

CHAPTER 5.

Spatial boundaries and traceability

This chapter provides requirements and recommendations for setting spatial boundaries when estimating emissions, removals, and other metrics. Setting the spatial boundary is determined by the type and level of traceability a company can establish to lands in its value chain. The concept of a spatial boundary is relevant for both scope 1 and scope 3 accounting; traceability is relevant for scope 3 accounting.

5.1 Overview

Spatial boundaries determine the specific lands that are included when accounting for scope 1 or scope 3 emissions, removals, or other metrics. The ability to accurately account for emissions, removals, and other metrics impacted by a company's activities depends on a company's level of traceability to the relevant lands and activities in its operations or value chain.


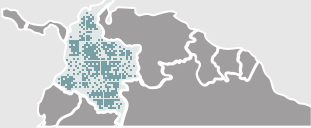



To account for emissions, removals, and other metrics, companies are required to:

- Define their scope 1 spatial boundary based on their organizational boundary. Define their scope 3 spatial boundaries (i.e., global, jurisdiction, sourcing region, land management unit [LMU], or harvested area) based on the level of traceability the company can establish to lands in its value chain (Requirement 5).
 - Apply the same spatial boundary for all accounting categories in their inventory.
- If companies account for agricultural scope 3 emissions, removals, and other metrics at a jurisdiction or sourcing region level, they are required to only include attributable productive lands within their spatial boundary (Requirement 6).
- Companies applying an LMU-level scope 3 spatial boundary may include non-productive lands proximate and adjacent to the productive lands if the required criteria are met (Requirement 7). However, the accounting approach for how to separate anthropogenic from natural impacts on non-productive lands when accounting for land management net biogenic CO₂ emissions and land management CO₂ removals is not covered in this version of the *Standard* (see Box 5.1 and Box 9.1 for details).
- If the company seeks to demonstrate physical traceability to define its spatial boundary (see Table 5.1), which may vary by activity in its value chain and/or volume of product, it is required to implement traceability systems (Requirement 8).
 - Table 5.2 provides definitions of eligible chain of custody models to demonstrate physical traceability.
 - If companies choose to report on impact traceability, they must report GHG emissions or removal impacts of projects and interventions separately from the physical GHG inventory.¹

Table 5.1 Traceability and spatial boundaries for emissions and removals accounting

Type of traceability	Level of traceability	Spatial boundary (see Figure 5.1)	Emissions accounting	Removals accounting
N/A	No knowledge of origin	Global	The most appropriate level of traceability, and the associated scope 3 spatial boundary, for an activity and/or product is context-specific based on the type of LMUs producing the goods or services and the reporting company’s position in the value chain (see Recommendation in Section 5.3 for details)	N/A
Physical traceability recommended	Known jurisdiction, country, or political region of origin	Jurisdiction		For removals, companies are required to establish physical traceability to the sourcing region, LMU, or harvested area (Requirement 20.LMR)
Physical traceability required (Requirement 8)	Known first point of aggregation or first processing facility	Sourcing region		
	Known land management units of origin	Land management unit (LMU)		
	Known field of origin	Harvested area		

Figure 5.1 Scope 3 spatial boundaries based on a company’s level of traceability

Spatial Boundary	Description	
Global	A spatial boundary representing all lands globally where biogenic products or raw materials are sourced from.	
Jurisdiction	A predefined, spatially explicit area based on a political or administrative boundary within which biogenic products or raw materials are sourced. This includes political boundaries based on a subnational jurisdiction (e.g., state or province), country, or political region (e.g., the European Union) of origin.	
Sourcing region	A predefined, spatially explicit land area that supplies a given raw material to the first point of aggregation or first processing facility in the value chain. Sourcing region boundaries may be defined relative to the tier of the value chain that is inclusive of multiple first points of aggregation or first processing facilities with overlapping areas that supply harvested raw materials.	
Land management unit (LMU)	A predefined, spatially explicit area of a given land use, managed according to a clear set of objectives according to a single land management plan to produce a given raw material or set of raw materials. An LMU may represent spatially explicit areas such as a farm, field, or plot.	
Harvested area	A spatially explicit area of productive agricultural land that was harvested at a given time to produce the relevant raw material.	

Attributable productive lands
 Lands not attributable to the product
 Lands outside the scope 3 spatial boundary



5.2 Requirements

REQUIREMENT 5:

Spatial boundary requirements²

Determining the spatial boundary: Companies **shall** define spatial boundaries as follows when accounting for scope 1 or scope 3 emissions, removals, or other metrics:

- **Scope 1 spatial boundary:** Companies **shall** define the scope 1 spatial boundary as the lands owned or controlled by the reporting company based on the selected consolidation approach.
- **Scope 3 spatial boundary:** Companies **shall** define scope 3 spatial boundaries (i.e. global, jurisdiction, sourcing region, land management unit, or harvested area), and the lands included or excluded within those boundaries, according to the definition of each scope 3 category and based on the company's level of traceability to known lands or regions for a given volume of a given product. Requirement 8 sets forth how companies establish traceability.

Same boundary across accounting categories: Companies **shall** apply the same spatial boundary when accounting for all land emissions, removals, and other land-related metrics in their inventory, as specified below:

- **Scope 1 spatial boundary:** Companies **shall** apply the same scope 1 spatial boundary to account for all scope 1 land emissions, removals, and other accounting categories in the inventory.
- **Scope 3 spatial boundary:** Companies **shall** apply the same scope 3 spatial boundary to account for all scope 3 land emissions, removals, and other accounting categories in the inventory, for a given volume of a given product or other specific scope 3 activity (e.g., certain leased lands or investments).

Determining scope 3 spatial boundary by category: The specific lands included within the scope 3 spatial boundary depend on the scope 3 category, as detailed below:

- **Lands associated with purchased and sold products or services** (i.e., scope 3 categories 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, and 12): Companies **shall** include lands in the scope 3 spatial boundary associated with the life cycle of products, materials, or services (e.g., crops, animal products, agricultural inputs, etc.) purchased, processed, used, or sold by the reporting company (as applicable), depending on the company’s level of traceability associated with a given volume of a given product or service:
 - If companies have no traceability, they **shall** include all lands globally where biogenic products or raw materials are sourced from.
 - If companies know the jurisdiction of origin, they **shall** include only attributable productive lands within the jurisdiction (see Requirement 6).
 - If companies have physical traceability to the first point of aggregation, they **shall** include only attributable productive lands within the sourcing region (see Requirement 6).
 - If companies have physical traceability to an LMU, they **shall** include all productive lands within the LMU boundary, and may include relevant proximate and adjacent non-productive lands (see Requirement 7).
 - If companies have physical traceability to an individual harvested area, they **shall** include productive lands within the harvested area boundary.
- **Lands related to franchises, leased assets, and investments** (i.e., scope 3 categories 8, 13, 14, and 15): Companies **shall** include lands associated with scope 3 leased assets, franchises, or investments in their scope 3 spatial boundary. Such lands are determined based on their selected consolidation approach.

REQUIREMENT 6:

Attributable productive lands for scope 3 accounting²

Companies that set a jurisdiction-level or sourcing region-level scope 3 spatial boundary **shall** only include attributable productive agricultural lands within their jurisdiction or sourcing region boundaries.

Attributable productive lands: All productive agricultural lands that produce the product or material sourced by the reporting company, or productive agricultural lands that use the product sold by the reporting company. Attributable productive lands **shall** exclude the following types of land:

- **Non-productive lands:** Lands that are not directly producing and/or not capable of producing the product or material sourced by the reporting company in the reporting year.
- **Lands producing other products or materials:** Productive lands or LMUs in land uses, forest types, or crop types not relevant to, or only producing something different than, the product or material sourced by the reporting company.
 - Productive lands that produce multiple products, including those associated with the reporting company, do not need to be excluded; see Section 5.4.1 in the *Guidance* for additional details.
- **Lands with harvest restrictions:** Lands with legal or regulatory restrictions that prohibit harvesting in the reporting year.
- **Lands with other protective status:** Lands with other protective status that would prevent the production of products or materials sourced by the reporting company or the use of products sold by the reporting company.

Lands that issued GHG credits: Companies **shall** identify any lands where emission reductions or removals were issued as GHG credits to be used as an offset or for compensation, to disclose information on GHG credits issued within the scope 3 spatial boundary (see Reporting GHG credits in Section 18.2.2).

Where data limitations prevent companies from meeting all the criteria for excluding specific lands, companies **should** apply a broader scope 3 spatial boundary to complete the accounting. In such cases, companies **should** explain the use of proxy data or other approaches that seek to exclude such lands and identify planned improvements.

REQUIREMENT 7:

Interim requirement on proximate and adjacent non-productive lands within LMUs for scope 3 LMU-level accounting³

Companies that set an LMU-level scope 3 spatial boundary **shall** include all productive lands in the LMU boundary and **may** include proximate and adjacent non-productive lands within the LMU boundary. Any proximate and adjacent non-productive lands included in the LMU boundary **shall** meet the following criteria:

- **Single land management plan:** Non-productive lands **shall** be owned or operated by the same farmer (or collective) and managed under a single land management plan as the land area producing the raw materials.
- **Connection to productive agricultural lands:** Non-productive lands **shall** be connected bio-physically, ecologically, and/or socio-economically to the productive lands such that they provide direct benefits to the sustainability and socio-economic health of the productive lands, and **shall** be limited to one or more of the following:
 - Land used for edge-of-field management practices (e.g., windbreaks, hedgerows, riparian buffers), subject to additional considerations (see Box 5.1).
 - Land integrated in agroforestry systems (e.g., tree intercropping/alley cropping, multi-strata agroforestry/shade trees, silvopasture).
 - Set-aside lands (e.g., conservation reserve land) that directly benefit the agricultural production system (e.g., reduce soil erosion, improve water quality, attract pollinators and other beneficial insects), subject to additional considerations (see Box 5.1).
- **Same boundaries across accounting categories:** If removals are accounted for on proximate and adjacent non-productive lands, all land emissions and other metrics associated with these lands **shall** also be accounted for and reported.
- **Same allocation methods:** The same allocation method **shall** be applied for emissions, removals, and other metrics across all products produced within the LMU to ensure no double counting (including no overcounting of removals or undercounting of emissions from the system).



