TRANSPARENCY FOR SUSTAINABLE ECONOMIES

Supply chain mapping in Trase

Summary of data and methods

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This document outlines the supply chain mapping approach used by Trase: Spatially Explicit Information on Production to Consumption Systems (SEI-PCS). SEI-PCS is a form of enhanced material flow analysis that was first published by Godar et al. (2015). It has evolved substantially through application in successive releases of the Trase platform (trase.earth) for specific countries and commodities.

The first section describes Trase's unique approach to supply chain mapping. A second section describes the various versions of SEI-PCS, up to the new version (2.2) released in September 2017. A final section looks at possible future developments of SEI-PCS within Trase.

The Trase team is constantly working to improve the supply chain mapping approaches that underpin Trase using new data sources and data technologies. We welcome feedback on our work and ideas for further improvement – please write to us at info@trase.earth.

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Supply chain mapping with SEI-PCS

The Trase initiative is an independent, impartial and science-based provider of decision relevant information needed to support a transition to a deforestation-free economy. Trase is at the forefront of a data-driven revolution in supply chain sustainability, drawing on vast sets of production, trade and customs data, for the first time laying bare the flows of globally traded commodities at scales that are directly relevant to decision-making. Its pioneering approach to data analysis and visualization provides full coverage of the export routes and buyers responsible for all production and trade, and the associated sustainability risks, of a given commodity.

The supply chain mapping at the core of Trase balances scale and data resolution. It does not yet go down to the level of individual farms or of individual consumer products or retailers. However, Trase is able to map commodity supply chains in their entirety, covering entire countries and farming sectors (e.g. Brazilian soy) at jurisdictional scales that are relevant to local decision-making (e.g. municipalities in Brazil).

Trase maps the entire middle section of a supply chain, linking regions of production to countries of import, via the individual companies that export and import a particular traded commodity. This builds on an enhanced form of material flow analysis that was first published by Godar et al. (2015): the Spatially Explicit Information on Production to Consumption Systems (SEI-PCS) approach. Different versions of SEI-PCS have been developed since 2015 and have been used in different Trase releases. They are described in the next section

More detailed arguments regarding the advantages of the 'middle-ground' material-flow supply chain mapping approach can be found in Godar et al. (2016). An example application to the assessment of virtual water flows embedded in Brazilian farming exports can be found in Flach et al. (2016).

Before applying SEI-PCS to a specific country and commodity, we publish national-level export data on www.trase.earth, linking countries of production to downstream traders and countries of import. This higher-level analysis, which we call "level 1", provides a coarser-grained analysis of material flows and associated sustainability impacts, risks and performance measures at national level, as well as an entry point for more detailed work on poorly studied geographies and sectors.

We then apply SEI-PCS approach to map subnational trade flows, discriminating producer regions down to the lowest level of government administrative unit the data and the complexity of the supply chain allow. Often this is defined by the availability of production data at subnational scales. This subnational supply chain mapping is referred to as "level 2". A third level, linking flows to the actual production farms, is a future aspiration, but Trase will focus on level 2 analyses during the coming years.

What makes SEI-PCS unique?

Three capabilities of SEI-PCS (level 2) together set it apart from other approaches to supply chain mapping:

1) It systematically links individual supply chain actors to specific production regions, and the sustainability risks and investment opportunities associated with those regions. In Brazil, SEI-PCS is able to link actors to individual producing municipalities, the country's smallest administrative unit. The finer the scale of these production regions, the more effectively Trase can differentiate the specific environmental, social and governance conditions associated with production and trade.
2) It names the individual companies that export, ship and import a given traded commodity.
3) It covers all of the exports of a given commodity from a given country of production, ensuring that shifts in the sourcing patterns – and associated social and environmental impacts and risks – of a particular buyer or trader can be tracked and assessed over space and time.

The uniquely broad coverage of the Trase supply chain maps means that users can prioritize the places and actors that warrant the greatest attention and only invest in acquiring further detail, including on the individual producers and consumers that are not mapped by Trase, where it is really needed.

Data sources

Central to the SEI-PCS approach is the use of multiple independent datasets to "triangulate" flows of traded commodities from regions of production via trading companies to countries of import. Trase uses data that was collected for other purposes, such as customs records and trade contracts, tax registration data, and production data. Trase is one of the first initiatives to make systematic use of per-shipment customs and shipping data for sustainability research. The SEI-PCS approach is highly flexible and can be adapted to include new datasets that can help add further detail and/or provide additional validation for individual material flows.

