Iceberg Data Lab

Enabling Sustainable Goals

Client Guide

Deforestation

April 2025

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A. Introduction

A.1 The State of Deforestation in the World

Deforestation, the large-scale clearing of forests, continues to be one of the most pressing environmental challenges of our time. According to the Global Forest Watch, the world lost approximately 10 million hectares of forest annually between 2015 and 2020. Deforestation significantly contributes to biodiversity loss, disrupts water cycles, and accounts for around 10% of global greenhouse gas emissions. The primary drivers include agricultural expansion, logging, infrastructure development, and urbanisation.

Regions such as Latin America, sub-Saharan Africa, and Southeast Asia have experienced the highest deforestation rates. Forests in these areas are often cleared to meet the global demand for commodities such as soy, palm oil, and beef[1]. While the rate of deforestation has slowed down in certain regions, such as parts of Europe and North America, the net global forest loss remains alarming, with tropical rainforests being the most severely affected.

A.2 State of the Three Main Forests in the World

The Amazon, often referred to as the "lungs of the Earth," spans over nine countries and houses approximately 390 billion trees. Unfortunately, deforestation in this region has surged due to cattle ranching, soy farming, and illegal logging. In 2022 alone, the Amazon lost over 13,000 square kilometres of forest. The loss not only threatens the rich biodiversity but also reduces the forest's capacity to act as a carbon sink, thereby exacerbating climate change.

The Congo Basin is the second-largest tropical forest in the world, overlapping six Central African countries. It provides critical ecosystem services and is home to thousands of unique species. However, the basin faces deforestation threats from logging, agriculture, and mining. The expansion of industrial plantations and small-scale subsistence farming, the latter using slash-and-burn cultivation techniques[2], contributes significantly to forest loss. Despite these challenges, the Congo Basin retains high forest cover compared to other major forests.

Southeast Asia's tropical forests, including those in Indonesia, Malaysia, and Papua New Guinea, are biodiversity hotspots. Unfortunately, these forests have experienced rapid deforestation due to palm oil production, rubber plantations, and illegal logging. Indonesia, for instance, has been a focal point for deforestation debates, with over half of its forest cover being lost since the 1960s. Peatland destruction in this region is particularly concerning due to its high carbon storage.

[1] WRI, Deforestation linked to agriculture
[2] INRAE, France's National Research Institute for Agriculture, Food and Environment

A.3 Initiatives to Reduce Deforestation

- **REDD+ (Reducing Emissions from Deforestation and Forest Degradation)**

REDD+ is a global initiative under the United Nations Framework Convention on Climate Change (UNFCCC). It incentivises developing countries to reduce deforestation and forest degradation by providing financial rewards for measurable reductions in carbon emissions. REDD+ projects often focus on enhancing forest governance, promoting sustainable land use, and engaging local communities in conservation efforts.

- **The EU Deforestation-Free Products Regulation**

In 2023, the European Union introduced a law aimed at curbing deforestation linked to imported products. Companies must prove that commodities such as soy, palm oil, cocoa, and beef sold in the EU are not sourced from deforested lands. This regulation sets a precedent for supply chain accountability and could significantly reduce global deforestation if implemented effectively.

- **Other relevant schemes**

Forest Stewardship Council (FSC): This certification ensures that forest products come from responsibly managed forests.

Global Forest Finance Pledge: Several countries pledged over $19 billion at COP26 to combat deforestation.

Indigenous Rights Advocacy: Empowering Indigenous communities has proven effective in protecting forests, as these groups often have a vested interest in sustainable land use.

A.4 The Seven Main Deforestation Commodities

- **Cocoa**

The global cocoa industry is a significant driver of deforestation, particularly in West Africa. Ghana and Côte d'Ivoire, the two largest cocoa producers, have lost extensive forest cover due to cocoa farming. Initiatives like the Cocoa & Forests Initiative aim to promote sustainable cocoa production.

- **Coffee**

Coffee cultivation, especially in Latin America, contributes to deforestation as farmers clear land to expand plantations. Shade-grown coffee is promoted as a sustainable alternative that maintains forest cover.

