2017 THE ALMOND CONFERENCE

WHAT YOU SHOULD CONSIDER BEFORE YOU GROW

Room 308-309 | December 5 2017

california almonds
Almond Board of California

growing ADVANTAGE
The Almond Conference

CEUs – New Process

Certified Crop Advisor (CCA)

- Sign in and out of each session you attend.
- Pickup verification sheet at conclusion of each session.
- *Repeat this process for each session, and each day you with to receive credits.*

Pest Control Advisor (PCA), Qualified Applicator (QA), Private Applicator (PA)

- Pickup scantron at the start of the day at first session you attend; complete form.
- Sign in and out of each session you attend.
- Pickup verification sheet at conclusion of each session.
- Turn in your scantron at the end of the day at the last session you attend.

Sign in sheets and verification sheets are located at the back of each session room.

AGENDA

- **Gabriele Ludwig,** Almond Board of California, moderator
- **Harbinder Maan**, Almond Board of California
- **William Matthews**, University of California Agricultural Issues Center
- **Doug Parker**, University of California

WHAT YOU SHOULD CONSIDER BEFORE YOU GROW

Harbinder Maan

Associate Director, Trade Marketing and Stewardship, Almond Board of California

california almonds®
Almond Board of California

AGENDA

1. Snacking fueling growth for almonds

2. Global markets, almond board of California consumer programs

3. Varieties, importance of flavor

4. Summary

1. SNACKING FUELING GROWTH FOR ALMONDS

- What is driving growth, trends?
- Where do our Almonds go?
- Innovation in Almond products

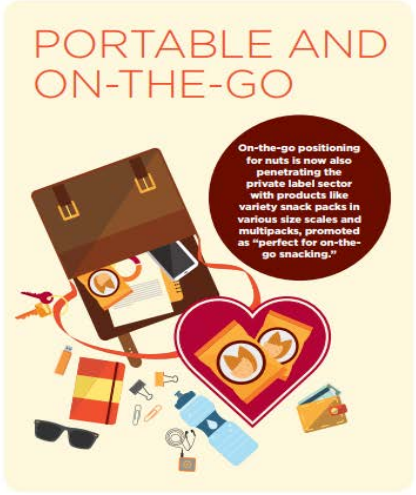
“SNACKIFICATION” OF SOCIETY – DRIVEN BY THE MILLENNIAL GENERATION

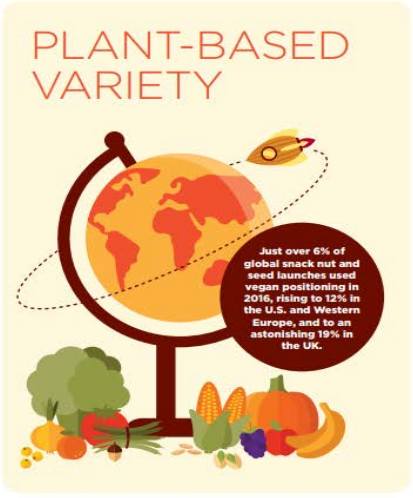
- Referred to as the “snackification” of society, these consumers are **shedding the traditional custom of eating three meals a day in place of eating smaller portions more frequently, or snacking.**
- Instead of cooking and having a traditional meal at home, **time-pressed consumers are increasingly turning to snack foods with 29%** of consumers **reporting eating snacks 3 or more times a week.**
- **Snack oriented categories continue to outperform the broader packaged food market** by a wide margin.
- **As a results we are seeing significant growth of sales in biscuits, snack bars, savory snacks, confectionery, ice cream, bakery snacks (cakes and pastries) and yoghurt. All big categories for almonds**

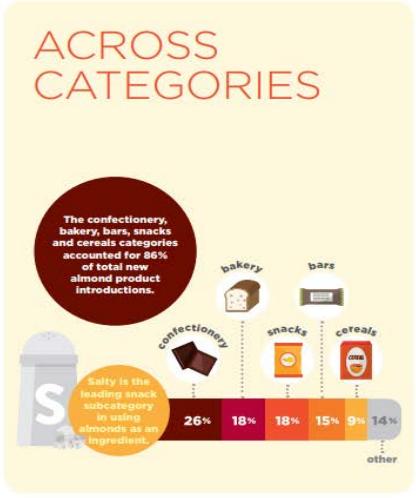
GLOBAL SNACKING TRENDS – INNOVA RESEARCH

HEALTH AND WELLNESS KEY INHERENT ACROSS ALL

- Clean label
  - Driven by the need to include fewer ingredients
  - Fewer preservatives
  - Free from [gluten and lactose]
- Portable and on the go
  - Increased snacking occasions
  - Convenience
- Plant based variety and lifestyle
  - Hero ingredients: natural source of fiber, protein (energy and satiety), minerals and or/vitamins
  - Better for the planet
- Across categories
  - Almonds driving innovation usage and forms in the key categories that drive growth



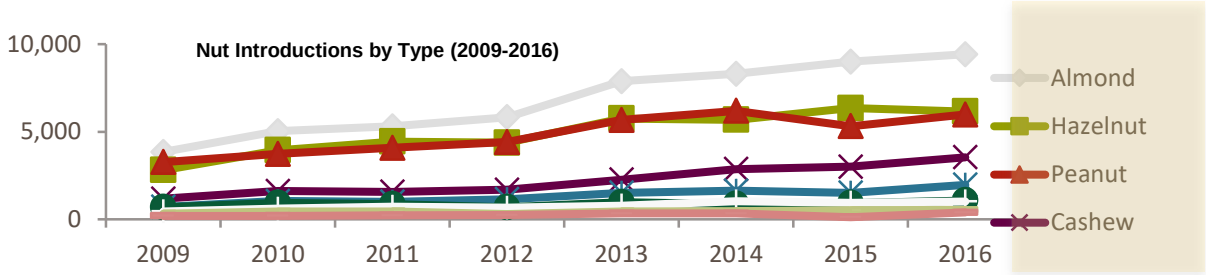




Source: Innova Market Insights 2017.

ALMONDS DOMINATE THE USE OF NUTS GLOBALLY

- Introductions of the majority of nut types have increased from 2015-2016.
  - Almonds increased its lead vs #2 hazelnuts for total introductions

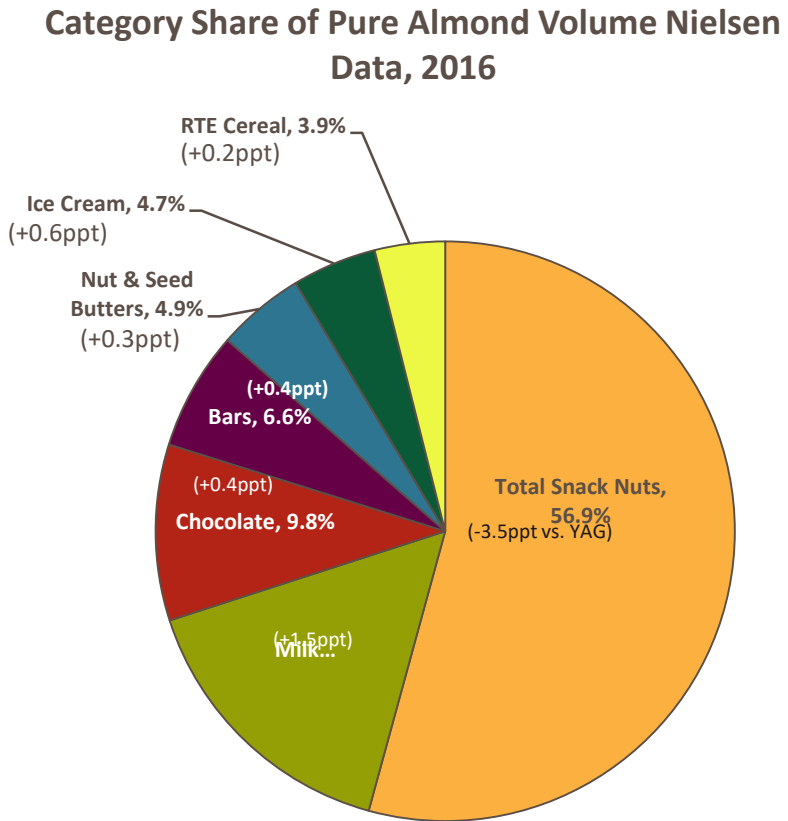


Nut Introductions by Nut Type: Change from 2015-2016				
Nut Type	*2015*	*2016*	*Change (#)*	*Change (%)*
Almond	9,005	9422	+417	+5%
Hazelnut	6,356	6162	-194	-3%
Peanut	5,316	5983	+667	+13%
Cashew	3,003	3544	+541	+18%
Walnut	1,515	1976	+461	+30%
Pistachio	926	1072	+146	+16%
Pecan	949	1024	+75	+8%
Macadamia	519	532	+13	+3%
Mixed Nuts*	125	388	+263	+210%
Global Nut Introductions**	**21,606**	**24,669**	**+3,063**	**+14.2%**

*Mixed Nuts include non specified and mixed nuts.
**Global Nut Introductions is lower than the sum of the nut types, since products containing more than one type of nut are counted only once.

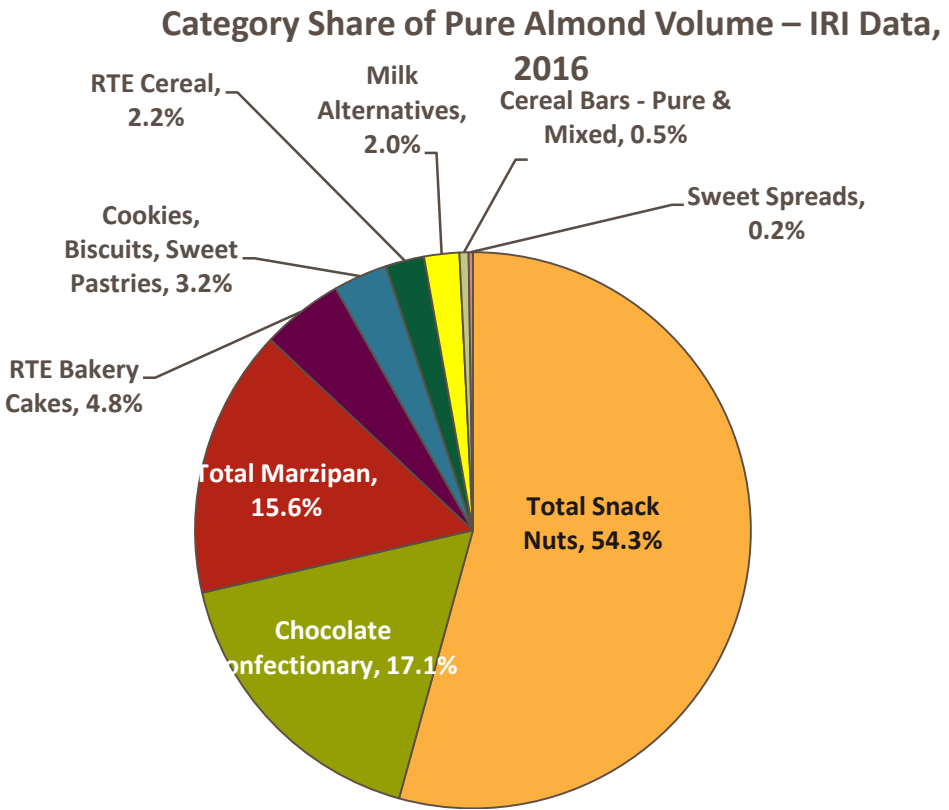
CATEGORY PERFORMANCE US: PURE ALMOND VOLUME SHARE BY CATEGORY

- While the total snack nut category still represents the largest pure almond volume share at 56.9
- Milk substitutes (15.7%, +1.5ppt) gained ice cream, chocolate (9.8%, +0.4ppt), bars (6.6%, +0.4ppt), nut & seed butters (4.9%, +0.3ppt), and cereal (3.9%, +0.2ppt) saw more modest gains.



CATEGORY PERFORMANCE GERMANY: PURE ALMOND VOLUME SHARE BY CATEGORY

- Total snack nuts category represents the largest pure almond volume share at 54.3%, followed by chocolate confectionary (17.1%) and total marzipan (15.6%).
- After these top-3 categories, shares decrease notably, with RTE bakery cakes ranking 4th (4.8% share) and cookies/ biscuits/sweet pastries in 5th (3.2% share).



