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# IMPACT INVESTING IN SAGO FOR SUSTAINABLE PEATLAND MANAGEMENT





# TABLE OF CONTENTS

<b>Introduction</b>	<b>2</b>	Sago Palm Development in Siak District	14
Peatlands in Indonesia	3	The Winrock Case	18
Sago Palm: A Sustainable Solution for Food Security and Peat Conservation in Indonesia	4	Several Important Lessons Emerge to Bring This Vision to Reality	21
Opportunities to Address National Food Security Challenges	10	<b>Lessons Learned</b>	<b>22</b>
<b>Sago Investment Opportunities in Siak District</b>	<b>11</b>	<b>Conclusion</b>	<b>23</b>
Siak District in Brief	11	<b>References</b>	<b>24</b>
Siak District Peatland Condition	13		

# INTRODUCTION



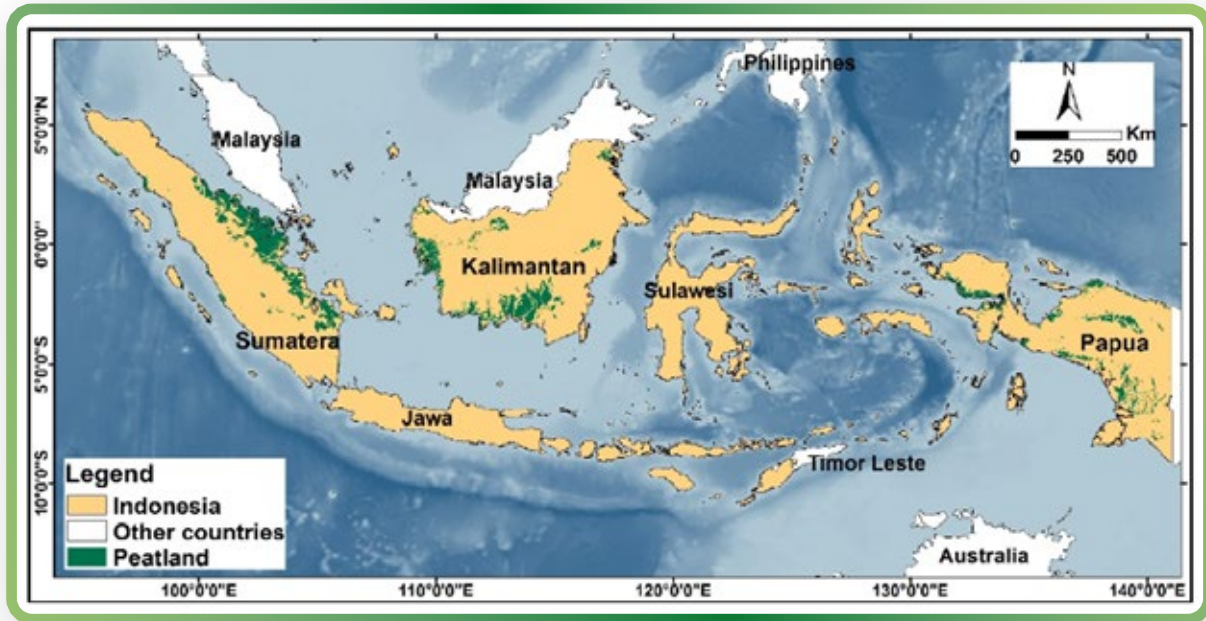
**Peatlands, also known as fens or bogs in Western countries and referred to as “lahan gambut” in Indonesia, are a distinctive type of wetland that constitutes approximately half of the world’s wetland areas.**

They can be found on every continent except Antarctica (Winrock International, A). In total, the world’s peatland ecosystem covers an area of 398 million hectares, about 34 to 45 million hectares of which is in tropical climates, with roughly 56.6% (25 million hectares) located in South East Asian countries (Yuwati, 2021).

These waterlogged ecosystems, rich in organic matter, began forming around 12,000 years ago, shortly after the last ice age. The constant saturation of the soil slows down the decomposition of deceased plants, transforming them into a dense, dark-coloured, and malleable substance known as peat, which effectively stores the carbon that the plants had previously absorbed (Winrock International, B).

However, these valuable and diverse habitats are rapidly vanishing. The conversion of land for urbanization and agriculture has led to the drainage and ditching of approximately 15% of the world’s existing peat deposits. As a result, vast amounts of carbon that would otherwise remain securely sequestered are being released into the atmosphere (Winrock International, B).

# PEATLANDS IN INDONESIA



**Figure 1. Indonesia's Peatland Distribution**

(Source: Yuwati, 2021)

**In Indonesia, Peatland covers an area of about 13.4 to 14.9 million hectares, mainly in the islands of Sumatra (5.85 million hectares), Kalimantan (4.54 million hectares), Papua (3.01 million hectares, and Sulawesi (0.03 million hectares) (KLHK, 2020).**

In recent decades, Indonesia has also experienced a significant increase in the destruction of its peatlands, leading to the release of carbon and exacerbating the risks of floods and fires. As illustration, in its Strategic Plan 2021-2024 document, the Peatland and Mangrove Restoration Agency of Republic of Indonesia or Badan Restorasi Gambut dan Mangrove Republik Indonesia (BRGM) reported that between 2016 to 2020, fire devastated a total of 706,284 hectares of peatland in Indonesia's 7 provinces: Riau, Jambi, South Sumatra in the Sumatra Island; West Kalimantan, Central Kalimantan and South Kalimantan in the Kalimantan Island and the Papua province (Badan Restorasi Gambut dan Mangrove, 2021).

This destruction occurs as peatlands are converted for economically viable purposes such as palm oil, acacia wood, and rubber tree plantations. As a result, Indonesia is faced with the challenging task of striking a balance between economic development and the environmental consequences of degradation, all while striving to fulfil its commitment under the Paris Agreement to reduce greenhouse gas (GHG) emissions by 29% by 2030 with own efforts and 41% by 2030 with international support (Winrock International, B). This commitment has even been increased by the Ministry of Environment and Forestry (KLHK) on September 23, 2022 that published an Enhanced NDC to reduce greenhouse gas (GHG) emissions by 31.89% by 2030 with own efforts and 43.20% by 2030 with international support.