Trase uses no private or confidential information. All data sources are either publicly available (including from government and industry websites as well as repositories) or available for purchase (such as from trade intelligence companies and government repositories). Where we have used purchased data to map supply chains of a specific commodity, such as per-shipment customs declarations or bills of lading, this data is masked alongside multiple other data sources in the SEI-PCS data model and is aggregated in a way that makes it impossible to reverse engineer the raw data.

A description of all the data sources currently used in Trase, and their sources, can be found at trase.earth.

What commodities and countries does Trase cover?

Over the next five years Trase aims to cover over 70% of the total traded volume of major forest-risk commodities that originate¨ in the tropics. These include soy, beef, palm oil, timber, pulp and paper, coffee, cocoa and aquaculture products.

From 2017, Trase will focus first on expanding to include all South American soy, and initiating new programmes of work on beef in Argentina, Brazil and Paraguay; palm oil in Indonesia and Colombia; and coffee in Colombia. Additional countries and commodities will be added in subsequent years based on capacity and funding opportunities.

While the modelling framework and decision logic that underpin SEI-PCS are transferable between different commodities and countries, each version of SEI-PCS is highly tailored to the specific context, requiring detailed knowledge of national production, logistics, taxation and other commodity-country-specific data. This means that with the current limited capacity of Trase, expanding to a new commodity and country requires approximately six months. To learn about plans for SEI-PCS and Trase expansion to other countries and commodities please sign up for our newsletter at trase.earth.

How SEI-PCS maps supply chains

For all SEI-PCS model versions the basic structure of the supply chain is defined by per-shipment and per-day bills of lading and customs declarations compiled from official sources. The information is acquired for specific trade codes (e.g. a specific type of soy oil), which together make up the total trade for a given commodity.

Trase provides the information in raw equivalents of the original crop or product using standardized conversion coefficients (e.g. for soy see Kastner et al. 2011), although detailed supply chain mapping of the different products that make up a commodity flow (e.g. soy cake) can be provided to interested users on a per-case basis.

Once this basic structure is in place, we identify the subnational origin of individual material trade flows by triangulating the information with other independent datasets, including on the logistics of trading companies, production and taxation. This cross-validation approach is implemented using a logic-based decision tree.

From supply chain mapping to sustainability indicators

In systematically linking individual supply chain actors to specific production regions Trase represents a step-change in our ability not only to link actors to places, but also to link actors to the sustainability risks and investment opportunities associated with different places. Trase unlocks the value of vast spatial datasets on deforestation and other environmental and social impacts, as well as the agricultural, economic and political conditions associated with different production regions, for the benefit of downstream actors. Environmental and social indicators of places of production are linked to individual trade flows in two ways.

First, quantitative indicators for a specific region – such as measures of deforestation – are embedded in the trade flows in Trase. This means that users have the option of visually resizing the trade flows to reflect potential contribution to that indicator. This method also means contributions to indicators associated with a trade flow can be summed across regions and actors for comparative analysis (e.g. as shown in the place and actor profiles on the Trase platform). Quantitative properties of the trade flow itself – such as the financial value of the commodity, or GHG emissions related to production or transportation – can also be used to rescale the flows.

Second, qualitative indicators such as the biome of origin or a categorical scale for an indicator that cannot be aggregated across regions, such as levels of legal compliance or extent of water scarcity, are reflected visually by recolouring a trade flow or by place-specific indicators in detailed profile reports.

