Supplementary Information

Indonesia's land use dilemma: Balancing food security, bioenergy expansion, and deforestation risks

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1. Supplementary Methods

1.1 Map creation

We created land cover maps by combining data from the Ministry of Environment and Forestry with mapping from MapBiomas. Land cover classes follow definitions described in Indonesia's National Forest Reference Level for Deforestation [1].

To map the new generation of food estates, we gathered information on locations, boundaries, hectares planned and cleared, commodities to be grown, yield, and, if relevant, rice type at each site. We gathered data in August of 2024, which we updated periodically through the end of 2024, scanning regency, district, and province-level news outlets, research studies on crop optimization, government publications on projects, and publications from non-profit organizations and non-governmental organizations (NGOs). For rice food estates, we examined news sources and government publications to determine the type of rice grown. When rice type was not available from news sources, we reviewed scientific studies on rice performance across food estates. In some cases, we were able to find the breed of rice and determine the type from the breed and location (see Supplementary Table 2.1).

To map indigenous lands, we georeferenced and scaled maps of Registered, Verified, and Certified indigenous lands as documented by the Ancestral Domains Registration Agency (BRWA) [2].

Consistent with methods recommended by the World Database on Protected Areas (WDPA) [3], to map protected areas, we downloaded all polygon and point data for Indonesia. We then created buffers around each point with radiuses equal to reported site area, maintaining polygon data as downloaded, combining to compile protected areas for exclusion.

Due to the need for long-term data on rice and oil palm productivity by province, and the recency of provincial pemekaran in Papua, we use a provincial map dating back to early 2022, during which time there were 34 Indonesian provinces, and only two within Papua.

1.2 Calculating crude palm oil production scenarios

1.2.1 Biodiesel

In accordance with biodiesel policies set by the Ministry of Energy and Mineral Resources (ESDM), we include public service obligation (PSO) micro enterprises, fisheries, agriculture, and transportation, as well as non-PSO transportation, electricity, industrial, and commercial sectors in future mandate scenarios [4]. For each end-user, we calculate biodiesel needed to meet a range of production scenarios, projecting future demand for diesel and updating biodiesel shares needed to supply 35%, 40%, or 50% of the diesel demand with crude palm oil (CPO) by 2030 [5]. We use bottom-up estimates of CPO demand across end uses to estimate demand in 2030. Reconstructed demand estimates from 2020-2023 match CPO consumption reported by the

Indonesian Oil Palm Association (GAPKI) with an average margin of error of only .17%, demonstrating the robustness of our bottom-up methods [6,7].

To determine biodiesel demand for cars, we calculate total vehicle kilometers traveled (VKT) among the diesel-powered vehicle stock at a range of biodiesel shares, noting that fuel efficiency shrinks as biofuel blending rates grow (see Equation 1). To calculate total VKT, we use 2015 estimates of VKT per province [8], normalized to 2020 and projected into the future, assuming VKT growth [9], and multiplied by cars per province in 2020 [10], assuming that 17% of the fleet is run by diesel [8]. Past estimates of fuel efficiency of diesel-powered (B0) cars and losses under 30% and 50% CPO blending found nearly linear efficiency loss [11], so we linearly interpolate between these rates to determine fuel efficiency under each blending rate.

We also consider buses, light-duty trucks, and heavy-duty trucks. To calculate vehicle stock, we interpolate projections of vehicle stock growth by mode between 2018 and 2030 [12]. We assume that a third of all light-duty trucks run on diesel [13], and that all buses and heavy-duty trucks run on diesel [13,14]. Vehicle stock is then multiplied by average annual national VKT by buses and light-duty trucks [14,Center for Transportation and Logistics Studies of Gadjah Mada University and South South North Project, 2003, as cited in 15], as well as heavy-duty trucks [16]. We use projections of VKT growth, normalized to 2020, for both buses and light-duty trucks [9]. Given a lack of data on VKT growth within heavy-duty trucking, we assume static VKT for this mode. Using literature on the average fuel efficiency of diesel-powered (B0) buses [14,Sandra, P.A., 2012, as cited in 15], light-duty trucks [17], and heavy-duty trucks [Sandra, P.A., 2012, as cited in 15], and subsequent efficiency losses with increased biodiesel blending [11], we calculate fuel efficiency by blending ratio, using the same methodology used for passenger cars.

Additionally, we include rail transportation, calculated using estimates of diesel consumption in 2024 [18] and annual growth in total kilometers traveled by diesel locomotive [19]. Hydrogenation derived renewable diesel (HDRD) accounts for a small share of CPO use in fuels. As HDRD is not included in biodiesel mandates, we assume that its use of CPO remains stable at 2023 levels [20].

Equation 1. CPO consumption by year and transit mode

$$CPO\ consumption\ = VKT\ \times\ VS\ \times VS_{d}\ \times\ eff \times \beta_{md} \times CPO\ \times\ convert\ to\ tons \times \beta_{ratio}$$

VKT = average vehicle kilometers traveled (km yr^{-1})
VS = vehicle stock, units
VS_{d} = share of vehicle stock powered by diesel
eff = fuel efficiency (km L^{-1}) under blending rate β_{ratio}
β_{md} = biodiesel mass density (kg L^{-1})

CPO = CPO per unit of biodiesel (kg kg^{-1})
β_{ratio} = biodiesel blending ratio

While Indonesia's sustainable aviation fuel (SAF) roadmap mandates that international flights from Indonesia use small shares of SAF beginning in 2017, CPO does not qualify as SAF under the International Civil Aviation Organization (ICAO) and other nations' standards. As used cooking oil or palm fatty acid distillate are primary feedstocks of consideration to meet this target, neither of which would increase CPO demand [21], and considerable uncertainty remains surrounding SAF blending in the coming decade, we omit aviation from our analysis. Given that a negligible share uses diesel, we do not include motorcycles in this analysis [13,14]. Additionally, we omit maritime shipping, as it is powered by oil and is not included in mandates [13].

Under a suite of de-desielization policies [22,23], we assume that all diesel electricity plants (PTLD) will retire by 2030. Until retirement, plants gradually increase biodiesel share in alignment with each biodiesel production scenario. We calculate industry diesel demand using estimates of business-as-usual industry final demand [24] and share of liquid fuel in industry [25] for 2025 and 2030, linearly interpolating between these years. We attribute additional biodiesel consumption to "other sectors", which includes the subsectors of mining, agriculture, and construction, each of which use diesel and biodiesel in backup electricity generators [24]. We calculate biodiesel demand for "other sectors" using data on final energy demand and share of liquid fuel in this sector [24].

