ALTERNATIVES TO CONVENTIONAL (PETROLEUM-BASED) PLASTICS IN PACKAGING

DEFINITIONS, BENEFITS AND CHALLENGES FOR THE HUMANITARIAN SECTOR

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JOINT INITIATIVE FOR
SUSTAINABLE HUMANITARIAN
ASSISTANCE PACKAGING
WASTE MANAGEMENT

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ABOUT THE JOINT INITIATIVE

The Joint Initiative for Sustainable Humanitarian Assistance Packaging Waste Management (JI) is a project funded by the United State Agency for International Development (USAID) Bureau for Humanitarian Assistance (BHA) bringing together a consortium of 21 humanitarian stakeholders—including donors, non-governmental organizations (NGOs), members of red cross/red crescent movement and United Nations (UN) agencies—to reduce the negative environmental impact of humanitarian action, particularly by tackling the issue of packaging waste.

The initiative supports the humanitarian community by addressing the problem of packaging waste in a holistic way, both upstream (e.g., providing guidance on how to reduce packaging) and downstream (e.g., providing guidance on secondary use or "repurposing" of packaging waste, using a circular economy approach).

The JI aims at promoting greater coordination and standardization within the humanitarian community on packaging sustainability, and more broadly, supply chains. It acts as a platform for knowledge-sharing by documenting humanitarian organizations' experiences, successes, and lessons learned and sharing these through webinars and case studies. Finally, the JI aims to advocate for effective solutions to the global waste management crisis and, more recently, to raise awareness of the link between packaging and climate change, through the emissions created during the production of packaging and end-of-life waste management.

AIMS OF THIS DOCUMENT

One particular type of packaging that is problematic for humanitarian actors and prevalent in their work, is plastic. According to a study carried out by the JI[1] where selected packaging data from several humanitarian organizations were analyzed, the most common plastic packaging types used by humanitarian organizations in which to deliver food aid are as follows.

- Polyethylene terephthalate (PET) – used for oil/water bottles.
- High-density polyethylene (HDPE) – used in vegetable oil containers.
- Polypropylene (PP) – used in woven bags for commodities such as rice and sorghum.

As a result, and given the emissions linked to plastic packaging throughout its lifecycle (from extraction to production and end-of-life management), humanitarian organizations are increasingly searching for alternatives to petroleum-based plastics—also referred to as "conventional" or "virgin" plastic—for their packaging.

Plastic pollution is a serious problem. A tiny proportion of the plastic we discard every day is recycled (it is commonly estimated that only 9% of plastic produced to date has been recycled), and plastics do not biodegrade (i.e., decompose naturally in a way that is not harmful to the environment).[2] Rather, they break down into ever smaller pieces known as microplastics, which have significant adverse environmental impacts.

[1] The Joint Initiative Packaging Baseline Assessment using 2021 data from World Food Programme (WFP), International Committee of the Red Cross (ICRC), United Nations Children's Fund (UNICEF), United Nations High Commissioner for Refugees (UNHCR) and USAID's BHA.
[2] https://www.unep.org/interactive/pollution-to-solution/

Although alternatives to plastic may help reduce the plastic pollution problem linked to poor end-of-life management, they should not be considered quick-fix solutions or "silver bullets." Rather, humanitarian organizations are encouraged to think on a bigger scale and make systemic shifts, by reflecting carefully on the "use case" for plastics packaging, i.e., what is its function? is it necessary? and the same result be achieved using a different type of packaging?

This document explores some of the alternatives to plastics packaging and their related challenges. Identifying sustainable alternatives is complex, and rather than providing answers, this document aims at providing information and points for reflection, to help both procurement and program staff make more informed decisions. The list of potential alternatives to petroleum-based plastics presented here is not intended to be exhaustive, but rather focus on some of the most widely used alternatives.