- **Avoid double counting:** If removals on adjacent or proximate non-productive lands are accounted for, companies **shall** provide justification that these removals were not already accounted for, either by other companies at the same or similar tiers of the value chain that source from or sell to that LMU (see Requirement 22), or by other companies or GHG programs as GHG credits used toward GHG targets (e.g., issuance and retirement of GHG credits for compensation targets; subject to Requirement 30).
- **Location limitations:** The location(s) of the adjacent and/or proximate non-productive lands **shall** meet the following criteria:
 - **Adjacent lands:** Lands that are abutting the productive land area and integrated into the agricultural management system.
 - **Proximate lands:** Lands that are near the productive land area and integrated into the agricultural management system.
- **Additional safeguards to account for anthropogenic CO₂ emissions and removals:**
 - Size thresholds – subject to forest and non-productive lands carbon accounting decision (see Box 5.1 for details).
 - Distance thresholds – subject to forest and non-productive lands carbon accounting decision (see Box 5.1 for details).
 - Additional criteria and/or safeguards may be necessary pending the final resolution on how to account for anthropogenic CO₂ emissions and removals on all forest lands and non-productive, non-forest lands (see Box 9.1 for details).

See Box 5.1 for a description of why Requirement 7 cannot currently be implemented and the plan to address this in future versions of the Standard.

Box 5.1 Additional considerations for proximate and adjacent non-productive lands to account for anthropogenic CO₂ emissions and removals

The interim Requirement 7 cannot currently be implemented because the following topics are still pending:

- The accounting approach for separating anthropogenic from natural impacts on all forest lands and non-productive non-forest lands when accounting for land management net biogenic CO₂ emissions and land management CO₂ removals. This topic is not covered in this version of the *Standard* (see Box 9.1 for details).
- The additional safeguards listed in Requirement 7 to account for anthropogenic CO₂ emissions and removals, including size thresholds, distance thresholds, and possible additional criteria and/or safeguards, pending the final resolution of the topic in the previous bullet point.

These topics have not been decided upon by the Independent Standards Board of the GHG Protocol. The final approach seeks to ensure only anthropogenic CO₂ emissions and removals are accounted for and to address concerns with companies including large areas of non-productive lands within LMUs that have limited connection to the production of agricultural products purchased by the reporting company. The criteria for proximate and adjacent non-productive lands may be revised in future versions of this *Standard*.



REQUIREMENT 8:

Interim traceability requirement

To account for scope 3 emissions, removals, and other metrics, companies apply a scope 3 spatial boundary determined by the level of traceability they can establish to known lands or regions. To apply a sourcing region, LMU, or harvested area as the scope 3 spatial boundary to account for emissions, removals and other metrics, companies **shall** have physical traceability to the sourcing region, LMU, or harvested area within their value chain. The level of traceability may vary by activity and/or volume of product.

Physical traceability: If companies seek to demonstrate physical traceability for an activity and/or volume of product in their value chain, companies **shall** implement traceability systems (e.g., through certification programs or audited internal systems) that apply the following chain of custody models:


- Identity preservation;
- Segregation;
- Controlled blending;
- Mass balance approaches in which the volume or proportion of specified characteristics in the product or material entering and leaving the batch, site, or group of sites within the same country and sourcing region⁴ is known and attributed⁵ over a defined reconciliation period (i.e., batch-level, site-level, multi-site-level, or group-level within the same country and sourcing region); and/or
- Mixes of these approaches.⁶

Companies cannot demonstrate physical traceability using book-and-claim approaches or those mass balance approaches where:

- the volume of inputs and outputs with the specified characteristics is unknown or not specified;
- non-proportional allocation⁷ was used to assign the specified characteristics to a volume of outputs;

- a reconciliation period was not defined (for a site-level, multi-site-level, or group-level); or
- mixing occurred in a group of multiple sites in different countries or sourcing regions.

Table 5.2 Chain of custody model definitions

Chain of custody model	Definition (Adapted from: ISO 22095:2020; ISEAL Alliance 2025)	Demonstrates physical traceability?	Physical relationship
Identity preservation	A chain of custody model in which materials or products with specified characteristics originating from a single source or origin are kept physically separate from materials or products originating from other sources throughout the value chain.	Yes	
Segregation	A chain of custody model in which materials or products with a set of specified characteristics are kept physically separate from materials or products without that set of characteristics. This model allows for mixing of materials with the same set of characteristics from multiple sources, but not mixing with materials or products without that set of characteristics.	Yes	
Controlled blending	A chain of custody model in which materials or products with a set of specified characteristics are mixed according to certain criteria with materials or products without that set of characteristics, resulting in a proportional attribution of the specified characteristics within all parts of the final output(s) or product group(s). <ul style="list-style-type: none"> • System boundaries: At a given stage in the value chain for a batch of products. 	Yes	
Mass balance	A chain of custody model in which materials or products with a set of specified characteristics are mixed according to defined criteria with materials without that set of characteristics, and where the volume of content with the specified characteristics can be attributed to any of the parts of the final output(s) or product group(s), at the transfer boundary. If the transfer boundary is producing various outputs or product groups, allocation has to be performed first. ⁷ The transfer boundary can be at a given stage in the value chain, where the volume of content with specified characteristics is reconciled at a: <ul style="list-style-type: none"> • Batch-level: for the final outputs from the batch at the point of blending. • Site-level (facility): for the final outputs at the site over a defined reconciliation period, recommended to not exceed 12 months. • Multi-site/group-level: for the final outputs from the multiple sites over a defined reconciliation period, recommended to not exceed 12 months. 	Yes, for the specified transfer boundaries, and if it meets specified criteria. No, for specified transfer boundaries that do not meet criteria, or for other unspecified transfer boundaries	
Book and claim	A chain of custody model in which the transfer of specified characteristics is not connected to the physical flow of material or products through the supply chain.	No	No physical relationship

Note: For definitions of terms in this table and additional guidance on applying them, refer to ISEAL Alliance (2025).

Impact traceability: If companies use alternative approaches to traceability, such as impact traceability systems, they **shall** report the associated values separately from the physical GHG inventory and disclose and justify the approach used. In the absence of requirements and guidance on impact traceability in this version of this *Standard*, companies using such approaches may wish to consult with their auditors and consider rules provided by relevant target-setting programs or applicable regulatory schemes in their jurisdiction(s) on how to disclose such activities in their reports, while ensuring full transparency and following all GHG accounting and reporting principles.⁸

5.3 Recommendations and options

Recommended considerations to determine the level of traceability and the scope 3 spatial boundary

The most appropriate level of traceability, and the associated scope 3 spatial boundary, that a company **should** strive to establish for a given product is context-specific based on the type of land management units producing the goods/services and the reporting company's position in the value chain.

Companies **should** strive towards establishing a level of traceability and set the scope 3 spatial boundary that enables the following:

- The most accurate, precise accounting for emissions, removals, and other metrics in the specific context. Companies **should** also follow the “higher accuracy data and methods” Recommendation in Section 6.3.
- The most credible allocation for emissions, removals, and other metrics.
- The most effective and efficient way to improve land management practices and foster collaborative investment for climate change mitigation within value chains.

In the absence of other information, companies **should** apply the scope 3 spatial boundary corresponding to the most specific level of physical traceability a company can establish. In general, setting a global scope 3 spatial boundary (i.e., corresponding to global or no traceability) does not satisfy the above criteria.

Recommendation for free, prior, informed consent; equity; and landholder rights

When engaging with value chain partners and other landholders included in a company's scope 3 spatial boundary, companies **should** ensure equity and acknowledge the rights of landholders by obtaining free, prior, informed consent; providing fair compensation for mitigation actions aimed to reduce their scope 3 emissions or increase scope 3 removals; and following best practices:

- **Free, prior, informed consent:** Companies **should** follow international best practices for obtaining free, prior, informed consent to include such lands within their scope 3 inventory. This **should** include explaining to farmers or other landholders the various options they have to monetize their emissions reductions or removals, including current and projected carbon prices.
- **Provide fair compensation:** Companies **should** provide fair compensation to farmers or other landholders for GHG mitigation efforts annually, in addition to payments for the products or services associated with the reporting company's value chain, and disclose that compensation.
- **Follow best practices:** For further resources and best practices, refer to guidance provided by the Food and Agriculture Organization,⁹ the Office of the UN High Commissioner for Human Rights, the Institute for Human Rights and Business, CARE Principles for Indigenous Data Governance,¹⁰ Science Based Targets initiative's *Forest, Land and Agriculture Guidance*, and so on.

5.4 Guidance on the requirements and recommendations

5.4.1 Setting the scope 1 and scope 3 spatial boundaries

The information in this section guides companies on selecting and setting appropriate spatial boundaries, and the lands that are included or excluded within a given spatial boundary.

Scope 1 spatial boundary

As set forth in Requirement 5, companies define their scope 1 spatial boundary as the lands owned or controlled by the reporting company based on the selected consolidation approach (see Section 4.4.1 for additional guidance on setting the organizational boundary). Companies must apply the same scope 1 spatial boundary when accounting for all accounting categories in the inventory (e.g., use the same boundary to estimate land use change emissions, land management CO₂ removals, land use, etc.).

