

# **Hay, Milk and the Trade Consequences of California Water Troubles**

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## **Issues**

- **Flux in water availability and price have driven changes farm water use in complex ways**
- **Observing temporary farm adjustments in face of temporary shocks helps us assess responses to longer term trends, but can also mislead**
- **Observers often raise judgement about water facts and notions based on seeming economic anomalies**
- **Among the most prominent and longstanding judgements are those about which crops farmers choose to grow in California**
  - **“Low value” crops**
  - **“Water intensive” crops**
  - **Crops the imply export of “virtual water”**
- **Some of this is economic nonsense and some is based on concerns that market incentives have been distorted by lack of fully functioning water markets.**

## **Questions, Objectives and Scope**

**What can economic modeling contribute to responding to questions such as:**

- Why grow alfalfa in a drought?**
- How can California continue to export water intensive commodities?**

**Does consideration of these questions reveal failed water markets?**

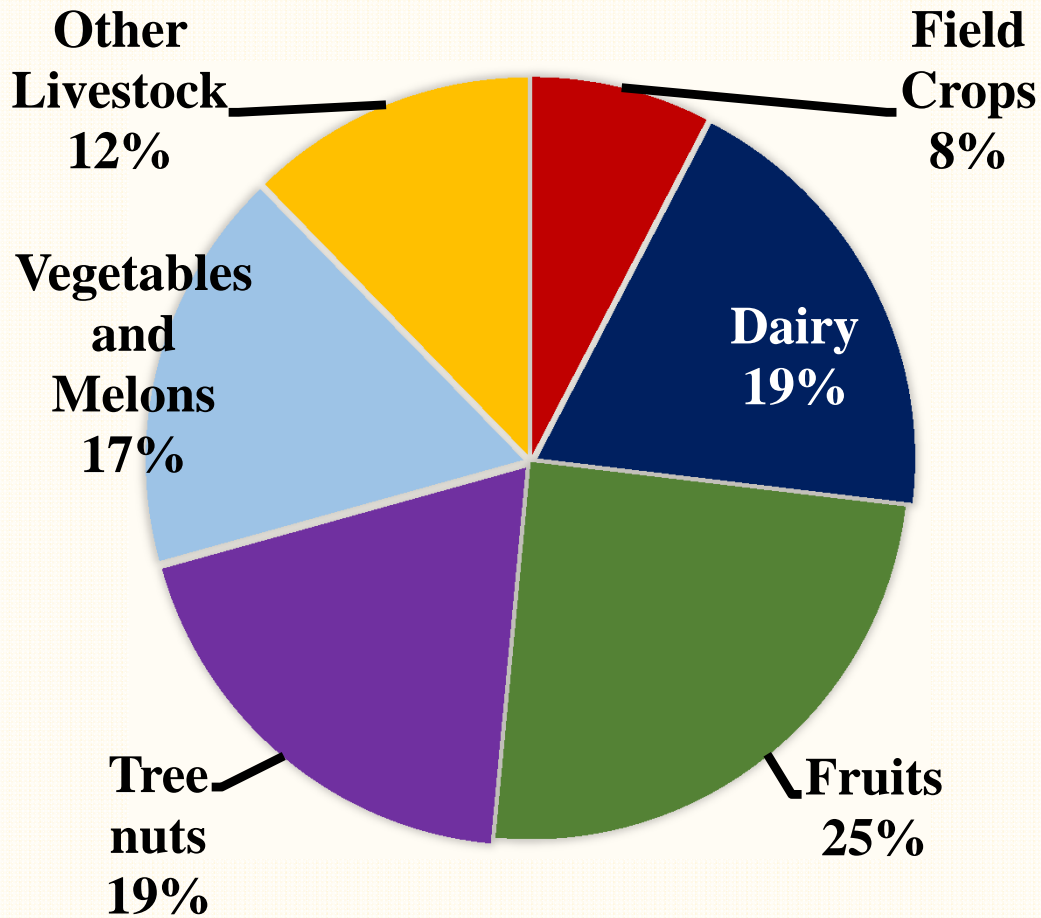
**Are changes underway reflecting pressures from more effective water market incentives and prices that better guide crop choice?**

**Today we clarify questions and what information can help us model.**

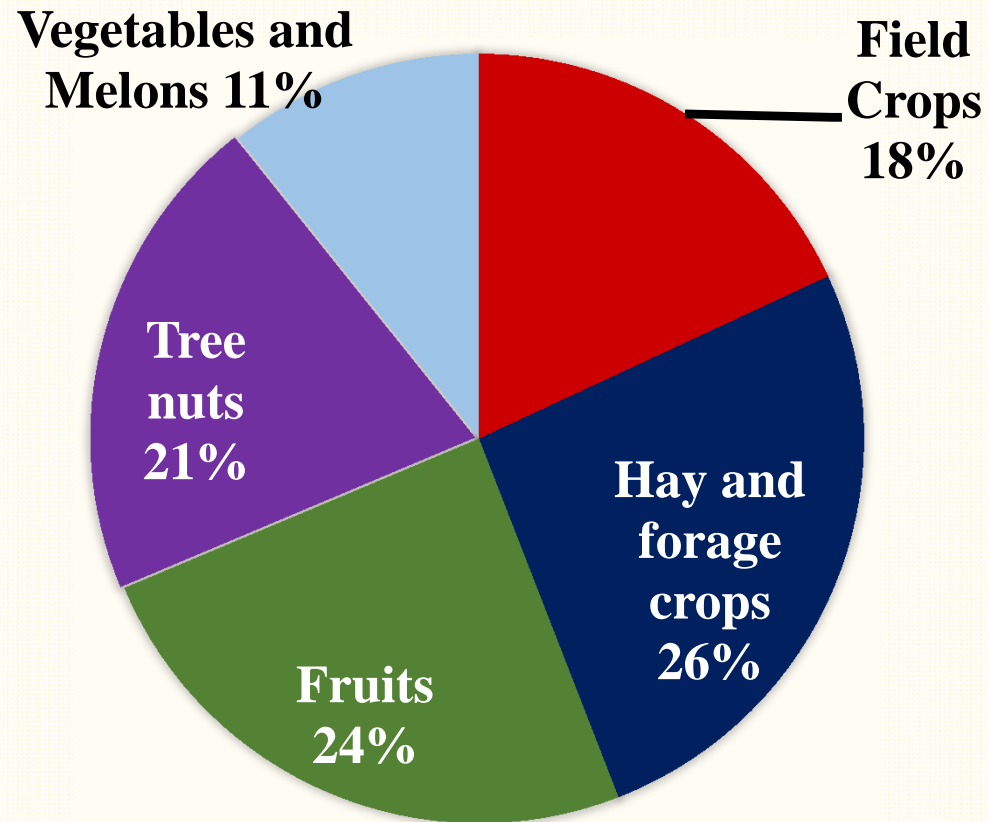
**Drought responses are useful guidance, but cannot provide simple answers to questions on the evolution of land and water use in the face of changing markets, climate and institutions**

