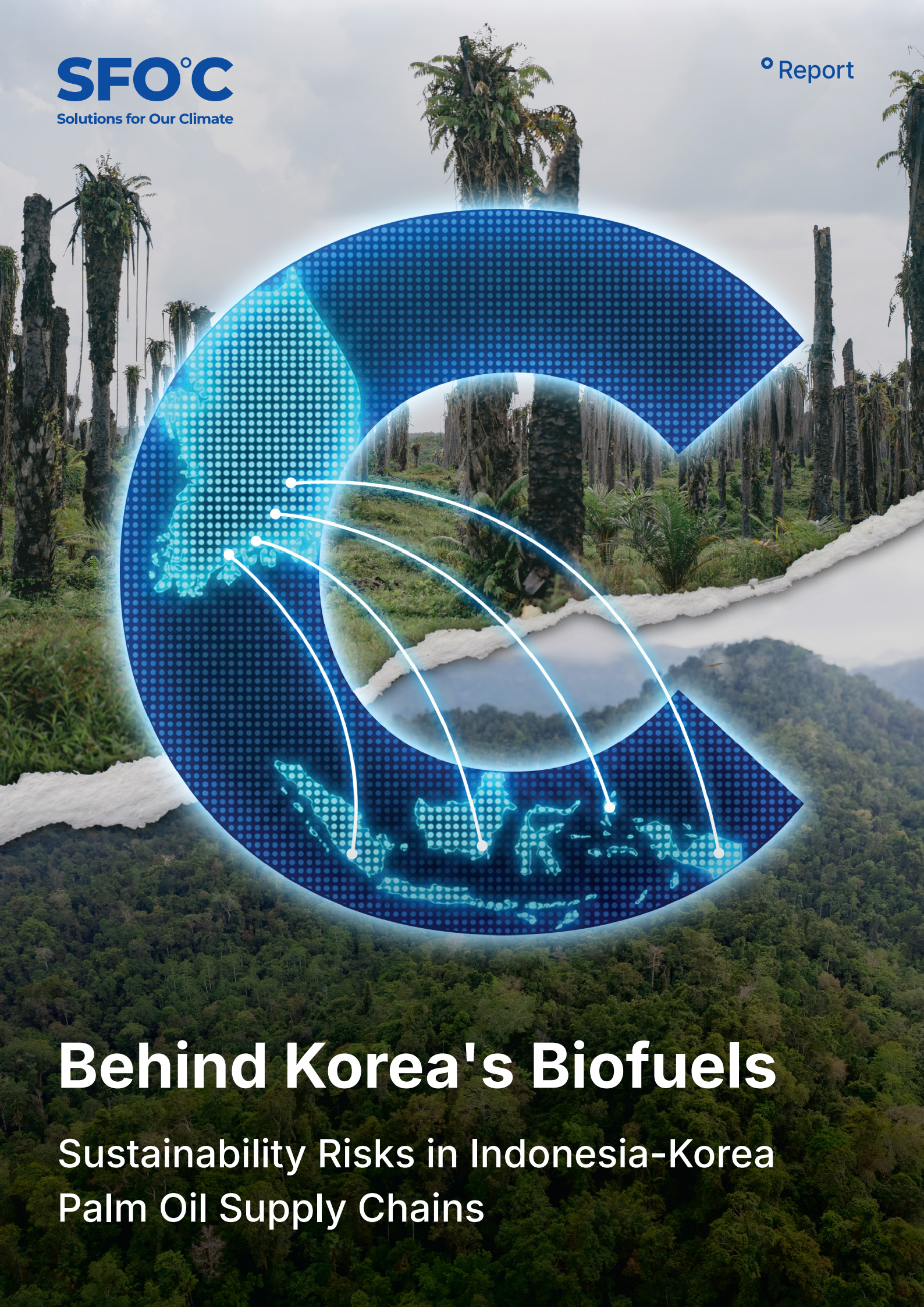




Behind Korea's Biofuels

Sustainability Risks in Indonesia-Korea
Palm Oil Supply Chains



Solutions for Our Climate (SFOC) is an independent nonprofit organization that works to accelerate global greenhouse gas emissions reduction and energy transition. SFOC leverages research, litigation, community organizing, and strategic communications to deliver practical climate solutions and build movements for change.

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Key findings

Korea's biofuel strategy is driving a rapid and deepening dependence on imported palm-based feedstocks. Palm oil and palm derivatives reached 72% of Korea's biodiesel mix in 2024, quadrupling since the start of the blending mandate in 2015. With most of these feedstocks originating from Indonesia, this trend is likely to further accelerate as biofuel demand spreads across the transport sector.

Korean companies are expanding upstream into Indonesia's palm oil sector. Direct investments and joint ventures involving Korean "Big Oil" are vertically integrating oil palm supply chains from plantations to biofuel refineries, shifting Korea's involvement from simple downstream purchasing to deeper establishment within Indonesia's resource governance.

Korea-linked supply chains remain exposed to environmental, social, and legality risks despite certification and pledges. More than 90% of export volumes are linked to documented cases of ecosystem degradation, land rights conflicts, and corruption in governance in Indonesia, underscoring weak enforcement and regulatory non-compliance.

A quarter of Korea's imports are from areas devastated by the 2025 Sumatra floods. Palm oil and derivatives from concessions implicated in the floods and subsequent permit revocations by the Indonesian government account for 23% of import volumes in 2025. Korea does not have any measure to address disaster-linked commodity trade.

Absent sustainability safeguards in Korea's biofuel policy are turning the country into a leakage market. As the EU moves ahead with deforestation-free requirements, suppliers unable to meet stringent standards may divert exports to laggard countries like Korea where all biofuels are incentivized without ESG considerations.

Korean companies are enabling this unsustainable supply chain model through the lack of a zero-deforestation policy. None of the identified Korean palm oil importers has a No Deforestation, No Peat, and No Exploitation (NDPE) or other deforestation-free commitments across their supply chain. Most companies lack human rights safeguards.

Policy recommendations



Government

- 1. Require full life-cycle assessment (LCA)
- 2. Adopt stringent sustainability criteria
- 3. Introduce supply chain due diligence regulation



Corporations

- 4. Commit to deforestation-free supply chain
- 5. Implement human rights and environmental due diligence
- 6. Enhance risk management and disclosure

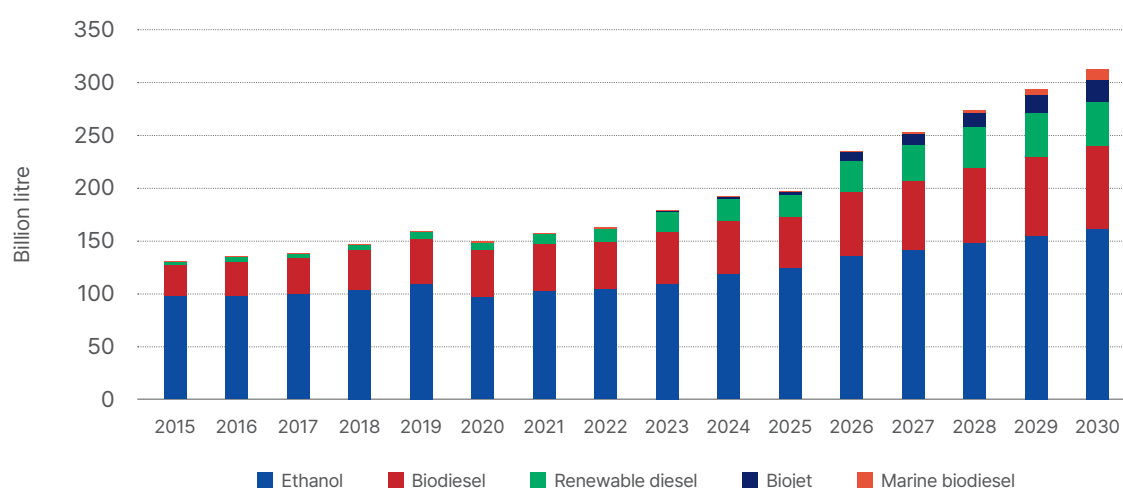
1. Background: The structural risks of palm-based biofuels

1.1. Biofuels and their “green” label

As countries seek alternatives to accelerate the phase-out of fossil fuels, biofuels—produced through the fermentation, transesterification, and other chemical processing of organic materials—along with other forms of bioenergy, are increasingly being promoted as cost-effective and “green” energy sources. However, the rapid expansion of biofuels also raises growing concerns about whether land-intensive fuel production can be scaled sustainably without intensifying pressures on forests, ecosystems, and local communities. While biofuel feedstocks are often presented as natural, easily regrown, or derived from agricultural and industrial waste streams, the environmental and social limitations of large-scale biofuel expansion remain widely underacknowledged.

The transport sector, from road to maritime shipping and aviation, is rapidly increasing demand for biofuels. Over the past two decades, global biofuel consumption has expanded seven-fold, driven largely by policy frameworks in Europe and the United States. The demand is expected to grow further under emerging government policies and international decarbonization frameworks.¹ (Fig. 1)

[Figure 1] Past trends and future forecasts on biofuel demands, accelerated case²



1 Transport and Environment. (2025, October). CrOP30 Why burning food for land-hungry biofuels is fueling the climate crisis. https://uploads.transportenvironment.org/production/files/202510_TE_international_biofuels_briefing.pdf

2 International Energy Agency. (2025, December 15). Renewable energy progress tracker. <https://www.iea.org/data-and-statistics/data-tools/renewable-energy-progress-tracker>

Biodiesel and ethanol remain the most widely used forms of biofuels,³ with biodiesel primarily consumed in diesel engines and ethanol blended into gasoline. These fuels rely heavily on crop-based feedstocks and their derivatives. Among these, palm oil is one of the most dominant inputs for biodiesel⁴ due to its high yield and low production costs. This pattern is clearly reflected in South Korea, where biodiesel production increasingly relies on palm oil and palm derivatives imported primarily from Indonesia.

This dependence carries significant environmental and social costs. Palm oil expansion has long been associated with deforestation, peatland conversion, biodiversity loss, ecological degradation, and human rights violations, particularly in tropical regions.⁵ Over the last two decades, oil palm plantation expansion contributed to approximately 3 million hectares of old-growth forest loss in Indonesia alone.⁶ Although deforestation linked to industrial palm oil production has declined significantly over the past ten years, recent data indicate signs of reversal since 2022. In 2025, 37,910 hectares of deforestation occurred within palm oil concessions, marking an increase from the previous year.⁷ Furthermore, life-cycle emissions particularly those from land-use change (LUC) undermine claims that crop-based biofuels constitute “carbon neutral” or “green” alternatives to fossil fuels.

Against this backdrop, this report examines the palm-based biodiesel supply chain connecting Indonesia and South Korea. It analyzes trade trends, key corporate actors, and their links to documented environmental and social risks. The report highlights the exposure risk embedded within South Korea's biofuel industry. In the absence of sustainability regulations and corporate safeguards, Korean biofuel supply chains remain vulnerable to deforestation-linked feedstocks and broader environmental and social harms associated with the Indonesian palm oil sector. This report therefore recommends strengthening government and corporate policies to exclude high-risk palm oil while reducing structural dependence on crop-based biofuels overall. This analysis draws on datasets including per-shipment trade records, Korea Customs Service data, company disclosures, and secondary research on news reports and independent investigations. Due to data limitations, the figures presented likely underestimate the full extent of trade volumes and supply chain exposure.

3 International Energy Agency. (n.d.). Biofuels. <https://www.iea.org/energy-system/low-emissions-fuels/biofuels>

4 OECD & FAO. (2023). OECD-FAO agricultural outlook 2023–2032. Chapter 9 Biofuels. OECD Publishing. <https://openknowledge.fao.org/server/api/core/bitstreams/56b4abb8-375f-44bc-8bc3-03273f4c1d9b/content>

5 Pendrill, F., et Al. (May, 2019). Agricultural and forestry trade drives large share of tropical deforestation emissions. *Global Environmental Change*. 56, 1–10. <https://doi.org/10.1016/j.gloenvcha.2019.03.002>; Xu, Y., Yu, L., Ciais, P. et Al. (2022). Recent expansion of oil palm plantations into carbon-rich forests. *Nat Sustain* 5, 574–577. <https://doi.org/10.1038/s41893-022-00872-1>

6 Gaveau, David L.A., Locatelli, B., et Al. (2022, March 29). Slowing deforestation in Indonesia follows declining oil palm expansion and lower oil prices. <https://doi.org/10.1371/journal.pone.0266178>

7 Auriga Nusantara. (2026, March 31). Status Deforestasi Indonesia 2025. https://auriga.or.id/press_release/detail/65/status-deforestasi-indonesia-2025?lang=id

1.2. Indonesia's biofuel policy and the limits of palm oil expansion

Indonesia's biofuel policy has tied the country's energy transition strategy to the continued expansion of palm oil production. As the world's largest producer of palm oil, Indonesia has positioned palm-based biodiesel as a central pillar of its efforts to reduce fossil fuel imports, strengthen energy security, and support domestic commodity industries. However, this strategy also structurally links decarbonization efforts to rising demand for a land-intensive commodity sector.

