j.scitotenv.2016.03.032
[45] Lupascu, M., Wijedasa, L.S. (2020). Paludiculture as a sustainable land use alternative for tropical peatlands: A review. Science of The Total Environment, 142111. https://doi.org/10.1016/j.scitotenv.2020.142111
[46] Noordwijk, M. (2019). Integrated natural resource management as pathway to poverty reduction: Innovating practices, institutions and policies. Agricultural Systems, 172: 60-71. https://doi.org/10.1016/j.agsy.2017.10.008
[47] Syahza, A., Bakce, D., Irianti, M. (2019). Improved peatlands potential for agricultural purposes to support sustainable development in Bengkalis District, Riau Province, Indonesia. Journal of Physics: Conference Series, 1351(1): 012114. https://doi.org/10.1088/1742-6596/1351/1/012114
[48] Jacobson, M.A., Hajjar, R., Davis, E.J., Hoagland, S. (2021). Learning from tribal leadership and the anchor forest concept for implementing cross-boundary forest management. Journal of Forestry. https://doi.org/10.1093/jofore/fvab031
[49] Manda, S., Tallontire, A., Dougill, A.J. (2020). Outgrower schemes and sugar value-chains in Zambia: Rethinking determinants of rural inclusion and exclusion. World Development, 129(104877). https://doi.org/10.1016/j.worlddev.2020.104877
[50] Narh, P. (2019). Sustainability outcomes of teak plantation development in Dormaa, Ghana. Environmental Development, 29: 44-54. https://doi.org/10.1016/j.envdev.2018.12.002
[51] Irianti, M., Nasrul, B., Syahza, A. (2020). Erosion control in sustainable plantation development efforts in Siak watershed region, Riau Province, Indonesia. Asian Journal of Scientific Research, 13(4): 259-269. http://doi.org/10.3923/ajsr.2020.259.269
[52] Widiati, W., Mulyadi, A., Syahza, A., Mubarak, M. (2020). Analysis of plantation management achievement

based on sustainable development. International Journal of Sustainable Development and Planning, 15(4): 575-584. https://doi.org/10.18280/ijsdp.150418
[53] Syahza, A., Asmit, B. (2019). Regional economic empowerment through oil palm economic institutional development. Management of Environmental Quality, 30(6): 1256-1278. https://doi.org/10.1108/MEQ-02-2018-0036