GLOBAL WOOD SUPPLY

IDENTIFYING LIKELY WOOD SOURCING REGIONS THROUGH SPATIAL ANALYSIS

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I. An Information Problem

Forests provide countless services, including harboring biodiversity, helping to regulate the Earth's climate, and providing the commodity inputs for wood products.

Companies that produce wood products and other stakeholders have become increasingly aware of the threat of deforestation and numerous additional social and environmental issues associated with wood sourcing.

The global, complex nature of wood product supply chains results in a lack of traceability. The subsequent lack of supply chain knowledge can inhibit companies from understanding the risks or benefits associated with their product sourcing.

II. The Client's Approach

The client of this project, The Sustainability Consortium, is a membership organization committed to advancing product sustainability. To this end, it has developed a Commodity Mapping Program to inform stakeholders on product sourcing impacts.

Curtis, P. (2015). Illustration of TSC Commodity Mapping Program Trade Network Model.

The Commodity Mapping Program utilizes trade and procurement data to model general supply flows and supports this information with geographic risk layers on relevant impacts.

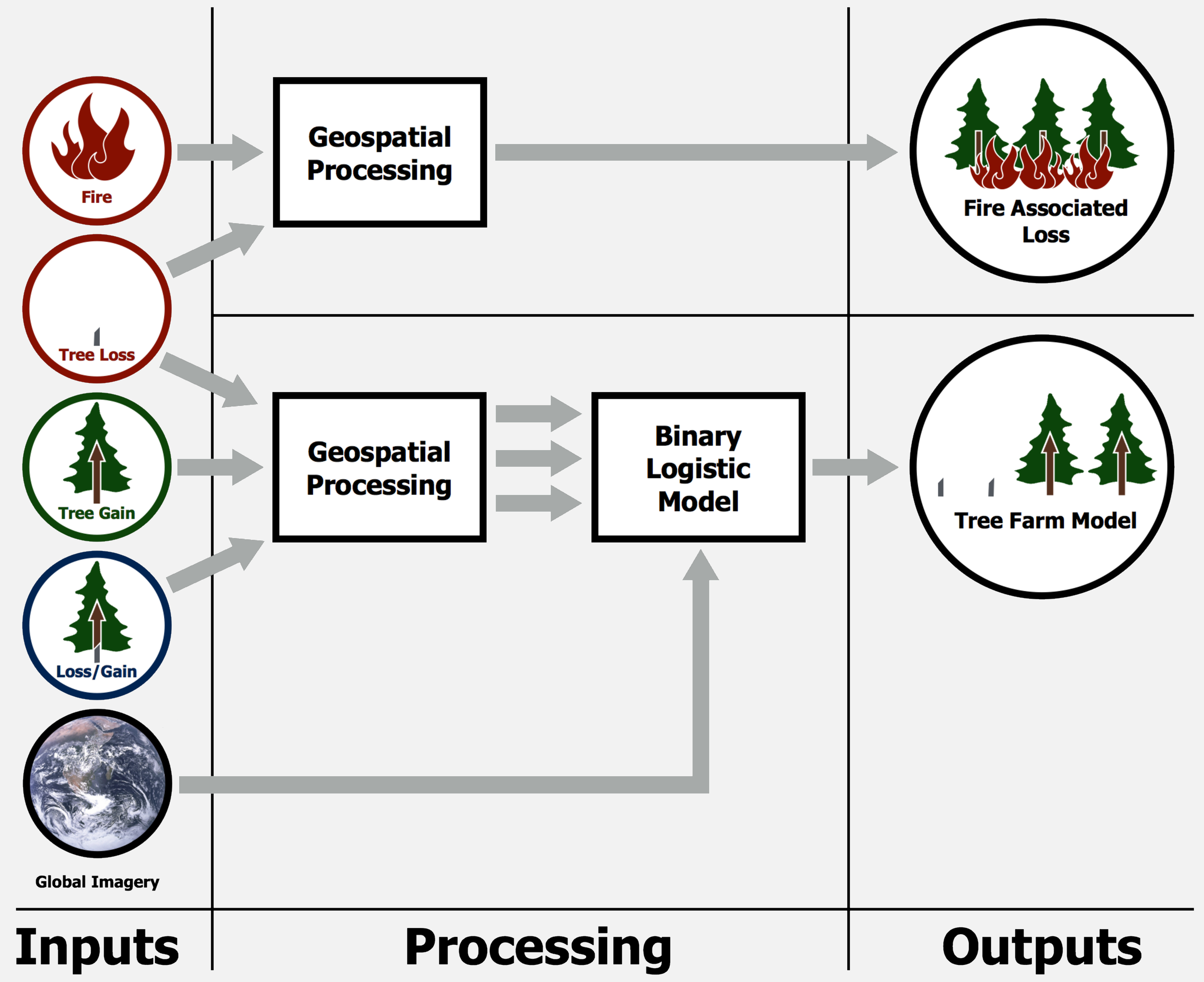
III. Project Significance

This project provides the spatial analysis needed to apply the Commodity Mapping Program to wood product supply chains.

