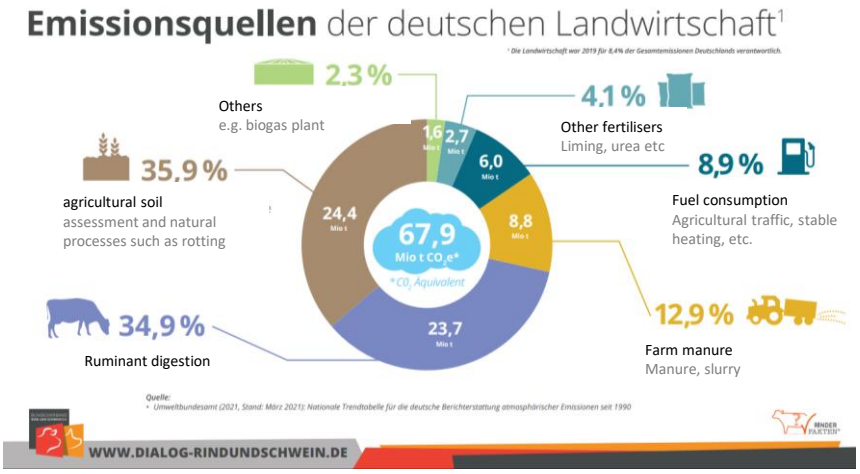
KLIMACO

CO_2 and methane

Calculation of GHG balances

The topic of climate change and greenhouse gases (GHG) is becoming increasingly important in politics, trade and society. The German government's Climate Protection Act states that every sector should make a contribution to climate protection.

This also applies to agriculture, which is responsible for around 9 % of greenhouse gas emissions in Germany. The largest share of agricultural emissions comes from animal husbandry and agricultural soils. This means that it is not one of the main polluters, but still makes a contribution. In the future, milk processors and retailers will therefore increasingly require proof of their farm-specific GHG emissions, a so-called carbon footprint of the milk supplied.



Benefits of individual farm climate assessments

- ✓ The detailed breakdown of GHG sources in the production processes can reveal important levers for reducing GHG emissions in dairy farming. → Identify options for action both at individual farm level and at agricultural policy level.
- ✓ Benefits for farmers: Most climate protection measures also pay off for the farms. Climate balances make it possible to show management strategies that have a negative impact on the climate and those that are climate-friendly, and provide solid facts for media and politics.
- ✓ Climate protection benefits: Ensured greenhouse gas reduction potential

Requirements for sound greenhouse gas calculations:

1. scientific calculation principles
2. practical calculation tool
3. networking with agriculture

→ Sum of GHG emissions from the entire production chain (e.g. also GHG emissions from imported feed, fertilizer production, etc.) to the produced quantity..

Cofinancé par l'Union européenne
Fonds européen de développement régional (FEDER)
Von der Europäischen Union kofinanziert
Europäischer Fonds für regionale Entwicklung (EFRE)

KLIMACO

CO_2 and methane

How can greenhouse gas emissions in agriculture be calculated?

GHG sources:

- GHG emissions arise along the production chain in the manufacture of resources, through the combustion of fossil fuels in agricultural machinery and buildings, and in particular through biochemical processes in animal and plant production. A distinction is made between direct, indirect and precursory emissions (see table).

Direct emissions	Indirect emissions	Precursory emissions
N2O emissions from fertilization	N2O emissions due to leaching from fertilization	CO2 eq. emissions from the production of inputs (e.g. mineral fertilizers, animal feed, energy sources, etc.)
N2O emissions from root and crop residues and by-products remaining in the field	N2O emissions from NH3 and NO losses (deposition of reactive nitrogen)	CO2 eq. emissions from the use of fossil fuels
CH4 emissions from the digestion of animals and farm manure	N2O emissions due to leaching from root and crop residues as well as by-products remaining on the field	CO2 eq. emissions from restocking/addition of animals
CO2 emission from carbonate-containing fertilizers and urea fertilization		

Greenhouse gas emissions

- Carbon dioxide (CO2) from the use of fossil fuels such as oil or coal.
- Methane (CH4) from the digestion of ruminants.
- Nitrous oxide (N2O) through conversion processes following nitrogen input into the soil.
- Different starting points for climate protection measures

- All these gases have a varying effect on global warming.
- To make the effect of these different greenhouse gases comparable, the so-called "Global Warming Potential" (GWP) was developed.