ALMOND FORMS AND ALMOND APPLICATIONS - INNOVA

Form	Stand-alone product	Other applications- Snack categories
Whole almonds			
Almond pieces			
Almond paste, butter			
Almond milk			
Almond flour			

EXAMPLES: ALMONDS ARE OFTEN SEEN IN PRODUCTS WITH ALLERGY FREE CLAIMS OR WITH ADDED VALUE

- Mainly as a key ingredient for gluten-free and for lactose-free products.

PRODUCT EXAMPLES: BAKERY

Vaasan

Finland

Vaasan Kotiuunin Toscapulla: Frozen Buns Topped With Almonds

Bodytrim

Australia

Bodytrim Ultra Low Carb Protein Indulgence Cookies

Sanford

Argentina

Okebon Molino Natural Galletitas Con Almendras Y Chia: Cookies With Almonds And Chia

Galletas Greco

Colombia

Greco Kurabie Galletas Con Almendras: Mediterranean Almond Cookies

Georg Goess

United States

Georg Goess Cinnamon Stars: Nut And Almond Cookie

Colussi

Italy

Colussi Panforte Del Palio Con Frutta Candita E Mandorle: Gingerbread With Candied Fruits And Almonds

Delicato Bakverk

Sweden

Delicato Pepparkaksrulle: Marzipan Roll

Auchan

Spain

Auchan Polvorones Sin Azucares Anadidos: No Added Sugar Polvoron

PRODUCT EXAMPLES: CONFECTIONERY

Ferrero Raffaello Coconut Specialty With Whole Almond

Laima

Estonia

Laima Exclusive Riga Black Balsam Sokolades Kofeksu Izlase Ar Pildijumu: Selection Of Chocolates With Filling

Carrefour

Tunisia

Carrefour Selection Pepites De Poire: Dark Chocolate With Pear Pieces

Lotte

Japan

Lotte Chocolantan Chocolate And Orange

Arcor

Argentina

Arcor Rocklets Almendras Con Chocolate Con Leche Confitado: Candy And Milk Chocolate Coated Almonds

Hershey

Chile

Hersheys Kisses Creamy Milk Chocolate With Almonds

Cenmaco

Spain

Pablo Garrigos Iba Ez Turron A La Piedra: Almond And Cinnamon Soft Turron

Britvic

Malaysia

Tango Milk Choc With Fruit And Nuts

PRODUCT EXAMPLES: SNACKS

Fangjiapuzi Putian Green Food

Xiangzhiwei Almonds

Morefoood

China

Dida Cat Daily Nuts

Mani

Iran

Mani Salted Almonds

Dongwoonongsan

South Korea

No Brand Mix Nuts

Quorum

Germany

Bonvallis Feigenfruchtschnitte Mit Mandeln: Compressed Fig Fruit with Almonds

Linan Ajie Fry Food

China

Kaixinyoushi Almond Kernels

Meme

Israel

Meme Date Snack With Peanuts

System Frugt

Finland

Earth Control Viikunaherkut: Fig Snack

PRODUCT EXAMPLES: BARS

Abbott

United States

Zoneperfect Nutrition Bars With Chocolate, Almond And Raisin

General Mills

United Kingdom

Nature Valley Popcorn Bars With Salted Caramel, Almond And Pretzel

Cloetta

Norway

Cloetta Muesli Bite Seeds: Muesli Bar With Milk Chocolate

Probiotec

United Kingdom

Celebrity Slim Program Fruit And Nut Meal Replacement Bar

Kind Bar

United States

Caramel Almond and Sea Salt

Rise Bar

United States

Rise Chocolatey Almond Protein Bar

General Mills

United States

Nature Valley Protein Chewy Bars With Peanut, Almond and Dark Chocolate

Pure Organic

United States

Pure Bar Dark Chocolate Berry Bars

INNOVA MARKET INSIGHTS

PRODUCT EXAMPLES: CEREALS

Everfrut

Ecuador

Everfrut Musli Natural Mora Y Chia: Natural Muesli With Blueberry And Chia

Gittis

Slovenia

Natur Aktiv Bio Porridge Med-Orescki Iz Kontroliranega Ekoloskega Kmetijstva: Organically Produced Porridge With Nuts

Lotte Mart

South Korea

Lotte Mart Choice L Almond Granola

Colussi

Italy

Misura Multigrain Muesli Croccante Con Mandorle E Uveta: Multigrain Crunchy Muesli With Almonds And Raisins

Got Milk Snacks

United States

Got Milk Crunchy Granola Cereal: Blueberry with Greek Yogurt

Jumbo

Netherlands

Jumbo Muesli Twister Amandel En Appel: Muesli With Almonds And Apple

Post Foods

Guatemala

Post Honey Bunches of Oats Cereal With Crispy Almonds

Lark Fine Foods

United States

Lark Ellen Farm Sweet And Salty Trail Mix

PRODUCT EXAMPLES: OTHER CATEGORIES

Stop And Shop

United States

Natures Promise Unsweetened Vanilla Almond Milk

Tj Alpha

China

Alpha Almond Juice

Isota Bio

Organic Rice and Almond Drink

Indolakto

Indonesia

Indoeskrim Tasty Max Vanilla Choco Almond Ice Cream Bar

Alpro

Spain

Asturiana Alpro Almendras Sabor Chocolate: Almond Drink with Chocolate Flavor

Foodmatch

United States

Divina Kalamata Fig Spread with Almonds

Rapunzel Naturkost

Italy

Rapunzel Crema di Mandorle Bianca: White Almond Cream

Bertolini

Italy

Casa Del Dolce Risotto Dolce Al Finissimo Mandorlato E Cioccolato: Sweet Rice With The Finest Almonds And Chocolate

UNITED KINGDOM: PRODUCT EXAMPLES

Waitrose

Waitrose 1 Spiced Plum And Almond Crumble

Marks And Spencer

Marks And Spencer The Collection Filled Medjool Date Selection

Lidl

Alesto Sports Mix

Tesco

Tesco Four Nut And Maple Crisp Cereal

Asda

Asda Extra Special Macaron Selection

Holland And Barrett

Holland And Barrett Good Stuff Alluring Sweet And Savory Almonds

Aldi

Specially Selected Intense Wasabi Almonds

Kellogg

Kelloggs Glorious Nut Muesli

CHINA: PRODUCT EXAMPLES

Hershey

Hersheys Kisses Assorted Chocolates

Lehefeng

Youme Assorted Nuts

Fangjiapuzi Putian Green Food

Xiangzhiwei Almonds

Buff Bake

Buff Bake Snickerdoodle Protein Almond Spread

Mamma Chia

Mamma Chia Chia Vitality Bar: Peanut Butter and Sea Salt With Chia

Jinhua Koukoufu

Koukoufu Almonds

Laiyifen

Laiyifen Daily Nuts Classic Faction

Metro

Fine Life Top Selected Almond

INDIA: PRODUCT EXAMPLES

Haldirams

Haldirams Pista Badam Biscuits: Indian Biscuits With Pistachio And Almond

True Elements

True Elements Seeds And Nuts Muesli Snack

Conserve Italia

Yoga Bars Nuts And Seeds Crunch

Britannia

Britannia Good Day Nuts Cookie With Pista, Cashew And Almond

Mondelez

Cadbury Dairy Milk Marvellous Creations Cookie Nut Crunch Milk Chocolate

Mtr Foods

Mtr Badam Drink With Rose Flavor

Patanjali Ayurved

Patanjali Navratna Elaichi Soan Papdi

Saravana Stores

Saravana Almonds

ALMOND BOARD CONSUMER PROGRAMS

- Snacking and health at the heart of the Almond Board of California consumer programs
- Global consumer snacking tracking study

GLOBAL MARKETING OVERVIEW – DIFFERENT NEEDS, DIFFERENT STRATEGIES, GLOBAL SNACKING

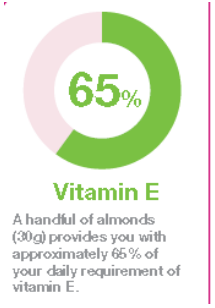
LEVERAGING HEALTH BENEFITS NUTRITION RESEARCH HIGHLIGHTS / 150++ PUBLISHED STUDIES

Heart Health: Almonds can lower total and LDL cholesterol when included in a healthy diet.

Weight Management: Almonds have a powerful satiating effect that provides long-term satisfaction and fullness and prevents over-eating.

A new way of calculating calories found that whole almonds provide about 20% fewer calories than originally thought.

Diabetes: Almonds lower the blood sugar impact of carbohydrate foods that they are eaten with, which affects fasting insulin levels.



- Almonds are the tree nut highest in the antioxidant vitamin E
- Consuming natural antioxidants from foods may have beauty benefits, working from the inside to help nourish and protect skin.

HEART HEALTH*

- High in monounsaturated ("good") fat
- No cholesterol or sodium
- A top food source of the antioxidant vitamin E

Learn More >

ENERGY

- 6 grams of protein per ounce
- 12 vitamins and minerals
- 13 grams of "good" monounsaturated fats
- Rich in magnesium

Learn More >

DIABETES

- Low glycemic index
- May improve certain risk factors
- Curbs cravings

Learn More >

POWERFUL NUTRITION

- Tree nut highest in six essential nutrients
- Prebiotic potential
- Plus protein and fiber

Learn More >

GLUTEN FREE

- Naturally 100% gluten free
- Lots of forms to choose from
- No-stress substitutions

Learn More >

WEIGHT MANAGEMENT

- 6 grams of power-packed protein
- 3.5 grams of satisfying fiber
- Good fit with popular weight-loss plans
- Just 160 calories per ounce

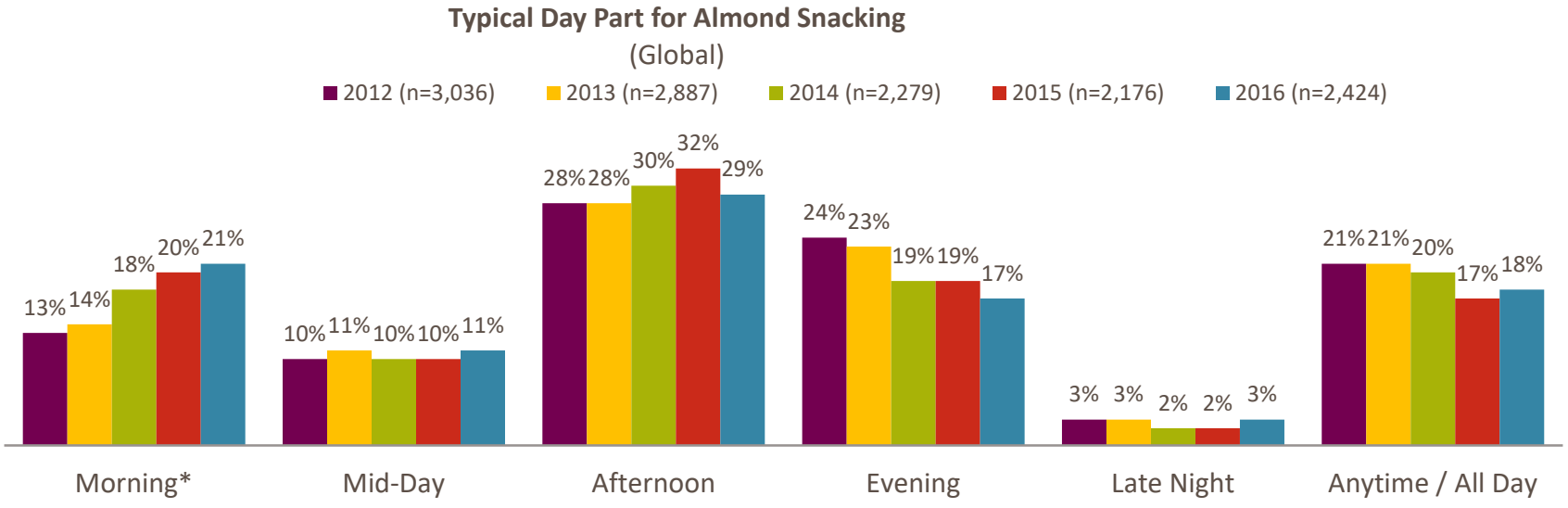
Learn More >

EXECUTIVE SUMMARY: GLOBAL

Total Sample	Almonds 2016 (n=5,000)	Almonds 2015 (n=4,500)	Gap ('16 vs. '15)	Top Nut	Second Nut	Almond Rank
Awareness						
Top-of-Mind – First Mention	21%	19%	+2 pt	Almonds	Walnuts	#1
Positive Story, Almonds – % of total	26%	23%	+3 pts	Almonds	Walnuts	#1
Almonds as first mentions in chocolate	30%	29%	+1 pt	Almonds	Hazelnuts	#1
Almonds as first mentions in bakery	28%	28%	-	Almonds	Walnuts	#1
Almonds as first mentions in snacks	22%	21%	+1 pt	Peanuts	Almonds	#2
Attitudes						
Almond liking (% Top 2 Box)	54%	55%	-1 pt	Almonds/Cashews		#1 (tie)
Almond health (% Top 2 Box)	54%	56%	-2 pts	Almonds/Walnuts		#1 (tie)
Almonds as the nut best described by…						
Healthy	29%	30%	-1 pt	-	-	-
Beauty	28%	27%	+1 pt	-	-	-
Nutritious	27%	28%	-1 pt	-	-	-
Skin	27%	29%	-2 pts	-	-	-
Almond Delivery on… (% excellent/good)						
Great Taste	74%	78%	-4 pts	-	-	-
Nutritious	74%	80%	-6 pts	-	-	-
Natural	73%	81%	-8 pts			
Crunch	73%	77%	-4 pts	-	-	-
Usage						
Heavy Users (% several x/week+)	24%	23%	+1 pt	Almonds	Peanuts	#1
Almonds eaten most as a snack	23%	24%	-1 pt	Peanuts	Almonds	#2
Almonds eaten most in other foods	23%	24%	-1 pt	Almonds	Peanuts	#1
Time of day for Almond snacking	Afternoon	Afternoon	-	-	-	-
Almond form for snacking	Natural w/ skin	Natural w/ skin	-	-	-	-

