

# Impact of Social Forestry Licensing Policy: Community Plantation Forest for Charcoal Production in the Mangrove Ecosystem of Karimun Regency, Kepulauan Riau Province

## *Dampak Kebijakan Pemberian Izin Perhutanan Sosial Hutan Tanaman Rakyat untuk Produksi Arang pada Ekosistem Mangrove Kabupaten Karimun Provinsi Kepulauan Riau*

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### Abstract

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This research analyses the suitability of permits for using mangrove wood in Karimun Regency for charcoal making, which has been going on for a long time. This charcoal was traded for local and foreign needs even before Indonesian Independence. However, it was only in 2010 that the official IUPHHK-HTR permit was enacted to regulate this activity. This study aims to analyze the suitability of forest area functions in community plantation forest permit areas based on the provisions of forestry laws and regulations, calculate the area of degraded/deforested as well as reforested forest cover using satellite image interpretation results, and identify institutions involved in processing mangrove wood into charcoal. The results showed that 59.55% of the forest area followed the permit, but there was deforestation of 802.29 ha (27%) and degradation of 72.53 ha (32.44%). On the other hand, reforestation efforts of 1,446.32 hectares were also carried out. This research was conducted using normative or doctrinal legal and overlay methods. The methods used in this research consist of normative or doctrinal legal research methods and overlay methods. Normative legal research focuses on the scope of legal conceptions, legal principles, and legal rules governing the suitability of forest area functions and granting social forestry licenses for community plantation forests. At the same time, the overlay method combines information from various maps. Various parties are involved in mangrove charcoal management, ranging from the Ministry of Environment and Forestry, Kepulauan Riau Provincial Government, Karimun Regency Government, and Wana Jaya Karimun Cooperative to 30 business license holders and charcoal collectors. This research recommends evaluating mangrove IUPHHK-HTR policies to ensure forest sustainability and balance between utilization and sustainability.

**Keywords:** Policy, Mangroves, Deforestation, Charcoal

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### Abstrak

Penelitian ini menganalisis kesesuaian izin pemanfaatan kayu mangrove di Kabupaten Karimun untuk pembuatan arang telah berlangsung sejak lama bahkan sebelum Kemerdekaan Indonesia, arang ini diperjualbelikan untuk kebutuhan lokal hingga mancanegara. Namun, baru tahun 2010 izin resmi IUPHHK-HTR diberlakukan untuk mengatur kegiatan ini. Penelitian ini bertujuan untuk menganalisis kesesuaian fungsi kawasan hutan pada areal izin

hutan tanaman rakyat berdasarkan ketentuan peraturan perundangan bidang kehutanan, menghitung luas tutupan hutan terdegradasi/terdeforestasi sekaligus tereforestasi menggunakan hasil penafsiran citra satelit serta mengidentifikasi lembaga yang terlibat dalam mengolah kayu jenis mangrove menjadi arang. Hasilnya menunjukkan bahwa 59,55% kawasan hutan sesuai dengan izin, namun terjadi deforestasi seluas 802,29 hektar (27%) dan degradasi 72,53 hektar (32,44%). Di sisi lain, upaya reforestasi seluas 1.446,32 hektar juga dilakukan. Berbagai pihak terlibat dalam pengelolaan arang mangrove ini, mulai dari Kementerian LHK, Pemprov Kepri, Pemda Kab. Karimun, Koperasi Wana Jaya Karimun, hingga 30 pemegang izin usaha dan penampung arang. Penelitian ini merekomendasikan evaluasi kebijakan IUPHHK-HTR mangrove untuk memastikan kelestarian hutan dan keseimbangan antara pemanfaatan dan kelestarian

**Kata kunci:** Kebijakan, Mangrove, Deforestasi, Arang

## 1. Introduction

Making charcoal from mangrove wood utilizes mangrove ecosystem resources in the Riau Islands Province. Data from the Department of Environment and Forestry shows that a permit or approval for reserve areas for mangrove wood utilization was granted by the Minister of Forestry in 2010 for the Mangrove Lestari Lingga Cooperative in Lingga Regency, covering an area of 12,195 ha (Pemkab Lingga, 2012) and Wana Jaya Karimun Cooperative in Karimun Regency, covering an area of 9,335 ha (Pemkab Karimun, 2010). Based on the Decree, the Regent of Karimun and the Regent of Lingga, on behalf of the Minister of Forestry, granted an IUPHHK-HTR to Wana Jaya Karimun Cooperative in 2010 (Koperasi Wana Jaya Karimun, 2022) and to the Mangrove Lestari Lingga Cooperative in 2012. Mangrove HTR management in Karimun Regency is carried out traditionally and involves local wisdom (Wulandari, 2019).

