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Ahold Delhaize – carbon footprint of fruits, vegetables, and mushrooms v3.0

Frequently asked questions about the data
collection form



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About Blonk Consultants

Blonk Consultants is a leading international expert in food system sustainability, inspiring and enabling the agri-food sector to give shape to sustainability. Blonk's purpose is to create a sustainable and healthy planet for current and future generations. We support organizations in understanding their environmental impact in the agri-food value chain by offering advice and developing tailored software tools based on the latest scientific developments and data.

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Introduction

Ahold Delhaize, a supermarket chain, is striving to reduce its Scope 3 greenhouse gas (GHG) emissions (or “carbon footprint”) by 15% before the year 2030. Scope 3 emissions encompass emissions that occur at the stage of their suppliers. To achieve this, Ahold Delhaize would like to get insight in the carbon footprint of the cultivation stage of fruits, vegetables, and mushrooms.

To create a carbon footprint, grower’s input data will be collected via an online form. This document provides an overview of Frequently Asked Questions (FAQ) about the use of this online data collection form.

What if my question does not appear in the document?

This FAQ document is not complete, and it will be updated based on issues that arise during the use of the data form.

When you have a question that is not answered in this document, you are invited to forward your question to your service provider. In collaboration with Blonk Consultants, your service provider will process the question and add it to this FAQ.



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1. General questions

1.1 Which data should I collect?

In the data collection form, the following data points will be put forward:

- H2: Surface area of land plot/greenhouse/mushroom farms
- H3: Yield (weight);
- H4: Percentage to Ahold Delhaize;
- H4: Fertilizer application (amount and type);
- H5: Growing media (amount and type);
- H6: Electricity consumption (amount and type);
- H7: Fuel consumption (natural gas); and
- H8: Diesel consumption (by grower and subcontractors)

Not all data points are relevant for all cultivation types. To indicate: a mushroom grower does not use any diesel, and a fruit orchard does not apply growing media. In the online data collection form only questions relevant to your type of cultivation will appear.

1.2 What is the time frame and year for which the datapoints are relevant?

The data collection form considers the most recent whole production year. The most recent production year can be the same as the most recent calendar year, for example January 2021 up until December 2021. Some crops are not cultivated in strict accordance with a calendar year. For example, the most recent production year could have started in October 2020 and ended in September 2021. Ultimately, the most important thing is that data should be filled in for 12 subsequent months.

Moreover, some crop cultivation cycles do encompass 12 months. For instance, mushrooms are cultivated in subsequent cycles. Each cycle's duration is a few weeks, therefore, there is no exact beginning and ending of the production year. In that case, data should still be filled in for activities that took place in 12 subsequent months.

1.3 What should I do if my crop/variety is not in the options?

Not all crops and varieties are available in the list of the data form. Choose the crop or variety that is closest. Provide in the comment section at the last page what was your choice.

1.4 What should I do if the data point is in a different unit than in the form?

Find the correct conversion factors and calculate the value in the unit indicated in the form. Frequently used conversion factors for specific data points are described in the following chapters.

1.5 What is calculated in accordance with my data?

A carbon footprint will be calculated. The carbon footprint provides insight in how and how much crop cultivation contributes to climate change, also known as global warming.

1.6 When will I receive the carbon footprint results?

The online data collection form collects company data. You will not receive the results directly after filling in the form. The data will be processed using LCA software to determine the carbon footprint. Blonk Consultants will share the results with your service provider. Your service provider will forward the results to you.

1.7 Who has access to my data?

The data will be processed by Blonk Consultants, and the data will be accessible to your service provider for gaining insight. The data will be used for calculating the carbon footprint only. The data will not be shared among other growers/farmers, neither with other service providers, nor with Ahold Delhaize. Blonk Consultants and your service provider are not authorized to share your data with a third party or publish in public.