While trade data and basic sourcing knowledge can point to the country of origin of a product's commodity inputs, this project identifies likely sourcing regions at the fine scale needed to highlight and address impacts that vary sub-nationally.

Procurement data or regional analysis might pinpoint a company's supply source, but the global scope of this project is needed to understand the benefits and risks from sourcing in a particular region relative to other regions.

IV. Methods to Characterize Global Canopy Change

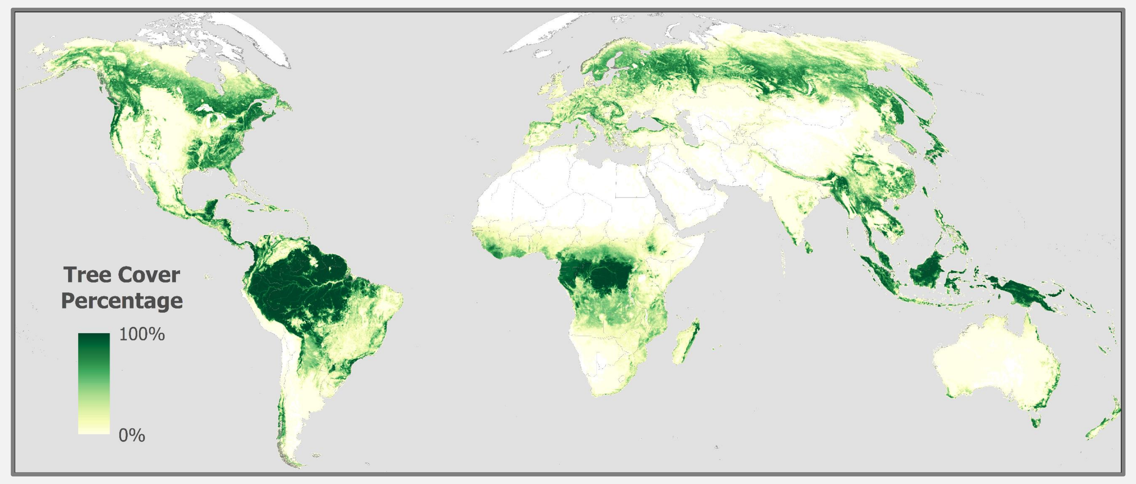


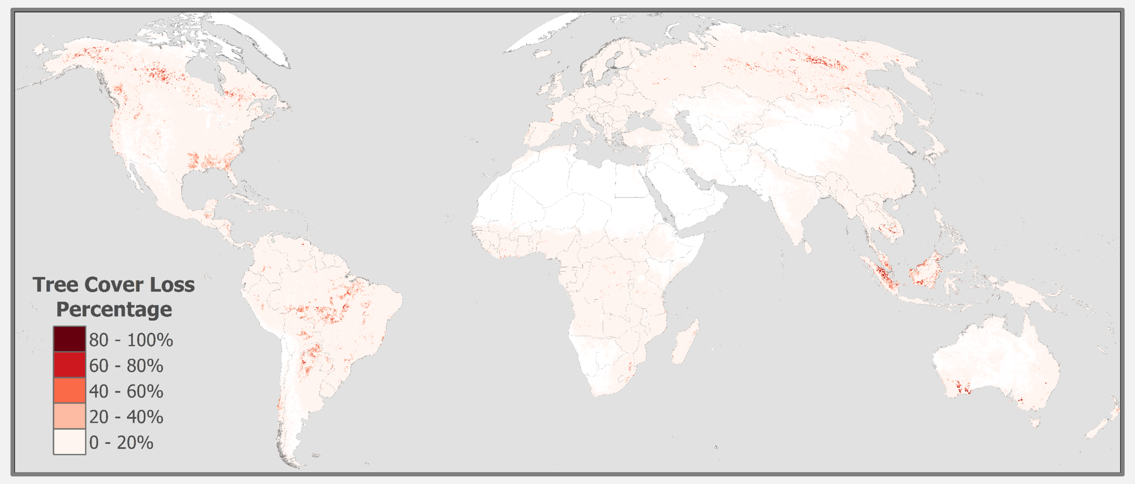
The Hansen et al. (2013) global tree cover dataset was used for both the fire and tree farm analysis. Burned area was categorized as canopy loss within one kilometer of a fire point, as was indicated by overlapping the Hansen Loss Year and MODIS Fire datasets. The tree farm analysis involved aggregating and overlaying the Hansen Loss and Gain datasets to demonstrate where areas of trees were cut and regrown at faster than natural rates. Observations of tree farms in Google Earth imagery provided the basis for a binary dataset that was used to show a significant relationship between tree cover gain and tree farm prevalence.

