



# Almond Water Footprints: Beyond the One-Gallon-Per-Nut Complex

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# Acknowledgements

## UC Davis Collaborators

- Fraser Shilling
- Michael Norton
- Hongfei Wang
- Camila Bonilla Cedrez

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Almond Board of California

# Why almonds?



- CA grows 80% of world's almonds; a growing market.
- Consumer preferences, including as meat alternative.
- 12% of CA's irrigated acreage, and expanding.
- 16% of CA's irrigation water, mostly groundwater.

# Why almonds?



Are almonds and other nuts really drought villains?

Los Angeles Times

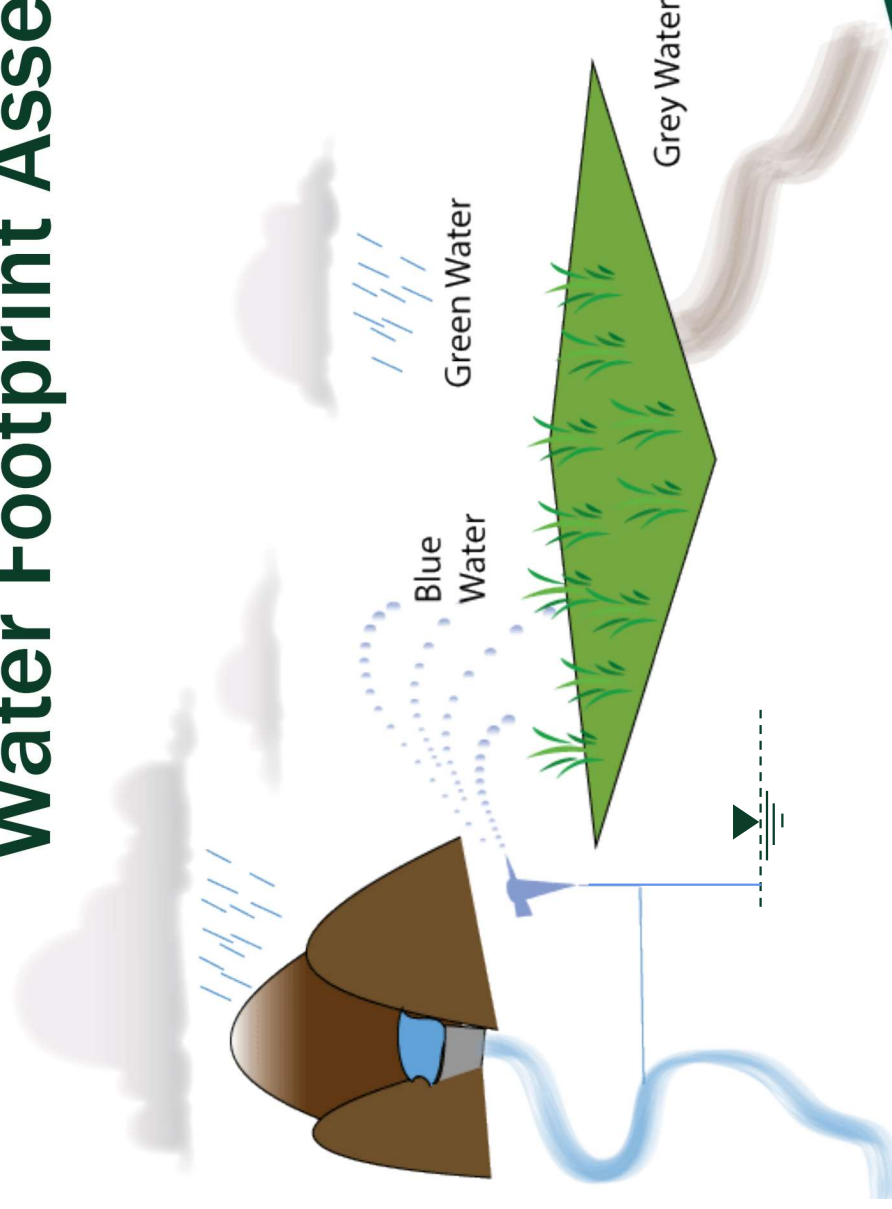
Almond milk: quite good for you - very bad for the planet