1.8 How will the carbon footprint results be used?

The goal of the project is to develop a systematic and scalable data collection for calculating the carbon footprint of potatoes, vegetables, fruit and mushrooms. The carbon footprint results will provide more insight in the contribution to climate change of various cultivation practices.

There will be no evaluation of the input of the data. Per service-provider CO₂-footprints will be calculated based on the aggregated results of all associated producers/growers. This will provide a starting point for monitoring and reducing the CO₂-emissions in the future

Prior to the upscaled data collection and carbon footprint calculation, it is not known what kind of and where reduction measures need to take place. Reduction measures will be designed after gaining insight in the summed carbon footprint.

1.9 How can I save my information?

After sending the data form, you will receive a PDF including your answers at the e-mail address you have provided. The filled in questions can also be saved PDF within the data form via the print icon (top right on the screen). Note that the document will be saved including all questions that are not requested or irrelevant to your questions. You can use this option to view your filled in information at a later stage, or to finish the form at a later stage.

1.10 What is the definition of terminology used in the data collection form?

Within the data collection form, several terms are used. Table 1 provides a term definition.

TABEL 1. TOELICHTING OP DE GEBRUIKTE BEGRIPPEN IN HET VRAGENFORMULIER.

Begrip	Toelichting
Type of cultivation	The form distinguishes four different types of cultivation: crops cultivated in orchards, crops cultivated on the open field, crops cultivated in greenhouses and mushroom farms. Other types of cultivation (e.g. in tunnels) are not part of the form.
Crop	Multiple kinds of crops exist. Each crop has specific cultivation requirements and a varying yield range. Examples of crops and their associated type of cultivation are pears (orchard), potatoes (open field), tomatoes (greenhouse) and mushrooms (mushroom farm).
Variety	In the form, varieties of crops are considered. A crop variety might be distinguished based on a different name of different cultivation requirements. This will be explained using a few examples. The crop 'tomato' exists in several varieties, two of them are 'cherry tomato' and 'roma tomato'. It is not required to distinguish varieties of 'cherry tomato', because it is assumed that cherry tomatoes have similar cultivation requirements and all cherry tomatoes are sold as 'cherry tomatoes'.

The crop 'leek' exists in several varieties, however, they are not sold under different names. Therefore the data collection form does not include varieties of leek.

1.11 Why are some questions repeated?

Data will be captured in different levels: per variety, per crop or per company.

Some questions are automatically specified within a certain, dedicated level. For example, the weight and yield of crops will be requested per variety (or per crop, when varieties are not important). For other data points there will be an inquiry to the level detail the data is actually known or available. Among companies this might differ. Some companies are able to indicate the exact amount of kWh used for a specific type of crop, because of advanced equipment, whereas for other companies their total consumption is available.

Questions that fit the variety or crop level, will be repeated for every variety and crop. Questions regarding energy sources (such as electricity, natural gas and diesel) will always be requested at company level but can optionally be requested per crop or variety. If the information per crop or variety is known, a specific carbon footprint will be calculated.

1.12 Why are certain numbers of questions skipped?

The questions are numbered. The answers to the questions determine which follow-up questions appear. The questions that are not relevant as a follow-up will be skipped. For this reason, it might seem as if certain numbered questions are skipped, but that is not an issue.

1.13 What if my company holds multiple locations?

When your company holds multiple locations there are two options:

1. Fill in the data form multiple times: one for each location. Specify the geographic location within each form.
2. Fill in the data form once and include all locations. Specify the geographic locations within the form. When you are filling in the data, add up the numbers of the different locations in scope.

You can fill in the form according to your preference. This preference might be based on the way your company holds track of administration of in- and outputs.

1.14 What should I do if I have multiple varieties of one particular crop?

It is possible that you produce multiple varieties of one crop. For some crops, it is possible to fill in the data form per variety separately. If this is impossible for your crop, fill in at each question the total value for all varieties of the crop from the last production year. See the yellow box for an example.

Example

You produce two varieties of apples: Elstar en Jonagold.

