ALLBIRDS PRODUCT CARBON FOOTPRINT METHODOLOGY

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Methodology Document Purpose

The Allbirds Sustainability team developed a life cycle assessment (LCA) tool to estimate the cradle-to-grave carbon footprint of products, identify hotspots, and drive emissions reductions. Over the years, Allbirds has partnered with several consultants to develop and validate the LCA tool, methodology, and datasets to calculate product carbon footprints. The Allbirds LCA tool has been third-party verified against the requirements of ISO 14067:2018 (see page 7).*

Carbon emissions data enables the Allbirds product team to make informed decisions in design and development, as well as track both product-level and company carbon footprints.

The purpose of this methodology document is to share additional detail behind the product carbon footprint calculations by providing an overview of current methodology and assumptions, data sources, and future improvements. The Allbirds LCA tool, and resulting product carbon footprints, will continue to evolve and improve over time with updated characteristics and methodology. Beginning in April 2020, Allbirds published the carbon footprint for every product in our permanent collection. Updated figures are published on our website annually with the essential goal of reducing product carbon footprints over time.

Characteristics of Allbirds Products

Allbirds is developing new categories of footwear and apparel inspired by natural and recycled materials, with the mission to create better things in a better way. The following practices are important to our product development and often help to lower our carbon footprint:

- We prioritize the use of natural materials, such as tree fibers and sugarcane, and recycled materials.
- We pursue material certifications such as FSC® or PEFC for tree products and packaging, ZQ Merino for wool, and Bonsucro for sugarcane to ensure responsible sourcing.
- We prefer manufacturing facilities located in regions with low carbon electricity grids. We also work to support supplier use of renewable energy (e.g., onsite solar, renewable energy credits, direct utility enrollment), wherever possible.
- We minimize packaging through design and strive for 100% recycled content.
- We prioritize shipping via ocean versus air and for select styles, we pursue the use of biofuels for ocean shipping.

As we work to reduce our carbon footprint over time, we also believe that we should be held accountable for our climate impact today. While there are emissions that we are not able to abate right now, we recognize the importance of also supporting high-quality carbon projects, with a focus on shifting to nature-based projects that remove or sequester emissions.

System Boundaries

The Allbirds LCA tool calculates the kilograms of carbon dioxide equivalent (CO_2e) emitted to make an Allbirds product. That means in addition to calculating carbon dioxide emissions, other greenhouse gases, like methane, are accounted for and converted to CO_2, assuming the global warming potential values provided by the Intergovernmental Panel on Climate Change (IPCC).

The cradle-to-grave product carbon footprint includes all emissions associated with materials (raw material production/extraction as well as materials processing), manufacturing, transportation, product use, and end of life, including fossil emissions, biogenic emissions/removals and direct land use change, as suggested by ISO 14067:2018.

Life Cycle Stage	**Overview**
Materials	● Production/extraction of raw materials, including waste ● Material processes that occur before Tier 1 factory, which may include yarn formation, textile formation, preparation, coloration ● Transportation of raw materials, primary textiles, and materials to Tier 1 factory ● Packaging
Manufacturing	● Manufacturing processes that occur at Tier 1 factories, which may include molding, cutting, stitching, and product assembly
Transportation	● Product transportation from Tier 1 factory to distribution centers ● Product transportation from distribution centers to customers, including returns
Product Use	● Customer care, including washing and drying product over lifetime ● Cycles assumed over lifetime, by product category: ○ Footwear: 3 wash ○ Apparel/Basics: 52 wash and dry

End of Life	• Emissions associated with final disposal of the footwear and socks after product use, assuming US municipal waste averages (80% landfill, 20% incineration)

Excluded Scope

Emissions associated with brick-and-mortar retail and headquarter operations (corporate offices, business travel, employee commuting, etc.) are not included in the product carbon footprint, but are accounted for at the company-level.

Functional Unit and Average Product Carbon Footprint

Functional Unit

The carbon footprints for product categories are calculated using the following sizes:

- Footwear (except Breezers): Men's 9
- Breezers: Women's 8
- Socks: Large (M9-12, W11)
- Men's Apparel: Large
- Women's Apparel: Medium

Our footwear functional unit represents the most produced size across Allbirds men's and women's footwear (women's sizes were normalized to men's sizes, excluding the Breezers). The Breezers are only available in women's sizing and size 8 is the most-produced size.

A size large is the functional unit selected for all sock products to correspond with the footwear size. Apparel products have separate carbon footprints for men's and women's style because the product fit can vary significantly, resulting in a considerable impact to the carbon footprints.

Allbirds Average Product Carbon Footprint

In 2023, our average product carbon footprint across all products was 5.54 CO_2e. You can read more about our decarbonization progress in the Allbirds 2023 Flight Status report.

