

Swap or Not? A climate-first guide to what 'plastic-free' swaps are 'worth it' for the environment – Out and About

Avoiding plastic while avoiding an increase in carbon dioxide emissions is not straightforward. Climate change is a greater existential threat. This guide aims to collate available information to help people decide which plastic swaps are better for the environment overall. Background notes are at the end.

Item	Pros	Cons	Overall?
Cutlery and tableware inc cups and bottles – the 'standard' is single use polypropylene cutlery or paper cups lined with plastic which need specialise recycling.			
Wooden cutlery  Image 1	Wood is biodegradable and compostable. Can be produced with low impact eg. Aspenware is produced with hydroelectric energy ¹ .	Slightly more expensive than single use plastic cutlery.	Good swap if take out option is needed. They can go into landfill or into the garden waste bin.
Bamboo/Melamine tableware  Image 2	Can be used for 4 years	Often as some plastic in the construction to bind the structure. This makes it harder to dispose of so will end up in landfill. There is significant water usage in washing cups, so again these must be reused sufficiently to break even (estimates vary but 20-100 uses!).	Good swap – compared to single paper board cups and compostable cups the impact is much lower. Concerns have recently been raised about hot drinks in melamine causing dangerous chemicals to leach into the drink. Glass may be better from this perspective. On 'light' usage of 250 coffees/year, the climate change impact is about 4x lower ²

¹ An Investigation into Sustainable Cutlery Solutions at UBC (2015) Joshua Carlton, Nick Knechtle, Rico Wen, Yuya Taniura, University of British Columbia

Reusable glass cup



Image 3

Typically last at least 4 years²

Glass is energy intensive to make but with repeated use this balances out.

There is significant water usage in washing cups, so again these must be reused sufficiently to break even (estimates vary but 20-100 uses!).

Glass is breakable, not allowed in some locations, recycling rate is fairly low although highly recyclable.

Good swap – compared to single paper board cups and compostable cups the impact is much lower.

On 'light' usage of 250 coffees/year, the climate change impact is about 4x lower²

Polypropylene cup/bottle



Image 4

Cheaper to buy than bamboo/glass cups

Light to carry

Not as long lasting as glass or bamboo – typical use = 30 x

Not generally collected in household recycling (but recyclable in principle).

On 'light' usage of 250 coffees/year, the climate change impact is about 2x lower²

Needs to be re-used at least 20 times to have less impact than a paperboard cup³

² Reusable Coffee Cups LifeCycle Assessment and Benchmark (2018) Report for KeepCup, Edge Environment

³ Reusable or Disposable cups Which Coffee Cup has a smaller footprint (2017) Pierre-Oliver Roy *Anthropocene Magazine*

<p>Stainless Steel bottles</p>  <p>Image 5</p>	<p>Long lasting</p> <p>Easy to clean</p> <p>Recyclable</p> <p>No leaching from plastic</p> <p>unbreakable</p>	<p>Making steel bottles is highly energy intensive. To balance out the production, bottles need to be re-used around 500 times. Some makes use carbon offsetting (by planting trees) to reduce the carbonfootprint of the bottle.</p>	<p>Probably good – IF the bottle is re-used sufficiently and/or recycled at end of life.</p> <p>Steel is highly recyclable.</p>
<p>Compostable cups/cutlery/takeaway containers, etc.</p>  <p>Image 6</p>	<p>Can break down in an industrial composting facility.</p> <p>If they have the Ok Compost sign can be composted at home</p> <p>Usually have lower carbon impact in production and extraction phase.</p>	<p>Unlikely to end up in an industrial compost facility without specialist waste collection in place.</p> <p>Most likely to end up in landfill where they won't break down/will break down and release methane which is bad for global warming.</p> <p>If they end up in plastic recycling they can contaminate the whole batch.</p> <p>Even if they have the OK Compost sign, most council waste collections won't take packaging. See Bioplastics summary below</p>	<p>Better to stock re-usable cups, offer incentives for using re-useable cups, have some 'borrow' cups that people can pay a deposit for.</p> <p>Use typical disposable cups if necessary and remind people to drop it at Costa/Starbucks for recycling – or arrange your own paper cup recycling bin with Veolia.</p>
<p>Stainless Steel cutlery</p>	<p>Can be re-used indefinitely.</p>	<p>Requires 19x as much energy as plastic cutlery to manufacture but can be re-used many times and 90% of end-of-life steel is recycled. For cafes the outlay is high, and there are ongoing washing costs.</p>	<p>Worth doing if will be re-used sufficiently.</p>
<p>Aluminium cans and foil</p>	<p>Can be recycled with no loss of quality. Strong.</p>	<p>Virgin aluminium has a carbon footprint about 6.2 x higher than virgin PET used for bottles. Foil can only be recycled if CLEAN</p>	<p>Recycled aluminium has about half the carbon footprint of virgin PET. Aluminum cans use mostly recycled aluminium. Buy recycled foil!!⁴</p>