To face the mass destruction of its peatlands, Indonesia has the choice of either restoring the peatlands through rewetting and finding alternative production systems that are tolerant of wetland conditions or continuing with current practices until both the ecosystem and the socioeconomic systems it supports collapse. The situation is complex, but local and national governments now recognize the urgent need to explore alternatives to current peatland management. The crucial question arises: Can these peatlands be successfully rewetted and restored while also preserving the local economy and protecting the remaining wetland forests? The answer to this question holds immense significance for the future of Indonesia's peatland, which accounts for a staggering 36 per cent of the world's tropical peatland (Netzer, 2020).

## SAGO PALM:

### A Sustainable Solution for Food Security and Peat Conservation

The sago-based food industry holds great potential for maintaining the carbon storage capacity of peatlands in Indonesia while providing economic alternatives to drainage-based agriculture through the cultivation of peat-friendly commodities.

Based on the directives of the Government of Indonesia (Food Security Agency, 2020) that increasing sago consumption will be focused on sago-producing provinces, namely Riau, Riau Islands, Sulawesi Southeast, South Sulawesi, Maluku, Papua and West Papua.

The need for increased consumption can be met through intensification with a productivity target of 5 tonnes/ha and expansion limited planting area in Riau province.

Sago palm, scientifically known as *Metroxylon sagu*, is an endemic peat plant with significant cultural, economic, and ecological value. Indigenous to Southeast Asia, particularly Indonesia and Papua New Guinea, sago palms naturally thrive in peat forests without the need for drainage. Adapted to waterlogged conditions and well-suited for peat soil, sago palms can flourish in areas unsuitable for other crops. Unlike many other crops, sago cultivation does not require peatlands to be drained, offering an excellent opportunity to reduce carbon emissions from these carbon-rich soils (Boserren et al., 2021; Winrock International, A).





### Environmental Benefits

(Bintoro et al., 2018)

- Sago palm is endemic to and grows well in swampy areas and on marginal lands that may not be suitable for other types of crops. By utilizing these areas for sago cultivation, it can help reduce the pressure on primary forests and prevent deforestation.
- Sago palms can be sustainably cultivated without the need for excessive fertilizers or pesticides, making them a more eco-friendly option compared to certain other crops that require intensive agricultural practices.
- Sago palm trees are excellent carbon dioxide (CO<sub>2</sub>) absorbers. Through the process of photosynthesis, they capture and store carbon, helping to mitigate the impacts of greenhouse gas emissions and climate change.



### Social & Local Economy Benefits

(Forests and Climate Change, 2021)

- Sago cultivation and processing can generate employment opportunities for local communities, especially in rural areas where alternative job prospects might be limited. From sago farmers and harvesters to processing plant workers, the industry can create a diverse range of jobs.
- Sago cultivation and processing often involve small-scale and family-owned businesses. Supporting and strengthening these local enterprises can empower communities to take charge of their economic development.
- As sago-based industries grow, they create opportunities for local trade and market development. Processed sago products can be sold regionally, nationally, and even internationally, enhancing the local economy and promoting local entrepreneurship.



### Health Benefits

(Forests and Climate Change, 2021)

- Sago starch is naturally gluten-free, making it an excellent alternative for individuals with celiac disease or gluten sensitivity. It allows those with gluten-related disorders to enjoy a starchy and filling food without triggering adverse reactions.
- Sago has a relatively low glycemic index (GI) compared to some other starchy foods like rice or potatoes. Foods with a low GI are digested and absorbed more slowly, leading to a slower and more gradual rise in blood sugar levels. This can help diabetic patients manage their blood glucose levels more effectively.
- Sago starch is easily digestible, which can be beneficial for individuals with sensitive digestive systems or those recovering from gastrointestinal issues. It is often recommended as a light and easily digestible food during illness or for infants and elderly individuals.

**Figure 2. Benefits of Sago as Food Security for Environmental, Social, Local Economy, and Health**

**Table 1. CO<sub>2</sub> Absorption Rate by Crop Type**

(Source: Adewale et al., 2019)

Crops	Average Harvest per Year	Average Number of Effective Day Cycle	Day Length (Hour)	Photosynthesis CO <sub>2</sub> m <sup>-2</sup> h <sup>-1</sup> (mg)	CO <sub>2</sub> Absorption mt ha <sup>-1</sup> year <sup>1</sup>
Sago	1	365	12	22	289
Corn	2.5	45	13	80	216
Rice	2.5	45	14	30	81
Cassava	1	180	15	39	168
Sugar Cane	1	180	16	52	225
Sweet Potato	2	80	17	23	88

Sago offers numerous advantages over other staple crops commonly used in Indonesia. Depending on environmental conditions, sago palms can yield 25 to 40 tons of edible starch per hectare annually, surpassing the yield of rice paddy (the most common staple crop in Indonesia) by over six times. Sago palms take about 8-10 years to mature and after that production continue through natural regeneration. Further, since sago palm is a native to the peatland, they require very little maintenance or inputs like fertilizer, making it far less labor intensive and carbon emissions from agricultural practices than other crops. Compared to other crops, sago trees are superior carbon dioxide (CO<sub>2</sub>) absorbers, thereby helping to mitigate the impacts of greenhouse gas emissions and climate change.

Sago starch offers two significant health benefits compared to white rice. Firstly, it is high in dietary fibres, promoting a healthy gut environment and reducing constipation. Secondly, it has a low glycemic index (GI), making it suitable for individuals with diabetes and obesity (Boserren et al., 2021).