- **Timber**

Illegal logging and unsustainable timber harvesting deplete forests worldwide. Certified timber programs like FSC and PEFC aim to ensure sustainable practices in the timber industry.

- **Meat**

Cattle ranching is the leading cause of deforestation in the Amazon. The demand for beef drives land conversion on a massive scale, with pastures replacing forested areas. Initiatives to reduce meat consumption and promote alternative proteins are gaining traction.

- **Rubber**

Rubber plantations in Southeast Asia contribute to significant forest loss. Sustainable rubber initiatives, such as the Global Platform for Sustainable Natural Rubber, encourage responsible production practices.

- **Soy**

Soy production, particularly in Brazil and Argentina, leads to deforestation to create farmland. Much of this soy is used for animal feed, linking it indirectly to meat production.

- **Palm Oil**

Palm oil cultivation in Southeast Asia has led to widespread deforestation, peatland destruction, and biodiversity loss. Certification schemes like RSPO (Roundtable on Sustainable Palm Oil) aim to mitigate these impacts by promoting sustainable production.

By addressing these commodities and implementing robust policies and consumer awareness campaigns, the global community can make significant strides in combating deforestation. A collective effort is essential to protect the world's forests and their invaluable ecological, cultural, and economic contributions.

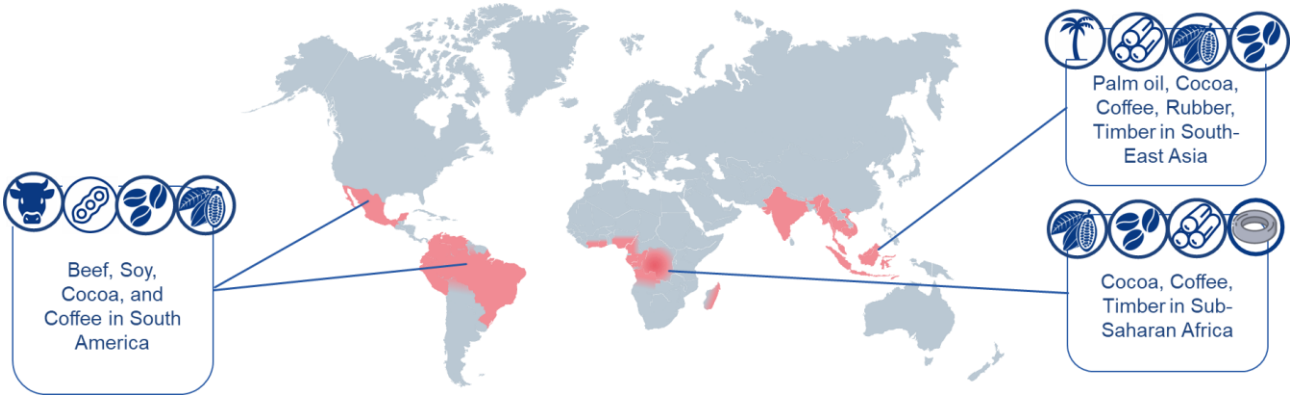


Figure 1: Overall approach of the IDL model

A.5 Challenges in Tracking Deforestation Efficiently

Tracking deforestation proves to be extremely difficult both locally and globally.

- **Inconsistent Data Collection**
  Deforestation tracking relies on satellite imagery, field surveys, and government reports. However, inconsistencies in data collection methodologies across regions and countries lead to fragmented and unreliable information.
- **Temporal and Spatial Resolution Limitations**
  Remote sensing technologies like satellites often have limitations in detecting small-scale deforestation or differentiating between natural forest loss and plantation activities. Seasonal changes and cloud cover further complicate accurate assessments.
- **Lack of Transparency and Governance**
  In regions with weak governance, illegal logging and land-use changes often go unreported.

Corruption and limited enforcement capacity exacerbate this issue, making it challenging to track deforestation effectively.

- **Dynamic and Complex Drivers**
  Deforestation is driven by a combination of agricultural expansion, infrastructure development, and market dynamics. Understanding and tracking these interconnected factors in real-time is difficult.
- **Technological and Financial Barriers**
  High-resolution monitoring systems and comprehensive tracking tools require significant investment. Developing nations, where deforestation rates are often highest, may lack the financial resources and technical expertise to deploy such systems effectively.