Since the late 2000s, the Indonesian government has steadily increased mandatory biodiesel blending requirements across the transport, industrial, and power sectors.⁸ Beginning with a 2.5% (B2.5) blending mandate under Regulation No. 32 of 2008 of the Ministry of Energy and Mineral Resources, the policy framework expanded to B15 for transport and industry and B25 for power generation in 2015, followed by B30 in 2020, B40 in 2025, and potential plans for B50 by 2026.⁹

These mandates have been reinforced through large-scale public subsidies and industrial policy support. Presidential Regulation No. 61 of 2015 established subsidy mechanisms funded through palm oil export levies, enabling the implementation and scaling-up of biodiesel blending programs.¹⁰ Between 2015 and 2023, the government allocated approximately IDR 179 trillion (USD 11.2 billion) in subsidies to support to support the biofuel industry.¹¹

Together, these measures have created a model that structurally drives the expansion of palm oil production. Rising blending mandates continuously increase domestic demand for crude palm oil (CPO), incentivizing further plantation development, refining capacity, and upstream investment. While efforts to increase per hectare productivity have been sustained, the policy framework at large has locked decarbonization efforts into the continued expansion of plantations into standing forests.^{12 13} By 2024, Indonesia's oil palm plantation area reached 16.8 million hectares, 18% of which was previously

8 Gabungan Pengusaha Kelapa Sawit Indonesia (GAPKI). (2017, July 28). Perkembangan Mandatori Biodiesel dan Prospek Indonesia dalam Pasar Biodiesel Dunia. <https://gapki.id/news/2017/07/28/perkembangan-mandatori-biodiesel-dan-prospek-indonesia-dalam-pasar-biodiesel-dunia/>

9 Reuters. (2026, March 9). Indonesia may revive B50 biodiesel mix plan as oil prices soar. <https://www.reuters.com/sustainability/climate-energy/indonesia-may-revive-b50-biodiesel-mix-plan-oil-prices-soar-2026-03-09/>

10 Database Peraturan BPK. (n.d.). Peraturan Presiden (PERPRES) No.61 Tahun 2015 tentang Penghimpunan dan Penggunaan Dana Perkebunan Kelapa Sawit. <https://peraturan.bpk.go.id/Details/41800/perpres-no-61-tahun-2015>

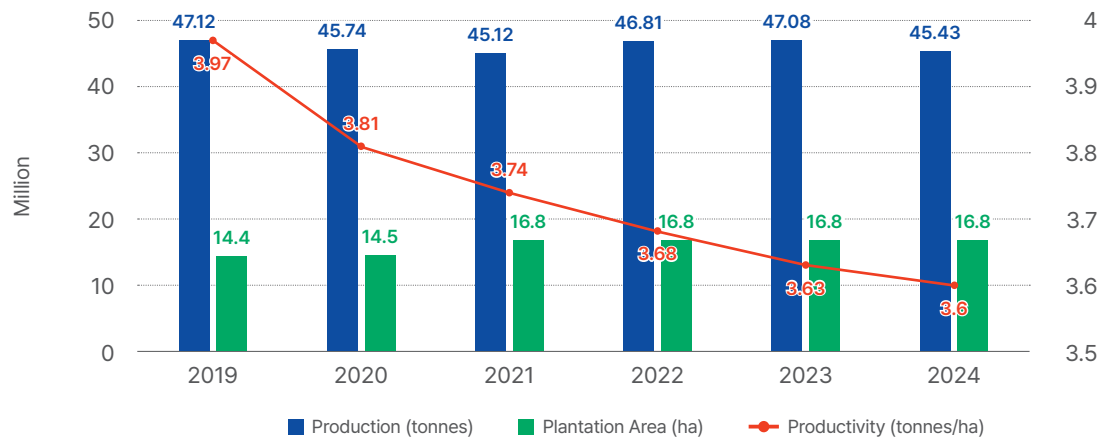
11 Sawit Watch. (2024). Kebijakan subsidi biodiesel Indonesia minim transparansi, keberadaan PEP di korporasi melanggengkannya?. <https://sawitwatch.or.id/wp-content/uploads/2024/03/Siaran-Pers-Kajian-PEP-Biodiesel-Final.pdf>

12 Moristanto, H. E., Kurniadi, C. B., & Amheka, A. (2022). The Impact of Biofuel Intensification on Integrated Climate-Land-Energy-Water System. *The Journal of Indonesia Sustainable Development Planning*, 3(1), 48-61. <https://doi.org/10.46456/jisdep.v3i1.297>

13 Nainggolan, D., et Al. (2021). Progressive biodiesel policy in Indonesia: Does the Government's economic proposition hold? *Renewable and Sustainable Energy Reviews*, 150, Article 111431. <https://doi.org/10.1016/j.rser.2021.111431>

forested.¹⁴ In the same year, total palm oil production recorded 45.4 million tonnes, 70% of which was destined for export markets.¹⁵ (Fig. 2)

[Figure 2] Indonesia palm oil industry trends (2019–2024)¹⁶



Evidence increasingly suggests that Indonesia's palm oil sector is approaching critical sustainability thresholds. A 2024 assessment of Indonesia's ecological carrying capacity estimated that the oil palm plantation area is already close to the country's estimated ecological capacity of 18.5 million hectares.¹⁷ Despite this ceiling, the government's food and energy estate agenda continues to envision 20 million hectares of new plantations, over 15 million hectares of which are forests.¹⁸ This trajectory implies that continued growth of palm-based biofuel demand would be fundamentally unsustainable.

Meanwhile, as cumulative pressures on forests became visible, the government has introduced multiple regulatory mechanisms intended to strengthen environmental governance in the palm oil sector. These include Law No. 32 of 2009 on Environmental Protection and Management,¹⁹ Law No. 39 of 2014 on

14 Gaveau, David L.A., Locatelli, B., et Al. (2022, March 29). Slowing deforestation in Indonesia follows declining oil palm expansion and lower oil prices. <https://doi.org/10.1371/journal.pone.0266178>

15 Direktorat Jenderal Perkebunan. (2025, December). Statistik Perkebunan 2024–2026. Sekretariat Jenderal Perkebunan. <https://ditjenbun.pertanian.go.id/?publikasi=buku-statistik-perkebunan-2024-2026-jilid-i>

16 Ibid.

17 Madani Berkelanjutan. (2024). Determining the Upper "Cap" on Oil Palm Plantations in Indonesia Based on Environmental Carrying and Assimilative Capacity (ECCAC) Perspectives. [https://madaniberkelanjutan.id/id/publication/determining-the-upper-%E2%80%9CCap%E2%80%9D-on-oil-palm-plantations-in-indonesia-based-on-environmental-carrying-and-assimilative-capacity-\(eccac\)-perspectives](https://madaniberkelanjutan.id/id/publication/determining-the-upper-%E2%80%9CCap%E2%80%9D-on-oil-palm-plantations-in-indonesia-based-on-environmental-carrying-and-assimilative-capacity-(eccac)-perspectives)

18 Wahana Lingkungan Hidup Indonesia (WALHI). (2025). Brief Paper Masyarakat Sipil: Bahaya Rencana Pembukaan 20 Juta Hektar Hutan untuk Pangan dan Energi. <https://www.walhi.or.id/uploads/2024-Rilis/Brief%20Paper%20Masyarakat%20Sipil%2020%20Juta%20Hektar%20Hutan%202025.pdf>

19 Database Peraturan BPK. (n.d.). Undang-undang (UU) No.32 Tahun 2009 Perlindungan dan Pengelolaan Lingkungan Hidup. <https://peraturan.bpk.go.id/details/38771/uu-no-32-tahun-2009>

Plantations,²⁰ and Presidential Instruction No. 8 of 2018 establishing a moratorium on new plantation licenses.²¹ More recently, Government Regulation No. 45 of 2025 introduced stricter penalties for plantations operating within designated forest areas,²² affecting an estimated 3 to 3.5 million hectares of existing estates.²³

Indonesia has also attempted to operationalize certification systems. The government-led Indonesian Sustainable Palm Oil (ISPO) scheme was established in 2011 as a mandatory framework for plantations, processing facilities, and bioenergy operations.²⁴ Voluntary standards such as the Roundtable on Sustainable Palm Oil (RSPO) and International Sustainability and Carbon Certification (ISCC) have similarly gained traction in response to international market requirements, with ISCC particularly focusing on the biofuel industry.

However, these safeguard systems continue to face substantial implementation and enforcement challenges. Multiple analyses have identified weak auditing frameworks, limited transparency, inconsistent field verification, and uneven compliance, particularly among smallholder producers.^{25 26} Notably, ISPO lacks a deforestation cut-off date, RSPO shows weak enforcement and auditor compliance, and ISCC heavily relies on operator self-reporting. None of these schemes covers more than half of the total plantation area. (Tab. 1)

-
- 20 Food and Agriculture Organization of the United Nations (FAO). (n.d.). FAOLEX Database: Law No. 39 of 2014 on Plantations (Indonesia). <https://www.fao.org/faolex/results/details/en/c/LEX-FAOC021119>
- 21 Database Peraturan BPK. (n.d.). Instruksi Presiden (INPRES) No.8 Tahun 2018 tentang Penundaan dan Evaluasi Perizinan Kelapa Sawit serta Peningkatan Produktivitas Perkebunan Kelapa Sawit. <https://peraturan.bpk.go.id/Details/92813/inpres-no-8-tahun-2018>
- 22 Database Peraturan BPK. (n.d.). Peraturan Pemerintah (PP) No.45 tahun 2025 tentang Perubahan atas Peraturan Pemerintah Nomor 24 Tahun 2021 tentang Tata Cara Pengenaan Sanksi Administratif dan Tata Cara Penerimaan Negara Bukan Pajak yang Berasal dari Denda Administratif di Bidang Kehutanan. <https://peraturan.bpk.go.id/Details/334445/pp-no-45-tahun-2025>
- 23 Business Today. (2025, October 17). Indonesia's New Land Use Regulation to Impact Palm Oil Players: CGS. <https://www.businesstoday.com.my/2025/10/17/indonesias-new-land-use-regulation-to-impact-palm-oil-players-cgs/>
- 24 Direktorat Jenderal Perkebunan, Kementerian Pertanian. (2022, November 4). Sertifikasi ISPO: Bentuk Penguatan dan Peningkatan Keberterimaan Produk Kelapa Sawit Indonesia Secara Global. <https://ditjenbun.pertanian.go.id/sertifikasi-ispo-bentuk-penguatan-dan-peningkatan-keberterimaan-produk-kelapa-sawit-indonesia-secara-global/>
- 25 Prabowo, H., Bellicia, A., Yazid, F. (2023). Transparency in Corporate Reporting (TRAC): Penilaian 50 Perusahaan Sawit di Indonesia. Transparency International. <https://ti.or.id/wp-content/uploads/2023/03/Laporan-TRAC-Sawit-.pdf>
- 26 Firmansyah, A. L., Awaludin, F. N., Mayang, D., Ramdi, T. H., & Arifin, Y. A. (2025). Penanaman kelapa sawit sebagai ancaman ekologis dalam perspektif hukum lingkungan. *Journal of Legal, Political, and Humanistic Inquiry*, 1(2), 239–247. <https://doi.org/10.65310/jcwx5398>

[Table 1] Palm oil and biofuel certification schemes

Certification	Type	Implementation rate	Limitation
Indonesia Sustainable Palm Oil (ISPO)	Mandatory	36% of total plantation area ²⁷	No deforestation cut-off date ²⁸ Lack of independent monitoring and transparency ²⁹
Roundtable on Sustainable Palm Oil (RSPO)	Voluntary	14%-16% of total plantation area ³⁰	Weak enforcement and auditing failure (auditors rely financially on the companies they assess) ^{31 32}
International Sustainability and Carbon Certification (ISCC)	Voluntary	N/A	Relies heavily on self-reporting rather than field verification ³³

Many Indonesian suppliers have also adopted corporate No Deforestation, No Peat, and No Exploitation (NDPE) commitments, yet environmental, social, and governance (ESG) concerns continue to persist across supply chains.³⁴ This gap between corporate pledges and on-the-ground implementation suggests that traceability systems and voluntary certification alone may be insufficient to address the broader structural pressures created by demand growth.

For importing countries such as South Korea, these dynamics create a twofold risk: exposure through supply chain links and pressure from rising demand. On one hand, Korean companies relying primarily on supplier declarations or voluntary certification remain exposed to deforestation-linked feedstocks. On the other hand, rising demand in and outside Indonesia risks reinforcing structural pressures for

27 Indonesia Palm Oil Strategic Studies (IPOSS). (n.d.). Pembinaan Sertifikasi ISPO untuk Pengakuan Global. <https://iposs.co.id/3938-2/>

28 European Forest Institute (EFI). (n.d.). Joint gap assessment of the EUDR information needs and information availability from the Indonesian Sustainable Palm Oil (ISPO) certification. https://efi.int/sites/default/files/files/flegtredd/Terpercaya/Other%20resources/ISPO_Joint_Gap_Assessment.pdf

29 Environmental Investigation Agency. (n.d.). An analysis of the new draft Indonesia Sustainable Palm Oil (ISPO) regulations. https://eia-international.org/wp-content/uploads/ISPO_Brief_English.pdf

30 Roundtable on Sustainable Palm Oil (RSPO). (2025, December 18). Impact Update 2025. https://rspo.org/wp-content/uploads/ImpactUpdate2025_FA_181225.pdf

31 Song, H., Kim, G., Shin, Y. (2023). Mission Failed: The limitations of palm oil certifications in preventing deforestation. Solutions for Our Climate. <https://forourclimate.org/research/347>

32 Owens, J. (2021, August 11). RSPO Criticisms Investigated. Ethical Consumer. <https://www.ethicalconsumer.org/food-drink/rspo-criticisms-investigated>

33 Greenpeace. (2021, March 10). Destruction: Certified. https://www.greenpeace.org/static/planet4-international-stateless/2021/04/b1e486be-greenpeace-international-report-destruction-certified_finaloptimised.pdf?_gl=1*sgq6lb*_up*MQ.*_ga*ODQ0MzlwNi4xNzc4MDUzMzc0*_ga_94MRTN8HG4*czE3NzgwNTMzMzMkbzEkZzAkDE3NzgwNTMzMzMkaJYwJGwwJGgzOTY4MDkzMzI

34 Hans Jong, N. (2026, May 27). Loopholes undermine palm oil industry's antideforestation pledges. Mongabay. <https://news.mongabay.com/2026/05/loopholes-undermine-palm-oil-industrys-antideforestation-pledges/>

further plantation expansion in a sector already approaching ecological limits. In this context, importing countries must alleviate the additional pressure by reducing their palm oil imports while Indonesia must strengthen sustainability safeguards and decouple biofuel demand from additional deforestation.

1.3. South Korea's biofuel expansion and dependence on palm oil

South Korea has expanded its demand for crop-based biofuels in a similar manner to reduce reliance on fossil fuels in the transport and energy sectors. The country's growing dependence on palm oil and palm derivatives has linked its decarbonization efforts to environmental and social risks embedded in overseas supply chains, particularly in Indonesia.

Since the introduction of the Renewable Fuel Standard (RFS) in 2015, the Korean government has steadily increased biodiesel blending mandate for the transport sector. The ratio currently stands at 4% (BD4), with plans to raise it to BD8 by 2030. The use of biofuels is subsidized in the power sector as well, with bio-heavy oil eligible for preferable renewable energy certificate multipliers under the country's Renewable Portfolio Standard introduced in 2012.

While initially concentrated on road transport, biofuel demand is now expected to expand further into aviation and maritime shipping. In 2025, the Ministry of Trade, Industry and Energy and the Ministry of Land, Infrastructure and Transport jointly announced a sustainable aviation fuel (SAF) blending mandate for international flights, targeting a 3–5% blending ratio by 2030.³⁵ In the maritime sector, biofuel demand is also expected to rise to meet the base target under the International Maritime Organization's Net-Zero Framework.³⁶

At the same time, South Korea's limited domestic resource base means that this growing demand is increasingly met through imported, predominantly palm-based feedstocks. Trade data suggest that imports of palm oil (HS 151190) and palm derivatives such as palm fatty acid distillate (PFAD) and palm oil mill effluent (POME) (HS 382312 and 382319) have risen sharply over recent years. With the fastest growth shown in palm derivatives from Indonesia, the country now supplies the majority of South Korea's PFAD and POME imports, while Malaysia remains the main source of refined palm oil.

