Greenhouse Gas Accounting Efforts Undermined by Disparate Tools and Frameworks

Scope 3 emissions, which include emissions upstream and downstream from a given company within its supply chain, represent a considerable challenge, and discussion about how to both account for and mitigate these emissions is a hot topic amongst companies taking climate action. For many companies, these Scope 3 emissions, which lie outside the company's direct control, represent the majority of their climate impact and mitigation potential. While rigorous organization-level greenhouse gas (GHG) accounting using the GHG Protocol Corporate Standard has enabled companies to identify emissions hotspots and track corporate progress in reductions over time, **variability in product-level GHG accounting standards and methodologies can prevent companies from understanding both their true emissions and their progress in reducing them.[1] Greater harmonization in product-level accounting could accelerate progress and enable better cross-organizational comparison.**

While these issues are present across many sectors, they are magnified in agriculture, where 70% of emissions from cradle to grave occur on farms. Yet, these emissions are often poorly understood due to considerable regional differences and variability based on production systems and practices. Nevertheless, it is urgent for companies to both understand and reduce emissions in their supply chains, as this is where most of the impact and mitigation potential lies. Indeed, many companies are making commitments to reduce emissions aligned with the Science Based Targets Initiative, and even more companies are beginning to consider climate risk due to increased scrutiny from investors.

Limiting future warming to 1.5° Celsius by the end of the century requires an absolute emissions reduction of over 75% from the food system by 2050 while producing more food for a growing population.[2] Few companies are on track to reduce emissions absolutely, not just per unit of production. Because most of these emissions come through purchased products, whether feed or raw ingredients, accurate accounting for agricultural products is a critical tool to strategically address and monitor GHG mitigation.

For companies producing, processing, or investing in food products, the challenge of comparing agricultural products sourced from hundreds of companies and tens of thousands of farms is daunting. Because most food emissions come from farms, companies need to collect data and calculate impact far upstream from buyers. Currently, companies are collecting a patchwork of data from their supply chains to estimate emissions — a mix of information on supplier practices and supplier-calculated GHG footprints. When companies estimate or aggregate emissions from suppliers using different methods, the results are apples and oranges. Comparing emissions measured with or cobbled together with different "yardsticks" does not yield decision-relevant insights or monitoring for impact, because measurement differences mask real performance differences. Coming together to address these challenges is critical given the urgency of the climate crisis — especially given the impact of food production and the global food system.

GHG accounting is a cornerstone of climate mitigation, as it is critical for setting corporate baselines, identifying hotspots to target mitigation measures, and monitoring progress against emissions reduction targets over time. These results show up in international climate conferences, in corporate social responsibility and sustainability reports, and even in investment decisions and international trade agreements.

However, the current landscape of product-focused GHG accounting standards doesn't meet the needs of global supply chains. Currently, there are many different, overlapping GHG accounting standards.

Organization-focused GHG accounting methodologies were designed so that "users of GHG information [can]… compare GHG emissions information over time in order to identify trends and to assess the performance of the reporting company."[3] These standards offer flexibility around accounting steps so that companies can choose methods that match their organizational structure and needs. Using these organizational standards, companies can effectively track progress over time and report publicly through platforms like CDP.[4]

Product standards often tighten and simplify accounting rules because they are designed to compare GHG footprints for a product across different producers. This is especially true for product standards created for a specific product where the methodologies are tailored to that

What is a GHG accounting standard?

A GHG accounting standard is a set of rules that governs what, when, and how GHG footprints are calculated. Standards typically specify which emissions sources need to be included, what data are required for calculations, and what types of calculations can be made.

Corporate-focused GHG accounting standards fall into two main categories: organization- and product-focused.

Organizational GHG accounting focuses on all the activities conducted by a business. The GHG Protocol Corporate Standard is the leading standard to ensure that companies are accurately comparing their corporate emissions over time.

Product (or service) GHG accounting instead focuses on a particular product, which is often only one of many products from a particular company (e.g., Product Environmental Footprint rules; Environmental Product Declaration rules). Product category rules (PCRs) are used to delineate rules for particular types of products.

For the purposes of this paper, we will refer to organizational or product GHG accounting in accordance with the above distinction. The focus of this brief is on product standards.

product. When standards are overly flexible, companies following the same standard may make different methodological choices that make results incomparable. Inflexible product-specific standards fix this issue only if companies all use the same standard — and there are many competing choices. For example, there are more than three different aquaculture standards[5] and the rules set by these standards vary widely.

