trase | TRANSPARENCY FOR SUSTAINABLE ECONOMIES

JUNE 2020

Trase 'SEI-PCS Colombia coffee v1.0.2' supply chain map: Data sources and methods

Trase maps supply chains for agricultural commodities, making it possible to link products and supply chain actors with specific areas of production, and associated sustainability risks and opportunities. It uses an approach called Spatially Explicit Information on Production to Consumption Systems (SEI-PCS) as the basis for this work (see this webpage or our manual for more detail). This document describes the data and methods that Trase used to map the subnational supply chain for Colombian exports of coffee, using a model called **'SEI-PCS Colombia coffee v1.0.2'**.

For all coffee exports, this model determined the likely department in which the coffee was produced. It used trade and production data, as well as information on company asset ownership and the road network. The model used linear programming to link departments of production to ports of export by minimising the overall transport distance. Table 1 provides an overview of key statistics.

Table 1. Summary statistics

	2012	**2013**	**2014**	**2015**	**2016**
Coffee exports (million tonnes*)	0.415	0.564	0.640	0.736	0.761
Number of exporting companies	104	111	119	141	202
Number of importing countries	94	95	92	91	96
Domestic market (% share of production)	33.4	13.6	12.1	13.4	10.8
Exports with unknown source of origin (%)	0	0	0	0	0

* = metric tons

Data and sources

Trade data

The model used per-shipment data (such as customs data, bills of lading or cargo manifests) for 2012 - 2016 covering exports of coffee beans, roasted coffee and processed coffee classified under the 'HS' customs codes in Table 2. We used a commodity-equivalence factor (see Table 2) to convert different products to a standard commodity equivalent, in this case coffee beans. We confirmed the quality of the data by comparing it with other data sources and with data in different aggregated forms such as Comtrade.

Domestic demand

We used the population of each of the departments of Colombia to determine the relative domestic demand for coffee from different parts of the country, and we considered total domestic demand to equal total production minus total exports (i.e. total production = exports + domestic demand).

Table 2. Coffee products, their HS codes and commodity-equivalence factors

HS code	Product	Commodity-equivalence factor
090111	Coffee green; not roasted or decaffeinated	1.00
090112	Coffee green; decaffeinated, not roasted	1.00
090121	Coffee green; roasted, not decaffeinated	1.25
090122	Coffee green; roasted, decaffeinated	1.25
090190	Coffee; husks and skins, coffee substitutes containing coffee in any proportion	1.25
210111	Extracts, essences and concentrates of coffee, and preparations with a basis of these extracts, essences or concentrates or with a basis of coffee	1.25
210112	Preparations with a basis of extracts, essences or concentrates or with a basis of coffee	1.25

Production data

We obtained municipality-level data on coffee production from the Ministry of Agriculture and Rural Development, through its Agronet website.

Supply chain data

Asset data

We collated information from an online database and company statements, on the ownership and location of assets including farms, points of purchase from local supply sheds, processing facilities, storage facilities, wholesalers, offices, and other assets of unknown type, which are likely to have included corporate offices but may have been other asset types (which accounted for 2385 of 6695 total assets). We have no information about the throughput or capacity of any of these assets.

Transportation data

Road network

We sourced the roadmap from DIVA-GIS. This was low-quality and required manual editing (e.g. adding bridges over rivers) using Google maps, and the OpenStreetMap shapefile for Colombia's roads, which we obtained from Geofabrik.de. The road network files did not extend to southern departments of Amazonas, Vaupés and Guainía. However, these are not coffee producing regions, and they have small populations meaning they are insignificant from the perspective of domestic demand. We therefore excluded them from the model.

Ports

The trade data provides information on the ‘City of Departure’, but not specifically the port. There are 11 unique city locations in the records.

Company data

Each trader has a unique tax number ('NIT' code). We used these NIT codes to identify traders in the trade data and to link traders to assets they own.

Boundaries

We used department boundaries and geocodes as defined by the National Department of Statistics.

SEI-PCS implementation

We used a simple linear program to allocate exports to production departments. The linear program minimised the overall distance coffee could have travelled from supply nodes (departments of production) to demand nodes (exports and domestic demand hubs). Supply nodes were constrained by production.

The linear program used a distance matrix, based on the road network data, to calculate distances between the geometric centres of departments of production (supply nodes) and both ports (export demand nodes) and the geometric centres of departments (domestic demand nodes). The model used information on company asset-ownership to apply a 'discount' to the distance, to reflect that companies preferentially source from their own facilities.

Subnational and company sustainability indicators

The Trase indicator manual for Colombia describes the connection of these supply chain data to municipal level sustainability indicators that cover agriculture, environment, territorial governance, actor commitments, socio-economic and contextual (e.g. biomes).

Changes from previous version(s)

Version	Publication date	Changes from previous version
1.0.2	June 2020	• New equivalence factors to convert exported products into coffee bean were used to generate the new results.
1.0.1	July 2019	• First release

How to cite this document

Trase. 2020. Trase 'SEI-PCS Colombia coffee v1.0' supply chain map: Data sources and methods. Available at www.trase.earth.

Annex: Glossary

Term	Definition	Example
Asset	In the context of Trase, a physical or material resource owned by a business or an economic entity that relates to the production, storage or processing of a commodity.	Soy silo, slaughterhouse, refinery, mill, farm.
Commodity equivalent	Measure used to relate the trade flows of different products to a commodity equivalent. This is obtained by using the commodity equivalence factor.	Soy oil and cake products are converted into soybean equivalents.
Commodity-equivalence factor	Factor used to convert the amount of a product into a commodity equivalent.	1 kg of soy meal and oil are equivalent to 1.031 kg of soybeans (3 g are waste).
Decision tree	Outlines the conditional filtering of trade data in order to link commodity exports to a logistic hub.	Each supply chain map manual contains a figure of their respective decision trees.
Distance matrix	The distances between different demand and supply nodes. This is used in the linear programming step to solve the problem of minimising the total distance incurred in meeting all of the demand.	Supply nodes are jurisdictions of production. Demand nodes include exports from ports and domestic demand nodes such as chicken farms for Brazil soy. Distances are based on the available road networks.
HS code	Unique code from the Harmonized System (HS) which describes the nature of the products being traded internationally.	1201: Soya beans, whether or not broken 120110: Soya beans, seed; whether or not broken
Jurisdiction	The territorial administrative units into which a country is divided.	Municipality in Brazil, kabupaten (district) in Indonesia, department in Argentina, department in Paraguay (lower resolution, with departments comprised of districts).

Linear programming	Linear programming (LP, also called linear optimisation) is a method to achieve the best outcome (such as maximum profit or lowest cost) in a mathematical model whose requirements are represented by linear relationships.	Use linear program to minimise the distance between logistic hubs and production municipalities.
Logistics	Activities related to the production, storage, processing, transport, trade, etc., of commodities in supply chains.	Chicken rearing, cattle slaughtering, soybean crushing, palm oil bulking, shipping.
Logistics hub	Jurisdiction containing one or more assets that are nodes in the commodity supply chain.	Municipality, department of silo location, slaughterhouse, palm oil mills.
Node	Jurisdiction, asset, trader or country representing a point of aggregation or transfer of a commodity through its supply chain.	
Supply chain	Sequence of nodes linking a jurisdiction of production to a country of import.	