MOST COMMONLY USED ALTERNATIVES TO CONVENTIONAL PLASTICS IN PACKAGING

CHALLENGES AND BENEFITS OF ALTERNATIVES TO CONVENTIONAL PLASTICS FOR PACKAGING:

BIODEGRADABLE PLASTICS	
Definition	Biodegradable plastics are composed of materials that can be broken down by microorganisms, such as bacteria and fungi. They degrade under certain conditions in a natural environment at a speed that depends on their composition.
Benefits	• Reduced dependency of fossil fuels. • Unlike petroleum-based plastics, they will eventually break down completely, although this is contingent upon specific conditions being in place, as well as appropriate collection methods being used (see below).
Challenges	End of life: • Only break down completely if exposed to specific conditions (e.g., humidity, temperature). When discarded into the ocean, most biodegradable plastics are much slower to degrade than in terrestrial settings.[3] • The term *biodegradable* can be misleading to the consumer who may think that it can be disposed of in the natural environment. • They require a separate collection system: if they end up in a landfill, their breakdown results in carbon and methane emissions.[4] When collected alongside recyclable plastics, they can contaminate recyclable plastic batches and cause damage to recycling infrastructure. **Cost**: Usually more expensive than conventional plastic although prices are falling as the market develops. **Toxicity**: Can also contain toxic additives to help the degradation process and contain fossil fuel materials (e.g., PBAT[5]). These are very harmful for the environment.[6] **Use:** Preservation of the packed items and its durability is a challenge given that the material is designed to eventually degrade. Therefore, the shelf life of these materials must be assessed when pre-positioning items.
COMPOSTABLE PLASTICS	
Definition	**The terms *compostable* and *biodegradable* are often used interchangeably, although they are not the same.** While all compostable plastics are biodegradable, not all

[3] Single Use Plastics: A Roadmap to Sustainability, UNEP 2018.
[4] Even when bioplastics eventually decompose in landfills, they will do so in absence of oxygen, which will lead to methane emissions. Methane is a strong greenhouse gas emission, 23 times more potent than carbon dioxide. The truth about bioplastics, Colombia Climate School 2018
[5]Polybutylene adipate terephthalate (PBAT) is a flexible material often used to make bags and sachets.
[6]Are Bioplastics and Plant-Based Materials Safer than Conventional Plastics? In Vitro Toxicity and Chemical Composition, Lisa Zimmermann et al., Environment International n°145.

	biodegradable plastics are compostable. Compostables are usually made of organic materials (like field corn and cellulose), which break down more easily. There are two types of compostables: home compostable and industrially compostable. The latter is designed to biodegrade only in an industrial composting plant that is designed to handle a high volume of waste under regulated conditions (i.e., temperature, moisture, pressure). Home composting, on the other hand, is the process of making compost at home.
Benefits	• Reduced dependency of fossil fuels. • If sourced responsibly, compostable plastics can offer environmental benefits, such as reducing waste and powering circular economy over petroleum-based plastics.[7] • Some compostable materials can be disposed of in food waste streams and treated as biowaste.
Challenges	End of life: • If designed to be composted in industrial facilities, they will only degrade if exposed to specific conditions (e.g., high temperature over a long period of time) and not in a home composter. However, **industrial composting is very rare in humanitarian contexts**, making this option less suitable for humanitarian organizations. • The term *compostable*' can be misleading to the consumer, who may think that it can be disposed of in the natural environment. • Compostable plastics in the marine environment will decompose differently than in a terrestrial setting (i.e., soil, landfill, composter) as the conditions required for rapid biodegradation are unlikely to be present.[8] • If not managed properly once it becomes waste, compostable plastics are unlikely to break down as intended.[9] In addition, some compostable materials still contain petroleum-based materials, which will generate contamination during the composting process. • Even if labeled as "home compostable", they are designed to biodegrade in the conditions of a well-managed home composter at lower temperatures, meaning that certain conditions still need to be in place for this to present a viable alternative. **Cost**: Compostable plastics are expensive than petroleum-based plastics, although the price difference is gradually becoming less significant. **Use:** There are challenges with storage, since compostable materials are designed to eventually degrade. Compostable plastic can degrade in a humid and hot environment; therefore, it is not suitable for many humanitarian contexts. The shelf life is limited, which prevents particular risks for pre-positioned items.[10]

[7] Is Biodegradable and Compostable Plastic Good for the Environment? Not Necessarily, World Wildlife Fund 2022
[8] Biodegradable Plastics and Marine Litter. Misconceptions, concerns and impacts on marine environments. United Nations Environment Programme (UNEP), Nairobi 2015
[9] Is Biodegradable and Compostable Plastic Good for the Environment?, World Wildlife Fund 2022
[10] ICRC has banned the use of biodegradable plastics for tarpaulins, and for the packaging of the EHIs.