Commercial and residential buildings are not included in biodiesel mandates. We include projections of commercial building biodiesel demand, but do not ramp up biodiesel share of total diesel. We find there to be negligible use of biodiesel in the residential sector [26].

1.2.2 Non-biodiesel CPO consumption

Indonesia exports the majority of CPO it produces, 64% in 2023.[6] We assume that Indonesian oil palm exports are equal to vegetable oil exports projected by the OECD-FAO [27]. Additionally, Indonesia exports small shares of biodiesel, included here in the broader category of exports. We assume that biodiesel export levels in 2023 remain constant through the end of the decade [20].

We assume that demand for CPO for cooking grows 5% annually, based on projections of population growth between 2023 and 2030 [28], following methods used in previous projections [29–31].

Oleochemical demand increased during the pandemic, driven by expanded use of cleaning products [32], and continues to rise: the Malaysian Investment Development Authority projects compound annual growth in the global market of 3.5-4% between 2024 and 2029, noting higher than average demand in the Asia Pacific [33]. In our analysis, we assume that CPO demand for use in oleochemicals grows 5.1% annually, consistent with estimates in other literature [29–31].

We assume that imports are negligible.

1.3 Calculating rice production scenarios

As with oil palm, we consider three rice production scenarios, shaped by ranges in domestic use and climate conditions. We define rice self-sufficiency as the ability to meet future rice demand without imports, and use the OECD-FAO Outlook tool's projection of imports in 2030 [27]. Under the lower-bound production scenario, *Reduced Imports*, Indonesia must produce additional paddy consistent with projected imports in 2030, converted to dry husked paddy (GKG). Similarly, under the *Self-Sufficiency* production scenario, Indonesia must negate projected imports, but we assume that production levels stagnate at 2023 rates, reflecting reduction in baseline smallholder production under El Niño conditions. For the most ambitious production scenario, *Exporter*, we assume that Indonesia ramps up rice production to meet President Prabowo Subianto's target of ten million tons of additional husked paddy by 2030 [5].

1.4 Suitability literature

We selected criteria based upon presence and significance in existing crop suitability literature for both oil palm [34–45] and rice [46–56]. To calculate weights, we used literature that explicitly noted weights found for oil palm [34,44,57–63] and rice [49–51,53–56,64,65].

1.5 Calculating yield and land conversion

Consistent with [39], we use the average of the last ten years of data (2013-2022) from BPS Indonesia to determine mean provincial CPO yield in kg ha^{-1} [66]. In the absence of historic data for Jakarta, Bali, East Nusa Tenggara, and West Nusa Tenggara, we assume that they can produce at levels consistent with the national average, while we assume that North Sulawesi's yield matches the ten year average in Gorontalo.

Under the assumption that clearing for oil palm begins in 2025, the first full year of President Prabowo's term, and given that the majority of forests cleared for plantations are fully cleared and converted within a year [67], we assume that oil palm plants will be planted by the end of 2025. Thus, yield estimates for 2030 are modulated to reflect their productivity in their fifth year of growth, based upon a standard oil palm yield curve in which plants produce 64.1% of their potential yield in their fifth year of growth [68].

To determine provincial rice yield, we use the average of the last seven years of rice production, as only seven years of data are available, as documented by BPS Indonesia [69].

1.6 Calculating emissions

For both crops, we determine changes in aboveground and belowground biomass following conversion from initial land cover to the given crop (Supplementary Table 2.16). Consistent with findings in Carlson et al., we assume that oil palm sequesters 25 MgC ha^{-1} on average during its first ten years of growth [70], while rice sequesters 12.36 MgC ha^{-1}. Carbon values for rice and all other land cover classifications, excluding oil palm, come from Indonesia's National Forest Reference Level [1].

Oil palm processing and production emissions include those from fertilizer application, transportation to mills, and from palm oil mill effluent, multiplied by the tons of CPO produced (see Supplementary Table 2.17). For rice, we obtained field emissions per hectare from a previous Southeast Asia-based study [71] that determined annual emissions under conventional flooding methods, including field flooding, fertilizer use, and changes in soil organic carbon. These field emissions, which we multiplied by the hectares converted in each result, do not include emissions from burning rice straw, which we included separately, as previous estimates find that between 43-75% of rice straw generated in Indonesia is burned on-site [72,73]. We use assumptions from previous work [72] to estimate total rice straw burned under each rice production scenario, multiplying by 1.2475 to determine tCO_2e emitted per ton combusted [74].

In addition, we consider emissions associated with conversion of peatlands, including one-time emissions associated with clearing fires on peatlands [70,75] and annual emissions from peat drainage [1,70,75,76]. Despite prohibitions on burning for plantation development [77], the practice of burning endures given partial enforcement and clearing needs [78]. Following assumptions used by Carlson et al., we test all-or-nothing use of fire in plantation development [70].

To determine emissions reductions from fuel switching, we calculated the estimated increase in biodiesel use between 2023-2030. We then multiplied this quantity by the reduction in emissions per ton of biodiesel used, determined by finding the difference between diesel [79] and CPO biodiesel emissions [80].

Given widespread use of oil palm residues such as palm kernel shells in processing, we assume negligible emissions from mills [81].

2. Supplementary Tables

2.1 Food estates

Province	Regency	District	Village	Commodity	Rice Type	Source
Aceh	Aceh Besar	Suka Makmur, Kuta Malaka, Ingin Jaya, Simpang Tiga, Darul Imarah, Darul Kamal	-	Rice and cattle	Irrigated Lowland	[82,83]
Aceh	Bener Meriah	from Pintu Rime Gayo to Syiah Utama	-	Rice, soybeans, corn, peanuts, green beans, cassava, sweet potato	Irrigated Lowland	[84]
Bangka Belitung Islands	Bangka	-	-	Coffee, cardamom, chili	Irrigated Lowland	[85]
Bangka Belitung Islands	Belitung	-	-	Red onions, shallots	Irrigated Lowland	[86]
Bangka Belitung Islands	Central Bangka	-	-	Coffee, cardamom, chili, sorghum, shrimp	Irrigated Lowland	[87–89]
Bangka Belitung Islands	East Belitung	-	-	Coffee, cardamom, chili	Irrigated Lowland	[86,90,91]
Bangka Belitung Islands	South Bangka	Toboali, Pulau Besar, Air Gegas	-	Rice	Upland	[86,92]