If standards are meant to be used in silos by companies tracking only their own emissions, then flexible and varied standards may be fine, but because companies source products from multiple producers and then sell to multiple buyers, using different GHG accounting methods to characterize these products creates problems. For products from their suppliers or competitors, companies cannot distinguish real differences from artificial accounting differences.

Product-level GHG accounting is no longer used by a few disruptor companies. Now it is being used to differentiate across suppliers and potential investments, to compare progress against global and regional benchmarks, to share lessons on mitigation, and even to rank companies' products against each other according to their reported performance. The lack of standardization makes it difficult for investors or buyers to compare footprints and progress against emissions targets between companies that use different standards for the same products. Furthermore, when accounting rules are not specified or standardized across companies, accounting methodology can be manipulated to enable greenwashing, where companies cherry pick calculations that offer a misleading picture of their emissions.

We know from financial accounting what consistent, harmonized accounting looks like. Each country has its own generally accepted accounting principles (GAAP) to enable consistency and comparison of results across companies. Many companies and countries are moving toward the International Financial Reporting Standard (IFRS), which is often more stringent than local regulations, to enable financial comparisons across the globe. Without a common set of rules, it would be impossible to judge and/or compare companies' outputs. This is just as true for GHG accounting as it is for financial accounting.

So, how far from harmonized are we? Accounting methodologies differ in a few key ways.

- **System boundaries** define what is included or excluded from the accounting system. A standard that includes more sources of emissions, all else being equal, will have higher emissions; standards that allow sequestration or offsetting may have drastically lower emissions. What is included may sometimes be set by an exclusion threshold[6] or by specific categories. Prior to the release of the Science Based Targets FLAG guidance, for example, exclusion or inclusion of land-use change emissions for raw ingredients was often a contentious decision that resulted in very different footprints. An example of differences in system boundaries across a few product standards is shown in Appendix 1.

- **Allocation** across products or processes occurs when there is a 'multi-functional process'. This means that the same process that generated emissions contributed to multiple products where the emissions for each individual product cannot be easily separated. For example, cattle emissions need to be split between milk, meat, and leather. Transport emissions need to be split across different cargo. There are many allocation options with mass, volume, energy, and economic allocation as the most common. Allocation choices should reflect how product decisions are made; for example, freight allocations are typically based on mass, while storage allocations are typically based on volume. Food products are often allocated by economic value, energy content (for feed), or mass. The difference between allocation methods can be large, especially when some products are more valuable than others. An example of some differences in allocation for feed ingredients is shown in Table 1 (page #5).

  The implications of actors in a supply-chain using differing allocation methods can be serious. Our analyses suggest that significant GHG emissions end up unaccounted for downstream.