A.6 Importance of Modelling Deforestation Through the Value Chain

Modelling deforestation through the value chain helps stakeholders understand the root causes and impact pathways of forest loss. This approach is essential for developing effective mitigation strategies because it identifies and addresses deforestation drivers at every stage of production and consumption.

A.7 Why Use LCA (Life Cycle Assessment) Models?

- **Holistic Environmental Impact Analysis**
  LCA models assess the environmental impact of products from raw material extraction to end-of-life disposal. This comprehensive approach highlights the deforestation footprint of commodities across their value chain.
- **Quantifying Supply Chain Emissions**
  Deforestation contributes to carbon emissions, and LCA models help quantify these emissions at various stages of the supply chain. For example, they can measure the impact of soy production for animal feed or palm oil cultivation for consumer goods.
- **Identifying Leverage Points**
  By mapping deforestation drivers, LCA models reveal critical intervention points where sustainable practices or policies can have the greatest impact. For instance, adopting sustainable sourcing practices or improving land-use planning.
- **Encouraging Corporate Accountability**
  Companies can use LCA-based modelling to assess their supply chains and ensure compliance with sustainability standards, such as the EU Deforestation-Free Products Regulation or FSC certifications.
- **Informing Policy and Consumer Choices**
  Policymakers and consumers can use insights from LCA models to implement targeted regulations and make informed purchasing decisions, respectively.

Iceberg Data Lab has developed a comprehensive model designed to track the deforestation impact at a commodity level across its entire value chain, encompassing scope 1, scope 2, and scope 3 emissions. This model leverages advanced data integration and analytical techniques to assess direct impacts (Scope 1), such as land-use changes, indirect impacts (Scope 2), including energy consumption in production, and upstream and downstream impacts (Scope 3), such as supply chain activities and product use. By offering a granular view of deforestation drivers and

emissions across all stages, the model provides actionable insights for businesses, policymakers, and stakeholders to implement effective mitigation strategies and ensure sustainability compliance.

B. Methodology

B.1 Global Methodology

The deforestation model is developed as a sub-category of the environmental pressure within the IDL Corporate Biodiversity Footprint (CBF). Specifically, it is classified under the broader category of Land Use Transformation.

For further details, please refer to the Core Methodology Client Guide, which explains the construction of Iceberg Data Lab's core model and the methodology for calculating physical flows based on financial data.