President Jokowi had invited G20 country leaders to plant mangroves to maintain mangrove areas as a commitment to environmental conservation. Jokowi also targets rehabilitating 600,000 ha of mangrove land to be completed by the end of 2024 by disbursing a budget of more than Rp 1 trillion (Kompas, 2021). Furthermore, Commission IV of the House of Representatives also conducted an unannounced inspection in early 2023 in the Jembatan 5 Bareleng, Batam City, where a warehouse was found containing piles of charcoal that had been packaged and ready for export. As a result of these activities, KLHK investigators have installed a police line so that the warehouse can no longer operate until the legal process is completed.

The resources of mangrove ecosystems are recognized for the environment and the benefit of the surrounding communities (Prasetyo et al., 2016). In addition to ecological functions, mangrove forests have economic and social functions, such as producing firewood (Majid et al., 2016). Over-utilization of mangrove ecosystem resources will have unfavorable impacts in the long term (Indrayanti et al., 2015). One of the negative impacts of excessive mangrove utilization is the reduction in the area of mangrove ecosystems as one of the carbon dioxide sink (Manuri et al., 2011). Kauffman & Donato (2012) stated that mangroves can store 3 (three) times more carbon than other forests.

Remote sensing is collecting information about objects and their environment from a distance without physical contact (Hanindito et al., 2014). Usually, this technique produces several forms of images that are further processed and interpreted to produce valuable data for applications in agriculture, archaeology, forestry, geography, geology, planning, and other fields. Land cover changes due to the activities of IUPHHK-HTR Koperasi Wana Jaya Karimun can be known by comparing the results of satellite image interpretation of 2009 and 2022 coverage. Change detection with remote sensing technology is applied by comparing multi-temporal images within a certain time using specific change detection algorithms. Land cover change analysis requires repetitive data collection, remote sensing imagery derived from Enhanced Thematic Mapper/Thematic Mapper (ETM/TM), Satellite Probatoire observation de la Terre (SPOT), radar and Advanced Very High-Resolution Radiometer (AVHRR) have been the primary data sources for analysis in recent decades (Lu et al., 2004). This research aims to provide advice and input to the government on the sustainability of logging licenses for mangrove wood species.

## 2. Material and Method

### 2.1. Time and Place

This research location is in Karimun Regency, Kepulauan Riau Province. The location studied is the social forestry permit area of the Karimun Wanajaya Cooperative Community Plantation Forest and the Forest Product

Utilisation Business Permit (PBPHH), formerly known as the Forest Product Primary Industry Business Permit (IUIPHH), which processes mangrove wood into charcoal in Karimun Regency. The study was conducted from February to April 2024 in the Kepulauan Riau Province.

## 2.2. Methods

The methods used in this research consist of normative or doctrinal legal research methods and overlay methods. Normative legal research is focused on the scope of legal conceptions, legal principles, and legal rules governing the suitability of forest area functions with the granting of social forestry licenses for community plantation forests. This is done because the laws and regulations can be considered an objective analytical knife with no tendency towards the research object. The overlay method is an information system that uses images formed by combining various maps. The map overlay is conducted on at least 2 (two) maps to create a new polygon intended as research analysis material.

## 2.3. Procedures

This research was conducted by collecting secondary data and interviewing key informants. Secondary data required for this research was sourced from the Kepulauan Riau Provincial Environment and Forestry Service, the Tanjungpinang Region XII Forest Area Consolidation Centre, the Sei Jang Duriangkang Watershed Management Centre, and websites providing laws and regulations related to the research. The materials used in this research are in the form of a Decree along with the attachment of the latest Riau Islands Province Forest Area Map, data on the Social Forestry permit of the Wanajaya Karimun Cooperative, the results of the interpretation of satellite imagery coverage in 2009 and 2022 in the Social Forestry Permit area, mangrove density maps in the Social Forestry Permit area, Decree on the granting of Forest Product Utilization Business Licenses or Decree on Forest Product Primary Industry Business License for processing mangrove wood into charcoal in Karimun Regency and laws and regulations in the forestry sector that regulate the use of mangroves into charcoal. Meanwhile, the tools used to support the research process are computer devices with the QGIS application. Recording devices for in-person interviews, smartphone communication media, stationery, and printing equipment.

