TSC’s Commodity Mapping Trade Network Model

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Version 1.0

Overview

The Sustainability Consortium’s Trade Network Model is designed to predict production regions for a given commodity based only on the country that it was purchased in. The model follows international trade flows back to countries that produce and export substantial quantities of the given commodity and takes into account broker nations that import and export a commodity but do not produce it.

Data and Methods

Beginning with the given commodity and purchase location, the first step is to evaluate if this commodity was likely to have been imported or domestically produced. If the country of purchase has substantially more domestic production than imports of the commodity of choice, it is deemed domestically produced, and the analysis is over. The purchase region is the source region. Otherwise, the model will begin to build a trade network and at least part of the production regions will be deemed external to the purchase nation.

To build the trade network, a graph structure is created utilizing trade statistics from FAOSTAT (http://www.fao.org/faostat/en/#home) with the purchase location being the first node in the graph, referred to as the root node. The primary data involved is FAO trade network data and FAO production data. For all major commodities, the FAO collects information on the exact number of metric tonnes that are imported and exported between all participating nations, as well as how much each nation produces domestically. Directed edges are added to this root node (directed to it) for each import record found for the purchase location and commodity given. Table 1 shows a sample of United States import records for pineapples while figure 1 shows the updated trade network after these import records have been added.

<table>
<thead>
<tr>
<th>Reporter Country</th>
<th>Partner Country</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>Costa Rica</td>
<td>976,603 T</td>
</tr>
<tr>
<td>USA</td>
<td>Mexico</td>
<td>85,250 T</td>
</tr>
<tr>
<td>USA</td>
<td>Honduras</td>
<td>53,790 T</td>
</tr>
</tbody>
</table>

Table 1. United States Pineapple Import Records (intentionally incomplete for simplicity)

Figure 1. Tier 1 trade network for pineapples purchased in the USA
As Figure 1 shows, the United States has 3 countries that it is sourcing pineapples from, in addition to its domestic supply. After creating the first tier of the network, each node (including the root node) is assigned a portion of the total supply. Total supply is the sum of domestic production and all imports. Given a domestic supply of 152,612 T, the total supply is:

\[ 152,612 \, T + 976,603 \, T + 82,250 \, T + 53,790 \, T = 1,268,255 \, T \]

The portion of the total supply is then calculated for each node. This portion is then further subdivided among that country’s domestic production and imports. This allows the trade network to account for ‘broker nations’ which import and re-export commodities. This is one of the most important features of this model, and what makes its approach to commodity sourcing unique.

With tier 1 established, we then assess each of the child/supplier nodes the same way we did the root: is their supply primarily domestic production, or do they import a significant portion of their supply. This process is repeated recursively until all branches in the network terminate at a nation that predominantly produces the commodity, importing little to none of it. It will often be the case that none of the tier-1 suppliers are importing anything, and the final network will resemble Figure 1. But the network can often expand to a second, and even third tier in rare cases based on production and trade between nations.

These identified production regions can then be analyzed with global or national production maps to allocate the exported production of interest to subnational regions in a producing country, giving a probable supply chain map.