V. Resulting Base Maps and Analysis

Starting Point

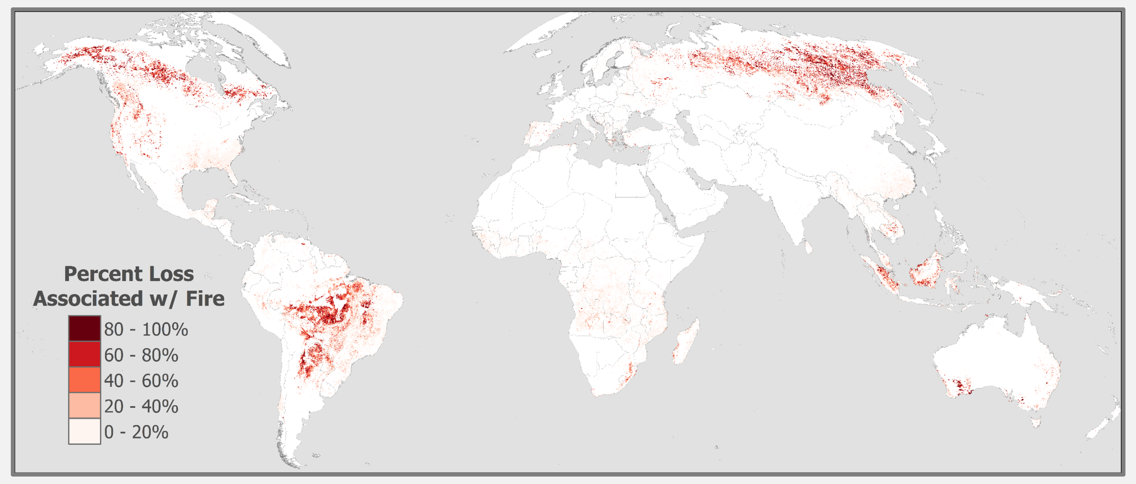
The broadest category for identifying wood sourcing regions is locations with tree cover. All areas containing tree cover are potential sourcing regions for wood products. However, in order for a tree to enter a supply chain, it must first be cut. Accordingly, examining areas of high tree cover loss provides a baseline for identifying wood sourcing regions.

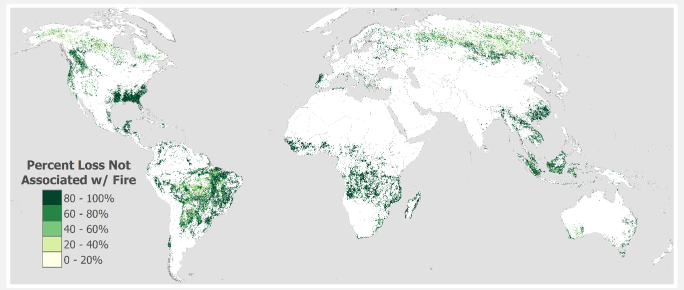




Loss Associated With Fire

Some tree loss is less likely to enter supply chains than others. Tree Loss associated with forest fire is not an intentional clearing. The wood that burns in such events is not accordingly inputted into supply chains at the same rate as other loss events.

