Summary of the OpenCompass Methodology

OpenCompass aims to support the entire agri-food value chain in order to improve its impact on the environment and human health.

OpenCompass is a software tool that measures the impact of agriculture on the environment and human health and identifies the farming practices that contribute to this impact. To measure this impact, OpenCompass relies on farming practices directly implemented by farmers (primary data).

OpenCompass's approach is rigorous and comprehensive, and aims to ensure that the complexity of agricultural systems and transition dynamics is fully and scientifically represented.

It consists of:

- identifying the main negative and positive externalities of farming practices (water pollution, toxicity linked to inputs, carbon storage, etc.),
- then selecting, for each of these externalities, the most relevant scientific indicators, drawn from life cycle assessment where appropriate, and supplemented by other methods based on scientific consensus when necessary.

To do this, it carries out cradle-to-gate LCAs, i.e. from sowing to harvest, and measures a set of environmental impacts relevant to agriculture. Given the limitations of LCA in measuring certain impacts, OpenCompass has added other indicators to make its method as comprehensive as possible. OpenCompass combines attributional LCA, which provides information on the impacts of processes directly associated with a product's life cycle, with consequential LCA, which considers the consequences of changes in production levels by simulating possible scenarios (Werf et al., n.d.).

Why use life cycle assessment to measure the impacts of agricultural production?

Life cycle assessment has certain advantages and makes it possible to answer questions that other types of assessment methods struggle to address:

- a life cycle perspective,
- a wide range of environmental impacts, which helps avoid pollution shifting,
- a quantitative method,
- a method based on scientific consensus from other fields of research, such as the Intergovernmental Panel on Climate Change (IPCC).

It is governed by two ISO standards, 14040 and 14044, which set out a framework for its implementation. It stands out for its quantitative, multi-stage, multi-criteria approach and its ability to offer a robust, structured, scientifically validated framework for aggregating and comparing different environmental issues (climate change, ecosystem health, water resources, energy and mineral resources, etc.).

Why supplement it with other indicators?

It is well documented in the literature that LCA often overlooks essential questions relating to biodiversity, soil quality, the impact of pesticides, or social change (Werf et al., n.d.). Werf et al. also recommend supplementing LCA with other available methods (biodiversity loss, land degradation, and the effects of pesticides) and taking ecosystem services into account.

Origin and nature of the indicators

The main objective of OpenCompass is to calculate the environmental impact of different agricultural productions from major crop types such as cereals, industrial crops, and field vegetable crops, etc.

At field or farm level, the impact of each production is calculated based on the farming practices implemented by the farmer. The results can then be aggregated to determine the total impact of a crop at farm level, sector level, etc.

The 21 indicators are not all of the same nature or the same methodological origin:

16 standard EF 3.1 LCA indicators

What sets the OpenCompass method apart is that LCA calculations are automated based on the practices actually implemented each year by the farmer. There is therefore no fixed crop rotation or defined technical pathway. For these technical and methodological choices, OpenCompass has mainly relied on the work of Agribalyse and the European PEF methodology.

Climate change, eutrophication, ecotoxicity, human toxicity, ozone depletion, particulate matter, resources, etc. These come from the European PEF/EF 3.1 method, expressed in physical units (kg CO_2 eq, CTUe, m^3, etc.), calculated from the input and practice data of each field. Emission models were selected from the scientific literature.

The systems studied fulfil a dual function:

- producing agricultural commodities (grain, stems, roots, depending on the crop),
- managing agricultural land and its ecosystem services.

These two functions justify the use of two complementary functional units.

The OpenCompass method makes it possible to calculate impacts per hectare and per kg of product. In order to take advantage of the benefits of each, two functional units have been chosen. Furthermore, using both functional units together helps avoid biased conclusions and provides a more complete picture of a farming system's environmental performance.

FU and reference flow: “1 ha of cultivated land”

Impacts expressed per hectare reflect the land management function and the intention to preserve agricultural land. This unit also facilitates decision-making when changing practices (Renaud-Gentié et al., 2019) and makes it possible to better account for the ecosystem effects of farming systems (Werf et al., n.d.).

FU and reference flow: “1 kg of harvested product”.

This unit emphasizes the production function by relating impacts to the quantity produced. In particular, it helps raise awareness of the effect of yield on environmental performance (Renaud-Gentié et al., 2019). However, an approach based solely on kilograms tends to closely link environmental impact to productivity, which can mask certain benefits of less intensive systems. Thus, an LCA based solely on this unit may favor conventional farming systems, which are likely to generate higher environmental impacts at the regional scale (Salou et al., 2017; Werf et al., n.d.).

Carbon storage

Carbon storage is calculated using the Simeo AMG model.

Ecological network and spatial fragmentation

These two indicators are measured at the level of the whole farm (not the field), based on the landscape and the size of the land parcels.

The 3 pesticide (phytosanitary) sub-scores

The phytoscore is an indicator of the risk of impact from plant protection products (PPPs): it estimates the potential impact of using a product — based on the physicochemical properties of its active substances and its application rate — on the environment and the health of the user. It is structured around three components (ecotoxicology, environmental fate, and user health).

Aggregation method

All indicators are calculated and available in their own units. Each indicator is then scaled to a value between 0 and 1, where 0 corresponds to practices with very low impact and 1 to practices with very high impact. They are then grouped by impact category.

Group	Indicators
Climate	Climate change, carbon storage
Water quality	Freshwater/marine eutrophication, freshwater ecotoxicity (inorganic/organic)
Air pollution	Terrestrial eutrophication, acidification, ozone depletion, fine particulate matter, photochemical ozone formation
Human toxicity	Carcinogenic/non-carcinogenic toxicity (inorganic/organic), phytoscore health

Resources	Fossil resources, minerals and metals, water use
Biodiversity	Ecological network, spatial fragmentation, phytoscore ecotoxicity

This score is converted into a grade: from A (0 to 0.2, excellent) to E (0.8 to 1, intensive).

The OpenCompass method is fully transparent and available.

To receive the full document: Contact us.