Life Cycle Assessment of Ready-to-Use-Therapeutic Food | Review

Project: Accelerating the reduction of the environmental impact of humanitarian action

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Science and Technology for Humanitarian Action Challenges (HAC)

Project website: https://climateactionaccelerator.org/accelerating-the-reduction-of-the-environmental-impact-of-humanitarian-action/

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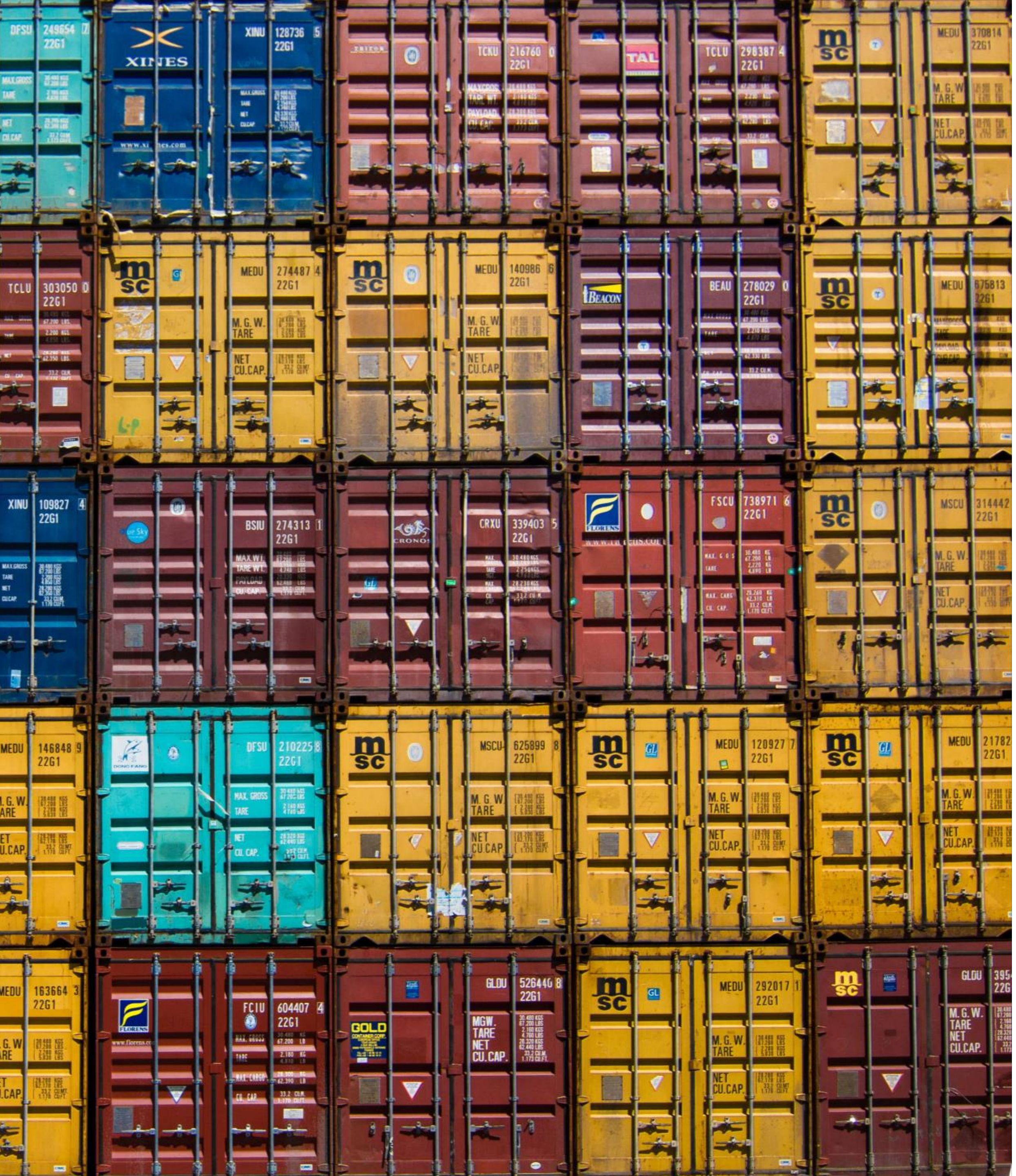


Acknowledgement

The project team warmly thanks Nutriset for sharing data and insights from their life cycle asessment of RUTF. The findings from this existing LCA served as a basis for the present analysis. All data was anonymised to ensure that no sensitive information is disclosed.