**Table 2. Resistant Starch Content by Crop Type**

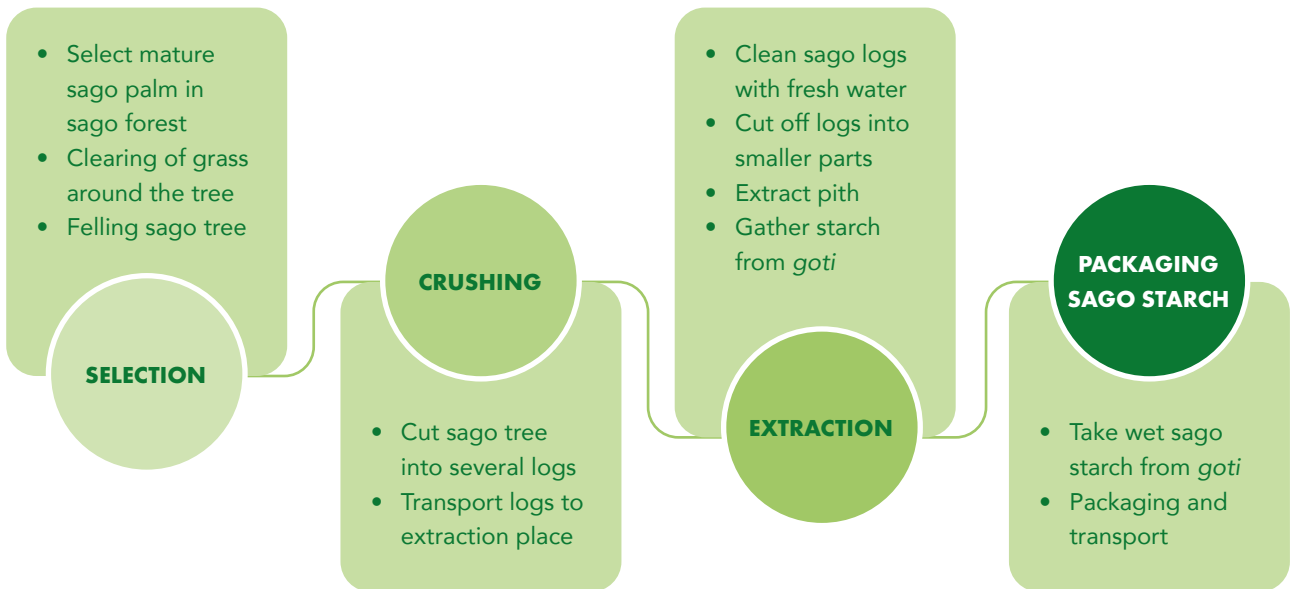
(Source: Dewayani et al., 2022)

Rice	2.72%
Sago	11.00%
Corn	1.16%
Sweet Potato	3.19%
Cassava	9.69%
Taro	4.12%

Another study reported that compared to other carbohydrate foods, sago also features higher Resistant Starch Content that can slow the absorption rate of glucose and lessen the chance of a postprandial increase of blood sugar.

Sago palms can be processed to produce a wide range of carbohydrate-rich, sago-based foods, providing ample opportunities to enhance the livelihoods of local communities residing in peatland areas. Extraction of sago from *Metroxylon* palms is simple using traditional technologies, by splitting the stem lengthwise and removing the pith which is then crushed and kneaded to release the starch before being washed and strained to extract the starch from the fibrous residue. The raw starch suspension in water is then collected in a settling container (Girsang, 2018).





**Figure 3. Stages Sago Tree into Sago Starch**

(Source: Girsang, 2018)

The primary product derived from sago palms is sago starch, obtained by grinding the pith and separating the starch from fibres and impurities. Sago starch, with its neutral taste, is commonly used as a thickening agent in various food products. It can also be processed and dried to produce sago flour, which finds applications in baking, such as bread, cakes, cookies, and pasta-like products like noodles and vermicelli.

Sago plays a vital role in traditional Indonesian dishes, including papeda (a staple in Papua) and sago congee (*bubur sago*), a popular dish made by cooking sago flour with water or coconut milk and sweetening it with palm sugar. Sago-based snacks like crackers and cookies are also widely consumed. The food industry in Indonesia has commercially produced and marketed a diverse range of sago-based products. Sago pearls (*mutiara sago*) are small, translucent balls made from sago starch and used in desserts, bubble tea, and other sweet treats. Instant sago powder and sago noodles are also popular for their convenience and easy preparation.



The traditional processing of sago starch (Shutterstock)

**Table 3. Indonesia's sago production by Province, 2015-2020**

(Source: Directorate General of Estate Crops, 2019)

No	Province	Production (Tons)					
		2015	2016	2017	2018	2019	2020
1	Riau	366,032	326,755	338,726	364,249	369,369	375,815
2	Papua	28,298	28,576	66,593	68,204	66,593	67,979
3	Maluku	9,683	9,370	8,134	8,157	8,927	9,113
4	South Kalimantan	3,836	4,150	4,130	4,045	4,173	4,229
5	South East Sulawesi	4,759	2,765	2,600	2,710	2,651	2,653
6	South Sulawesi	2,650	3,069	3,073	3,136	2,964	3,026
7	Riau Islands	3,314	3,540	3,571	3,364	1,492	1,523
8	Aceh	1,359	1,287	1,711	1,746	1,745	1,781
9	West Papua	1,520	1,520	1,520	1,657	1,571	1,604
10	Others	2,585	2,581	2,856	6,274	6,010	6,142

If seen in Table 4, the biggest production of Sago in Indonesia is in Riau Province, this is because the people of Riau have long used sago as an alternative source of carbohydrates, to be processed into a variety of traditional foods, such as sepolet, gedegob, jalab bread, rice cake and sago cendol (<https://pilarpertanian.com/sagu-riau-menapadunia>).

Riau Province is the largest producer of Sago in Indonesia, given that sago has long been considered as an important alternative source of carbohydrates by people in this province, processed into a variety of traditional foods, such as sepolet, gedegob, jalab bread, rice cake and sago cendol

(<https://pilarpertanian.com/sagu-riau-menapadunia>). Sago starch from the Riau province also serves other domestic market in Indonesia, with Java island as the main market. Dried sago from Riau is distributed to Cirebon, Java for further processing. Other important sago suppliers, Sulawesi followed by Maluku and provinces in Papua island, mostly serve customers in the Java island (Trisia et al., 2021).

As the middle class segment in Indonesia continues to rise, with a heightened focus on health, there is an anticipated increase in the demand for healthy food in the upcoming years. This will consequently also drive domestic demand for sago-based foods among Indonesian customers.