Guide to SEI-PCS versions

VERSION	COMMODITIES	RELEASE DATES	DESCRIPTION AND CHANGES
0.0	Brazilian soy, Indonesian palm oil	Never publicly released, discontinued.	Links subnational production regions to countries of consumption based on assumptions of mass-balance. Does not include company information. First published by Godar et al. (2015).
1.0	Brazilian soy	30 November 2015 (COP 21), discontinued.	Precursor to Trase, published on Transformative Transparency platform. Uses per-shipment customs data with information on exporters, importers and carriers. Otherwise similar to v.0.
2.0 (Trase)	Brazilian soy	11 November 2016 (COP 22), discontinued.	First release of SEI-PCS on www.trase.earth. Uses detailed per-shipment customs data to identify municipalities of taxation for each shipment, and multiple independent datasets to identify soy logistical hubs (storage, crushing facilities). Production municipalities are connected to logistic hubs within soy-sheds based on levels of production.
2.1 (Trase)	Brazilian and Paraguayan soy	20 March 2017(Tropical Forest Alliance meeting, 2017)	As v 2.0 but with optimization modelling to link logistical hubs to production municipalities.
2.2 (Trase)	Brazilian soy	20 September 2017	Links per-shipment information from customs data to localities of production and logistics facilities based on common asset-level tax registration numbers (eliminating the need for multiple validation datasets).

The development of SEI-PCS

SEI-PCS was first developed for Brazilian soy, for which the latest version is 2.2 (see below), covering the period 2010-2016. Version 2.2 for Brazilian soy offers a robust modelling framework to add new years of soy production and export as data become available. It also provides the logic basis for mapping the supply chains of other Brazilian farming commodities using analogous data sources.

SEI-PCS v.0 (Brazilian soy, Indonesian palm oil)

SEI-PCS v.0 predated the Trase platform and was published in Godar et al. (2015). It used aggregated customs data (which are more detailed than national level country-country exports provided, e.g. by FAOSTAT and COMTRADE) and detailed production data at the highest subnational resolution available. SEI-PCS v.0 covered all exports of Brazilian soy from 2001 to 2011.

It linked subnational production regions with countries of consumption but did not provide the names of individual trading companies. Sourcing areas were identified using a minimum transportation cost model and matrix algebra based on mass-balance calculations (i.e. proportional shares) to link three independent stages in the supply chain – region of production to port of export, port of export to country of first import, and country of first import to country of final consumption after re-exports. The main weaknesses of this approach are that individual ‘supply chains’ are mapped in independent stages. These stages are linked using assumptions of mass balance export facilities are linked to production regions using a least cost transportation model.

SEI-PCS v.0 has the advantage that it can be run in any country of the world for which aggregated customs data are available and there is some information on subnational production, as well as at least a basic mapping of domestic transportation options (to calculate a cost-surface). These relatively light data requirements allow for modelling long time-series, potentially going back decades. As such its strength lies more in understanding general trends in subnational sourcing (e.g. at biome or state levels) and international trade patterns, than detailed mapping of commodity flows.

SEI-PCS v.0 is currently discontinued in favour of more data-driven approaches that are far more accurate in determining subnational sourcing patterns, although its results have been used in a number of publications on international commodity trade and land-use change (including Flach et al. 2016; Garrett et al. 2017; le Polain de Waroux et al. 2017)

SEI-PCS v.1.0 (Brazilian soy)

SEI-PCS v.1.0 predated the Trase platform and was used in the precursor of Trase, the now discontinued Transformative Transparency Platform, which was presented as a password-access version at COP 21 in Paris in December 2015.

The main change between SEI-PCS v.0 and v.1.0 is that v.1.0 uses per-shipment custom declarations and/or bills of lading that include nominal information on the exporters, importers and carriers that make up a given supply chain. However, similarly to v.0, SEI-PCS v.1.0 is still based on the stitching together of a domestic transportation cost model with per-shipment customs data where only the state of production and the port of export are known. As such the accuracy of the model in identifying municipal level origin of individual material flows was similar to v.0, with the main difference being that specific exporters and importers were associated with specific production regions with a good level of accuracy at state and biome scales.

SEI-PCS v.1.0 meant that, for the first time, it was possible to list all companies trading a given commodity, with exact volumes and destination countries for each, together with a reasonable estimate of the subnational region where the commodity was produced. Importantly, SEI-PCS v.1.0 demonstrated the untapped potential of per-shipment trade data and opened the door to additional developments to reduce the dependence on mass-balance approaches, and improve both the coverage and accuracy of individual material flows – developments that provided the basis for the first version of SEI-PCS to be used by Trase (v.2.0).