Contents

Introduction

Objectives and scope

Objectives:

- Using models of the humanitarian supply chain to identify key levers to reduce the impact of RUTF (climate, human health, plastic leakage) and analyzing potential product variations accordingly.
- Establish emission factors for plastic mats adapted to the humanitarian sector

Scope & System Boundary:

- Cradle-to-grave system boundary for the assessment of impact across the complete life cycle.
- System boundary:
  - The materials, production, distribution, use and disposal of the product are in scope of our study (see slide 10 for details)
  - Any additional processes applied to the product after production are not in scope e.g. unplanned storage, etc.
  - The procurement of the packaging material is modelled, with the upstream activities of the packaging being out-of-scope

Methodology

The results are calculated following the Environmental Footprint 3.1 indicator system in two categories:

- **Climate Change**: Global Warming Potential (GWP100)
- **Impact on Human Health**:
    - Human Toxicity: Carcinogenic and Non-carcinogenic
    - Ionising Radiation
    - Particulate Matter Formation
    - Photochemical Oxidant Formation
  - Weighted using the approach detailed in the EF methodology – with a percentage assigned to each sub indicator (see reference)
  - Normalized for one citizen so as to aggregate and represent as a single score for human health

Plastic leakage: Experimental projection of the amount of plastic leaked into nature via mismanagement of waste

References:
"European Platform on LCA | EPLCA.". https://eplca.jrc.ec.europa.eu/EnvironmentalFootprint.html
Joint Research Centre (European Commission), Alessandro Kim Cerutti, Rana Pant, and Serenella Sala. 2018. Development of a Weighting Approach for the Environmental Footprint. Publications Office of the European Union. https://data.europa.eu/doi/10.2760/945290

End-of-life

This study aims to model the impact differences between various waste management methods tailored closer to humanitarian contexts. The following end-of-life options were modelled in the analysis, as appropriate:

- **Open dump** (unmanaged)
- **Open burning** (unmanaged)
- **Unsanitary landfill** (minimal management)
- **Sanitary landfill** (managed site)
- **Municipal incineration** (managed plant)
- **Recycling** (as modelled)

For plastics, the differences in measured impact between each end-of-life scenario are similar. (For more info on the impacts and sources of end-of-life impact measurement please see annex.)

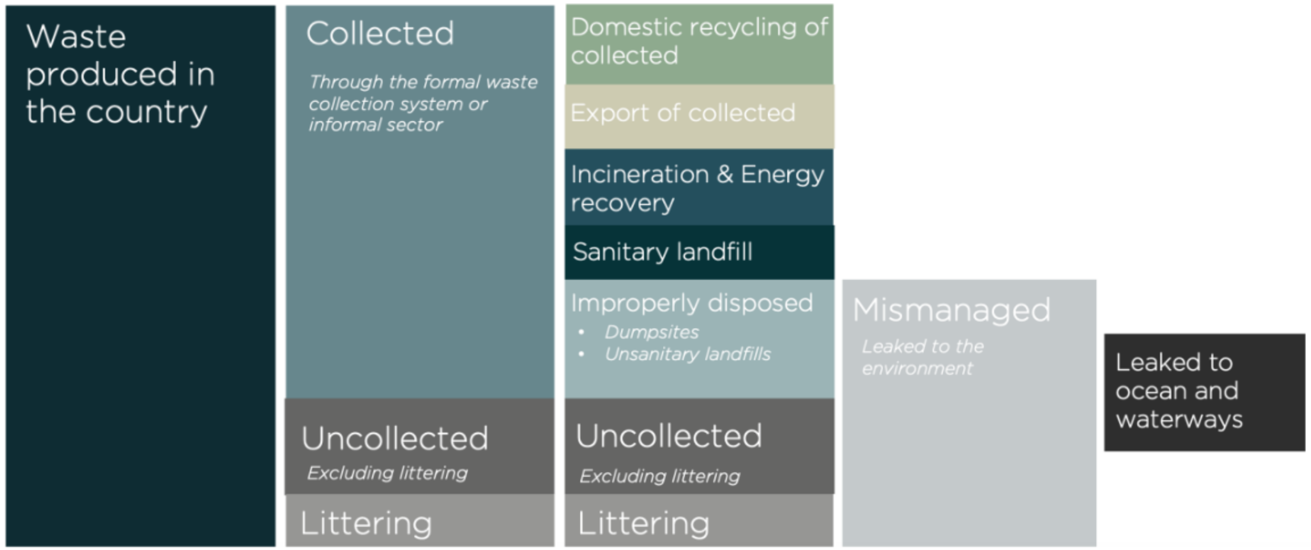
According to the LCA methodology, the analysis of greenhouse gas (GHG) emissions (Global Warming Potential)—is limited to a 100-year timeframe. As a result, any additional impact from plastic degradation in landfills occurring beyond this period is neither measured nor compared to other waste disposal methods.