- The netto production for Elstar is 10 tonnes.
- The netto production for Jonagold is 20 tonnes.
- The fertilization for Elstar is 50 kg N
- The fertilization for Jonagold is 80 kg N

For questions regarding netto production, fill in the total value: $10+20 = 30$ tonnes. Questions regarding fertilization, fill in the total fertilization, so $50+80 = 130$ kg N.

2. Data point: land occupation

2.1 What is meant by cultivated land occupation?

In the form, the cultivated land occupation per crop or per variety is requested. The land occupation is defined as the total surface area / land plot on which the crop/variety is cultivated. If the cultivated land occupation is requested (for example for open field), then this is regarding the total surface that is used for the last production year for the crop. In the case of a land plot of 3 hectares that is used continuously during the last production year with two number of crop rotation, the total cultivated are is 6 hectares.

2.2 What is the unit of land occupation?

The requested unit for land occupation is designated in the question, and it depends on the type of cultivation. The cultivated land occupation of land plots is requested in hectares (ha), whereas for greenhouses and mushroom farms the land occupation is requested in square metres (m²). The units can be converted to one another: 1 ha = 10 000 m².

2.3 What do I do if I have produced multiple crops/varieties alternating on the same land?

Some crops/varieties have a shorter production cycle than one year, such as cabbage or lettuce. In this case, one land plot is used multiple times alternating the type of crop/variety. Information regarding the cultivated land is requested for the open field and the greenhouse. If there are multiple rotations for the same or varying products on one plot of land, then the total cultivated land will be bigger than the surface of the land plot. Sum up per product the cultivated land from the different rotations to calculate the total cultivated land of the last production year.

3. Data point: yield

3.1 What is meant with yield?

The yield of a crop or variety is the weight of the production that is measured when the products leave the producer. This is the weight **after** potential drying or cutting of the product. The system boundary is 'cradle-to-farmgate' and the carbon footprint will be calculated for the (fresh) product by the producer.

The yield of a crop differs per season. In the data form, the total values of a full production year is requested and therewith an average carbon footprint is calculated for the entire year. Additionally, no distinction is made between different seasons.

In some cases, the yield varies per crop per year. For example, at an orchard, the yield during the nursery state is different than in the steady state. The calculations for one product for the carbon footprint include one entire production year. The carbon footprint of one product can vary year by year, for example, due to droughts in one year or because of the age of the orchard.

3.2 What unit should I use for the yield?

The requested unit is expressed in the question, and this depends on the type of cultivation. The yield always entails the mass weight, at the moment the products leave the company of the producer. It can be expressed either in kilogram (kg) or tonnes (ton). These units can be converted. 1 ton = 1,000 kg.

3.3 What is the netto production in case of processed products?

It could occur that processing occurs after the production facility, for example the pressing of oranges to produce fruit juices. In this case, the data form still requests the total yield of the fresh product of an unprocessed orange. For this information, the carbon footprint is calculated. To illustrate, for 1 kg of orange juice, 3 kg oranges are required, and the carbon footprint for 1 kg of fresh unprocessed oranges is 2 kg CO₂e. Then the carbon footprint for 1 kg orange juice, is the same as 3 kg of fresh oranges, which is 6 kg CO₂e. The conversion factor from fresh to processed needs to be calculated by hand. In the example, the factor is 3. Additionally, for calculating the carbon footprint for the processed product, extra emissions from energy consumption or transport, should be included.

4. Datapoint: percentage Ahold Delhaize

4.1 What is meant with percentage of the total netto production?

The data form requests information on the activities of your company. This includes crops and varieties that are sold via a service provider to Ahold Delhaize. Some information is not per crop available and will be requested at company level (e.g. annual account of the electricity consumption). To correctly divide the information, an estimation of the product on the share of the company for the data form is required. In order to do this, a percentage is requested of the total yield that filled in for this form.