Bangka Belitung Islands	West Bangka	-	-	Porang, cassava, corn	Irrigated Lowland	[93]
Central Kalimantan	Gunung Mas	-	-	Cassava	Irrigated Lowland	[94,94,95]
Central Kalimantan	Kapuas	-	-	Rice, cassava	Lebak Swamp	[95–97]
Central Kalimantan	Pulang Pisau	-	-	Rice, ducks, fish, fish, mustard greens, kale, and cayenne pepper, pineapple, durian, longan, water spinach	Lebak Swamp	[94,98]
Central Kalimantan	South Barito	-	-	Rice	Lebak Swamp	[94,99]
Central Kalimantan	West Kotawaringin	-	-	Rice	Lebak Swamp	[94,96,97,100]
East Kalimantan	Muara Muntai	Muara Muntai, Muara Wis	-	Rice	Irrigated Lowland	[101,102]
East Kalimantan	North Penajam Paser	Babulu	Gunung Mulia, Gunung Intan, Sebakung Jaya	Rice	Irrigated Lowland	[101,102]

East Kalimantan	Paser	Long Ikis, Long Kali, Pasir Belengkong, Tanah Grogot	-	Rice	Irrigated Lowland	[101,102]
East Nusa Tenggara	Belu	-	-	Corn	Irrigated Lowland	[103]
East Nusa Tenggara	Central Sumba	Katiku Tana	-	Rice, corn	Rainfed Lowland	[104,105]
East Nusa Tenggara	East Sumba	-	-	Sorghum	Irrigated Lowland	[103]
Jambi	East Tanjung Jabung	Nipah Panjang, Berbak, East Muara Sabak, Dendang, Sadu	-	Rice, corn, soybean	Tidal Swamp	[106,107]
Jambi	Merangin	Merangin	-	Cassava	Irrigated Lowland	[106,108]
Jambi	Muaro Jambi	Kumpeh, Sungai Gelam	-	Rice, corn, soybean, peanut	Irrigated Lowland	[94,108,109]
Jambi	West Tanjung Jabung	Batang Asam Pengabuan, Senyerang	-	Rice	Irrigated Lowland	[106,110]
North Kalimantan	Bulungan	-	-	Rice	Tidal Swamp	[111,112]

North Sumatra	Humbang Hasundutan, West Pakpak, Central Tapanuli, North Tapanuli	-	-	Garlic, shallots, potatoes	Irrigated Lowland	[94,113–115]
Riau	Kota Dumai	-	-	Shrimp	Irrigated Lowland	[94]
Riau	Rokan Hilir	-	-	Rice, corn	Irrigated Lowland	
South Papua	Boven Digoel, Merauke, Mappi, Asmat	-	-	Rice, sugarcane, palm oil, cassava, corn	Irrigated Lowland	[116–119]
South Sumatra	Banyuasin	-	-	Rice, corn	Tidal Swamp	[94,96,120,121]
South Sumatra	East OKU	-	-	Rice, corn	Rainfed Lowland	[94,120,122]
South Sumatra	Musi Banyuasin, Musi Rawas	-	-		Irrigated Lowland	[94]
South Sumatra	Ogan Komering Ilir	-	-	Rice, corn	Irrigated Lowland	[94,120]
South Sumatra	Ogan Komering Ulu	-	-	Rice	Rainfed Lowland	[122–125]

West Kalimantan	Bengkayang	Jagoi Babang, Bengkayang, Ledo, Suti Semarang, Lumar	-	Sorghum	Irrigated Lowland	[126,127]
West Kalimantan	Ketapang	South Matan Hilir	-	Coconut, oil palm, rubber, coffee, cocoa, sugar cane	Irrigated Lowland	[94,128]
West Sulawesi	Majene	East Banggae	Baruga	Shallots	Irrigated Lowland	[129]
West Sulawesi	Mamuju	-	Bambu	Rice, cloves, nutmeg, shallot, corn	Irrigated Lowland	[130]
West Sumatra	Agam	Lubuk Basung	Jorong V Sungai Jaring	Corn	Irrigated Lowland	[131]
West Sumatra	Pariaman City	Batang Tajongkek	Batang Tajongkek	Avocado	Irrigated Lowland	[132]
West Sumatra	South Pesir	Bayang	Koto Berapak Bayang	Corn	Irrigated Lowland	[133]
West Sumatra	South Solok	-	-	Corn	Irrigated Lowland	[134]

2.2 Excluded layers

Crop	**Land Constraint**	**Physical Feature**	**Land Cover Class**	**Other Features**
Oil Palm	*Concessions*	Unsuitable slope, elevation, temperature, & precipitation	Water, settlement, transmigration, airport/seaport, mining, oil palm, fish pond	Protected areas **Area outside concessions**
Oil Palm	*Open Development*	Unsuitable slope, elevation, temperature, & precipitation	Water, settlement, transmigration, airport/seaport, mining, oil palm, fish pond	Protected areas
Oil Palm	*Forest Protection*	Unsuitable slope, elevation, temperature, & precipitation	Water, settlement, transmigration, airport/seaport, mining, oil palm, fish pond, **primary dryland forest**, **primary mangrove forest**, **primary peat swamp forest**, **degraded dryland forest**, **degraded mangrove forest**, **degraded peat swamp forest**, **forest plantation**	Protected areas **Peat**
Rice	*Concessions*	Unsuitable slope, elevation, temperature, precipitation, soil texture, & soil pH	Water, settlement, transmigration, airport/seaport, mining, rice, fish pond	Protected areas **Food estate planning areas not dedicated to planting rice**
Rice	*Open Development*	Unsuitable slope, elevation, temperature, precipitation, soil texture, & soil pH	Water, settlement, transmigration, airport/seaport, mining, rice, fish pond	Protected areas
Rice	*Forest Protection*	Unsuitable slope, elevation, temperature, precipitation, soil texture, & soil pH	Water, settlement, transmigration, airport/seaport, mining, rice, fish pond, **primary dryland forest**, **primary mangrove forest**,	Protected areas **Peat**

			primary peat swamp forest, degraded dryland forest, degraded mangrove forest, degraded peat swamp forest, forest plantation, estate crop, pure dry agriculture	