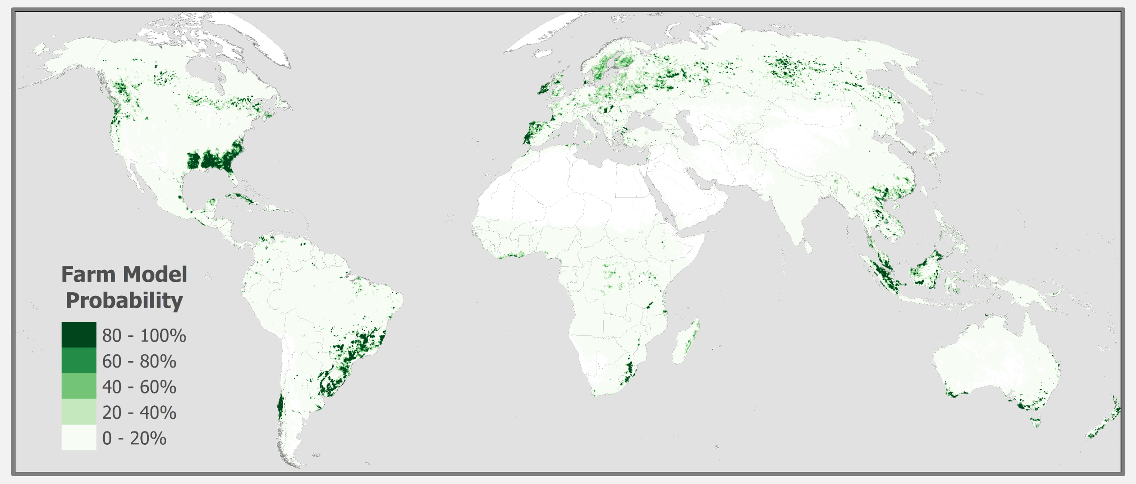




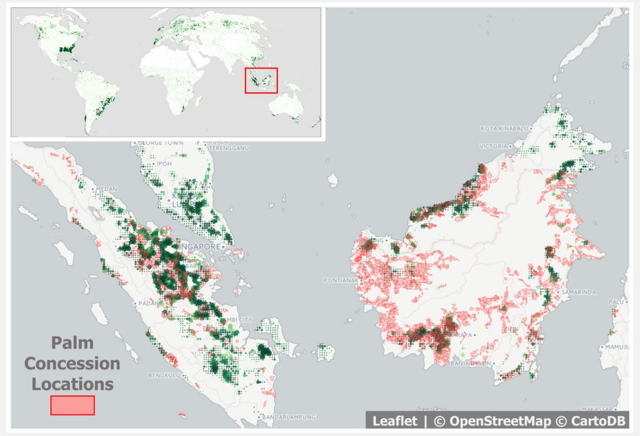
Subtracting the loss associated with fire from the total loss data removes unlikely sourcing regions. However, at this time, the intentional burning of regions shortly after harvesting wood overestimates fire loss in regions like the Amazon.

Tree Farms

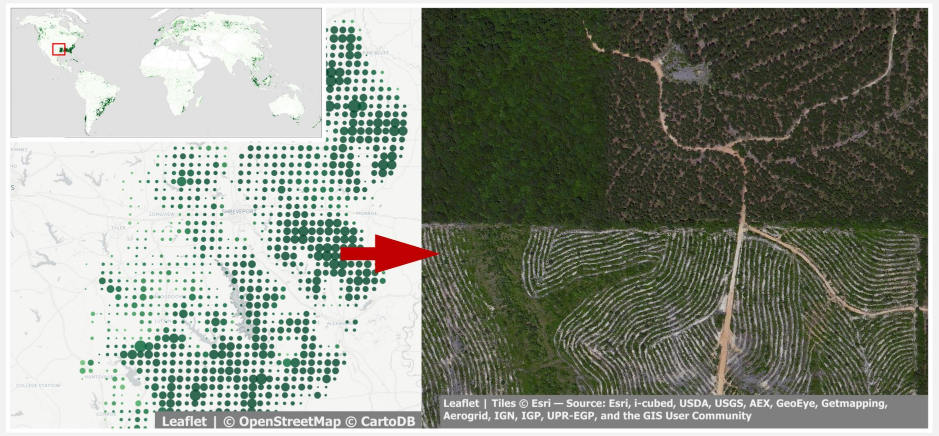
Tree loss that is associated with tree farms is very likely to enter supply chains. This wood is grown specifically for its economic and consumer benefit.



Palm plantations have similar loss and growth characteristics as tree farms. This similarity creates predictions of tree farms that must be corrected by palm concession data. (WRI GFW, 2016)

