SEI-PCS Indonesia palm oil v1.1 documentation

SEI-PCS Indonesia palm oil v1.1 maps the sub-national supply chain for exports of crude and refined palm oil products in 2015. It uses domestic and international shipment records, road network information, asset ownership data and regional palm oil production statistics to determine the most likely point of origin for a given export. The model relies largely on mathematical optimisation to establish supply chain connections, but is underpinned by verifiable data on shipment volumes, asset capacities and known links between companies (traceability reports).

Data

1. Trade data

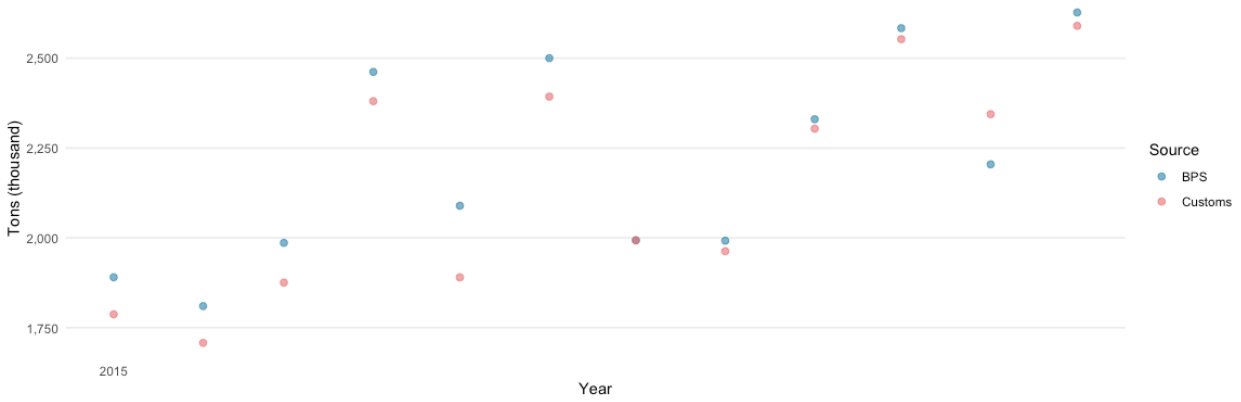
1.1 Export

Per-shipment customs data for products exported under the Harmonised System (HS) code 1511 - Palm oil and its fractions; whether or not refined, but not chemically modified. This includes all crude palm oil (CPO) and refined palm oil (RPO) products in Table 1. It does not include palm kernel oil, biodiesel or palm oil derivatives.

Table 1: Palm oil HS codes and conversion coefficients (to CPO equivalent).

HS	Product	Conversion coefficient
15111000	Crude palm oil	1.000000
15119091	Solid fractions of refined palm oil	1.052632
15119092	Unsolid fractions of refined palm oil	1.052632
15119099	Unsolid fractions of refined palm oil	1.052632

When compared to official monthly export volumes published by BPS, the results look like so:

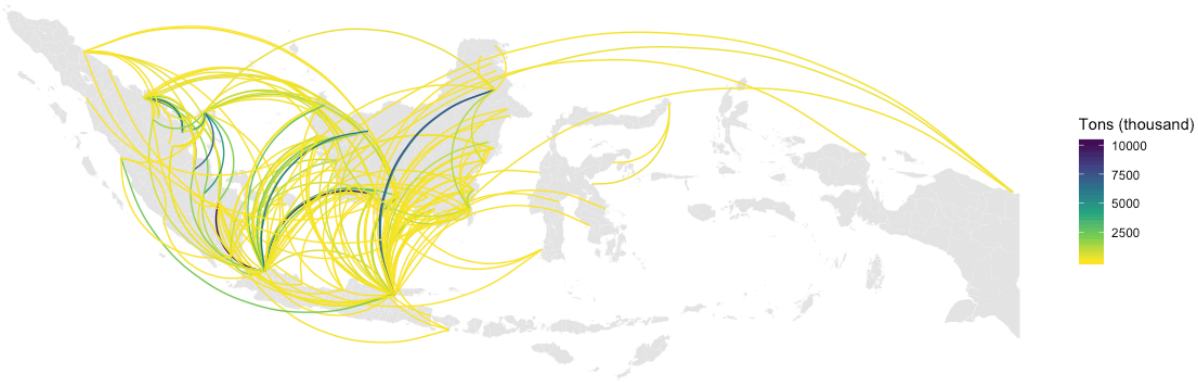


Customs data compared to BPS statistics for 2015

1.2 Domestic

Per-shipment domestic trade data for CPO and RPO in 2015. This data follows a similar structure to international trade records, with a date stamp, exporter name, importer name, volume, port of loading and port of destination.