To illustrate: you produce products A (10 tons), B (30 tons) and C (60 tons). From product A (10 tons) the total yield goes to the service provider from Ahold Delhaize, for product B (15 tons) half of it, and nothing for product C (0 ton). In this case, you fill in the form for product A and product B. Thereby, you fill in the total value for each product: 10 tons product A and 30 tons product B. The total energy consumption will be requested for the entire company. This energy will be divided on the basis of the percentage of the total production for which you fill in the form. The example is regarding the total production of products A and B in relation tot the total production of your company: $40\% = (10 \text{ tons} + 30 \text{ tons}) / (10 \text{ tons} + 30 \text{ tons} + 60 \text{ tons})$.

4.2 Why is the percentage Ahold Delhaize per crop/variety requested and also of the entire company?

In question 8c the percentage for which this form is filled in is requested for the entire company. This is to allocate the data points at company level (for electricity or diesel) to the products that are sold to Ahold Delhaize (via a supplier or trading company).

Further on in the data form, the percentage for Ahold Delhaize is requested again for the crops/varieties. This is regarding the percentage for Ahold Delhaize of the total yield of a specific crop/variety. This percentage is necessary for the data points at company level (for electricity or diesel) and at crop level (for fertilization) to designate correctly for specific varieties. The percentage of Ahold Delhaize of specific varieties can deviate from the percentage for Ahold Delhaize at company level.

For example, a grower with 5 products (A, B, C, D, E) can produce 80% of the total company activities for Ahold Delhaize. At product level, the percentage for Ahold Delhaize is 100% for the products A, B, C, D, because the total production is for Ahold Delhaize. And 0% for product E since it is produced for a different supermarket. For product E, the grower does not need to fill in the form. By filling in 80% as a company percentage in combination with a product percentage of 100% for the products A, B, C, D, it provides a clear overview that besides the products filled in on the form, there are more company activities. This makes it possible to divide the total diesel consumption over the various products.

5. Data point: fertilization

5.1 What is meant with fertilization?

To determine the carbon footprint the total nitrogen input (kg N) originating from organic and synthetic fertilizer is requested. In addition, when relevant, carbon-dioxide fertilization is requested too.

5.2 What unit is used for fertilization?

The requested unit appears in the question and depends on the type of cultivation. For organic and synthetic fertilizer, the unit is frequently in total kilogram nitrogen (kg N).

5.3 What CO₂-fertilization should I include?

CO₂-fertilization can be applied in greenhouses. Some greenhouses use their own Combined Heat and Power plant (CHP), which emits CO₂ directly in the greenhouse as a fertilizer. The CO₂ from the reused from the CHP should not be filled in at the fertilizer section to prevent double counting. Provide at fertilization **only** the amount of CO₂ which is purchased **besides** the CO₂ from the CHP.

6. Data point: growing media, compost, and casing soil

6.1 What is the definition of growing media, compost, and casing soil?

Some crops are cultivated on growing media, compost, or casing soil. To determine the carbon footprint it is important how much peat was used, as growing media or casing soil. For that reason, the use of growing media/casing soil **with and without** peat will be distinguished. For the greenhouse production, only the amount of growing media with peat is requested. In the case of mushrooms farms, per crop the amount of substrate, compost and casing soil is requested per type of crop.

6.2 What is the unit of growing media and casing soil?

The requested unit appears in the question and depends on the type of cultivation. The volume might be requested in cubic meter (m³), and the mass might be requested (e.g. in kilogram, kg or ton).

7. Data point: electricity consumption

7.1 What does electricity consumption involve?

Electricity consumption (in kWh or MWh) that is related to company activities is requested. This includes all activities regarding the production including cooling, sorting, and processing of the products at the company. Electricity consumption for private use or housing of subcontractors does not need to be accounted for. It is allowed to subtract electricity consumption for private use/housing of subcontractors if your private home/housing of subcontractors is located on the company terrain.

7.2 What is the unit of electricity consumption?

Electricity consumption is requested in kilowatt-hour (kWh) or megawatt-hour (MWh).