2.3 Categories for reclassification between mapping sources

Mapbiomas	Ministry of Environment and Forestry
NA	-
	Primary Dryland Forest
Forest	Degraded Dryland Forest
	Primary Mangrove Forest
	Primary Peat Swamp Forest
	Degraded Mangrove Forest
	Degraded Peat Swamp Forest
	Wetland Shrub
Mangrove	Swamp
Forest Plantation	(Industrial) Plantation Forest
	Shrub
Vegetation	Savana
	Perennial Crops
	Dry Cultivation
Agriculture	Dry Cultivation & Shrub
	Bare Land
	Airport/Seaport
Bare Ear	Settlement
th	Transmigration
Mine	Mining
Fish Pond	Coastal Fish Pond
Water	Water
Palm	-
Ricefield	Rice

2.4 Pairwise comparison matrix in AHP, oil palm

Factor	Slope	Elevation	Soil Texture	Precip-itation	Temp-erature	Mill	City	Road	Trans-migration
Slope	1	7	1	1/2	2	3	9	1	9
Elevation	1/7	1	1/9	1/9	0.2	1/3	4	1/6	1
Soil Texture	1	9	1	1	3	5	9	2	9
Precipitation	2	9	1	1	3	5	9	2	9
Temperature	1/2	5	1/3	1/3	1	2	9	1	7
Mill	1/3	3	1/5	1/5	1/2	1	9	1/3	4
City	1/9	1/4	1/9	1/9	1/9	1/9	1	1/9	1/3
Road	1	6	1/2	1/2	1	3	9	1	8
Trans-migration	1/9	1	1/9	1/9	1/7	1/4	3	1/8	1

2.5 Pairwise comparison matrix in AHP, rice

Factor	Slope	Precipitation	Soil pH	Temperature	Soil Texture
Slope	1	1	3	1/3	1
Precipitation	1	1	3	1/3	1
Soil pH	1/3	1/3	1	1/6	1/3
Temperature	3	3	6	1	3
Soil Texture	1	1	3	1/3	1

2.6 Normalized comparison matrix and weights in AHP, oil palm

Factor	Slope	Elevation	Soil Texture	Precip-itation	Temp-erature	Mill	City	Road	Trans-migration	Weight
Slope	0.16133	0.16970	0.22901	0.12931	0.18258	0.15233	0.14516	0.12926	0.18621	**0.16**
Elevation	0.02305	0.02424	0.02545	0.02874	0.01826	0.01693	0.06452	0.02154	0.02069	**0.03**
Soil Texture	0.16133	0.21818	0.22901	0.25862	0.27387	0.25388	0.14516	0.25853	0.18621	**0.22**
Precipitation	0.32266	0.21818	0.22901	0.25862	0.27387	0.25388	0.14516	0.25853	0.18621	**0.24**
Temperature	0.08067	0.12121	0.07634	0.08621	0.09129	0.10155	0.14516	0.12926	0.14483	**0.11**
Mill	0.05378	0.07273	0.04580	0.05172	0.04565	0.05078	0.14516	0.04309	0.08276	**0.07**
City	0.01793	0.00606	0.02545	0.02874	0.01014	0.00564	0.01613	0.01436	0.00690	**0.01**
Road	0.16133	0.14545	0.11450	0.12931	0.09129	0.15233	0.14516	0.12926	0.16552	**0.14**
Trans-migration	0.01793	0.02424	0.02545	0.02874	0.01304	0.01269	0.04839	0.01616	0.02069	**0.02**

2.7 Normalized comparison matrix and weights in AHP, rice

Factor	Slope	Precipitation	Soil pH	Temperature	Soil Texture	Weights
Slope	0.15789	0.15789	0.18750	0.15385	0.15789	**0.16**
Precipitation	0.15789	0.15789	0.18750	0.15385	0.15789	**0.16**
Soil pH	0.05263	0.05263	0.06250	0.07692	0.05263	**0.06**
Temperature	0.47368	0.47368	0.37500	0.46154	0.47368	**0.45**
Soil Texture	0.15789	0.15789	0.18750	0.15385	0.15789	**0.16**

2.8 Oil palm suitability model development

Feature	Unit/ Feature Description	Original Spatial Resolution	Dataset Used
Elevation	Meters	1 arc-second	im.carto [135]
Slope	Degrees	1 arc-second	Calculated using elevation raster.
Temperature	Monthly (℃)	30 arc-second	WorldClim [136]
Precipitation	Monthly (mm)	30 arc-second	WorldClim [136]
Soil Texture	USDA Topsoil Class	30 arc-second (ca. 1 km²)	Harmonized World Soil Database [137]
Major City	With population above 50,000	Point data	Geonames[138]
Processing Mill	Oil palm, 2022	shpfile	Global Forest Watch [139]
Transmigration Site		shpfile	
Major Road		polyline	OpenStreetMap[140]
Non-governmental Land Cover	11 classes	30 meter	MapBiomas [141]
Governmental Land Cover	22 classes	shpfile	Ministry of Environment and Forestry
Combined Land Cover	23 classes	30 meter	

Peat		shpfile	Global Forest Watch [142]
Protected Areas		shpfile; Point data	WDPA [143]
Oil palm concessions		shpfile	Greenpeace [144]

2.9 Rice suitability model development

Feature	**Unit**	**Original Spatial Resolution**	**Dataset Used**
Elevation	Meters	1 arc-second	im.carto [135]
Slope	Degrees	1 arc-second	Calculated using elevation raster.
Temperature	Monthly (℃)	30 arc-second	WorldClim [136]
Precipitation	Monthly (mm)	30 arc-second	WorldClim [136]
Soil Texture	USDA Topsoil Class	30 arc-second	Harmonized World Soil Database [137]
Soil pH	Top, -log (H+)	250 meter	ISRIC [145]
Non-governmental Land Cover	11 classes	30 meter	MapBiomas [141]
Governmental Land Cover	22 classes	shpfile	Ministry of Environment and Forestry
Combined Land Cover	23 classes	30 meter	
Peat		shpfile	Global Forest Watch [142]
Food Estates		30 meter	Compiled

2.10 Oil palm combined suitability

Feature	Ranking					Weight
	Perfect	**Suitable**	**Moderate**	**Marginal**	**Unsuitable**	
Elevation (m)	<500	500 - 850	850 – 1,050	1,050 – 1,500	>1,500	3%
Slope (°)	0–8	8–16	16–30	30–35	>35	16%
Soil texture class	loam, sand clay loam	sandy loam	clay, loamy sand	sand	-	22%
Mean annual precipitation (mm)	1,700–2,875	1,450–1,700	1,250–1,450	1,000–1,250	<1,000	11%
	1,700–2,875	2,875–3,250	3,250–3,625	3,625–4,000	>4,000	
Mean annual temperature (°C)	22 - 33	20-22	19-20	18-19	<18	24%
	22 - 33	33 - 34	34 - 35	35 - 38	>38	
Oil palm processing mill distance (km)	0-3	3-5	5-8	>8	-	7%
Major city distance (km)	0-9	9-15	15-25	>25	-	1%
Transmigration location distance (km)	0-5	5-10	10-18	>18	-	2%
Major road distance (km)	0	0-.01	.01-2	>2	-	14%