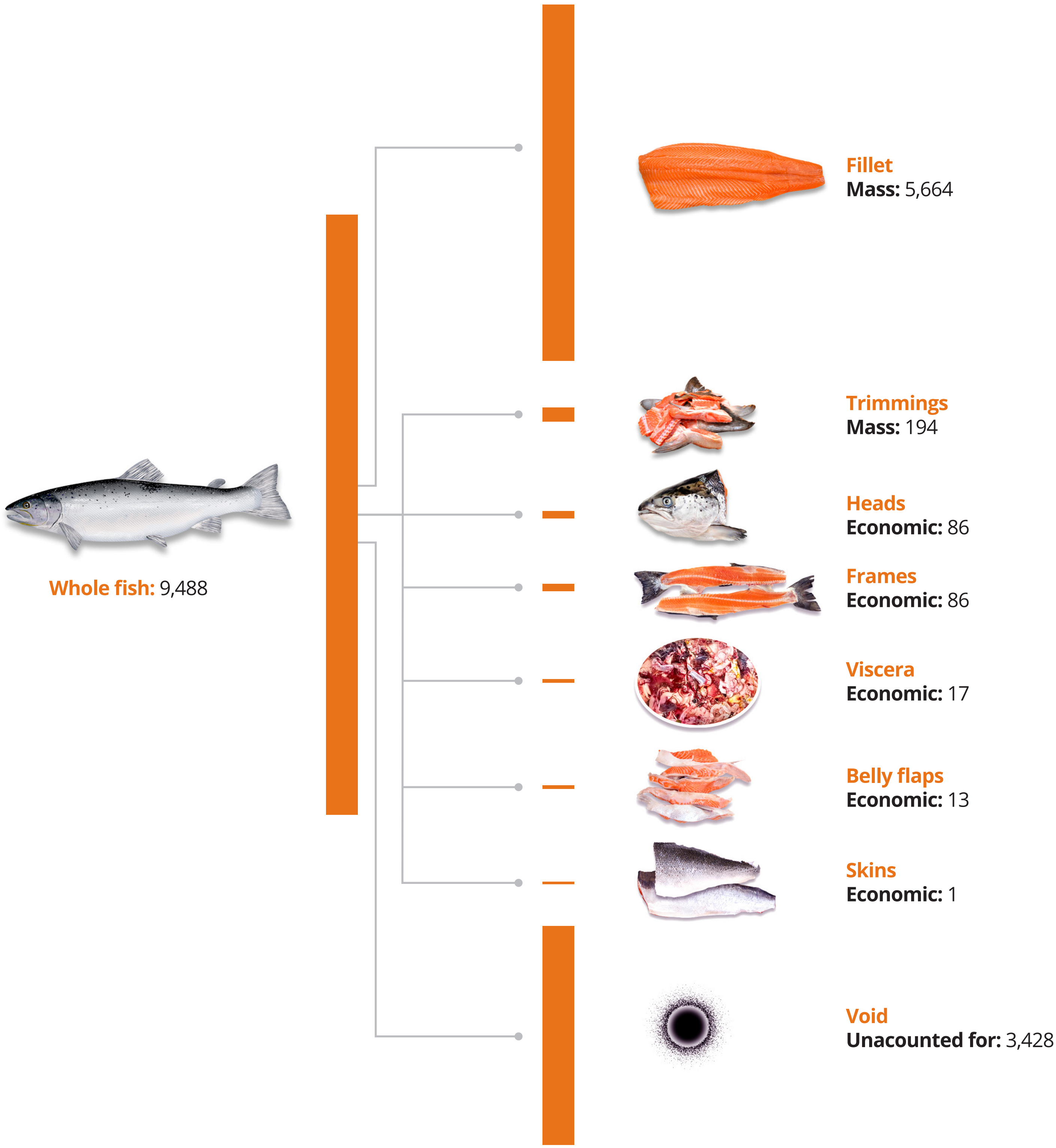


Figure 1: Total emissions for aquaculture salmon (2.4 million tons at 3.9 $kgCO_2e/kg$ live weight) allocated to co-products. For co-products, the allocation method that gives the lowest footprint is assumed and noted (e.g., mass for fillet). Numbers in thousand tons CO_2e.

Credit: Xenia Zhao

In the example shown in Figure 1 (above), over 1/3 of the total emissions from salmon production are not passed downstream when each actor uses the allocation method that gives them the lowest footprint.

Table 1: Examples of GHG footprint differences by allocation method

$kgCO_2e$/kg product	Footprint with economic value	Footprint with mass
Bovine meal (animal feed)	0.7	8.6
Maize gluten meal	1.4	1.1
Palm kernel expeller	1.4	7.0
Soybean hulls	1.3	3.4

Data source: GFLI emissions factor database

- **Data requirements:** Product accounting standards also differ in what data are used for calculations. These data fall into two categories: primary and secondary. Primary data are specific to one's operations and may include sourcing data, the amount of electricity used in a plant, etc. Secondary data include average or default data (e.g., avg. distance to port) as well as the emissions factors that translate activities like electricity usage into GHG emissions. Standards often differ in which data must be primary and which secondary data is allowed to be used.

For agricultural products, impacts for the same product produced in different ways can vary 10- to 100-fold, so the differences across individual supply chains are rarely similar to the default data. For example, Table 2 (below) shows how deforestation alone can multiply typical on-farm emissions tenfold.

Variability in other practices like fertilizer application, burning crop residues on fields, and manure management can also create huge differences. Even for farms using similar production practices in close proximity, emissions rates per product unit vary 2-5 times.

Some companies and multi-stakeholder platforms have begun to develop and use GHG calculators to lessen the challenge of measuring GHG emissions. Such calculators have the potential to ease the burden of understanding the boundaries, allocation, and methodological challenges by standardizing what primary data is collected and what secondary data is used to perform the calculations. However, emissions differences due to accounting practices are still reflected across GHG calculators and may even be accentuated by them. We have found that calculators' accounting results for the same operations can vary over 2x due to methodological differences alone. **This variability means even the most conscientious companies will have difficulty in tracking their emissions reduction progress, and ill-intentioned companies will be able to find systems and data sets that allow them to report the lowest possible emissions.**