BIO-BASED PLASTICS	
Definition	Bio-based plastics are made partially or fully from plant/renewable materials (e.g., sugar cane, maize, coco husk waste or natural polymers/fibers such as starch, cellulose and bamboo)**. Some biobased are biodegradable,**[11] **and others are not.** Bio-based plastics represent about 1% of the plastics available on the market; however, their production is increasingly growing. The most commonly used are PLA[12] (used to make cups, cutlery, or bags), PHB[13] (used to make bags and single-use cutlery), PHA[14] (used to make packaging items such as films, boxes, coating, fibers and foam material), and PBS[15] (used to make disposable plates and cutlery, as well as bags). The definition of a certain percentage threshold value of biobased mass content in packaging to be considered bioplastics is not clearly defined and varies from one country to another. According to the USDA Bio-preferred Program, "the minimum share of renewable material ranges from 7 to 95 percent" depending on defined product category rules.[16]
Benefits	• Just like compostable and biodegradable plastics, biobased plastic helps to save fossil resources. • If sourced responsibly, biobased plastics can offer environmental benefits.[17] The Bioplastic Feedstock Alliance[18] (BFA) has developed a shared sustainability assessment for plant-based plastics to help actors make thoughtful decisions about biobased plastic sourcing and drive change at scale. • Some biobased materials are compostable.
Challenges	End of life: • Biobased plastics are not always biodegradable. Despite their biological origins, degradation in natural environmental conditions is very slow, and industrial composting is required to achieve complete biodegradation.[19] This can be misleading to the consumer who may dispose of it in the natural environment, and as described above, industrial composting opportunities are not readily available in contexts where humanitarian organizations are operating. • Some biobased plastics are still partially composed of fossil-based plastic (bio PET/starch blends) and contain chemicals that make their end-of-life management challenging.[20]

[11] Environmental Biodegradation of Synthetic Polymers II. Biodegradation of Different Polymer Groups. Eubeler, J.P., Bernhard, M., and Knepper, T.P. (2010) TrAC Trends in Analytical Chemistry 29, 84–100.
[12] Polylactic Acid, see *What Is PLA?*, TWI 2017
[13] Polyhydroxybutyrate-PHB is commonly used to make bags and single-use cutlery.
[14] Polyhydroxyalkanoate-PHA is polyester used to make packaging items such as films, boxes, coating, fibers and foam material.
[15] Polybutylene Succinate- PBS is commonly used to make plates, cutlery, and bags.
[16] EUBIO_Admin, Is There a Certain Percentage Threshold Value That Marks the Minimal Bio-Based Carbon Content / Bio-Based Mass Content in a Product/Material to Be Called Bioplastics?, European Bioplastics e.V.2018
[17] Is Biodegradable and Compostable Plastic Good for the Environment?, World Wildlife Fund 2022
[18] The Bioplastic Feedstock Alliance is a multi-stakeholder working group formed by some of the world's leading companies to advance knowledge of bioplastics and their potential social and environmental impacts.
[19] Biodegradable Plastics and Marine Litter. Misconceptions, concerns and impacts on marine environments, UNEP 2015
[20] Are bioplastics and plant-based materials safer than conventional plastics? In vitro toxicity and chemical composition, Lisa Zimmermann, Andrea Dombrowski, Carolin Völker, Martin Wagner, Environment International 2020