## 2.4. Data Analysis

This study uses several data analysis techniques to ensure the accuracy and reliability of research instruments and test the relationship between existing variables. The methods used include basic spatial tests and advanced spatial overlays.

# 3. Result and Discussion

The overlay between the attachment map of the Karimun Regent Decree Number 192 dated 4 November 2010 concerning the Granting of a Business Permit for Utilisation of Timber Forest Products in Community Plantation Forests in Plantation Forests to the Wana Jaya Karimun Cooperative in Karimun Regency (Penkab Karimun, 2010) with a map of the forest area of Riau Islands Province updated in 2023 obtained from the Forest Area Stabilisation Centre Region XII of the Ministry of Environment and Forestry. Based on a review of the HTR permit map attachment, it was found that the forest area map used as the basis for the issuance of HTR permits is a map attached to the Minister of Forestry Decree Number 173/Kpts-II/1986 dated 6 June 1986 concerning the Designation of Forest Areas in the Riau Province as Forest Areas, where all HTR areas in the decision are in forest areas with production functions, namely limited production forests, production forests and convertible production forests. However, to date, the forest area in the HTR license area has undergone many changes in function and designation, as described in Figure 1.

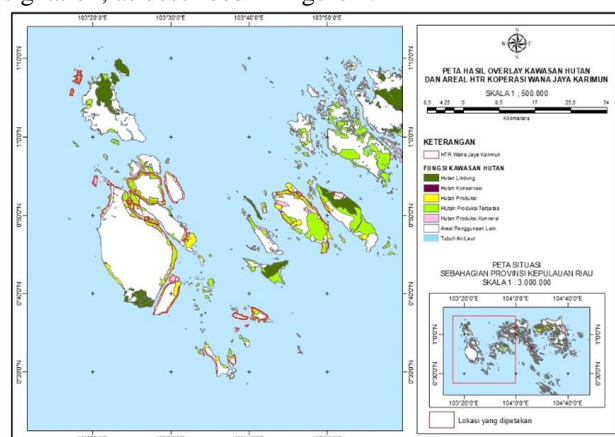


Figure 1. Overlay map of forest area and HTR area of Wana Jaya Karimun cooperative

Based on the Regulation of the Minister of Environment and Forestry Number 9 of 2021 concerning Social Forestry Management, it is stated that Community Plantation Forest, in the future abbreviated as HTR, is a plantation forest in production forests developed by community groups to increase the potential and quality of production forests by applying a silviculture system to ensure the sustainability of forest resources (Kementerian Lingkungan Hidup dan Kehutanan, 2021). Furthermore, from the total area, HTR management is given a maximum of 5,000 ha per management unit and 15 ha for each family head. Furthermore, in the Regulation of the Minister of Environment and Forestry Number 7 of 2021 concerning Forestry Planning, Changes in Forest Area Designation and Changes in Forest Area Function, and Use of Forest Areas, it is stated that production forests are forest areas that have the primary function of producing forest products in the form of timber and non-timber (MenLH, 2021). Regulation of the Minister of Environment and Forestry No. 8 of 2021 on Forest Planning and Preparation of Forest Management Plans, as well as Forest Utilisation in Protected Forests and Production Forests has regulated that the utilization of timber forest products is an activity to utilize and cultivate forest products in the form of timber without damaging the environment and not reducing its primary function (Kementerian Lingkungan Hidup dan Kehutanan, 2021).

Taking into account the provisions of the laws and regulations as mentioned above, the appropriate forest area function in the community plantation forest social forestry management area on behalf of the Wanajaya Karimun Cooperative is a forest area with a production function of  $\pm 5,556.52$  ha consisting of  $\pm 21.28$  ha of production forest area,  $\pm 4,979.39$  ha of limited production forest area and  $\pm 555.85$  ha of convertible production forest area. Then, remember that the utilized area is mangrove vegetation that can be utilized without damaging the environment, with a maximum area of 5,000 ha per management unit. In addition, there is also the function of limited production forest areas, which are managed more conservatively. However, the legislation no longer distinguishes between limited and production forest areas.