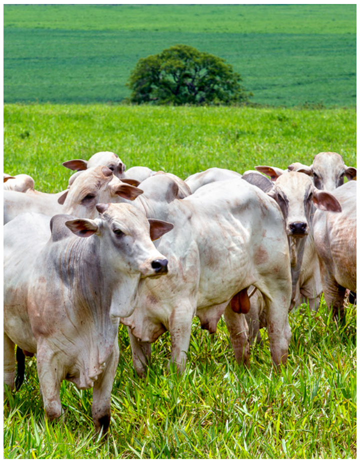
Harmonizing around a single methodology for product-based accounting or providing clear tools to translate between values calculated with different methodologies is vital to better understand and mitigate emissions within the food and agricultural sector. We see 3 critical reasons for harmonization:

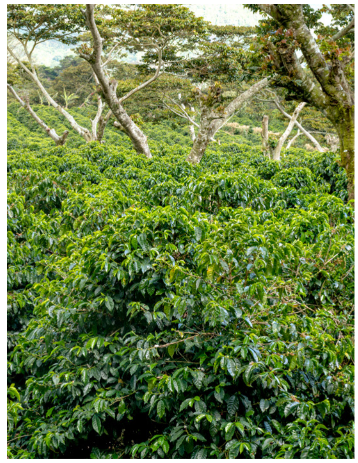
1 **Comparison across suppliers or investments:** Conscientious investors or buyers increasingly want to compare emissions data from multiple suppliers but have found that suppliers of the same product may report footprints that are 10x different. Without better data and comparison of accounting methodologies, it is impossible to know whether those differences reflect better suppliers, different production systems, better practices, or different accounting. Some of these groups have also investigated setting up screens to identify better or worse performance

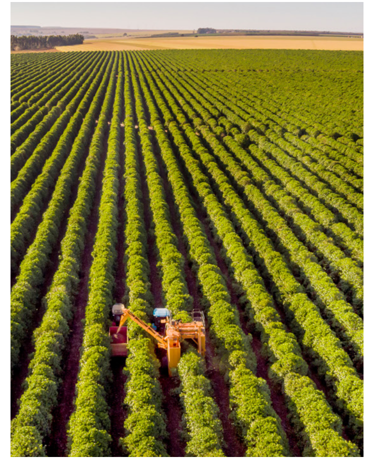
Table 2: Examples of GHG footprint differences from farming & deforestation practices (tons CO_2e)[7]

	Oil palm fruit	Soybean	Beef
Typical footprint on farm (excluding land use change)	0.5	0.7	57
Sample range of emissions within a country (excluding land use change)[8]	0.4 – 0.7	0.2 – 1.2	28 – 65
Footprint from deforestation (added to range above if applicable)	1.8	9.6	525

Grass-fed vs feedlot cattle	Shade-grown vs full-sun coffee







across suppliers of particular products. However, the thresholds to define what constitutes better or worse performance must also use the same methodologies as the suppliers. Adding to this challenge, data on such performance variances are often only available for some regions in certain accounting frameworks and for other regions using a different method. And finally, what is acceptable performance today (e.g., better) will not be acceptable 10 to 20 years from now.

2 **Setting targets:** External targets are also becoming essential to determine what can be considered credible action or a high-versus-low impact choice. For example, the Science Based Targets initiative has released Forest, Land, and Agriculture (FLAG) guidance specifying absolute land sector targets as well as intensity-based targets for key commodities. The GHG Protocol Land Sector and Removals Guidance draft specifies how companies need to account for their Land Sector emissions and removals. Greater standardization of product-based accounting in food and agriculture would further ensure that accounting is done in a consistent manner.

Using different accounting methods is like intentionally speaking different languages.

3 **Knowledge sharing:** Finally, we know that the actions needed to address climate change are unprecedented; every company and operation will need to contribute. To achieve this globally and over the next decades, companies cannot independently make the same mistakes repeatedly. We need to share lessons about what works and what does not. Using different accounting methods is like intentionally speaking different languages. If one company reports a 5tCO_2e reduction but with an unknown methodology, another company cannot know if that would translate to a 1tCO_2e or 10tCO_2e reduction if they implemented it.

How, then, can we proceed?

- **Globally standardized methodologies and reporting requirements for product accounting:** Agreeing on narrow, standardized methods and reporting processes will allow us to compare progress and benchmarks and learn from each other. There are already some examples of how we are moving in this direction:
  - The European product environmental footprint category rules are moving in the right direction towards robust requirements that create comparability.[9]
  - Forthcoming guidance (later in 2023) from the GHG Protocol on land-sector emissions and removals will help standardize corporate accounting (but not product accounting).