USAGE: DAY PART FOR ALMONDS AS A SNACK (GLOBAL)

- Almonds tend to be consumed more frequently in the afternoon and morning dayparts.
  - While evenings and “all day” still remain substantial, though both appear to be tapering off slightly in popularity.



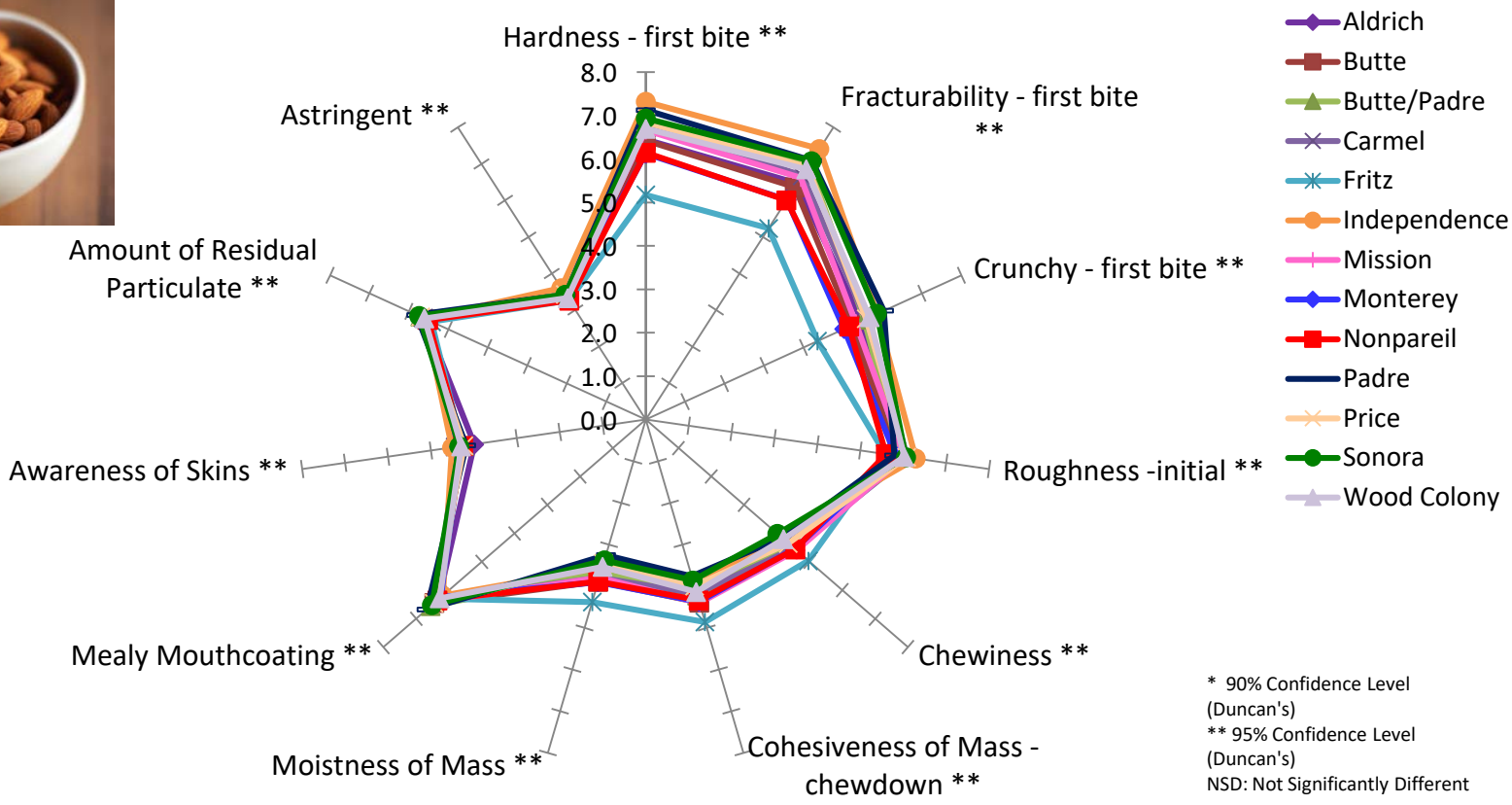
* *Includes those selecting “First thing in the morning” in India*

Q17: And which of these times of day best describe when you typically eat almonds by themselves (e.g., as a snack)?
Base: Snack on almonds in Q16.

VARIETIES AND THE IMPORTANCE OF FLAVOR

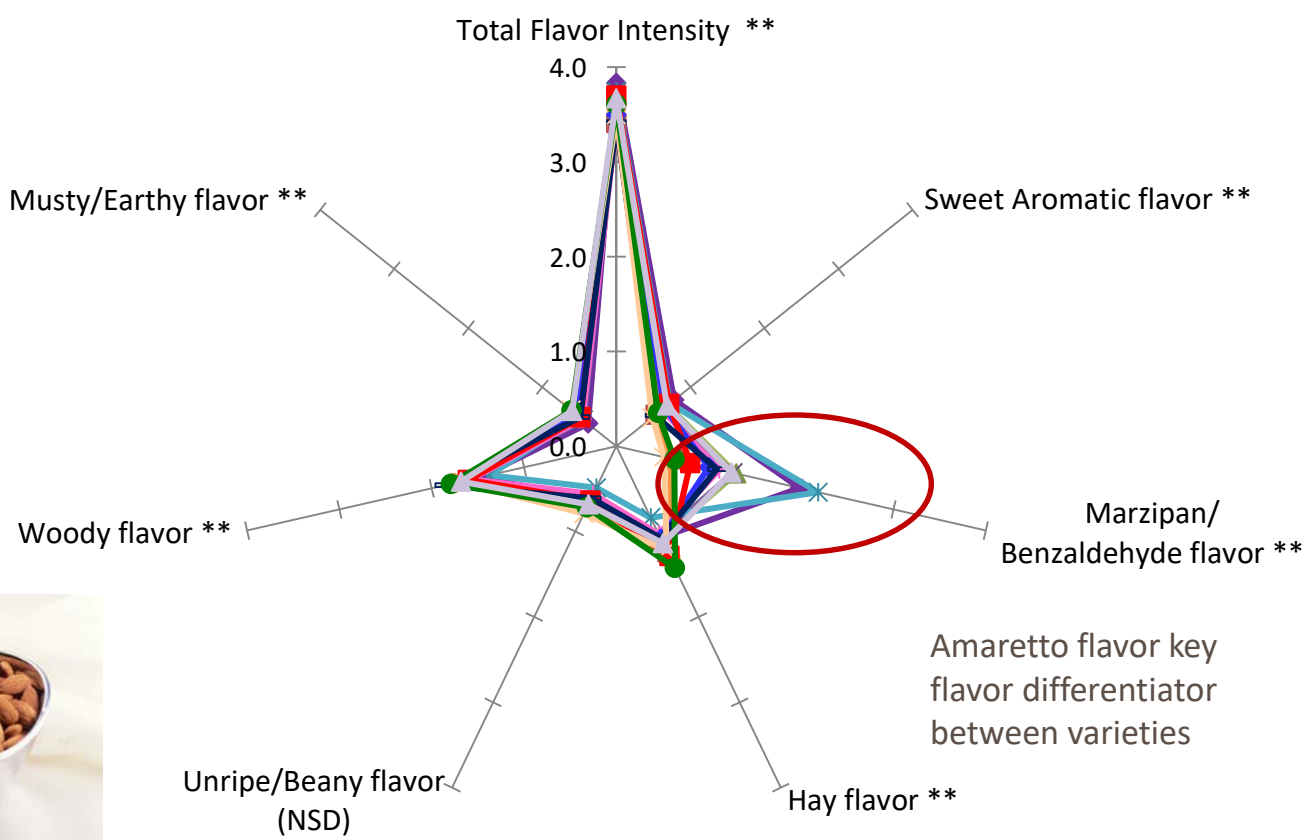
- Why should you care?
- How different are almond varieties?

TEXTURE PROFILE – KEY SENSORY ATTRIBUTES OF ALMONDS



* 90% Confidence Level (Duncan's)
** 95% Confidence Level (Duncan's)
NSD: Not Significantly Different

WHAT DIFFERENTIATES ALMONDS - FLAVOR PROFILE – KEY SENSORY ATTRIBUTES FOR ALMONDS



Amaretto flavor key flavor differentiator between varieties

* 90% Confidence Level (Duncan's)
** 95% Confidence Level (Duncan's)
NSD: Not Significantly Different

WHY AND WHERE IS FLAVOR IMPORTANT?

Consistent consumer experience is important

Food Categories
- Low almond flavor desired

1. Almond Milk
2. Almond flour/meal, for baking and gluten free cooking

Food Categories
- Strong almond flavor/ aroma desired

1. **Snacking**
2. **Chocolate**
3. **Almond butter**
4. **Baking**

SUMMARY

- Almonds deliver on all of today's snacking trends
- Innovation continues to grow and new categories like almond milk and almond meal are fueling better tasting alternatives for many consumers
- Almond versatility is highlighted by the breadth of use as a snack and ingredient
- Almonds healthy halo is firmly established in many markets around the world
- Consumers and media love almonds
- Almonds poised for continued growth around the world!

What to Plant: Almonds or Other Crops?

The Almond Conference
December 5, 2017
Sacramento, California

Prepared by Daniel A. Sumner
with collaborators
Antoine Champetier, Tristan Hanon,
Hyunok Lee, William A. Matthews, Jeremy Murdock, and Donald Stewart
University of California Agricultural Issues Center

Presented by William Matthews

Motivation, Orientation and Overview

Growers chose among many options based on site specific soil, climate and institutional factors.