The data contains information about 1,990 shipments in 2015, accounting for 5.4 million tons of palm oil (21% of exports). While we believe this to be comprehensive, we have not been able to verify the volumes against official statistics and therefore it is possible that there are gaps in the data We are currently pursuing additional means of verification.

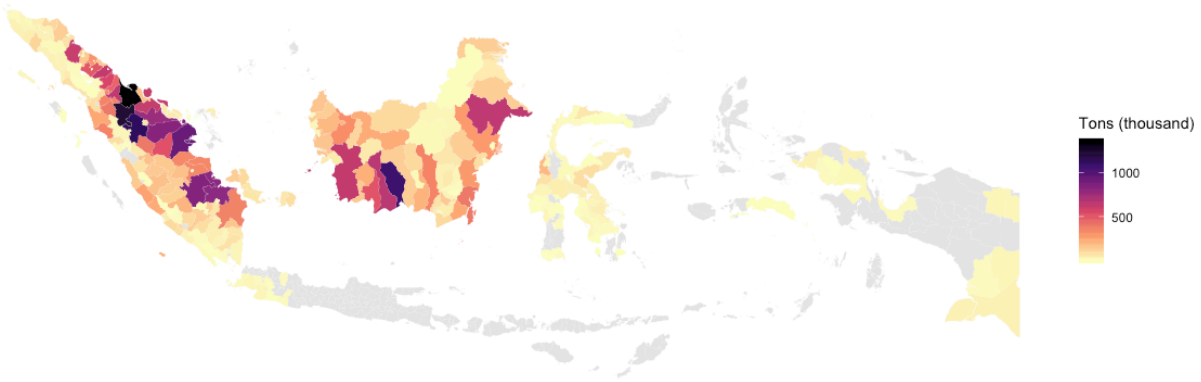


Domestic shipments in 2015

2. Production data

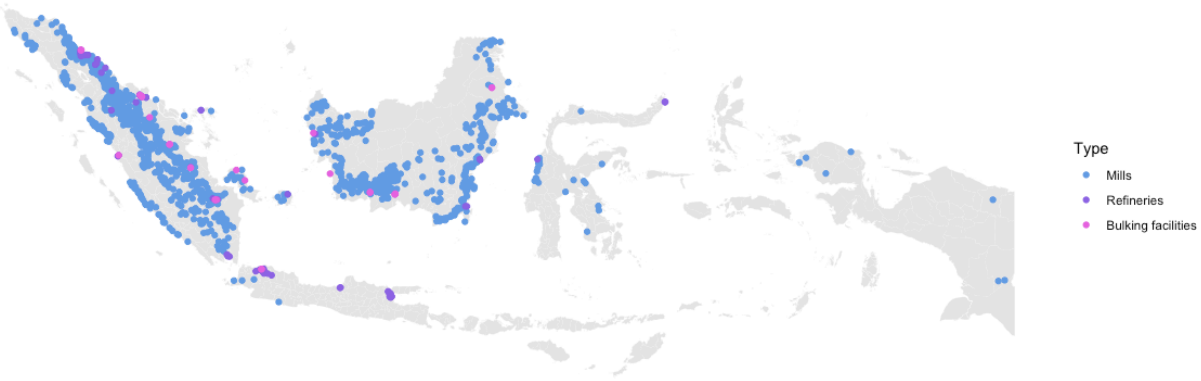
Palm oil production data are derived from province level CPO statistics provided by the Directorate General of Estate Crops via the government statistics agency (BPS). These data

are cut to the jurisdictional level (kabupaten - districts - see section 5) using palm oil cover data generated by Auriga on the basis of 2016 SPOT imagery.



Palm oil production at the kabupaten level in 2015

3. Logistics data



Logistics data

3.1 Mills

Recently released (November 2019) update to the Universal Mill List (UML), a collaborative effort between numerous NGOs and research institutions.

The mill list includes 1,096 assets with verified locations, ownership data and capacity information. For SEI-PCS v1.1 we have used the 758 mills that were known to be in operation in 2015.