- **Quality control for collected data:** Companies or investors can request standardized data from the companies with which they interact. Often, this takes the form of standard Excel entry templates that ask for specific operational information or, when GHG footprints are directly supplied, information on how they were calculated. This is a critical but often time-consuming process, as many suppliers need extensive engagement to complete these forms. When suppliers are asked for different information by buyers, this can create more time spent on reporting than on other sustainability actions. Streamlining which information is collected by downstream buyers, at what frequency, and using cloud services to reduce multiple requests for the same data could reduce this burden.

- **Pre-competitive collaboration:** Collaboration among companies to collect, request information from suppliers on, and report product-based GHG emissions in a standardized way can lessen the burden of individual quality control and harmonization. For example, the Global Salmon Initiative has worked with World Wildlife Fund to follow the same GHG accounting procedures for salmon farms and for their feed suppliers. Speaking the same language around emissions will allow this group of salmon producers to compare progress and see whether interventions are effective, as well as to what degree and with what hurdles.

- **Transparency in reporting:** Whether estimates are coming from companies or from academic papers, critical methodological steps are often missing. This means that companies often cannot know if emissions factors are suitable for their uses or can be compared against other estimates. If GHG targets are set without specifying a methodology, similar problems arise when companies compare their own footprints to these targets. Some companies have already started providing detailed methodological information to their buyers when providing footprint data.

Technical innovations can support these actions. For example, a centralized cloud-based system to store relevant primary and secondary data for companies and their buyers could improve and harmonize quality control, collaboration, and transparency. It could also make coalescing around a standardized methodology an easier shift. Providing such data would be a cost of doing business for entering certain markets. If participation in such a system were a market requirement, it would even the playing field across companies and their suppliers, ensuring that all stakeholders dedicate resources not only towards data collection but also harmonization.

Companies need to speak the same accounting language to compare product performance and collaborate toward climate action. With increasing regulation surrounding climate risk, as well as pressure from investors, consumers, and others, the ability to accurately report on and mitigate GHG emissions will not only be vital for the environment, but also for businesses' bottom lines. Furthermore, if companies want to meet their Scope 3 goals, then understanding true emissions, not only averages, is the only way they will be able to target interventions with producers and ensure their success. While progress still needs to be made on standardization, companies should continue to increase critical work on mitigation efforts. Product-level GHG accounting standardization is vital to ensure real progress is being made on the ground and not just on paper, but climate change is not waiting for accounting standards to catch up.

Emily Moberg
Director, Scope 3 Carbon Measurement and Mitigation,
Markets Institute, World Wildlife Fund
Emily.Moberg@wwfus.org

Katherine Devine
Director, Business Case Development
Markets Institute, World Wildlife Fund
Katherine.Devine@wwfus.org

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Appendix 1: Example of system boundary differences

Note that in some cases, the criteria are potentially subjective (e.g., if excluding the category doesn't alter conclusions).

	PAS 2050	GHGP PS	ISO 14067
Exclusion threshold	<1%	Flexible	If does not alter conclusions
Capital goods (buildings/boats)	X	Optional	✓
Offsets	X	X	✓
Land use change	✓	✓	✓ (reported separately)
Soil carbon	Optional	Guidance forthcoming	✓

Note: further differences on the ambiguity of terminology can be found in the individual standards listed. The above table serves only to illustrate that, depending on accounting procedures, what is included in a given standard has high variability.

Footnotes/Citations

1 This issue is not new. Ingwersen & Stevenson (2012) *Journal of Cleaner Production* highlighted the incompatibility of results from different product category rules over a decade ago.

2 Based on integrated assessment models of the food system for 2020: https://wwfint.awsassets.panda.org/downloads/dcf_critical_for_1_5_pathway___summary_and_techincal_methods.pdf

3 GHG Protocol Corporate Standard

4 CDP is a not-for-profit charity that runs the global disclosure system for investors, companies, cities, states and regions to manage their environmental impacts.

5 The British PAS2050-2, the Norwegian standard 9428, the ISO 22948, and forthcoming PEFCR marine fish.

6 Small contributing sources may be omitted when exclusion thresholds are used.

7 Assuming average 2020 yield from FAOSTAT and carbon content for deforestation from Global Forest Watch, 544tCO2e/ha: WRI GFW data for 'commodity driven deforestation' average 2001-2015. Amortized over 20 years. Average emissions to farm-gate without LUC from Poore & Nemecek (2018) Science.

8 These values are taken from Poore & Nemecek for a single country each; these are for Brazil for soy; Indonesia for oil palm fruit; Ghana for cocoa beans; USA for beef (beef herd). They are for on-farm emissions only, excluding LUC. These are underestimates of full variability, since each data point is often reflective of multiple farms.

9 https://ec.europa.eu/environment/eussd/smgp/PEFCR_OEFSR_en.htm