Since the other presentations in this session are evaluating irrigation water availability and almond demand and global markets, we highlight a few other crucial economic issues

1. **Farm costs and returns data for comparing crops**
2. **Demand and market prospects for other commodities**
3. **Low interest rates and high labor costs for almonds versus other crops**
4. **Simulations of supply (pollination) and demand and impacts on almonds**
5. **Government subsidy policy including crop insurance**

Farm Costs and Returns for Tree Crops Compared

SAMPLE COSTS TO ESTABLISH AN ORCHARD AND PRODUCE

ALMONDS

SACRAMENTO VALLEY
Micro-Sprinkler Irrigation-2016

Kathrine S. Pope	Farm Advisor, UC Cooperative Extension, Yolo County
Danielle M. Lightle	Farm Advisor, UC Cooperative Extension, Butte & Glenn County
Richard P. Buchner	Farm Advisor, UC Cooperative Extension, Tehama-Shasta Counties
Franz Niederholzer	Farm Advisor, UC Cooperative Extension, Sutter-Yuba Counties
Karen Klonsky	Extension Specialist Emeritus, Department of Agricultural and Resource Economics, UC Davis
Daniel A. Sumner	Director, Agricultural Issues Center, Professor, Department of Agricultural and Resource Economics, UC Davis
Donald Stewart	Staff Research Associate, Agricultural Issues Center and Department of Agricultural and Resource Economics, UC Davis
Christine A. Gutierrez	Staff Research Associate, Agricultural Issues Center and Department of Agricultural and Resource Economics, UC Davis

2016

SAMPLE COSTS TO ESTABLISH AND PRODUCE

ALFALFA

TULARE COUNTY, SOUTHERN SAN JOAQUIN VALLEY
300 Acre Planting

Prepared by:

Nicholas Clark	UC Cooperative Extension Farm Advisor, Fresno, Tulare, and Kings Counties
Carol A. Frate	UC Cooperative Extension Farm Advisor Emeritus, Tulare County
Daniel A. Sumner	Director, Agricultural Issues Center, Department of Agricultural and Resource Economics, UC Davis
Karen Klonsky	Specialist in Cooperative Extension, Department of Agricultural and Resource Economics, UC Davis
Donald Stewart	Staff Research Associate, Department of Agricultural and Resource Economics, UC Davis
Christine A. Gutierrez	Staff Research Associate, Department of Agricultural and Resource Economics, UC Davis

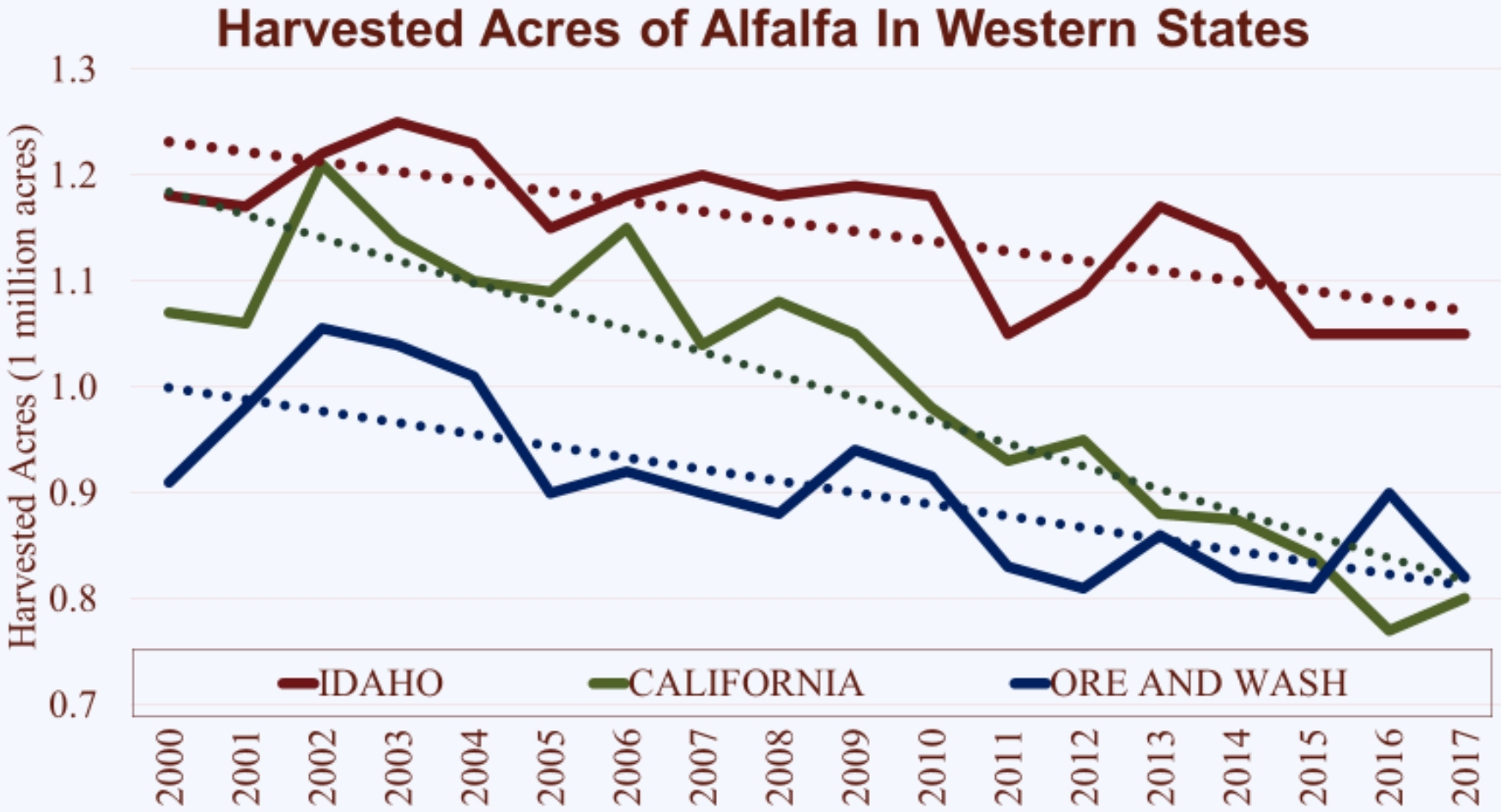
SAMPLE COSTS TO ESTABLISH AND PRODUCE

ENGLISH WALNUTS

In the Sacramento Valley
Micro Sprinkler Irrigated

ne K. Hasey	UC Cooperative Extension Farm Advisor, Sutter, Yuba and Colusa Counties
hard P. Buchner	UC Cooperative Extension Farm Advisor, Tehama, Glenn and Butte Counties
en Klonsky	UC Cooperative Extension Specialist, Department of Agricultural and Resource Economics, UC Davis
Sumner	Director, Agricultural Issues Center, Department of Agricultural and Resource Economics, UC Davis
a Anderson	Ag Issues Center, Department of Agriculture and Resource Economics, UC Davis
Stewart	Staff Research Associate, Ag Issues Center, Department of Agricultural and Resource Economics, UC Davis

- Every commodity in every location has a different set of cost and returns characteristics
- Cost studies are accurate in details only for the time and place specified
- Growers, buyers, investors, bankers, researchers and others must interpolate and extrapolate to make use of the studies. And, these studies do not forecast future returns or costs


Harvested Acres of Alfalfa In Western States
Harvested Acres (1 million acres)
1.3
1.2
1.1
1.0
0.9
0.8
0.7
IDAHO
CALIFORNIA
ORE AND WASH
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017

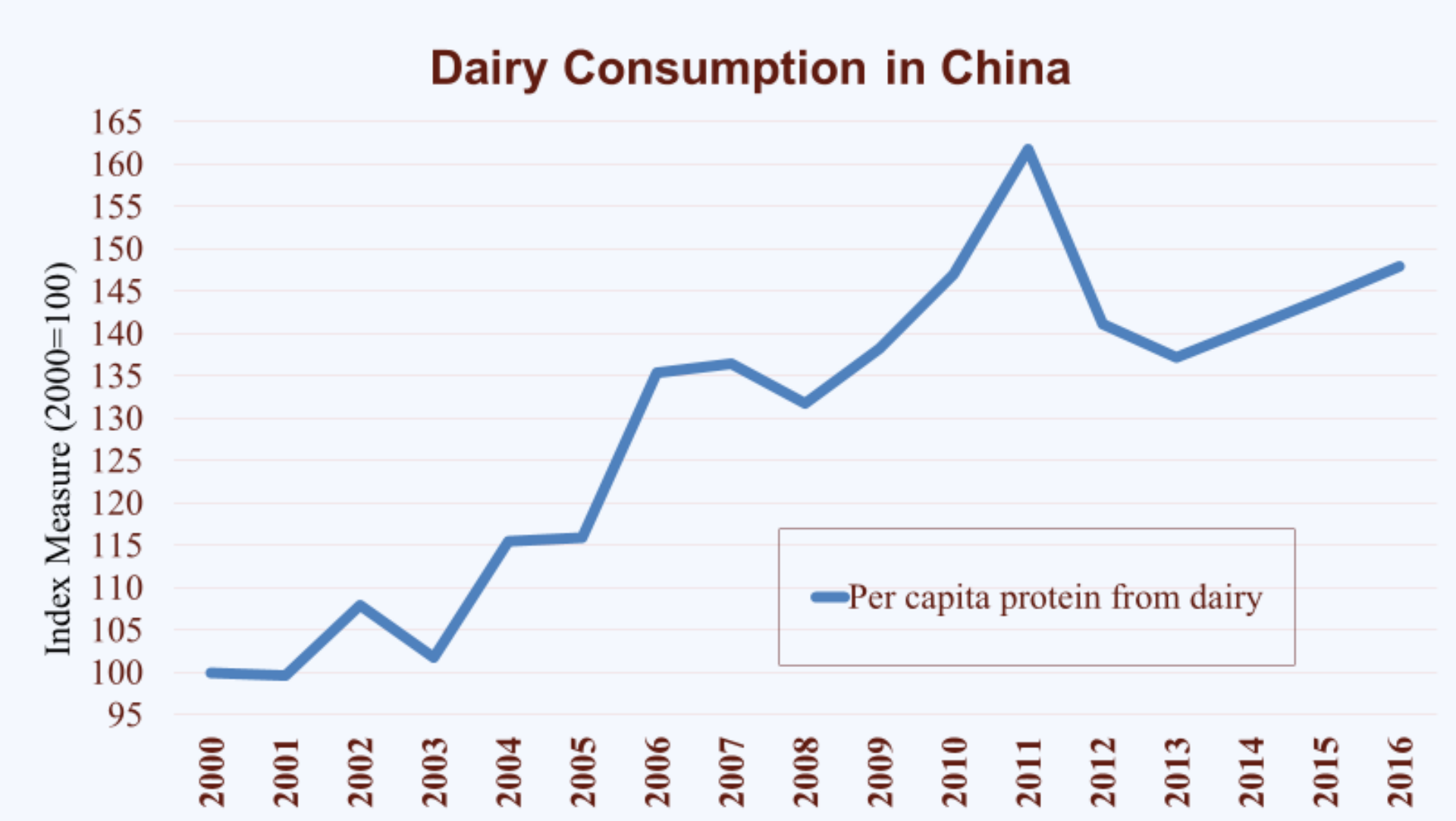
The relative net returns of almonds and alfalfa helps explain part of the decline in hay acres

But,

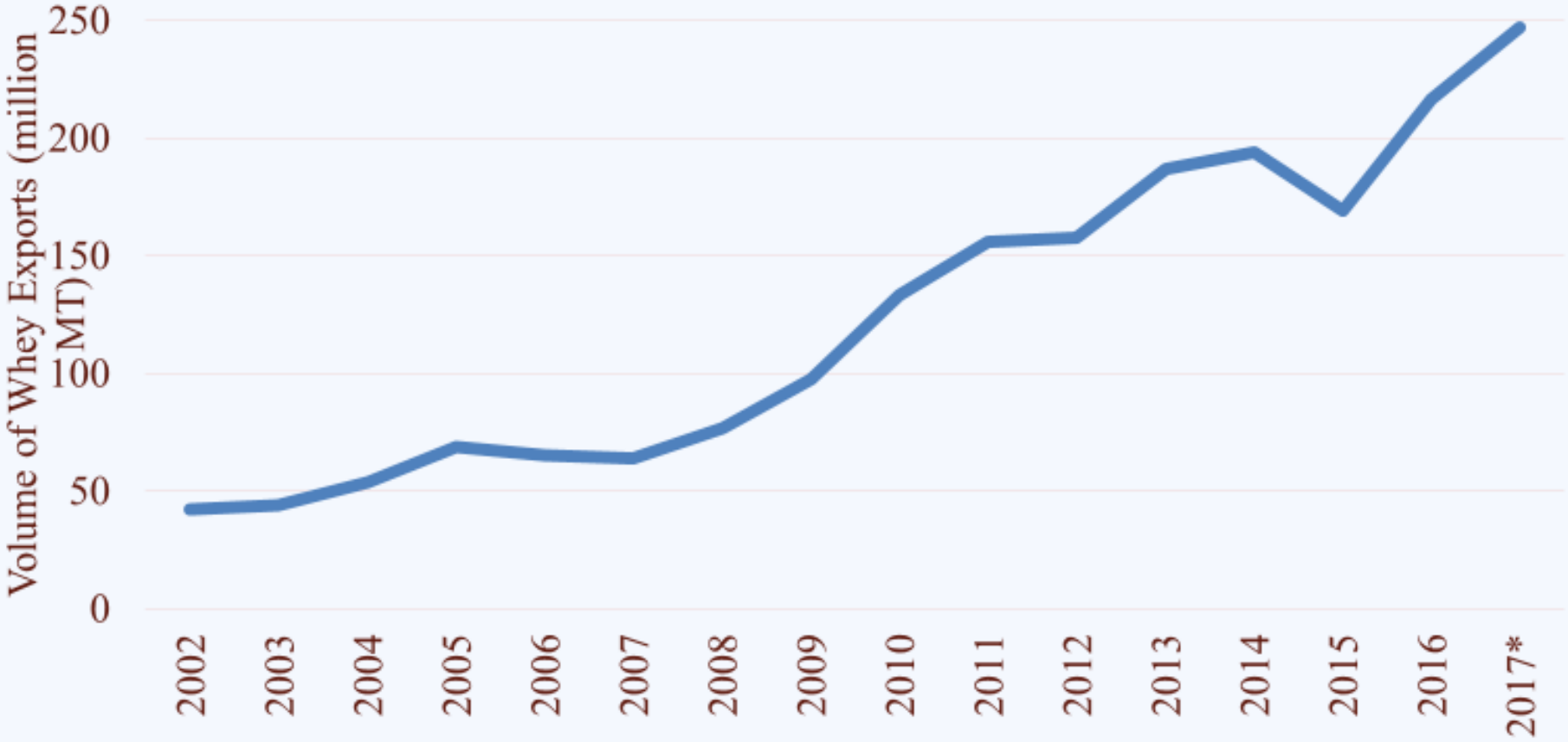
- **Milk cow numbers (the major demand factor for alfalfa) have been flat in California for a decade.**
- **Alfalfa acres has also fallen in the other states, which have no tree nut expansion**
- **Idaho has dairy expansion and ships alfalfa to California so there is more going on than just nuts!**