Plastic leakage

This project aims to estimate the mismanaged waste that may occur at the end of life of products distributed by humanitarian organisations.

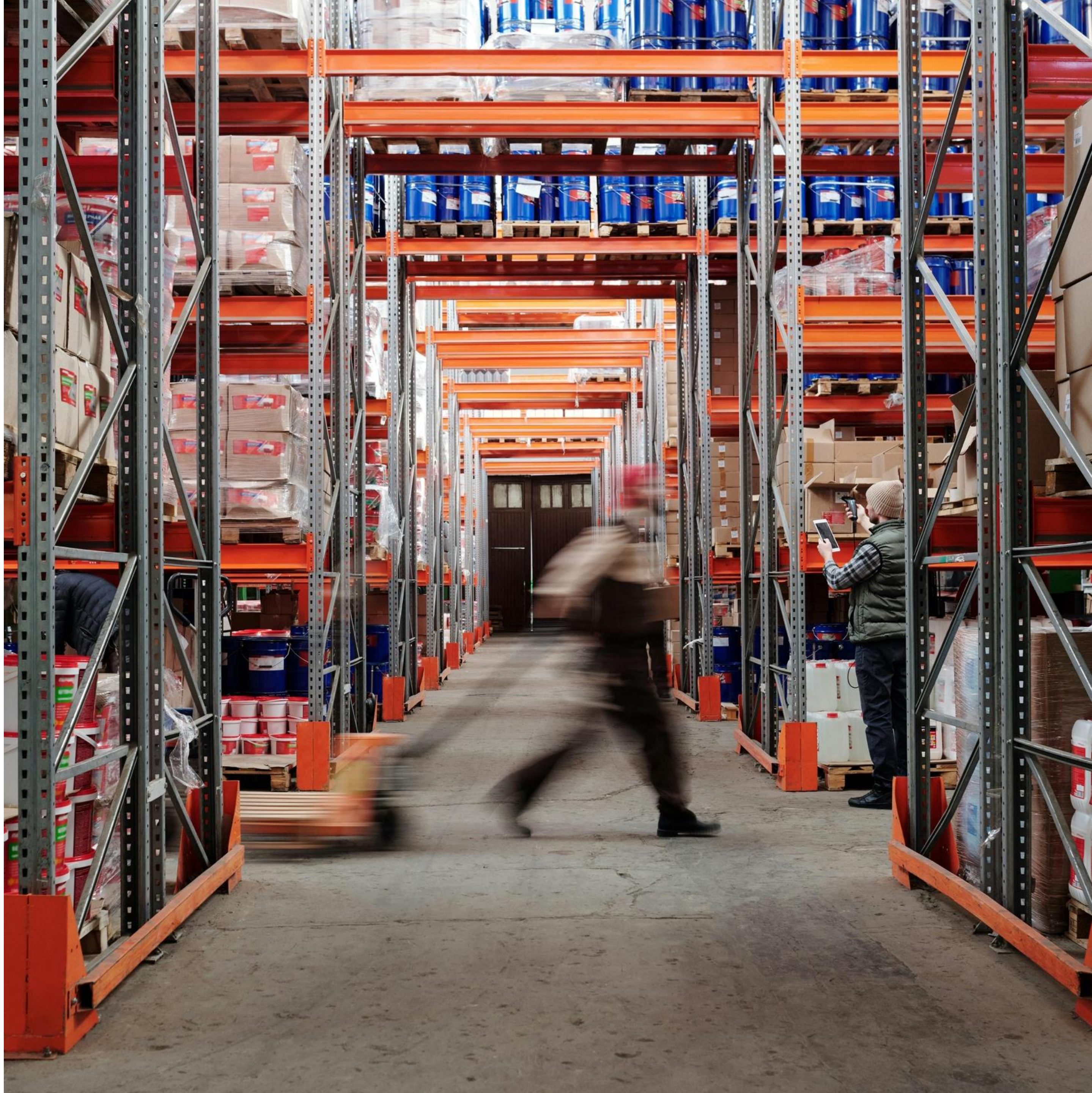
The modelled scenarios are analysed for plastic leakage by selecting the waste management method that is modelled and calculating the projected leakage (or lack thereof) due to the same.

For more information, please refer to: "Global Plastic Environmental Analytics Platform." Plasteax. https://plasteax.earth/.