	Cost: Biobased plastics are more expensive than petroleum-based plastics (PLA can be 20% to 50% more expensive).[21] **Toxicity:** Biobased plastics are not always free of toxic additives that are included for performance purposes (flexibility, hardness, etc.) In fact, biobased materials and petroleum-based plastics can be similarly toxic.[22] Environmental footprint: • Biobased plastics require significant land use for their production; therefore, competing with food production and contributing to the risk of deforestation. However, companies are increasingly making bioplastics from agricultural waste (e.g., almond shells), waste landfill methane, or methane from food waste. • Their production often involves the use of pesticides and fertilizers and is also water-intensive; the water footprint of bioplastics varies between 1.4 m3/kg to 9.5 m3/kg.[23] • It is complex to compare the carbon footprint with that of petroleum-based plastic because this depends greatly on the type of biobased plastics used. Some studies show that PLA is less carbon intensive when compared to petroleum-based plastics.[24] However, other studies have found that biobased PET bottles perform worse than conventional PET bottles (when compared using 13 different environmental impact categories), offering only better performance (about 10%) in one category, i.e., abiotic depletion (fossil fuels).[25]
BIO-REGENERATIVE MATERIALS: SEAWEED, HEMP, MUSHROOM[26]	
Benefits	• Unlike biobased materials, land use to produce these regenerative materials is highly productive and efficient (no pesticides are required and, for seaweed in particular, no fresh water is required). • The raw material is usually available in large quantities everywhere (this is particularly the case for seaweed). • Bioregenerative materials are usually 100% home compostable although some are still mixed with fossil fuel polymers.
Challenges	Cost and availability: • Significantly higher cost than petroleum-based plastics. • The market is not yet well developed, and suppliers are not currently able to supply this in large quantities to meet the needs of humanitarian organizations. Use:

[21] The financial impact of replacing plastic packaging by biodegradable biopolymers. Journal of Cleaner Production, 2020
[22] Are bioplastics and plant-based materials safer than conventional plastics? In vitro toxicity and chemical composition. Lisa Zimmermann, Andrea Dombrowski, Carolin Völker, Martin Wagner, Environment International 2020.
[23] The Water and Land Footprint of Bioplastics the Water and Land Footprint of Bioplastics, Ratri Endah and others 2018
[24] Spierling et al. (2018) estimated that if biobased plastics replaced about two thirds of the world's demand for plastic, they could possibly save 241–316 Mt of CO_2-eq annually.
[25] Comparative Cradle-To-Grave Life Cycle Assessment of Bio-Based and Petrochemical PET Bottles, Iris Vural Gursel et al. 793 Science of The Total Environment 148642, 2021
[26] Some suppliers include Loliware, Sway, Ecovative Ecoware, Notpla.

	• Currently difficult to use for food products (challenges related to finding a sufficient replacement to plastic to act as the moisture barrier). • Shelf life is a challenge especially in hot and humid environments, making it not well adapted to many humanitarian contexts.
NATURAL FIBERS: JUTE AND COTTON[27]	
Definition	Includes packaging made from materials such as jute or cotton, typically used as a replacement for single use plastics bags.
Benefits	Jute and cotton bags are reusable, last much longer than plastic bags, and can be used multiple times for different purposes. There is the possibility to use bags for awareness raising or visibility purposes (printing on the bag), which is an added value for humanitarian organizations to reinforce their communications work.
Challenges	**End of life:** After they are no longer usable, jute and cotton bags are very rarely recycled.[28] **Cost**: Natural fibers are more expensive than petroleum-based plastics (depending on the context, cotton or jute bags can be up to four times more expensive than PP[29] bags). **Use:** While these materials can be used for secondary packaging, they are difficult to use for primary food packaging items, especially in a humid environment or where a long shelf life is required (difficult to protect food items from humidity and mold). Environmental footprint: • While a shift to natural fibers may reduce the impacts from the use of fossil fuel resources and greenhouse gas emissions, these fibers do not always have equivalent properties and are not necessarily more sustainable over the entire life cycle.[30] • They are only better from a carbon emissions perspective if they are **actually reused.** It is estimated that the carbon footprint of a jute bag is 30 times that of a PE plastic bag. Similarly, the total carbon footprint of a cotton bag is approximately 170 times higher than a plastic bag.[31] • Cotton production currently requires a lot of fossil-fuel-derived chemical inputs (pesticides and fertilizers), as well as water. **Hygiene:** If not washed properly, using natural fibers may increase the risks to human health when reused, making them a source of harmful bacteria.

[27] Joint Initiative case study

[28] Very few textiles (<1%) are recycled back into clothing, with another 12% are used in products such as cleaning cloths, insulation material and mattress stuffing. Sustainability and Circularity in the Textile Value Chain - Global Stocktaking, 2020 UNEP

[29] Polypropylene- e.g.: large bags used for rice distributions.