2.11 Irrigated lowland rice physical suitability

Feature	Ranking				Weight
	Perfect	Suitable	Moderate	Unsuitable	
Slope (°)	<3	3 - 5	5 - 8	>8	16%
Soil texture class	clay, sand clay loam	sandy loam, loam	loamy sand	sand	16%
Soil pH	5.5 - 7	4.5 - 5.5	<4.5	-	6%
		7-8	>8	-	
Number of wet months (>200 mm)	6 - 8	4 - <6	2 - <4	<2	16%
		-	>8 - 10	>10	
Mean annual temperature (°C)	25 - 28	23 - <25	21 - <23	<21	45%
		>28 - 30	>30 - 33	>33	

2.12 Rainfed lowland rice physical suitability

Feature	Ranking				Weight
	Perfect	Suitable	Moderate	Unsuitable	
Slope (°)	<3	3 - 8	8 - 15	>15	16%
Soil texture class	clay, sand clay loam	sandy loam, loam	loamy sand	sand	16%
Soil pH	5.5 - 7	5 - 5.5	<5	-	6%
		7-8	>8	-	
Mean annual precipitation (mm)	1,500 - 2,000	1,000 - <1,500	700 - <1,000	<700	16%
		>2,000 - 2,500	>2,500 - 3,000	>3,000	
Mean annual temperature (°C)	22 - 25	20 - <22	18 - <20	<18	45%
		>25 - 27	>27 - 29	>29	

2.13 Upland rice physical suitability

Feature	Ranking				Weight
	Perfect	Suitable	Moderate	Unsuitable	
Slope (°)	<3	3 - 8	8 - 15	>15	16%
Soil texture class	clay, sand clay loam	sandy loam, loam	loamy sand	sand	16%
Soil pH	5.5 - 7.5	5 - 5.5	<5	-	6%
		7.5-8	>8	-	
Mean annual precipitation (mm)	1,500 - 2,000	1,000 - <1,500	700 - <1,000	<700	16%
		>2,000 - 2,500	>2,500 - 3,000	>3,000	
Mean annual temperature (°C)	24 - 29	22 - <24	18 - <22	<18	45%
		>29 - 32	>32 - 35	>35	

2.14 Tidal swamp rice physical suitability

Feature	Ranking				Weight
	Perfect	Suitable	Moderate	Unsuitable	
Slope (°)	-	-	-	-	16%
Soil texture class	clay, sand clay loam	sandy loam, loam	loamy sand	sand	16%
Soil pH	5. 5 - 7	5 - 5.5	<5	-	6%
		7-8	>8	-	
Mean annual precipitation (mm)	2,000 - 2,500	1,500 - <2,000	1,000 - <1,500	<1,000	16%
		>2,500 - 3,000	>3,000 - 3,500	>3,500	
Mean annual temperature (°C)	25 - 28	23 - <25	21 - <23	<21	45%
		>28 - 30	>30 - 33	>33	

2.15 Lebak swamp rice physical suitability

Feature	Ranking				Weight
	Perfect	Suitable	Moderate	Unsuitable	
Slope (°)	-	-	-	-	16%
Soil texture class	clay, sand clay loam	sandy loam, loam	loamy sand	sand	16%
Soil pH	5.5 - 7	5 - 5.5	<5	-	6%
		7-8	>8	-	
Number of wet months (>100 mm)	3 - 4	-	-	<3	16%
		>4 - 6	>6 - 8	>8	
Mean annual temperature (°C)	25 - 28	23 - <25	21 - <23	<21	45%
		>28 - 30	>30 - 33	>33	

2.16 Productivity by province in 2030

Province	**Oil Palm Yield, tCPO ha^{-1}**	**Rice Yield, tGKGha^{-1}**	**Province**	**Oil Palm Yield, tCPO ha^{-1}**	**Rice Yield, tGKG ha^{-1}**
Aceh	1.97	5.54	West Nusa Tenggara	1.55	5.13
North Sumatra	2.78	5.14	East Nusa Tenggara	1.55	4.12
West Sumatra	2.31	4.8	West Kalimantan	1.83	3.03
Riau	2.54	3.91	Central Kalimantan	2.8	3.23
Jambi	2.07	4.53	South Kalimantan	2.26	3.97
South Sumatra	2.5	5.22	East Kalimantan	2.18	3.76
Bengkulu	2.45	4.73	North Kalimantan	2.07	3.45
Lampung	1.78	5	North Sulawesi	0.55	4.31
Bangka Belitung Islands	2.59	3.57	Central Sulawesi	2.22	4.54
Riau Islands	2.13	2.97	South Sulawesi	2.06	5.04
Jakarta	1.55	4.96	Southeast Sulawesi	1.16	4.07

West Java	1.75	5.71	Gorontalo	0.55	4.84
Central Java	1.55	5.66	West Sulawesi	2.34	5.04
Yogyakarta	1.55	4.99	Maluku	1.13	3.84
East Java	1.55	5.68	North Maluku	2.07	3.61
Banten	1.33	5.1	West Papua	1.6	3.98
Bali	1.55	6.02	Papua	2.41	4.33