7.3 Where can I find my total electricity consumption?

The total electricity consumption is specified on the annual account sent by your energy provider.

7.4 How should I take electricity consumption for private use into account?

See 7.7.

7.5 How should I take electricity consumption for housing of subcontractors into account?

See 7.7.

7.6 I generate electricity using solar panels or wind mills. How can I take that into account?

Self-generated green electricity will be requested separately from to electricity **consumption**. For self-generated electricity, fill in the total amount of kWh that was generated using solar panels or wind mills. The total amount of self-generated green electricity might exceed total electricity consumption.

7.7 How should I take company-specific electricity consumption into account?

The relevant data for electricity consumption encompasses electricity consumption that is solely related to company-specific activities including cooling, sorting, and processing of products. This excludes private use or housing of sub-contractors. To indicate:

- Total electricity consumption of my company and all housing is known in kWh.
- My private home is located on the company terrain.
- There are (temporary) housing facilities for sub-contractors.

Information about electricity consumption for households is available at

<https://www.nibud.nl/consumenten/energie-en-water/>.

Example

Your household exists of two members and your private home is on the same site where your company is located.

- During a period of one month 8 members of sub-contractors live on site.
- There are no separate electricity meters available.
- According to the NIBUD the total usage for 2 people is 1800 kWh per year.
- According to the NIBUD the total usage of 4 people is 3940 kWh per year.
 - This is equal to 7880 kWh for 8 people for one year.
 - This is equal to 657 kWh for 8 people for one month.
- The total measured electricity consumption of the entire company, including private consumption, and (temporary) housing is 20.000 kWh per year.
- The total electricity consumption of the company is calculated by deducting the private consumption and the temporarily residency consumption from the total consumption.
- $20.000 \text{ kWh} - 1800 \text{ kWh} - 657 \text{ kWh} = 17.543 \text{ kWh}$
- In the form, fill in the total consumption of the company: 17.543 kWh.

8. Datapoint: natural gas consumption

8.1 What is defined as natural gas consumption?

This concerns the natural gas consumption (in m³) that directly is connected to the company activities. Other natural gas consumption (for example private consumption or housing of sub-contractors) is not requested and can be deducted from the total.

8.2 What is the unit of natural gas consumption?

The natural gas consumption is requested in cubic meter (m³).

8.3 Where do I find my total natural gas consumption?

This is written in your annual statement of your natural gas supplier.

8.4 How should I take natural gas consumption for private use into account?

See 8.6.

8.5 How should I take natural gas consumption for housing of subcontractors into account?

See 8.6.

8.6 How should I take company-specific natural gas consumption into account?

Solely the natural gas consumption that is directly linked to the company activities should be filled in. This excludes the private consumption and potential consumption from residency of staff members. To illustrate:

- The total natural gas consumption of my company and all housing together is known in cubic meter (m³).
And/or I live on the same site as my company
- And/or there is a (temporary) housing for sub-contractors

Information about electricity consumption for households is available at <https://www.nibud.nl/consumenten/energie-en-water/>.

In the example below, there is only private consumption and no temporary residency. In question 7.7 there is an example that illustrates temporary residency of staff members.

Example

- My private home is a detached house and no subcontractors live on site.
- According to the NIBUD, your total natural gas consumption of a detached house is 2.050 m³ per year.
- The total measured natural gas consumption of the entire company, including private consumption, and (temporary) housing is 10.000 m³ per year.
- The total natural gas consumption of the company is calculated by deducting the private consumption and the temporarily residency consumption from the total consumption.
 $10.000 \text{ m}^3 - 2.050 \text{ m}^3 = 7.950 \text{ m}^3$.
- In the form, fill in the total consumption of the company: 7.950 m³.

8.7 What data should I fill in regarding CHP?

Greenhouses could use a combined heat and power plant (CHP) to generate heat and electricity. If you indicate that you use a CHP in the greenhouse some questions appear regarding the CHP numbered K4a to K4f. Here you fill in the information regarding the CHP, including when you partly do not use the heat and/or electricity for the greenhouse (but for external usage or another part of the company).