Source: EA – Earth Action

LCA Results



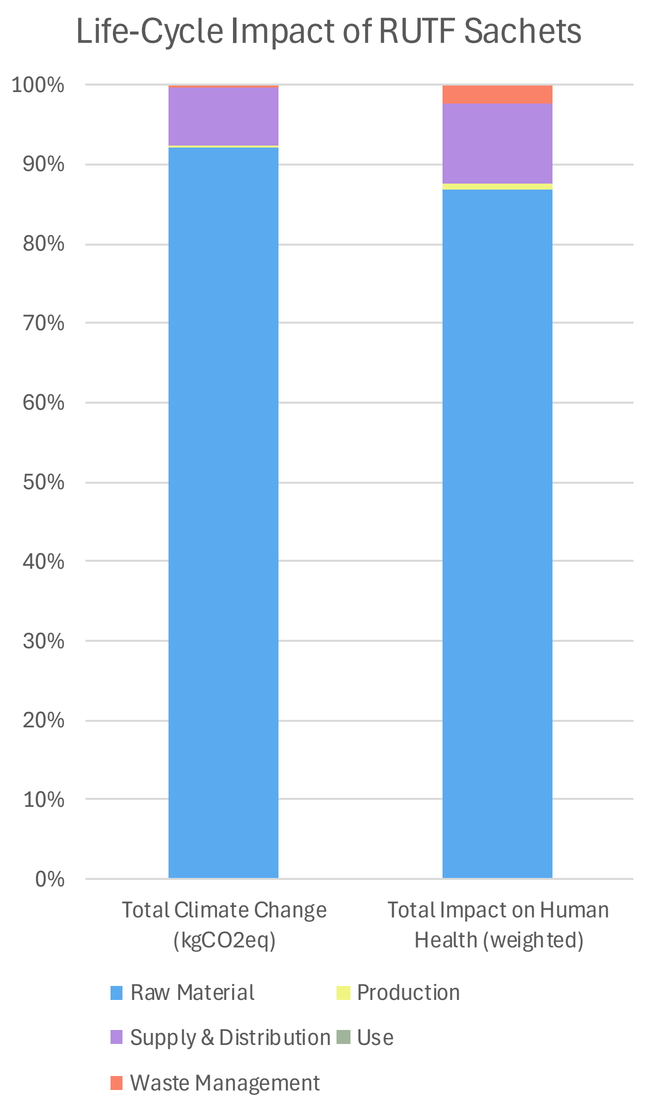
Key Product Parameters & Assumptions

LIFE-CYCLE STAGE	PARAMETER	DESCRIPTION OF MODEL
GENERAL	Field Context	92g net weight
Raw Material	Bill of Materials	Milk Powder, Peanut Paste, Vegetable Oil, Sugar, etc
	Packaging	PET, Aluminium Foil & Cardboard
Production	Manufacturing Location	France
	Manufacturing Processes	Modelled using energy use only
Supply & Distribution	Transport Chain	TRUCK transport of materials to factor SEA shipping of product to regional distribution centre TRUCK transport to distribution location
Use	Lifespan	-
	Usage Processes	None (consumable)
Waste Management	Product Disposal Method	None (consumable)
	Packaging Disposal Method	Open Burning