theguardian

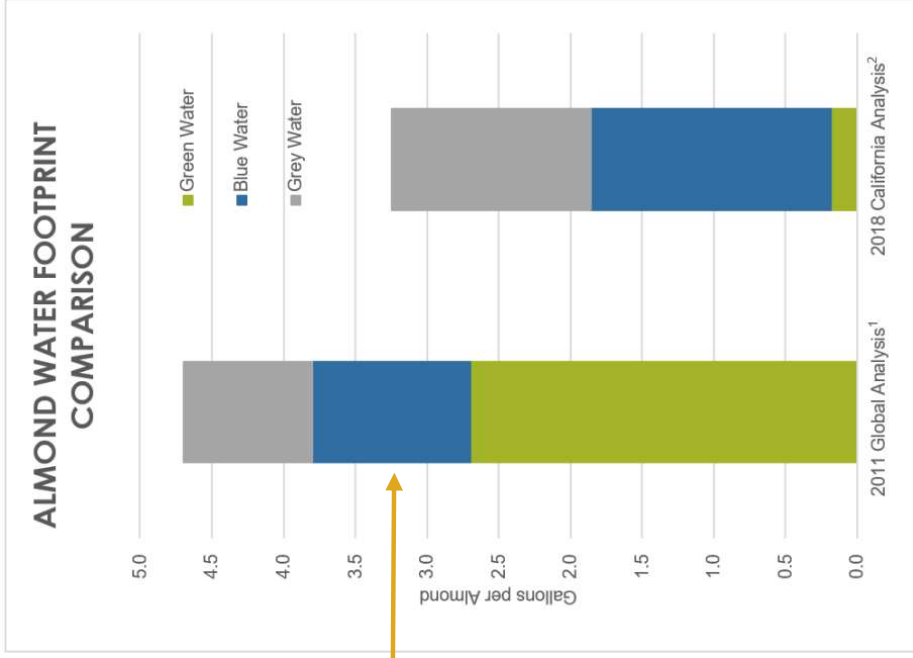
Lay Off the Almond Milk, You Ignorant Hipsters  
**Mother Jones**

# Water Footprint Assessment

- Consumptive water use
  - blue, green, grey
- Production chain up to consumer
- [www.waterfootprint.org](http://www.waterfootprint.org)
- ISO 14046



# Almond Water Footprint



“1 gallon per nut”

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## Water-indexed benefits and impacts of California almonds

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### ARTICLE INFO

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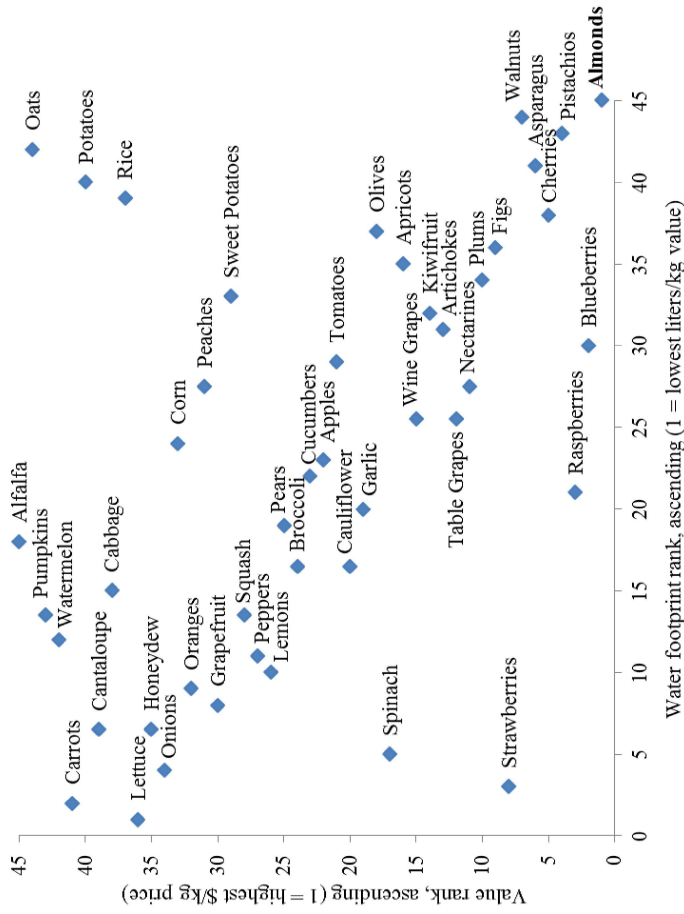
### ABSTRACT