# California agriculture is diverse, by receipts and acreage

## Cash receipts (2015)

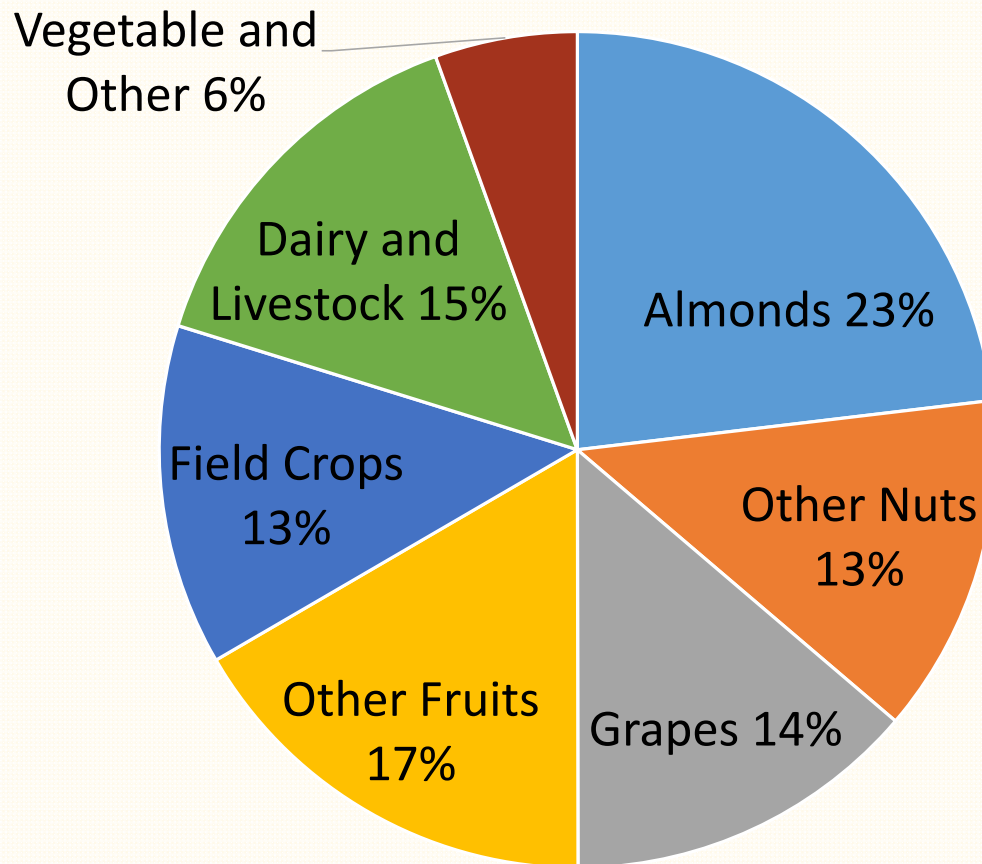


## Acreage (2015)



# California Agriculture Exports

Approximately \$20 billion port value; about 27% of California farm value is exported



# **What does water intensity even mean for California Agriculture?**

## **A Quick Example: California Drought**

(Water per serving of food: Can such data be useful for consumers or policy makers?)

- **The *New York Times*, *LA Times* and others publicize how much water is embedded in each serving of food and how much of that food is from California.**
- **The top of the list for high water use per serving is beef.**

**(No surprise: animal products use more of almost all natural resources)**

- **A strong recommendation: “Californians should avoid meat to help save water”**

**Governor Brown said eat veggie burgers during the drought.**

**The general advice to consumers about how food is produced... eat “responsibly”.**

**The same reasoning and evidence used to push for sustainability standards in the U.S. government nutrition guidelines**

# How much “drought-relevant” water is actually in California beef?

**A 3 oz. steak uses about 880 gallons of water on the farms and ranches**

However in California:

- Almost 90 percent of the water is winter rain on the California pastures that could grow no other crop. That water can make no contribution to drought relief because it cannot be captured. (If the cattle did not eat the grass, runoff to streams would be smaller.)
- About 10 percent of the water comes in trainloads of corn and soybeans from the Midwest. No California water is included!
- That leaves a little over 10 gallons per serving of beef in the hay for the cattle grown in California using irrigation water that could be shifted to other uses.

(Source: N. Anderson and D. Sumner, *ARE Update*, 2016, <http://giannini.ucop.edu/are-update/19/3/which-california-foods-yo/>)



# California told to be Anti-Beef and Anti-Local for Drought Sustainability

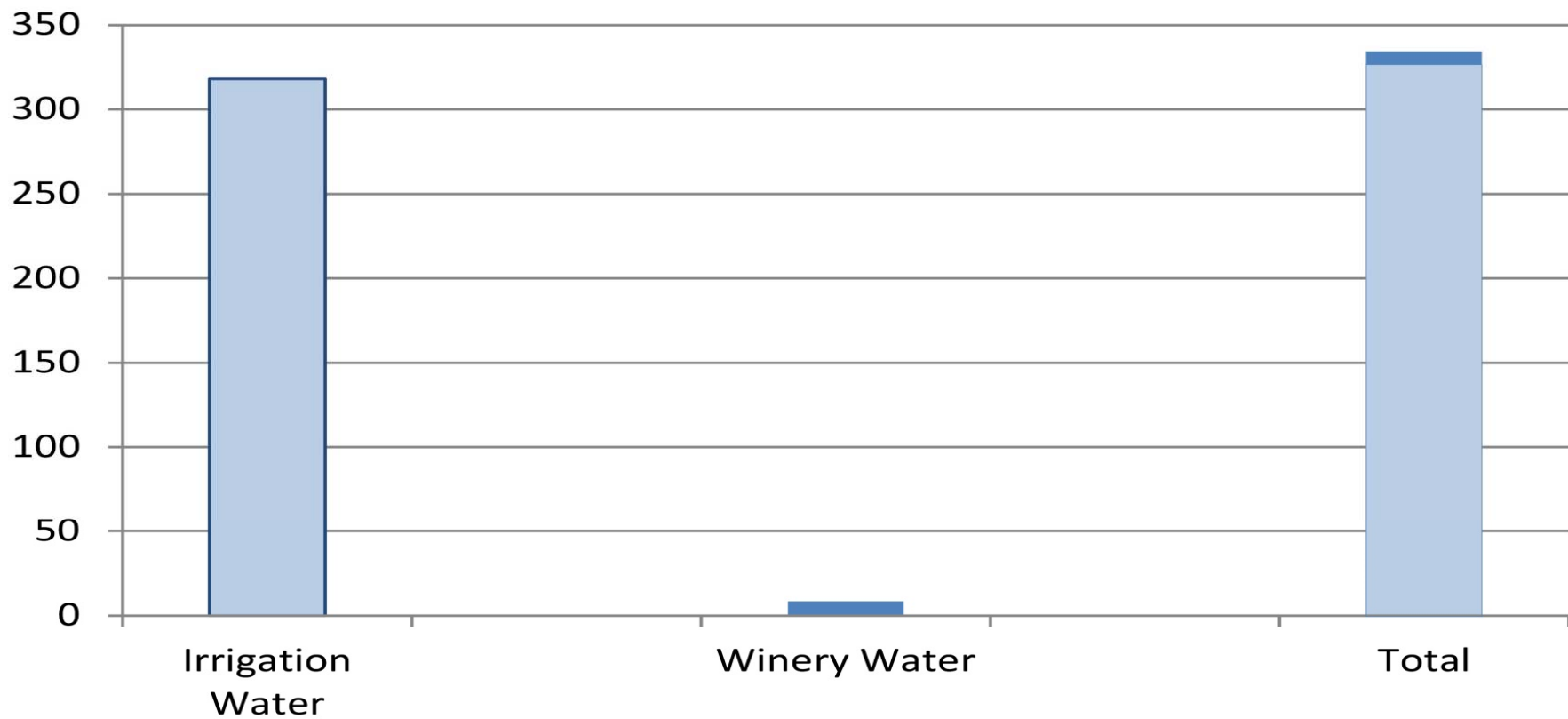
California beef has about 10 gallons of drought relevant water per serving, roughly equal to the 9 gallons per serving of tomatoes or broccoli.