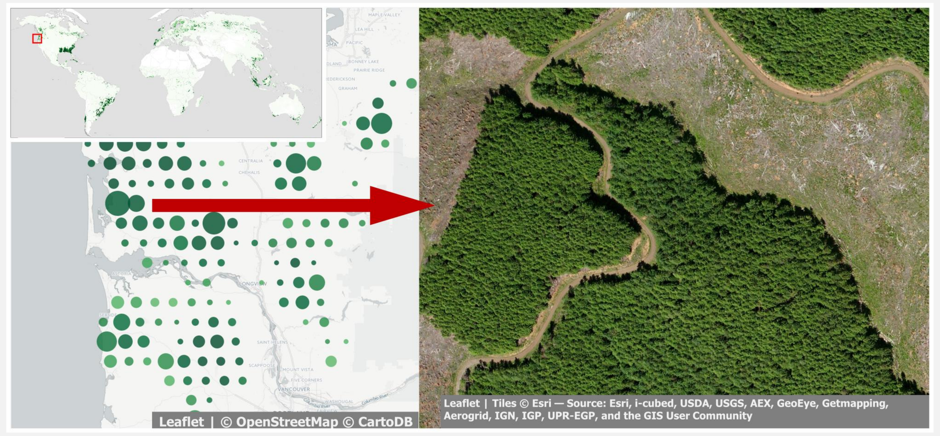


1. Southeastern United States



2. Chilean Forest

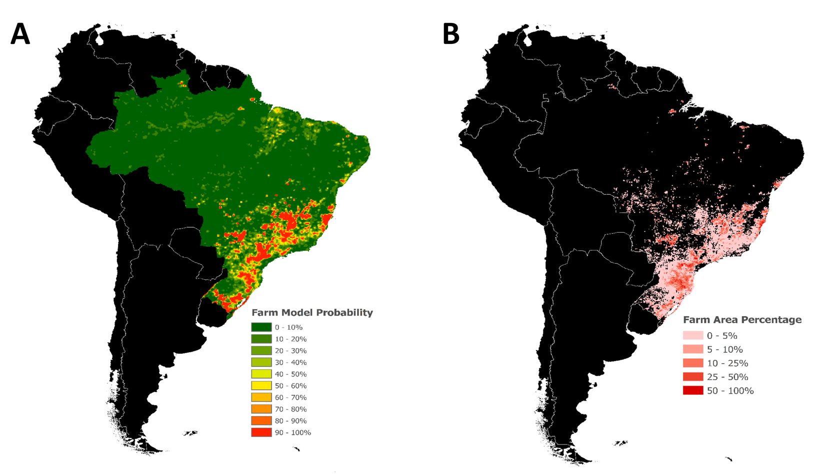
3. United States Pacific Northwest



The Southeastern United States (1) and central Chile (2) are productive wood-sourcing regions. Both show evidence of tree farming, a harvest practice that features homogenous rows of trees grown on large plantations. The Google Earth imagery inset delineates these characteristics and verifies that the model correctly predicts the presence of a tree farm. Interestingly, the tree farm model also predicts certain areas that are not traditionally considered to be plantations, such as in the Pacific Northwest (3). The knowledge that managed forests, such as those in protected areas or national parks, feature similar loss and gain cycles as tree farms could inform thinking and future research on forest management. (Grid scale: 10km x 10km; size of circle corresponds to percentage tree loss, i.e. larger circles indicate higher percentages)

VI. Comparative Analysis

WRI Global Forest Watch recently published a dataset that shows tree plantations in a select number of tropical countries (Peterson et al., 2016; WRI GFW, 2016) By focusing on several countries, this dataset retains a high level of precision and therefore serves as a solid baseline to judge the accuracy of this project's global tree farm model. A comparative analysis demonstrates a strong correlation between the two datasets, both of which effectively identify tree farms in South America.



When all areas of tree loss are included, the correlation (between tree farm probability shown in our model [A] and tree farm prevalence predicted by WRI [B]) is around 0.58. However, when only areas experiencing greater than 25% tree cover loss are included, the correlation is nearly 0.85. Overall, a comparison with an alternate dataset verifies the predictive power of our logistic model in areas with high tree cover loss.

VII. Conclusions

This project demonstrates that layering canopy cover loss and gain data can predict with consistency the likelihood of a given area of canopy cover corresponding with a tree farm. Due to the commercial nature of tree farms, the canopy changes identified and characterized using our methodology are likely to result in commercial forest products. By subtracting the likely plantation areas and forest lost to fire from total forest loss, the methodology developed in this project also reasonably predicts where wood is sourced from non-plantation sources. This analysis represents an initial step that contributes to a larger global forest product model. Ultimately, the base maps developed in this report will enable inter-regional analysis of wood product supply chains to predict the relative impacts of specific sourcing regions and products.

References

Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S.A., Tyukavina, A., ... & Townshend, J.R.G. (2013). High-Resolution Global Maps of 21st-Century Forest Cover Change. *Science, 342*, 850–53.

Peterson, R., Aksenov, D., Espipova, E., Goldman, E., Harris, N., Kuksina, N., ... & Shevade, V. (2016). Mapping Tree Plantations with Multispectral Imagery: Preliminary Results for Seven Tropical Countries. *World Resource Institute: Technical Note*.

World Resources Institute (WRI) Global Forest Watch (GFW). (2016). Oil palm concessions (select countries). *Open Data Portal*. Retrieved from http://data.globalforestwatch.org/datasets/

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