The results of the area calculation also show a difference between the Decree granting HTR licenses and the area calculated using the Geographic Information System tool. Karimun Regent Decree No. 192/2010, dated 4 November 2010, stipulates that the area licensed is 9,335 hectares (Pemkab Karimun, 2010). According to the results of spatial calculations using Q-GIS, the HTR area is 9,331.47 hectares. The difference of  $\pm 3.53$  hectares is thought to be due to differences in the coastline of the base map used in making the HTR area map before the One Map policy issued by the Geospatial Information Agency (GIA).

Data from the interpretation of satellite imagery coverage in 2009 shows that not all land cover in the HTR area is mangrove vegetation. Of the total HTR area of  $\pm 9,331.4$  ha, the area with mangrove vegetation is only  $\pm 2,846.3$  ha, consisting of a primary mangrove forest of  $\pm 223.6$  ha and a secondary mangrove forest of  $\pm 2,622.7$  ha. The distribution of land cover can be seen in the following Figure 2.

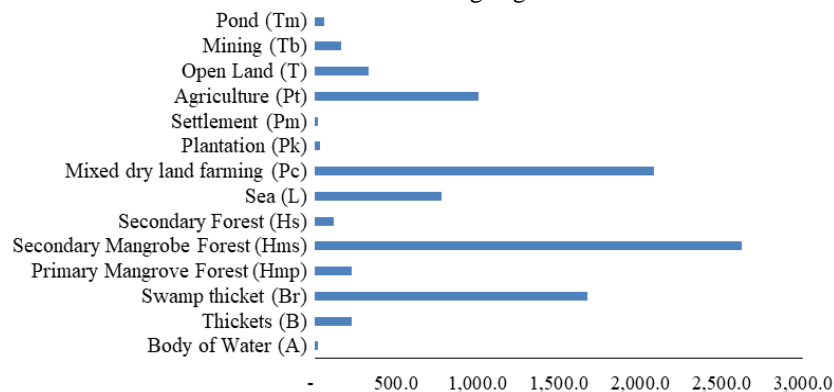


Figure 2. Classification of land cover in the area of 'people's plantation forest' of Wana Jaya Karimun Cooperative from the interpretation of satellite imagery coverage in 2009

In addition to mangrove vegetation, forested areas covered an area of  $\pm 115.7$  hectares with a land cover type of secondary dryland forest (Hs). However, holders of primary industry business permits in the Karimun Regency do not utilize wood in secondary dryland forests as raw material. Another land cover type that has the potential to be planted with mangrove species is swamp scrub (Br), with an area of  $\pm 1,676$  hectares. Other land cover types that have not been planted with mangrove species as raw material for charcoal consist of water body (A), scrub (B), sea (L), mixed dryland farming (Pc), plantation (Pk), settlement (Pm), dryland farming (Pc), open land (T), mining (Tb) and ponds (Tm). Community Plantation Forest is essentially a license granted by the government to individuals or community groups living in or around forest areas. By being given access to managed forest areas, communities are expected to improve the condition of unproductive forest areas by planting trees to be utilized sustainably following their functions. This follows the Minister of Environment and Forestry Regulation Number 9 of 2021 concerning Social Forestry Management.

Table 1. Results of land cover intersect in 2009 and 2022

	2022															Grand Total (Ha)	
	PL	A	B	Br	Hmp	Hms	Hrs	Hs	L	Pc	Pk	Pm	Pt	T	Tb		Tm
2009	A		0,0			5,9			9,0			0,3		0,0			15,2
	B		116,4		2,0	30,6			26,0	26,5	7,9	12,7					222,3
	Br		66,9	315,8		545,1	132,5	71,4	19,0	270,8	218,4	12,6		17,9	5,6		1.676,0
	Hmp		11,4	1,4	97,7	72,5	0,0		9,0	8,1		11,4	12,2	0,0			223,6
	Hms		26,0	163,2	60,2	1.818,5	-	1,3	9,0	296,5	116,9	54,1		77,0			2.622,7
	Hs					7,1		102,3	4,5					1,8			115,7
	L		-	0,3	0,0	0,1			776,1	0,2			0,3			0,0	777,0
	Pc	16,1	98,7	37,4		203,4	5,1	103,2	1,6	1.432,6	40,1	125,6		13,1	5,0		2.081,8
	Pk			3,2						10,1	8,4			8,8			30,5
	Pm											15,7					15,7
	Pt	22,8	98,4	32,1		225,8		19,6	5,5	411,0		61,7	103,3	18,4		5,0	1.003,6
	T	16,3	19,6	10,9		61,5			7,2	142,0	-	46,8		18,0	5,2		327,5
	Tb	0,1	33,9	4,6	1,7	10,1		10,6	5,6					14,2	82,5		163,1
	Tm					17,7						21,1					56,9
Grand Total (Ha)	55,2	471,3	568,7	161,5	2.998,3	137,7	308,5	872,5	2.597,9	391,7	362,2	115,5	169,2	98,4	23,1	9.331,4	