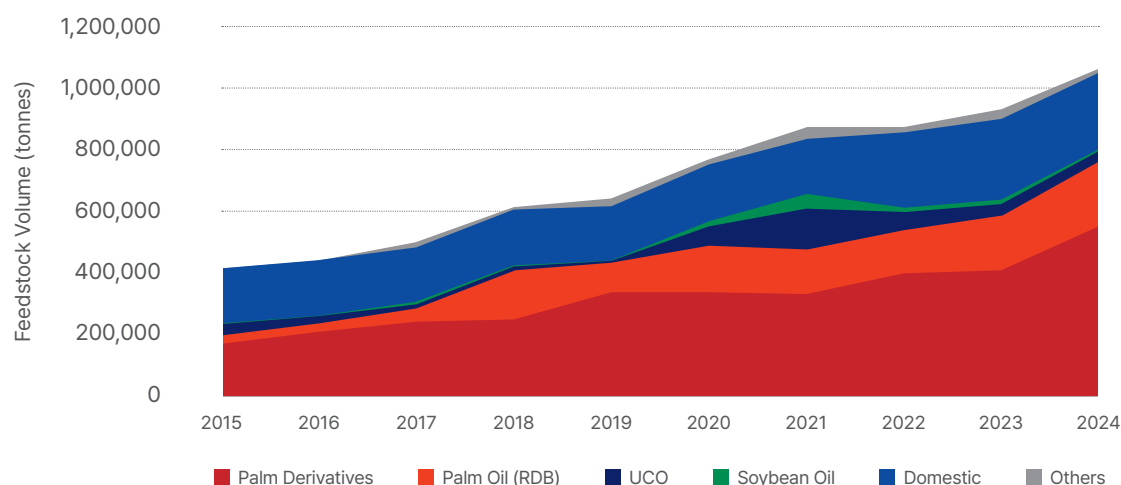
This trend aligns with the rapid expansion of South Korea's biodiesel industry. In 2024, palm oil and derivatives used for biodiesel recorded 766,000 tonnes, a fourfold increase since the introduction

35 Ahn, S. (2025, September 19). South Korea mandates sustainable aviation fuel blending for international flights from 2027. Chosun Ilbo. <https://biz.chosun.com/en/en-policy/2025/09/19/RNSAQRHSVJATLGGOCVVYKIDTDQ/>

36 Han, Y., Hong, S., Chi, Y. (2026). Shipping Decarbonization Continues: South Korea's Choices amid IMO Delay. Solutions for Our Climate. <https://forourclimate.org/research/641>

of the RFS in 2015. Proportion-wise, palm-related inputs now account for 72% of the biofuel mix, a substantial increase from less than 50% in 2015.³⁷ (Fig. 3) This dependency is expected to deepen further as biofuel mandates spread across the transport, aviation, and maritime sectors, while Indonesia increasingly prioritizes domestic refining, raising the share of derivatives available for export.

[Figure 3] South Korea's biodiesel feedstock composition³⁸



This trend inevitably deepens South Korea's exposure to LUC emissions, deforestation risks, and governance challenges embedded within producer country supply chains. Unlike the EU, South Korea has not adopted sustainability safeguards to screen out deforestation- or conflict-linked feedstocks. Current policy frameworks solely focus on expanding blending ratios and securing fuel supply in the absence of sustainability or legality requirements. This creates growing risks that South Korea is becoming a destination market for palm-based products unable or unwilling to meet tightening sustainability requirement elsewhere.³⁹ In 2022, South Korea had the highest share of non-NDPE Indonesian palm oil imports among Global North countries, with 38% of imports linked to suppliers lacking NDPE commitments and 42% when including suppliers with unknown commitments.⁴⁰

37 U.S. Department of Agriculture, Foreign Agricultural Service. (2026). Oilseeds and products annual: Korea. USDA Foreign Agricultural Service.

38 Ibid.

39 Drost, S., Kuepper, B., and Piotrowski, M. (2020). South Korean Companies Have Outsized Impact on Palm Oil Leakage Market. Chain Reaction Research. <https://www.aidenvironment.org/wp-content/uploads/2021/06/South-Korean-Companies-Have-Outsized-Impact-on-Palm-Oil-Leakage-Market-4.pdf>

40 Trase. (n.d.). Trase data. Indonesia palm oil. <https://trase.earth/explore/supply-chain/indonesia/palm-oil>

Highlight 1 **Leading measures to address deforestation and land-use change emissions**

The EU's experience illustrates the risks associated with expanding biofuel demand without robust sustainability safeguards.⁴¹ The EU initially promoted biofuels through the 2009 Renewable Energy Directive (RED),⁴² which significantly increased demand for crop-based biofuels. In response to mounting concerns over indirect land-use change (ILUC), the RED II delegated act of 2019 classified palm oil as a high-ILUC-risk feedstock and introduced a phase-out target by 2030.⁴³ ILUC emissions occur when expanding demand for biofuel feedstocks displaces existing agricultural production and indirectly drives conversion of forests and other ecosystems elsewhere. These emissions can significantly undermine the climate benefits claimed for crop-based biofuels.

The EU has since moved toward stricter traceability and deforestation safeguards. From 2027, the EU Deforestation Regulation (EUDR) will require commodities such as palm oil to be deforestation-free, legally sourced, and fully traceable.⁴⁴ While important loopholes and bilateral agreements limiting the implementation remain,⁴⁵ the EUDR has been overwhelmingly supported by civil society in both Europe and Indonesia due to its potential to improve the domestic forest governance.⁴⁶ Moreover, the Greenhouse Gas Protocol Land Sector and Removals Standard, effective from 2027 within the voluntary GHG Protocol framework, will also require companies to account for LUC emissions and improve supply chain traceability.⁴⁷ Under these emerging standards, biofuel emissions can no longer be treated as "carbon-neutral" without accounting for upstream land carbon impacts and potential leakage effects.

In this context, strengthening traceability systems and sustainability safeguards remains important, but may be insufficient on their own if overall demand for palm-based biofuels continues to rise. As ecological pressures intensify in producer countries and global sustainability requirements tighten, reducing structural dependence on palm-based biofuels becomes increasingly important alongside improving supply-chain governance and due diligence mechanisms.

41 Keating, D. (2015, April 26). EU caps "bad" biofuels. Politico. <https://www.politico.eu/article/eu-caps-bad-biofuels/>

42 European Commission. (n.d.). Renewable Energy Directive. https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en

43 European Commission. (2019). Commission Delegated Regulation (EU) 2019/807. Official Journal of the European Union. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R0807>

44 European Commission. (n.d.). Regulation on deforestation-free products. https://environment.ec.europa.eu/topics/forests/deforestation/regulation-deforestation-free-products_en

45 Environmental Investigation Agency. (2025, March 7). 'Alarming' rise in palm oil products being imported into the EU to make biofuels due to loophole. <https://eia-international.org/news/alarming-rise-in-palm-oil-products-being-imported-into-the-eu-to-make-biofuels-due-to-loophole/>

46 Madani Berkelanjutan. (2024, June). Indonesian Civil Society Position Paper: Considerations for benchmarking Indonesia's EUDR readiness – What the palm oil example reveals. https://madaniberkelanjutan.id/wp-content/uploads/2024/06/ENG-Position-Paper-Bersama-CSO-Indonesia_-Siapkah-Indonesia-untuk-EUDR.pdf

47 Greenhouse Gas Protocol. (2026). Land Sector and Removals Standard. <https://ghgprotocol.org/land-sector-and-removals-standard#supporting-documents>

2. Analysis: Supply chain risks embedded in Indonesia-Korea palm oil trade

2.1. The complexity of the palm oil supply chain

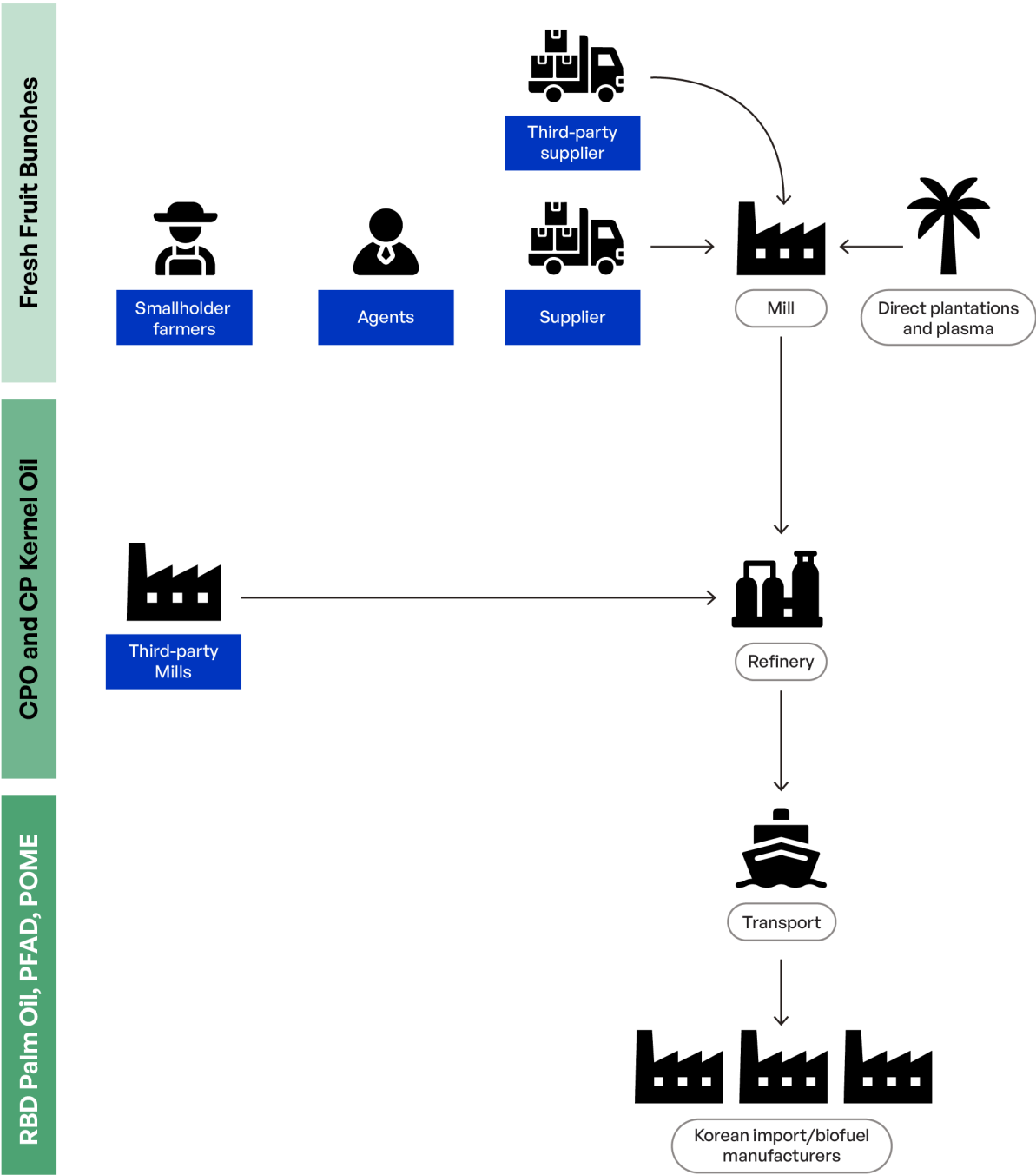
The Indonesia–Korea palm oil trade is characterized by highly fragmented and multi-layered supply chains involving plantations, mills, refineries, traders, biofuel manufacturers, and downstream fuel distributors operating across multiple jurisdictions. Rather than direct plantation-to-buyer relationships, palm oil and palm derivatives are typically blended, refined, and traded through interconnected networks before reaching Korean end users.⁴⁸ This structure complicates transparency, traceability, and plantation-level verification throughout the supply chain.⁴⁹

South Korea's biofuel sector relies not only on crude and refined palm oil (CPO), but increasingly on palm-derived products such as palm fatty acid distillate (PFAD) and palm oil mill effluent (POME). These products move through particularly opaque supply chains due to mixed refining streams, intermediary trading, and aggregation across multiple facilities. As a result, tracing derivatives back to specific plantations or mills is often significantly more difficult than for CPO itself. (Fig. 4)

48 Song, H., Kim, G., Shin, Y. (2023). Mission Failed: The limitations of palm oil certifications in preventing deforestation. Solutions for Our Climate. <https://forourclimate.org/research/347>

49 Ibid.

[Figure 4] Complex supply chains of palm oil and palm derivatives



Indonesia's export market is also highly concentrated among a relatively small number of large refinery and trading groups operating extensive plantation, milling, refining, and export infrastructure across the archipelago. These companies frequently rely on mixed sourcing systems combining company-owned concessions, third-party suppliers, independent mills, and smallholder producers. Consequently, even where direct operations maintain sustainability commitments or certification coverage, downstream buyers may remain exposed to risks associated with indirect suppliers elsewhere within broader sourcing networks.

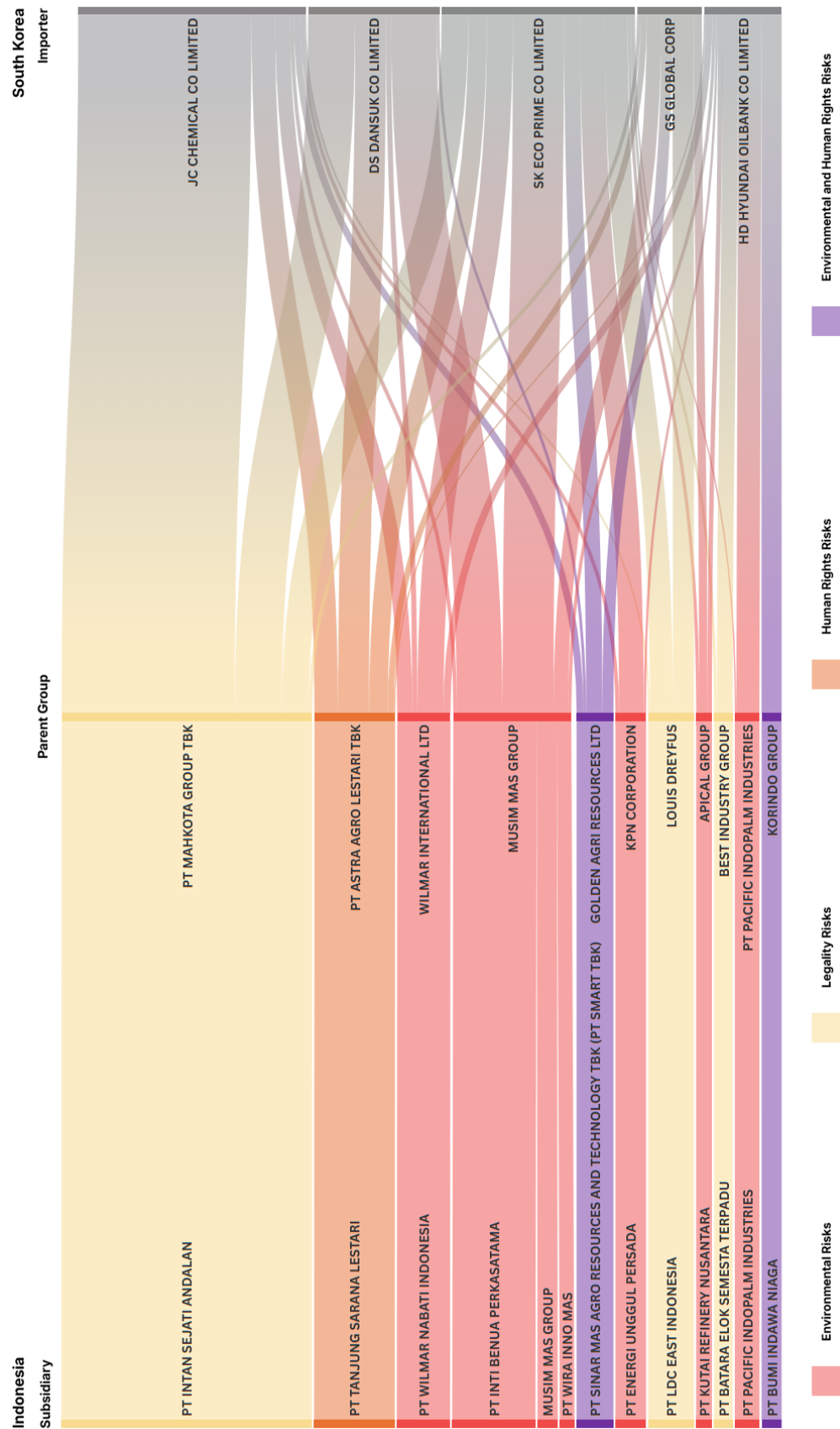
The structure of Indonesia's export market is further shaped by domestic refining priorities and biofuel mandates. As Indonesia expands biodiesel blending targets, increasing volumes of CPO are redirected toward domestic refining and fuel production, while export markets increasingly consist of refined products and derivatives rather than directly traceable CPO streams. These dynamics additionally complicate supply chain oversight for importing countries reliant on palm-derived feedstocks.