2.17 Emissions factors for AGB and BGB by land cover type

	Emissions Factors for AGB and BGB, MgCarbon ha^{-1}						
Land cover class	**Sumatra**	**Kalimantan**	**Papua**	**Sulawesi**	**Java**	**Bali & Nusa Tenggara**	**Maluku**
Primary dryland forest	439.53	420.41	346.45	320.28	448.77	361.78	306.83
Secondary dryland forest	285.67	287.55	289.95	214.29	270.61	178.96	217.78
Primary mangrove forest	309.62	325.1	315.48	309.62	309.62	309.62	309.62
Primary swamp forest	433.87	347.81	271.9	303.53	303.53	303.53	303.53
Secondary mangrove forest	131.59	173.66	167.39	131.59	131.59	131.59	131.59
Secondary swamp forest	252.61	263.17	170.65	249.62	249.62	249.62	249.62
Plantation forest	100.4	100.4	100.4	100.4	100.4	100.4	100.4
Dry shrub	74.64	74.64	74.64	74.64	74.64	74.64	74.64
Estate crop	63.74	63.74	63.74	63.74	63.74	63.74	63.74
Settlement areas	2.8	2.8	2.8	2.8	2.8	2.8	2.8
Bare ground	2.97	2.97	2.97	2.97	2.97	2.97	2.97
Savanna and grasses	5.02	5.02	5.02	5.02	5.02	5.02	5.02
Open water	0	0	0	0	0	0	0
Wet shrub	23.91	23.91	23.91	23.91	23.91	23.91	23.91
Pure dry agriculture	16.89	16.89	16.89	16.89	16.89	16.89	16.89
Mixed dry agriculture	77.56	77.56	77.56	77.56	77.56	77.56	77.56
Paddy field	12.36	12.36	12.36	12.36	12.36	12.36	12.36
Fish pond/aquaculture	0	0	0	0	0	0	0
Port and harbor	0	0	0	0	0	0	0
Transmigration areas	16.89	16.89	16.89	16.89	16.89	16.89	16.89
Mining areas	0	0	0	0	0	0	0
Open swamp	0	0	0	0	0	0	0
Oil palm	25	25	25	25	25	25	25

2.18 Emissions factors for clearing, peat drainage, production, and processing

	Emissions Factor	Unit	Source
Clearing Fire	553.21	$tCO_2e\ ha^{-1}$	[170,75]
Oil Palm Fertilizer	.39	$tCO_2e\ t^{-1}CPO$	[75]
Oil Palm Transportation	.091	$tCO_2e\ t^{-1}CPO$	[75]
Palm Oil Mill Effluent (POME)	1.01	$tCO_2e\ t^{-1}CPO$	[75]
Peat Drainage	57.63	$tCO_2e\ ha^{-1}\ yr^{-1}$	[1,70,75,76]
Burning Rice Straw	1.24	$tCO_2e\ t^{-1}$ rice yr^{-1}	[72,74]
Rice Cultivation	24.55	$tCO_2e\ ha^{-1}\ yr^{-1}$	[71]

3. Supplementary Results

3.1 Area converted for oil palm production by province, land constraint, and production scenario (kHa)

	Concessions			Open Development			Forest Protection		
	B35	*B40*	*B50*	*B35*	*B40*	*B50*	*B35*	*B40*	*B50*
Aceh	135.1	146.4	160.9	148.0	159.0	302.4	145.6	214.0	304.1
Bali	-	-	-	43.1	58.0	68.0	56.7	66.5	69.0
Banten	-	-	-	162.9	195.9	204.9	190.5	198.5	202.2
Bengkulu	21.2	25.3	31.1	17.8	30.3	30.4	30.3	30.5	31.0
Yogyakarta	-	-	-	13.8	23.8	26.1	23.6	25.9	26.1
Jakarta	-	-	-	2.1	2.4	2.4	2.1	2.1	2.1
Gorontalo	13.2	13.2	13.2	111.7	130.7	140.3	120.6	123.8	175.6
Jambi	102.2	109.1	113.9	297.9	322.9	449.3	280.3	289.1	322.7
West Java	-	-	-	432.1	469.1	626.1	436.1	581.2	667.4
Central Java	-	-	-	224.1	244.6	393.9	228.8	374.1	395.5
East Java	-	-	-	311.8	324.3	382.1	302.8	354.8	396.1
West Kalimantan	1,068.5	1,223.8	1,908.2	109.1	109.9	167.4	97.1	103.5	155.2
South Kalimantan	156.2	193.5	204.5	327.0	487.9	648.8	379.5	462.8	620.2
Central Kalimantan	931.1	1,199.0	1,595.2	157.6	211.0	278.9	150.8	184.2	373.9
East Kalimantan	676.6	754.5	1,178.3	258.9	345.0	466.9	260.4	270.9	311.2
North Kalimantan	203.7	220.6	320.2	40.2	41.4	46.7	31.6	31.7	35.9
Bangka Belitung	18.4	27.7	36.1	15.4	15.8	17.2	15.1	15.1	21.3

Islands									
Riau Islands	20.9	24.4	27.2	22.0	25.3	25.4	19.5	19.5	20.0
Lampung	14.1	14.1	14.4	253.6	269.5	386.7	267.3	342.6	600.7
Maluku	4.9	5.6	6.7	26.5	39.0	41.0	29.1	30.1	41.4
North Maluku	29.0	30.3	47.6	36.3	61.9	62.5	45.7	48.5	80.3
West Nusa Tenggara	-	-	-	1.7	1.7	1.8	1.6	1.7	2.3
East Nusa Tenggara	-	-	-	23.1	24.8	34.5	14.9	24.5	30.7
Papua	308.5	396.1	682.6	94.6	126.3	128.1	25.8	25.8	26.1
West Papua	222.9	255.4	349.3	66.1	94.9	97.5	32.2	32.6	34.5
Riau	309.6	494.4	518.6	292.3	298.0	602.1	222.1	222.1	356.7
West Sulawesi	12.6	12.6	12.6	97.7	127.3	138.2	107.5	118.9	162.3
South Sulawesi	52.2	52.3	52.5	209.3	297.1	549.3	226.5	226.5	380.6
Central Sulawesi	99.9	111.0	121.1	132.0	185.1	214.3	130.3	160.0	261.6
Southeast Sulawesi	28.1	28.6	28.6	70.2	110.3	158.3	95.9	135.3	183.1
North Sulawesi	6.9	6.9	7.1	19.4	24.0	43.6	22.5	42.0	66.8
West Sumatra	35.1	35.3	36.5	109.8	143.7	183.6	104.3	133.3	201.3
South Sumatra	266.3	314.5	358.2	638.4	822.6	1,087.2	693.8	770.5	1,101.8
North Sumatra	111.8	117.7	129.6	458.5	488.1	541.3	468.6	488.4	661.2