**Table 4. Distribution of Sago Stands by Country**

(Source: Konuma, 2018)

Country	Wild Stands	(Semi-) Cultivated Stands	Grand Total
Papua New Guinea	1,000,000	20,000	1,020,000
Indonesia	1,250,000	148,000	1,398,000
Malaysia	-	45,000	45,000
Thailand	-	3,000	3,000
Philippines	-	3,000	3,000
Other Countries	-	5,000	5,000
<b>TOTAL</b>	<b>2,250,000</b>	<b>224,000</b>	<b>2,474,000</b>

As a country with the largest sago agriculture land area in the world, Indonesia holds the potential to become the leading exporter of sagobased products. While sago is primarily consumed in Southeast Asian countries and is considered as relatively niche compared to other commodities, it promises the potential for broader market expansion.

Being naturally gluten-free, sago can cater to the rising demand for alternative gluten-free and plant-based diets worldwide. Further, there is a growing interest in traditional and indigenous ingredients among global customers and sago can attract customers looking for unique and authentic flavors.

However, despite growing demands from the export market, Indonesia's export performance has been inconsistent and fluctuated, largely due to a lack of reliable large-scale supply (Rivai et al., 2021).

As a result, we saw a trade balance deficit in 2012-2014 and 2018-2019. This calls for a more serious effort, among others through the introduction of policies to drive Indonesia's export performance, generate a positive impact on the country's economy and cement Indonesia's position as the world's largest exporter of sago commodities.

**Table 5. Indonesia's Sago Starch Export Volume and Value, 2010-2021**

(Source: Directorate General of Estate Crops, Ministry of Agriculture Republic of Indonesia, 2022)

Year	Export	
	Volume (Tons)	Value (000 US\$)
2010	4,195	1,494
2011	2,168	4,182
2012	5,257	1,013
2013	7,287	1,963
2014	9,001	3,236
2015	10,316	3,153
2016	7,711	2,672
2017	11,485	3,088
2018	12,908	3,216
2019	13,893	3,277
2020	13,175	2,861
2021	13,191	2,467

# OPPORTUNITIES TO ADDRESS NATIONAL FOOD SECURITY CHALLENGES

**Sago-based food products also present exciting opportunities to address Indonesia's national food security challenges.** As the fourth most populous country in the world, the Indonesian government faces the responsibility of ensuring food security for a population of over 270 million people, which is projected to reach 300 million by 2025.

To tackle this issue, the Indonesian government has initiated the development of approximately 2 million hectares of new farmland known as Food Estates, following the enactment of Presidential Decree No. 22/2009. To also mitigate the country's carbon footprint, a significant portion of these Food Estates is planned to be established in peatlands (Boserren et al., 2021).

**In conclusion, large-scale cultivation of this endemic peatland plant can play a crucial role in improving the economic well-being of communities residing near peatland areas, while simultaneously preserving and restoring Indonesia's extensive peatlands.**

However, the sago palm is currently not fully recognized and utilized at a scale where it can truly make a difference in addressing these opportunities and challenges. Additionally, the sago palm agriculture industry has yet to adopt sustainable management practices that are essential for ensuring its long-term viability and preventing overexploitation.

This case study explores the pioneering sago palm cultivation project undertaken by Winrock International, a U.S.-based non-profit organization, in Siak District. It delves into the lessons learned from this initiative, as well as issues in scaling up the project on a larger level in Indonesia to generate an even greater impact.