Table 1 shows the land cover changes resulting from the interpretation of satellite imagery of 2009 and 2022 coverage. Deforestation, degradation, and reforestation were calculated by classifying each land cover into forested and non-forested categories. Forested land cover in this study consists of Hmp, Hms, Hs, and Hrs. Meanwhile, non-forested land cover consists of A, B, Br, L, Pc, Pk, Pm, Pt, T, Tb, and Tm.

Based on the Regulation of the Director General of Forestry Planning Number P.1/VII-IPSDH/2015 on Guidelines for Land Cover Monitoring, the interpretation of satellite imagery at the Ministry of Environment and Forestry is divided into 23 land cover classes. However, because there are differences in the coastline of the HTR license area, the area in the sea is referred to as L. The results of satellite image interpretation show that HTR land cover in 2009 consisted of 14 classes, and land cover in 2022 consisted of 15 classes.

Deforestation is defined as the permanent conversion of forest to another land cover. Factors that cause deforestation include agricultural conversion, forest fires, timber harvesting, and firewood use (Ahmed & Glaser, 2016). The sustainability of mangrove forests is threatened due to human activities that use environmentally unfriendly materials. It is known that mangroves are a place of life and a source of food for several types of animals in general, such as galah shrimp, bajang shrimp, and so on, as well as several other types of fish of high economic value that can be caught by local fishermen (Ismail & Habibah, 2023). Local communities that work as fishermen also depend on their families' livelihoods from natural resources, such as small fish and shrimp fishermen who live around mangrove forests, if mangrove deforestation continues. Of course, this will also affect the sustainability of fishermen's livelihoods in the future (Khodijah, 2014).

In this study, deforestation is the phenomenon of changing forested land cover to non-forested. From the interpretation data, it is known that in the HTR area with a forested land cover of 2,961.89 ha consisting of Hmp covering 223.57 ha, Hms covering 2,622.67 ha, and Hs covering 115.65 ha, deforestation has occurred by 802.29 ha or 27%. The most deforestation occurred in the Hms land cover of 742.64 ha (25.07%). Meanwhile, it is not too significant for Hmp and Hs land cover, namely Hmp covering 53.39 ha (1.80%) and Hs covering 1.81 ha (0.21%). The distribution of deforestation is presented in Figure 3.

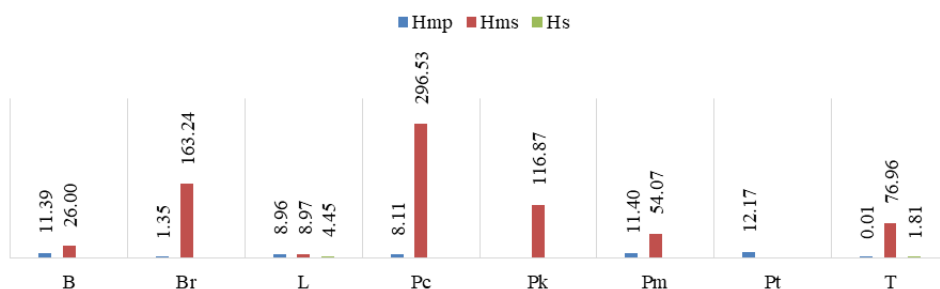


Figure 3. Deforestation distribution in the Wana Jaya Karimun HTR area

Figure 3 shows that the highest deforestation rate occurred in the land cover of Hms to Pc, Br, and Pk, with a contribution of 296.53 ha, 163.24 ha, and 116.87 ha, respectively. Based on interviews with the community and HTR license holders, the change in land cover is due to the condition of the forest area in the license area is not clean and clear/many overlapping land tenures, making it difficult to carry out planting activities in the area.