SEI-PCS v.2 (Brazilian soy – trase.earth)

SEI-PCS v.2, which currently encompasses three versions (2.0, 2.1 and 2.2), is the first version of SEI-PCS that was included in the online platform trase.earth. V.2 represents a major improvement on v.1.0 in two ways. First, v.2 uses additional information from per-shipment customs declaration and bill of lading data that identifies the municipality where tax was paid on that shipment within the country of production – avoiding the need for mass-balance approaches to stitch different steps of the supply chain together. Second, SEI-PCS v.2 takes the within-country locality of taxation as its starting point and uses multiple independent data sources to identify soy sourcing areas, eliminating completely the need to use transportation cost modelling to link export facilities to logistic hubs (e.g. silos, crushing facilities). These two advances allow for the entire supply chain from logistic hub to country of import to be data-driven, with modelling only being required to allocate logistic hubs to production municipalities.

SEI-PCS v.2.0 (Brazilian soy)

SEI-PCS v.2.0 was the first version of SEI-PCS to be used by Trase on the public transparency platform trase.earth and was the version used to map exports of Brazilian soy during the launch of Trase at COP 22 in Marrakech in November 2016. SEI-PCS v.2.0 covered all exports of Brazilian soy for 2015.

SEI-PCS v.2.0 uses per-shipment customs declaration data, linking a municipality of taxation to country of import as the backbone of the supply chain. The significance of the municipality of taxation for each shipment is determined by cross-validating against multiple independent datasets to determine whether there is evidence, within the municipality, of a soy farm, a storage facility, a crushing facility, a port terminal, a trading company's offices removed from the physical soy supply chain, or another unknown facility.

A decision tree logic is used to match per-shipment municipalities of taxation to known soy facilities. In this way, if a soy facility – say a storage silo – associated with a given trader can be independently detected (e.g. via data on the distribution of silos from the Soy Industry Association) as being in the same municipality as the municipality of taxation for a given shipment (or in a neighbouring municipality) then that municipality is associated with that shipment.

Neighbouring municipalities are detected using Voronoi polygons, the size of which varies depending on density of logistic hubs, with an upper limit of 200 km from the centroid of the taxation municipality. In other cases, the shipment is classified as being of unknown origin.

The decision tree considers different branches for soybeans, soy cake and soy oil exports, with sub-branches for the matching taxation data and per-shipment customs information (constrained by the state of origin, as registered in customs information) depending on different data sources that report the geographic location of soy supply chain logistics, including self-declared assets per trader on company websites, government and industry data on the distribution of silo and crushing facilities owned by different traders.

A number of further constraints are imposed using expert knowledge on soy logistics – typically to correct for mismatches between official state of production and municipality of taxation as registered in customs declarations, which in most cases are due to production and storage facilities being situated in neighbouring states, or the direct shipping of farmed soy to distant silos through waterways to reduce transportation costs.

The level of confidence in supply chain mapping in SEI-PCS v.2.0 varies depending on the scale of analysis. There is no uncertainty in allocating trade flows to states and biomes, and there is a high level of confidence in allocating to logistic hubs – storage silos and warehouses – depending on the type and number of independent data sources used to validate the per-shipment customs data. In v.2.0 76% of total exports of Brazilian soy in 2015 were mapped to the level of logistic hubs. Identification of production municipalities for each shipment is done by allocating soy from each logistic hub to neighbouring municipalities, within a soy-shed around the centroid of the hub municipality, in proportion to their respective levels of production.

The municipality of origin remained unknown for 24% of unresolved export volume in v.2.0 – mostly related to import-export trading companies that have limited participation in the physical supply chain, or trading companies for which we could not find enough information on the distribution of logistic facilities from official sources and their own websites.

SEI-PCS v.2.1 (Brazilian soy and Paraguayan soy)

SEI-PCS v.2.1 for Brazilian and Paraguayan soy was released at the Brazil launch of Trase at the Tropical Forest Alliance General Assembly in Brasilia in March 2017.

v.2.1 differed from v.2.0 in the inclusion of a constrained linear-programming solution that allocates soy producing municipalities (with known levels of production and supply chain logistics) to mapped logistic hubs (with known levels of demand, based on cross-validated customs data) based on a transportation cost surface. SEI-PCS v.2.1 included all soy exports from Brazil for 2015 and 2016.