Baseline Results

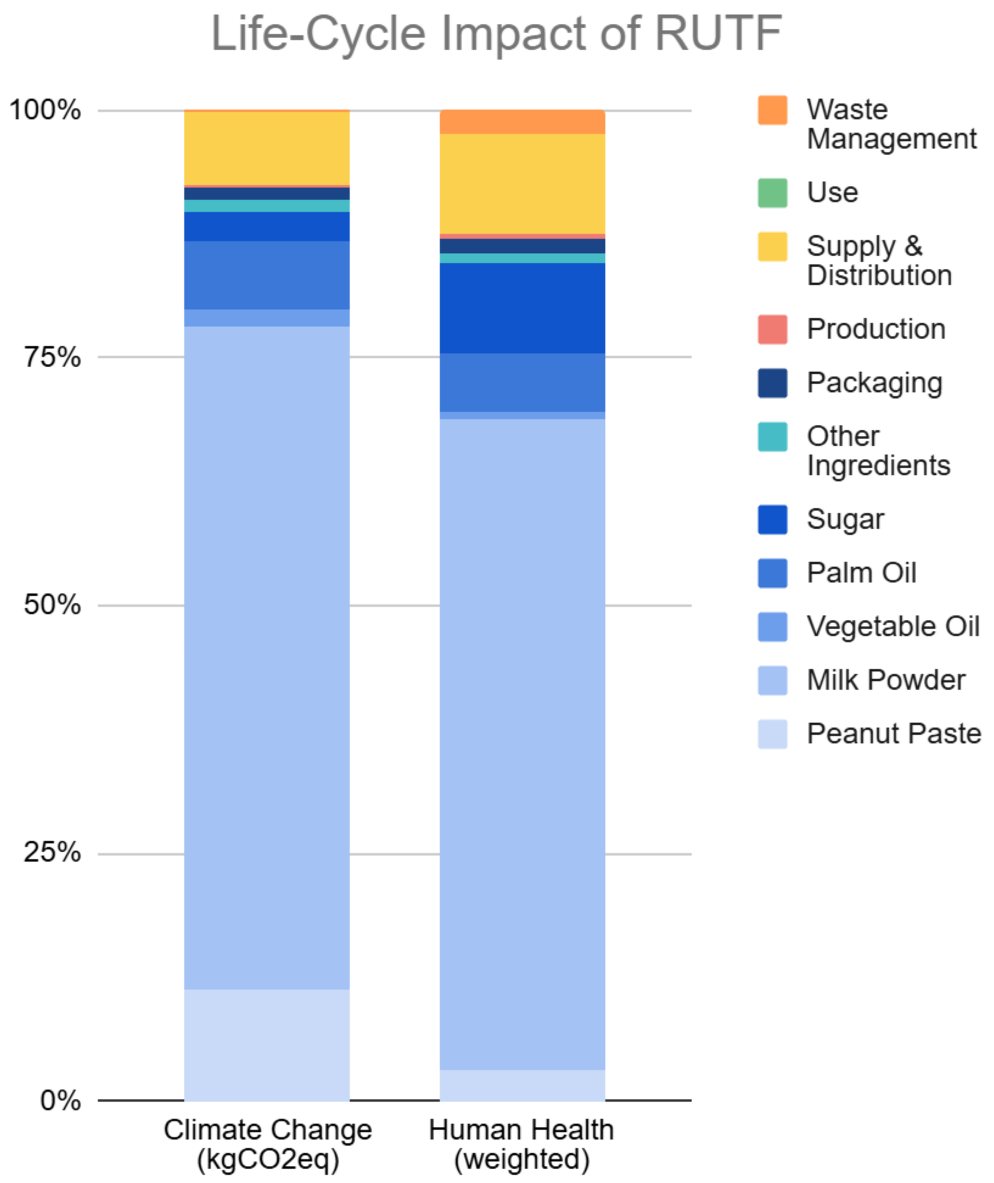
- Raw materials account for **92%** of the total GHG Emissions of the item, and **87%** of the total impact on human health.
- Milk protein alone accounts for **67%** of total GHG emissions and **66%** of the overall impact on human health.
- As the raw materials are imported from various locations, supply and distribution make up the next largest share of impact with **7%** of total GHG Emissions and **10%** of total impact on human health.
- The disposal of the RUTF packaging has very little impact on GHG Emissions, however it makes up **2%** of the impact on human health
- Plastic leakage
  - The packaging is considered as open-burned, causing no leakage for all scenarios

Emission factors per sachet (92g)		Unit
Cradle-to-grave	0.58	kgCO2eq/sachet
Cradle-to-gate	0.55	kgCO2eq/sachet



Baseline Results

- The graph illustrates the contribution of each raw material to overall impacts.
- Across ingredients, milk powder stands out as the dominant contributor across the entire lifecycle, followed by palm oil and peanut paste.



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Variations per lifecycle stage

	Raw Material	Production	Use Life	Supply & Distribution	Waste Management
Baseline	Baseline Recipe (average procurement)	Made in France with energy from grid	-	International distribution from France to Central Africa	Open burning of packaging
	Baseline Recipe with Lower carbon milk Protein*	Made in Niger with energy from grid		Local distribution from Niger to adjacent locations (material imported)**	
		Made in France with renewable energy			

* Best avaialble factor in ecoinvent 3.11 on climate change.

** All raw mateirals are considered imported (milk from Europe, peanut from Argentina, …) for the Niger scenario while milk is considered as locally sourced in the France scenario.