Scope 3 spatial boundary

Companies define their scope 3 spatial boundaries, and the lands included within or excluded from those boundaries, according to the scope 3 category (or categories) relevant to the reporting company's activities and the company's level of traceability to known lands or regions by activity and/or product type. Companies must apply the same scope 3 spatial boundary when accounting for all accounting categories in the scope 3 inventory, for a given volume of a given product or other specific scope 3 activity.

Companies may set different scope 3 spatial boundaries for different discrete volumes of a given product type that correspond to different levels of traceability. For example, a consumer goods company based in the United States may set a land management unit (LMU)-level spatial boundary for the soy that is traceable to specific LMUs in the United States, but use a jurisdictional spatial boundary to analyze the soy they source from Brazil (and that is only traceable to that jurisdiction). These distinct scope 3 spatial boundaries of analysis reflect the different levels of traceability the company has in its value chain(s).

In general, a company can set one of the five different spatial boundaries described below (Figure 5.2), which correspond to increasingly refined levels of traceability—a global, jurisdictional, sourcing region, land management unit, or harvested area spatial boundary:

- **Global scope 3 spatial boundary:** A spatial boundary representing all lands globally where biogenic products or raw materials are sourced from. A company may set a global scope 3 spatial boundary when the company has no traceability to a jurisdiction or region of origin, or has no traceability information.
- **Jurisdiction scope 3 spatial boundary:** A jurisdiction is a predefined, spatially explicit area based on a political or administrative boundary within which biogenic products or raw materials are sourced. Companies that have upstream traceability to a country or other subnational jurisdiction of origin for the goods they purchase, or downstream traceability to a country or other subnational jurisdiction where the goods they sell are used, may apply a national, subnational, or political region spatial boundary. The relevant spatial boundary could be a political boundary based on a subnational jurisdiction (e.g., state or province), country, or political region (e.g., the European Union) of origin or use.

Companies should apply a jurisdictional boundary that is most representative of the lands that supply to or distribute from the point in the value chain to which they have traceability. For example, if the reporting company only has traceability to a food processing facility, they should consider the jurisdictional boundary that is most representative of the lands from which that facility sources materials. Where appropriate, a boundary that combines a group of countries or subnational jurisdictions may also be applicable if that

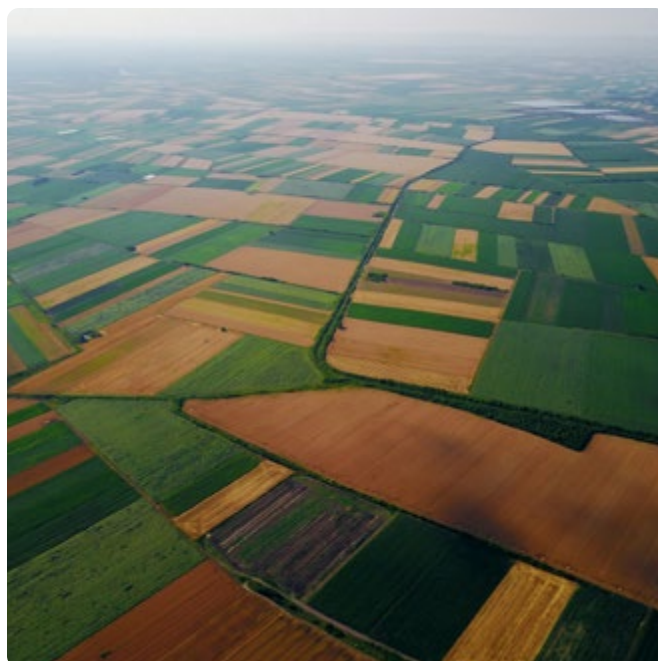
combined jurisdictional boundary is more representative of lands that supply to or distribute from the point in the value chain to which the company has traceability (while noting preference for the most detailed level of resolution).

To set a national, state, or provincial jurisdiction scope 3 spatial boundary, physical traceability is recommended but not required (see Table 5.1). If a company sets a scope 3 spatial boundary at a more granular subnational political boundary (e.g., a county, municipality, etc.), companies should treat this as a sourcing region scope 3 spatial boundary and meet the corresponding physical traceability requirements (see Section 5.4.2 and Table 5.1).

- **Sourcing region scope 3 spatial boundary:** A sourcing region is a predefined, spatially explicit land area that supplies a given raw material to the first point of aggregation or first processing facility in a value chain.¹¹ A point of aggregation is a location that receives harvested raw materials from land management units for processing or distribution further down the supply chain. For example, for a grain crop, the first point of aggregation may be a grain elevator, and the sourcing region would include all farms supplying a grain crop to a particular elevator or set of elevators. Sourcing region spatial boundaries may be defined relative to the tier of the value chain that is inclusive of multiple first points of aggregation or first processing facilities with overlapping areas that supply harvested raw materials. Using the same grain elevator example, a company could define its sourcing region based on a set of grain elevators it sources from, and the sourcing region’s spatial boundary would be determined based on all the farms supplying to that set of grain elevators.
- **Land management unit (LMU) scope 3 spatial boundary:** A land management unit (LMU) is a predefined, spatially explicit area of a given land use, managed according to a clear set of objectives, according to a single land management plan to produce a given raw material or set of raw materials. An LMU can refer to different management systems depending on the land use (see Table 5.3). LMUs can also include communal and indigenous lands managed according to a single land management plan by traditional communities and other types of land tenure and management models.

As set forth in Requirement 7, if companies set an LMU-level scope 3 spatial boundary, all productive lands within the LMU spatial boundary must be included, and certain non-productive lands can also be included in the LMU spatial boundary of analysis, subject to specific criteria (but see Box 5.1 in the *Standard* noting why Requirement 7 is not currently implementable). For example, the LMU boundary for a coffee plantation could encompass multiple fields of coffee in different age classes, as well as shade trees or other trees in the canopy and subcanopy on productive lands within that LMU (or set of LMUs) that are not harvested but are included within the land management plan for the plantation to ensure agroecological function and are managed accordingly.

- **Harvested area scope 3 spatial boundary:** A harvested area is a spatially explicit area of productive agricultural land that was harvested at a given time to produce the relevant raw material. This spatial boundary accounts only for the impacts of activities to produce the given raw material on a discrete area of productive land and



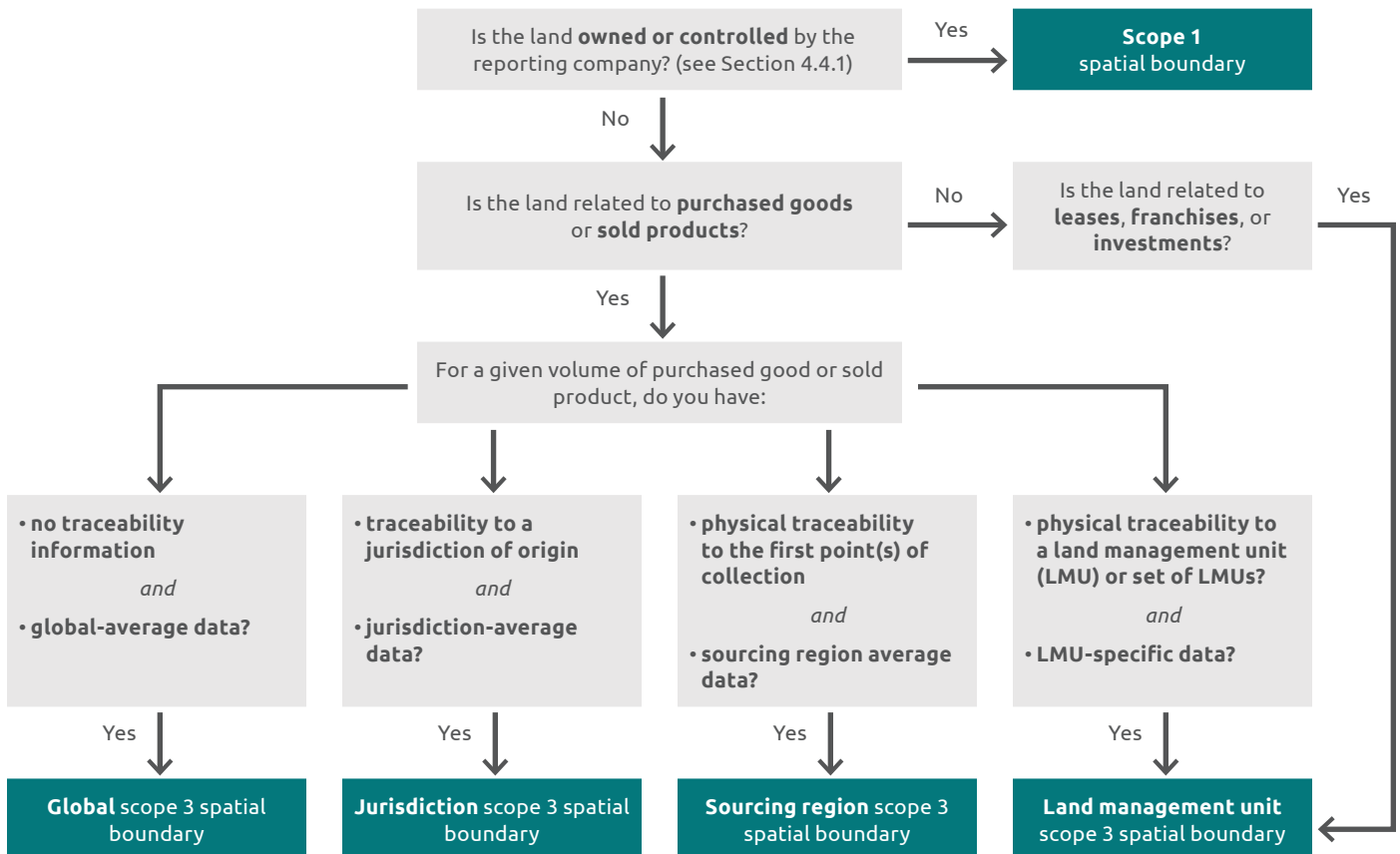
does not include the impacts of activities on productive lands that produced other raw materials or activities on other non-productive lands. For example, a farm producing wheat, barley, and oats could delineate a set of harvested area boundaries for the wheat fields, barley fields, and oat fields and provide information from each respective field-level boundary to companies purchasing the respective crop from that farm.