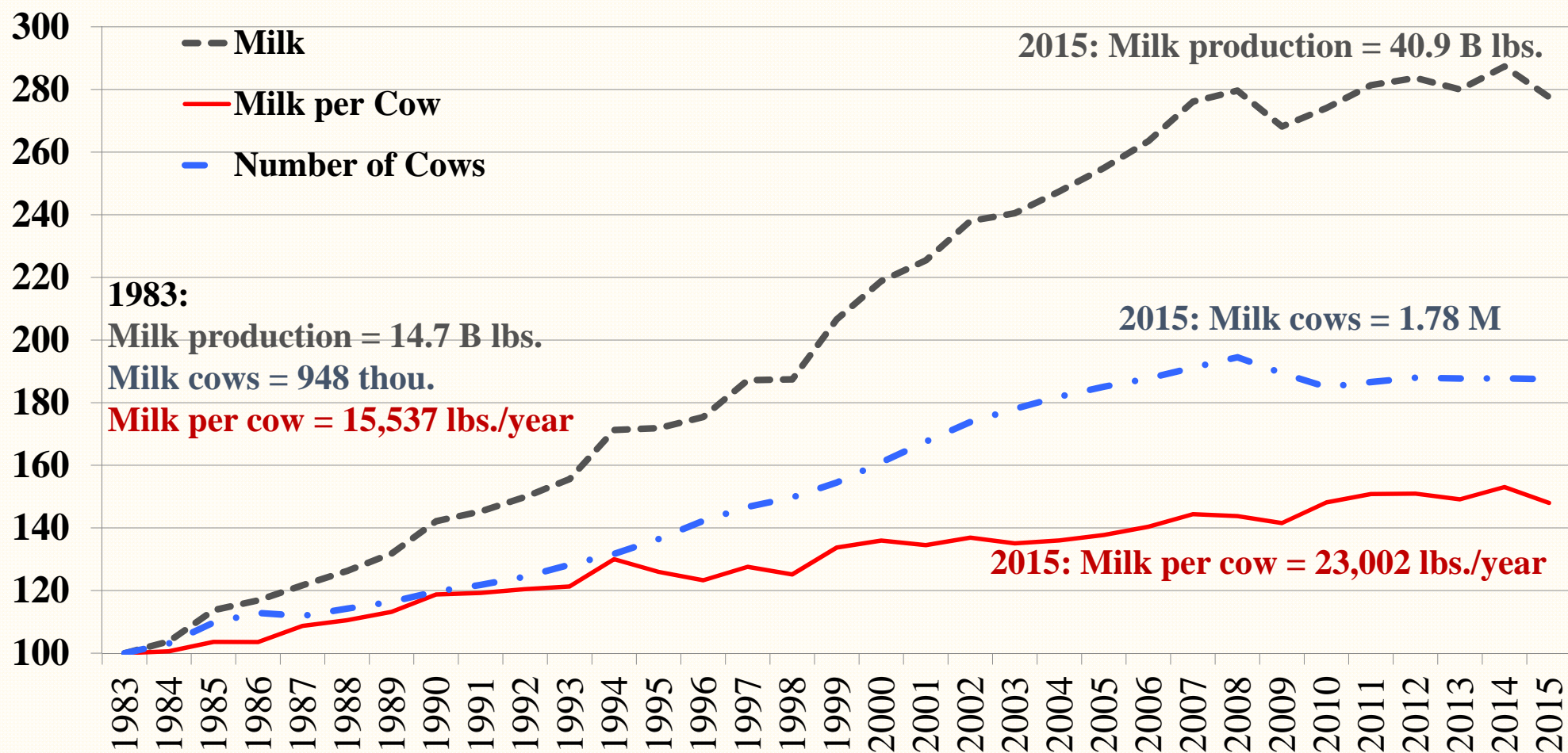
So, even if there is an externality of using California water in a drought; even if irrigation water is underpriced, beef (even California-produced beef) is not a culprit.

Such buyer advice (and proposed standards) implied lower demand for no sensible reason.

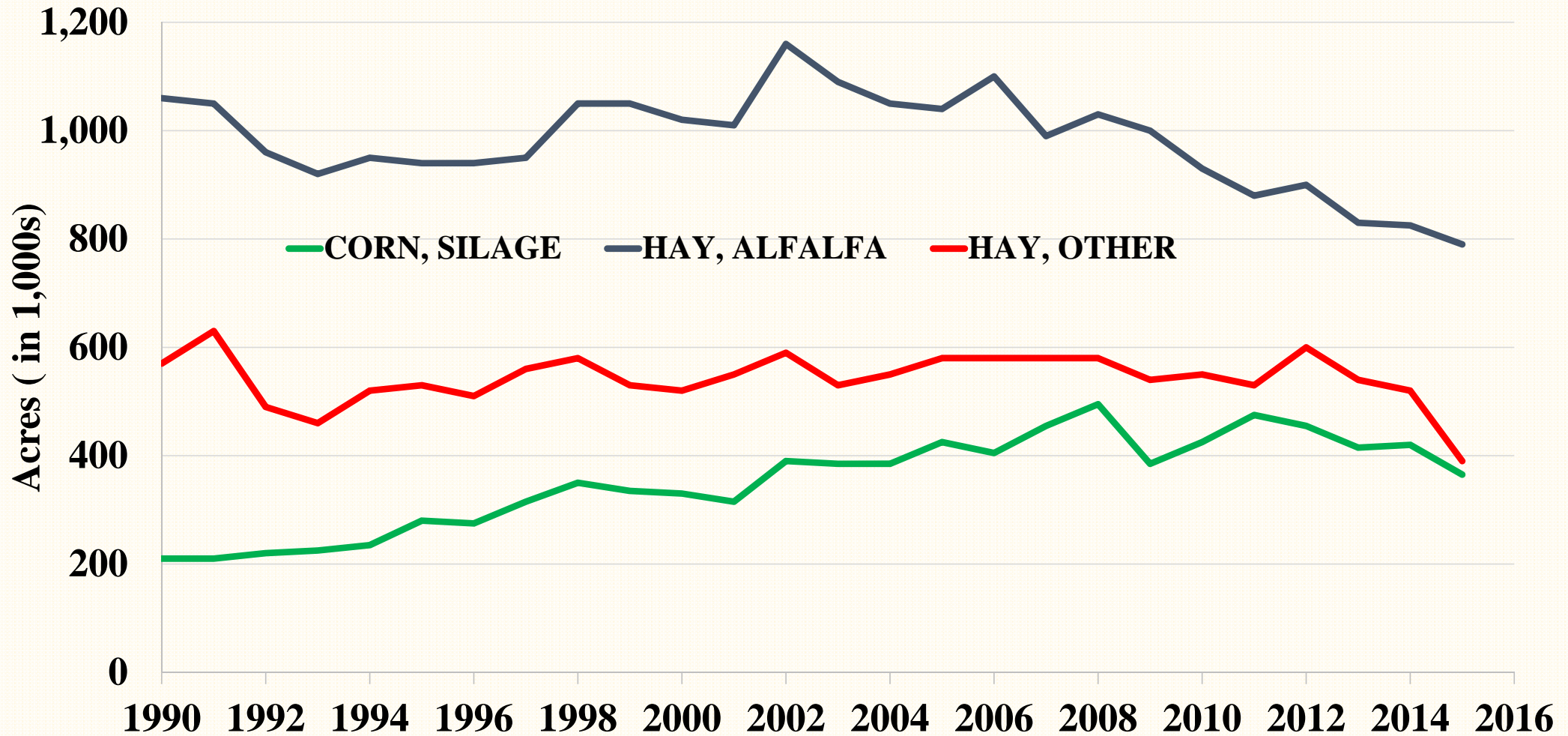
## Water into wine: Gallons of Water per Gallon of Wine ... and what to do about it