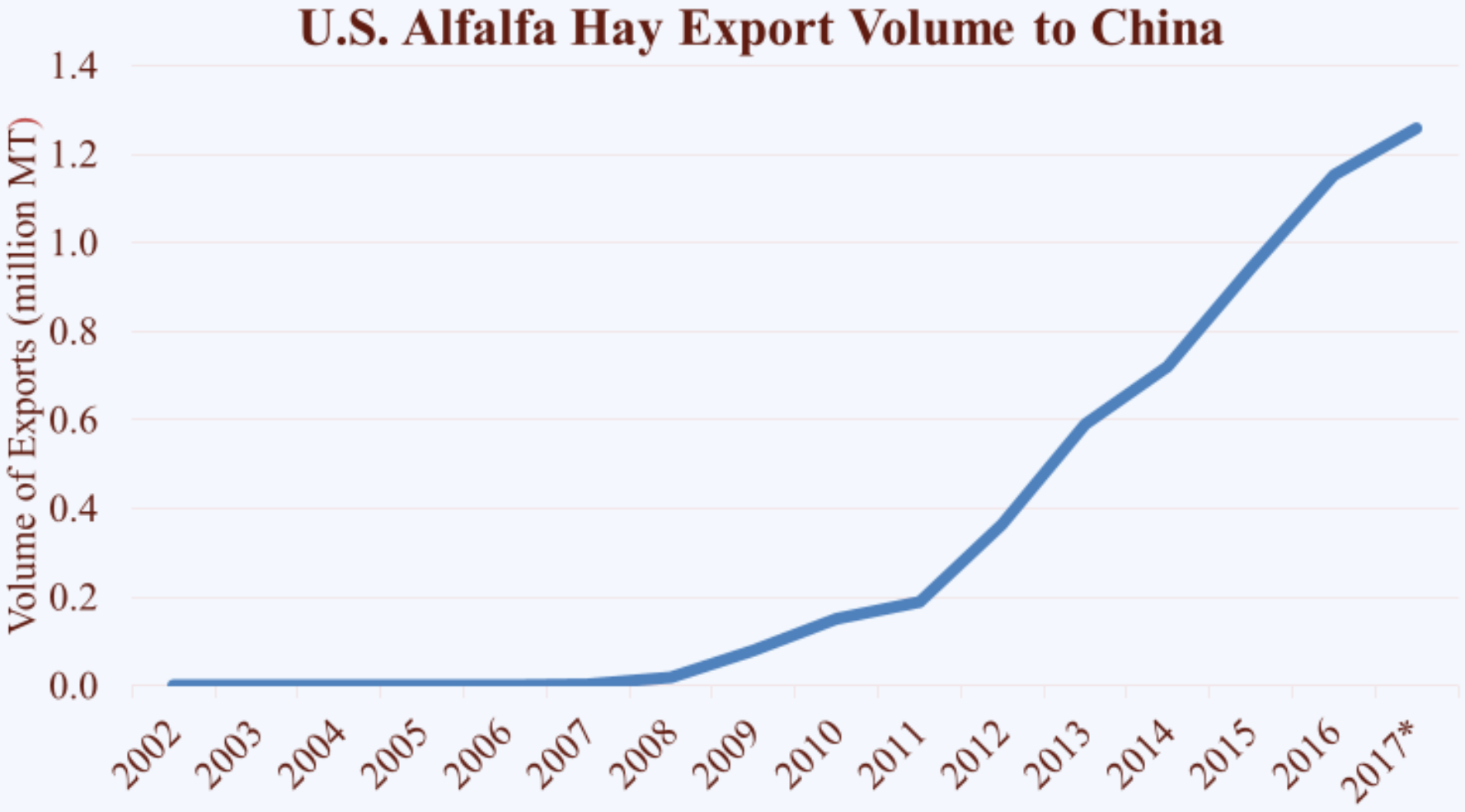
The future of almonds depends on demand growth, but demand growth applies to competing commodities too!

For example, alfalfa depends on milk demand growth in Asia…


Dairy Consumption in China
Index Measure (2000=100)
165
160
155
150
145
140
135
130
125
120
115
110
105
100
95
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
Per capita protein from dairy

U.S. Whey Product Export Volume to China




U.S. Alfalfa Hay Export Volume to China
Volume of Exports (million MT)
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017*

Demand in Asia depends on economic growth driving markets, but markets are only useful for California crops if the markets are open

Consider the Korean-U.S. Free Trade Agreement that improved access to the worlds 11th largest economy

The agreement came into force just in 2012 and is allowing US products to compete with those from the many other places that have FTAs with Korea.

KORUS-FTA access improvement for tree nuts

Tree Nut Product	Base Rate	FTA Terms
Almonds, Shelled	8%	Duty free year 1 (Jan 1, 2012)
Almonds, In Shell	8%	Duty free year 1 (Jan 1, 2012)
Walnuts, Shelled	45%	Straight line decline to duty free at year 15 (2026)
Walnuts, In Shell	30%	Straight line decline to duty free at year 6 (2017)

Interest Rates, Credit and Labor

- **Low interest rates and more credit availability, means lower capital for establishment**
- **Our cost and returns studies have documented declines in interest rates for both operating capital and capital recovery (land prep, trees, irrigation etc.)**
- **The rate of return required for a good investment is lower is cost of capital is lower.**

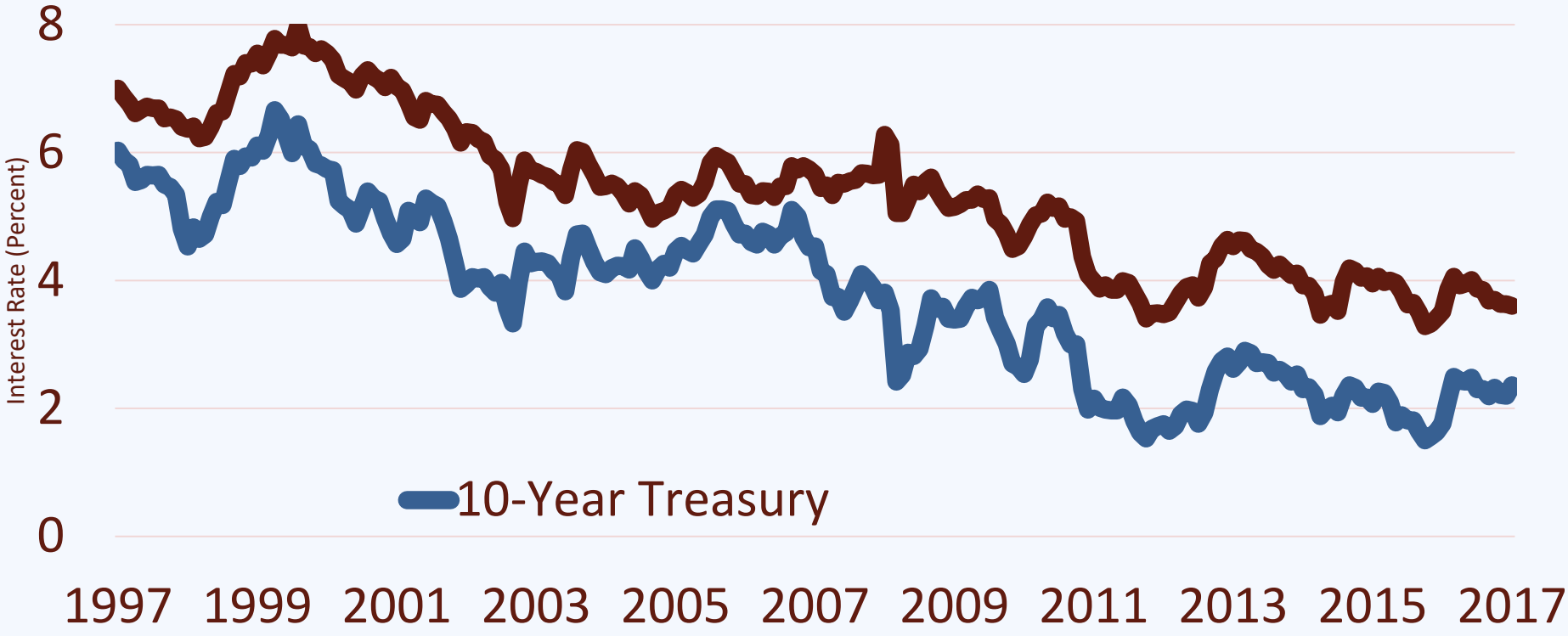
- **At the same time labor costs have risen, but tree nuts have lower shares of hired labor costs compared to other tree and vine crops and capital intensive vegetables, and labor regulations in California are driving cost higher over the next 5 years.**

Year	Operating Cost Interest Rate	Capital Recovery Rate
2011	5.75	5.75
2016	4.75	3.75

Source: UC AIC Cost and Returns Studies, Almond Orchard Establishment Studies

Interest Rates Have Declined Substantially Over Past 20 Years

Lows in the past two years. It is hard to see rates lower, leaving only up side risk for the cost of capital. This reminds us of Paul Rhode's explanation of the expansion of California trees and vines in the early 20th Century



Potential Effects of Negative Developments on Almonds: The Pollination Nexus

Consider economic model simulations of impacts of potential negative developments affecting almonds and honeybees

- Largest impacts from changes in almond demand; That is, impacts to the almond industry and growers.
- Uses data on input cost shares, production relationships and market patterns
- Uses an inelastic demand for almonds consistent with recent estimated and market patterns (when quantity available drops price rises by proportionately more).
- Uses an elastic long run almonds supply for downward shocks that build in some adjustment costs but recognizes that alternative crops are available if almonds become less attractive

Source:

“Simulating Bees, Almonds, and Honey”, Lee, Sumner, and Champetier 2017

Impacts of Shifts up in Almond Costs or Shifts down in Almond Demand

Variable	Water Price Increase (20%)	Almond Market Downturn (20%)
Almond Quantity	-3.3%	-15.9%
Almond Price	9.4%	-11.7%
Almond Pollination Fee	-2.7%	-19.5%
Almond Grower Revenue and Cost	5.8%	-25.8%