Forest degradation is a condition where there is a decrease in the quality of forested land cover, resulting in reduced flora and fauna diversity in the area. In this study, forest degradation occurs if there is a decrease in the class of forested land cover from primary to secondary. The results of the geographic information system analysis show that in the HTR area with a land cover of Hmp covering an area of 223.6 ha in 2009, forest



degradation occurred in 2022, covering an area of 72.53 ha or 32.44% with details changing to Hms covering 72.49 ha and Hrs covering 0.04 ha.

To save the existence of primary natural forests and peatlands and to continue efforts to reduce emissions from deforestation and forest degradation, the President of the Republic of Indonesia has issued Instruction Number 5 of 2019 concerning the Termination of the Granting of New Licences and Improving the Governance of Primary Natural Forests and Peatlands (Pemerintah Republik Indonesia, 2019). Furthermore, based on the Instructions, the Minister of Environment and Forestry has issued a decree granting new licenses in primary forest and peatland areas. The Decree has been amended several times, most recently by Decree No. SK.12764/MENLHK-PKTL/IPSDH/PLA.1/11/2023 on the Determination of Indicative Maps for the Cessation of Granting Business Licences, Approval for the Use of Forest Areas, or Changes in the Designation of New Forest Areas in Primary Natural Forests and Peatlands in 2023 Period II (Kementerian Lingkungan Hidup dan Kehutanan, 2021). Given that the HTR area contains primary forest cover, logging should no longer be carried out because it contradicts the Presidential Instruction and the Minister of Environment and Forestry Decree.

Reforestation is an activity carried out to build or improve the condition of damaged forests. This activity is carried out through planting or protection so that the environment is again forested and plays a role according to its function. Mangrove sustainability is maintained because it is influenced by traditional ecological knowledge. Besides that, local institutions and local communities (multi-stakeholders) must be involved in managing and preserving natural resources (Habibah et al., 2023). It was found that reforestation occurred; namely, there was a change in the land cover class of coverage in 2009 from non-forested to forest in 2022.

Table 2. Reforestation in the HTR area of Wana Jaya Cooperative Karimun

		2022				
2009	PL	Hmp	Hms	Hrs	Hs	Grand Total (Ha)
	A		5,93			5,93
	B	1,97	30,61			32,58
	Br		545,05	132,54	71,39	748,98
	L	0,03	0,09			0,12
	Pc		203,41	5,08	103,22	311,71
	Pt		225,81		19,62	245,43
	T		61,46			61,46
	Tb	1,65	10,12		10,61	22,38
	Tm		17,73			17,73
	<b>Grand Total (Ha)</b>	<b>3,65</b>	<b>1.100,21</b>	<b>137,62</b>	<b>204,84</b>	<b>1.446,32</b>

Table 2 shows that in the HTR area, there has been reforestation of 1,446.32 ha, with details of non-forested areas becoming Hmp of 3.65 ha (0.25%), Hms of 1,100.21 ha (76.07%), Hrs of 137.62 ha (9.52%) and Hs of 204.84 ha (14.16%). The largest land cover contribution to reforestation was in the Br cover (51.79%), followed by Pc (21.55%) and Pt (16.97%). In comparison, the contribution of non-forested to forested cover was dominated by Br at 37.69% (545.05 ha), followed by Pt at 15.61% (225.81 ha) and Pc at 14.06% (203.41 ha). The occurrence of reforestation is caused by the protection and planting carried out by the Wana Jaya Karimun Cooperative, where in its annual work plan document, permit holders are required to protect the HTR permit area and carry out planting. This is also corroborated by the statement of the head of the Cooperative during the interview.