For further guidance on what lands are included or excluded from a jurisdictional, sourcing region, LMU, or harvested area scope 3 spatial boundary, see “Determining lands that must be included or excluded for accounting purposes within the scope 3 spatial boundary” below.

Selecting the appropriate scope 3 spatial boundary

Setting a scope 3 spatial boundary to satisfy the requirements and recommendations in this *Standard* depends on several considerations. As set forth in Requirement 5, this *Standard* requires that companies set the scope 3 spatial boundary, for a given volume of a given product or other specific scope 3 activity (e.g., certain leased lands or investments), according to the level of traceability a company can establish to known lands or regions. Requirements 5 and 8 establish that companies must have physical traceability to the relevant scope 3 spatial boundary to apply data specific to lands included in that spatial boundary when accounting for emissions, removals, or other metrics (e.g., companies are required to have physical traceability to a given farm or set of farms in order to account for scope 3 land emissions using supplier-specific emission factors from that farm or set of farms). Figure 5.2 presents a decision tree to determine the appropriate scope 3 spatial boundary according to traceability and data availability considerations.

Figure 5.2 Determining the scope 1 and scope 3 spatial boundaries



Requirement 5 in the *Standard* does not require a company to apply a scope 3 spatial boundary equivalent to the most granular level of traceability the reporting company can establish. As discussed below, there may be context-specific reasons to set a certain scope 3 spatial boundary instead of another. There are also tradeoffs inherent to implementing traceability systems that can establish the traceability required to accurately account for emissions, removals, and other metrics in a sourcing region, set of LMUs, or set of harvested areas. This *Standard* recommends that companies strive towards establishing a level of traceability, and to set the corresponding scope 3 spatial boundary of analysis that enables the following:

- The most accurate, precise accounting for emissions, removals, land use, and other metrics in the specific context.
- The most credible allocation for emissions, removals, land use, and other metrics.
- The most effective and efficient way to improve land management practices and foster collaborative investment for climate change mitigation within value chains.

In general, setting a global scope 3 spatial boundary (i.e., corresponding to global or no traceability) does not satisfy the above-listed criteria. Thus, at a minimum, companies should strive to achieve traceability to a region or country of origin to apply a jurisdictional or more granular scope 3 spatial boundary.

Three important considerations when setting the appropriate scope 3 spatial boundary are:

1. **Data accuracy and availability:** While average data that correspond to broader spatial boundaries are often more readily available, setting a broader spatial boundary limits the relevance of the corresponding average data to the corporate value chain activity in question. For example, using a global or jurisdiction scope 3 spatial boundary and global or jurisdictional average emission factors or activity data to account for the emissions associated with crop management or livestock management practices would not adequately capture the reduced emissions, enhanced removals, or land use savings, and so on, due to specific actions implemented on specific farms within that jurisdiction.

Conversely, using data that corresponds to more granular scope 3 spatial boundaries (such as the LMU or harvested area scales) would more accurately account for the practices of a given supplier. However, companies sourcing land-based products are less likely to have access to such LMU- or harvested area-specific data (e.g., farm-level or field-level data on fertilizer types, fertilizer application rates, and soil carbon stock changes) or the traceability systems to ensure the lands and activities within these granular scope 3 spatial boundaries are attributable to the reporting company's activities (i.e., that these specific farms or fields are in fact those that produced the agricultural products purchased by the reporting company).

2. **Same boundaries across accounting categories (requirement):** As set forth in Requirement 5, companies must apply the same scope 3 spatial boundary when accounting for all land emissions, removals, and other metrics in their inventory, for a given volume of a given product or other specific scope 3 activity (e.g., certain leased lands or investments). When completing their scope 3 accounting, companies may encounter data availability limitations. For example, data related to average or specific activities on sourcing lands within the given scope 3 spatial boundary may be available to complete the accounting for some accounting categories, but not for others. For example, a company that establishes traceability to a subnational jurisdiction of origin and sets a subnational jurisdictional scope 3 spatial boundary may have access to subnational jurisdiction-level land use change emission factors, but not to subnational jurisdiction average fertilizer or manure management emission factors.

In situations where data availability is incomplete, the company has the following options to complete the scope 3 accounting while satisfying the spatial boundary requirements in Chapter 5:

- Prioritize the collection of missing data to be able to complete the accounting at a more granular scope 3 spatial boundary. In the example above, the reporting company could work with producers and other buyers in the subnational jurisdiction to collect average producer data in the subnational jurisdiction.
- Apply a broader scope 3 spatial boundary.

3. Requirements to report land management CO₂ removals: As set forth in Requirements 20 and 21 in Chapter 12 in the *Standard*, if a company chooses to report removals, it must establish physical traceability to a sourcing region, LMU, or harvested area and use empirical data specific to the sinks and pools where carbon is stored within the corresponding scope 3 spatial boundary to complete the scope 3 accounting. In other words, a company that chooses to report removals cannot account for any removals using data that corresponds to a scope 3 spatial boundary coarser than a sourcing region (e.g., national average removal factors) and must establish physical traceability to at least the first point of aggregation (see Figure 13.1).

Determining lands that must be included or excluded within the scope 3 spatial boundary

As set forth in Requirement 5, the specific lands included in the scope 3 spatial boundary depend on the scope 3 category and level of traceability. For lands associated with purchased and sold products or services (i.e., scope 3 categories 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, and 12), companies must include lands in the scope 3 spatial boundary associated with the life cycle of products, materials, or services (e.g., crops, animal products, agricultural inputs, etc.) purchased, processed, used, or sold by the reporting company, depending on the company's level of traceability associated with a given volume of a product or service.

1. Accounting at a jurisdiction scope 3 spatial boundary: As set forth in Requirements 6 and 7, companies that set a jurisdiction-level scope 3 spatial boundary must account for emissions, removals, and other metrics only on attributable productive lands in the jurisdiction scope 3 spatial boundary.

Attributable productive lands are defined as all productive agricultural lands within the jurisdiction or sourcing region boundary that produce the product or material sourced by the reporting company, or are productive agricultural lands where products sold by the reporting company are used. Attributable productive lands **included** in the relevant scope 3 spatial boundary are determined as follows:

- For crops, all croplands where the crop type purchased by the reporting company was produced in the reporting year, including croplands that produce the crop as part of a crop rotation.
- For products sourced from a jurisdiction where the product is typically produced as part of a multi-output cropping system (e.g., intercropping, double- or multi-cropping systems), companies can include in the jurisdictional scope 3 spatial boundary all agricultural lands that have produced that product in the past five years or all productive lands in the relevant crop rotation.
- For animal products, all lands used for livestock grazing (e.g., pastureland, rangeland, paddocks, etc.) and croplands used for feed production consumed by the livestock over the livestock's life cycle.

For all products, companies are required to **exclude** the following types of lands specified in Requirement 6:

- *Non-productive lands:* Lands that are not directly producing and/or not capable of producing the product or material sourced by the reporting company in the reporting year. For example, if the reporting company sources wheat from a jurisdiction in the reporting year, companies must exclude non-productive lands in that jurisdiction that did not produce wheat.

- *Lands producing other products or materials:* Productive lands or LMUs in land uses or crop types not relevant to, or only producing something different than, the product or material sourced by the reporting company. For example, if the reporting company sources wheat from a jurisdiction in the reporting year, companies must exclude productive lands in that jurisdiction that produce soybeans, canola, barley, etc. in the reporting year.
 - Note: Productive lands that produce multiple products (e.g., as part of a cropping system), including the product(s) attributable to the reporting company, should be included (see guidance above for inclusion of lands with multi-output cropping systems). For example, if the reporting company sources soybean from a jurisdiction, companies should include land in that jurisdiction that also produced maize in the reporting year as part of a soybean-maize rotation. Similarly, land temporarily fallow or planted in cover crops between two cycles of planted soybean in the jurisdiction should also be included in the jurisdiction scope 3 spatial boundary.
 - *Lands with harvest restrictions:* Lands with legal or regulatory restrictions that prohibit harvesting in the reporting year. For example, if the reporting company sources cocoa in the reporting year, companies must exclude lands that are under legal protection (e.g., harvest moratorium) that prohibits the harvest of cocoa on those lands in the reporting year.
 - *Lands with another protected status:* Lands with another protected status that would prevent the harvest of products or materials sourced by the reporting company or the use of products sold by the reporting company. For example, if the reporting company sources wheat in the reporting year, companies must exclude lands that are under legal protection that forbids production of wheat (e.g., conservation reserve or nature conservancy lands adjacent to wheat production systems).
- 2. Accounting at a sourcing region scope 3 spatial boundary:** As set forth in Requirements 5 and 6, companies that set a sourcing region-level scope 3 spatial boundary must account for emissions, removals, and other metrics only on attributable productive agricultural lands in the sourcing region scope 3 spatial boundary. Guidance on identifying and including all attributable productive lands within the sourcing region is the same as that provided above for a jurisdiction scope 3 spatial boundary.

A sourcing region may comprise multiple LMUs or be an area within a single LMU, depending on the geography and sector. A sourcing region may be situated within a single country or span multiple countries or other geopolitical boundaries. The boundary of the sourcing region may be defined based on the attributable productive lands in:

- all LMUs that supply products to a first point of aggregation or processing facility;
- a sourcing radius that extends from the first point(s) of aggregation or processing facility (or facilities);
- a set of subnational jurisdictions (e.g., counties or municipalities) that supply to the first point(s) of aggregation or processing facility (or facilities); or
- other methods that satisfy Requirement 6.