# SAGO INVESTMENT OPPORTUNITIES IN SIAK DISTRICT

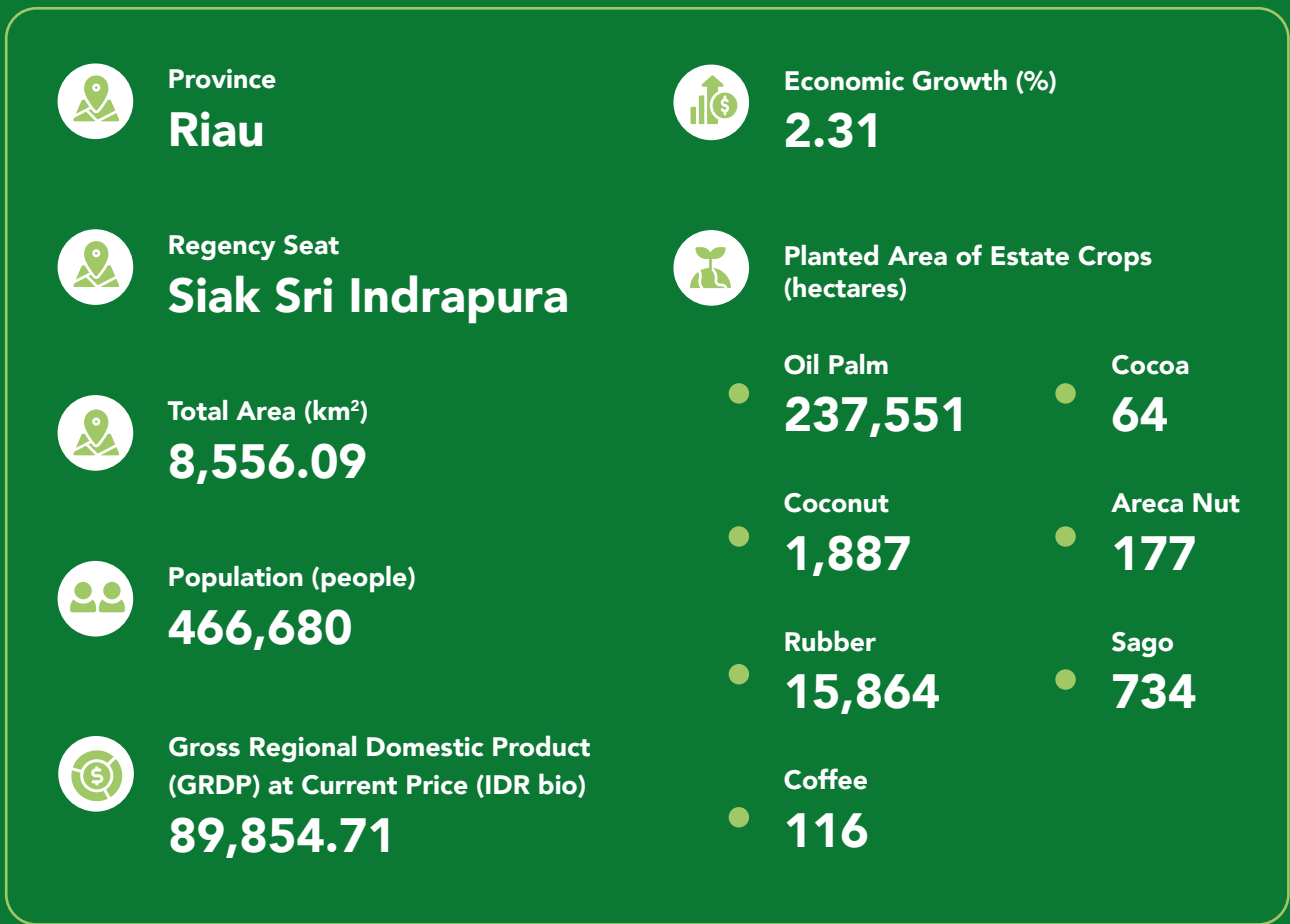
## SIAK DISTRICT IN BRIEF



Figure 3. Map of Siak District

Located in the Riau Province on the Island of Sumatra, Siak District occupies an area of roughly 8,600 km<sup>2</sup> with a total population of over 465,000 based on the 2021 census.

This regency holds great importance due to its historical significance as the former capital of the Sultanate of Siak Sri Indrapura, a prominent Malay kingdom during the 18<sup>th</sup> and 19<sup>th</sup> centuries. Siak is intersected by the Siak River, a picturesque waterway that serves as a vital transportation route and supports local livelihoods, such as fishing and river tourism. The river is flanked by lush vegetation and offers stunning views, making it a popular destination for nature enthusiasts and those seeking outdoor activities.



**Figure 4. Siak District in Brief (2021)**

(Source: Siak Regency in Figure 2022, BPS–Statistics of Siak Regency)



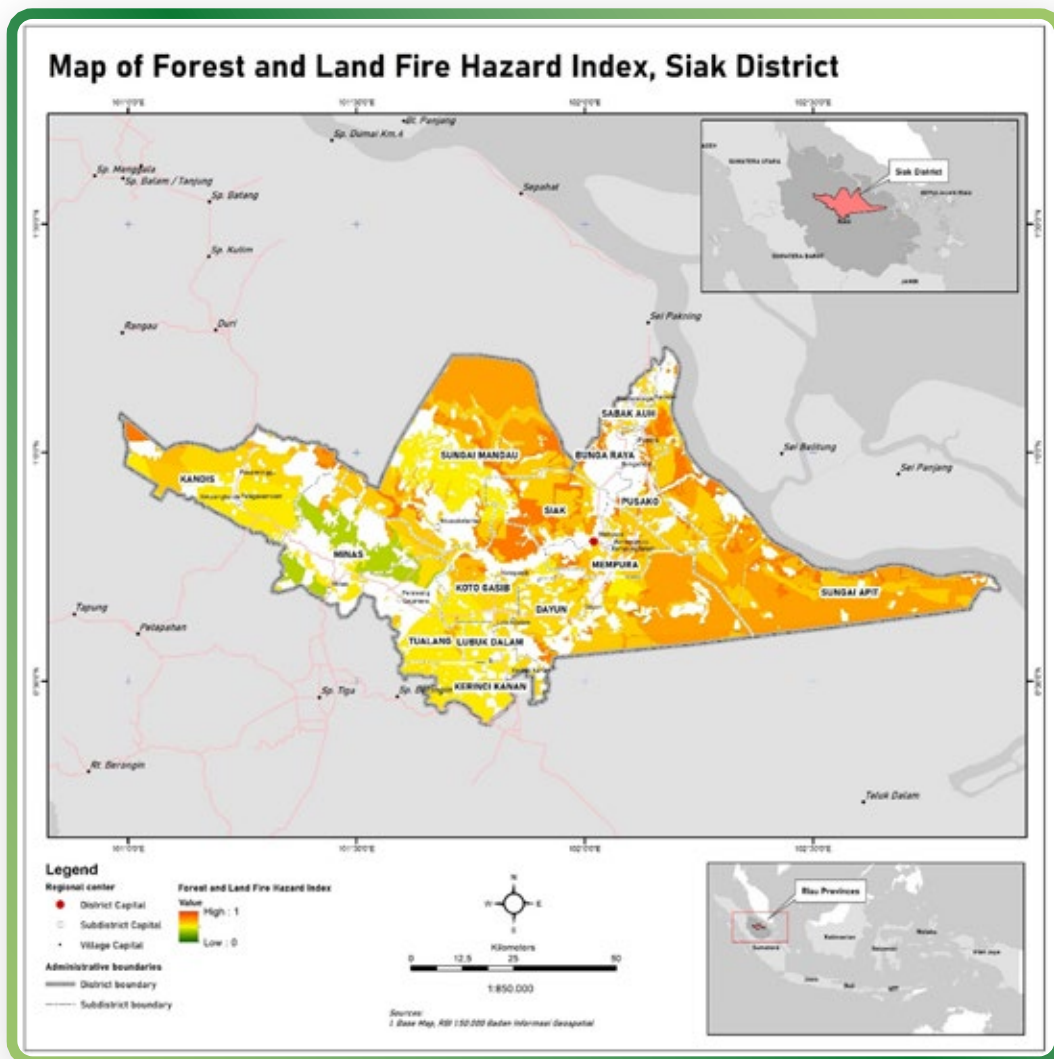
Palm oil plantation landscape (iStock)

This district is blessed with abundant natural resources, particularly oil palm plantations, which contribute significantly to its economy. The palm oil industry plays a vital role in providing employment opportunities and driving economic growth in the region. Based on the statistics published in 2022 by Badan Pusat Statistik or Statistics Indonesia, the total planted palm oil area reached 237,551 hectares as of the end of 2021, producing over 854,980 tons of fresh fruit bunches and employing 64,325 farmers (BPS–Statistics of Siak Regency, 2022).

# SIAK DISTRICT PEATLAND CONDITION

Siak District also boasts vast expanses of peatland and tropical forests, which are crucial for biodiversity conservation and carbon storage. Spreading over 12 sub-districts, peat area covers 53.22% of Siak Districts' total area. 34.76% of this district's total area, or roughly 302,291 hectares, is categorized as deep peat swamps (GBT), while the remaining 18.47% is categorized as shallow peat swamp (MDW), which covers an area of 160,615 hectares. Most of the deep peat swamps are located in forest areas, forestry company concessions and plantation areas, while the remaining deep peat is situated in kecamatan Koto Gasip, Dayun, Mempura and Sungai Apit (Tropical Forest Alliance, 2023).