CO_2 - Äquivalente

- The GWP compares the climate impact of a greenhouse gas over a fixed period of time with that of CO2. E.G.: CO2 = 1, methane= 25, nitrous oxide= 298.
- The effect of the various greenhouse gases can be translated into CO2 using this tool - into so-called CO2 equivalents. The greenhouse gases can now be compared with each other.

Yearly balance

- To be able to draw up an annual balance, long-term processes are related to the crop: The effect of fertilizers, pre-crop and post-crop effects, as well as emissions from root and crop residues and by-products left on the field, such as straw, have to be added to the stand responsible for their occurrence, even if the effect is spread over several years.

Greenhouse gas reduction

- By knowing where exactly emissions occur in agricultural production and how high they are, the biggest levers for greenhouse gas reduction can already be identified.

Cofinancé par l'Union européenne
Fonds européen de développement régional (FEDER)
Von der Europäischen Union kofinanziert
Europäischer Fonds für regionale Entwicklung (EFRE)

KLIMACO

CO_2 and methane

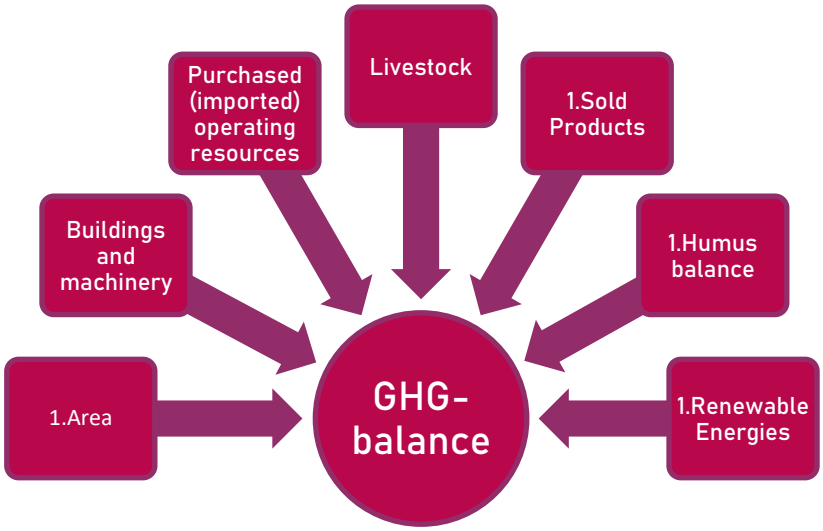
What is a GHG balance?

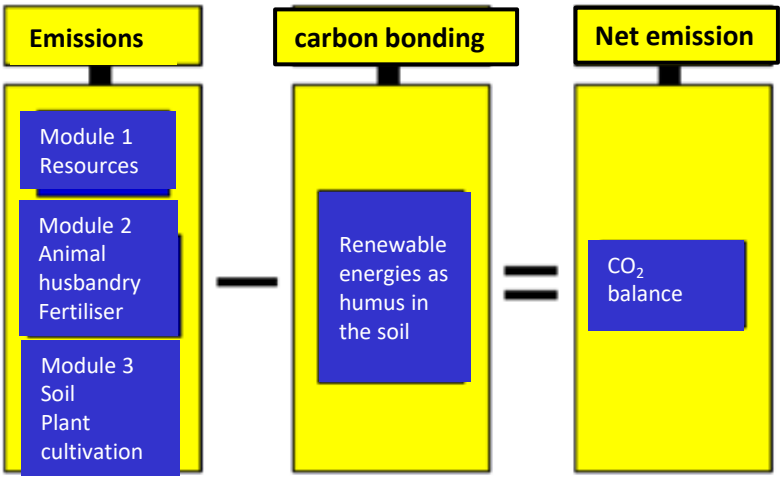
- The direct and indirect GHG emissions at the operational level as well as the GHG emissions of the upstream chain are calculated. In addition to the emissions, C storage and renewable energies are mapped.
- Based on this, the climate impact is shown.
- For a GHG balance, the GHG sources and - if available - GHG reductions must be identified and the emissions quantified.
- The production of food generates GHGs along the entire production chain. This can happen, for example, directly on the farm through the consumption of diesel or upstream, for example, through the energy-intensive production of nitrogen fertilizers. All GHG emissions that occur during the production of a product are taken into account in the GHG assessment.