Consideration should be given to the following factors when determining the most appropriate approach to determining which lands to include or exclude from the sourcing region scope 3 spatial boundary:

- *Multiple collection points:* Where multiple collection points are in close proximity and have overlapping sourcing areas, a single sourcing region covering the total area for all facilities may be appropriate.
- *Setting a consistent boundary:* Ideally, the sourcing region scope 3 spatial boundary should not change over time, so the defined boundary should correspond to both current and anticipated future sourcing needs.

- *Productive lands within land management units:* For LMUs that fall within the defined sourcing region scope 3 spatial boundary, only productive lands within those LMUs are included. Productive lands are the physical areas of land used to produce a crop, livestock, animal product, or other biogenic product or service, or multiple products as part of a crop rotation, in the reporting year, or the physical areas of land where a sold product was applied in the reporting year. Non-productive land within LMUs are excluded when accounting at a sourcing region scope 3 spatial boundary. Non-attributable land outside of attributable productive lands within LMUs, including conservation areas or other non-productive land areas with harvest restrictions, must also be excluded.

As set forth in Requirement 6 and the reporting requirements in Section 18.2.2, companies must also identify any lands in the scope 3 spatial boundary where emission reductions or removals were credited and sold as GHG credits to be used as an offset or for compensation. The reporting requirements in Section 18.2.2 set forth that companies must report two separate figures: scope 1 and 3 emissions (and scope 1 and 3 removals, if applicable), independent of any GHG credit transactions and also adjusted for sold credits. Companies are also required to disclose how double counting with GHG credits was avoided, if the company is using the inventory to track progress towards targets. These requirements are relevant for sourcing region, LMU, and harvested area scope 3 spatial boundaries. See Chapter 18 for more guidance on accounting for GHG credits.

3. Accounting at an LMU scope 3 spatial boundary: Companies that set an LMU-level scope 3 spatial boundary must include all productive lands in the LMU boundary and may include proximate and adjacent non-productive lands within the LMU boundary that meet specific criteria as set forth in Requirement 7 (but see Box 5.1 in the *Standard* noting why Requirement 7 is not currently implementable). The criteria for proximate and adjacent non-productive lands may be revised in future versions of this *Standard*. Examples of proximate and adjacent non-productive land that may meet the pending criteria in interim Requirement 7 include:

- **Edge-of-field practices:** Examples include windbreaks, pollinator strips, prairie strips, buffer strips, and riparian strips, etc., on non-productive land that falls within the LMU scope 3 spatial boundary.
- **Non-productive land in agroforestry systems:** Examples include land with trees and other vegetation that falls within a silvopasture grazing LMU; land with trees and other vegetation (e.g., land with shade trees in multi-strata systems) that do not produce the raw commodity purchased by the reporting company but that fall within an agroforestry LMU; land with trees and other vegetation in alley cropping or tree intercropping systems that do not produce the raw commodity purchased by the reporting company but that fall within the LMU.
- **Set-aside lands:** Examples include conservation reserve land, conserved wetlands, and other protected, non-productive land connected to the productive land within the LMU scope 3 spatial boundary and that also satisfies the criteria in Requirement 7.

4. Accounting at a harvested area scope 3 spatial boundary: For croplands and grasslands, the harvested area can be a field where a crop or animal product is produced. Fields are smaller units managed according to a specific set of practices that make up a broader farm, plantation, ranch, or grazing management unit.

Table 5.3 Examples of land management units (LMUs), by land use

Land use	Examples of land management units
Croplands	An agricultural management unit, such as a farm, plantation, orchard, or vineyard.
Grasslands	A grazing management unit, such as a ranch, pasture, or multi-paddock grazing system.

Setting the scope 3 spatial boundary for scope 3 franchises, leased assets, or investments

The scope 3 spatial boundary for leased assets, franchises, or investments includes lands related to the reporting company's leased assets, franchises or investments that are not included in their organizational boundary. Such leased assets, franchises, or investments are included within scope 3 when they are not included in the organizational boundary (corresponding to scope 1) based on the selected consolidation approach but are still relevant to the reporting company's value chain (see Section 4.4.1 for further details). For example, if a financial services company implements an operational control consolidation approach and has an interest in some farmlands, but does not have operational control over those lands, the company includes these farmland assets in its scope 3.

Setting the land carbon leakage boundary to account for land carbon leakage

The land carbon leakage boundary determines the specific lands that are included in the analysis when quantifying land carbon leakage, where required, using the COC calculation approach (see Chapter 8). Note that the land carbon leakage boundary is distinct from a company's scope 1 or scope 3 spatial boundaries used to account for emissions, removals, and land use (including land occupation and, optionally, the carbon opportunity cost of land use). The land carbon leakage boundary can include the same lands in the reporting company's scope 1 or scope 3 spatial boundaries, but can also encompass lands that lie *outside* those boundaries as well (as land carbon leakage is by definition an indirect impact). For further guidance on setting the land carbon leakage boundary, see Section 8.4.3.

Case study: General Mills and Regrow—Sourcing Region

As a global food manufacturer, General Mills has agricultural emissions in their scope 3, category 1 (purchased goods and services). General Mills partnered with Regrow to quantify soil organic carbon (SOC) stock change, along with non-CO₂ GHG emissions associated with one of its sourcing regions for spring wheat in the US Northern Great Plains. Using empirical data sources from remote sensing technology and biogeochemical modelling, General Mills was able to achieve IPCC Tier 3-level estimates of its upstream land-related emissions and removals in a supply chain with traceability to the sourcing region.

General Mills sources wheat from extensive geographies, primarily through upstream commodity aggregators and millers, which makes it very challenging to physically track commodity sources to the field level. To define its spring wheat sourcing regions, General Mills used a three-step approach:

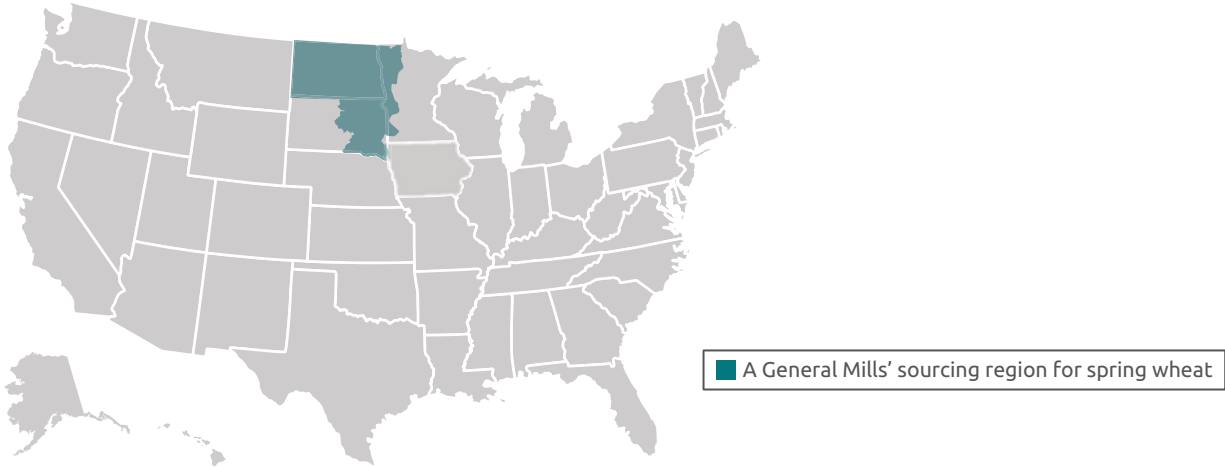
1. US Environmental Protection Agency level III and IV ecoregions and the US Department of Agriculture's (USDA) Cropland Data Layer provide approximate cultivation boundaries for spring wheat.
2. These regions are further constrained using data provided by General Mills' suppliers, including locations of mills and the county of origin from which mills are receiving grain.
3. Regrow uses satellite imagery to delineate the attributable productive lands growing spring wheat within the sourcing region.

After identifying attributable productive lands, Regrow estimates SOC stock change using its OpTIS (Operational Tillage Information System) remote sensing technology and DNDC (denitrification decomposition) biogeochemical model. OpTIS uses machine learning to evaluate satellite observations of aboveground biomass, including historical crop rotation and grower practices that impact carbon stocks, such as cover crops and tilling. Regrow then incorporates public and private data sources on soil, weather, and other farm management parameters, and models SOC stock changes and non-CO₂ emissions using DNDC.

Case study: General Mills and Regrow—Sourcing Region (cont.)

The DNDC model has been applied to a wide range of agroecosystems globally and extensively validated through more than 500 peer-reviewed publications. Use of a process-based model such as DNDC for estimating changes in SOC stock requires regional calibration and validation, which Regrow completes for each sourcing region it analyses. This approach provides General Mills with IPCC Tier 3-level precision at a large geographic scale. Non-CO₂ emissions and SOC stock change estimates are provided in the table below.

A General Mills’ sourcing region for spring wheat



Non-CO₂ emissions and soil organic carbon change estimates for spring wheat in General Mills’ sourcing region over a three-year period

Crop Year	Emissions (tCO ₂ e/ha)			Removals (net tCO ₂ e/ha)
	CH ₄ Emissions ± standard error	Direct N ₂ O emissions ± standard error	Indirect N ₂ O emissions ± standard error	ΔSOC ± standard error
2019	0	1.04 ± 0.00261	0.408 ± 0.00051	0.603 ± 0.0031
2020	0	1.002 ± 0.00368	0.181 ± 0.00031	0.8 ± 0.00436
2021	0	3.084 ± 0.0122	0.322 ± 0.00088	0.293 ± 0.00756

Note: Crop year for spring wheat refers to the calendar year in which the wheat was planted and harvested; non-CO₂ GHG emissions: CH₄ emissions from crop residue and N₂O from fertilizer application, N-fixation, crop residue, and soil organic matter breakdown; ΔSOC: ΔSOC measured by Regrow as the difference in SOC values for a given area over the crop year. Model version from July 2024. Newer versions of the analysis since producing this case study allocate wheat emissions on a harvest-to-harvest time period.