Impact of Shifts in Pollination Demand or in the Costs of Pollination

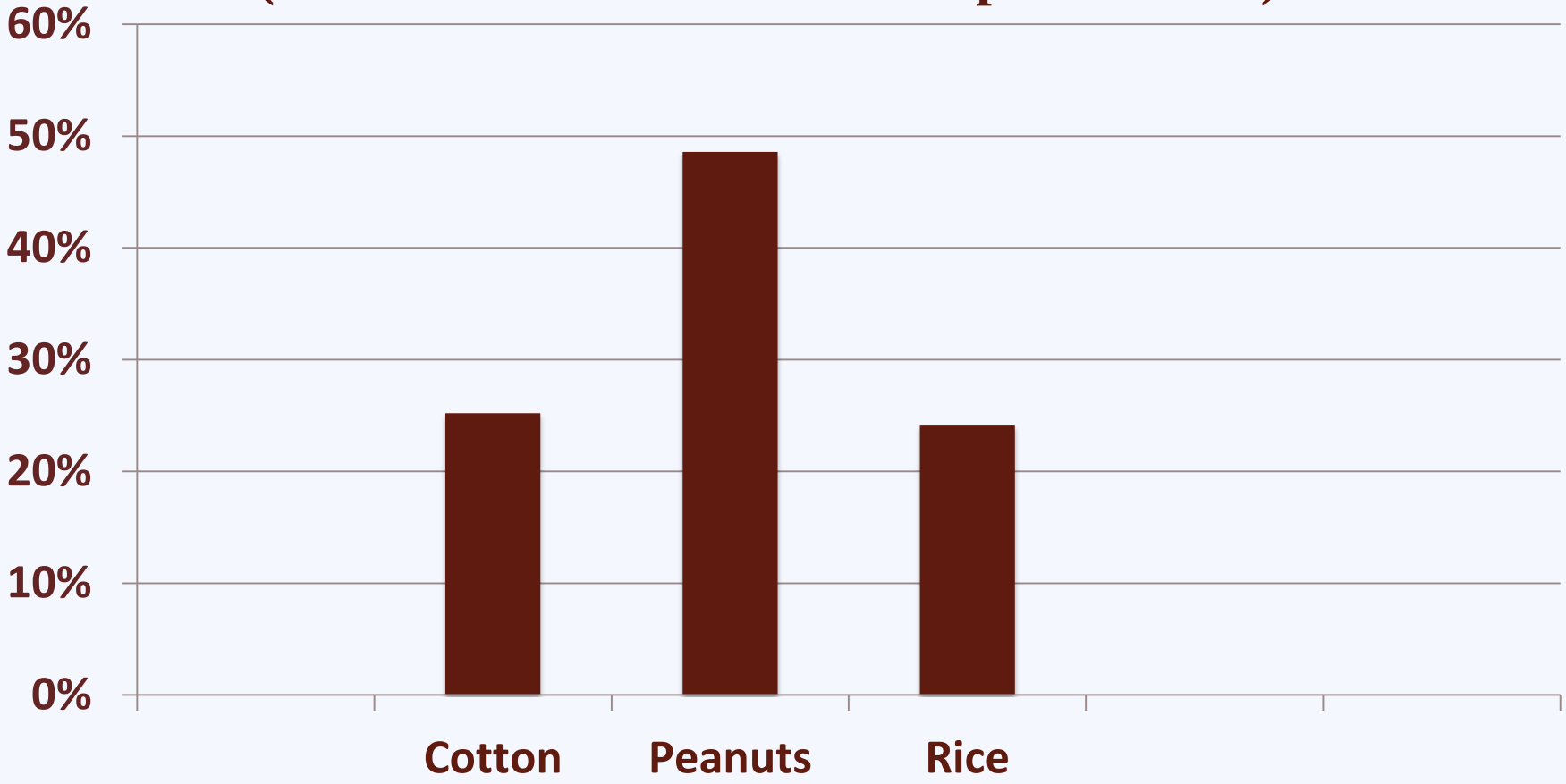
Variable	Self-Fertile Acreage Increase (11%)	Increased Bee Colony Loss (20%)
Almond Quantity	0.5%	-0.1%
Almond Price	-1.4%	0.3%
Almond Pollination Fee	-13.3%	2.9%
Almond Grower Revenue	-0.9%	0.2%
Almond Grower Cost	-2.2%	0.2%

Farm Bill, Commodity Subsidies and Almonds

- **Leaders of Agriculture Committees in Congress say the new farm bill is coming in early 2018.**
- **Crop insurance and insurance-style programs have emerged as central**

1. **Subsidies help crops compete for land and water (still some upland cotton and lots of rice in California)**
2. **Crop insurance subsidy makes eligible crops more attractive to bankers**
3. **Subsidy by increasing supply of feed crops, insurance and other subsidies cause a bit more use in feeding rations**
4. **Dairy does have a subsidy program that may encourage more cows, but more for small farms in the east than big farms in the west.**

Federal Farm Commodity Subsidy as a Percent of Value (Almonds about 3% from crop insurance)



Tree crops used to claim little federal farm subsidy

- **Trade and domestic promotion paid with taxpayer support and checkoff funds**
- **R&D programs**
- **Nutrition programs, including school lunch provide demand support**
- **Environmental cost share programs are available**
- **But these are small in relation to size of the industry**

- **But now tree crops also use crop insurance subsidy extensively. These programs are much more like a production subsidy like the program grains, oilseeds and cotton**

Does crop insurance subsidy affect what is grown, where and by how much? Yes, but no data yet for tree nuts.

- **The premium subsidy has two potential impacts on area planted to a specific crop:**
  1. **Crop insurance subsidy is much like any production subsidy. This production impact occurs even with risk neutral farmers.**
  2. **Also, crop insurance subsidy stimulates more insurance and even more of the crop with subsidized insurance.**

Econometric estimation using acreage and insurance data for national field crops shows large and significant impacts of crop insurance subsidy on cropping patterns and choice across crop. (Yu, Smith, Sumner (2017))

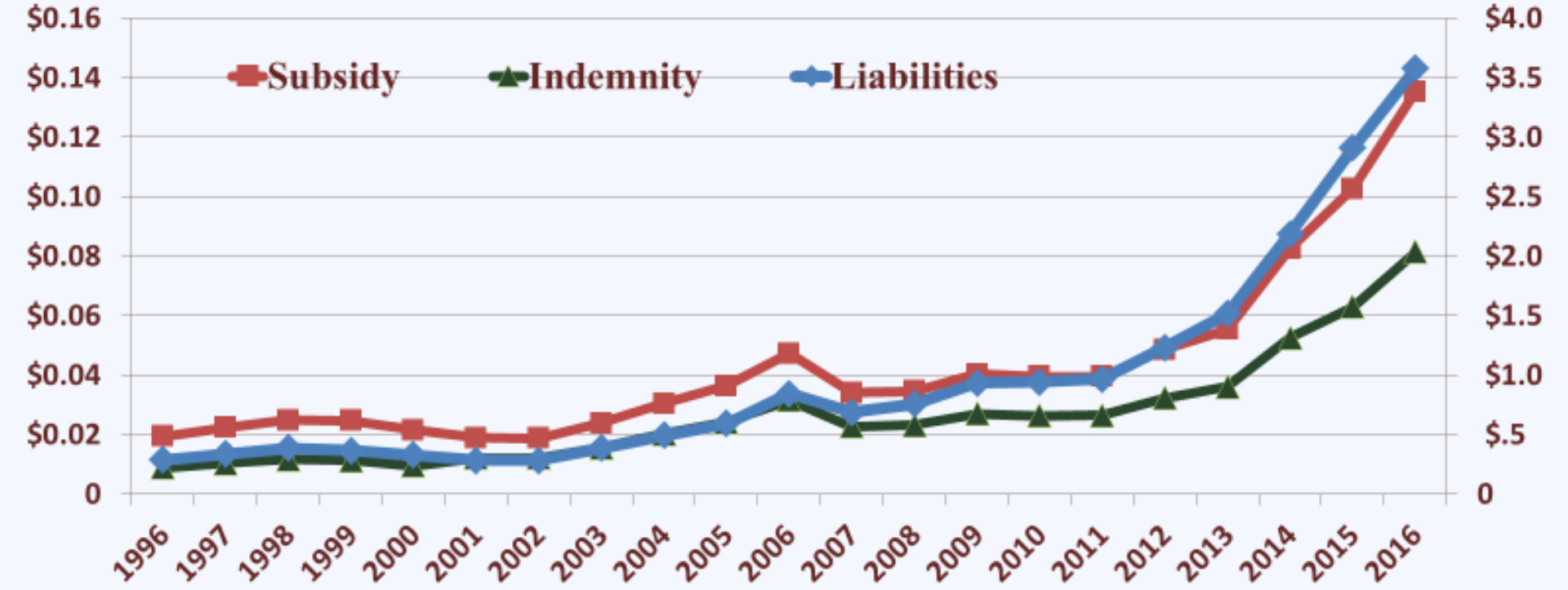
Research on trees, vines, vegetables, and other specialty crops is underway

Crop Insurance in California: Acres Insured, Liabilities, and Premium Subsidy, 2016

	Net Acres Insured (Thousands)		Liability	Premium Subsidy
	CAT	Total	($ Millions)	($ Millions)
Almonds	257	749	3,578	81
Grapes	217	466	1,242	24
Rice	51	496	507	9
Tomatoes	10	246	580	7
Calif. total		6,653	9,982	290
CA share of U.S.		2.3%	9.9%	5.0%

Source: Risk Management Agency, USDA

Crop Insurance Program: Total Liabilities, Subsidy, and Indemnity, CA Almonds Total, 1996-2016 ($ Billions)



Note: Left axis is subsidy and indemnity. Right axis is for liabilities.

Subsidy for almonds is about 3% of crop revenue

Final Remarks

- **No one can reliably predict prices or costs and revenues into the future for the horizon of an almonds orchard, and especially not relative to the other available investments.**
- **We can, however, outline the major considerations facing and industry**
- **Here we have highlighted a few of those for almonds**
- **We have focused on issues broader than almond costs and returns, to emphasize issues such as growing demand for other commodities, interest rates, trade agreements, and farm policy as affecting the relative position of almonds.**

We close with two additional points:

1. Global competitors have not yet challenged California's dominant position in global markets but that is not guaranteed.

2. The suitability of almonds to California conditions and the competitive vigilance of the California industry are the best guarantors of success. But, that does not necessarily mean industry growth. If marginal costs rise as production strains suitable resources, other regions in the world may be in a better position to expand.

Thank you

aic.ucdavis.edu

Consider Water Before You Grow

California Institute for Water Resources

Doug Parker
Director, California Institute for Water Resources
Strategic Initiative Leader, UC ANR Water Initiative
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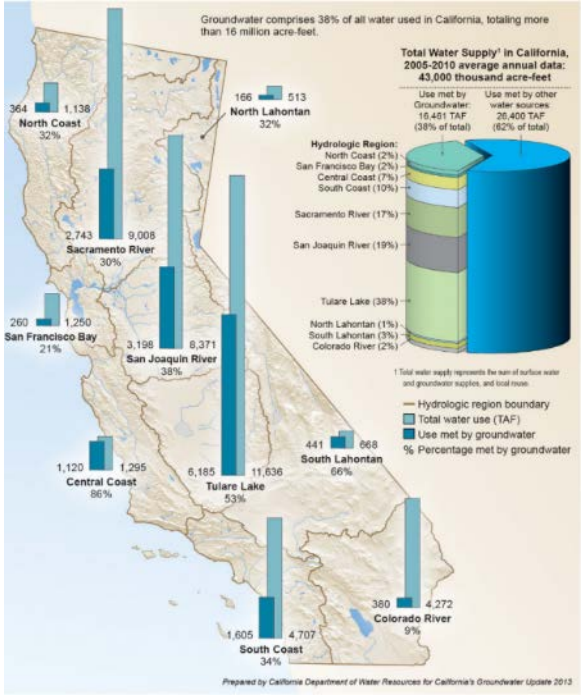
Where does your water come from?

- Irrigation District?
  - Where do they get it?

