Data Collaboration for Alternative Protein LCA Modelling Software

Background

Evidence of alternative proteins' environmental benefits compared to conventional animal-based proteins stems from a few studies primarily conducted at the industry level. Such studies demonstrate that plant-based meat can be produced with up to 98% less emissions, 93% less land, and 99% less water than conventional meat and that cultivated meat can be produced with up to 92% less emissions, 95% less land, and 78% less water than conventional meat. However, most alternative protein companies that want to make company- and product-specific environmental claims lack robust, standardized, and representative supporting data.

Life cycle assessments (LCAs) are the most widely used tool for quantifying and evaluating the environmental impact of producing goods and services. While LCAs can provide robust results, they can also be capital- and time-intensive, reducing their viability for many alternative protein manufacturers with limited resources. An increasingly popular lower-cost alternative is using LCA modeling software.

LCA modeling software can offer a quick and easy solution to providing accurate analysis of product impacts. However, there are several drawbacks to the LCA modeling software available on the market. First, they often require expensive subscriptions or product assessment fees. Second, although progress has been made, the software can be complicated to use and requires a high level of understanding of LCAs and the types of LCA data required to conduct an assessment. Finally, existing software lack specific parameters to accurately assess alternative protein products due to the novel ingredients and manufacturing processes used.

Objective

To address the current challenges surrounding Alternative Protein LCAs, GFI has commissioned Foodsteps to design, develop, and deploy bespoke LCA modeling software to estimate the environmental impacts of alternative proteins. The longer-term ambition for this project is threefold.

1. Provide a no-cost entry point for alternative protein manufacturers–both those specializing in alternative proteins and companies looking to diversify their product offering–to engage with the environmental impact of their products.
2. Drive progress in identifying, collecting, and integrating data on the environmental impact of alternative protein ingredients and processes.
3. Contribute to preparing and positioning companies to communicate their environmental impact to consumers, investors, and other stakeholders.

The final product to be developed by Foodsteps will be divided into two offerings. The first is a free, open-access resource that provides essential features to enable users to measure a limited number of products across key impact categories such as Greenhouse Gas (GHG) emissions, water use, land use, (freshwater) eutrophication, and (terrestrial) acidification. The second offering will provide a more comprehensive assessment, including the option to produce product impact labels, which will be provided for a fee.

Request for Data

The software will use a combination of peer-reviewed studies/data and mathematical models to calculate the emissions from ingredients and manufacturing processes of alternative protein products. However, a key barrier to the software's success is the current data gap for alternative protein ingredients and manufacturing processes. As such, we are inviting companies to share data (under NDA) about their products, including ingredients, quantities, by-products, manufacturing processes, and energy usage.

As part of this agreement, we will anonymize all data into representative averages/data points. This will enable the software to utilize novel data without the risk of exposing proprietary company data. Alternatively, and subject to discussion, companies may be able to include their branded ingredient/s as product inputs, promoting their product to platform users.

Companies interested in sharing data on their manufacturing process and/or ingredients can view and complete a custom version of the **LCA software data collection form template**, which will be shared with you after you express your interest in participating to Tom Chapman (tomc-contractor@gfi.org). The form provides detailed guidance on the types of information required to be included in the software.

We primarily seek data to understand the impacts of the ingredients and processes outlined below. If your processes or ingredients are not on this list, but you would like to be part of the project, please get in touch to discuss their inclusion in the modeling software.

If you have any questions and to discuss your potential participation, please contact tomc-contractor@gfi.org.