The process of identifying and cross-validating trade data with independent datasets on logistics facilities is time-consuming and poses challenges in scaling up SEI-PCS v.2.0/2.1 to other commodities and countries. This is because it requires the compilation of case-specific validation data, such as self-declarations, that may be incomplete (especially for small traders, which may not report their own logistics on their website or in other documents). SEI-PCS v.2.1 was replaced on trase.earth by v.2.2 in September 2017 for Brazilian soy (though v.2.1 is still used for Paraguayan soy) which substantially overcomes this limitation by using comprehensive tax registration data that is mapped directly with customs data.

A similar approach to v.2.1 was implemented in Paraguay, with the exception that province level constraints are not reported in Paraguayan customs data. As such the importance of self-declared logistics by traders increased with respect to the soy supply chain map in Brazil. Given that the resolution of the analysis is limited to province level (due to the lack of production data at municipal levels) but that there is a high level of coverage of soy logistics per trader in the country (which has a much-reduced number of traders compared to Brazil), the analysis can be assumed to have a similarly high level of accuracy. These analyses present the first use of detailed customs data provided by the Paraguayan government, covering the years 2014-2016.

SEI-PCS v.2.2 (Brazilian soy)

SEI-PCS v.2.2 for Brazilian soy was released on 20 September 2017, encompassing all soy exports from Brazil for the years 2010-2015.

SEI-PCS v.2.2 has the same basic data-driven structure as v.2.1 but eliminates the need to validate taxation localities for each shipment against multiple independent datasets and matches trade data directly to a comprehensive database of asset-level taxation registries that includes the ownership, economic activity (e.g. soy storage, crushing), locality, and date of registration of all registered assets for a given sector in a given country. This information can be matched to per-shipment trade data using the same asset-level and dated tax registration number that appears in both datasets, automating the process of integration across all shipments.

In Brazil, the asset-level tax registration is provided by the National Registry of Legal Entities (CNPJ) number, and encompasses about 80,000 individual assets from more than 40,000 individual companies and other legal entities. This registry is complete, so there is no single record in the trade data that does not also appear in the tax data. Similar to the previous version of SEI-PCS, v.2.2 still uses the state of production as recorded in trade data to constrain the matching process between trade and tax data, in addition to expert-knowledge based rules to constrain feasible logistic routes.

The full decision tree used for SEI-PCS v.2.2 for Brazilian soy encompasses more than 120 branches – associated with different commodities (soybeans, cake, oil), matching of taxation municipality to state of production, and matching of taxation municipality to registries of different soy logistics facilities (e.g. farm, silo, warehouse, crushing facility) – in the same municipality.