Impact Assessment

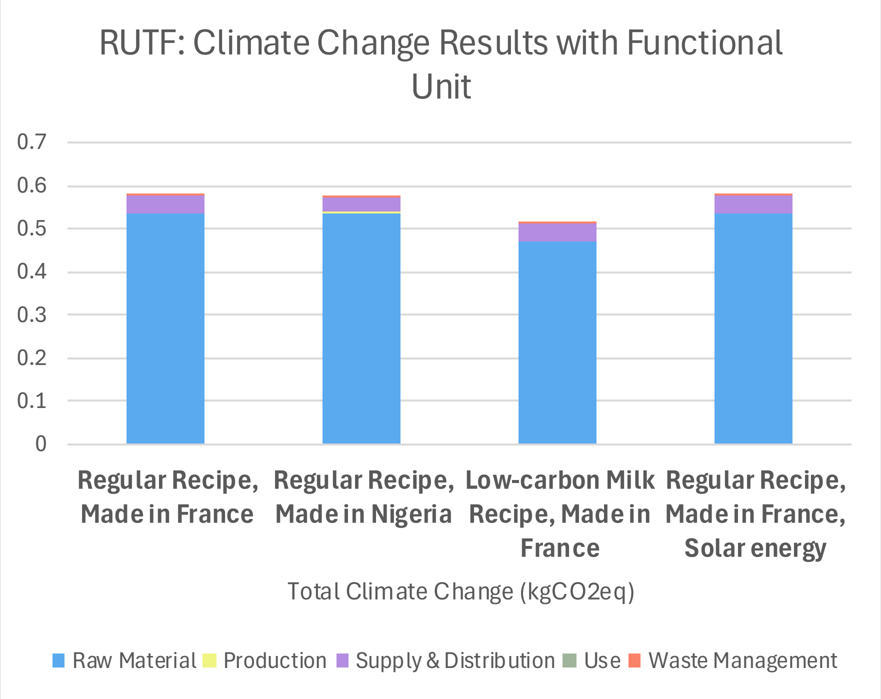
- Switching to locally produced RUTF might appear to be a promising strategy. However, when accounting for changes in ingredient sourcing, the potential reductions are limited—approximately 1% for climate change impacts and 3% for human health impacts.

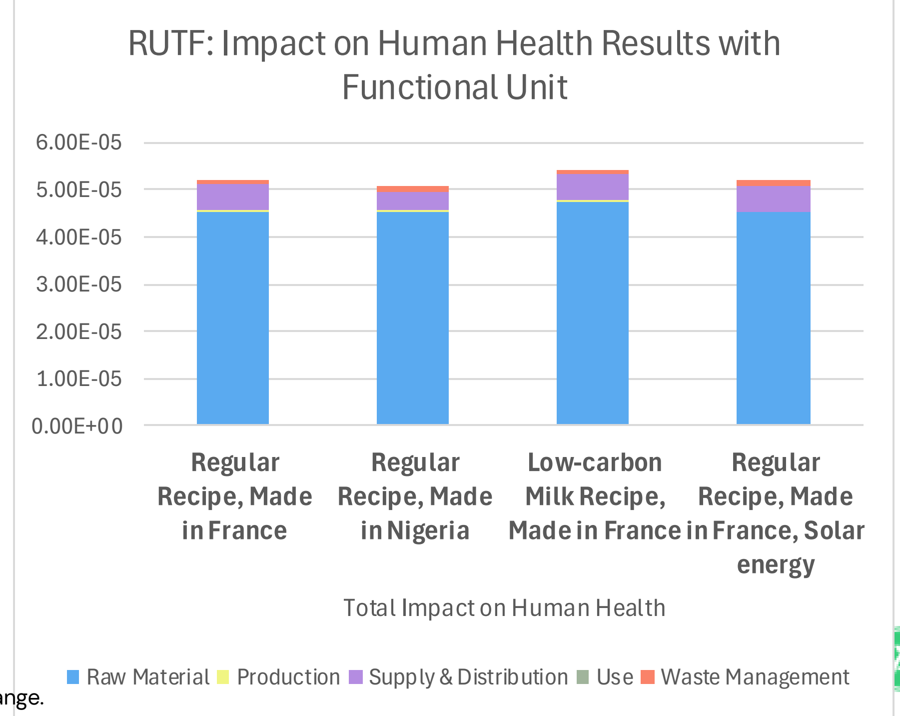
- To explore additional decarbonization strategies, a scenario was modelled in which average milk was replaced with a lower carbon impact alternative, sourced from pasture-fed cows with the lowest climate footprint. While this substitution could reduce the product’s climate impact by 11%, it would also lead to a 4% increase in the impact on human health.*

- Producing with renewable energy would only have a limited impact, saving 0.01% of climate change and 0.5% of human health impacts. This is because energy represents a very small proportion of impacts, and the French baseline energy has a limited impact.

- These variation are not significant and are in the uncertainty areas, so no clear conclusion can be deducted.

- **Ultimately, this study underscores the substantial environmental impact of milk within the product’s formulation.**





* This is not the “best” possible milk, but an example from South African milk calculated in ecoinvent that appears to be the less impactful regarding climate change.

Key conclusions of comparative analysis

- To reduce the impact of RUTF, changing the location of the production has a relatively low impact:
  - ▼ 1% climate change
  - ▼ 3% impact on human health

- This study highlights the significant contribution of milk to the overall impact.
- Better agricultural practices can contribute to the reduction of the impact.*
- A key next step in assessing the decarbonization potential of RUTF involves exploring the possibilities of reducing the milk-based content in RUTF, while continuing to ensure optimal health outcomes for patients.
- Implementing such changes would require updates to the WHO Codex Alimentarius standards for RUTF.