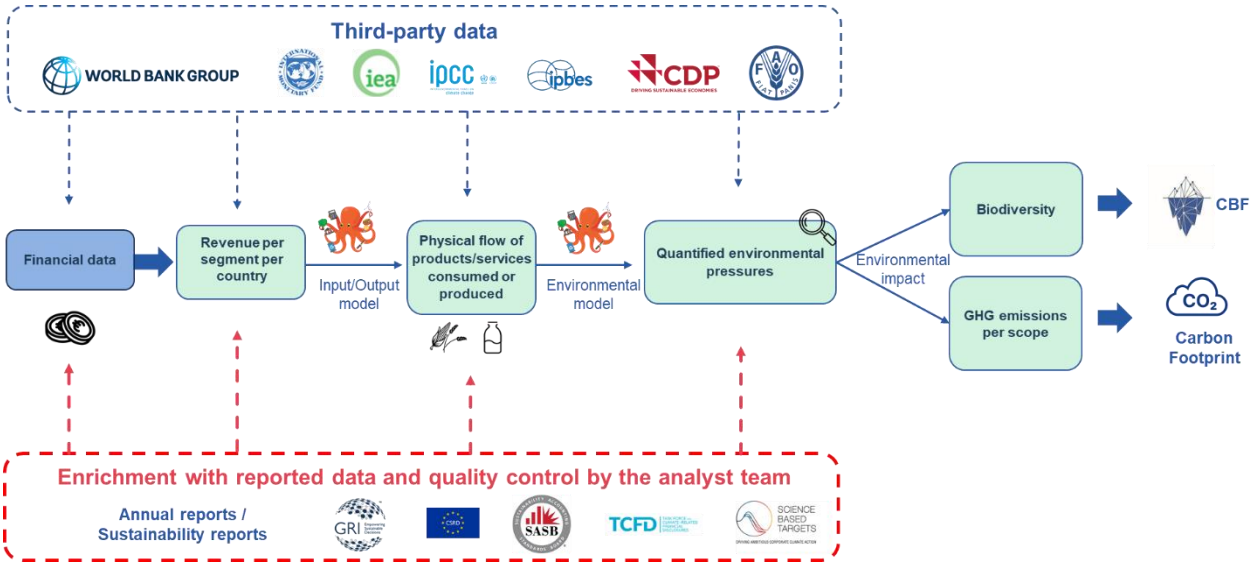
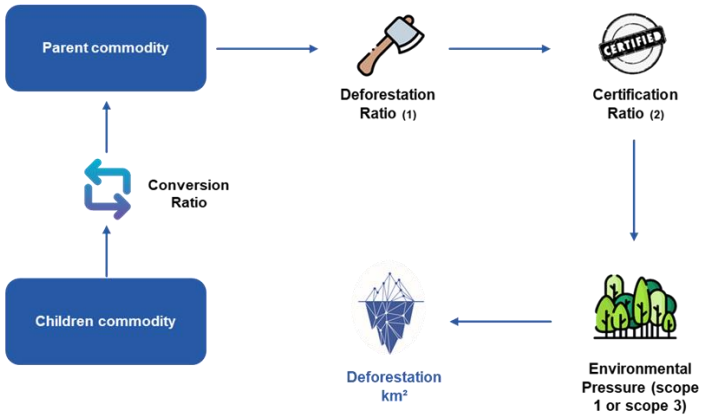


Figure 2: Overall approach of the IDL model

B.2 Deforestation methodology: overall approach

Figure 3 below summarises the overview of the methodology of the deforestation product:

- **Step 1:** Commodity quantity is determined using IDL input/output model.
- **Step 2**: After determining the commodity quantity, a series of ratios are applied to calculate the deforestation impact. These include the certification rate, deforestation ratio, conversion ratio (when applicable), and land-use pressure. Land-use pressure is categorised as scope 1 when deforestation results directly from operations, or scope 3 (upstream) when deforestation is caused by suppliers.
    - The deforestation impact is given in km^2.



(1) Source from: WEF, IUCN NL, WRI, FAO, UNDP, Global Forest Watch, Global Forest Coalition, Forest Trends, Reforest Action, CIFOR-ICRAF…
(2) Source from certificates registry or annual reports

Figure 3: Overall approach of the deforestation model

B.3 Deforestation methodology: detailed description

B.3.1 Deforestation commodities, producing countries and workflow

Companies contribute to deforestation either directly, by producing primary commodities (e.g., timber, meat, cocoa beans, soybeans and others), or indirectly, by using processed agricultural products (e.g., chocolate, cocoa powder, processed coffee). To account for these scenarios, 22 commodities are categorised into two groups: parent commodities and children commodities. The deforestation methodology will vary slightly between these groups, as detailed later.

The commodities taken into consideration are the following:

Parent commodity	Children commodity
Green coffee	• Processed coffee • Coffee beverage
Cocoa beans	• Cocoa powder • Chocolate
Soybeans	• Oil soybean
Palm oil fruit	• Oil palm • Palm kernels
Timber	• Wood panels • Wood chips • Wood material • Wood furniture • Chemical pulp • Mechanical pulp • Wood material for treatment • Wood and products of wood and cork articles of straw and plaiting materials (20)
Cattle, meat	• Products of meat
Natural rubber	• None

Table 1: Overall approach of the IDL model

Deforestation is calculated at the level of countries with a high rate of deforestation due to intensive crop and livestock farming. It includes Brazil, Colombia, Ethiopia, Honduras, India, Mexico, Thailand, Cameroon, Ivory Coast, Dem. Rep. of Congo, Malaysia, Ecuador, Ghana, Guinea, Nigeria, Indonesia, Madagascar, Vietnam, Peru, Argentina, Bolivia & Paraguay.

