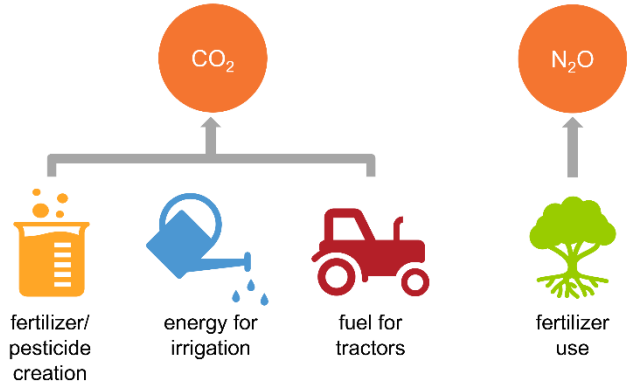


CARBON FOOTPRINT OF ALMONDS

What is a carbon footprint and how is it calculated?

Carbon footprints measure the net amount of greenhouse gases (GHGs), mainly carbon dioxide (CO₂), that are released in the process of creating a product. In agriculture, nitrous oxide (N₂O) is also a significant GHG. This is calculated by assessing the GHG emissions from all of an industry or company’s activities as it relates to creating that product, often using a life cycle assessment (LCA).



An LCA is an accounting system looking at all of the inputs used and outputs generated during the production of a product from its inception to end of life, known as “cradle to grave.” For almonds this spans everything from the creation of the irrigation tubing and fertilizers used in the orchard to growing the trees at the nursery before they’re planted to orchard removal at end of life. The figure above depicts the most significant activities in almond production and their associated greenhouse gases.

What is Scope 3?
 There are three scopes of emissions that companies consider as they look at the environmental impact of a product over its journey from raw material to final consumption. **Scope 3** refers to those happening outside of a company’s direct control but related to their products. For a company that sources almonds, this number would include the emissions from growing almonds along with the emissions from anything else included in their final product.

Meeting regulatory requirements

Recent legislation in California¹ and Europe² will require companies above a certain annual revenue to consider and report their entire supply chain’s GHG emissions. Will this legislation apply directly to growers and handlers? Most likely, no. However, handlers may need to submit carbon footprint information to their buyers to help them will Scope 3 reporting. In addition, companies may ask about efforts to reduce GHG emissions to include in their reporting requirements.

California almonds’ carbon footprint

There are two California-specific LCAs conducted by UC Davis, published in 2015^{3,4} and 2021⁵, which follow the impact of producing an almond from planting to hulling and shelling. Those include things like the fuel used by farm machinery and in the transport and pumping of irrigation water, as well as manufacturing the fertilizer that nourishes the trees as they grow. While fundamentals like growing trees don’t change, the adoption of new, lower-impact practices and shifts in inputs and outputs (like energy composition and coproduct utilization) mean impacts shift over time and can decrease almonds’ carbon footprint – hence the need to keep these analyses up to date.

By adding up all these figures (and converting those that aren’t CO₂ into a CO₂ equivalent), we can estimate the total carbon footprint of California almond production. This is reported as CO₂ equivalent per kilogram of almonds and reported by region⁶ as well as a Central Valley average. This data for almonds is included in the World Food LCA Database.

	Without Substitution	With Substitution	Characteristics
Sacramento Valley <small>Tehama to Sacramento County</small>	2.89 kg CO ₂ e/kg kernel	0.97 kg CO ₂ e/kg kernel	Greater water availability
North San Joaquin Valley <small>San Joaquin to Fresno County (N of SJ River)</small>	2.26 kg CO ₂ e/kg kernel	0.51 kg CO ₂ e/kg kernel	Longer orchard lifespans
South San Joaquin Valley <small>Fresno (S of SJ River) to Kern County</small>	2.86 kg CO ₂ e/kg kernel	1.95 kg CO ₂ e/kg kernel	Higher yields with higher water and nutrient demand
Central Valley Average	2.53 kg CO ₂ e/kg kernel	1.23 kg CO ₂ e/kg kernel	

What numbers should I use?

LCA's standard methodology produces two sets of numbers – each with a distinct purpose.

