

# A Life Cycle Assessment of Greenhouse Gas Emissions for Almond Processing and Distribution in California

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## PROJECT SUMMARY

### Objectives:

- The objective of this project is to apply life cycle assessment (LCA) to model greenhouse gas (GHG) emissions, criteria air pollutants, and energy consumption resulting from California almond processing and distribution, and link these LCA outcomes to previous modeling of almond production, and hulling and shelling. Linking these previous modeling results will provide total life cycle results for almond products at their point of entry to major importing regions, allowing for retailers or consumers to understand the energy and greenhouse gas footprint of almonds at their point of entry to markets around the world.

### Background and Discussion:

California almond growers have to contend not only with significant environmental variables, but also with a complex regulatory environment. Accordingly, in running operations and formulating their business plans, they have to take into account such factors as energy use, GHG emissions, and other forms of air pollution in both the short and long run. This project is designed to furnish growers, handlers and others in the almond industry with a model that will enable them to better understand the production processes and practices that contribute to GHG emissions, air pollution and energy use.

In previous years we created an almond orchard management model to simulate the life cycle energy and resource inputs and waste, pollution, and co-product outputs, such as prunings and

wood from removed trees. The LCA model results showed that irrigation and fertilization were the largest contributors to energy consumption in almond production, and that using orchard biomass in bioenergy applications improves the greenhouse gas and energy performance of almonds.

In 2013 we initiated research to expand this model to include processing of almond products and distribution. We have collected data from cooperating hullers/shellers and processors. Processes included in the scope of this analysis include transport from field to the hulling and shelling site; transport (where required) to processors sorting; fumigation; and, depending on the facility, additional steps including roasting, blanching, slicing, etc. We are also modeling international shipment to the first port of entry based on export statistics and freight modeling. Our goal is to continue data collection until we have enough facilities where summary statistics can be reported, thus providing high quality information and maintaining the anonymity of cooperating businesses.

The results will report life cycle GHG emissions, criteria air pollutants, and energy per unit of product at its point of entry to foreign markets or point of distribution prior to retail in the domestic market. This will provide environmental and energy indicators that are relevant to interested retailers and consumers.

**Project Cooperators and Personnel:** Sonja Brodt, Agricultural Sustainability Institute, University of California, Davis

**Graduate Student Researcher:** Katherine Hoerberling, International Agricultural Development, University of California, Davis

### For More Details, Visit

- Poster location 75, Exhibit Hall A + B during the Almond Conference; or on the web (after January 2016) at [Almonds.com/ResearchDatabase](http://Almonds.com/ResearchDatabase)
- 2014 - 2015 Annual Reports CD (13.AIR8.Kendall); or on the web (after January 2016) at [Almonds.com/ResearchDatabase](http://Almonds.com/ResearchDatabase)
- Related projects: 15-AIR2-Smart; 15-PREC6Smart; 14-PREC1-DeJong; 14-STEWCR0P4-Kimmelshue