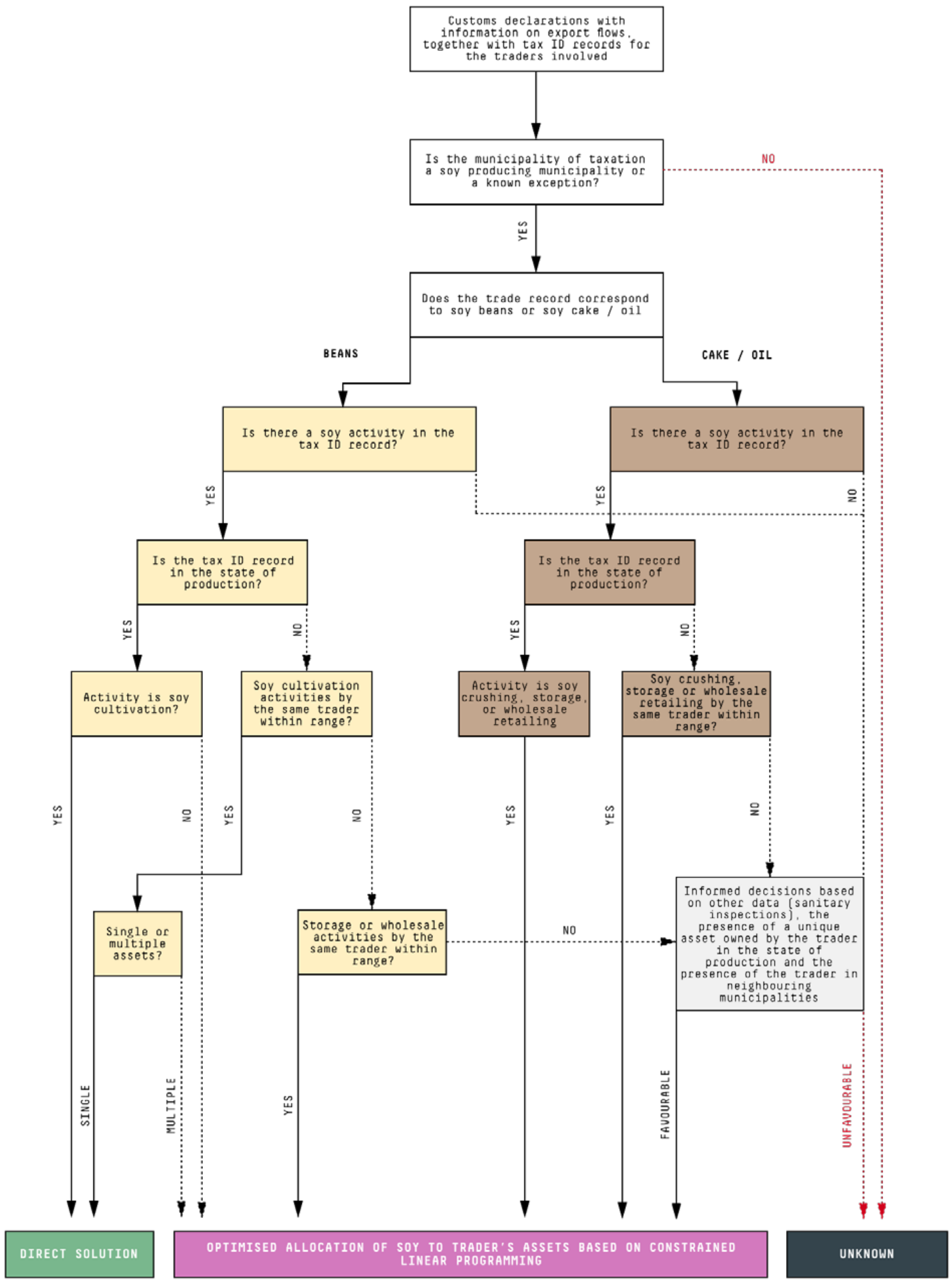
In the few cases where the tax record is not associated to a soy activity, then soy assets by the same company are looked for in the neighbouring regions of 200 km around the centroid of the municipality of taxation. If these are not found (around 8% of the total volume in 2015, for example) the sourcing of the exported shipment is declared to be unknown.

In all cases the allocation of soy between municipalities of production and logistics hubs is performed either through direct matching, when there is evidence of soy farms that are owned by the same trader, or transportation cost modelling based on linear programming optimization (following the approach used in v.2.1 linking production municipalities to silos, crushing facilities and wholesale retailing activities such as logistic hubs).

SEI-PCS v.2.2 also uses additional data on sanitary controls (stating which assets of individual trading companies are allowed to export to specific countries) to improve the identification of municipalities of production. While these datasets are still not comprehensive, forthcoming developments by the Brazilian government are expected to help Trase improve the identification of unknown sourcing pathways.

A greatly simplified version of the decision tree for SEI-PCS v.2.2 Brazilian soy is shown in Figure 1. It reveals the means by which municipalities of production are assigned to individual shipments, via either “direct matching” or “constrained linear programming”.

Simplified decision tree for SEI-PCS v.2.2 Brazilian soy



The first step in the decision tree is to check whether the municipality associated to the tax record is a soy-producing municipality, or, if not, whether it is one of a handful of known exceptions based on expert knowledge of logistics routes in the Brazilian soy supply chain.

From here, the decision tree separates trade records into those relating to soy beans and those relating to soy cake or oil, before going on to make further distinctions based on the location of the tax ID record and the particular soy-related activity with which it corresponds. Specifically, these branches consider

- whether the tax ID record is associated with a municipality in the state of production
- which of the soy-related activities the tax ID record corresponds to –with soy cultivation activities allowing a direct match to the production municipality
- whether the trading company has assets in the municipality of taxation or neighbouring municipalities
- whether there is scope to cross-reference with other complementary datasets to improve accuracy of the soy allocation to municipalities.

Given the comprehensive nature of the asset-level tax registry, SEI-PCS v.2.2 represents a major improvement in both the extent of the supply chain that can be mapped (<10% of volumes are unknown depending on year, compared to more than 20% in v.2.1 and v.2.0), as well as the level of confidence associated with individual traded shipments (as they are linked to the location of specific assets of the same trading company, instead of the localities of any asset of that company, obtained from datasets that are often not complete or comprehensive).