[30] Plastic in Textiles: Towards a Circular Economy for Synthetic Textiles in Europe, European Environment Agency, 2021.

[31] Should you sway plastic bags for tote bags to reduce your impact? Tabitha Whiting, 'Should You Swap Plastic Bags for Tote Bags to Reduce Your Impact?', April 2019

CARDBOARD/PAPER[32]	
Definition	Cardboard can be brown or white. Brown cardboard is usually made from 100% natural materials, but not all brown cardboard is made from recycled materials.
Benefits	• Made from natural materials, which degrade in the natural environment. • Available in most contexts in which humanitarian organizations operate. • Existence of a market for recycled cardboard/paper in which humanitarian organizations operate. • Presence of recycling companies that can recycle paper/cardboard in many countries.
Challenges	End of life: • When adhesives or coatings are added to "imitate" the technical properties of plastics (protecting from humidity etc.), the material is more difficult or even sometimes impossible to recycle, and the adhesives or coatings may end up as micro plastics in the natural environment. • White (bleached) cardboard contaminates the recycling process and is damaging to the environment, also when disposed of in landfill or burnt. • When adhesives or plastic inner liners are used, this renders the cardboard packaging itself difficult to recycle (because it is poly material). • Cardboard packaging may not be recycled when contaminated with grease because the paper fibers will not be able to be separated from the oils during the pulping process. **Cost**: Overall, cardboard and paper are more expensive than plastic packaging, although price depends on context. **Use**: Cardboard and paper do not resist certain humidity factors when stored. If damaged by humidity, these types of packaging cannot be reused. Environmental footprint: • Production of cardboard and paper is energy- and water-intensive when compared to plastics.[33] • Cardboard is heavier than plastic so it can generate more emissions during its transport and take up more room in freight containers.[34] Cardboard and paper can contribute to deforestation if not sourced from sustainably managed forests.

[32]Read about ICRC's experience in replacing plastic with cardboard packaging for hygiene kits in Afghanistan ICRC Afghanistan replacing plastic in NFI distributions, Joint Initiative case study 2022
[33] Comparison of Environmental Impact of Plastic, Paper and Cloth Bags, Kirsty Bell and Suzie Cave 2011.
[34] Comparison of Environmental Impact of Plastic, Paper and Cloth Bags, Kirsty Bell and Suzie Cave 2011.

RECYCLED PLASTIC	
Definition	Recycled plastics are plastics that are made partially or sometimes fully from recycled petroleum-based plastics.
Benefits	• Using packaging made of recycled plastics reduces the need to produce new plastic products and, therefore, helps save resources and emissions. • Recycled plastics have a lower global warming potential than petroleum-based plastics. Specific figures comparing petroleum-based plastics (PET, HDPE, and PP) with the recycled equivalent can be seen in this study produced by the Association of Plastic Recyclers and in the newsletter produced as part of the ICRC/IFRC/UNHCR Eco-design Tarpaulin Project 2021–2023. • A strong supply of post-consumer recycled plastic in combination with responsibly sourced plant-based plastic, means we will no longer need to rely on fossil fuels to meet our remaining need for new plastic.[35]
Challenges	**Cost:** Recycled plastic packaging can cost more than petroleum-based plastic packaging. **Toxicity:** Using recycled plastics may pose health risks when used to manufacture food packaging/recipients. For example, food-grade packaging made from recycled plastics may pose health risks (there may be risks linked to the plastic's original purpose e.g., storage of chemicals such as pesticides). Even food grade materials may include potentially harmful chemicals.[36] **Use**: The quality and durability of recycled plastics are inferior to virgin petroleum-based plastics, and the quality and durability are generally less **sturdy.** This naturally discourages manufacturers from offering these products, which may perform less well and, therefore, be considered to be of inferior quality by customers. **Availability:** Recycled plastic packaging is not as available as petroleum-based plastic packaging because demand outweighs supply. Environmental footprint: The recycling process can be energy intensive and is not yet sufficiently regulated in many of the countries in which humanitarian actors are operating. If not carried out according to environmental standards, the recycling process can generate contamination of soil and water, and the collection of recyclables (before arriving at the recycling infrastructure) is often carried out in poor conditions (e.g., informal sector, use of child rubbish pickers).

