

Name:

Greenhouse balance per hectare

Definition:

This indicator measures the amount of Greenhouse Gases (GHG) emitted into the atmosphere during the whole season. It is measured in CO₂ equivalent per hectare (t/ha).

Calculation method:

To calculate it, emissions from the soil and emissions corresponding to farming operations and inputs' manufacturing will be added.

GHG Balance (t CO_{2equ}/ha) = Soil balance (t CO_{2equ}/ha) + Emissions of Farming Operations (t CO_{2equ}/ha)

These two parameters will be calculated as follows:

Soil emissions balance

For the calculation of this parameter it will be taken into account both Carbon Dioxide (CO₂) and Nitrous Oxide (N₂O).

CO₂ emissions / fixation

To estimate the amount of CO₂ that is emitted (or sequestered) into the atmosphere due to land use we will be based on what is stated in the Kyoto Protocol.

The Kyoto Protocol set the ton of CO₂ equivalent as the single transaction unit in order to standardize the quantification of emissions and compliance with international commitments by industrialized countries. To convert one unit of Carbon (C) into a unit of Carbon dioxide (CO₂), it is needed to make the equivalence according to the molecular weight of each component. These are 12 and 44 for Carbon and CO₂ respectively. Therefore the conversion rate is:

$$\text{Ton CO}_2/\text{ha} = 44/12 * X \text{ Ton C/ha}$$

$$\text{Ton C/ha} = \pm(\Delta \% \text{OM}_{0-30} * D (\text{t/m}^3) * 3000 \text{ m}^3) / 1.7$$

Where

D: Bulk density (1.35 t/m³ if no specific data are available for the plot)

Δ %OM₀₋₃₀: Increase/decrease of the level of organic matter in the 0-30 cm profile.

Increase of the level of organic matter means fixation of CO₂, and decrease means CO₂ emissions.

N₂O emissions

The values for this parameter will be calculated on the basis of the methods and equations to estimate anthropogenic emissions of N₂O from managed soils described by the Intergovernmental Panel on Climate Change (IPCC).

Simplified equation for the calculation of these emissions is:

$$N_2O-N = [(F_{SN} + F_{ON} + F_{SOM}) * EF_1]$$

Where:

- N_2O-N = annual N_2O-N emissions produced from managed soils, kg N_2O-N /yr.
- F_{SN} = annual amount of synthetic fertiliser N applied to soils, kg N yr⁻¹.
- F_{ON} = annual amount of animal manure, compost, sewage sludge and other organic N additions applied to soils, kg N yr⁻¹.
- F_{SOM} = annual amount of N in mineral soils that is mineralised, kg N/yr.
- EF_1 = emission factor for N_2O emissions from N inputs. Default value: $EF_1 = 0,01$

The conversion of N_2O-N emissions to N_2O emissions for reporting purposes is performed by using the following equation:

$$N_2O = N_2O-N * (44/28)$$

Farming operations Emissions

This parameter will be obtained by adding the emissions corresponding to the combustion of the fuel spent in order to carry out farming operations and to the manufacturing of inputs used in the farm. It will be calculated by transforming the energy consumption into CO_2 equivalent. The conversion factor is:

$$1 \text{ MJ} = 20 \text{ g of Carbon}; 1 \text{ g of Carbon} = 3.67 \text{ g of } CO_2 \text{ equivalent}; 1 \text{ MJ} = 74 \text{ g of } CO_2 \text{ equivalent}$$

Using the values of this indicator, another indicator can be calculated giving information on the management of crop:

- Greenhouse balance per kg of crop yield. This indicator measures the amount of Greenhouse Gases (GHG) emitted into the atmosphere (in CO_2 equivalent) during the whole season per kg of crop yield (kg CO_2 /kg).

Bibliography and references:

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