Certification systems add another layer of complexity. ISPO, RSPO, and ISCC certifications are widely used throughout export-oriented and biofuel supply chains, yet certification coverage often differs across subsidiaries, concessions, mills, and product streams within the same corporate group. In practice, Korean buyers frequently rely on supplier declarations and mass-balance certification systems rather than fully segregated supply chains, limiting the ability to independently verify plantation-level sourcing conditions.

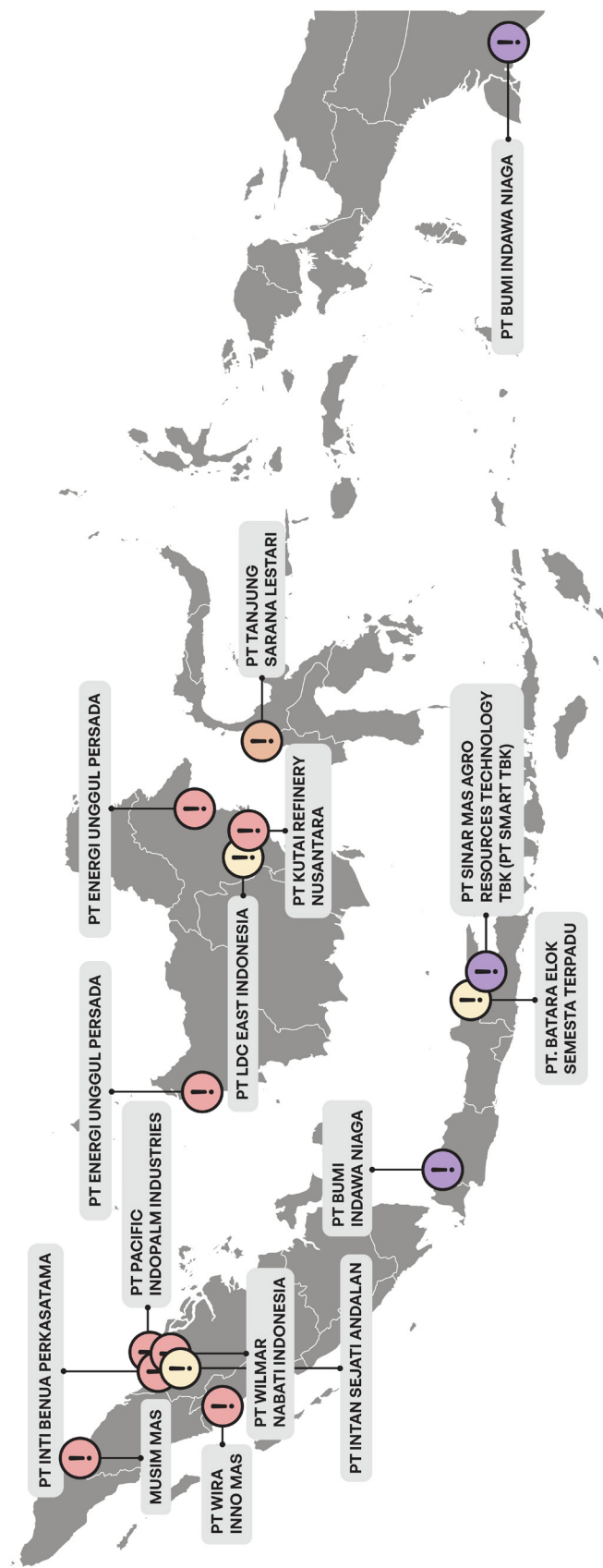
2.2. Key Indonesian producers and supply chain risks

This report analyzes the exports of palm oil and palm derivatives from Indonesia to South Korea based on commercially available per-shipment export data for the period of 2023–2025. The dataset used covers HS 151190, 382312, 382319, estimated to exceed the official import volumes declared to the Korea Customs Service by 15%. The analysis found that Korean companies sourced palm oil and derivatives from a total of 37 Indonesian refineries, 13 of which accounted for approximately 90% of export volumes. (Fig. 5) These refineries are linked to several major conglomerates operating extensive plantation, milling, refining, and export infrastructure predominantly across the islands of Sumatra and Kalimantan. (Fig. 6)

[Figure 5] Trade flow and supply chain risks of palm oil and derivatives from Indonesia to South Korea (2023–2025)



[Figure 6] Palm oil refineries exporting to South Korea



A notable feature of Korea-linked supply chains is the dominance of vertically integrated producer groups operating across multiple stages of the palm oil value chain simultaneously. Companies such as Wilmar Group, Musim Mas Group, Apical Group, and others control interconnected networks of production infrastructure and export terminals while also relying heavily on third-party sourcing networks. As a result, exports to South Korea frequently contain feedstocks aggregated from multiple suppliers, regions, and risk profiles. (Tab. 2)

[Table 2] Summary profiles of major palm oil refineries exporting to South Korea

Producer group	Estimated export volume (t)	Certification	Korean buyers	Sustainability risks
PT Mahkota Group Tbk	550,000	ISPO, ISCC	DS Dansuk GS Global JC Chemicals SK Eco Prime	Environment Legality
Musim Mas Group	250,000	RSPO, ISPO, ISCC, NDPE	DS Dansuk GS Global HD Hyundai Oilbank JC Chemical SK Eco Prime	Environment Legality
Wilmar International Ltd	110,000	RSPO, ISPO, ISCC, NDPE	DS Dansuk HD Hyundai Oilbank JC Chemical SK Eco Prime	Environment
PT Astra Agro Lestari Tbk	170,000	ISPO	DS Dansuk GS Global HD Hyundai Oilbank JC Chemical SK Eco Prime	Environment Legality Human rights
Louis Dreyfus	100,000	RSPO, ISCC, NDPE	GS Global JC Chemical SK Eco Prime	Transparency Legality
Golden Agri Resources Ltd	80,000	RSPO, ISPO, ISCC, NDPE	DS Dansuk GS Global JC Chemical SK Eco Prime	Environment Legality Human rights
KPN Corporation	70,000	ISCC	HD Hyundai Oilbank JC Chemical SK Eco Prime	Environment Human rights
Hayel Saeed Anam Group	50,000	RSPO, ISCC	HD Hyundai Oilbank SK Eco Prime	Environment
Korindo Group	40,000	ISCC (subsidiary)	HD Hyundai Oilbank	Environment

Producer group	Estimated export volume (t)	Certification	Korean buyers	Sustainability risks
BEST Group	40,000	ISCC (subsidiary)	HD Hyundai Oilbank SK Eco Prime	Legality
Apical Group	30,000	RSPO, ISCC	GS Global HD Hyundai Oilbank SK Eco Prime	Environment

Several patterns emerge from the supplier analysis. First, many Korea-linked refinery operators maintain sustainability certifications and NDPE commitments while simultaneously remaining connected to supplier networks associated with environmental or governance controversies. This reflects the structural complexity of indirect sourcing, where certified refinery operations may continue receiving feedstocks from third-party mills or suppliers operating in high-risk landscapes.

Second, some Korea-linked suppliers, accounting for 23% of export volumes in 2025, were involved in operations in regions affected by the severe floods that struck the island of Sumatra in late 2025. Major plantation and refinery groups—including Wilmar, Musim Mas, Golden Agri Resources (Sinar Mas Group), Astra Agro Lestari, and others—have concessions or sourcing networks located in flood- and landslide-prone watersheds across Aceh, North Sumatra, and West Sumatra. Some of the suppliers had their forest utilization permits revoked for environmental and land use violations following government investigations in response to the deadly floods in early 2026.

Third, many groups face a multitude of social and governance risks in addition to direct deforestation. Musim Mas Group is being investigated for environmental crimes by the Special Criminal Investigation of the Riau Police. Korindo Group's FSC certification has been revoked over deforestation and human rights concerns in Papua, while Apical Group has faced repeated allegations regarding sourcing connected to deforestation and conflict near the Gunung Leuser Ecosystem. These cases illustrate that sustainability risks extend beyond land-use change alone and include legal, labor, and human rights concerns.

2.3. Key Korean buyers and supply chain risks

South Korea's palm oil imports are concentrated among a relatively small group of biodiesel refiners, commodity traders, and energy companies importing PFAD, POME, refined palm oil, and other palm-derived feedstocks. Trade flow analysis identified JC Chemical, DS Dansuk, SK Eco Prime, GS Global, and HD Hyundai Oilbank as key actors involved in importing or processing Indonesian palm oil and palm derivatives for biofuel products.

Highlight 2 Big 5 Korean biofuel companies using palm oil

JC Chemical is a long-established Korean company notable for being the only domestic biofuel producer with full vertical integration,⁵⁰ from palm plantation ownership in Indonesia through to biodiesel production in South Korea. The company imports primarily refined palm oil and operates across biodiesel, bio-heavy oil, and related by-products. Trade data suggest that imports increased sharply from 2023 to 2024 before declining in 2025.

DS Dansuk is an established producer of bioenergy fuels supplying oil refineries, shipping companies, and power utilities. While bioenergy products account for more than half of the company's sales, trade data indicate that DS Dansuk's imports of palm oil and palm stearin declined substantially since 2023.

SK Eco Prime is one of South Korea's largest specialized biodiesel producers, focusing on the production of biodiesel and bio-heavy oil. Part of SK Group, the company has undergone ownership changes and is now fully controlled by private equity investors. Trade data indicate that SK Eco Prime has emerged as a major importer of palm-based feedstocks, particularly PFAD, from Indonesia, with volumes rising sharply since 2023.

GS Global is the general trading arm of GS Group and plays a key role in sourcing and trading palm oil and derivatives used in Korean biofuel supply chains. While GS Global itself is responsible for importing refined palm stearin and palm oil with a notable increase in imports in 2025, it operates within the broader corporate group that includes GS Caltex as an affiliated refining company.

HD Hyundai Oilbank is one of South Korea's major petroleum refiners and a core energy affiliate of HD Hyundai Group. The company is actively expanding into biodiesel and sustainable aviation fuel (SAF). Correspondingly, trade data show rising imports of palm-based feedstocks, particularly PFAD, from Indonesia since 2024. In 2025, HD Hyundai Oilbank entered a PFAD supply agreement with Korindo and LX International worth a total of 80,000 tonnes annually.⁵¹

Further information on corporate ownership, financing relationships, and detailed import patterns is provided in Annex I.

Korean companies sourcing from the same group of large Indonesian refinery operators and trading houses with documented sustainability controversies creates exposure across South Korea's supply chain. Many of the Korean importers are linked to supplier groups associated with sourcing from high-risk landscapes, the 2025 Sumatra floods, land rights disputes, and corruption.

However, unlike markets where sustainability regulations increasingly require plantation-level traceability and due diligence, Korean buyers either fail to assess sustainability risks entirely or

50 Kim, G. (2026, January 14). 제이씨케미칼, 인도네시아 팜 농장 보유...바이오 연료 시장 확대 수혜. 머니투데이. <https://www.mt.co.kr/sto ck/2026/01/14/2026011408445472666>

51 The Korea Herald. (2025). Hyundai Oilbank renews push for biofuel business. <https://www.koreaherald.com/article/3244736>

demonstrate limited transparency and weak sustainability governance. Most Korean companies remain several tiers removed from plantation origins, unaware of indirect sourcing networks, third-party supplier relationships, and upstream land-use risks embedded within Indonesian supply chains.

Publicly available disclosures also show that three of the mapped companies do not publish sustainability reports. None pledged to No Deforestation, No Peat, and No Exploitation (NDPE) or equivalent deforestation-free frameworks. Where disclosures exist, risk management and mitigation approaches remain narrowly framed. Reported measures primarily focus on life-cycle assessment or general environmental management, without explicitly addressing palm-based feedstocks or upstream land-use risks. Environmental or biodiversity policies are typically high-level and largely oriented toward domestic operations, with limited to no coverage of overseas supply chains where the most significant risks arise.

Only one company appeared to have adopted a human rights and due diligence policy referencing the protection of local communities. However, this policy is similarly limited in scope, seemingly focusing on the company's direct operations rather than extending across its full supply chain. In addition, none of the companies responded to a questionnaire sent as a research tool for this report, limiting visibility into their risk management practices and broader approach to supply chain sustainability.

At the same time, some Korean firms are moving further upstream into Indonesia's palm oil sector through refinery investments and plantation ownership. POSCO International and GS Caltex's joint AGPA refinery project in East Kalimantan illustrates this shift toward greater Korean involvement in Indonesia itself.⁵² POSCO International's simultaneous expansion of plantation holdings through the acquisition of Sampoerna Agro further deepens exposure to land-use and governance risks subject to Indonesian domestic policy and regulatory conditions.

Highlight 3 Korean Big Oil expanding upstream into Indonesia's palm oil sector

POSCO International & GS Caltex: Vertical integration of the palm oil value chain

POSCO International and GS Caltex are deepening the Korean involvement in Indonesia's palm oil sector through upstream investments linked to South Korea's growing biofuel demand. Their AGPA refinery complex in Balikpapan, East Kalimantan, completed in late 2025, represents a major step toward vertical integration involving Korean Big Oil.