[35] Can Plant-Based Plastic Solve the Plastic Pollution Crisis?, World Wildlife Fund, 2021.
[36] The European Commission has adopted new rules on the safety of recycled plastic materials intended to come into contact with food. This regulation will set clear rules to ensure that recycled plastic can be safely used in food packaging but would not apply in most of the contexts in which humanitarian organizations are operating.

RECOMMENDATIONS

GENERAL RECOMMENDATIONS:

- Anticipate the additional costs related to alternative packaging and include these in budget proposals.
- Avoid packaging that is made of several different materials (e.g., plastic laminated with aluminum, laminated cardboard, or paper mixed with adhesive of plastic coating) because this affects the recyclability of the packaging item.
- Plan for adequate end-of-life management (e.g., by ensuring a separate collection and recycling stream if it exists).
- Prioritize the use of alternatives with the lowest possible percentage (or absence) of toxic materials.
- Raise general awareness of staff and beneficiaries (through sensitization activities, information campaigns, etc.) on packaging waste, and strongly encourage the reuse of packaging that is designed to be reused after distribution.
- When using recycled materials (plastics, cardboard etc.) where possible, visit the recycling site to ensure minimum quality checks and compliance with environmental and social standards. For instance
  - **EN 15343:2007**: Plastics recycling traceability and assessment of conformity and recycled content.
  - **Regulation EC 282/2008:** Requirements for plastic materials, articles, and parts thereof containing recycled plastic and intended to come into contact with foodstuffs.
  - **ISO 15270:2008:** Guidelines for the recovery and recycling of plastics waste.
- Be aware that the term "recyclable packaging", which can be misleading, particularly in humanitarian contexts, because the recyclability of a material is context-specific and depends on the availability of a local recycling market (e.g., PET plastic can be recycled in location A but not in location B). Ensure that instructions on packaging waste disposal are context specific.

RECOMMENDATIONS REGARDING COMPOSTABLE/BIODEGRADABLE PLASTICS PACKAGING:

- When choosing compostable and biodegradable plastics prioritize the use of the materials that have been approved with labels and standards, if possible (such as ASTM D6400, AS5810, ISO17088, and TIS 17088 certification,) and home compostable, rather than industrially compostable plastics.[37]
- For compostable and biodegradable plastic packaging, prioritize this type of packaging for immediate distribution rather than prepositioning since shelf life can be limited.

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RECOMMENDATIONS REGARDING PACKAGING MADE FROM NATURAL FIBERS:

- Prioritize the use of fibers that are certified according to ecological and social criteria (such as the Global Organic Textile Standard https://global-standard.org).

RECOMMENDATIONS REGARDING PACKAGING MADE FROM CARDBOARD OR PAPER:

- Choose brown cardboard over white, bleached cardboard.
- Give preference to recycled cardboard or paper over virgin cardboard.
- Wherever possible, choose cardboard or paper that comes from sustainably managed forests (e.g., use labels/certification such as that of the Forest Stewardship Council/ FSC).
- If a logo or design is required, ensure that the ink used is organic (non-organic ink generates contamination during the recycling process), and use black ink if and where possible.
- Prioritize paper tape where possible rather than acrylic packing tape.

CONCLUSION

Whilst recognizing that petroleum-based plastics provide a wide range of benefits (particularly their low cost, resistibility, durability, and protective quality) for humanitarian assistance packaging, the global scale of plastic production is contributing significantly to climate change and the waste management crisis[38] and humanitarian organizations must take action now. However, **choosing sustainable alternatives to fossil fuel-based plastic is complex and should not be seen as a "quick-fix solution".**

There is a need to consider a wide range of factors and to weigh issues such as cost, options for end-of-life management, and availability against humanitarian organizations' duty to reduce their environmental footprint (i.e., to "do no harm"), as well as the overall performance of the packaging. In short, there is no one-size-fits-all response.

Notwithstanding, here are some considerations for humanitarian actors:

- Alternatives to petroleum-based plastics are particularly challenging to use for food items. The quality and functionality of packaging (e.g., stability, strength, water resistance) remains a priority because food loss and food waste resulting from inappropriate or defective packaging can cause significant carbon emissions.[39]

- Refusing and reducing the amount of packaging used to deliver humanitarian relief items is key to minimizing the waste generated by the humanitarian sector. Packaging serves a purpose but is not always essential and can sometimes be removed.