Components of a GHG balance

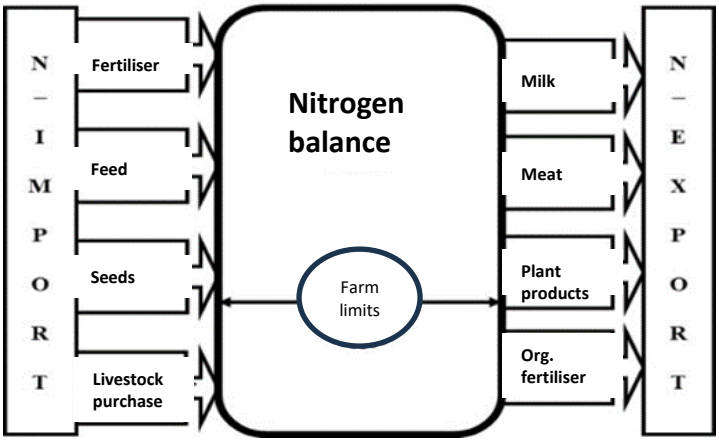
To prepare a GHG balance, information is needed on the following areas :

1. Farmed area (size, crops, yields and their use, tillage, fertilization, C storage).
2. Livestock (size, inflows/outflows, type of husbandry, manure management)
3. Existing farm equipment (buildings and machinery)
4. Purchased (imported) inputs (seed, fertilizer/plant protection products, feed, contract labor, fuel, electricity heating, water)
5. Products sold
6. Humus balance
7. Renewable energy production





Scheme of the farm gate balance



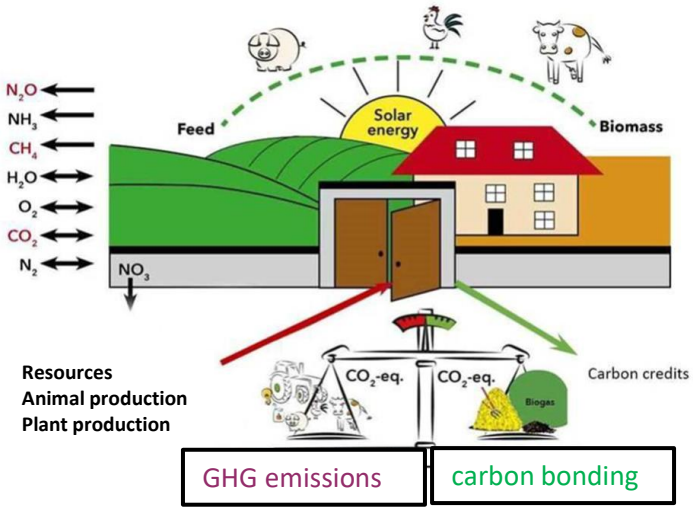
Cofinancé par l'Union européenne
Fonds européen de développement régional (FEDER)
Von der Europäischen Union kofinanziert
Europäischer Fonds für regionale Entwicklung (EFRE)

KLIMACO

CO_2 and methane

Important adjusting screws for climate-friendly production

- In plant production:
  1. Use nitrogen efficiently
  2. Enrich the soil with humus
  3. Secure yields
- In animal production:
  1. Efficient use of feed
  2. Gas-tight slurry storage
  3. Ensuring animal performance
- In biogas production:
  1. Using substrates and fertilizers produced in a climate-friendly way
  2. Use heat productively
  3. Avoid gas losses and use gas potential



When analysing the GHG balances, a critical view is necessary, the balances have to be interpreted:

- What is the significance of the balance, what data has been included in the balance and how are the results reached? (Methodology).
- Which sectors have high energy consumption and why?
- Are implemented measures visible?

The informative value of balances depends on the quality of their data basis. They (only) show rough tendencies, only depict partial areas; balances contain various uncertainties.

Goals

- Get an overview of the detailed composition of GHG emissions.
- Make GHG hotspots in their own operations and upstream production processes visible.
- Be able to compare the climate impact of one's own operation with anonimised results of similar operations and identify development potential.
- Identify measures that both reduce GHG emissions and bring economic benefits (by simulating the target operation).
- Make information on the carbon footprint of farms available to society.

Cofinancé par l'Union européenne
Fonds européen de développement régional (FEDER)
Von der Europäischen Union kofinanziert
Europäischer Fonds für regionale Entwicklung (EFRE)