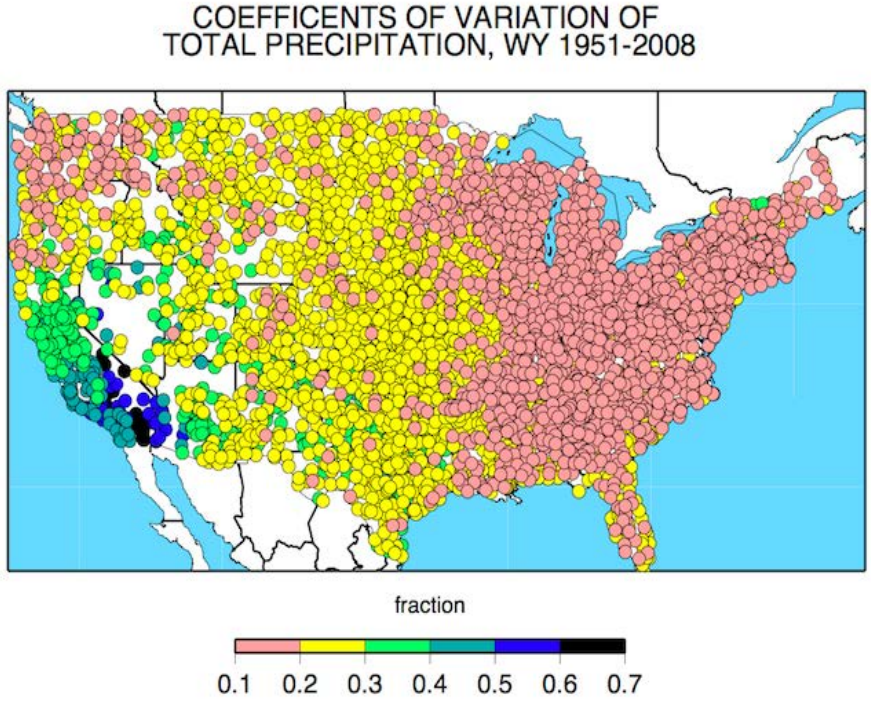
- Own water right?
  - How secure/senior is it?

Groundwater Use in California: 2005 – 2010 Average

- Is Groundwater your Primary Water Source?
- Is Groundwater a Supplement to Surface Water Supplies?
  - Normal Year?
  - Drought Year?



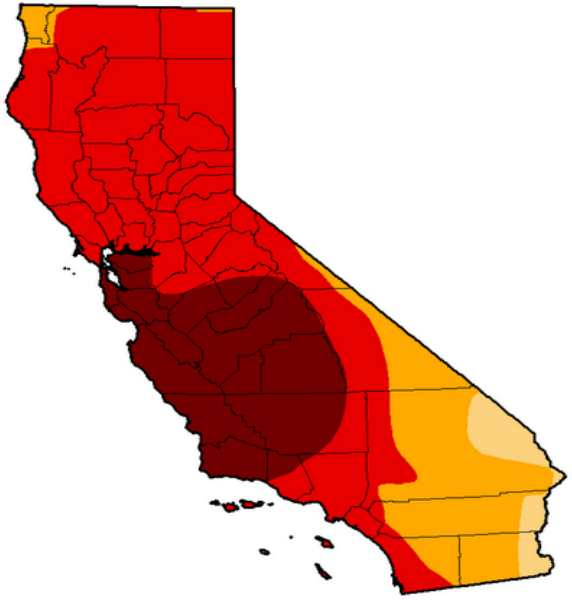
Variation in Annual Precipitation



Source: Dettinger et al (2011

U.S. Drought Monitor

California



Download:

April 22, 2014

(Released Thursday April 24, 2014)

Valid 7 a.m. Eastern

Statistics type: (•) Traditional (D0-D4, D1-D4, etc.) ( ) Categorical (D0, D1, etc.)

Drought Condition (Percent Area):

Week	Date	Nothing	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	4/22/2014	0.00	100.00	100.00	96.01	76.68	24.77
Last Week	4/15/2014	0.00	100.00	99.80	95.21	68.76	23.49
3 Months Ago	1/21/2014	1.43	98.57	94.18	89.91	62.71	0.00
Start of Calendar Year	12/31/2013	2.61	97.39	94.25	87.53	27.59	0.00
Start of Water Year	10/1/2013	2.63	97.37	95.95	84.12	11.36	0.00
One Year Ago	4/23/2013	2.84	97.16	63.42	30.00	0.00	0.00

View More Statistics

Intensity:

- D0 - Abnormally Dry
- D1 - Moderate Drought
- D2 - Severe Drought
- D3 - Extreme Drought
- D4 - Exceptional Drought

*The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying **text summary** for forecast statements.*

Author(s):

Richard Heim, NOAA/NCDC

2015 CVP Allocations

Year 2015	Contractors	Feb 27, 2015
	North of Delta	
	Agricultural Contractors (Ag)	0%
	Urban Contractors (M&I)	25%*
	Wildlife Refuges (Level 2)	75%**
	Settlement Contractors/Water Rights	75%**
	American River M&I Contractors	25%*
	In Delta - Contra Costa	25%*
	South of Delta	
	Agricultural Contractors (Ag)	0%
	Urban Contractors (M&I)	25%*
	Wildlife Refuges (Level 2)	75%**
	Settlement Contractors/Water Rights	75%**
	Eastside Division Contractors	0%
	Friant - Class 1	0%
	Friant - Class 2	0%

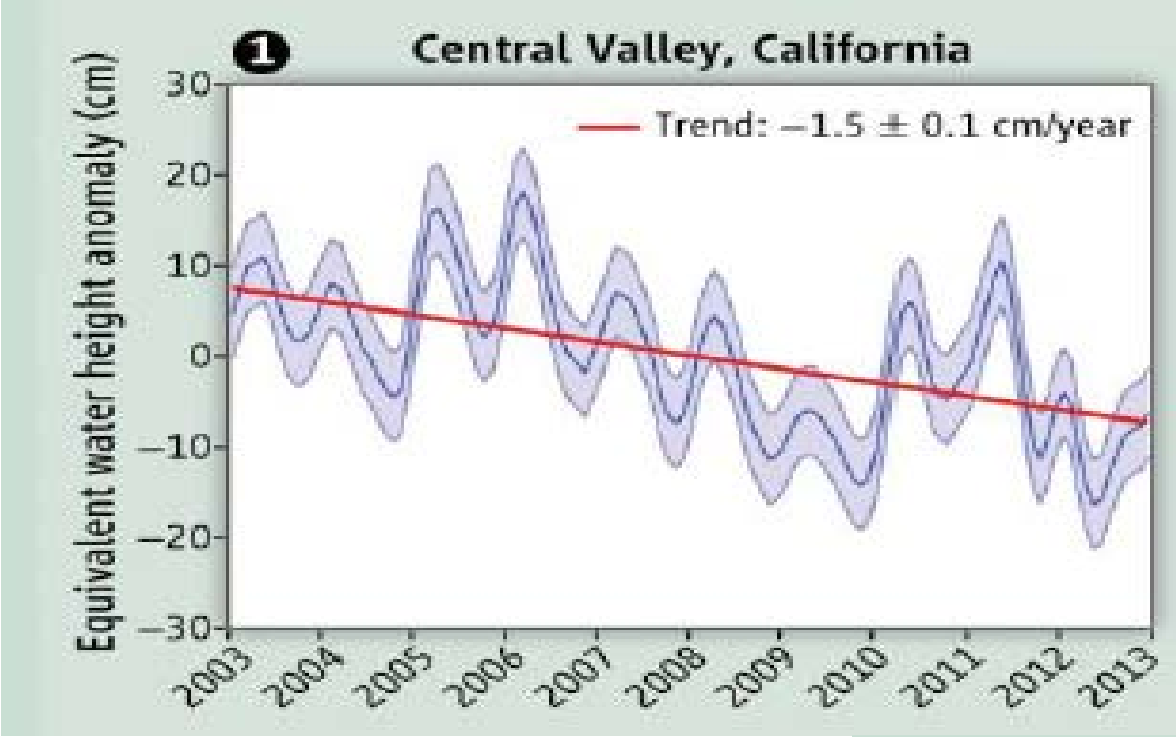
2015 SWP Allocations

- December 1 10%
- January 15 15%
- March 2 20%

The Importance of Groundwater for Drought Relief

- Groundwater Usage
  - Normal Year 38%
  - Drought Year 60%

Groundwater



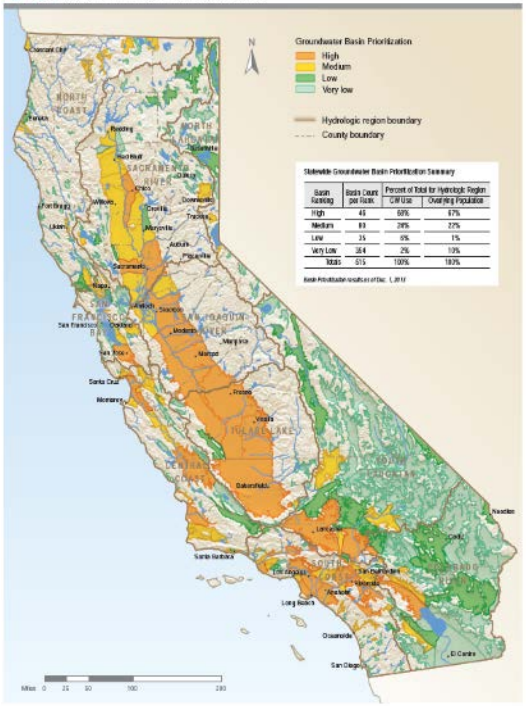
Famiglietti and Rodell, 2013

California Groundwater Management

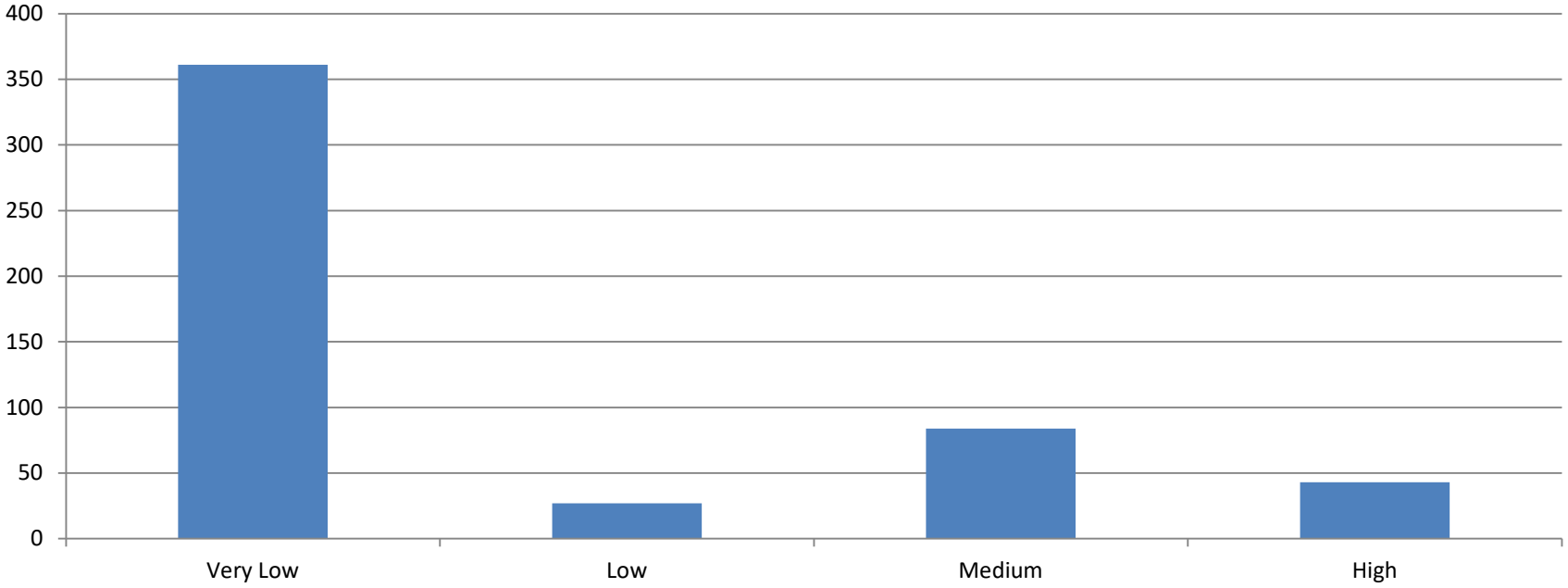
- 2014 Sustainable Groundwater Management Act
  - Local Management with State Oversight
  - Groundwater Sustainability Agencies (2017)
  - Groundwater Sustainability Plans (2020/2)
  - Fully Implemented (2040/2)

Groundwater Basin Prioritization

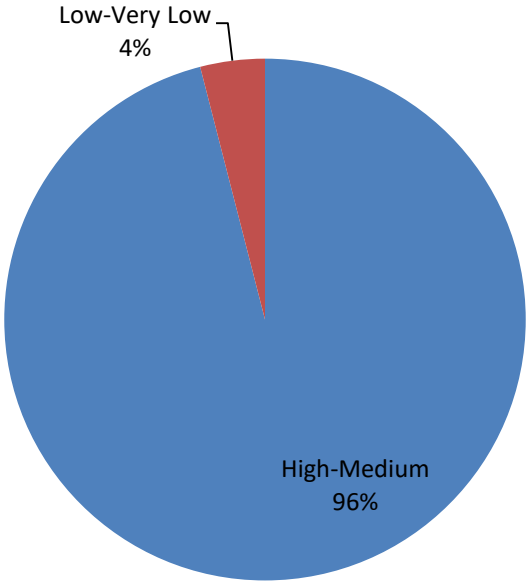
Figure 3-31 CASGEM Final Basin Prioritization Results