# California Cows, Milk and Milk per Cow, 1983-2015 (Indices)

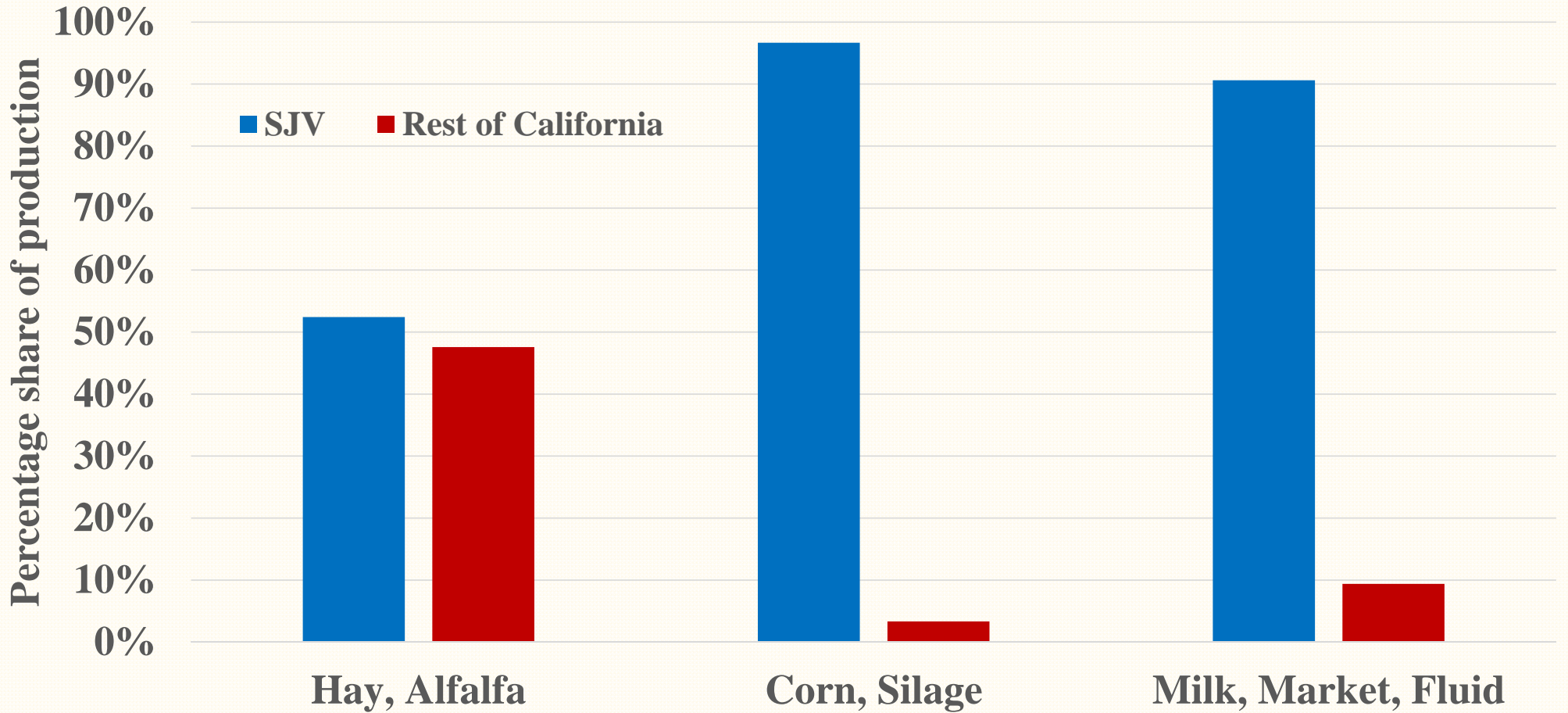


# California Hay and Corn (silage) acreage from 1990 to 2015



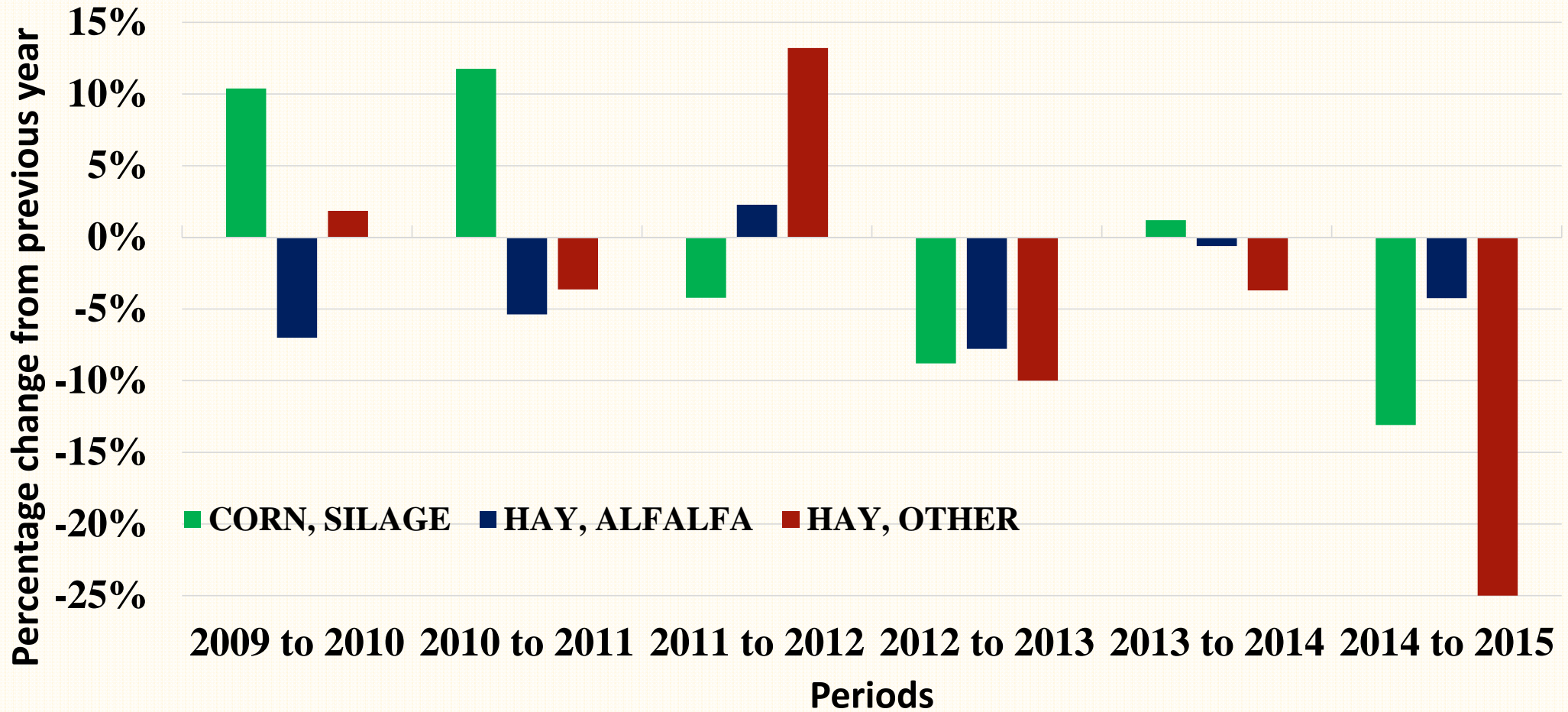
Source: USDA NASS

# Production in San Joaquin Valley

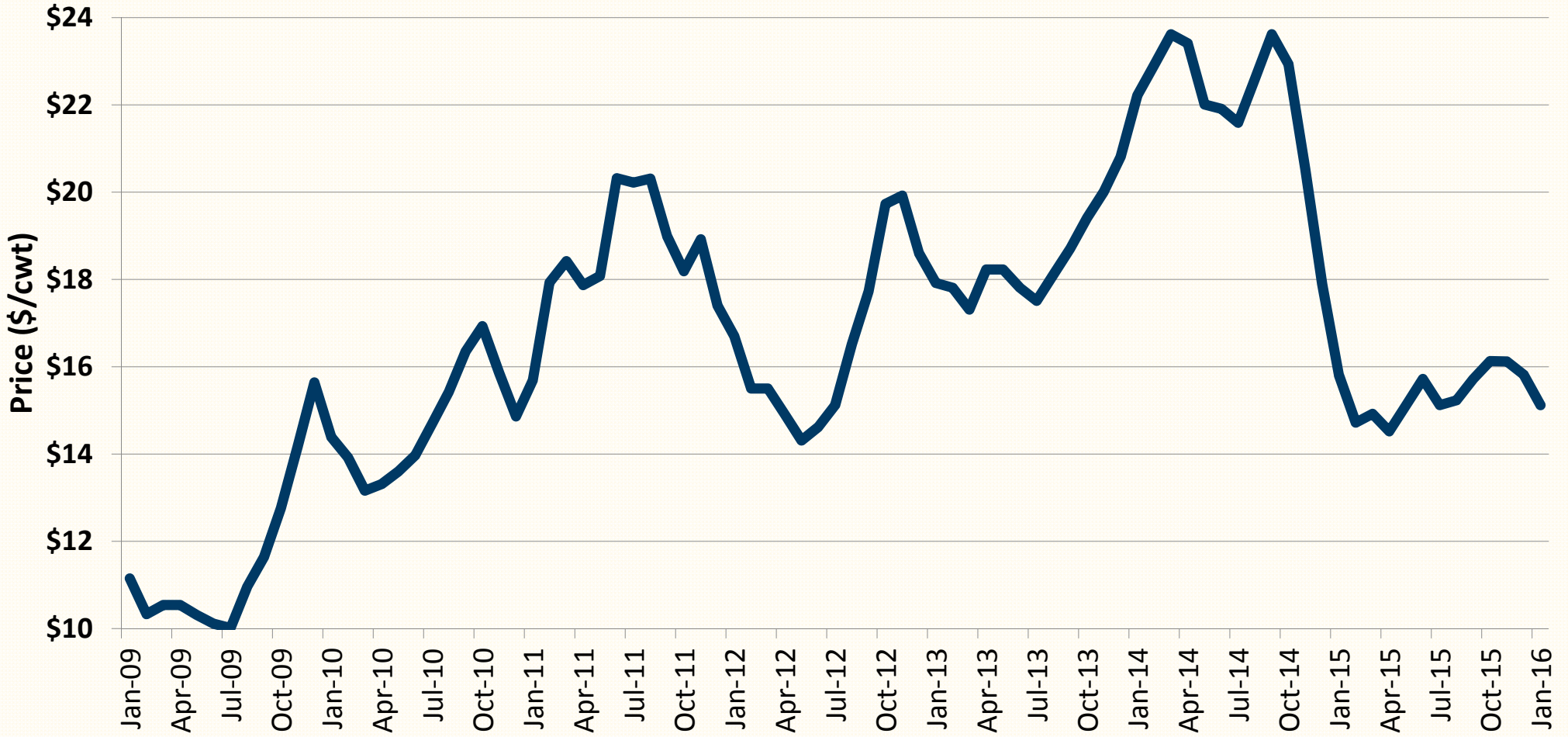


Source: USDA NASS; California County Ag Commissioners' Data 2014

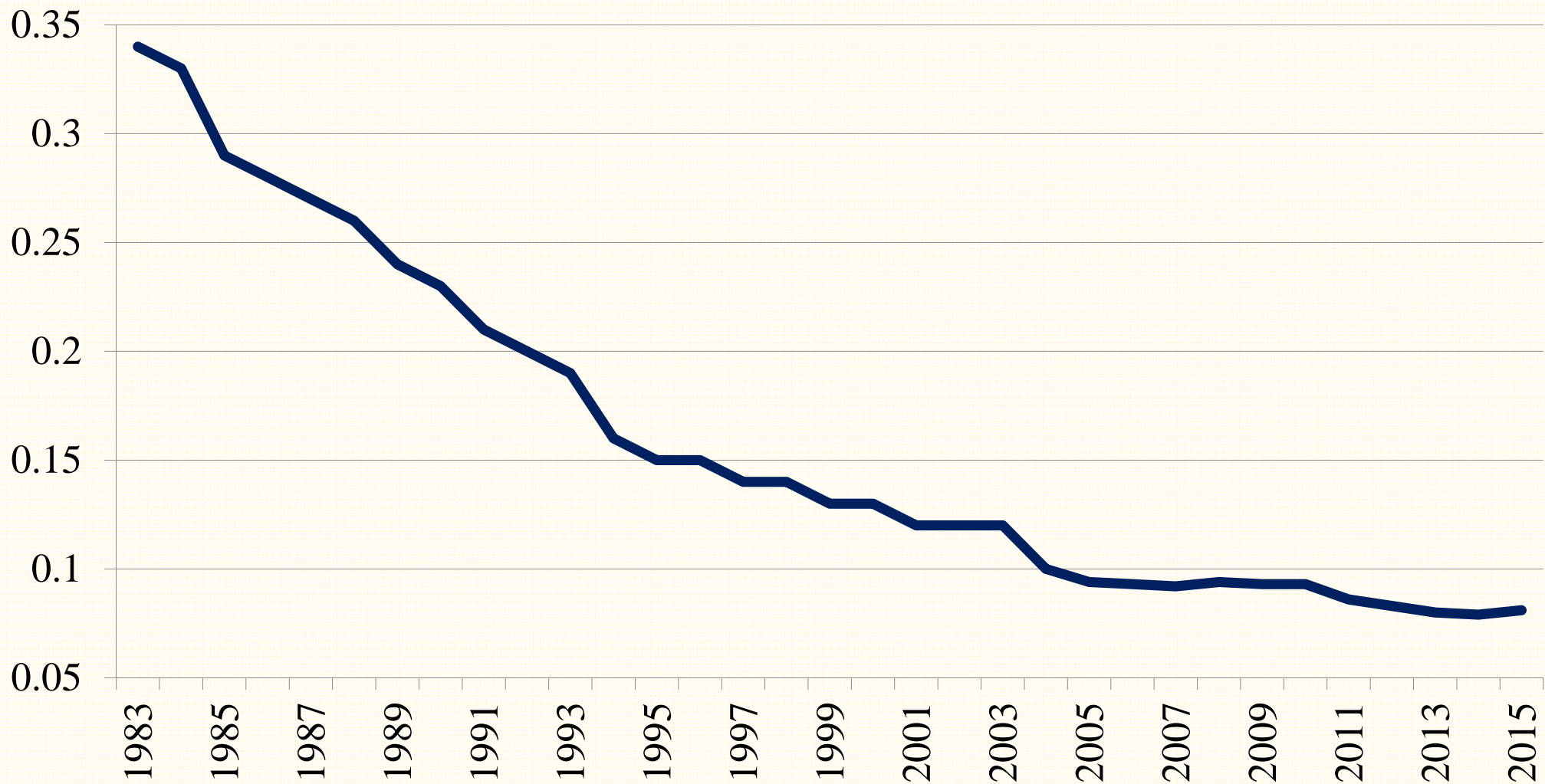
# California Hay and Corn (silage) acreage change from 2009 to 2015



# California All Milk Price



## Share of Class 1 in California Fat Utilization





# California Dairy Farm Cost of Production (CDFA)

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<i>Feed Costs</i>	<i>Hired Labor</i>	<i>Replacement Costs</i>	<i>Operating Costs</i>	<i>Marketing Costs</i>	<i>Total Cost</i>
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Dollars per CWT

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<b>2006</b>	<b>6.84</b>	<b>1.53</b>	<b>1.98</b>	<b>2.66</b>	<b>0.50</b>	<b>12.64</b>
<b>2012</b>	<b>11.48</b>	<b>1.52</b>	<b>1.24</b>	<b>2.80</b>	<b>0.54</b>	<b>17.57</b>
<b>2013</b>	<b>11.46</b>	<b>1.52</b>	<b>1.08</b>	<b>2.77</b>	<b>0.55</b>	<b>17.37</b>
<b>2014</b>	<b>11.05</b>	<b>1.56</b>	<b>1.37</b>	<b>2.88</b>	<b>0.56</b>	<b>17.42</b>
<b>2015</b>	<b>10.46</b>	<b>1.70</b>	<b>2.12</b>	<b>2.93</b>	<b>0.56</b>	<b>17.78</b>

# California Dairy Farm Feed Costs

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## *Feed Cost per CWT*

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	2014	2015
<b>Forage costs</b>	<b>\$5.05</b>	<b>\$4.83</b>
<b>Concentrates</b>	<b>\$ 6.00</b>	<b>\$ 5.57</b>
<b>Total Feed Costs</b>	<b>\$ 11.05</b>	<b>\$ 10.41</b>

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- So forage is almost half of feed cost, which is 65% of farm costs for milk.
- Forage costs are about 30% of the costs of milk on the farm and higher for milk used for tradables