California almonds have been the focus of recent media scrutiny because of the large amount of water required to grow individual nuts and, by extension, for the industry as a whole. With almond orchard acreage doubling in the last two decades and becoming California’s most extensive irrigated crop, the questions arise: what are the benefits and impacts derived from this use of scarce water? Can we use this information to make decisions about growing and consuming this particular crop? We first use a water footprint approach to estimate total impact on water per unit of almond production in California, including variation in the water footprint over time (2004–2015) and across the production area. We then compare almonds to a set of other foods and crops grown in California using water footprint values and three other dimensions: nutritional value, per-unit-weight economic value, and total economic value. The water footprint of California almonds averaged 10,240 liters per kilogram kernels (or, 12 liters per almond kernel), with substantial variation over the time period analyzed. Water footprint values also varied twofold across the production area, with the smallest water footprint being in the southern counties of California’s Central Valley. In relation to dietary benefits, almonds were among the top three foods analyzed providing the greatest nutritional benefit per unit weights, however they had the highest

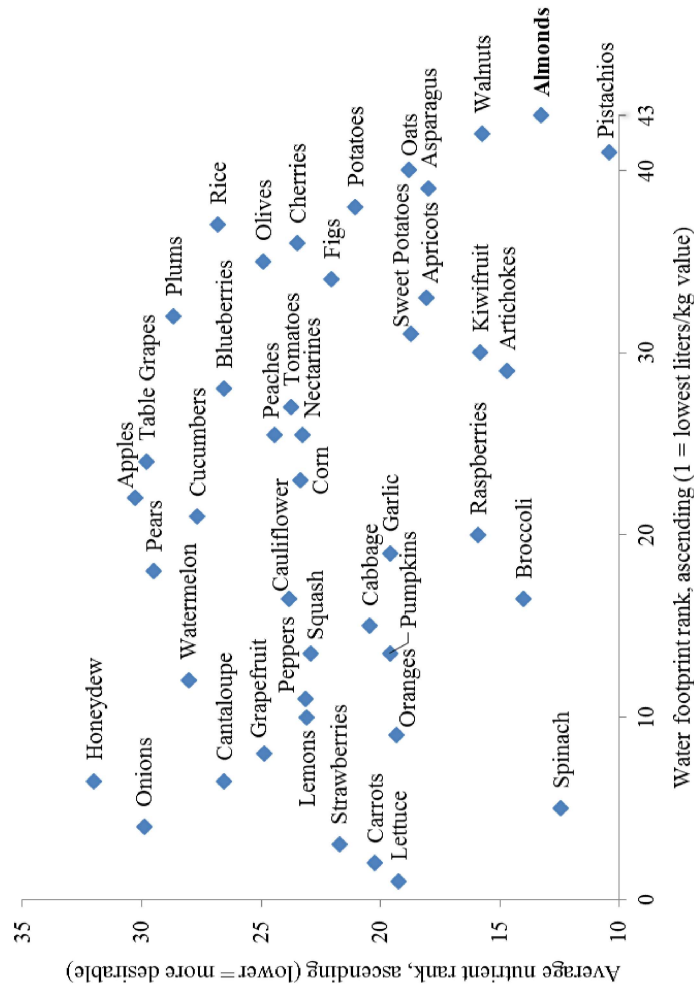


# Almonds vs other crops

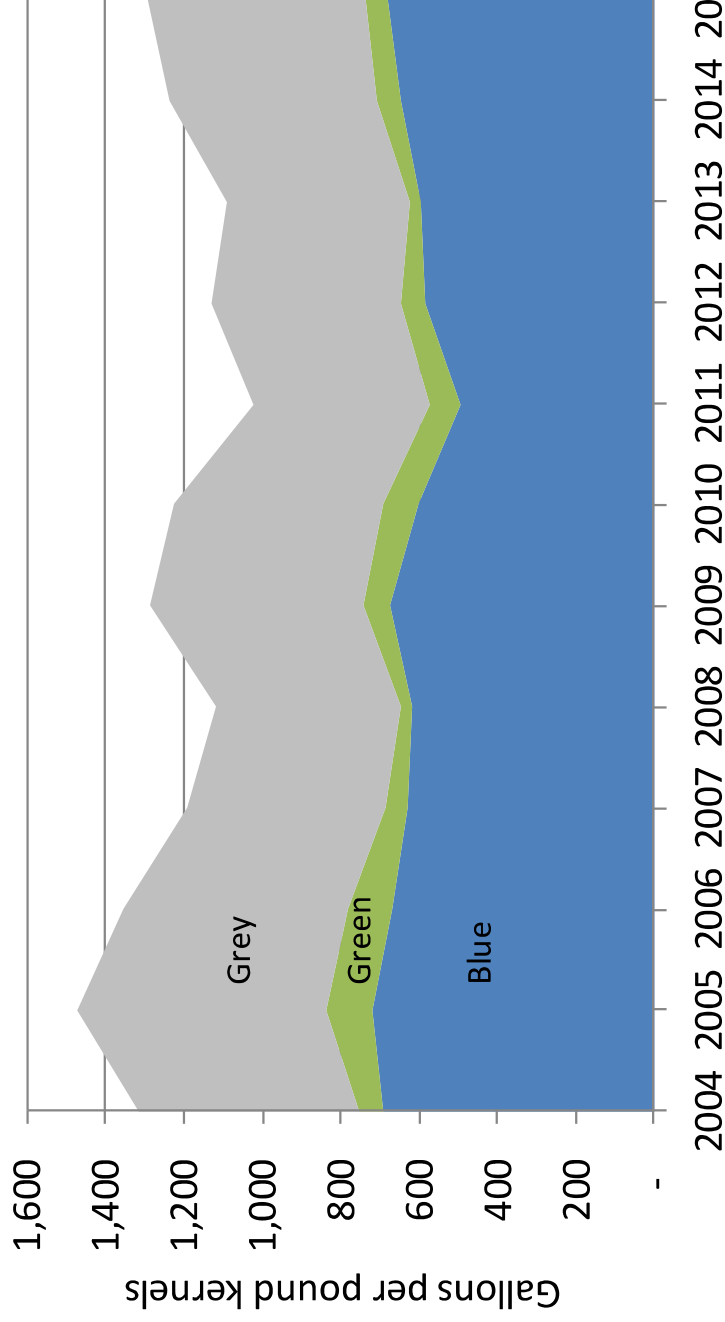
## Value rank



## Nutrient rank



# How can almond WF be further reduced?



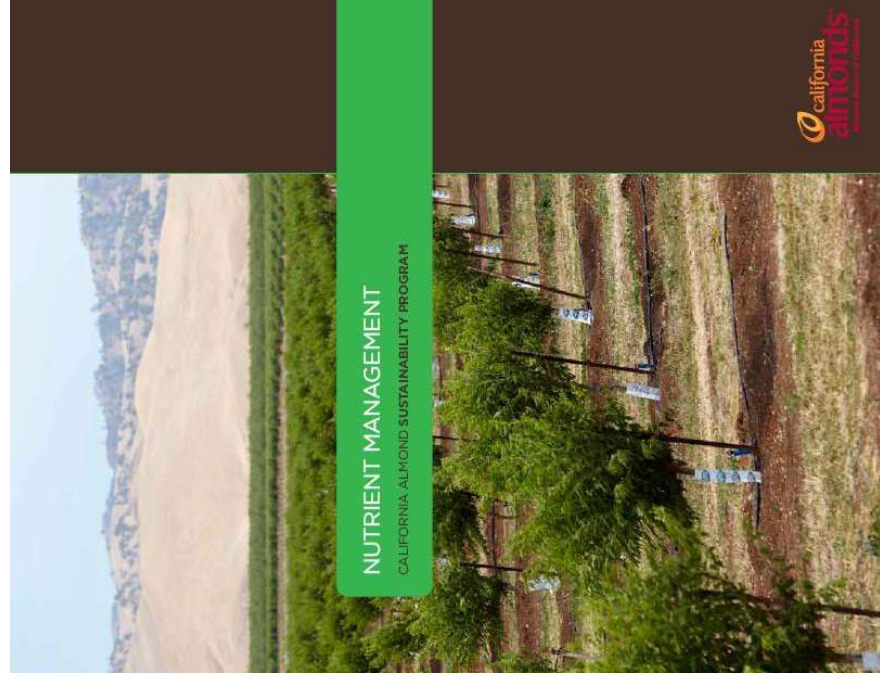
*Estimating how grower practices reduce calculated blue, green, and grey WF ...and examining the off-setting value of sustainability actions relative to the calculated WF*



# On-farm practices

Planting Stage	Growing Season	Harvest Season	Dormant Season	On-Farm Practice	Blue WF	Green WF	Grey WF
X				Site selection		X	
X				Soil preparation		X	X
X	X	X	X	Energy management	X		
	X		X	Soil management	X	X	X
X	X			Irrigation management	X		X
X	X		X	Nutrient management			X
	X		X	Bare-surface management	X	X	X
		X		Waste management			X
	X		X	Biochar	X	X	X