B.3.2 Deforestation ratio

Section 1: Parent commodities

This section aims to determine the annual deforestation rate associated with each commodity. It is important to note that this rate applies to primary commodities—those that directly cause deforestation (e.g., coffee beans rather than processed coffee).

Quantifying this data poses significant challenges, as it is not readily accessible and remains difficult to track, even with satellite data solutions. To derive the most accurate estimates, data from multiple sources are cross-referenced. These sources include, but are not limited to:

- Agriculture ministries of the producing countries
- International and regional organizations: WEF, WRI, UNDP, FAO, IUCN…

For instance, coffee is participating up to 4% in global deforestation in Brazil, Soybean 20%, Cattle 60% and so on.

The computation within IDL model is based on the following formula.

Let:

- $\mathbf{C_i}$ be the set of the 22 countries, indexed by **i** (where **i** = 1, 2, …, 22);

- $\mathbf{P_j}$ be the set of the 7 commodities, indexed by **j** (where **j** = 1, 2, …, 7);
- $\mathbf{DR_{i,j}}$ represent the deforestation ratio for country $\mathbf{C_i}$ and commodity $\mathbf{P_j}$.

We can then define $\mathbf{Dr_{i,j}}$ as:

$$DR_{i,j} = f\ (C_i\ , P_j)$$

where $\mathbf{DR_{i,j}}$ is the observed deforestation ratio for each country $\mathbf{C_i}$ due to commodity $\mathbf{P_j}$.

Section 2: Children commodities

As for the children commodities, the deforestation ratio proxy used is the same deforestation rate as its parent commodity and then follows the same formula.

B.3.3 Conversion ratio for children commodities

For children commodities, the methodology involves applying a conversion rate to link them to their corresponding parent commodity, thereby standardizing the calculation process. Conversion data are derived by cross-referencing various industrial and institutional sources.

The computation within IDL model is based on the following formula.

Let:

- $\mathbf{C_i}$ be the set of the 9 commodities, indexed by **i** (where **i** = 1, 2, …, 9);
- $\mathbf{CVR_i}$ represents the conversion rate for commodity $\mathbf{C_i}$.

We can then define $\mathbf{CVR_i}$ as:

$$CVR_i = f\ (C_i)$$

where $\mathbf{CVR_i}$ is the observed conversion rate for item $\mathbf{C_i}$.

B.3.4 Certification ratio

Certification is an important lever in the fight against deforestation. However, the profusion of these schemes makes it difficult to understand and identify which are sufficiently robust. A certificate will be deemed satisfactory if it meets four key criteria:

- **External audit**: An external audit is an independent evaluation conducted by a third-party organization to verify the accuracy, transparency, and integrity of the carbon certification process. It ensures that the carbon reductions claimed by a project are real, measurable, and meet established standards, lending credibility and trustworthiness to the certification.

- **Complaint mechanism**: A complaint mechanism is a formal process allowing stakeholders, such as affected communities or environmental organizations, to raise concerns or objections regarding a certified project. This mechanism ensures

accountability and offers a pathway for addressing grievances, fostering transparency and responsiveness within the certification framework.

- **Global coverage**: Global coverage refers to the certification's applicability and recognition across various countries and regions. A certification program with global coverage ensures that it meets internationally accepted standards, allowing for consistent evaluation of carbon reduction projects worldwide and facilitating participation from diverse locations.

- **Selection process**: The selection process outlines the criteria and procedures used to determine which projects or organizations qualify for certification. This includes requirements for project eligibility, baseline carbon measurements, and specific reduction methods. A clear selection process ensures that only projects meeting rigorous standards receive certification, maintaining the program's quality and credibility.

In addition to the certification schemes, there are initiatives that operate like a certification but only require you to join their program, or to take their pledge. These schemes will also be considered for some commodities.

Finally, only meat convenience will not be considered for certification at this stage, given the operational difficulties involved. Indeed, meat certification is country-specific and requires specific monitoring to ensure its robustness.