## Non-milk Costs of Milk Processing, by Product

	Butter		Non-Fat Dry Milk		Cheese	
	<i>2014</i>	<i>2013</i>	<i>2014</i>	<i>2013</i>	<i>2014</i>	<i>2013</i>
	<i>Dollars per cwt</i>					
<b>Processing Labor</b>	<b>\$7.08</b>	<b>\$6.42</b>	<b>\$4.60</b>	<b>\$4.84</b>	<b>\$5.81</b>	<b>\$5.84</b>
<b>Processing Non-Labor</b>	<b>\$6.58</b>	<b>\$6.43</b>	<b>\$11.33</b>	<b>\$11.22</b>	<b>\$8.58</b>	<b>\$8.21</b>
<b>Packaging</b>	<b>\$1.33</b>	<b>\$1.36</b>	<b>\$1.52</b>	<b>\$1.45</b>	<b>\$2.44</b>	<b>\$2.78</b>
<b>Other Ingredients</b>	<b>\$0.34</b>	<b>\$0.28</b>	<b>\$0.00</b>	<b>\$0.00</b>	<b>\$2.81</b>	<b>\$2.80</b>
<b>Misc., Admin., and ROI</b>	<b>\$3.10</b>	<b>\$2.75</b>	<b>\$2.66</b>	<b>\$2.46</b>	<b>\$3.91</b>	<b>\$3.28</b>
<b>Total Cost</b>	<b>\$18.43</b>	<b>\$17.24</b>	<b>\$20.11</b>	<b>\$19.97</b>	<b>\$23.55</b>	<b>\$22.91</b>

## **Milk into tradeable dairy products?**

**About 10 pound of milk per pound of cheese:**

**So with farm “cheese” milk @ \$12.50/cwt = \$1.25 for milk needed for a pound of cheese. Other costs are about \$0.23 per pound of cheese. So the farm-level milk costs are the dominant driver of cheese costs and equally so for the other tradable milk products.**

- Block cheese price \$1.44 (April, 2016) down to \$1.34 ... May 24 spot price!**
- Whey and lactose sales made up the revenue difference for cheese makers**
- Farm milk is 75% of cost for cheese/whey maker**

# Costs to Produce Alfalfa

## 2016 Southern SJV

- **Border flood irrigation**
- **\$130 per acre-foot, (\$10.83 per acre-inch).**
- **From April to October, ten irrigations totaling 64 acre-inches (5.3 acre-feet) of water are applied**
- **Yield is 10 tons/acre**

## 2014 Sacramento Valley

- **Sub-surface drip irrigation**
- **\$65 per acre-foot (\$5.42 per acre-inch)**
- **From April to September, irrigations totaling 4.5 acre-feet, (54 acre-inches) of water are applied**
- **Yield is 9 tons/acre (7 tons/acre in this region for flood irrigation)**

Sources: 2016 Alfalfa Costs & Returns Study (300 acres) – SJV South; 2014 Alfalfa Costs & Returns Study – SDI – Sacramento Valley & Northern Delta

## Costs to Produce Alfalfa

	2016 Flood Irrigation		2014 Sub-surface Drip	
	(\$/acre)	(\$/ton)	(\$/acre)	(\$/ton)
<b>Irrigation Cost (excl. labor)</b>	<b>\$693</b>	<b>\$69.30</b>	<b>\$295</b>	<b>\$32.78</b>
<b>Total Cultural Costs</b>	<b>\$956</b>	<b>\$95.60</b>	<b>\$640</b>	<b>\$71.11</b>
<b>Total Harvest Costs</b>	<b>\$379</b>	<b>\$37.90</b>	<b>\$294</b>	<b>\$32.67</b>
<b>Land Cost</b>	<b>\$488</b>	<b>\$48.80</b>	<b>\$380</b>	<b>\$42.22</b>
<b>Establishment Cost</b>	<b>\$315</b>	<b>\$31.50</b>	<b>\$226</b>	<b>\$28.25</b>
<b>Drip System Cost</b>			<b>\$194</b>	<b>\$24.25</b>
<b>Total Costs</b>	<b>\$2,409</b>	<b>\$240.90</b>	<b>\$2,260</b>	<b>\$251.11</b>

Sources: 2016 Alfalfa Costs & Returns Study (300 acres) – SJV South; 2014 Alfalfa Costs & Returns Study – SDI – Sacramento Valley & Northern Delta

## **Water into Hay into Milk?**

**Irrigation water costs 30% of alfalfa cost in Southern SJV flood system**

**Irrigation water costs about 13% of alfalfa cost in Sac Valley sub-drip system**

**In SSJV 30% x 30% means water is 9% of farm milk cost and about 7% of the at the plant cheese cost and about 5% of the export price of cheese.**

**Using Sac Valley hay 13% x 30% => 4% x 0.75 => 3% of export price of cheese is irrigation water.**

**A major cost but not itself dominant. Doubling the price of water matters, but so does regulation of cheese plants for GHG etc.**

## **International Dairy Markets: Long Term Trends and Short Term Variability**

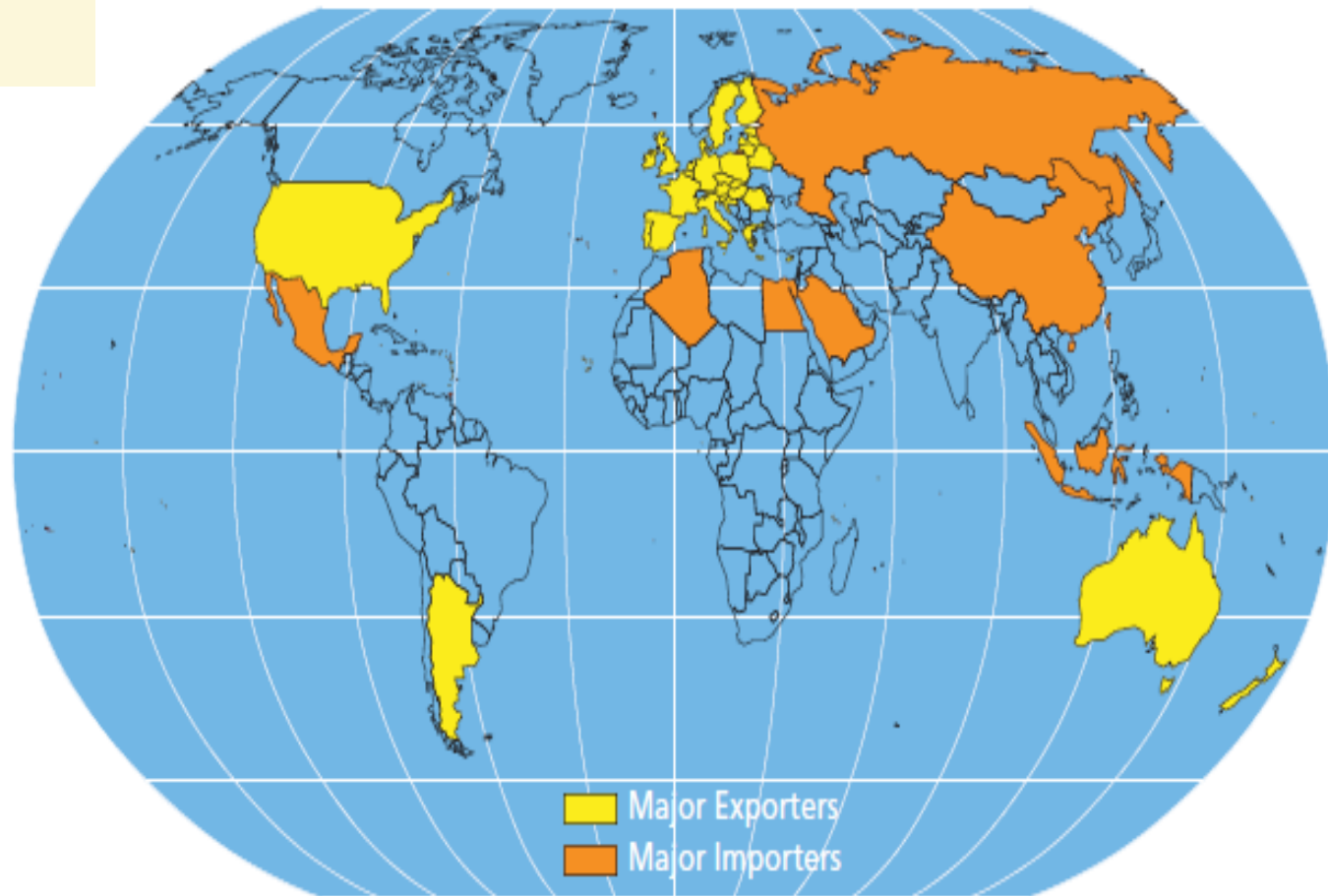
**The long term growth in demand for California dairy is likely not in California or U.S. markets to the east, but in Asian markets to the west.**