52 Chosun Biz. (2025, November 20). GS Caltex and POSCO INTERNATIONAL open palm oil refinery in Indonesia to supply bio feedstock. <https://biz.chosun.com/en/en-industry/2025/11/20/QKBBQAKMXJGB3HIQC3JWULVZYQ/>

The project mobilized approximately USD 170 million (KRW 260 billion) in investment and has an annual refining capacity of 500,000 tonnes of palm oil products intended for export to South Korea, China, and Indonesia. The refinery is expected to play a strategic role in supplying biodiesel feedstocks to the Korean market, with commercial operations and certification expected in 2026.⁵³

The refinery is expected to source CPO mostly from POSCO International's own plantations in Indonesia. Since 2011, POSCO International has operated plantations and mills through its subsidiary PT Bio Inti Agrindo (PT BIA) and further expanded its plantation holdings by 128,000 hectares in late 2025 through the acquisition Sampoerna Agro.⁵⁴ These developments reflect a broader shift from downstream purchasing toward direct ownership and control across the palm oil value chain.

At the same time, POSCO International has faced longstanding criticism over environmental and social impacts associated with its plantation development. PT BIA destroyed over 27,000 hectares of rainforest in Papua between 2011 and 2018, alongside violating the rights of Indigenous peoples and local communities.⁵⁵ Although POSCO International later adopted NDPE policy and RSPO certification,⁵⁶ these commitments were criticized for greenwashing the company's deforestation past and their effectiveness remaining dependent on implementation, monitoring, and supplier oversight.

Korindo Group & HD Hyundai Oilbank: Direct exposure to deforestation-linked supply chains

Korindo Group, an Indonesian conglomerate owned by a Korean family, represents a direct Korea-linked supply chains through an offtake agreement with HD Hyundai Oilbank. The relationship links yet another Korean Big Oil to a corporate group with a history of large-scale deforestation and human rights abuses.

Since 2013, Korindo subsidiaries cleared more than 50,000 hectares of natural forests in Papua and parts of Maluku, alongside allegations involving Indigenous land rights violations and inadequate grievance and remedy mechanisms.⁵⁷ These findings ultimately led to the revocation of the Group's Forest Stewardship Council certification, underscoring the severity of the concerns raised.⁵⁸

53 POSCO International. (2026, January 29). 2025년 4분기 경영실적. 포스코인터내셔널.

54 The Korea Times. (2025, November 20). POSCO International to invest \$862 million in Indonesian palm oil business. <https://www.koreatimes.co.kr/business/companies/20251120/posco-international-to-invest-862-mil-in-indonesian-palm-oil-business>

55 Government Pension Fund Global. (2015). Recommendation to exclude Daewoo International Corporation and POSCO from the Government Pension Fund Global. pp. 3–5. <https://etikkradet.no/recommendation-daewoo-270315/>

56 Mighty Earth. (2020, March 02). Major Rainforest Destroyer in Indonesia Pledges to Address its Deforestation Legacy. <https://mightyearth.org/article/major-rainforest-destroyer-in-indonesia-pledges-to-address-its-deforestation-legacy/>; PT Bio Inti Agrindo. (n.d.). Sustainability. <https://ptbia.co.id/sustainability>

57 Aidenvironment. (2016). Burning Paradise. <https://www.mightyearth.org/wp-content/uploads/2018/02/2016-08-25-FINAL-Korindo-report-English-3.pdf>

58 Forest Stewardship Council (FSC). (n.d.). Policy association cases: Korindo Group. <https://connect.fsc.org/current-cases/policy-association-cases/korindo-group>

Korindo has disputed several allegations, articulated “no-deforestation” commitments,⁵⁹ and stated that it no longer operates in the palm oil sector.⁶⁰ However, the supply agreement with HD Hyundai Oilbank, alongside documented forest loss associated with Korindo-linked operations as recently as 2025,⁶¹ raises questions about the effectiveness of its sustainability commitments and practices in managing ESG risks.

Given this record, direct sourcing relationships involving Korindo should be treated as heightened risk exposure rather than as indirect or legacy linkages when assessing Korea-linked palm oil supply chains.

59 Korindo Group. (2026, April 15). Korindo responds to misinterpretation on no deforestation commitments. <https://korindonews.com/korindo-responds-to-misinterpretation-on-no-deforestation-commitments/>

60 Ibid.

61 Earthsight. (2025, October). Risky business. EU Timber imports linked to the destruction of Borneo's Forests. <https://www.earthsight.org.uk/media/download/2395>

3. Deep dive: Risk profiles of Indonesian palm oil suppliers to South Korea

3.1. PT Mahkota Group Tbk

Certification and Policy: ISPO and ISCC⁶²

➤ PT Intan Sejati Andalan (Bengkalis, Riau)

Certification and Policy: ISPO and ISCC⁶³

Sustainability Risks:

- **Environment**

- **Certification/buyer grievance**

In 2025, PT ISA mill appeared on Fuji Oil's Grievance List due to connection to a supplier involved in peatland degradation,⁶⁴ although Mahkota Group clarified that it had ceased purchase from the flagged concession in 2024.

- **Legality**

- **Civil society investigation**

In 2025, Indonesia's Environmental Conservation Institute (LKLH) noted land-use permit noncompliance involving PT ISA's operations within national forest areas in Bengkalis, Riau.⁶⁵

Exports to South Korea: Based on trade data analysis, PT ISA exported to JC Chemical, SK Eco Prime, and DS Dansuk in 2023 and 2024, and GS Global in 2023. PT ISA exported over 550,000 tonnes of palm oil and PFAD to South Korea over the period of 2023–2025, with volumes peaking in 2024.

62 PT Mahkota Group Tbk. (n.d.). Standards and Certifications. <https://www.mahkotagroup.com/en/profil/standard-dan-sertifikasi>

63 Ibid.

64 Fuji Oil Group. (2025, October). Public Grievance List. https://www.fujioil.co.jp/pdf/en/sustainability/grievance_mechanism/2510_public_grievance_list.pdf

65 Metro TV News. (2025, April). Disinyalir Banyaknya Perusahaan dan Perkebunan Kelapa Sawit yang Belum Memiliki Izin Kawasan Hutan, di Duga Salah Satunya PT. INTAN SEJATI ANDALAN (PT.ISA). <https://www.metronewstv.co.id/2025/04/disinyalir-banyaknya-perusahaan-dan.html>

3.2. Musim Mas Group

Certification and Policy: ISPO, RSPO, ISCC, and follows the NDPE Implementation Reporting Framework (IRF);⁶⁶ Public Disclosure Program for Environmental Compliance (PROPER), and Traceability to Mill and Traceability to Plantation Verification schemes⁶⁷

Sustainability Risks:

- **Environment**

- **Civil society investigation**

Investigations by Rainforest Action Network (RAN) in 2023 found that Musim Mas Group sourced from mills close to a plantation involved in deforestation and conflict in Gunung Leuser National Park, Aceh Tamiang (Sumatra).⁶⁸ A follow-up RAN investigation in 2024 identified new similar evidence in another part of the Leuser Ecosystem,⁶⁹ where supplier mills are located near the ecosystem and the Rawa Singkil wildlife conservation area. RAN has identified a number of these mills as being at risk of sourcing illegal palm oil,⁷⁰ although it remains unclear to which refinery the supply is directed.

- **2025 Sumatra floods linkage**

The following supplier mills overlap with areas affected by the recent deadly Sumatra floods. Evidence links increased flood intensity with forest loss and weakening of watershed absorption capacity following region-wide plantation development. Sourcing from these areas raises additional concerns around heightened exposure to flood risks, reduced landscape resilience, and amplification of downstream social impacts, including climate vulnerability and damage to local livelihoods.⁷¹

66 Musim Mas Group. (n.d.). NDPE implementation reporting framework (IRF) profile. <https://www.musimmas.com/sustainability/responsible-sourcing/irf-profile/>

67 Musim Mas Group. (n.d.). Certifications and Verifications. <https://www.musimmas.com/sustainability/certifications-and-verifications/>

68 Rainforest Action Network (RAN). (2024a). Illegal Deforestation Persists in Indonesia's Gunung Leuser National Park. <https://www.ran.org/leuser-watch/illegal-deforestation-persists-in-indonesias-gunung-leuser-national-park/>

69 Rainforest Action Network (RAN). (2024b). Orangutan Capital Under Siege. <https://www.ran.org/leuser-watch/orangutan-capital-under-siege/>

70 Rainforest Action Network (RAN). (2024c). P&G Accused of Failing to Deliver on Public Commitment to Restore Illegal Palm Plantations in Leuser Ecosystem. <https://www.ran.org/leuser-watch/pg-accused-of-failing-to-deliver-on-public-commitment-to-restore-illegal-palm-plantations-in-leuser-ecosystem/>

71 Musim Mas Group. (n.d.). List of Suppliers. <https://www.musimmas.com/sustainability/responsible-sourcing/traceability/list-of-suppliers/>

Location	Mill
Aceh Singkil	PT Singkil Sejahtera Makmur, PT Ensem Lestari, PT Perkebunan Lembah Bhakti I, PT Perkebunan Lembah Bhakti II, PT Delima Makmur
Aceh Tamiang	PT Betami, PT Bumi Tamiang Sentosa, PT Tri Agro Palma Tamiang
Subulussalam	PT Bangun Sempurna Lestari

- **Legality**

- **Government enforcement**

In 2025, Musim Mas Group was involved in a corruption case for allegedly bribing judges handling a 2022 case related to the provision of CPO export facilities and its derivatives linked to the Group.⁷² Most recently, the Riau Regional Police's Special Criminal Investigation Directorate officially named Musim Mas as a corporate suspect in an alleged environmental crime case related to palm oil plantation cultivation in the border area of the Air Hitam River and the forest area in Ukui District, Pelalawan Regency. Based on the results of expert calculations, the losses due to environmental damage in the case amounted to IDR 187.8 billion (USD 10.6 million).⁷³

Exports to South Korea: Based on trade data analysis, PT Musim Mas is estimated to export 40,000 tonnes of PFAD to SK Eco Prime and DS Dansuk in 2025.

- **PT Inti Benua Perkasatama (Dumai, Riau)**

Certification and Policy: ISPO, RSPO, ISCC, and NDPE; applies Traceability to Mill (TTM) verification statement^{74 75}

Sustainability risks:

- **Environment**

- **2025 Sumatra floods linkage**

72 Kejaksaan Agung Republik Indonesia. (2025). Penyitaan Uang RP 1,3 Triliun Perkembangan Perkara CPO Minyak Goreng Terdakwa Korporasi. <https://www.kejaksaan.go.id/index.php/conference/news/6212/read>

73 VOI. (2026, May 18). Becomes Suspect, Riau Police Traps PT Musim Mas in Environmental Destruction Case. <https://voi.id/en/news/575781>

74 Musim Mas Group. (n.d.). Certifications and Verifications. <https://www.musimmas.com/sustainability/certifications-and-verifications/>

75 Musim Mas Group. (n.d.). NDPE implementation reporting framework (IRF) profile. <https://www.musimmas.com/sustainability/responsible-sourcing/irf-profile/>

One supplier mill, Agrowiratama Mill, owned by PT Musim Mas, is located in Sungai Aur of Pasaman Barat Regency, Sumatra. The area was affected by the major flooding in Sumatra, last November.

Exports to South Korea: Based on trade data analysis, IBP exported over 180,000 tonnes of PFAD and refined palm oil to DS Dansuk, GS Global, SK Eco Prime, and HD Hyundai Oilbank over the period of 2023–2025.

➤ PT Wira Inno Mas (Padang, West Sumatra)

Certification and Policy: ISPO, RSPO, ISCC, and NDPE.^{76 77}

Sustainability risks:

- **Environment**

- **2025 Sumatra floods linkage/government enforcement**

PT Wira Inno Mas has received palm oil from mills linked to companies implicated in the 2025 Sumatra floods as recently as September 2025.⁷⁸ One such supplier was PT Tri Bahtera Srikandi (PT TBS), a plantation and mill operator under PT Sago Nauli Plantation. In December 2025, Indonesia's Ministry of Environment and Forestry (KLHK) sealed PT TBS's plantation and mill due to environmental concerns following the severe flooding.⁷⁹ Another supplier, PT Perkebunan Pelalu Raya, was among the 28 companies whose forest utilization permits were revoked by President Prabowo Subianto after government findings linked corporate land-use violations in Aceh, North Sumatra, and West Sumatra to the floods and landslides.⁸⁰

Exports to South Korea: Based on trade data analysis, WIM exported over 30,000 tonnes of refined palm products to GS Global, JC Chemical, and DS Dansuk, peaking in 2025.

76 Musim Mas Group. (n.d.). Certifications and Verifications. <https://www.musimmas.com/sustainability/certifications-and-verifications/>

77 Musim Mas Group. (n.d.). NDPE implementation reporting framework (IRF) profile. <https://www.musimmas.com/sustainability/responsible-sourcing/irf-profile/>

78 Musim Mas Group. (2025). Wira Inno Mas – Padang, West Sumatra. <https://www.musimmas.com/report/wira-inno-mas-padang-west-sumatra-july-september-2025/>

79 Kementerian Lingkungan Hidup (KLH)/Badan Pengendalian Lingkungan Hidup (BPLH). (2025, December 11). KLH/BPLH segel kebun sawit di Tapanuli Tengah: Menteri LH tegaskan penegakan lingkungan pasca banjir. <https://kemenlh.go.id/news/detail/klhbplh-segel-kebun-sawit-di-tapanuli-tengah-menteri-lh-tegaskan-penegakan-lingkungan-pasca-banjir>

80 Tempo. (2026, January 20). Daftar 28 Perusahaan yang Dicabut Izin Pemanfaatan Hutan. <https://www.tempo.co/politik/daftar-28-perusahaan-yang-dicabut-izin-pemanfaatan-hutan-2108623>

Highlight 4 2025 Sumatra floods worsened by palm oil plantations

Figure 7. Sumatra floods affected areas (left), via Google Earth; and flood aftermath (right) ("Galodo Padang Panjang - Nov 2025" by Rahmatdenas, via Wikimedia Commons, licensed under [CC BY 4.0.](https://creativecommons.org/licenses/by/4.0/))

In November 2025, Indonesia experienced devastating floods across Sumatra Island, affecting the provinces of Aceh, North Sumatra, and West Sumatra. The disaster resulted in over 1,208 deaths and displaced more than one million residents, making it one of the deadliest flood events in the region in recent years.⁸¹

The floods were triggered by extreme rainfall associated with Tropical Cyclone Senyar, but their severity was amplified by underlying environmental degradation. Over the past decade, extensive deforestation and land-use change have weakened the island's ecological resilience. Between 2016 and 2025, approximately 1.4 million hectares of forest across the three provinces were cleared by 631 corporations operating under permits for mining, palm oil, geothermal, and hydropower projects.⁸²

This large-scale loss of forest cover disrupted critical hydrological functions and switched Sumatra's forests from vital carbon sinks to major sources of greenhouse gas emissions. For smallholder oil palm plantation in Sumatra peat drainage generates substantial and persistent CO₂ emissions. These are estimated at ~178 metric tonnes per hectare annually in the early stages of drainage, declining to ~121 metric tonnes for recently established plantations and 70–85 metric tonnes in long-established sites.⁸³

81 Badan Nasional Penanggulangan Bencana (BNPB). (2025). Rekapitulasi Terdampak Bencana. <https://gis.bnpb.go.id/bansorsumatera2025/>

82 Wahana Lingkungan Hidup Indonesia (WALHI). (2025, December 02). Legalisasi Bencana Ekologis di Sumatera dan Tuntutan Tanggung Jawab Negara serta Korporasi. <https://www.walhi.or.id/legalisasi-bencana-ekologis-di-sumatera-dan-tuntutan-tanggung-jawab-negara-serta-korporasi>

83 Khasanah, N., van Noordwijk, M. (2019, January). Subsidence and carbon dioxide emissions in a smallholder peatland mosaic in Sumatra, Indonesia. *Mitig Adapt Strateg Glob Change*. <https://doi.org/10.1007/s11027-018-9803-2>

At the same time, reduced canopy cover and degraded soil structure lowered water infiltration while increasing surface runoff. Watersheds that once absorbed up to 55% of rainfall have lost much of their retention capacity, resulting in faster and more destructive flooding during heavy precipitation events.⁸⁴

Deforestation and plantation expansion for palm oil was also linked to destruction encroached upon the Leuser Ecosystem—the last habitat where Sumatran tigers, rhinos, orangutans, and elephants coexist. Research found that several major palm oil corporations operating in the affected provinces were linked to the floods through concessions and supply chains in ecologically sensitive landscapes.⁸⁵ In Aceh, Sinar Mas Group, through Golden Agri Resources and PT SMART, maintained palm oil supply chain connections in areas surrounding the Leuser Ecosystem and Rawa Singkil—regions repeatedly associated with deforestation and flooding. Musim Mas Group operated extensively in Aceh Tamiang, Aceh Singkil, Aceh Timur, and Subulussalam, all of which experienced severe flooding in late 2025.