First, questions regarding the natural gas and/or biogas input of the CHP are requested (questions, K4a, K4b and K4c). The total gas input is required to calculate the total emissions from the CHP. Subsequently, the amount of generated heat is requested (questions K4d) and the amount of electricity (questions K4e) that is generated by the CHP and next is sold to external companies. The amount of sold energy is necessary to calculate the share of the total emissions of the CHP that are allocated to private use in the greenhouse. Finally, the amount of CO₂ is requested that is purchased besides the CHP production, and that is used for the fertilization of crops (question K4f). Only the extra emissions for the purchased CO₂ are included and not the CO₂ generated from the CHP, to avoid double counting.

9. Data point: diesel consumption (diesilverbruik)

9.1 What is defined as diesel consumption and what does it involve?

The relevant data for diesel consumption encompasses diesel consumption that is solely related to company-specific activities. This includes diesel consumption of sub-contractors performing specific company-related activities (e.g. spreading manure). Diesel consumption for private use does not have to be reported.

9.2 What is the unit of diesel consumption?

Diesel consumption is requested in Liters (L).

9.3 How should I take diesel consumption for private use into account?

See 9.5.

9.4 How should I take into account diesel consumption of sub-contractors?

See 9.5.

9.5 How should I take company-specific diesel consumption into account?

The relevant data for diesel consumption encompasses diesel consumption that is solely related to company-specific activities. This includes diesel consumption of sub-contractors. In case you rent a ploughed land plot, you include the diesel consumption of the sub-contractor. This excludes diesel consumption for private use. The data form requests the total diesel consumption in two parts: (1) the diesel consumption for activities by the producer and (2) the total diesel consumption for activities by sub-contractors. To indicate:

- The total amount of diesel purchased in litres (l) is known.
- I live at the same location as my company and use diesel for driving a car.
- A subcontractor is responsible for some of the on-farm activities (e.g. spreading of manure)

Example

- Retrieve the total amount of diesel that was purchased via the company.
 - For example, this might be 5000 L diesel.
- Estimate the amount of diesel that was destined for private use.
 - For example, 2000 L diesel was used to drive a car
- Estimate the company-specific activities performed by your sub-contractor. Are the activities similar to the activities that you perform yourself? How much diesel do you use for them?
 - For example, 100 L diesel is used to sow crops, this is similar to spreading manure. The spreading of manure is in total executed 5 times by the sub-contractor and is estimated at 500 litre diesel.
- In the form, fill in the diesel consumption in two parts:
 - Diesel consumption by the producer: 3.000 litre (= 5.000 litre - 2.000 litre).
 - Diesel consumption by the sub-contractor: 500 litre.

9.6 How do I divide diesel over multiple locations?

In the case of multiple locations there are two options:

1. You fill in the form for all locations and then the total diesel consumption doesn't need to be split over multiple locations. By filling in the form for all crops at different locations, the calculation model on the background will distribute the diesel consumption accordingly. In case the diesel consumptions is available per product, the data form provides the option to fill in the value per product.
2. You fill in the form per location separately. For each form, indicate as specific as possible the diesel consumption per location. This estimation can be made by splitting the diesel consumption on the basis of the total cultivated land per location or on the basis of the number of hours per location.

10. Other questions

10.1 Which information should I include on the CHP?

See chapter 8 on natural gas consumption.

10.2 Why is water consumption not requested?

Water consumption plays an important role in crop cultivation. Water consumption is influenced by and influences water scarcity and availability within a country. In addition, it affects the habitats of wildlife. Water consumption is not requested, because it does not influence the carbon footprint of a crop. Therefore, it is out of scope of this project.