⁴ <http://www-materials.eng.cam.ac.uk/energyforschools/downloads/D-PackagingRecycling.pdf>

Bags			
The 'standard' is the LDPE plastic carrier bag typically given out in supermarkets.			
 Recycled plastic bag (LDPE)  Image 7	Relatively low impact to produce.	Will not break down in landfill. Can end up in waterways.	Recycled LDPE bags: Reuse for grocery shopping at least 1 time for climate change, at least 2 times considering all indicators; finally reuse as waste bin bag. ⁵
 Polyester bags Image 8	Relatively low impact to produce. Can be recycled.	Made from hydrocarbons.	Polyester bags: Reuse for grocery shopping at least 2 times for climate change, and up to 35 times considering all indicators; finally dispose with recyclables, otherwise reuse as waste bin bag if possible, lastly incinerate. ⁴
 Polypropylene Bags Image 9	Strong, can withstand repeated use.	Have significant impact on ozone depletion, terrestrial eutrophication, freshwater eutrophication and water use ⁴ If used for food, especially meat, will need regular washing.	To match an LDPE carrier bag: PP bags, non-woven: Reuse for grocery shopping at least 6 times for climate change, and up to 52 times considering all indicators; finally dispose with recyclables, otherwise reuse as waste bin bag if possible, lastly incinerate. PP bags, woven: Reuse for grocery shopping at least 5 times for climate change, at least 45 times considering all indicators; finally dispose with recyclables, otherwise reuse as waste bin bag if possible, lastly incinerate. ⁴

⁵ The Danish Environmental Protection Agency (2018) Life Cycle Assessment of Grocery Carrier Bags project number 1985. See also note on Life Cycle Assessment at the end of this document.

Biodegradable (inc compostable) plastic bags



Image 10

Can be re-used as compost caddies

Usually have lower carbon impact in production and extraction phase.

“Bioplastics also cannot be recycled and if mixed with recyclable plastics, **can contaminate the process**. Sadly, most “biodegradable” plastic bags still **end up in landfill**, where they break down slowly and add to methane emissions.”⁶

There is no marine standard for ‘biodegradable’. If they do end up in the ocean they may not biodegrade or be any better than plastic bags.

Better to stock re-usable bags, offer incentives for using re-usable bags, have some ‘borrow’ bags that people can pay a deposit for.

Stock plastic bags if necessary and remind people to re-use them, use as bin liners when no longer needed.

To match an LDPE carrier bag: Can be directly reused as waste bin bags for climate change, should be reused **up to 42 times** for grocery shopping considering all other indicators. Finally, reuse as waste bin bag if possible, otherwise incinerate.⁴

Paper bags



Image 11

Unbleached minimally inked paper can be composted

Paper requires over three times the energy to make a bag equivalent to a plastic bag – even at 100% recycling. The energy is most likely to come from fossil fuels. Even lightweight recycled paper bags take more energy to make than a plastic bag.

Paper bags can be reused far fewer times than plastic bags. They often break and more are needed.

If paper ends up in landfill it may rot and release carbon dioxide and methane.⁷

Not a great swap. Stick with plastic or as above.