As experienced by other peatland areas in Indonesia, those in Siak District also face daunting challenges due to deforestation, drainage, and land conversion for agricultural purposes, particularly for oil palm plantations. According to the most recent report released in 2019, approximately 80% of peatland areas in the Siak District, equivalent to approximately 383,300 hectares, have undergone degradation and deforestation due to agricultural activities, land conversion, and fire (Nduru, 2019).



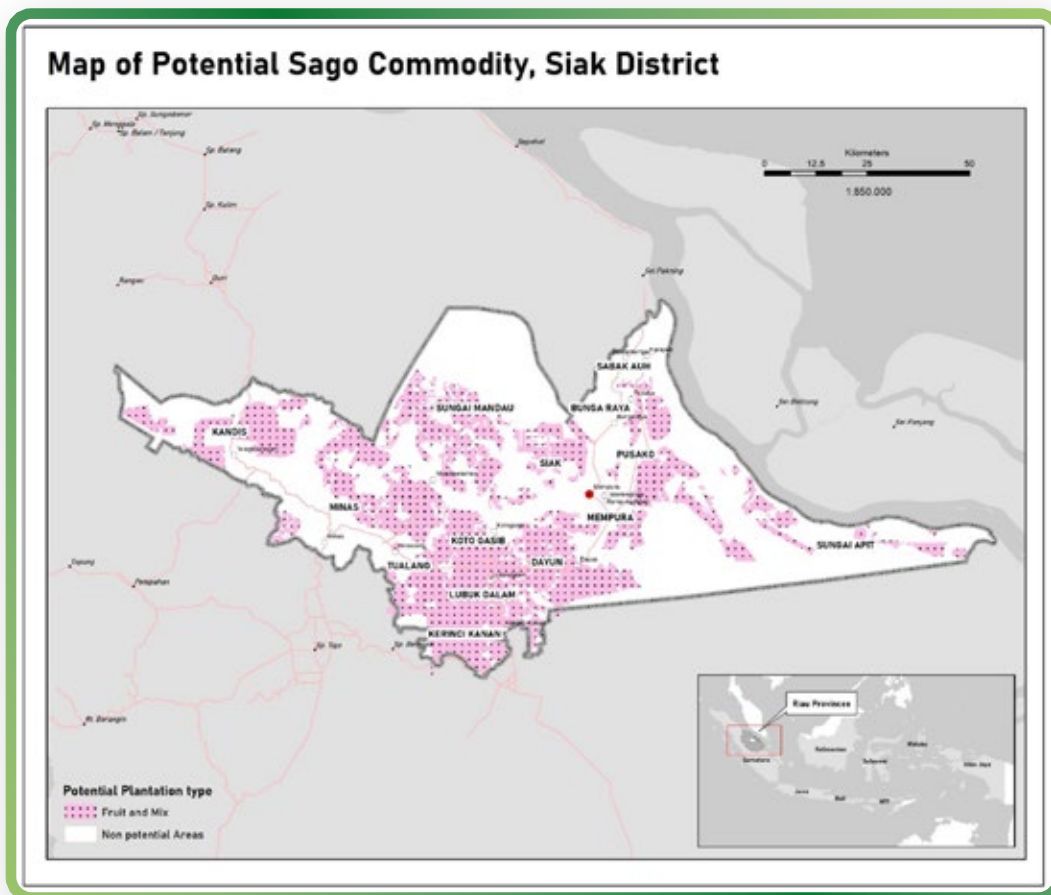
**Figure 5. The Fire Risk Index in Siak District**  
(Tropical Forest Alliance, 2023)

# SAGO PALM DEVELOPMENT IN SIAK DISTRICT

Efforts have been made to overcome the above problems by promoting sustainable practices through Sago. Based on the direction of the Ministry of Agriculture through the Food Security Agency (2020) that it is necessary to diversify local food sources of non-rice carbohydrates such as sago which has been developed in Siak Regency, this is at the same time able to support the achievement of SDG 1 which focuses on poverty alleviation, where agriculture and food have the main key to SDG 2 focusing on explicitly on food by trying to “end hunger, achieve food security and better nutrition, and promote sustainable agriculture”, but many other goals relate to challenges in the food system. Sustainable agriculture plays a central role in achieving SDG 6 on water, SDG 12 on sustainable consumption and production, SDG 13 on climate change adaptation and mitigation, and SDG 15 on land use and ecosystems.

Considering that the potential sago cultivation area spans between 3,500 to 5,000 hectares in the Siak District (Tropical Forest Alliance, 2023), the cultivation of sago commodity has been selected as one of the eight viable initiatives for promoting sustainable peat management in this region.

At the national level, the Indonesian government has implemented regulations and policies to protect peatlands and reduce the risk of fires, including a moratorium on new peatland development. Various initiatives and partnerships have also been established to restore degraded peatlands and support the conservation of these valuable ecosystems. As an illustration, in a bid to accelerate efforts in reducing the district’s ecological footprint and promote a more sustainable way of living, on July 22, 2016, the Indonesian Minister of Environment and Forestry declared Siak as a Green District.



**Figure 6. Map of Potential Sago Commodity in Siak District**  
(Tropical Forest Alliance, 2023)





Sago palm plantation (suarakendari.com)

Through the Siak District Regulation No. 22 of 2018, which was then followed by District Regulation No. 4/2022 on Green Siak, the government of Siak District has also introduced its “Siak Hijau” or Green Siak program, which declares Siak as a green regency, outlining the district’s strategy, policy, and indicator toward green Siak (Samnuzulsari et al., 2023).

Green Siak engages in various initiatives aimed at addressing deforestation and illegal logging. They focus on two main strategies: establishing protected forest areas and promoting sustainable forestry practices. In addition to protecting forests, Green Siak recognizes the importance of supporting local communities, encouraging sustainable agriculture practices, which promote responsible land use and minimize the negative impacts of farming

on the environment. Overall, Green Siak’s multi-faceted approach aims to strike a balance between environmental conservation and socio-economic development. By protecting forests and supporting sustainable agriculture, they work towards preserving the natural environment while ensuring the well-being of local communities.