**Dairy markets are increasingly global.**

**California dairy producers and processors have become globally competitive**

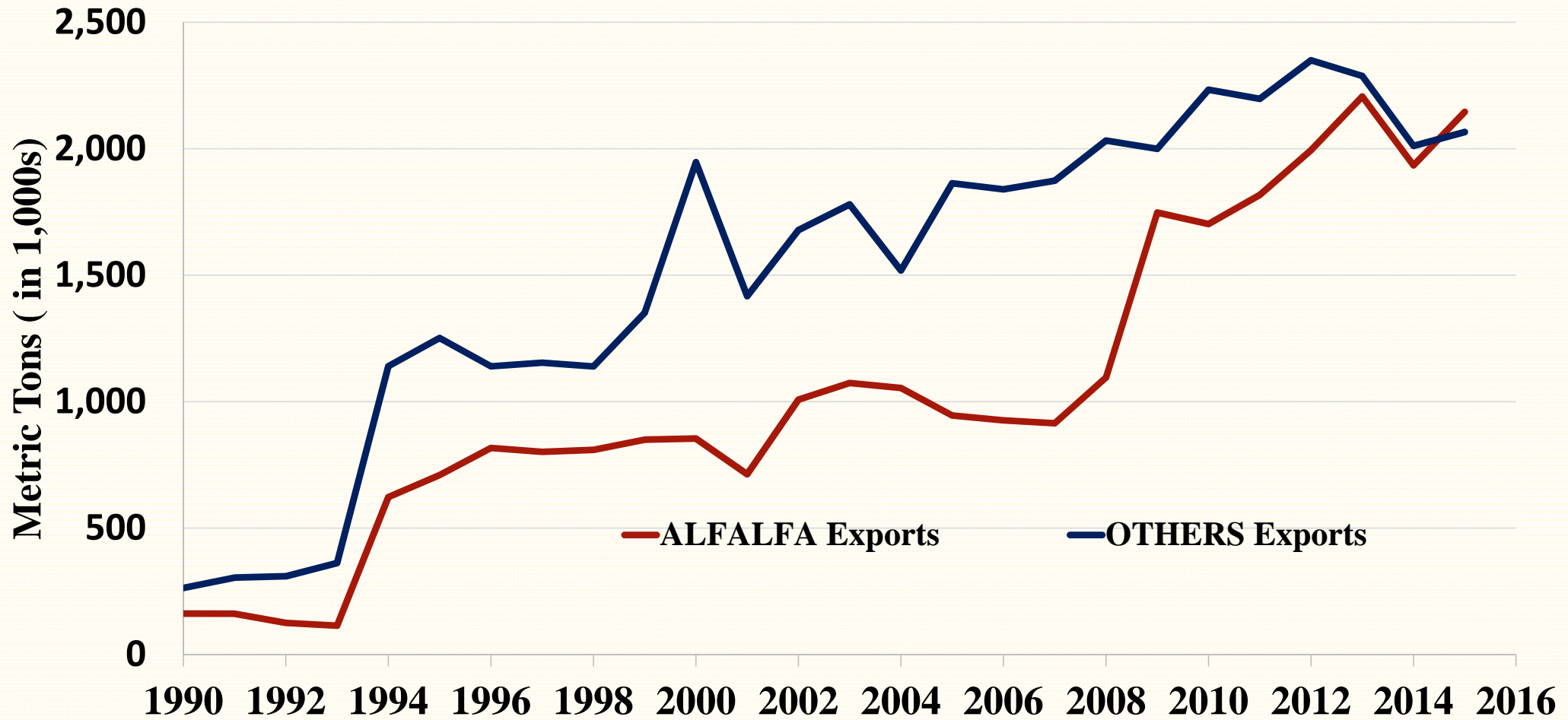
**Will they lose that will expensive water?**