3.2 Area converted for rice production by province, land constraint, and production scenario (kHa)

	Concessions			**Open Development**			**Forest Protection**		
	Reduced Imports	*Self-Sufficiency*	*Exporter*	*Reduced Imports*	*Self-Sufficiency*	*Exporter*	*Reduced Imports*	*Self-Sufficiency*	*Exporter*
Aceh	-	-	1.2	-	-	-	-	-	1.0
Jambi	2.2	87.6	213.8	2.3	88.3	317.5	0.2	143.7	316.6
West Kalimantan	-	-	-	-	2.5	5.3	-	5.1	19.8
Central Kalimantan	0.0	0.2	4.2	-	-	0.4	-	0.3	17.0
East Kalimantan	0.3	157.0	271.4	0.3	92.8	200.9	0.5	102.1	179.6
North Kalimantan	-	-	37.0	-	-	5.0	-	-	83.7
Bangka Belitung Islands	-	-	0.5	5.6	82.8	344.9	5.7	252.1	487.8
Lampung	-	0.1	0.4	-	0.1	0.4	-	0.1	0.3
East Nusa Tenggara	-	-	6.2	-	-	51.0	-	-	92.5
Papua	81.2	688.8	1,647.5	76.2	644.2	1,101.6	78.0	400.8	1,040.9
Riau	-	0.1	39.2	-	-	232.0	0.0	37.6	38.8
West Sumatra	-	-	-	-	19.4	19.4	0.0	17.2	25.7
South Sumatra	-	1.5	28.2	-	4.2	27.7	0.0	5.5	20.8

3.3 Emissions intensity by crop, land constraint, and production scenario ($tCO_2e\ ha^{-1}$)

Concessions			Open Development			Forest Protection		
B35	*B40*	*B50*	*B35*	*B40*	*B50*	*B35*	*B40*	*B50*
406	425	472	130	138	130	68	48	40

Concessions			Open Development			Forest Protection		
Reduced Imports	*Self-Sufficiency*	*Exporter*	*Reduced Imports*	*Self-Sufficiency*	*Exporter*	*Reduced Imports*	*Self-Sufficiency*	*Exporter*
601	545	577	597	465	545	315	247	219

3.4 Emissions intensity by crop, land constraint, and production scenario, joint scenario ($tCO_2e\ ha^{-1}$)

Concessions			Open Development			Forest Protection		
B35	*B40*	*B50*	*B35*	*B40*	*B50*	*B35*	*B40*	*B50*
403	437	474	211	213	175	110	93	114

Concessions			Open Development			Forest Protection		
Reduced Imports	*Self-Sufficiency*	*Exporter*	*Reduced Imports*	*Self-Sufficiency*	*Exporter*	*Reduced Imports*	*Self-Sufficiency*	*Exporter*
598	630	576	597	490	542	305	230	234

3.5 Peatlands converted for oil palm and rice production by province, land constraint, and production scenario (kHa)

	Concessions			Open Development			Concessions			Open Development		
	B35	*B40*	*B50*	*B35*	*B40*	*B50*	*Reduced Imports*	*Self-Sufficiency*	*Exporter*	*Reduced Imports*	*Self-Sufficiency*	*Exporter*
Aceh	14	14	17	-	-	-	-	-	-	-	-	-
Jambi	7	13	17	11	13	19	1	14	103	1	11	103
West Kalimantan	115	135	296	7	7	14	-	-	-	-	-	-
South Kalimantan	6	15	15	1	2	2	-	-	-	-	-	-
Central Kalimantan	117	205	270	30	40	46	-	-	-	-	-	-
East Kalimantan	5	7	57	-	-	-	0	0	3	-	-	3
North Kalimantan	0	0	22	-	-	-	-	-	-	-	-	-
Bangka Belitung Islands	-	-	-	-	-	-	-	-	-	-	1	17
Riau Islands	-	-	-	1	1	1	-	-	-	-	-	-
Lampung	-	-	-	-	-	2	-	-	-	-	-	-
Papua	12	24	73	1	2	2	23	92	134	23	79	108
West Papua	15	17	19	4	7	7	-	-	-	-	-	-
Riau	85	242	258	19	19	61	-	-	36	-	-	180
South Sumatra	22	45	51	11	30	38	-	-	12	-	-	12
North Sumatra	3	5	7	-	1	4	-	-	-	-	-	-

3.6 Registered indigenous land converted for oil palm production by province, land constraint, and production scenario (kHa)

	Concessions			Open Development			Forest Protection		
	B35	*B40*	*B50*	*B35*	*B40*	*B50*	*B35*	*B40*	*B50*
Aceh	22	25	37	1	1	3	1	4	4
Bali	-	-	-	-	-	-	0	0	0
Bengkulu	1	1	1	0	0	0	0	0	0
Jambi	-	-	-	-	-	1	-	-	-
West Java	-	-	-	0	0	0	-	-	-
West Kalimantan	107	117	151	8	8	10	7	17	20
South Kalimantan	5	5	5	4	4	8	1	1	5
Central Kalimantan	67	85	106	7	8	8	6	7	12
East Kalimantan	25	27	33	28	38	44	21	15	16
North Kalimantan	16	18	18	0	0	0	0	0	0
Maluku	-	-	-	1	2	2	1	0	0
North Maluku	1	1	4	1	2	2	1	10	11
West Nusa Tenggara	-	-	-	1	1	1	1	1	1
East Nusa Tenggara	-	-	-	1	2	2	1	1	1
Papua	132	173	226	59	79	81	17	17	17
West Papua	5	5	5	5	5	5	2	1	1
Riau	21	21	21	20	20	32	15	15	23
South Sulawesi	23	23	23	5	7	7	6	5	10
Central Sulawesi	1	1	1	4	6	6	5	4	6

South Sumatra	-	-	-	12	12	29	9	0	0
North Sumatra	16	16	16	104	111	114	108	111	114

3.7 Registered indigenous land converted for rice production by province, land constraint, and production scenario (kHa)

	Concessions			**Open Development**			**Forest Protection**		
	Reduced Imports	*Self-Sufficiency*	*Exporter*	*Reduced Imports*	*Self-Sufficiency*	*Exporter*	*Reduced Imports*	*Self-Sufficiency*	*Exporter*
West Kalimantan	-	-	-	-	-	1	-	1	1
Central Kalimantan	-	-	-	-	-	0	-	-	0
East Kalimantan	0	8	19	0	5	9	0	5	15
North Kalimantan	-	-	-	-	-	-	-	-	0
East Nusa Tenggara	-	-	-	-	-	0	-	-	1
Papua	-	-	211	-	-	50	-	-	80
South Sumatra	-	-	-	-	1	1	-	-	-

3.8 Area converted for oil palm production by province, land constraint, and production scenario, joint scenario (kHa)

	Concessions			**Open Development**			**Forest Protection**		
	B35	*B40*	*B50*	*B35*	*B40*	*B50*	*B35*	*B40*	*B50*
Aceh	133.1	144.3	159.0	128.6	210.7	226.3	190.1	205.3	279.6
Bali	-	-	-	32.9	33.1	35.4	31.8	34.1	34.1
Banten	-	-	-	74.0	75.6	78.0	69.9	72.3	72.3
Bengkulu	24.4	24.9	30.7	28.0	28.0	55.3	28.2	28.2	54.8
Yogyakarta	-	-	-	13.8	14.0	14.2	13.6	13.8	13.8