A roadmap has been developed to guide the preparation and implementation of Siak’s RPJMD (2016-2021) and RPJPD (2005-2025) by the regency government, as well as ensure alignment with Siak’s vision of “The Realization of an Advanced and Prosperous Siak Regency in a Malay Religious and Cultured Society and to Become a Tourism Destination in Sumatra”, and the spirit the Sustainable Development Goals/SDGs (Tropical Forest Alliance, 2023).

# SUSTAINABLE PEAT MANAGEMENT THROUGH PEAT-FRIENDLY COMMODITIES: SAGO

## 8 Investable Initiatives

(Government of Siak District, 2022)

1

Sustainable Palm Oil

2

Sustainable Peat Management through Peat-friendly Commodities: Sago

3

Sustainable Peat Management through Peat-friendly Commodities: Snakehead Fish

4

Sustainable Peat Management through Zamrud National Park

5

Sustainable Peat Management through Peat-friendly Commodities: Pineapple

6

Sustainable Peat Management through Paludiculture in Land Under Agrarian Reform (Tanah Obyek Reforma Agraria)

7

Sustainable Peat Management through Peat-friendly Commodities: Bee Honey

8

Sustainable Peat Management through Bungaraya Agrotourism

In May 2022, the Government of Siak published its Jurisdictional Investment Outlook 2022 document, outlining investment opportunities within the District that will support the comprehensive approach to the sustainable development of Siak District. Prepared using the jurisdictional approach, this document attempts to harmonize stakeholders' economic interests with environment conservation efforts, ensuring that economic development can be carried out without degrading natural resources and the environment.

The Jurisdictional Investment Outlook 2022 document includes a list of investable jurisdictional initiatives, curated collaboratively with all stakeholders, representing a combination of commodity production and conservation

opportunities (Government of Siak District, 2022), ensuring alignment between the pursuit of economic development with the conservation of natural environment.

As one of the eight investable initiatives for sustainable peat management, the development of sago as a commercial commodity seeks to assist sago farmers by providing adequate sago processing facilities, assistance in agricultural cultivation practices, water management improvements, capacity building initiatives, as well as restoration and improvement of peatland management in the Siak District. In the downstream area, efforts will focus on opening new market access through the production and marketing of sago derivative products.

# SUSTAINABLE PEAT MANAGEMENT THROUGH PEAT-FRIENDLY COMMODITIES: SAGO

## Goals and Targets

(Government of Siak District, 2022)



**Manage natural resources to the fullest extent in the interest of the people with the principle of sustainability**

- Support the development of peat-friendly alternative commodities with an economic and ecological value that can provide an alternative income for around 100 farmers by 2024.
- Improve agricultural practices and land management (including water management) by peatlands to improve environmental quality in an area of 100 ha by 2024.
- Reduce 10,000 tons of CO<sub>2</sub>e carbon emissions from project activities by 2024.
- Reduce the risk of peatland fires through sustainable paludiculture practices in the approximately 1,000 ha



**Support the people's interest in the utilization of natural resources to develop the economy of the people and genuine regional income**

- Strengthen the role of Village-owned Enterprises (BUMKam) in managing commodities with the community in 10 villages by 2024.
- Provide better market access for alternative commodities that have direct impacts on farmers and communities by 2024.
- Participatory planning for commodity development programs under Village-owned Enterprises in 3 villages have been carried out in 2024.

## THE WINROCK CASE

### **To promote the sago-based food industry in Siak District, Winrock International is collaborating with community members, government agencies, and universities.**

The objective is to introduce, enhance, and raise awareness about sago-based food production, particularly in regions that require strengthened restoration and rehabilitation efforts due to the rapid expansion of oil palm and acacia plantations (Nurtanti, 2023).

Winrock International offers technical support to develop the Green District strategy by employing an inclusive approach that involves local community leaders and stakeholders in peatlands. This collaborative effort aims to establish economically viable and environmentally sustainable wetland paludiculture production on a scalable level. The paludiculture system offers a promising solution for smallholder farmers to transition towards cultivating crops native to peatlands, facilitating restoration efforts while reducing the occurrence of fires, land subsidence, and emissions. Additionally, this transition helps farmers adopt more sustainable land use practices and livelihoods. The implementation of the paludiculture cropping system represents a departure from conventional practices and introduces a sustainable and economically viable alternative that restores the ecosystem services crucial for protecting these delicate peatlands.

Dr Blanca Bernal, a senior specialist on Winrock's Ecosystems Services team, shares:



**“Paludiculture is the growth of crops that are tolerant to wet conditions. What we’re doing in this project is fostering those as a part of rehabilitating the peatland and maintaining the productivity of the land because people produce food and income, but they can do it in a way that doesn’t mean draining the peatlands and planting palm oil. You can still grow crops that are going to be profitable and are going to support livelihoods” (Winrock International, B).**

**DR BLANCA BERNAL**  
Senior Specialist, Winrock's Ecosystem Services



Sago palm plantation (BPSI LHK Kuok)

**The area where the social forestry schemes are implemented contains a peat dome system of more than 700,000 hectares, or roughly the size of 1.7 million football fields, combined (Winrock International, B).**

Within this area, Winrock International offers assistance for the cultivation of 490 hectares of land, targeted to produce approximately 1,000 tons of dry sago flour annually, by employing 100 farmers from the local community. Environmentally, this initiative is expected to reduce the percentage of annual deforestation by 3% and maintain the peat's average water table by 40 centimetres (Tropical Forest Alliance, 2023).

One of the most common things that farmers do is to sell sago logs cut into 1 meter length of tual directly to the local trader, which will bring tual sago logs to some sago mills in Kepulauan Meranti. Therefore, there is a lot of potential income for sago farmers lost for transport. However, with a relatively small investment of around US\$ 50,000 – 100,000 community-owned mills can be built with low and simple technology, allowing farmers to process the logs into wet sago starch that can be sold to local market, which can double potential profits – as sago tual can be sold to their self-managed sago mills at a higher purchase price.