Number of Basins by Prioritization Level



Percentage Water Use by Basin Prioritization



Planning for Uncertain Water Supplies

- Irrigation Efficiency
- Fallowing a Portion of Your Land
  - Growing any Annual Crops?
  - What is in Your Portfolio?
- Deficit Irrigating Your Orchard

- What about the Long-Run? (Climate Change)

Achievements in Water Conservation

Adoption of New Irrigation Technologies

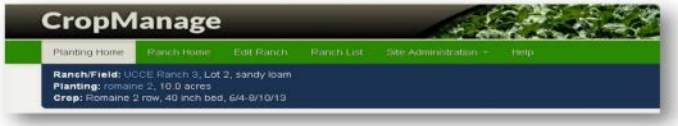
Surface → Sprinkler → Drip → Subsurface Drip

Evolution of Technologies
Management of New Systems
Optimization by Crop and Cropping Systems

Irrigation Optimization and Management

- Irrigation System Optimization
  - Distribution Uniformity
- Irrigation Management (When to Irrigate and How Much)
  - California Irrigation Management Information System (CIMIS)
    - Crop Coefficients
  - Hand Held Probes
  - Wireless Technologies
  - Web-Based Solutions
    - CropManage

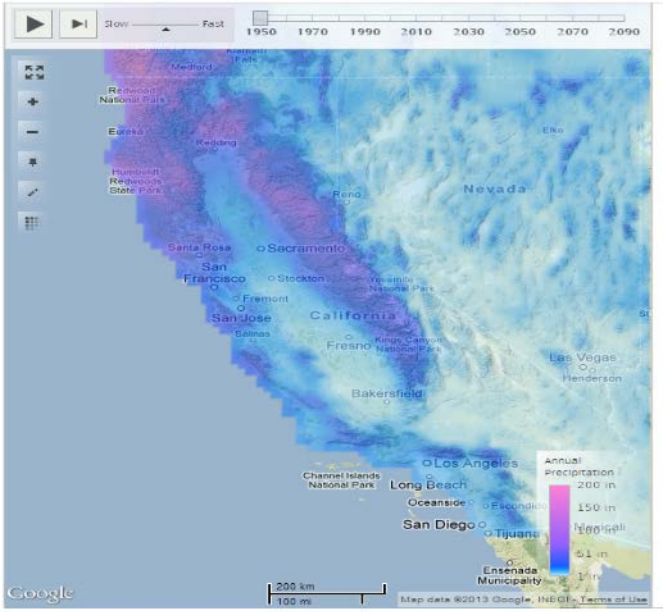
CIMIS



Climate change and water in California

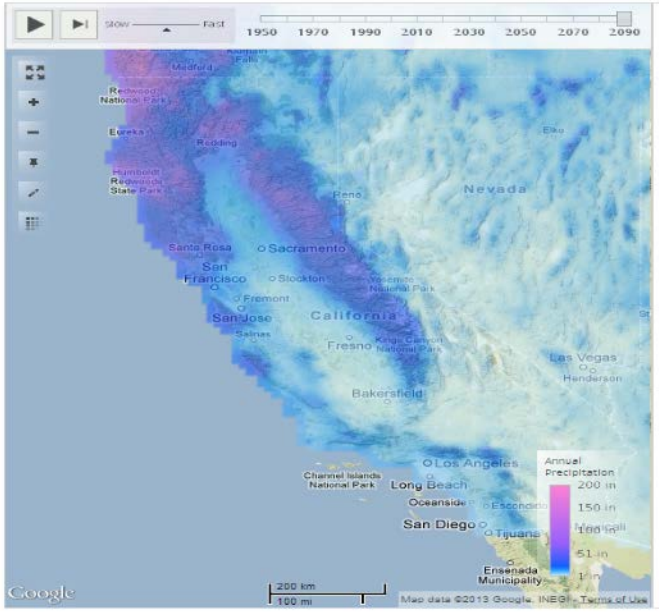
1950

PRECIPITATION: DECADAL AVERAGES MAP



2090

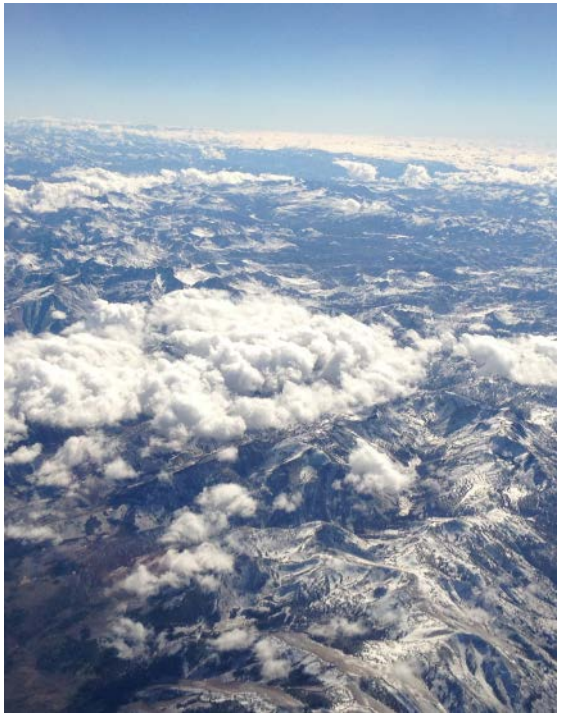
PRECIPITATION: DECADAL AVERAGES MAP



Average of four commonly used climate scenarios – see cal-adapt.org for more information.

CA Water Facts

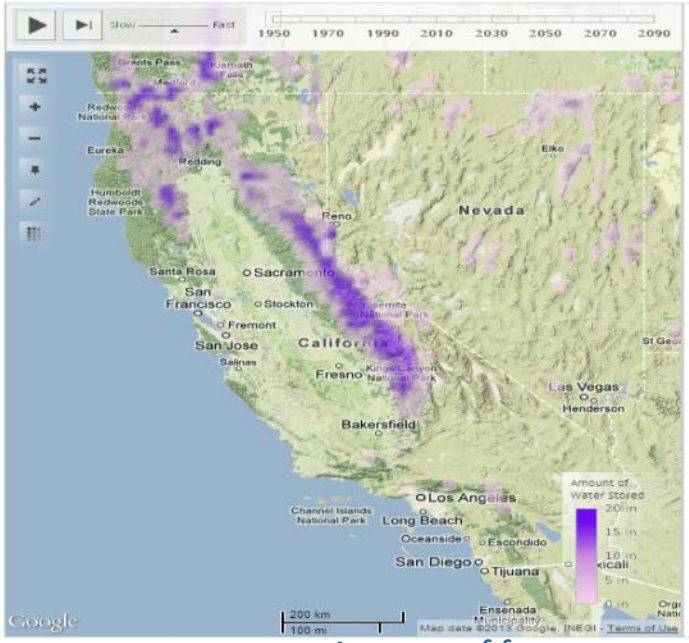
- 43 MAF Surface Storage
- 150+ MAF Groundwater Storage
- 15 MAF Snowpack
  - Decreasing to 10-11 MAF with Climate Change



Climate change and water in California

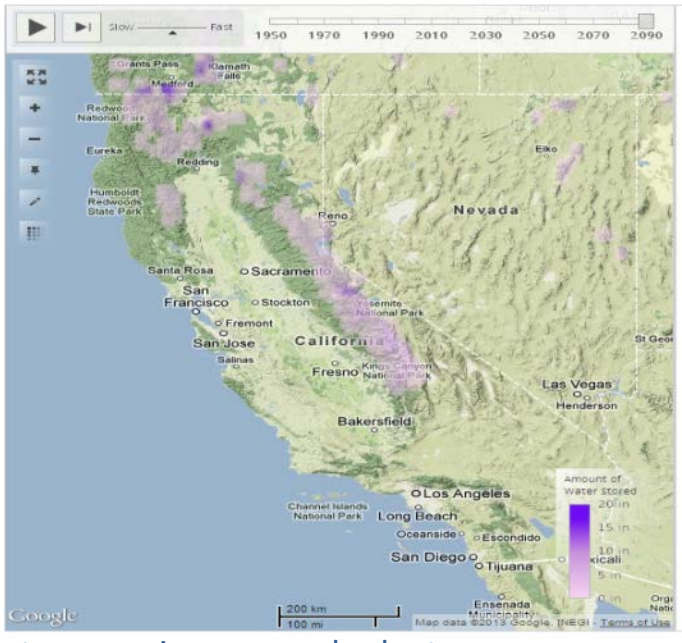
1950

SNOWPACK: DECADAL AVERAGES MAP



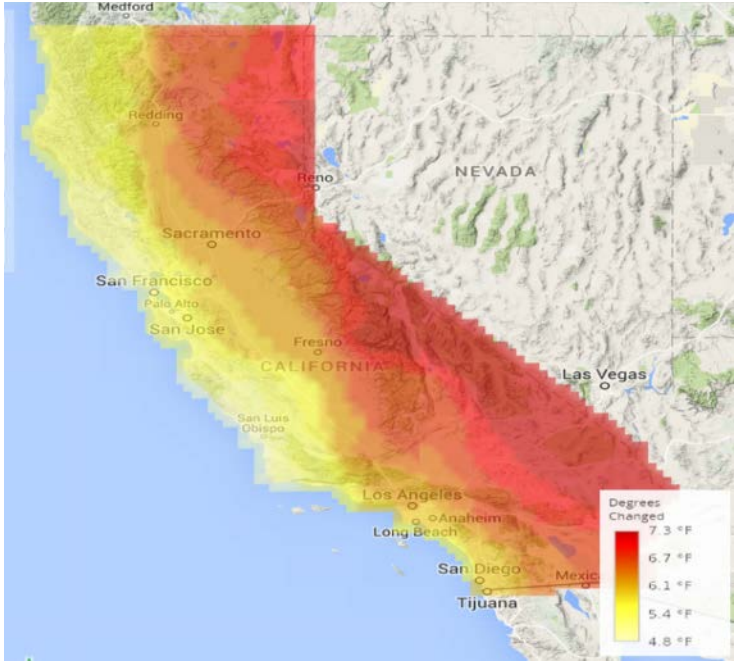
2090

SNOWPACK: DECADAL AVERAGES MAP



Average of four commonly used climate scenarios – see cal-adapt.org for more information.

Climate change and temperature in California



Average of four commonly used climate scenarios – see cal-adapt.org for more information.

Thank You

What's Next

Tuesday, December 5 at 1:45 p.m.

- Common Errors in Orchard Set Up– Room 308-309
- Repositioning Plant-Based Protein – Room 306-307
- The Science and Practice of Intentional Recharge in Almond Orchards – Room 312-313
- Produce Safety Rule for Farms: How to Comply and What About the Grower Exemption? – Room 314

CEUs – New Process

Certified Crop Advisor (CCA)

- Sign in and out of each session you attend.
- Pickup verification sheet at conclusion of each session.
- *Repeat this process for each session, and each day you with to receive credits.*

Pest Control Advisor (PCA), Qualified Applicator (QA), Private Applicator (PA)

- Pickup scantron at the start of the day at first session you attend; complete form.
- Sign in and out of each session you attend.
- Pickup verification sheet at conclusion of each session.
- Turn in your scantron at the end of the day at the last session you attend.

Sign in sheets and verification sheets are located at the back of each session room.

Research Poster Sessions

Wednesday, December 6
3:00 p.m. – 5:00 p.m.

Featured topics:
- Irrigation, nutrient management
- Breeding
- Soils, if related to organic matter input
- Sustainability, irrigation improvement continuum, life cycle assessment, dust
- Food quality and safety

Thursday, December 7
1:30 p.m. – 2:30 p.m.

Featured topics:
- Insect and disease management
- Fumigation and alternatives
- Biomass (including biochar-related efforts)
- Pollination
- Almond Leadership Program

2017 Research Update Book

- Pickup your copy at the ABC Booth in Hall A+B
- Includes a one-page summary of every current ABC-funded research project