Based on the Minister of Environment and Forestry Regulation No. 9 of 2021 on social forestry management, it is stated that every social forestry license holder of community plantation forest management must prepare an Annual Work Plan document that is assessed and endorsed by the Head of the local Forest Management Unit (Kementerian Lingkungan Hidup dan Kehutanan, 2021). Based on interviews with members of the Wana Jaya Karimun Cooperative and inspection of the 2022 RKT document, it is known that timber forest product utilization activities are carried out selectively and maintain local wisdom in the form of thutilizationon of branches and trubusan with a diameter of  $\geq 10$ cm (assuming a shrinkage of 2 cm without skin) which are collected and harvested from secondary mangrove stands. The management of the HTR area is divided into five districts/working areas as the smallest management unit is responsible for planning, land preparation, nursery, planting, maintenance, production of branches or trubusan, marking/measuring, timber testing, administration of forest products, circulation and marketing as well as protection and security of the working area. These activities are carried out by 33 members of the cooperative, 8 of whom are administrators and 25 of whom are members.

The Forest Products Administration manages mangrove timber collected or harvested, and the forest resources provision and reforestation fund are paid. The wood is then transported to the location of the forest product primary industry business permit, the charcoal kitchen, a place to burn wood into charcoal. The transported timber has a Certificate of Legality of Forest Products - Logs (SKSHH-KB). Based on data from the Riau Islands Provincial Office of Environment and Forestry and interviews with IUIPHH holders, there were 30 charcoal panglongs in 2022 the Karimun Regency area. 1 (one) panglong employs a minimum of 9 (nine) people and a maximum of 55 (fifty-five) people. These workers consist of male and female workers. For

example, a charcoal kitchen in the name of Mui Sai following the Decree of the Head of the Karimun Regency Agriculture and Forestry Service Number SK-522/DISTANHUT/IUIPHHK/X/2012/030 concerning Granting a Timber Forest Products Primary Industry Business Permit to Mr. Mui Sai in Karimun Regency, Kepulauan Riau Province, which employs nine workers consisting of 6 men and three women or a charcoal kitchen in the name of Sui Ngie Al Sugijo following the Decree of the Head of the Karimun Regency Agriculture and Forestry Service Number: SK-522/DISTANHUT/IUIPHHK/X/ 2012/027 concerning Granting a Timber Forest Products Primary Industry Business Permit to Mr. Sui Ngie Al Sugijo in Karimun Regency, Kepulauan Riau Province, which employs 55 people consisting of 35 men and 20 women.

Charcoal from burning mangrove wood is transported to the charcoal warehouse before 2021, called the Registered Storage of Processed Wood (TPT-KO). The charcoal is transported using water to the charcoal warehouse on Rempang Island, Batam City, equipped with a processed wood transport note issued by the IUIPHH holder. The charcoal warehouse then conducts marketing activities for local needs and exports to several countries. The institutions involved in the logging process to export are presented in Figure 4.



Figure 4. Institutions involved in mangrove charcoal exploitation in Karimun Regency

## 4. Conclusions

Based on the overall results of the above study, it can be concluded as follows: the appropriate forest area functions cover approximately 59.55% of the total licensed area. Deforestation affects about 802.29 ha, representing 27% of the total forested area. In 2022, forest degradation impacted 72.53 ha (32.44%), while reforestation efforts covered around 1,446.32 ha. Based on satellite imagery interpretation, forested land cover in 2009 was only about 2,961.89 ha (31.74%) of the total HTR area. This consisted of Hmp covering approximately 223.57 ha, Hms covering about 2,622.67 ha, and Hs covering around 115.65 ha. Comparing the land cover from 2009 to 2022 reveals a deforestation rate of roughly 802.29 ha or 27% of the total forested area. Additionally, the Hmp area of approximately 223.6 ha in 2009 experienced degradation in 2022, affecting 72.53 ha (32.44%), with details showing changes to Hms of around 72.49 ha and Hrs of about 0.04 ha. Reforestation efforts in the HTR area covered approximately 1,446.32 ha. The Wana Jaya Karimun HTR management involves several institutions, including the Ministry of Environment and Forestry, Kepulauan Riau Provincial Government, Karimun Regency Government, Wana Jaya Karimun Cooperative, 30 forest product primary industry business license holders, and Private Legal Entities responsible for collecting charcoal stored in warehouses and marketed for local or foreign needs.

## 5. Suggestion

To ensure the long-term sustainability of mangrove forests and achieve a balance between utilization and conservation, a comprehensive evaluation of the mangrove IUPHHK-HTR policy is crucial. Additionally, periodic environmental impact assessments of charcoal production businesses that rely on forest products are necessary to monitor and mitigate potential adverse effects on the environment and local communities.

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