Note: The calculations are based on impact factors from the ecoinvent 3.11 database. Several of these factors were recently updated, resulting in lower environmental impacts for certain raw materials. As a result, the current findings may differ from those of previous analyses.

* RSPO Palm oil, agroforestry practices ,.. had not been integrated in the scenarios as impact assessment factors are not available for this study..

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Thank you!

Holloway, L., Salomon, B., Greene, A., & O'Kennedy, B. (2022). *The Climate Impact of Plant-based Ready-to-Use Therapeutic Food*. Clearstream Solutions report for Valid Nutrition. Available at: https://www.validnutrition.org/wp-content/uploads/2022/10/220722_Valid-Nutrition-Report-Final-July-2022.pdf

Earth Action, The Climate Action Accelerator. (2023) *'Life Cycle Assessment of a Nutriset sachet'*

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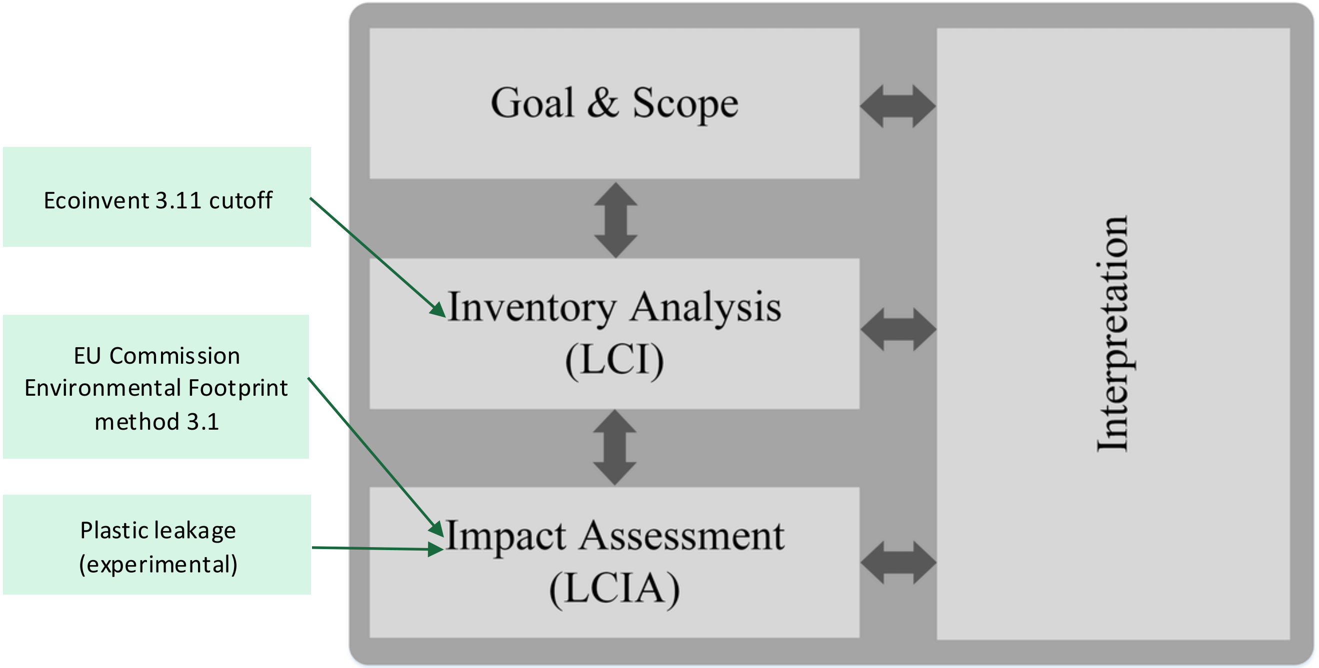
Methodology

The primary database used is Ecoinvent 3.11

The studies utilize the data from the **cut-off system model which allocates the entire impact of the material to its primary user** without any ‘rewards’ for its potential for being recycled.

Consequently, any recycled materials do not carry the burden of the impact of the primary use of the material and rather track the impacts from the recycling process onward.



Life cycle assessment (LCA) steps according to ISO 14040, 14044, and 14067.