Unmatched (unknown) shipments in SEI-PCS v.2.2 correspond to shipments that are taxed in regions where the trading company is not related in the tax records to soy production, warehouses, processing facilities or wholesale retailing operations. The majority of such records are likely to be explained by spot-market trading given the nature of the associated companies – often import-export companies with headquarters outside the countries of export or import where the soy is purchased from another trader. However, even in these cases the state of production of the shipment is most often known from customs data.

In addition to increased coverage and accuracy the comprehensive matching of trade and tax data that is implemented by SEI-PCS v.2.2 is inherently more scalable to other commodities that have similarly short supply chains of storage and processing (e.g. maize, cotton, sugar cane).

What next for SEI-PCS and Trase

Rather than a specific method, SEI-PCS offers a novel data-driven approach to mapping global commodity supply chains that harnesses data that are typically not used for supply chain mapping. These data sources vary by commodity and country, with new data becoming available all the time, for example in response to open-government initiatives or to meet new sanitary and health standards in both domestic and international trade.

In addition to new data sources becoming available new data gathering and modelling techniques are also making it possible to access and use pre-existing data in new and more systematic ways. The Trase team will continue to explore new ways to improve supply chain mapping using the SEI-PCS approach, including through these new data sources and methods as well as new logic-based systems that combine and cross-validate independent datasets to improve both the coverage and accuracy of our work.

A priority for the next year will be extending SEI-PCS v.2.2, and new developments of it, to new commodities and regions, with an emphasis on soy and beef in Latin American, oil palm in Indonesia and coffee in Colombia, but also encompassing other commodities that can be relatively easily mapped once the method is established for a given country, such as maize, cotton and sugar.

Alongside the development of the main SEI-PCS product, linking subnational regions of production to companies and importing countries, Trase will also publish per-shipment national level export data for a wider set of countries and commodities, in addition to global coverage of bilateral trade flows for all farming commodities based on national trade statistics, providing a powerful entry point for high-level analyses of trade dynamics.

Some of the areas of research and development of SEI-PCS and related supply-chain mapping work that are planned for the coming period include:

- Improved accuracy of linking logistic hubs to production regions – at as fine a spatial scale as possible – using tax records not reported in export operations to further constrain transport optimization methods
- Improved information on the importing companies that physically handle commodities at ports and sell to downstream buyers
- Inclusion of commodity re-exports from the country of first import to other countries where the commodity is then processed or consumed
- Inclusion of embedded exports of farming commodities in animal products, such as soy in chicken and pork exports from Brazil

In the more longer term, will be working on improvements in the following areas:

- Exploring ways to extend the supply chain mapping of SEI-PCS beyond the country of final consumption to buyers (manufacturers, retailers – initially through pilot work with private-sector partners), as well as on the production side from regions of production to individual properties and concessions
- Improved mapping of material flows that are traded by commercial trading companies that do not physically handle the commodity
- Exploring ways to extend supply chain mapping of SEI-PCS to domestic buyers and markets
- Mapping of relationships and dependencies between traders and other companies (including subsidiaries, parent companies and investors)
- Improved visualizations to capture the growing complexity and richness of the SEI-PCS supply chain mapping, including the use of graph theory and 3D visualizations.

In addition to improvements in supply chain mapping a major area of research and development for Trase is the inclusion of additional environmental, social, economic and governance indicators associated with both specific production regions and supply chain companies. Inclusion of new indicators will be guided by engagement with key stakeholders, and will also include indicators of environmental and social impacts associated with downstream stages of the supply chain, including for example emissions associated with transportation and processing.

The supply chain mapping products developed by Trase for specific commodities and countries will all be made publicly available on the Trase Data Portal. These data will be used by the Trase partnership and wider research and practice community to advance understanding of the dynamics and sustainability of global commodity trade, including progress on sustainability targets and commitments and the effectiveness of government and voluntary interventions to improve supply chain sustainability. Research led by the Trase team will be published through the Trase Info Brief and Issue Brief series, as well as blogs, and research papers – all of which will contribute to an annual supply chain sustainability assessment exercise that Trase will convene starting in 2018. Please sign up for the Trase newsletter at trase.earth to follow these developments.

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