In North Sumatra, PT Astra Agro Lestari held concessions in flood- and landslide-prone areas. Similar patterns were identified West Sumatra, where corporations including Wilmar Group, Golden Agri Resources, Musim Mas Group, PT Astra Agro Lestari, and Bakrie Sumatra Plantations operated concessions or maintaining supply chain connections in disaster-prone watersheds. Importantly, the Indonesian government recognized the role of destructive land-use practices in worsening the disaster. In response to the floods, the government revoked the forest utilization permits of 28 companies—including 22 operating in natural and plantation forest concessions and six in mining, plantation, and timber utilization sectors—due to violations linked to flooding in the affected areas.⁸⁶

Despite many of these companies maintaining sustainability commitments and certifications, implementation and enforcement remain inconsistent and often ineffective. The disaster highlighted broader governance gaps within Indonesia's plantation and extractive sectors and demonstrated how environmental degradation linked to plantation expansion can intensify not only deforestation and biodiversity loss, but also disaster vulnerability and large-scale impacts on local communities.

84 Badan Meteorologi Klimatologi dan Geofisika (BMKG). (2025, December 15). Tragedi Sumatera: Ketika Hutan Hilang, Bencana Datang. <https://gaw-bariri.bmkg.go.id/index.php/karya-tulis-dan-artikel/artikel/385-tragedi-sumatera-ketika-hutan-hilang-bencana-datang>

85 JATAM, Hutan Hujan, AWF & KSPPM. (2026). Katastrofe Sumatra: Analisis bencana ekologis dan faktor struktural pemicunya. <https://www.hutanhujan.org/files/id/Katastrofe%20Sumatra%20Jatam%20AWF%20KSPPM%20Januar%202026.pdf>

86 Tempo. (2026, January 20). Daftar 28 Perusahaan yang Dicabut Izin Pemanfaatan Hutan. <https://www.tempo.co/politik/daftar-28-perusahaan-yang-dicabut-izin-pemanfaatan-hutan-2108623>

3.3. Wilmar International Ltd

Certification Policy: ISPO, RSPO, ISCC, and NDPE^{87 88}

Sustainability risks:

- **Environment**

- **Government/court enforcement**

Indonesia's Attorney General's Office seized IDR 11.8 trillion (USD 729 million) from Wilmar subsidiaries as part of a corruption probe involving allegations of bribery to secure palm oil export permits during the 2022 cooking oil crisis.⁸⁹ The case escalated after investigations revealed that several judges involved in an earlier acquittal had allegedly accepted bribes.

- **Civil society investigation**

Wilmar has been alleged several times to cause environmental pollution through its subsidiaries, including river contamination and waste leakage cases across regions in Indonesia.^{90 91} Despite multiple investigations and calls for accountability, these cases have often remained unresolved, resulting in a prolonged regulatory and governance deadlock.

➤ PT Wilmar Nabati Indonesia (Riau, East Java, West Sumatra, Central Kalimantan)

Certification and Policy: ISPO, RSPO, ISCC, and NDPE^{92 93}

Sustainability risks:

- **Environment**

- **Government/court enforcement**

PT WNI has received palm oil from mills linked to companies implicated in the environmental and permitting violations associated with the Sumatra floods. These include PT Sago Nauli and

87 Wilmar International Limited. (n.d.). Certification. <https://www.wilmar-international.com/sustainability/certification>

88 Wilmar International Limited. (n.d.). Sustainability. <https://www.wilmar-international.com/sustainability>

89 Business Today. (2025, June 18). Wilmar Claims Cooking Oil Export Was Done In Compliance Of Indonesia Law. <https://www.businesstoday.com.my/2025/06/18/wilmar-claims-cooking-oil-export-was-done-in-compliance-of-indonesia-law/>

90 Widiyanto, E. (2022, 3 March). Kebun dan pabrik sawit Wilmar diduga cemari sungai di Kalimantan Barat. Mongabay Indonesia. <https://mongabay.co.id/2022/03/03/kebun-dan-pabrik-sawit-wilmar-diduga-cemari-sungai-di-kalimantan-barat/>

91 Rizal. (2023, February 15). Limbahnya diduga cemari sungai, warga demo PKS Wilmar Group. Elaeis. <https://www.elaeis.co/berita/baca/limbahnya-diduga-cemari-sungai-warga-demo-pks-wilmar-group>

92 Wilmar International Limited. (n.d.). Sustainability. <https://www.wilmar-international.com/sustainability>

93 Wilmar International Limited. (n.d.). Certification. <https://www.wilmar-international.com/sustainability/certification>

PT TBS—the latter sealed by KLHK in December 2025. In a separate action, President Prabowo Subianto revoked the forest utilization permits of 28 companies found to have contributed to land use violations leading to floods and landslides across Aceh, North Sumatra, and West Sumatra—mirroring the cases connected to PT WIM.⁹⁴

– **2025 Sumatra floods linkage**

PT WNI owns mills located within the flooded regions in Sumatra, as well as sources from the region's other suppliers.⁹⁵

Location	Mill
Subsidiaries	
Agam, West Sumatra	AMP Plantation
Pasaman Barat, West Sumatra	PT Gersindo Minang Plantation
Solok Selatan, West Sumatra	PT Kencana Sawit Indonesia
Third-party suppliers	
Agam, West Sumatra	PT Muatiara Agam, PT Karya Agung Megah Utama
Pasaman Barat, West Sumatra	PT Bintara Tani Nusantara, PT Agro Wira Ligatsa, PT Andalas Agro Industri, PT Sari Buah Sawit
Air Balam, West Sumatra	PT Bakrie Pasaman Plantation
Tapanuli Selatan, North Sumatra	PT Maju Indo Raya

Exports to South Korea: Based on trade data analysis, PT WNI exported over 110,000 tonnes of refined palm oil products and fatty acid derivatives to SK Eco Prime, JC Chemical, HD Hyundai Oilbank, and DS Dansuk over the period of 2023–2025.

3.4. PT Astra Agro Lestari Tbk

Certification and Policy: ISPO⁹⁶

Sustainability risks:

94 Tempo. (2026, January 20). Daftar 28 Perusahaan yang Dicabut Izin Pemanfaatan Hutan. <https://www.tempo.co/politik/daftar-28-perusahaan-yang-dicabut-izin-pemanfaatan-hutan-2108623>

95 Wilmar International Limited. (n.d.). Traceability. <https://www.wilmar-international.com/sustainability/supply-chain-transformation/traceability/supply-chain-map>

96 PT Astra Agro Lestari Tbk. (2024). Sustainability Report 2024. <https://www.astra-agro.co.id/wp-content/uploads/2025/04/SR-AAL-2024.pdf>

- **Environment and human rights**

- **Civil society investigation**

In 2024, UN Special Rapporteurs accused PT Astra Agro Lestari (PT AAL) Tbk of human rights and environmental abuses linked to the company's operations in Sulawesi, following findings by Friends of the Earth and WALHI. AAL and its subsidiaries allegedly operated without necessary permits on Indigenous ancestral and farming communities' lands without meaningful consultation or the free, prior and informed consent (FPIC) of the communities.⁹⁷ PT AAL Tbk denied the allegations and maintained that all operations complied with Indonesian law.⁹⁸

Recent analysis by JATAM also highlighted that AAL's concessions in North Sumatra and West Sumatra were in flood- and landslide-prone areas, where extensive land-use change has weakened natural hydrological buffers. JATAM identified AAL—alongside Wilmar, Golden Agri Resources, Musim Mas, and Bakrie Sumatra Plantations—as part of a cluster of large operators whose activities contributed to landscape degradation, increasing regional vulnerability to flash floods and landslides.⁹⁹

- **PT Tanjung Sarana Lestari (Pasangkayu, West Sulawesi)**

Certification and Policy: None

Sustainability risks:

- **Legal and human rights**

- **Civil society investigation**

PT Tanjung Sarana Lestari (PT TSL) has direct suppliers that have been repeatedly linked to land tenure and permit violations. One direct supplier, PT Letawa of Pasangkayu, West Sulawesi, has been the subject of multiple reports concerning violations of rights to cultivate (HGU) boundaries.¹⁰⁰ In November 2025, residents in Jengeng Raya Village and Lariang Village reported that houses and huts were demolished by excavators accompanied by hired security personnel. According to the Pasangkayu Regency National Land Agency, the contested area

97 Hans Jong, N. (2025, March 3). UN accuses Indonesia's No. 2 palm oil firm of rights & environmental abuses. Mongabay. <https://news.mongabay.com/2025/03/un-accuses-indonesias-no-2-palm-oil-firm-of-rights-environmental-abuses/>

98 Business & Human Rights Centre. (2025, May 16). PT Astra Agro Lestari (AAL)'s response to the allegations. <https://www.business-humanrights.org/en/latest-news/pt-astra-agro-lestari-aals-response-to-the-allegations/>

99 JATAM, Hutan Hujan, AWF & KSPPM. (2026). Katastrofe Sumatra: Analisis bencana ekologis dan faktor struktural pemicunya. <https://www.hutanhujan.org/files/id/Katastrofe%20Sumatra%20Jatam%20AWF%20KSPPM%20Januar%202026.pdf>

100 Fathir, A. R. (2025, May 3). PT Letawa Dilaporkan ke Polda Sulbar atas Dugaan Perambahan Lahan. INews Mamuju. <https://mamuju.inews.id/read/589529/pt-letawa-dilaporkan-ke-polda-sulbar-atas-dugaan-perambahan-lahan>

lay outside PT Letawa's HGU permit. Since the incident, tensions between local communities and the company have remained high.¹⁰¹

Another supplier, PT Lestari Tani Teladan (PT LTT)—also owned by AAL and a direct supplier to PT TSL—has faced repeated allegations of agrarian conflict in Central Sulawesi.¹⁰² PT LTT has been accused of operating on land outside its HGU boundary where residents claimed that parts of their land overlapped with the company's concession.

Exports South Korea: Based on trade data analysis, PT TSL exported over 170,000 tonnes of refined palm oil and PFAD to JC Chemical, DS Dansuk, SK Eco Prime, and HD Hyundai Oilbank over the period of 2023–2025.

3.5. Louis Dreyfus

Certification and Policy: RSPO, ISCC, and NDPE¹⁰³

3.5.1. PT LDC East Indonesia

Certification and Policy: RSPO, ISCC, and NDPE¹⁰⁴

Sustainability risks:

- **Legality**

- **Government finding/official notice**

While PT LDC East Indonesia does not own any mill, its direct and indirect sourcing from third parties¹⁰⁵ have been riddled with issues.

101 Realita.co. (2026, March 4). PT Letawa Terancam Ditutup, Alat Berat Disita Polda Sulbar. <https://realita.co/amp/baca-47259-pt-letawa-terancam-ditutup-alat-berat-disita-polda-sulbar>

102 Berita Satu. (2025, August 25). Warga 5 Desa Protes Lahan Sawit, Konflik Agraria Donggala Memanas. <https://www.beritasatu.com/nusantara/2915118/warga-5-desa-protes-lahan-sawit-konflik-agraria-donggala-memanas>

103 Louis Dreyfus Company. (n.d.). Sustainable Palm Oil. <https://www ldc.com/sustainability/responsible-supply-chain/sustainable-palm-oil/>

104 Louis Dreyfus Company. (2024). NDPE IRF Verification Statement (FY2024). <https://www ldc.com/wp-content/uploads/FY-2024-NDPE-IRF-Verification-Statement.pdf>

105 Louis Dreyfus Company. (2025). Palm Traceability to Mill List. <https://www ldc.com/sustainability/responsible-supply-chain/sustainable-palm-oil/>

Mill Name	Parent Company Name	Issue
PT Nirmala Agro Lestari	Astra Agro Lestari	Land dispute issue with people in Lamandau. PT NAL planted palm oil outside the HGU area, which belonged to Mr. Abidinnor. ¹⁰⁶
PT Satu Sembilan Delapan	Kuala Lumpur Kepong	Received red PROPER rating ¹⁰⁷ from the Indonesian Ministry of Environment for 2023–2024. ¹⁰⁸
PT Etam Bersama Lestari	Triputra Agro Lestari	Received red PROPER rating in East Kalimantan for 2024–2025. ¹⁰⁹
PT Hamparan Perkasa Mandiri	Triputra Agro Lestari	Received black PROPER rating. ^{110 111}

- **Transparency**

- **Civil society investigation**

LDC East Indonesia did not respond to requests for information on its involvement with PT AAL after concerns were raised about PT AAL's human rights and environmental abuses.¹¹²

Exports to South Korea: According trade data analysis, LDC East Indonesia exported over 100,000 tonnes of PFAD and refined palm products to SK Eco Prime and GS Global in 2025 and in smaller amount to JC Chemical in 2024.