References:
“Ecoinvent v3.11.” n.d. Ecoinvent. https://ecoinvent.org/ecoinvent-v3-11/

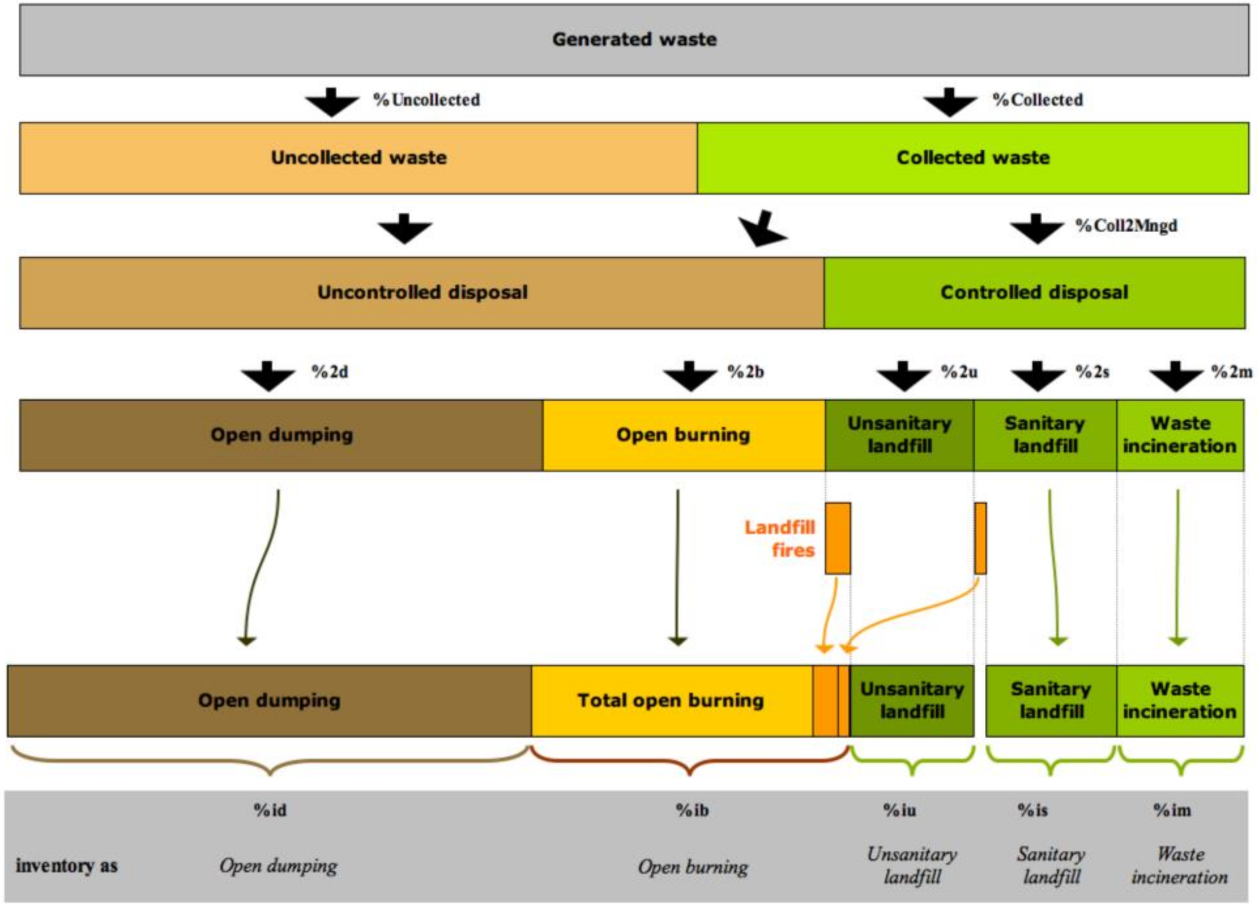
End-of-life waste managemen

This study aims to model the impact differences between **managed and mismanaged** waste tailored closer to humanitarian contexts.

The end-of-life impact for *a mix of plastic waste* reduces as below:

Method	GHG Emissions	Impact on Human Health
Open Burning	~HIGHEST~	~HIGHEST~
Municipal Incineration	-2.60%	-96.03%
Unsanitary Landfill	-93.80%	-99.40%
Open Dumping	-95.50%	-99.87%
Sanitary Landfill	-96.22%	-99.06%

Open burning creates maximum impact for both categories, but beyond that there are differences between climate change and human health on the specific magnitude of reduction.



Doka, G., 2018, Inventory parameters for regionalised waste disposal mixes

This study uses values for specific types of plastic wherever necessary, however the proportions of impact follow similar trends across the types of plastic product. This is therefore the standard impact implication for plastic products at end-of-life. Whenever possible, recycling is also modelled as a waste treatment option within the scope of the study.

NOTE: The methods listed above have differences in how long it takes for the plastic to be removed. It is part the LCA methodology that measurements are limited to a 100 years, therefore any further impact due to the degradation of plastic in landfills is not measured or compared with other methods of disposal.