- Packaging items that are designed to be reused and are reused in practice (by beneficiaries and humanitarian organizations) are consistently better than single-use packaging.[40]

- There is a need to be mindful not to perpetuate the "single use" mindset, even for non-plastic packaging. Instead, we should think more about what role the packaging plays (protection from rain, UV, hygiene issues, shelf-life challenges) and whether a more sustainable material can serve the same purpose.

[38] For more information, see the Packaging, Plastics and Climate Change Info Sheet produced by the Joint Initiative 2022.
[39] WWF estimates that 6%–8% of human-caused carbon could be reduced if we end food waste, https://www.worldwildlife.org/stories/fight-climate-change-by-preventing-food-waste.
[40] https://www.unep.org/resources/report/single-use-plastics-roadmap-sustainability.

RESOURCES FROM THE JI AND PARTNERS

- Packaging, Plastics and Climate Change, Joint Initiative info sheet, 2022.
- Sustainable criteria for packaging products, Joint Initiative/DRC/ICRC/UNICEF, 2022.
- Shelter Box's success in removing single use plastics, Joint Initiative case study, 2022.
- ICRC Afghanistan replacing plastic in NFI distributions, Joint Initiative case study, 2022.
- WFP Plastic free e-voucher shops, Cox Bazar Bangladesh, Joint Initiative case study, 2022.
- ICRC/IFRC/UNHCR Eco-design Tarpaulin Project 2021–2023 Project Newsletter, December 2022.
- UKAID Guidance Note on Packaging of Commodities, 2022.
- ACTED case study, Holistic Approach to Managing and Reducing Waste, 2023.

PUBLICATIONS

- Single use plastics a roadmap to sustainability, UNEP 2018.
- Biodegradable Plastics and Marine Litter. Misconceptions, concerns and impacts on marine environments, UNEP 2015.

ARTICLES

- The truth about bioplastics, Colombia Climate School, 2018.
- Is Biodegradable and Compostable Plastic Good for the Environment?, World Wildlife Fund 2022
- What Is PLA?, TWI 2017.
- The financial impact of replacing plastic packaging by biodegradable biopolymers, Journal of Cleaner Production 2020.
- The Water and Land Footprint of Bioplastics the Water and Land Footprint of Bioplastics, Ratri Endah et al. 2018.
- Comparative Cradle-To-Grave Life Cycle Assessment of Bio-Based and Petrochemical PET Bottles, Iris Vural Gursel et al., 793 Science of The Total Environment 148642, 2021.
- Are bioplastics and plant-based materials safer than conventional plastics? In vitro toxicity and chemical composition, Lisa Zimmermann, Andrea Dombrowski, Carolin Völker, Martin Wagner, Environment International 2020.
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- Sustainability and Circularity in the Textile Value Chain - Global Stocktaking, 2020 UNEP.
- Food packaging Forum, fact sheets on food packaging materials.
- Virgin vs. Recycled Plastic Life Cycle Assessment Energy Profile and Life Cycle Assessment Environmental Burdens, White paper, Association of Plastic Recyclers 2020.
- Are Bioplastics and Plant-Based Materials Safer than Conventional Plastics? In Vitro Toxicity and Chemical Composition, Lisa Zimmermann and others, Environment International n°145.

- EUBIO Admin, Is There a Certain Percentage Threshold Value That Marks the Minimal Bio-Based Carbon Content / Bio-Based Mass Content in a Product/Material to Be Called Bioplastics?, European Bioplastics e.V.2018.
- Comparison of Environmental Impact of Plastic, Paper and Cloth Bags, Kirsty Bell and Suzie Cave 2011.
- Plastic in Textiles: Towards a Circular Economy for Synthetic Textiles in Europe, European Environment Agency 2021.

This document was produced by the Joint Initiative for Sustainable Humanitarian Assistance Packaging Waste Management. If you wish to find out more or have suggestions on this document, please get in touch with joint.initiative@icf.com.

JOINT INITIATIVE
FOR SUSTAINABLE HUMANITARIAN ASSISTANCE PACKAGING WASTE MANAGEMENT

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