10.3 Why is the use of pesticides/herbicides not requested?

The use of chemical and biological pesticides/herbicides is an important aspect of crop cultivation. It influences the quality and toxicity of land and water sheds in which they accumulate. Flora and fauna are affected by high toxicity levels. The use of pesticides/herbicides is not requested, because it does not affect the carbon footprint (it does not contribute to global warming). Therefore, it is out of scope of this project.

10.4 What are points of attention while filling in the form?

In the data form, several data points are requested in different units. It is important that each data point is filled in with the correct unit, so that the carbon footprint is calculated accurately. Below several points of attention are presented:

- Be aware of the units that are requested. For example, the annual bill of your energy company is provided in kilowatt hour and in the data form the energy consumption is requested in megawatt hour. In this case, it is important to convert the value from kilowatt hour to megawatt hour, then the filled in data can be processed correctly.
- The data form requests the total value of the entire last production year. If you have multiple varieties of one crop, provide the total sum of all varieties. For example, if you produce from the crop 'apples', the varieties 'Elstar' and 'Jonagold', then provide the sum of the amount of fertilizer for both 'Elstar' and 'Jonagold'. The total sum should be filled in.
- Some questions request the total amount of kilogram and not the amount of kilogram per hectare. For example, the input for fertilization is the total nitrogen dose kilogram N applied during the last production year. This is indicated in the question.
- After some questions, a control question is added to check if the previous answers are filled in with the correct unit. Read this questions carefully to determine if the calculation model will use the correct values to determine the carbon footprint.

10.5 How is carbon storage used?

For calculating the carbon footprint, carbon capture is not included. This is regarding biogenic CO₂ that is part of the short carbon cycle and according to the guidelines of the European Commission cannot be accounted for. The CO₂ captured by the tree/plant is released again after the release of the fruits or after cutting of the trees. These biogenic CO₂ emissions are equal to the uptake of CO₂ by the plant, which crosses each other out in the total carbon footprint. Below you find an elaborate explanation.

Explanation carbon storage

To calculate the 'carbon footprint' all emissions (among which are CO₂, N₂O and CH₄) that contribute to climate change are recorded. Climate change is an irreversible proces. By the International Panel of Climate Change (IPCC) a number of scenarios are analyzed, in which the effects on the living environment are included. In general, a timeframe of 100 years is used as a reference for the influence on our living environment and the effect of emissions. The following explanation is based on the impact assessment method of ReCiPe 2016 (Huijbregts et al., 2016). A method that is widely used for calculating environmental impact.

Carbon storage in biomass and in the ground

For calculating environmental impact, a distinction is made between biogenic and fossil CO₂ emissions. Biogenic CO₂ emissions are part of a short carbon cycle. A plant takes up CO₂ from the air and captures – partly stores it in its own biomass and partly in the ground. At the moment that the plant (for example a one-year crop) is harvested, the carbon that was stored is released. When it is a perennial plant, it could store CO₂ for longer (such as a tree). When the tree is cut, the CO₂ storage will stop, and due to disruption of the ground, this will also release CO₂.

According to the Product Environmental Category rules (PEFCR), guidelines created by the European Commission (European Commission, 2018), capturing carbon within *biomass* can only be included when the tree is at least 100 years old. When the tree is younger, the carbon cycle is too short. According to the PEFCR inclusion of carbon capturing in the *ground* is only allowed as attachment of the study if there is a guarantee that the ground (for instance, an orchard) remains unchanged for 100 years. For example, if the carbon is released after 15 years because the trees are cut, then these emissions should be included in the carbon footprint. The CO₂ that is stored in the fruits and in the parts of the tree that are cut, is released annually as biogenic CO₂ emissions.

Land transformation (Land Use Change)

This is regarding CO₂ emissions released when a forest or permanent grassland is transformed with a different type of land. Because the vegetation is removed, earlier captured CO₂ is released. Land transformation should be included as part of the carbon footprint. When a producer can guarantee that the land is not transformed in the last 20 years (PEFCR and PAS2050 (BSI, 2011)), no extra emissions need to be added for land transformation.

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