Each certificate will therefore have a percentage allocated:

- **Full deforestation potential**: certificate meeting all criteria will have 100% meaning that its fully preventing any new deforestation impact;

- **Partial deforestation potential**: certificate meeting partial criteria will have 50% meaning that it is preventing only half of the deforestation impact;

- **No deforestation potential**: certificate not meeting any criteria will have 0%, meaning that it is not preventing deforestation to occur.

Let:

- **N** be the total number of criteria (in this case, N = 4);

- **x** the number of criteria met by the certificate
- **DP** the deforestation prevention

$$DP(x) = \{100\% \; if \; x = 4 \; then \; 50\%, \qquad if \; 1 \leq x \leq 3 \; then \; 0\%, \qquad if \; x = 0 \; then \; 0\}$$

Certification list is present in **Annex 1** that presents each certification scheme and the source.

Final computation

Using these ratios, the deforestation impact can be calculated for both parent and children commodities.

Parent commodities

For parent commodities, the formula is as follows for scope 1 (if deforestation is generated directly by the company operations):

$$Deforestation\ impact = commodity\ quantity * certificate\ ratios * deforestation\ ratio * commodity\ direction = production * scope\ 1\ land\ use\ pressure$$

For scope 3 (if deforestation is generated by the suppliers):

$$Deforestation\ impact = commodity\ quantity * certificate\ ratios * deforestation\ ratio * commodity\ direction = consumption * scope\ 3\ land\ use\ pressure$$

Note: By "direction," it refers to whether the commodity is consumed or produced, which enables the IDL model to apply the appropriate land use pressures under either Scope 1 or Scope 3.

Children commodities

For children commodities, the formula is as it follows:

$$Deforestation\ impact = commodity\ quantity * certificate\ ratio * deforestation\ ratio * commodity\ direction * conversion\ ratio$$

Note: For children commodities in this section, the deforestation impact is attributed to Scope 3, as these commodities are consumed rather than produced, making the direction "consumption." Additionally, it is assumed that if a children commodity appears in production, the corresponding parent commodity will be present in consumption.

B.3.5 Deforestation aggregation and double accounting

Once deforestation impacts are computed on a commodity level, the IDL model aggregates it at a sector level, then at an entity level and finally at a portfolio level as described in “Core Methodology Guide”.

Once the computation is complete, a recalibration for double counting is carried out, as outlined in the "Core Methodology."

B.3.6 Data quality & limitations

Data inaccuracy is mainly due to the multiplication of data sources, which are not consistent with each other.

Deforestation results are also challenged by the FAO allowing to check if the global signal is coherent.

C. Glossary

FAO - Food Agriculture Organization: is a specialised agency of the United Nations that leads international efforts to defeat hunger and improve nutrition and food security.

FSC - Forest Stewardship Council : s an international non-profit, multistakeholder organization established in 1993 that promotes responsible management of the world's forests via timber certification.

Global Forest Watch: is an open-source web application to monitor global forests in near real-time. GFW is an initiative of the World Resources Institute (WRI), with partners including Google, USAID, the University of Maryland (UMD), Esri, Vizzuality and many other academic, non-profit, public, and private organizations

LCA - Life Cycle Assessment: s a methodology for assessing environmental impacts associated with all the stages of the life cycle of a commercial product, process, or service.

RSPO - Roundtable on Sustainable Palm Oil: was established in 2004 with the objective of promoting the growth and use of sustainable palm oil products through global standards and multistakeholder governance.

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D. ANNEX – Certification assessment

Certification	External Audit	Compliant Mechanism	Global Coverage	Selection Process
Rainforest Alliance	x	x	x	x
Fairtrade	x	x	x	x
Common Code for the Coffee	x	x	x	x
Fair for Life	x	x	x	x
Roud Table of Responsible Soy	x	x	x	x
Proterra Standard	x	x	x	x
Round Table on Sustainable Palm Oil	x	x	x	x
Forest Stewardship Council	x	x	x	x
Fair Rubber	x	x	x	x
Programme for the Endorsement of Forest Certification	x	x	x	x
Sustainable Biomass Program	x	x	x	x

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