To match an LDPE carrier bag:
Unbleached paper bags: Can be directly reused as waste bin bags for climate change, should be reused and up to **43 times** considering all other indicators. Finally, reuse as waste bin bag if possible, otherwise incinerate.
Bleached paper bags: Reuse for grocery shopping at least 1 time for climate change, and up to **43 times** considering all indicators; reuse as waste bin bag if possible, otherwise incinerate.⁴

⁶ <https://www.unenvironment.org/news-and-stories/story/innovation-abounds-plastic-substitutes-its-behaviour-change-will-save-our>

⁷ How Bad Are Bananas?: The Carbon Footprint of Everything Mike Berners Lee

<p>PET bags</p>  <p>Image 12</p>	<p>Strong, can withstand repeated use.</p> <p>Relatively low impact on climate change (double an LDPE bag)</p>	<p>Have significant impact on ozone depletion, terrestrial eutrophication, freshwater eutrophication and water use⁴</p>	<p>To match an LDPE carrier bag:</p> <p>PET bags: Reuse for grocery shopping at least 8 times for climate change, and up to 84 times considering all indicators; finally dispose with recyclables, otherwise reuse as waste bin bag if possible, lastly incinerate.⁴</p>
<p>Cotton tote bags</p>  <p>Image 13</p>	<p>Can be re-used loads of times</p>	<p>Cotton production (organic or not) is water and fertiliser intensive, conventional cotton requires a lot of pesticides to produce. Interestingly, organic cotton has a higher climate change impact than conventional cotton⁸</p> <p>Cotton bags need to be re-used at least 150⁹-173 times to be responsible for fewer emissions than a single plastic bag. They are worse than single use plastic bags on all but two environmental measures including effect on marine life due to fertiliser run off.¹⁰,</p> <p>If used for groceries may need regular washing, esp if carrying meat products. This has a climate implication.</p>	<p>Avoid buying/stocking new ones unless they are recycled.</p> <p>To match an LDPE carrier bag:</p> <p>Organic cotton bags: Reuse for grocery shopping at least 149 times for climate change, and up to 20000 times considering all indicators; reuse as waste bin bag if possible, otherwise incinerate.</p> <p>Conventional cotton bags: Reuse for grocery shopping at least 52 times for climate change, and up to 7100 times considering all indicators; reuse as waste bin bag if possible, otherwise incinerate.</p>

⁸ Bisinella, V., Albizzati, P. F., Astrup, T. F., & Damgaard, A. (Eds.) (2018). Life Cycle Assessment of grocery carrier bags. København Ø: Danish Environmental Protection Agency. Miljøprojekter, No. 1985

⁹ Bisinella, V., Albizzati, P. F., Astrup, T. F., & Damgaard, A. (Eds.) (2018). Life Cycle Assessment of grocery carrier bags. København Ø: Danish Environmental Protection Agency. Miljøprojekter, No. 1985

¹⁰ Environment Agency Life Cycle Assessment of supermarket carrier bags in 2006. Report SC030148. Environment Agency, Bristol, 120pp.

Background: Life Cycle Analysis (LCA) – How Do We Know The Impact of Products?

LCAs are used to work out the impact of products on the environment. They take into account production, use and disposal. Environmental factors considered include global warming potential, pollution of rivers with algae, water use, acid rain, resource depletion, toxicity on humans, toxicity on freshwater plants and creatures, marine life, land ecology and production of smog. All life cycle assessments involve many background assumptions so perfect accuracy is impossible, however they provide an evidence base for evaluating the options and while precise figures vary between studies there is much commonality.