**The annual per unit carbon footprint is the average carbon footprint calculated based on the product carbon footprints in that year and the units produced in that year. In other words, it is the total product-related emissions in that year, divided by the total number of units produced in that year.*

Literature Review of Footwear LCAs

Limited research exists on the environmental impact of footwear production—there are few LCAs to begin with and even fewer are transparent about detailed methodology and assumptions. Footwear comes in a variety of styles for different functions, so it is difficult to arrive at the carbon footprint of a "standard sneaker". We compiled a range of carbon footprints from approximately 5 kg CO_2e/pair to 30+ kg CO_2e/pair within the footwear industry.

The academic LCA of a running shoe, performed by MIT, "estimated that the carbon footprint of a typical pair of running shoes made of synthetic materials is 14 ± 2.7 kg CO_2e/pair". The report was published in 2012, but remains the most comprehensive and transparent footwear LCA that is publicly available.

As we calculate our product carbon footprints, we think it is helpful to have a reference point. When making comparisons, it is important to ensure consistent methodology and assumptions (i.e., same boundaries, functional unit), so we developed a set of assumptions for a "standard sneaker", based on the MIT study, to run through our own LCA tool. The resulting carbon footprint is 14.1 kg CO_2e/pair, with the following assumptions:

Life Cycle Stage	**Standard Sneaker Assumptions**
Functional Unit	• Men's 9 shoe: weighs 674 grams
Materials	• 100% virgin synthetics: 32% polyurethane (PU), 29% polyester, 11% polypropylene (PP), 10% ethylene-vinyl acetate (EVA) foam, 10% rubber, 4% nylon, 4% thermoplastic polyurethane (TPU) • Assumes similar rates of material waste to our production • Shoebox weighs 178 g and is 100% virgin cardboard
Manufacturing	• 6.39 kWh of electricity consumption - on-site coal combustion reported in the MIT LCA is excluded from Allbirds standard sneaker analysis • Made in China
Transportation	• Ocean versus air transportation split of 83/17, per 'Fashion on Climate' report released by the Global Fashion Agenda • Same product global distribution as Allbirds
Product Use	• None
End of Life	• Fate of average US municipal waste (80% landfill, 20% incineration)

Data Sources

Data sources used to calculate the carbon footprint include a mix of primary and secondary data, including other life cycle assessments, material databases, and scientific literature reviews. Primary data is used when available and is triangulated with reputable, industry-specific data. A summary of key data sources by life cycle stage is listed below:

Life Cycle Stage	Data Sources
Materials	• Product bill of materials (BOM) • Carbon intensities from supplier LCAs and LCA databases
Manufacturing	• Primary energy consumption data from Allbirds factories • Electricity grid emissions factors by country and region (ecoinvent Data v.3.8) • Carbon intensities of fuels and other impacts (ecoinvent Data v.3.8)
Transportation	• Product global distribution and transportation modes • Consumer purchase method and product return rate • Distances by mode (Searates distance estimator) • Carbon intensities by mode (EPA GHG Emission Factors Hub)
Product Use	• Product care label instructions • Wash cycle energy intensities (Product Environmental Footprint Category Rules: T-Shirt) • Dry cycle energy intensities (ENERGY STAR Residential Clothes Dryers Report) • Electricity grid emissions factors by country and region (ecoinvent Data v.3.8)
End of Life	• Product end of life fate: percentage landfill versus incineration (EPA Waste Reduction WARM) • Packaging recycling rate (EPA Municipal Solid Waste: paper and paperboard recycled) • Landfill and incineration carbon intensities by material type (ecoinvent Data v.3.8)

Limitations & Future Improvements

While our LCA tool will always be evolving and improving, we have to start somewhere. We will continue to update our methodology based on improvements to underlying data, as well as in-line product changes. In the meantime, here are the main limitations we see:

- While we strive to make our materials and manufacturing assumptions as specific to our supply chain as possible, in some cases (due to lack of data) we use global industry averages.
- When we use a range of data sources, there can be discrepancies in the scope and methodology. We do our best to ensure that values from different sources are comparable, though sometimes we are unable to confirm. In these instances, we select conservative assumptions to represent the highest likely carbon footprint.
- Gathering data for product use is challenging because a wide range of actions can occur throughout the product's life depending on a consumer's behavior. We applied conservative assumptions for the number of wash and dry cycles over a product's lifetime, and we're working to better measure and influence how our customers care for Allbirds products.
- Our model currently only measures global warming potential, CO_2e, but we are working to incorporate other indicators (e.g., water, waste).

Allbirds is committed to working with LCA experts to continuously improve our approach to carbon footprinting as our business grows to reflect the current state of our operations.

** In March 2023, Allbirds announced M0.0NSHOT, with our adjusted approach to accounting for the product carbon footprint. The carbon footprint of M0.0NSHOT accounts for on-farm carbon sequestration for the wool, in addition to emissions, which is a deviation from standard industry practice. As a result, the calculated carbon footprint for M0.0NSHOT, unlike Allbirds' standard products, is not fully aligned to ISO 14067. However, Allbirds believes this wool carbon intensity value captures a more comprehensive model of the total emissions fluxes happening on-farm.*