Jakarta	-	-	-	0.5	0.5	0.5	0.2	0.2	0.2
Gorontalo	13.2	13.2	13.2	111.7	127.6	173.1	107.2	152.3	152.3
Jambi	102.0	107.9	112.6	309.1	432.0	440.6	302.3	307.4	644.4
West Java	-	-	-	197.0	248.6	323.1	175.8	250.0	250.0
Central Java	-	-	-	68.1	85.5	103.8	55.4	73.7	73.7
East Java	-	-	-	95.3	129.6	165.1	79.6	115.0	115.0
West Kalimantan	1,134.2	1,218.4	2,068.3	106.1	163.0	175.8	136.2	144.8	198.7
South Kalimantan	149.4	185.6	187.3	438.2	473.1	505.7	430.4	444.5	723.5
Central Kalimantan	911.4	1,231.0	1,580.7	201.9	284.5	438.4	184.5	336.6	336.6
East Kalimantan	674.4	763.7	1,174.0	324.1	433.1	425.8	281.9	276.2	416.6
North Kalimantan	205.4	224.1	316.4	41.4	46.7	46.9	35.5	35.7	19.0
Bangka Belitung Islands	18.4	27.7	36.1	17.2	8.2	21.6	17.2	24.5	21.0
Riau Islands	20.9	24.8	27.2	25.3	25.4	25.8	19.6	20.0	43.6
Lampung	12.3	12.3	12.6	213.2	259.0	479.0	249.7	467.9	548.1
Maluku	4.9	5.6	6.7	38.2	39.2	49.5	29.3	39.6	39.6
North Maluku	29.0	30.3	47.6	57.5	58.1	89.9	44.2	75.7	202.8
West Nusa Tenggara	-	-	-	1.5	1.5	2.1	1.4	2.0	2.0
East Nusa Tenggara	-	-	-	21.8	22.5	28.7	11.9	18.1	17.8
Papua	309.6	390.4	632.5	126.0	127.7	134.5	25.5	25.5	22.4
West Papua	222.5	254.5	352.1	91.6	93.7	93.7	30.3	30.3	30.3
Riau	313.3	494.9	518.2	458.6	593.7	651.6	347.6	399.8	399.8

West Sulawesi	12.0	12.0	12.0	111.5	111.5	231.5	135.9	135.9	222.9
South Sulawesi	50.8	50.9	51.1	126.2	134.4	281.0	118.2	264.4	480.9
Central Sulawesi	98.4	108.3	118.2	126.0	155.2	229.5	127.8	200.8	333.3
Southeast Sulawesi	28.1	28.6	28.6	98.5	106.5	146.8	91.1	130.8	130.8
North Sulawesi	6.5	6.5	6.7	22.2	22.2	48.4	20.4	44.7	44.7
West Sumatra	34.2	34.4	35.6	117.4	133.5	295.0	152.7	152.7	267.0
South Sumatra	258.2	308.3	347.9	852.6	891.5	1,572.4	927.0	1,023.9	1,482.2
North Sumatra	101.1	106.8	119.2	406.0	471.2	567.3	478.3	535.5	535.5

3.9 Area converted for rice production by province, land constraint, and production scenario, joint scenario (kHa)

	Concessions			**Open Development**			**Forest Protection**		
	Reduced Imports	*Self-Sufficiency*	*Exporter*	*Reduced Imports*	*Self-Sufficiency*	*Exporter*	*Reduced Imports*	*Self-Sufficiency*	*Exporter*
Aceh	-	-	1.2	-	-	-	-	-	1.5
Jambi	2.0	84.8	176.7	2.1	128.1	269.5	0.1	104.7	219.7
West Kalimantan	-	-	-	-	1.9	2.8	-	2.7	65.9
Central Kalimantan	-	0.2	15.2	-	-	0.4	-	0.3	14.2
East Kalimantan	0.2	121.4	182.9	0.2	37.2	135.9	0.4	40.9	79.9
North Kalimantan	-	-	35.6	-	-	15.0	-	2.4	97.5
Bangka Belitung Islands	-	-	0.5	3.8	109.5	260.4	4.0	177.3	509.7
Lampung	-	0.1	0.3	-	-	0.3	-	0.2	0.2

East Nusa Tenggara	-	-	6.2	-	-	51.0	-	20.4	128.3
Papua	81.4	703.1	1,770.6	78.0	645.3	1,372.5	79.7	581.8	1,181.5
Riau	-	15.9	16.9	-	-	136.6	-	1.0	1.0
West Sumatra	-	-	-	-	2.2	2.2	-	-	3.7
South Sumatra	-	4.6	26.4	-	3.3	24.8	-	7.1	19.3

3.10 Peatlands converted for oil palm and rice production by province, land constraint, and production scenario, joint scenario (kHa)

	Concessions			**Open Development**			**Concessions**			**Open Development**		
	B35	*B40*	*B50*	*B35*	*B40*	*B50*	*Reduced Imports*	*Self-Sufficiency*	*Exporter*	*Reduced Imports*	*Self-Sufficiency*	*Exporter*
Aceh	14	14	17	-	0	0	-	-	1	-	-	-
Jambi	7	13	17	11	17	18	1	33	96	1	9	96
West Kalimantan	117	137	298	7	15	19	-	-	-	-	-	-
South Kalimantan	6	14	14	2	2	2	-	-	-	-	-	-
Central Kalimantan	112	234	264	35	51	53	-	-	-	-	-	-
East Kalimantan	5	9	55	-	-	-	-	-	3	-	-	3
North Kalimantan	-	1	22	-	-	-	-	-	-	-	-	-
Bangka Belitung Islands	-	-	-	-	-	1	-	-	-	-	2	15
Riau Islands	-	-	-	1	1	1	-	-	-	-	-	-
Lampung	-	-	-	0	1	1	-	-	-	-	-	-
Papua	12	20	60	2	2	2	23	94	135	23	81	123

West Papua	15	17	22	7	7	7	-	-	-	-	-	-
Riau	85	242	258	56	61	63	-	15	16	-	-	123
South Sumatra	20	47	49	16	17	22	-	9	12	-	-	12
North Sumatra	2	5	6	3	3	3	-	-	-	-	-	-

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