Creating accurate GHG inventories at a sourcing-region level can serve as a foundation for collaboration at broader regional scales. By investing in estimating sourcing region-specific emissions and SOC stock changes, General Mills can update their GHG inventory baseline to inform scope 3 reporting as it works with others to mitigate emissions across the region. In addition to removals accounting and monitoring, where fields may be losing SOC, General Mills finds value in these tools to update N₂O and CH₄ emissions and to make better assumptions about other emission sources, such as tractor diesel use. This approach leads to more accurate and dynamic land management emission calculations that are updated annually and incorporated into full life cycle assessments for a more complete measure of both a raw material’s carbon intensity and its life cycle emissions.

5.4.2 Traceability

Traceability refers to the ability of a company to identify, track, and collect information in the value chain of goods and services purchased or sold by the company, including upstream and downstream processes and products. For land sector companies, this can include upstream traceability to where the products a company purchases are produced (e.g., grazing lands and land producing feed crops for beef production systems), or downstream traceability to where the products a company sells are used (e.g., croplands where fertilizers and other agricultural inputs sold by agribusiness companies are applied).

As set forth in Requirement 8 (“Interim traceability requirement”), traceability to a relevant spatial boundary can be defined in one of two ways:

- **Physical traceability:** The ability of a company to identify, track, and collect information on activities (e.g., activity data or GHG emissions or removals factors) related to material flows of goods and services in its value chain, across its upstream and downstream processes and products. When accounting for scope 3 emissions, removals, and other metrics, a scope 3 spatial boundary is set that corresponds to the level of traceability a company has for the products or services it purchases or sells (see Requirement 5). To set a sourcing region, land management unit (LMU), or harvested area scope 3 spatial boundary, companies must have physical traceability to that sourcing region, LMU, or harvested area within their value chain. For example, a coffee retailer could establish physical traceability to a specific coffee plantation by tracking the physical transfer of coffee beans from a given coffee plantation to an aggregator, a coffee roaster, and subsequently to their coffee shop.
- **Impact traceability:** The ability of a company to identify, track, and collect information on the GHG emissions or removals impacts of projects or interventions in the value chain of goods and services purchased or sold by the company, including upstream and downstream processes and products. If companies use alternative approaches to physical traceability, such as impact traceability systems, they must report the associated values separately from the physical GHG inventory and disclose and justify the approach used. For example, a coffee retailer could demonstrate impact traceability to a specific coffee plantation based on incentives they directly provide to support climate mitigation in the plantation’s operations, but without tracking the material flow of coffee beans. In this case, the coffee retailer needs to report such impact separately from their physical GHG inventory.

Box 5.2 describes the approach for traceability set forth in version 1 of this *Standard* and how future versions of this *Standard* will be updated to reflect outcomes related to traceability from the GHG Protocol’s other active workstreams.



Box 5.2 GHG Protocol's cross-sectoral approach to traceability

Since the publication of the GHG Protocol's suite of corporate standards and guidance (from 2004 to 2015), there have been many important developments in GHG accounting and reporting. Between 2022 and 2023, the public was invited to provide input and suggestions for revising the corporate suite of standards, including new and additional guidance on topics such as traceability. This feedback informed the standard development plans that govern the updates which the GHG Protocol plans to make to its standards and guidance in 2026–2028.

GHG Protocol's workstream on *Actions and Market Instruments* (AMI) is considering the role of market instruments and impacts of actions in GHG accounting and reporting across different sectors. Traceability and chain of custody models, project-based GHG quantification, and other market-based mechanisms are some of the approaches that will be discussed. The relevance and appropriate role of quantified impacts of corporate actions and market instruments in relation to the reporting company's organizational boundary and value chain will be considered during the AMI and *Scope 3 Standard* development workstreams.

In anticipation of the outcomes of the AMI workstream, version 1 of this *Standard* provides the "interim traceability requirement" (see Requirement 8), which defines the chain of custody models that can and cannot be used to demonstrate physical traceability for land sector companies and companies choosing to account for and report CO₂ removals (see Table 5.2). This interim traceability requirement should not be interpreted as a precedent for the AMI process or as a final approach adopted by the GHG Protocol for the long term. The interim requirement will be revisited in future versions of this *Standard* to reflect the outcomes of the AMI workstream.

Traceability systems, chain of custody models, and certification programs

Companies use traceability systems to demonstrate the level of traceability that is required for accounting at different scope 3 spatial boundaries (i.e., jurisdiction, sourcing region, LMU, or harvested area). A traceability system is a set of procedures that allows an entity to track and record how specific materials or products move from one entity to another and are transformed throughout their value chain, from production to processing to end use. Traceability systems operate using different types of chain of custody models.

A chain of custody model is an approach taken to control inputs and outputs and transfer specified characteristics within the chain of custody system (e.g., from the LMU[s] where the raw material was produced to the product's end use).¹² This *Standard* recognizes five general chain of custody models used by certification programs: identity preserved, segregation, controlled blending, mass balance, and book and claim. Table 5.2 in the *Standard* describes each model and whether the model can establish physical traceability through a value chain.

Companies applying a jurisdiction spatial boundary (e.g., country, state, or province) are not required to establish physical traceability.¹³ Companies applying more granular scope 3 spatial boundaries, such as a sourcing region, set of LMUs, specific LMU, set of harvested areas, or specific harvested area, must demonstrate physical traceability by implementing traceability systems that apply identity preserved, segregation, controlled blending, and certain types of mass balance chain of custody models that meet the specified criteria in Requirement 8. These chain of custody models provide the highest integrity methods for establishing physical traceability to suppliers:

- **Identity preserved** and **segregation** chain of custody models provide certainty that a specified characteristic is present in a product or material by keeping that material physically separated from other materials without the specified characteristic, as it flows through the value chain. For example, these types of chain of custody models could ensure that a food ingredient was produced organically.

- **Controlled blending** models provide certainty that a known proportion of a specified characteristic is present in a material by tracking the amount of material with the specified characteristic that is mixed with other material without that specified characteristic. This happens at batch-level system boundaries to ensure proportional attribution (i.e., that the assignment of specified characteristics to each of the output materials or products mirrors what was physically blended). For example, if a piece of fabric is attributed with 70 percent of a certain quality of wool through a controlled blending approach, this is the proportion physically present in that fabric.

- **Mass balance** models provide a likelihood that a material contains a specified characteristic. Proportional attribution is not ensured because the amount of material with the specified characteristic is not being tracked within each of the outputs. Instead, the volumes with the specified characteristic entering the system boundary are being tracked over a defined period to assign the specified characteristic to a corresponding volume of outputs from the mix. For example, if a product is attributed with zero land use change emissions, this means that an equivalent amount of product was grown on land with no recent deforestation, and this product entered the same mix. This chain of custody model uses non-proportional attribution because the actual amount of “zero-deforestation” material physically present in the outputs is unknown. Nevertheless, the volume attributed with the zero-deforestation characteristic will not be larger than the volume of product that was produced on lands with no recent deforestation.



The following criteria for mass balance chain of custody models set forth in Requirement 8 are necessary to increase the probability that a material contains a specified characteristic:

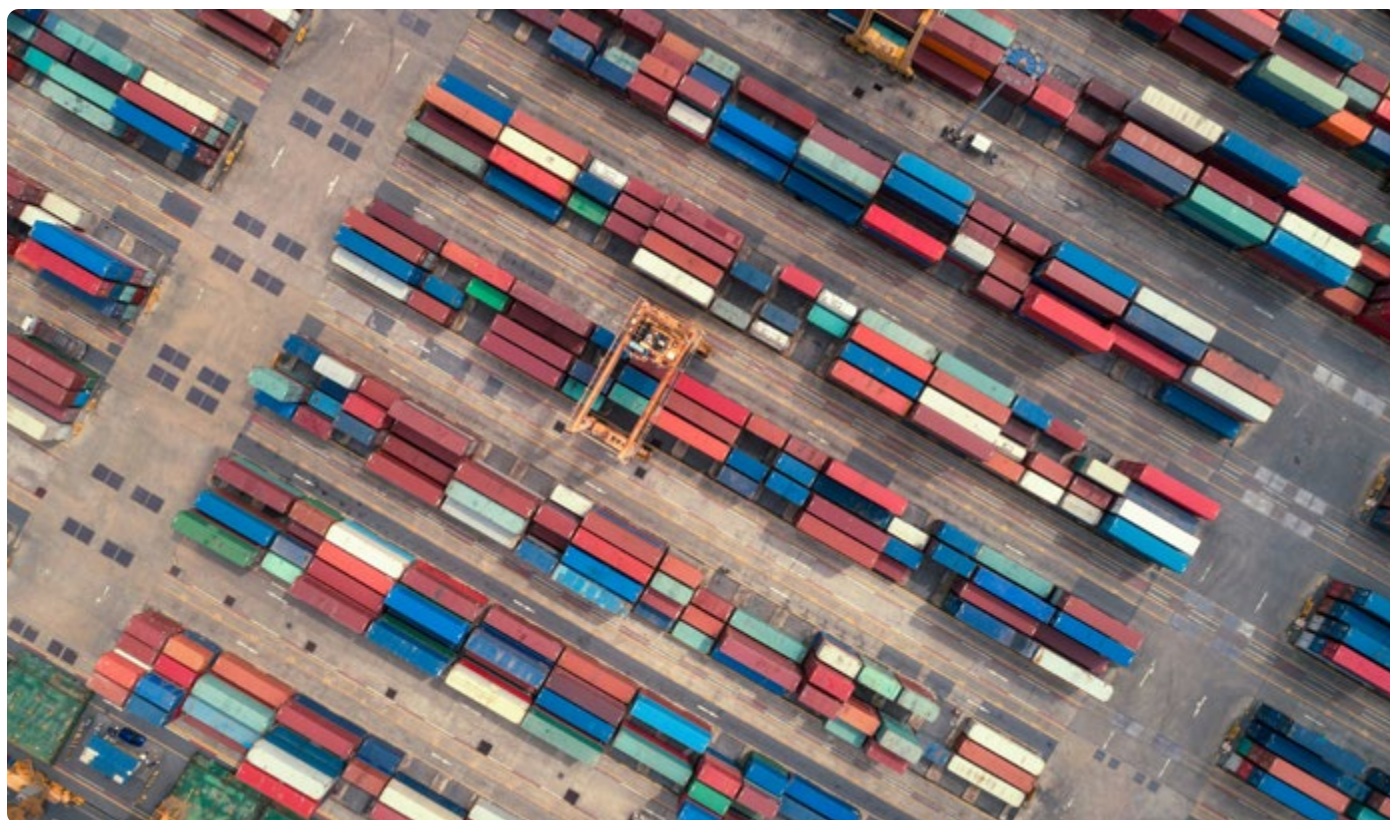
- Tracking volumes of material with specified characteristics that enter and leave defined system boundaries (batch-level, site-level, multi-site, and group-level) ensures there is no over- or undercounting of such characteristics when they are attributed to an output.
- Proportional allocation ensures quantitative specified characteristics are not over- or underestimated in a product or co-product that is part of a system. See the allocation guidance in Section 6.4.5, which can be used to meet this proportional allocation criterion.
- Defining reconciliation periods sets a time frame within which inputs and outputs with specified characteristics are balanced. This increases the probability of attributed characteristics being physically present in the material.
- Multi-site and group-level mass balance models allow for specified characteristics to be attributed across more than one site or facility. Therefore, defining a narrow geographical area for volume reconciliation to occur (e.g., within the same sourcing region and country) increases the probability of a specified characteristic being physically present in a company’s value chain. Exceptions can apply when a sourcing region crosses a border and encompasses more than one country.

Clearly defining these elements within a mass balance model increases the probability of a specified characteristic being present in the value chain of a company. The criteria above can be further strengthened to increase the probability of specified characteristics being present in a product. For example, relevant geographical boundaries and reconciliation periods could be narrowed even further.

Chain of custody model definitions and related terms have been adapted from ISEAL Chain of Custody guidance,¹⁴ which provides more details, definition, and additional guidance for relevant terms (e.g., attribution, proportional attribution, product groups, specified characteristics, system boundary, and volume reconciliation period).

Other forms of mass balance not specified in Requirement 8, and **book and claim** chain of custody models, provide less certainty of a physical connectivity between the final product and the origin of the product or raw materials. Companies can separately account for and report information from such chain of custody models but cannot use such information to support scope 3 accounting within the physical GHG inventory, per the interim traceability requirement.

Certification programs are one option a company can use to implement traceability systems and improve traceability in their value chain over time. For example, a food processing company that sources palm oil can purchase palm oil from certified sources using a mass balance certification program (e.g., Roundtable for Sustainable Palm Oil [RSPO] mass balance-certified sustainable palm oil). The applicability of the specified characteristics tracked by a certification program to GHG accounting depends on the type of information the specified characteristics provide and the chain of custody model used by the certification program. For example, an organic soy certification program can track specific volumes of soybeans that were produced on farms with the specified characteristics of implementing organic farming management practices (e.g., farm operations do not apply prohibited substances and only plant organic seeds); however, those characteristics do not fully determine the specific emissions or removals associated with producing those certified volumes of organic soy.



Another example of how the chain of custody model used by the certification program can impact GHG accounting is deforestation- and conversion-free (DCF) certification, which may provide information on the area (e.g., farm-level polygons) where certified volumes were sourced from. DCF certification programs using an identity-preserved approach can identify the specific farms or plantations associated with certified volumes to support direct land use change (dLUC) calculations, whereas a mass balance approach may have less information on the set of farms or plantations associated with certified volumes, depending on the certification program (see Section 7.4.8 for additional details on using DCF certification programs to inform LUC emissions accounting).

Certification programs should ensure the certification system protects against double counting, particularly for certification based on mass balance models. This can be achieved by ensuring that the quantity of certified volumes with specified characteristics do not exceed the actual production from those locations producing materials with the specified characteristics; having clear reconciliation procedures at each system boundary for how materials with specified characteristics and materials without that set of specified characteristics are attributed to the final outputs; and that exclusivity of the benefits is guaranteed to the purchaser of the certified volumes. Companies that use certification programs are required to report the type of certification programs and chain of custody models used (see the reporting requirement in Section 6.2.2).

Certification programs can also help improve data reliability and verification if the certification process includes data audits. Certification programs may have access to data that can support complete and accurate scope 3 accounting (e.g., data on the category of land conversion, spatial boundaries of LMUs or sourcing regions, and/or emissions factors).

Case study: PepsiCo—Physical traceability

Disclaimer: This case study reflects GHG Protocol guidance and PepsiCo's approach as of August 2025.

PepsiCo is a global convenient food and drinks company guided by its PepsiCo Positive (pep+) vision—a strategic end-to-end transformation that puts sustainability at the center of its business strategy, seeking to drive growth and build a stronger, more resilient future. The GHG Protocol *Land Sector and Removals (LSR) Standard and Guidance* provides guidance for PepsiCo to refine its quantification of land-related emissions and removals and understand how to reflect impacts from its sustainability initiatives in PepsiCo's scope 3 GHG inventory.

Agriculture involves complex supply chains; therefore, the level of physical traceability varies. For example, there is generally better physical traceability for deforestation-risk commodities such as palm oil. For other commodities, such as row crops, establishing physical traceability as defined by the GHG Protocol *LSR Standard* interim requirement on physical traceability is often difficult or impractical. In this respect, PepsiCo currently focuses on having physical traceability to sourcing regions and traceability of impact to specific farms via positive agriculture projects implemented within the sourcing region.

PepsiCo accounts for palm oil emissions at two levels of traceability:

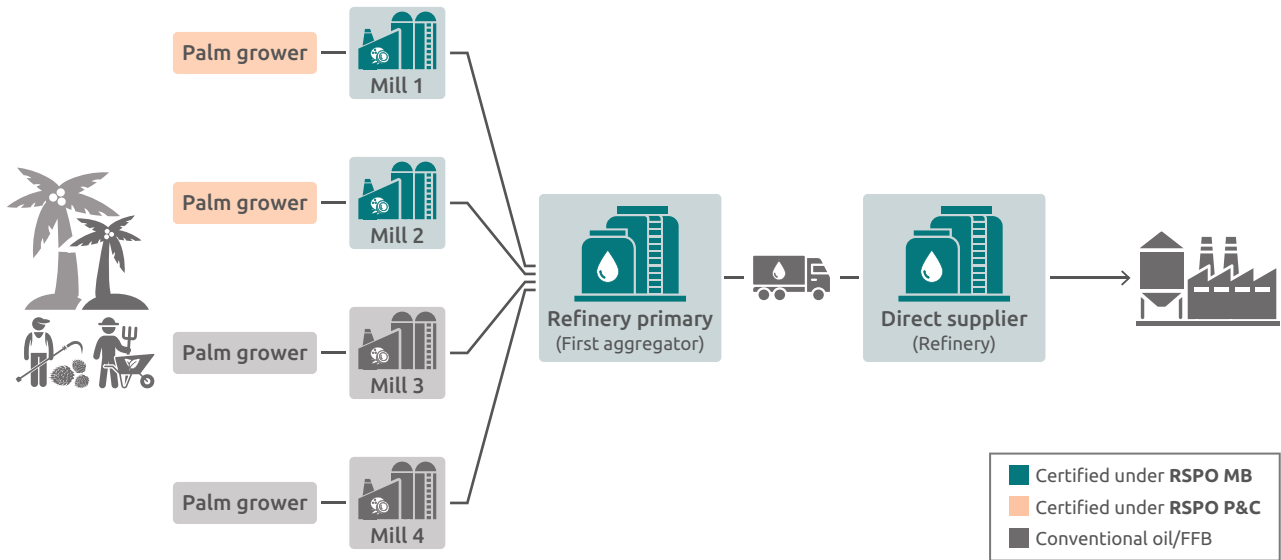
- 1. Traceability to the mills:** PepsiCo strives to achieve this through RSPO mass balance (MB) certification and the collection of the full list of palm oil mills in its physical supply chain.

As of 2024, PepsiCo sources RSPO MB for 99 percent of its palm oil volumes.⁹ At the start of the RSPO chain of custody, certified Fresh Fruit Bunches (FFB) can be sold as physically certified (mass balance or segregated) or book and claim credits. PepsiCo purchases RSPO MB, which requires that when certified and non-certified materials are mixed during processing, only the equivalent volume of certified sustainable palm oil can be sold as MB products. The volume of certified palm oil is reconciled at each site over a defined reconciliation period, meeting requirements for site-level MB physical traceability in this *Standard*.

Case study: PepsiCo—Physical traceability (cont.)

Because RSPO MB certification does not guarantee that a physical final product does not have any deforestation or conversion during the assessment period, PepsiCo also collects the full list of palm oil mills in its physical supply chain mix, which comprises both the certified and non-certified mills. Each mill is then mapped to the national or subnational jurisdiction it belongs to, and PepsiCo accounts for palm oil land use change (LUC) emissions at the jurisdictional level.