3.6. Golden Agri Resources Ltd

Certification and Policy: ISPO, RSPO, ISCC, and NDPE¹¹³

Sustainability risks:

106 Seputar Borneo. (2025, December 22). Bupati Lamandau Fasilitas Sengketa Lahan Warga dan PT Nirmala Agro Lestari. https://seputarborneo.com/news/20674_Bupati_Lamandau_Fasilitas_Sengketa_Lahan_Warga_dan_PT_Nirmala_Agro_Lestari.html

107 Red rating is given to companies that do not meet the minimum environmental management standards set by statutory regulations

108 Berau Terkini. (2025). 9 Perusahaan Dapat Rapor Merah, Pemkab Berau Wajib Serius Beri Pembinaan. <https://berauterkini.co.id/9-perusahaan-dapat-rapor-merah-pemkab-berau-wajib-serius-beri-pembinaan/>

109 Seputar Fakta. (2025, July 8). 13 Perusahaan di Kutim Dapat Peringkat Merah Properda, DPRD Desak Tindak Tegas. <https://seputarfakta.com/seputar-kaltim/13-perusahaan-di-kutim-dapat-peringkat-merah-properda-dprd-desak-tindak-tegas-11860>

110 Given to companies whose activities cause serious environmental damage and do not carry out environmental management efforts in accordance with the provisions.

111 Bontang Post. (2025, July 14). Ini Perusahaan di Kutim yang Dinilai Bermasalah dalam Pengelolaan Lingkungan. <https://bontangpost.id/ini-perusahaan-di-kutim-yang-dinilai-kementerian-lh-bermasalah-dalam-pengelolaan-lingkungan/>

112 Business & Human Rights Resource Centre. (2025). United Nations alleges the second-biggest Indonesian palm oil company of egregious human rights violations and environmental degradation. <https://www.business-humanrights.org/en/latest-news/united-nations-alleges-the-second-biggest-indonesia-palm-oil-companies-on-its-egregious-human-rights-violations-and-environmental-degradation/>

113 Golden Agri-Resources (GAR). (n.d.). Sustainability Certifications. <https://www.goldenagri.com.sg/sustainability/certifications/>

- **Legality**

- **Civil society investigation**

In 2020, RSPO accepted Forest Peoples Programme's complaint against Golden Agri Resources Ltd. The complaint alleged that GAR Ltd was illegally operating oil palm plantations inside Indonesia's protected forest zone, citing bribery convictions of multiple PT GAR officials in Central Kalimantan as evidence.¹¹⁴

- **PT Sinar Mas Agro Resource and Technology Tbk (PT SMART Tbk) (Headquarters in Jakarta)**

Certification and Policy: ISPO, RSPO, ISCC, and NDPE¹¹⁵

Sustainability risks:

- **Environment**

- **Civil society investigation**

In Aceh, Sinar Mas Group—including PT Sinar Mas Agro Resource and Technology (SMART Tbk)—had supply chain linkages around the Leuser Ecosystem and Rawa Singkil, areas repeatedly associated with deforestation, peatland degradation, and recurrent flooding.¹¹⁶ These locations were significantly affected during the 2025 Sumatra floods, damage of which civil society groups linked to long-term land-use change by plantation companies operating in upstream watersheds.

- **Human rights**

- **Civil society investigation**

In 2025, Amnesty International reported that PT SMART Tbk was involved in forced evictions of local residents around the Padang Halaban Plantation in North Labuhanbatu, North Sumatra.¹¹⁷

Exports to South Korea: Based on trade data analysis, PT SMART Tbk exported approximately 80,000 tonnes of PFAD and refined palm products to SK Eco Prime, GS Global, JC Chemical, and DS Dansuk over the period of 2023–2025, peaking in 2024.

114 Forest Peoples Programme. (2020, March 20). Large scale bribery and illegal land-use violations alleged on large parts of Golden Agri Resources palm oil plantations. <https://www.forestpeoples.org/publications-resources/press-releases/article/large-scale-bribery-and-illegal-land-use-violations-alleged-on-large-parts-of-golden-agri-resources-palm-oil-plantations/>

115 PT Sinar Mas Agro Resources and Technology Tbk. (n.d.). Sertifikasi. <https://www.smart-tbk.com/berkelanjutan/sertifikasi/>

116 JATAM, Hutan Hujan, AWF & KSPPM. (2026). Katastrofe Sumatra: Analisis bencana ekologis dan faktor struktural pemicunya. <https://www.hutanhujan.org/files/id/Katastrofe%20Sumatra%20Jatam%20AWF%20KSPPM%20Januar%202026.pdf>

117 Amnesty International Indonesia. (2025, February). #KamiBersamaPadangHalaban: Hentikan penggusuran di Padang Halaban dan hormati hak asasi manusia. <https://www.amnesty.id/kabar-terbaru/siaran-pers/kamibersamapadanghalaban-hentikan-penggusuran-di-padang-halaban-dan-hormati-hak-asasi-manusia/02/2025/>

3.7. KPN Corporation

Certification and Policy: Unknown

➤ PT Energi Unggul Persada (Headquarters in Jakarta)

Certification and Policy: ISCC¹¹⁸

Sustainability risks:

- **Environment**

- **Government finding/official notice**

PT Energi Unggul Persada (PT EUP) has been involved until recently in marine pollution in East Kalimantan due to an inadequate waste management system and suspected illegal soil extraction without proper permits.¹¹⁹

- **Human rights**

- **Government finding/official notice**

In 2025, PT EUP was connected to alleged environmental pollution affecting the nearby community in Mempawah, West Kalimantan. After residents complained about the impact of industrial waste, the provincial government decided to monitor and evaluate the pollution's spread.¹²⁰

Exports to South Korea: Based on trade data analysis, PT EUP exported close to 70,000 tonnes of PFAD to SK Eco Prime, HD Hyundai Oilbank, and JC Chemical over the period of 2023–2025, with a peak in 2025.

3.8. PT Pacific Indopalm Industries

Certification and Policy: RSPO and ISCC¹²¹

118 International Sustainability and Carbon Certification (ISCC). (n.d.). All Certificates Database. <https://www.iscc-system.org/certification/certificate-database/all-certificates/>

119 Niaga Asia. (2025, May 21). PT Energi Unggul Persada Harus Selesaikan Permasalahan Lingkungan dan Sosial. <https://www.niaga.asia/pt-energi-unggul-persada-harus-selesaikan-permasalahan-lingkungan-dan-sosial/>

120 RRI Pontianak. (2025, November 13). Pemprov Kalbar Pantau Dampak Industri PT Energi Unggul Persada. <https://berita.rri.co.id/pontianak/regional/1971718/pemprov-kalbar-pantau-dampak-industri-pt-energi-unggul-persada>

121 HSA Group. (n.d.). PT Pacific Indopalm Industries. <https://hsagroup.com/en/explore-hsa-business/our-companies/industrial-companies/pt-pacific-indopalm-industries.aspx>

Sustainability risks:

- **Environment**

- **Civil society investigation**

Investigations by the Environmental Investigation Agency (EIA) found that several RSPO-member companies under Hayel Saeed Anam (HSA) Group—including PT Pacific Indopalm Industries—had concealed links to four large palm oil plantation concessions in Papua, covering nearly 160,000 hectares. These concessions, operated through opaque offshore companies, were documented to have engaged in significant rainforest clearance, with two concessions alone clearing more than 1,900 hectares in a single year.¹²² In 2018, RSPO formally accepted complaints filed by EIA and Greenpeace, triggering an investigation into undisclosed ownership ties and violations of RSPO rules. After a delay of five years, RSPO dismissed the case.¹²³

Exports to South Korea: Based on trade data analysis, PT Pacific Indopalm Industries exported over 50,000 tonnes of PFAD to HD Hyundai Oilbank and SK Eco Prime over the period of 2023–2025.

3.9. Korindo Group

Certification and Policy: Unknown

Sustainability risks:

- **Environment**

- **Certification/buyer grievance**

Korindo Group was stripped of its Forests Stewardship Council (FSC) certification following findings that the company failed to meet FSC's social and environmental standards. Investigations linked Korindo to large-scale deforestation in Papua, including clearance of high conservation value forests and violations of Indigenous people's rights related to land acquisition. FSC concluded that Korindo did not demonstrate sufficient effort to address these

122 Environmental Investigation Agency. (2018, November 30). RSPO members' concealed links to Papua palm oil plantations to be formally investigated. <https://eia-international.org/news/rspo-members-concealed-links-papua-palm-oil-plantations-formally-investigated/>

123 Environmental Investigative Agency. (2023, October 24). Shocking: Palm oil watchdog takes five years to address and dismiss deforestation complaint. <https://eia-international.org/news/shocking-palm-oil-watchdog-takes-five-years-to-address-and-dismiss-deforestation-complaint/>

impacts or comply with required remediation measures, leading to its disassociation from the scheme.¹²⁴ The Group continues to be linked to environmental and social issues to this day.¹²⁵

> PT Bumi Indawa Niaga

Certification and Policy: ISCC

Sustainability risks:

- **Environment:**

- **Indirect linkage**

PT Bumi Indawa Niaga (PT BIN) is a trading branch of Korindo Group. While it is difficult to identify refinery and mill supply, the company is linked to Korindo Group with extensive, independently documented cases of deforestation and human rights abuses in Papua and North Maluku, as established through multiple investigations by civil society organizations and certification bodies.

Exports to South Korea: Based on trade data analysis, Korindo Group exported over 40,000 tonnes of PFAD and POME to HD Hyundai Oilbank through PT BIN over the period of 2023–2025, with a peak in 2024.

3.10. Best Industry Group

Certification and Policy: Unknown

> PT Batara Elok Semesta Terpadu (Gresik, East Java)

Certification and Policy: ISCC¹²⁶

Sustainability risks:

124 Business & Human Rights Resource Centre. (2021, July 14). Forest Stewardship Council rejects Korindo Group, cites lack of improvements in social and environmental standards. <https://www.business-humanrights.org/en/latest-news/forest-stewardship-council-rejects-korindo-group-cites-lack-of-improvements-in-social-and-environmental-standards/>

125 Earthsight. (2025, October). Risky business. EU Timber imports linked to the destruction of Borneo's Forests. <https://www.earthsight.org.uk/media/download/2395>

126 International Sustainability and Carbon Certification (ISCC). (n.d.). All Certificates Database. <https://www.iscc-system.org/certification/certificate-database/all-certificates/>

- **Legality:**

- **Government enforcement**

PT Batara Elok Semesta Terpadu (PT BEST) was sanctioned by the Business Competition Supervisory Commission for violating competition law during the 2022 cooking oil shortage. The company was fined IDR 15.24 billion (USD 1.03 million) for intentionally reducing production and sales volumes to influence the government's price cap policy despite the company's sufficient stock.¹²⁷

Exports to South Korea: Based on trade data analysis, PT BEST exported approximately 40,000 tonnes of PFAD to HD Hyundai Oilbank and SK Eco Prime over the period of 2023–2025.

3.11. Apical Group

Certification and Policy: RSPO and ISCC¹²⁸

Sustainability risks:

- **Environment**

- **Civil society investigation**

According to a RAN investigation in 2023, Apical Group was found to have sourced from mills close to a plantation involved in deforestation in Gunung Leuser National Park, in Aceh. Another RAN investigation in 2024 found other new similar evidence.¹²⁹ Like the case of PT WIM and PT WNI, Apical Group also sourced palm oil from the PT TBS mill linked to the Sumatra floods in 2025.¹³⁰

➤ PT Kutai Refinery Nusantara (Balikpapan, East Kalimantan)

Certification and Policy: RSPO and ISCC^{131 132}

127 Kompas. (2023, May 27). Tujuh Perusahaan Minyak Goreng Didenda Total Rp71,28 Miliar. <https://www.kompas.id/artikel/tujuh-perusahaan-minyak-goreng-didenda-total-rp-7128-miliar>

128 Apical Group. (n.d.). Standards & Certifications. <https://www.apicalgroup.com/about/overview/standards-certifications/>

129 Rainforest Action Network (RAN). (2024, March 5). Illegal Deforestation Persists in Indonesia's Gunung Leuser National Park. <https://www.ran.org/leuser-watch/illegal-deforestation-persists-in-indonesias-gunung-leuser-national-park/>

130 Apical Group. (n.d.). Pemantauan Rantai Pasokan melalui Teknologi. <https://www.apicalgroup.com/id/keberlanjutan/pemantauan-rantai-pasokan-melalui-teknologi/>

131 Roundtable on Sustainable Palm Oil (RSPO). (n.d.). Search members. <https://rspo.org/search-members/>

132 International Sustainability and Carbon Certification (ISCC). (n.d.). All Certificates Database. <https://www.iscc-system.org/certification/certificate-database/all-certificates/>

Sustainability risks:

- ***Environmental***

- **Civil society investigation**

PT Kutai Refinery Nusantara (KRN) was found to have relied on third-party suppliers linked to deforestation in North and East Kalimantan as per RAN's letter in 2021, to which the Apical group also replied that all Apical activities were done with comprehensive deforestation monitoring and due diligence.

Although Apical Group maintained that its supply chain was monitored for deforestation, RAN's recent findings from the Mahakam Landscape showed that extensive rainforest loss in East Kalimantan continued to be driven by major corporate suppliers feeding downstream processors,¹³³ indicating that deforestation-risk feedstocks could still enter refineries such as PT KRN despite corporate "no-deforestation" pledges.

Exports to South Korea: Based on trade data analysis, PT KRN exported over 30,000 tonnes of PFAD, POME, and refined palm products to GS Global, HD Hyundai Oilbank, and SK Eco Prime over the period of 2024–2025, with a steep increase in 2025.

133 Rainforest Action Network (RAN). (2025, December 5). Mahakam landscape: Borneo's last biodiverse backbone under threat. <https://www.ran.org/forest-frontlines/mahakam-landscape-under-threat/>

4. Conclusions: Policy recommendations for forests and climate

South Korea's biofuel sector is increasingly dependent on palm oil and palm derivatives from Indonesia, which remain implicated in environmental, social, and legality issues. While many Indonesian supplier groups have formally adopted corporate sustainability certifications and commitments, these have not translated into consistent action on the ground. This report's findings link certified and non-certified Indonesian suppliers alike to documented cases of deforestation in protected areas, peatland degradation, and land tenure conflicts, along with corruption and legality scandals.

These cases underscore the limitation of certifications and voluntary commitments in contexts where sustainability enforcement is complex. Although voluntary commitments exist, they focus on company levels rather than at the landscape level where the more severe consequences arise due to cumulative ecosystem degradation and contested land. Relying on supplier declarations and legality certifications alone shifts responsibility away from end-users, effectively externalizing systemic risks. Without binding sustainability safeguards and effective corporate due diligence, Korean actors are exposed to these environmental and social issues, along with unaccounted emissions risks.

The risks become particularly significant as international standards tighten. With the EU enforcing its Deforestation Regulation and phasing out palm- and soy-based biofuels in line with the Renewable Energy Directive (RED), South Korea and other economies with weaker or absent safeguard become leakage market for non-compliant, high-risk palm oil products. Without concrete action taking place on the demand side, South Korea's biofuel consumption risks embedding its import dependence in deforestation, high emissions, and social conflicts, undermining both the country's climate commitments and international efforts towards establishing deforestation-free supply chains.