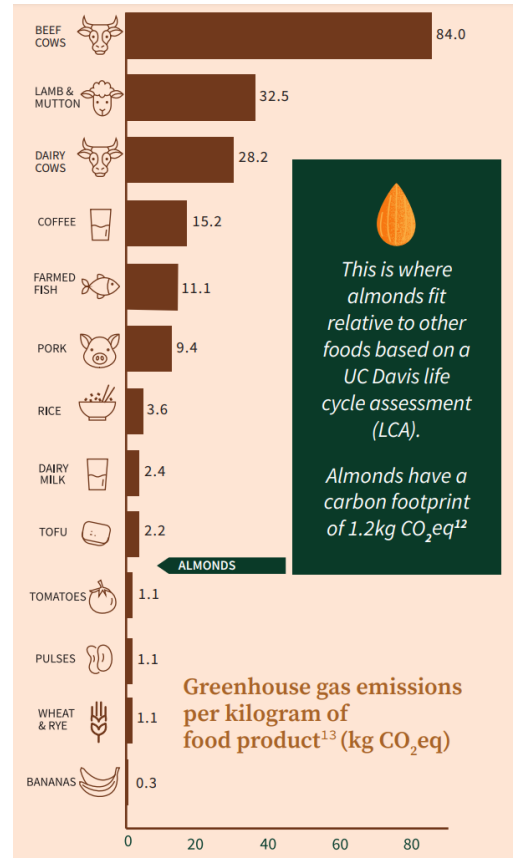
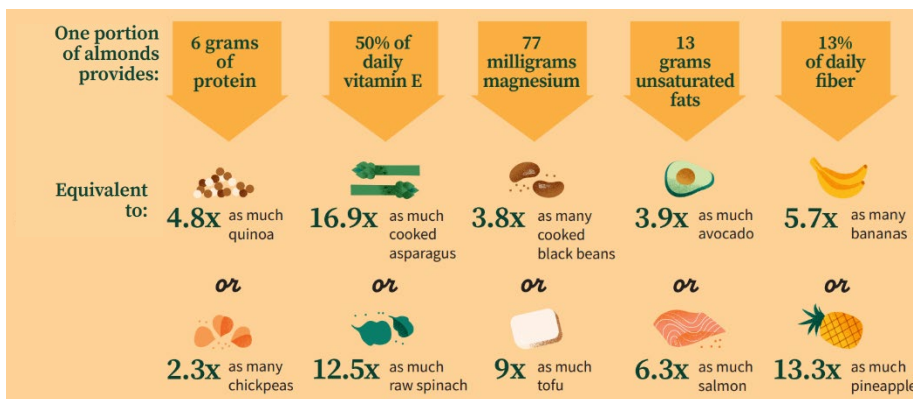
With substitution accounts for the utilization of coproducts which reduce the need to produce something else. For example, the use of almond hulls as dairy feed reduces the need to grow other feed and its associated environmental impact. We use this number when talking about California almonds' carbon footprint generally as it provides a more holistic look at the industry's impact.

Without substitution figures are used when accounting for an entire supply shed rather than an individual ingredient. This avoids double counting and is used for Scope 3 regulatory reporting.

How almonds stack up

A carbon footprint is hard to understand without a comparison. The great news? Almonds have a lower carbon footprint than many other foods. A University of Oxford study found that nuts are responsible for far fewer GHG emissions per kilogram of food compared to things like beef, dairy and poultry.⁷

What's more, almonds are nutrient dense, providing a high amount of nutrients per serving compared to other foods.⁸



Want to learn more about California almonds' climate smart credentials?

Visit Almonds.com/Carbon

¹ Covington & Burling LLP. 2023. California SB 253 Climate Corporate Data Accountability Act will require disclosure of Scope 1, 2, and 3 GHG emissions for companies doing business in California with greater than \$1 billion in annual revenue.

² Inside Energy and Environment. 2023. EU Corporate Sustainability Reporting Directive legislation requires EU companies with more than 500 employees and a net worldwide turnover of €150 million and non-EU companies with €150 million in net turnover generated in the EU to report Scope 1, 2, and 3 GHG emissions.

³ Alissa Kendall, et al. Life Cycle-Based Assessment of Energy Use and Greenhouse Gas Emissions in Almond Production. Part 1: Analytical Framework and Baseline Results. Journal of Industrial Ecology. 2015.

⁴ Alissa Kendall, et al. Life Cycle-Based Assessment of Energy Use and Greenhouse Gas Emissions in Almond Production. Part II: Uncertainty Analysis through Sensitivity Analysis and Scenario Testing. Journal of Industrial Ecology. 2015.

⁵ Elias Marvinney, et al. A scalable and spatiotemporally resolved agricultural life cycle assessment of California almonds. The International Journal of Life Cycle Assessment. 2021.

⁶ While almond growing regions are typically split between Sacramento Valley, and North and South San Joaquin Valley, the LCA utilized hydrologic regions. See Figure 3 for delineations of those regions or reference this map: bit.ly/4dW0j9c. Note that two small areas in northern Fresno County are in the North San Joaquin Valley region.

⁷ Joseph Poore, et al. Reducing food's environmental impacts through producers and consumers. Science. June 2018.

⁸ US Department of Agriculture, Agricultural Research Service. USDA National Nutrient Database for Standard Reference, Release 28. 2015.