Capacity values were obtained through reference to reports from provincial plantation agencies (Dinas Perkebunan), the initial SIPERIBUN results and RSPO/ISPO filings. There were 86 mills for which we could not find a value. For these we used a spatial interpolation at the kabupaten or province level (depending on the availability of other mills). This was

found to be more accurate than a kriging interpolation when tested on a sample of known values.

3.2 Refineries & bulking facilities

Refinery and bulking facility data from Aid Environment and desk-based research carried out by the Auriga team. The data does not yet include comprehensive information on capacity, but it does include ownership and location information which unlocks the value of traceability reports (section 3.3).

3.3 Traceability reports

Traceability reports (TR) are corporate self-declarations detailing sourcing patterns. For the palm oil supply chain they are typically given at the mill level.

In 2015, 4 of the 37 exporting groups published TR outlining the mills associated with their refineries and bulking facilities. For SEI-PCS v1.1 these processing facilities were linked to ports of export on the basis of proximity and ownership. The reports do not contain volumes, but the connections provided are used to constrain allocation during the model implementation.

3.4 Plantations

Spatially explicit data on plantation licenses (HGUs) were used to determine the location and ownership of palm estates. This data was provided by Auriga and Greenpeace. It is not comprehensive, and importantly it lacks information on smallholder plantations.

3.5 Transport cost matrix

Road network data from the geospatial agency (BIG) was used to determine the cost of transport between ports and mills and also between mills and kabupaten. This data was made available per-island (Sumatra, Kalimantan, Sulawesi, Java, Maluku, Papua) and as such the quality varies across the country. In some locations, such as Riau island, we were not able to access the data so we have supplemented it with distance as the crow flies.

Additionally, in order to include palm oil produced on small coastal islands in Sumatra we have added connections to the road network in order to allow for the roll-on-roll-off ferries that transport palm as fresh fruit bunches (FFB), and would therefore not be captured by domestic shipments.

4. Companies

A unified dictionary of company names and parent groups was generated in order to align and connect exporting companies, domestic traders and asset owners. Parent group information was drawn from Indonesian corporate research (CDMI) and company filings (AHU).

5. Boundaries

Jurisdictional boundaries (kabupaten and province) as defined by BIG, the Indonesian geospatial agency, in 2016. These are paired with geocodes provided by BPS to give a standard identifier for each area.

SEI-PCS Implementation

1. Define exporting nodes. These are groups of shipments in the customs records that have the same exporter, port of export and sub-commodity (either CPO or RPO).
2. Check each exporting node for asset ownership. If neither the exporter nor the exporter's parent group own assets in the logistics data then declare the origin of the palm oil as *unknown* (< 1% of volume, 40 exporters).
3. Connect exporting nodes to domestic shipments. If the exporting node is listed as a recipient of a domestic shipment then connect the two. In doing so, attach a new domestic node to the exporting node to account for the domestic exporter and domestic port of loading. This step allows exporting nodes to be connected to other parts of the country and, importantly, other companies (domestic exporters). Depending on the volume of domestic shipments received by the exporting node there are two potential outcomes:
    - Domestic shipment volume > exported volume: re-allocate export volume proportionally to each of the ports of origin stated in the domestic shipment data.
    - Domestic volume < export volume: re-allocate the volume given in the domestic shipment data. The remaining volume must be supplied by the island on which the port of export is situated (unless that island is Java or within Riau Islands in which case the origin of the volume is declared as *unknown* due to limited production and a lack of information on sourcing).

Note - domestic shipment data plays a critical role in determining the origin of palm oil consumed in the domestic market in Indonesia. Any palm oil which is produced by an island but not exported internationally or domestically remains in the Indonesian market. This is the case for both Kalimantan and Papua.

4. Connect exporting nodes (and any associated domestic nodes) to mills. There are three pathways here: the first is via traceability reports, the second is direct ownership of a mill by an exporter (or domestic exporter) and the third is indirect ownership of a mill by an exporter's group (or domestic exporter's group). In each case, the connections act to establish a network of mills which are subsequently passed to a mathematical optimisation model. This model allocates volumes from nodes to mills on the basis of the demand at the node (total volume being exported) the supply at the mill (capacity) the cost of transport and the type of node to mill connection that has been established. Where the connection is from a traceability report, an expected sourcing pattern is calculated beforehand, and penalties applied to any deviation from that pattern.

5. Connect mills to kabupaten of production. Additional step of mathematical optimisation accounting for the cost of transport, production of palm oil in the kabupaten and the existence of plantations owned by the company in that kabupaten.