To meet the global goals of energy transition and biodiversity conservation, these regulatory gaps and leakage risks must be addressed at the policy and corporate level alike. Below are six policy recommendations for the government of South Korea and Korean corporate actors.

Government

1. Require full life-cycle assessment (LCA)

Given the international recognition of LCA in addressing the climate crisis, biodiversity loss, and pollution, the government must establish comprehensive LCA-based criteria for biofuels. The

greenhouse gas (GHG) emissions assessment must address supply chain emissions, including indirect land-use change. Implementing full LCA standards is the first step to ensure avoiding and phasing out high-risk, high-impact feedstocks.

2. Adopt stringent sustainability criteria

The government must introduce sustainability criteria for biofuels based on standards including, but not limited to, lifecycle GHG emissions, biodiversity impacts, and human rights considerations, in alignment with international climate and biodiversity protection commitments. Compliance must be verified through strong supply chain due diligence, with ineligible feedstocks excluded from counting toward renewable energy targets.

3. Introduce supply chain due diligence regulation

The government must establish mandatory regulations for corporations and financial institutions to conduct environmental and human rights due diligence across their biofuel supply chain. This regulatory framework should include grievance and remedy mechanisms and allow only the products verified as 'deforestation-free' to enter the market. Reducing the forest footprint embedded in supply chains would strengthen South Korea's commitments on decarbonization and biodiversity protection.

Corporations

4. Commit to a deforestation-free supply chain

Companies involved in palm oil supply chains must declare and implement time-bound No Deforestation, No Peat, and No Exploitation (NDPE) policy. These commitments must apply across the entire supply chain, with strong monitoring and exclusion policies for suppliers with links to harmful practices, such as deforestation, human rights violations, corruption, and illegality.

5. Implement human rights and environmental due diligence

Given weak enforcement and persistent controversies associated with certified suppliers, companies must enhance supply chain-wide due diligence, rather than continuing to rely on self-reporting and voluntary certification from producers.

For companies and financial institutions, harmful and NDPE non-compliant practices must be monitored, identified and mitigated by strengthening due diligence mechanisms such as transparent, independent assessments, open grievance mechanisms and subsequent exclusion criteria.

6. Enhance risk management and disclosure

Companies and financial institutions involved in biofuel supply chains must integrate deforestation, biodiversity impact, and all related GHG emissions into their risk management and disclosure frameworks. This requires systemic risk identification, exposure assessment, and transparent reporting of supply chain and financial risks, as well as mitigation actions aligned with international disclosure norms.

Annexes

Annex I. Profiles of Korean biofuel companies assessed in the report

Name	Description	Import trends
JC Chemical	JC Chemical was founded in 2006 as a Korean renewable energy company specializing in the production of biodiesel, bio-heavy oil, and related renewable fuels. The company has been listed on KOSDAQ since 2011.¹³⁴ JC Chemical operates across biodiesel production, bio-heavy oil, and by-products such as glycerin and fatty acids. The company is the only Korean biofuel producer with full vertical integration,¹³⁵ from owning palm plantations to manufacturing biodiesel. JC Chemical lists PT Niagamas Gemilang in Indonesia as one of its consolidated subsidiaries. PT Niagamas Gemilang is a palm plantation supplying crude palm oil (CPO). Seoul Oil is the leading shareholder with 40.26%. JC Chemical has lending relationships with KDB, Shinhan Bank, EXIM, NH Nonghyup, IBK, KB Kookmin Bank, KEB Hana Bank, Woori Bank, Busan Bank, and Bank Mandiri.	Trade data analysis shows that JC Chemicals imports mainly refined palm oil. Imports increased significantly from 2023 to 2024 but declined from 2024 to 2025.
DS Dansuk	Founded in 1984, DS Dansuk has evolved into a major Korean producer of bioenergy fuels serving industrial clients across global markets. Its business is structured around supplying liquid fuels to oil refineries, shipping companies, and power utilities, with product lines specifically tailored to each sector.¹³⁶ In 2024, bioenergy products accounted for more than 50% of total sales.	Trade data analysis shows that DS Dansuk imports mainly refined palm stearin and palm oil. The imports have decreased substantially over the period of 2023–2025.

134 Financial Supervisory Service (DART). (2025). JC Chemical Co., Ltd Annual report (FY 2024). <https://dart.fss.or.kr/dsaf001/main.do?rcpNo=20250312001076>

135 Kim, G. (2026, January 14). 제이씨케미칼, 인도네시아 팜 농장 보유...바이오 연료 시장 확대 수혜. 머니투데이. <https://www.mt.co.kr/stoek/2026/01/14/2026011408445472666>

136 Financial Supervisory Service (DART). (2025, March 21). DS Dansuk Co., Ltd. Annual report (FY 2024). <https://englishdart.fss.or.kr/dsbh001/main.do?rcpNo=20250321001800>

Name	Description	Import trends
SK Eco Prime	Previously known as SK Chemical, the company was renamed SK Eco Prime in February 2020. Its primary business is the production and sale of biodiesel and bio-heavy oil. SK Eco Prime is owned by Sentry Holdings,¹³⁷ which is in turn controlled by Hillhouse Investments,¹³⁸ one of Asia's largest private equity investors. Before the ownership shift to Hillhouse, SK Eco Prime had been under Hahn & Company, a major Korean private-equity firm. Recent media reports noted that Hillhouse has faced challenges in refinancing SK Eco Prime due to the company's previous biofuel price-fixing scandal, which increased financial and reputational scrutiny in the lending market.¹³⁹ SK Eco Prime receives financial and lending services from KEB Hana Bank and KB Kookmin Bank despite recent refinancing challenges.	Trade data analysis shows that SK Eco Prime imports primarily PFAD. The company has become the major importer of palm feedstocks from Indonesia over the period of 2023–2025, with a steep increase in 2025.
GS Global (and GS Caltex)	GS Global is the general trading arm of GS Group, which holds a 50.7% ownership stake in the company. As a diversified trading and industrial operator, GS Global engages in commodity distribution, logistics, manufacturing, and strategic project development across multiple sectors in South Korea and internationally.¹⁴⁰ Its clients include POSCO, Hyundai Steel, Idemitsu, GS Caltex, GS E&R, GS EPS, Volkswagen Group Korea, and BYD. GS Global and GS Caltex are sister affiliates within GS Group. GS Caltex is owned by GS Energy and Chevron in equal parts.¹⁴¹ In late 2025, GS Caltex, together with POSCO International, completed and began operating the AGPA Refinery Complex (ARC), a new palm oil refining facility located in Balikpapan, East Kalimantan. The ARC facility processes CPO into a range of refined palm products including biodiesel feedstocks and edible oils, with an annual refining capacity of 500,000 tonnes.	Trade data analysis shows that GS Global primarily imports refined palm stearin and palm oil. Its imports of palm oil feedstocks increased substantially in 2025.

137 Financial Supervisory Service (DART). (2025). SK Eco Prime consolidated audit report (FY 2024). <https://dart.fss.or.kr/dsaf001/main.do?rcpNo=20250414002159>

138 European Commission, Directorate-General for Competition. (2024). Case M.11658 – HMLYS II Holdings Limited / Xiamen C&D Commodities / JV: Commission Decision pursuant to Article 6(1)(b). https://ec.europa.eu/competition/mergers/cases1/202434/M_11658_10206562_31_3.pdf

139 The Bell. (2025, May 15). '담합 이슈' SK에코프라임 리파이낸싱 난항. <https://www.thebell.co.kr/front/newsview.asp?click=F&key=202505151014051000104085>

140 Financial Supervisory Service (DART). (2025, March 18). GS Global Corp Annual report (FY 2024). Financial Supervisory Service DART. <https://englishdart.fss.or.kr/dsbh001/main.do?rcpNo=20250318001328>

141 Financial Supervisory Service (DART). (2025, March 31). GS Caltex Corporation Annual report (FY 2024). <https://englishdart.fss.or.kr/dsbh001/main.do?rcpNo=20250331002860>

Name	Description	Import trends
HD Hyundai Oilbank	HD Hyundai Oilbank is one of South Korea's major petroleum refining companies, operating as a core energy affiliate within the HD Hyundai Group. HD Hyundai holds over 70% equity ownership in the company, while Aramco holds 17%.¹⁴² From the 2024 consolidated financials, refining amounted to 86% of HD Hyundai Oilbank's revenue. The 2024 consolidated report indicated portfolio expansion into biodiesel and Sustainable Aviation Fuel. HD Hyundai Oilbank maintains financial relationships with KDB, Shinhan Bank, EXIM, KEB Hana Bank, Woori Bank, ING Bank, and United Overseas Bank.	Trade data analysis shows that HD Hyundai Oilbank primarily imports PFAD. In line with the company's expansion into biodiesel, the company's imports increased since 2024.

142 Financial Supervisory Service (DART). (2025, March 28). HD Hyundai Oilbank Co., Ltd Annual report (FY 2024). <https://dart.fss.or.kr/dsaf001/main.do?rcpNo=20250328000054>

Annex II. Certifications and sustainability risks of Indonesian exporters assessed in the report

Legend:

○ = holds certification/commitment

○*= parent group-level commitment

X = not held/not disclosed

Evidence type:

- **Government/court enforcement:** formal actions such as permit revocation, sealing/closure orders, fines, court rulings
- **Government finding/official notice:** documented findings or notices by government bodies with conclusive sanction or court decision yet to be made
- **Certification/buyer grievance:** entries on certification schemes' compliance systems or buyers' formal grievance logs
- **Civil society investigation:** NGO or media investigations
- **Indirect linkage:** geographic overlap, parent-company ties, or other inferential links that warrant caution but are not dispositive

Parent Group	Subsidiary	Entity Level	RSPO	ISPO	ISCC	NDPE	Sustainability issue	Evidence type
PT Mahkota Group Tbk	PT Intan Sejati Andalan (Bengkalis, Riau)	Subsidiary level	X	○	○	X	① Peatland-related grievance linked to supplier (2025) ② Land-permit non-compliance within national forest in Riau (2025)	① Certification/buyer grievance ② Civil society investigation
Musim Mas	-	Group level	○	○	○	○	① Deforestation and conflict in the Leuser Ecosystem (2023, 2024) ② Supplier overlap with flood-impacted areas (2025) ③ CPO corruption case (2025) ④ Environmental crime case in the border area of the river and the forest in Air Hitam Village (2026)	① Civil-society investigation ② Indirect linkage ③ Government/court enforcement ④ Government finding

Parent Group	Subsidiary	Entity Level	RSPO	ISPO	ISCC	NDPE	Sustainability issue	Evidence type
Musim Mas	PT Inti Benua Perkasatama (Dumai, Riau)	Subsidiary level	○	○	○	○	Supplier overlap with flood-impacted areas (2025)	2025 Sumatra floods linkage
Musim Mas	PT Wira Inno Mas (Sumatra)	Subsidiary level	○	○	○	○	Supplier revocation of permits due to environmental concerns (2025)	Government/court enforcement
Wilmar International Ltd	-	Group level	○	○	○	○	① CPO corruption case (2025) ② Involvement in environmental pollution, including river contamination, due to poor waste management (2022, 2023)	① Government/court enforcement ② Civil-society investigation
Wilmar International Ltd	PT Wilmar Nabati Indonesia (Sumatra, Kalimantan, Riau, and Java)	Subsidiary level	○	○*	○	○*	① Supplier revocation of permits due to environmental concerns (2025) ② Suppliers overlap with flood-impacted areas (2025)	① Government/court enforcement ② 2025 Sumatra floods linkage
PT Astra Agro Lestari Tbk	-	Group level	X	○	X	X	① UN Special Rapporteurs accusation of human rights and environmental abuses in Sulawesi (2024) ② Concessions in North Sumatra overlap with flood-impacted areas (2026)	Civil-society investigation
PT Astra Agro Lestari Tbk	PT Tanjung Sarana Lestari (Pasangkayu, West Sulawesi)	Subsidiary level	X	X	X	X	Legal and human rights violations by direct suppliers	Civil-society investigation

Parent Group	Subsidiary	Entity Level	RSPO	ISPO	ISCC	NDPE	Sustainability issue	Evidence type
Louis Dreyfus	PT LDC East Indonesia (Balikpapan, East Kalimantan)	Subsidiary level	○	X	○	○	① Third party suppliers with land dispute issues and red/black PROPER ratings (2024-2025) ② No response to request for information on PT AAL abuses linkage (2025)	① Government findings/official notice ② Civil-society investigation
Golden Agri Resources Ltd		Group level	○	○	○	○	Accepted RSPO complaint of bribery and illegality in protected forest zone operation (2020)	Civil-society investigation
Golden Agri Resources Ltd	PT SMART Tbk (Jakarta)	Subsidiary level	○	○	○	○*	① Deforestation and conflict in the Leuser Ecosystem (2023, 2024) ② Involvement in forced evictions in North Sumatra (2025)	Civil-society investigation
KPN Corporation	PT Energi Unggul Persada (Kalimantan)	Subsidiary level	X	X	○	X	① Involvement in marine pollution due to poor waste management and illegal soil extraction in East Kalimantan (2025) ② Involvement in environmental pollution case involving nearby communities due to poor waste management in West Kalimantan (2025)	Government finding/official notice
Hayel Saeed Anam	PT Pacific Indopalm Industries (Dumai, Riau)	Subsidiary level	○	X	○	X	Reported links to Papua concessions associated with forest clearance (2018 onwards)	Civil-society investigation
Korindo Group	PT Bumi Indawa Niaga	Group and subsidiary levels	X	X	○	X	FSC certification revocation due to deforestation and human rights abuse in Papua (2021)	Certification/buyer grievance
Best Industry Group	PT Batara Elok Semesta Terpadu (East Java)	Subsidiary level	X	X	○	X	CPO competition law violation (2023)	Government/court enforcement

Parent Group	Subsidiary	Entity Level	RSPO	ISPO	ISCC	NDPE	Sustainability issue	Evidence type
Apical Group	-	Group level	○	X	○	X	① Deforestation and conflict in the Leuser Ecosystem (2023, 2024) ② Suppliers overlap with flood-impacted areas (2025)	① Civil-society investigation ② Indirect linkage
Apical Group	PT Kutai Refinery Nusantara (East Kalimantan)	Subsidiary level	○	X	○	X	Reliance on third party suppliers linked to deforestation in North and East Kalimantan	Civil-society investigation

Note: RSPO¹⁴³ and ISCC¹⁴⁴ certifications statuses are not consistently disclosed across company websites. Verification was conducted through manual searches of the ISCC and RSPO databases and publicly available company information.

143 Roundtable on Sustainable Palm Oil (RSPO). (n.d.). Search members. <https://rspo.org/search-members/>

144 International Sustainability and Carbon Certification (ISCC). (n.d.). All Certificates Database. <https://www.iscc-system.org/certification/certificate-database/all-certificates/>

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