Illustration of the palm oil mass balance chain of custody model



Note: Some palm growers are certified under RSPO Principles & Criteria (P&C), while other suppliers further down the supply chain (e.g., mills, traders, refineries) are certified under RSPO Mass Balance (MB). While PepsiCo sources RSPO Mass Balance (MB) for 99 percent of its palm oil volumes, its physical supply chain includes both certified and uncertified materials due to mixing. They therefore established mill-level traceability for their physical supply mix as part of their ambition to strive for deforestation-free sourcing by 2025 and conversion-free sourcing by 2030.^b

2. Traceability to the Land Management Unit (LMU) or oil palm plantation: To address peat oxidation emissions, a major source of emissions in palm oil besides land use change, PepsiCo implements peat management projects. They require the projects to be implemented on plantations that supply to mills within their full mill list.

PepsiCo signs contracts with the landowner and the mill to ensure PepsiCo retains the “right to report” and prevent any erroneous double counting. The landowner and the mill provide attestation to PepsiCo that the mill does not allocate the GHG impacts to any other customer nor include them in the mill-average emission factor. This reconciliation at the mill level ensures no more palm oil is sold as having lower peat emissions than that which comes into the mill, enabling PepsiCo to meet the requirement for mass balance chain of custody to specific LMUs in this *Standard*.

Achieving these levels of physical traceability in palm oil took a decade of industry collaboration, which individual companies could not achieve alone. Industry collaboration will also be needed moving forward to determine where physical traceability is more feasible versus more difficult, and to ensure it is balanced with the resources required to scale adoption of sustainable farming and forestry practices. PepsiCo aims to continue engaging in industry dialogues and collaborations to inform our approach in this space.

Notes: a. The remaining 1 percent comes from smallholder book and claim credits; b. PepsiCo set this ambition in its **Stewardship of Forests and Natural Ecosystems Policy**. High-risk commodities include ingredients and materials at high risk of deforestation and conversion as defined in our **Calculation Methodology**. Systemic challenges continue to be an industry-wide barrier to reaching fully deforestation-free sourcing, but PepsiCo continues striving toward this ambition and expects to reach more than 90 percent by the end of 2025. PepsiCo’s **Stewardship of Forests and Natural Ecosystems Policy** and **Calculation Methodology** are available at [PepsiCo](#). Disclaimer: The GHG Protocol has not reviewed and does not endorse resources shared outside of this text box.


How traceability systems are used to justify the use of primary or secondary data

Traceability systems are used to justify what type of data (i.e., primary or secondary data) can be used to account for the emissions, land occupation, leakage, and so on, attributable to a company’s operations or value chain activities. For definitions of primary and secondary data, and general guidance on selecting and evaluating data, see Section 6.4.

Primary data is needed to demonstrate reduced emissions from the implementation of a specific GHG emissions reduction strategy or value chain intervention, which would not otherwise be captured through secondary data. For example, if a company sources dairy products from a region where some farmers use enteric methane inhibitors, the reporting company would need LMU-level (i.e., farm-level) data for those LMUs on which livestock were fed the inhibitors. This data would allow the reporting company to accurately account for reduced scope 3 emissions using an improved CH₄ emission factor representative of the practice and animal products being sourced from those specific farms.

To report removals due to specific actions in a company’s value chain, the reporting company must establish traceability to the specific carbon pools where the carbon is stored and use empirical data specific to those carbon pools to monitor carbon stock changes over time to ensure that the principles of permanence, accuracy, and conservativeness are met. Chapters 12–14 provide further details on the requirements and guidance for accounting for and reporting removals. Table 5.4 provides additional guidance on the level of traceability required and associated data needed to account for land emissions and removals at different spatial scales.

Table 5.4 Level of traceability and data specificity corresponding to different scope 3 spatial boundaries

Spatial boundary	Level of traceability	Data specificity	Accounting accuracy	Does it satisfy removals accounting requirements?
Global	No knowledge of region of origin or use (i.e., no traceability)	Global average secondary data	Least precise  Most precise	Not eligible for removals accounting
Jurisdictional	To a national (i.e., country) or subnational jurisdiction, or political region of origin or use	Average secondary data representative of attributable productive lands in the jurisdiction		Eligible if sourcing region safeguards and other removals requirements are met
Sourcing region	To the first aggregation point(s) or processing facility (or facilities) of origin or point of distribution for use	Data on attributable productive lands in the sourcing region(s)		Eligible if removals requirements are met
Land management unit (LMU)	To the LMUs of origin or use	Primary data for the specific LMU(s)		Eligible if removals requirements are met
Harvested area	To the fields or forest stands of origin or use	Primary data for the specific harvested area(s)		Eligible if removals requirements are met

Primary data can be distinguished by the position of a given company in the value chain relative to the reporting company. For this purpose, the “tier 1, 2, ... X supplier” nomenclature is useful to describe the position of suppliers and data available from those suppliers, relative to the reporting company within a supply chain.¹⁵ Primary data from a tier 1 supplier refers to data from a company that directly supplies the reporting company. Primary data from a tier 2 supplier refers to data from a company that directly supplies the reporting company’s own tier 1 suppliers. The numbering convention of “tier X suppliers” continues to increase in this way up to the producer of the raw materials within a given LMU or set of LMUs. For example, a company that sells furniture could have primary data from the furniture manufacturer (their direct or tier 1 supplier), primary data from the sawmill that produces the wood products sold to the furniture manufacturer (the furniture company’s tier 2 supplier), and primary data from the forest management company that manages the forest and harvests timber sold to the sawmill (the furniture company’s tier 3 supplier).

Improving traceability by identifying increasing tiers of suppliers back to the original LMUs associated with the production of raw materials can provide reliable primary data. Doing so can enable a company to use more accurate modeling approaches or to apply direct measurements to improve estimates. In some cases, the supplier is known but cannot provide primary data on land emissions, removals, or other metrics. In such cases, the supplier may still be able to provide relevant information regarding production practices, site conditions, site history, and other information, allowing the reporting company to use modeling or hybrid calculation methods based on primary activity data from the supplier combined with secondary emission factors or carbon stock data.

If their suppliers are unknown, the reporting company should work to increase the availability of primary data by identifying their suppliers and, in the meantime, may either use global, national, or regional secondary data to quantify GHG emissions and other metrics (but not removals). Once companies achieve better value chain traceability, they can work to improve suppliers’ ability to provide primary data and improve the quality of such data to better reflect actions or interventions within the value chain of the reporting company.



Endnotes

- 1 This interim requirement will be revisited in future versions of this *Standard* to reflect the outcomes of the GHG Protocol’s workstream on actions and market instruments. The current requirement does not set a precedent for that process and is not a final approach.
- 2 This text includes elements that may change to align with the resolution on forest carbon accounting in future versions of this *Standard*. See Box 9.1.
- 3 This interim requirement is relevant to defining the spatial boundary of agricultural value chains. The approach to account for CO₂ emissions and removals on all forest lands and non-productive non-forest lands is not covered in this version of the *Standard*. See Box 5.1.
- 4 Companies may provide justification where mass balance is applied for a sourcing region that comprises more than one country. Such sourcing regions should be justified based on the sourcing region definition, considering which producers supply raw materials to the first point of aggregation or processing facility (i.e., a global mass balance system does not conform with the sourcing region definition).
- 5 This requirement is for the proportional or non-proportional attribution of specified characteristics within product groups.
- 6 This approach builds on Version 2.0 (2025) of ISEAL’s “[Chain of custody models and definitions](#),” and ISO’s 22095:2020 “[Chain of custody – General terminology and models](#)”.
- 7 For the allocation of specified characteristics between product groups, refer to the “scope 3 allocation recommendations” and “agriculture sector allocation recommendations” in Section 6.3.
- 8 The GHG Protocol’s workstream on actions and market instruments may provide further updates to the definition and how it relates to the GHG inventory and broader GHG report.
- 9 See [FAO FPIC](#) guidance.
- 10 See [Global Indigenous Data Alliance](#) guidance.
- 11 Other programs may use terms other than “sourcing region” to refer to a similar spatial boundary, but which may be defined slightly differently. For example, the Value Chain Initiative (VCI) defines the term supply shed as “a group of suppliers providing functionally equivalent goods or services within a fixed and spatially defined area that is demonstrably part of a company’s supply chain. The supply shed includes all suppliers within designated boundaries, regardless of their practices or segmentation” (VCI, 2025). For a supply shed to be considered a sourcing region, it needs to supply to a first point of aggregation or first processing facility in the value chain and include all attributable productive lands within the relevant spatial boundary.
- 12 Adapted from ISEAL Alliance (2025).
- 13 If a company sets a scope 3 spatial boundary at a more granular subnational political boundary (e.g., a county, municipality, etc.), companies should treat this as a sourcing region scope 3 spatial boundary and meet the corresponding physical traceability requirements (see Section 5.4.2 and Table 5.1).
- 14 ISEAL Alliance (2025). This ISEAL guidance was revised in 2025, with input from stakeholders that included the GHG Protocol.
- 15 Note that the tier system to describe suppliers, although it uses the same terminology, is distinct from the “Tier 1, 2, 3” system employed by the IPCC to classify quantification methods (see Section 6.4.3.1 for discussion). The tier system used by the IPCC describes calculation approaches by their level of methodological complexity, data requirements, and accuracy. A Tier 1 method is a relatively simple calculation approach, requiring less data, but produces estimates with larger uncertainty ranges. A Tier 3 method is more complex and data intensive, but produces estimates with relatively reduced uncertainty ranges. Note that the IPCC tier terminology can also be used to describe emission factors or other outputs of the calculation method (e.g., “Tier 2 emission factor”).

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