Plastic is amazingly durable and this is both its upside and its downside. “From a purely carbon perspective, its inability to rot is good news in as much as it won’t add to methane emissions from landfill: if we assume that the plastic is put in the bin rather than tossed into a street or field, those hydrocarbons are going back underground where they came from.”⁶ With well managed waste streams, plastic may be the least worst single use option. However, there is no guarantee that waste will be well managed and much of the UK’s plastic waste is shipped abroad where its fate may be unclear. **The aim should be to avoid single use items – of any time, given that all materials have a climate implication.**

For each bag material, a figure is given for the number of times a bag must be reused to have the equivalent impact of an LDPE plastic bag based on climate change or total impact. These figures come from the 2018 Danish study, which states that in addition to climate change, “The selected impact categories were: climate change, ozone depletion, human toxicity cancer and non-cancer effects, photochemical, ozone formation, ionizing radiation, particulate matter, terrestrial acidification, terrestrial eutrophication, freshwater eutrophication, ecosystem toxicity, resource depletion, fossil and abiotic. We also took into account depletion of water resource.”

Bioplastics Issues

There has been an upsurge in bioplastics as swaps for single use plastic. However, unless a suitable waste stream is in place these are likely to be worse overall for the environment. The UN Environment Report on plastic alternatives concludes:

- “The purposeful agricultural production of biomass to supply the biopolymer industry has to be balanced against the need to support food production and preserve biodiversity. ...
- There is scope to increase the use of agricultural and horticultural waste as a source of natural fibres and as a raw material for biopolymer production.
- Biomass-based biopolymers such as PLA, PHA and TPS show great potential, especially for packaging and other single use, **provided they are used in closed loop-systems.** Their promotion as a greener alternative is unjustified in the absence of the effective provision of industrial composting or anaerobic digestion facilities; i.e. they are not suitable for dispensing ‘fast food’ in uncontrolled public spaces.
- The increasing use of PLA, PHA and TPS and similar biopolymers **will not reduce per se the amount of plastic waste reaching the ocean** or ending up in landfill. In addition, there is a risk that such polymers will contaminate recycling waste streams”¹¹

“The primary feedstock for bioplastics today is corn, which is rife with agro-political conflict and often grown and harvested unsustainably; because of these reasons, and because it competes with food supply, it is not likely to be a long-term solution in the plastics world”.¹²

¹¹ Exploring the potential for adopting alternative materials to reduce marine plastic litter (2017) UNEP

¹² Paper Or Plastic? A Look At The Facts, Myths And Numbers Of Shopping Bags Huffington Post 2008

Images sources:

Image 1: <https://www.amazon.co.uk/ecotableware-disposable-cutlery-perfect-alternative/dp/B01F7ZUN7W>

Image 2: https://www.ukprintprice.com/ecoffee-bamboo-8oz-travel-cup?qclid=EAlaIQobChMIuYWH2p_F4AIVBpPtCh3ESA7JEAQYAYABEgJbz_D_BwE

Image 3: <http://www.phatrice.com/b2b/keepcup-brew-cup-8oz>

Image 4, 6:

https://www.researchgate.net/profile/Joana_Almeida15/publication/328600555_Reusable_coffee_cups_life_cycle_assessment_and_benchmark/links/5bd7e2fd4585150b2b90c367/Reusable-coffee-cups-life-cycle-assessment-and-benchmark.pdf

Image 5: <https://www.onegreenbottle.com/shop/800ml-new-tough-canteen-print-sample-steel-cap-no-logo/>

Image 7: <https://www.eppm.com/industry-news/plastic-carrier-bags-prove-to-have-the-lowest-environmental-/>

Image 8: <https://united-promotion.manufacturer.globalsources.com/si/6008852980708/pdtl/Polyester-shopping/1157635192/Shopping-tote-polyester-bag.htm>

Image 9: <https://www.indiamart.com/proddetail/non-woven-pp-bags9751642848.html&psig=AOvVaw0YoTrMpKI5INh6loainCqL&ust=1549469658672867>

Image 10: <https://www.canplastics.com/features/biopolymers-a-brief-biography/>

Image 11: <https://muraplast.com/en/products/papirnata-ambalaza/papirnate-vrecice-s-ravnom-ruckom/>

Image 12: <https://simplygreensolutions.com/products/rpet-stitch-bond-laminated-grocery-tote-fully-customizable>

Image 13: <https://www.firelabel.co.uk/caps-and-bags/bags/totes-and-shoppers/w201-westford-mill-premium-cotton-tote-bag.html>

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