Manufacturing Processes

Manufacturing Technique	High-level description
Plant-based products	
Dry fractionation	A process to concentrate and extract protein content from plant-based ingredients through sieving or sifting, air classification, electrostatic separation, or a combination of these solvent-free techniques.
Wet fractionation	A process to isolate and extract protein content from plant-based ingredients using solvents to extract, precipitate, and centrifuge proteins, oils, carbohydrates, and fibers.
High Moisture Extrusion (HME)	Heating plant-based ingredients in a twin-screw extruder that is then cooled in a precisely thermal-controlled dye leading to the formation of fibers.
Low Moisture Extrusion (LME)	Mixing plant-based ingredients through an opening in a perforated plate or die designed to produce the required shape.
Mixing and Molding	A processing step that mixes plant-based proteins (either as outputs from an HME or LME process, or whole-food plant proteins), with fats/oils, hydrocolloids, emulsifying agents, oleogels, thickeners, binders, gelling agents, coloring agents, and flavoring agents, and then molds them into a final product.
Hulling/shelling	The separation of nuts or grains from the case or shell to expose the main body of the plant prior to extracting liquid for use in, for instance, plant-based milks or yogurts.
Shearing and homogenization	A homogenizer is a mixer used to create a uniform and even mixture by forcing material through a narrow, confined space. Multiple industries rely on homogenizers to produce stable, uniform, and consistent products.
Biomass Fermentation-derived products	
Solid state	Solid state fermentation (SSF) takes place in a solid matrix (inert support or substrate) in the absence or near absence of free water. The substrate is provided with

	specific moisture or feedstock to support the growth and metabolic activity of microorganisms.
Submerged	Cultivating microorganisms in liquid nutrient media, often in an enclosed vessel or bioreactor. Fermentation using gas feedstocks and hydrogen-fixing microorganisms to generate whole-cell protein.
Biomass Fermentation Downstream Processing (DSP)	The series of operations required to take the biomass produced through the biomass fermentation process and derive from them a pure and homogeneous protein product. The key steps for biomass fermentation DSP are heat-inactivation and dewatering.
Precision Fermentation-derived products	
Submerged	A process in which microbial hosts are designed and fed nutrient media to produce specific functional ingredients (e.g., proteins, fats/oils).
Precision Fermentation Downstream Processing (DSP)	The series of operations required to the functional ingredients produced through the precision fermentation process and derive from them a pure and homogeneous product. The key stems for precision fermentation DSP are: dewatering (strained and centrifuged), micro filtration / polishing, diafiltration / concentration and drying (spray drying).

Ingredients

- Protein isolates from pea, soybean, fava bean, mung bean, oat, chickpea, and wheat gluten, among others.
- Plant-based oils, such as coconut oil, canola oil, sunflower oil, shea butter, and cocoa butter, among others.
- Feedstock components for submerged fermentation, such as glucose, ammonia, hydrolysates, and inorganic salts, among others.
- Solid-state fermentation substrates, such as rice straw, sugarcane bagasse, beet pulp, and wheat straw, among others.
- Cell culture medium components for cultivated meat, fat, and seafood, such as glucose, amino acids, inorganic salts, vitamins, and growth factors, among others.
    a) Note: glucose and inorganic salts overlap with the feedstock components referenced above.

- Plant-based hydrocolloids, emulsifying agents, oleogels, thickeners, binders, gelling agents, coloring agents, and flavoring agents, such as agar agar, locust bean gum, xanthan gum, tapioca flour, aquafaba, and methyl cellulose, among others.

Project Partners

About GFI

The Good Food Institute is a nonprofit think tank working to make the global food system better for the planet, people, and animals. Alongside scientists, businesses, and policymakers, GFI's teams focus on making plant-based and cultivated meat delicious, affordable, and accessible. Powered by philanthropy, GFI is an international network of organizations advancing alternative proteins as an essential solution needed to meet the world's climate, global health, food security, and biodiversity goals.

Learn more at www.gfi.org.

About Foodsteps

Foodsteps is a UK based start-up which offers software, data and communication solutions to help food businesses measure, reduce and communicate their food's environmental impact. We are a mission-driven company that envisions a world where food is a solution to the climate crisis. We bring significant experience developing cutting-edge tools, data and science to the field of life cycle assessment and food sustainability, and have contributed to significant scientific advancements in our field.

Learn more at https://www.foodsteps.earth.