Winrock was involved in the establishment of a small sago mill in Bunsur Village, Siak District. Employing members of the surrounding community with all proceeds return to the community, the small mill serves as a pilot initiative to promote active participation of community members, by enabling farmers to extract starch, dewater and dry it before packaging (Winrock International, C). Depending on the size and capacity, a number of sago mills can be developed across the Siak District, to offer community members a new source of additional or alternative income, while simultaneously protecting the surrounding peatland through the promotion of sago cultivation as the peat endemic plant (Tropical Forest Alliance, 2023).

During the official inauguration of this new sago mill, Wahyudi, the head of the Sungai Apit subdistrict, stated:



**“We use this peatland with environmentally friendly management, one of which is by cultivating the land with the commodity that is peatland friendly and it has been tested by the experts, and to introduce to the whole world that this is peatland, we can take advantage of its existence” (Winrock International, C).**

**WAHYUDI**  
Head of the Sungai Apit Subdistrict



Sago palm plantation (Alamy)



Sago starch (ExportersIndia.com)

## SEVERAL IMPORTANT LESSONS EMERGE TO BRING THIS VISION TO REALITY

First, for sago commodities to thrive, it is crucial to ensure that farmers have convenient access to markets. This necessitates the establishment of a network comprising collectors and processing facilities. In this case, the government can play a significant role in developing a robust supply chain by fostering an investor-friendly environment and creating favourable conditions for the industry's growth.

Second, despite its superior health benefits compared to white rice, sago-based food products are still considered a poor man's diet by many Indonesian communities (Boseran et al., 2021; Nurtanti, 2023). This calls for the implementation of innovative marketing and communication campaigns to promote sago as a healthy and organic alternative to other staple foods such as rice and wheat-based noodles, elevating the image of sago as a fashionable and healthy food.

Lastly, the sago palm is currently not fully recognized and utilized at a scale where it can truly make a difference in addressing these opportunities and challenges. With only 734 hectares of sago plantation remaining in the Siak District for example (BPS–Statistics of Siak Regency, 2022), this initiative will not generate a large-scale impact on the livelihood of the surrounding communities and also a limited contribution to carbon emission reduction initiatives (Nurtanti, 2023). It is, therefore, necessary to start campaigning for the restoration of peatlands, both to improve the environmental condition of Indonesia's wetlands while also expanding the sago plantation area to support a growing and sustainable sago food-based industry.

# LESSONS LEARNED



The Sago palm offers an exciting potential in contributing to food security in Indonesia, while simultaneously safeguarding the country's peatlands and potentially reducing the occurrence of annual peat fires. Moreover, the health advantages associated with the Sago palm, stemming from its abundant fibre content and low glycaemic index, can aid Indonesia in addressing prevalent public health concerns like diabetes and obesity.



To promote sago-based products as a viable alternative staple food for the Indonesian population, it is imperative for the Government to integrate sago palm cultivation into its Medium-term and Long-term Development Plans. This will ensure a long-term commitment and garner widespread support from the industry, facilitating the establishment of a robust supply chain that enables efficient distribution of sago-based products from smallholders to the market.



Sago plants need to be developed optimally through plant cultivation technology (pre-harvest including plant rehabilitation technology) so that there is a sustainable management of sago palm utilization.



Policies are needed that support the sago trade system pattern from upstream to downstream.



Finally, a well-planned and creative communication strategy is essential to educate the public about the numerous health benefits associated with sago-based products in comparison to other staple food alternatives. Leveraging the increasing popularity of healthy lifestyles among Indonesia's growing middle class, sago-based products can be positioned as fashionable, organic, and nutritious food options.



# CONCLUSION

**This case introduces the potential of paludiculture as an approach to plant cultivation in peatlands for economic and ecological objectives.** Unlike conventional agriculture, which often involves draining wetlands for crop production, paludiculture introduces the cultivation of peat-friendly commodities, in this case sago palm, which embraces wetland conditions and employs specific cultivation techniques suitable for these environments. The goal is to strike a balance between economic productivity and environmental conservation, promoting biodiversity and the preservation of valuable wetland ecosystems.

**This case also highlights lessons that we can learn from Winrock International's contribution in promoting paludiculture practices within the Siak District.** Winrock's involvement commenced with their participation in the development of the Jurisdictional Investment Outlook 2022 for the district. Published in May 2022, this document serves as a crucial platform for embracing the paludiculture approach in Siak, acting as a blueprint for identifying

investment opportunities that support both the economic well-being of the local population and the implementation of a comprehensive and integrated approach to sustainable development in Siak.

It is anticipated that this case study can serve as a valuable reference for other districts in Indonesia, showcasing the adoption of paludiculture practices as a viable alternative. By harnessing the economic potential of wetlands while minimizing environmental impacts and contributing to climate change mitigation and adaptation efforts, paludiculture can address current and future challenges. Specifically, it is hoped that this case example can inspire local governments, companies, and non-profit institutions to take bolder strides towards scaling up sago palm cultivation, thereby generating greater impact for the environment and the surrounding communities.

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## THE TROPICAL FOREST ALLIANCE

TFA is a global multistakeholder partnership platform initiated to support the implementation of private-sector commitments as well as to amplify demand-side engagement in major economies towards the transition to reduced deforestation commodity supply chains. Hosted by the World Economic Forum, TFA partners with 170+ organizations - companies, government entities, civil society, indigenous peoples, local communities and international agencies. TFA operates regional platforms in Latin America, West and Central Africa, China, and Southeast Asia.

## FILANTROPI INDONESIA

Perhimpunan Filantropi Indonesia (PFI) is a non-profit and independent organization established to advance the philanthropic sector in Indonesia. Our strategic mission is to increase the number and quality of philanthropy in Indonesia as a means to strengthen the role of civil society in the country in social, humanitarian and environmental development through strengthening institutional infrastructure and developing space for philanthropy and the non-profit sector. As a Philanthropy Hub, PFI is the central platform for philanthropists and credible thought leaders to encourage strengthening the philanthropy ecosystem in Indonesia to achieve sustainable development in Indonesia.

## WINROCK INTERNATIONAL

WINROCK International is one of the international non-profit organizations that has the main program of peat ecosystem restoration in Siak Regency, to encourage the community to improve the quality of peatland management, this institution carries out Paludicultural agricultural activities and businesses that focus on developing local commodities, such as sago, horticultural crops and perennials endemic to peatlands.

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