# Grey WF reduction



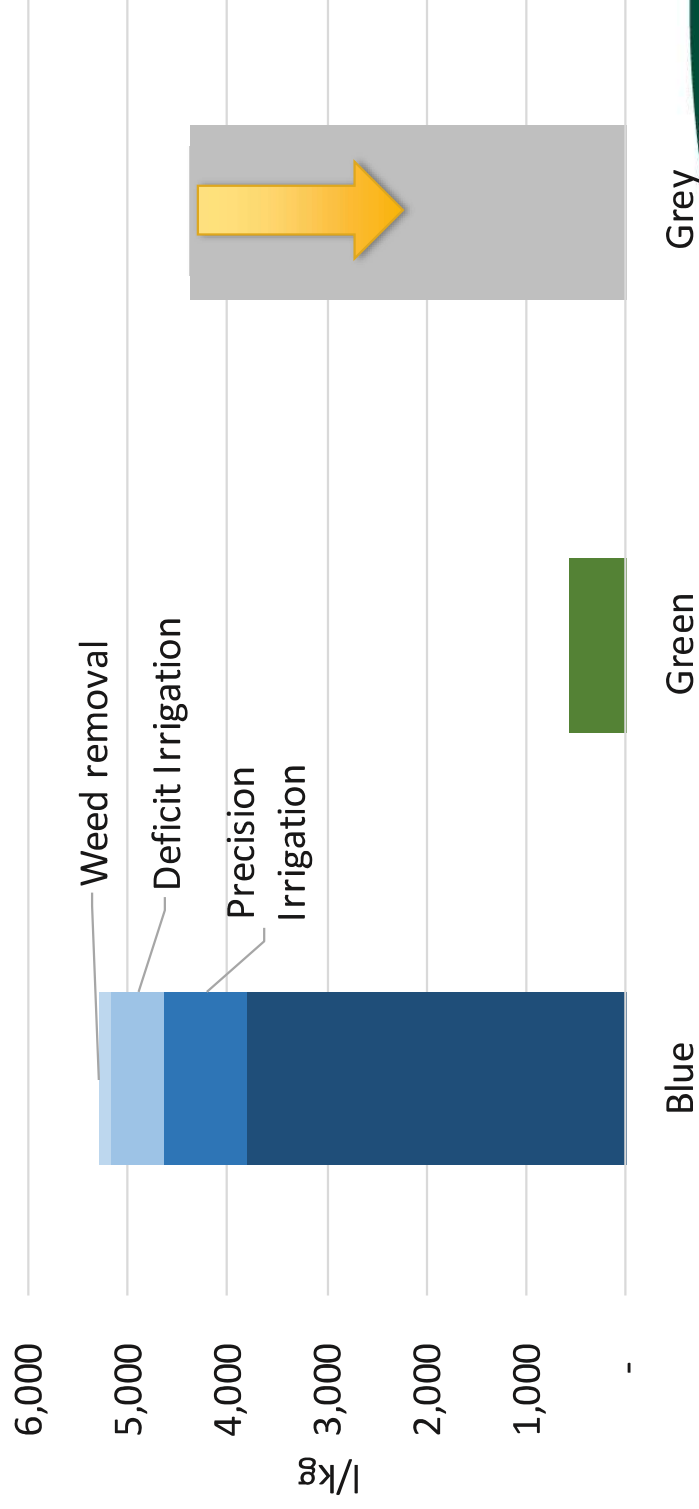
Nitrogen:

Right source, amount, timing, place

## Nutrient Management

		lbs/acre
1	How many pounds of nitrogen (N) were applied per acre for this orchard in the season being assessed?	lbs/acre
2	How many pounds of phosphorus (P) were applied per acre for this orchard in the season being assessed? (NOTE: Please use actual P instead of P <sub>2</sub> O <sub>5</sub> *)	lbs/acre
3	How many pounds of potassium (K) were applied per acre for this orchard in the season being assessed? (NOTE: Please use actual K instead of K <sub>2</sub> O*)	lbs/acre
4	What is the percent soil organic matter for this orchard, as measured in the past 5 years**? IF YOU HAVEN'T TESTED FOR THIS, CHECK HERE <input type="checkbox"/>	%

# Practices to reduce WF





Thank you!

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