**Major Dairy Exporters and Importers**

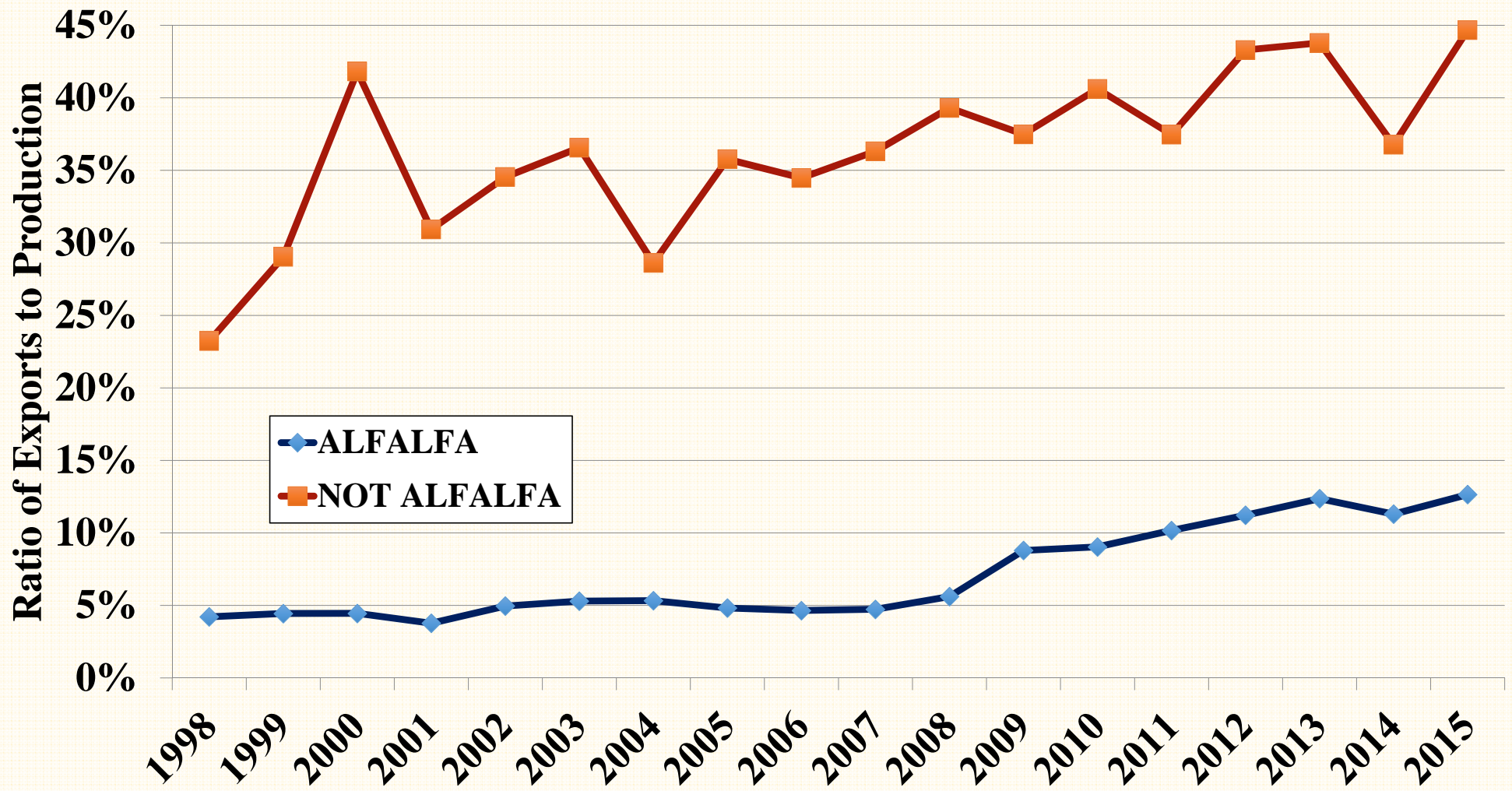




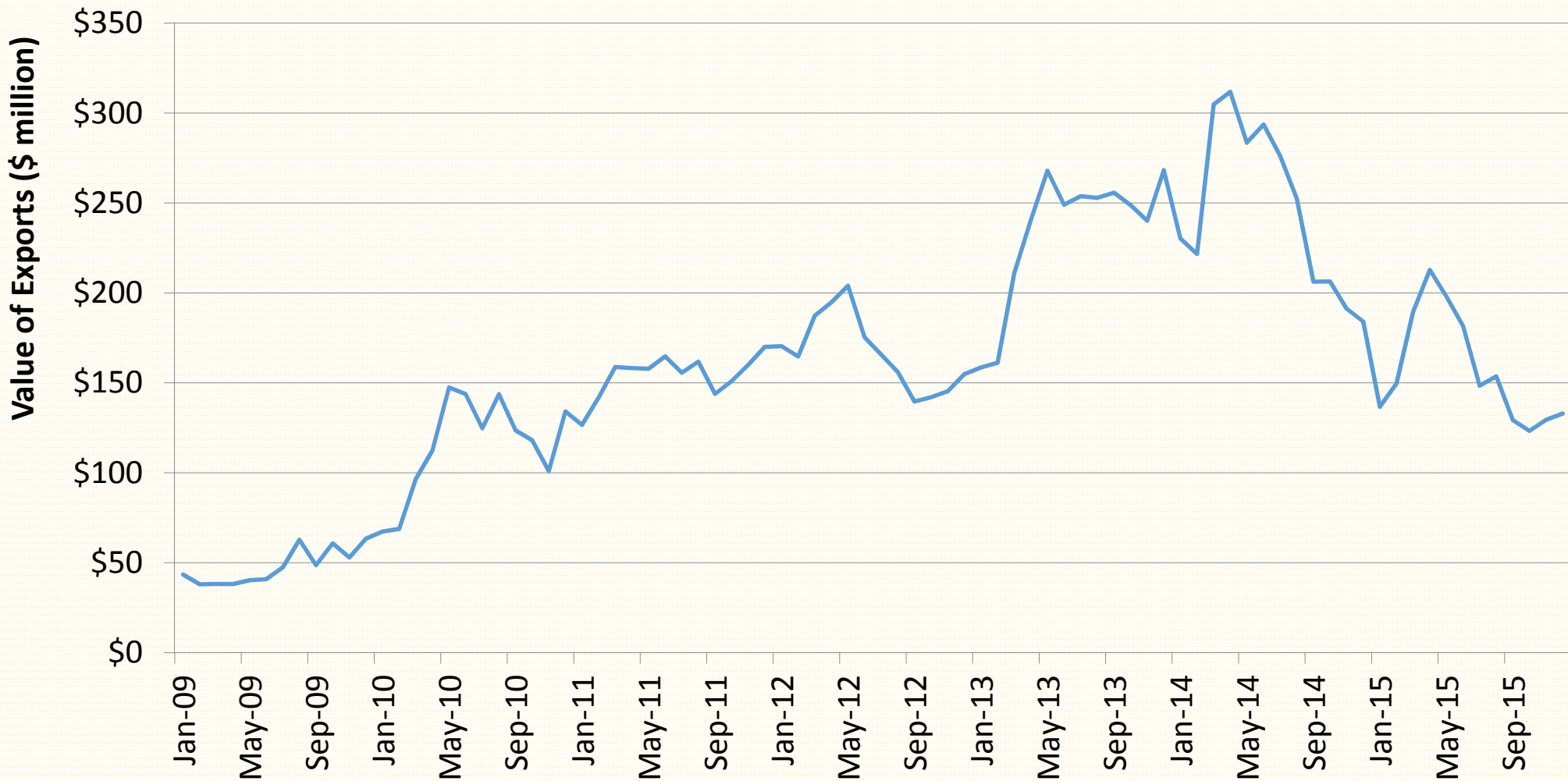
# West Coast Ports export volume of Hay from 1990 to 2015



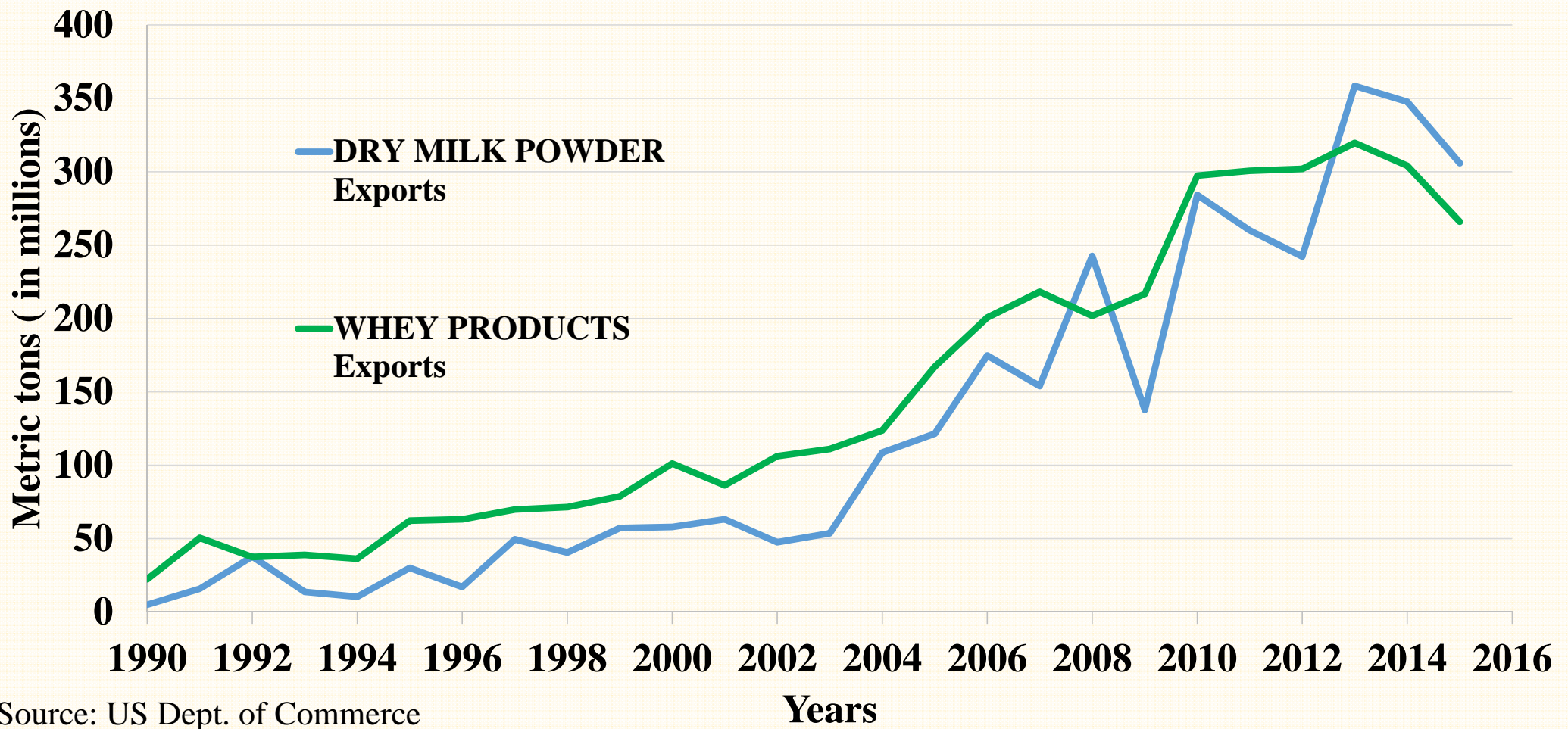
## Ratio: West Coast Hay Exports to Western States Production



# Value of Dairy Exports Through California Ports

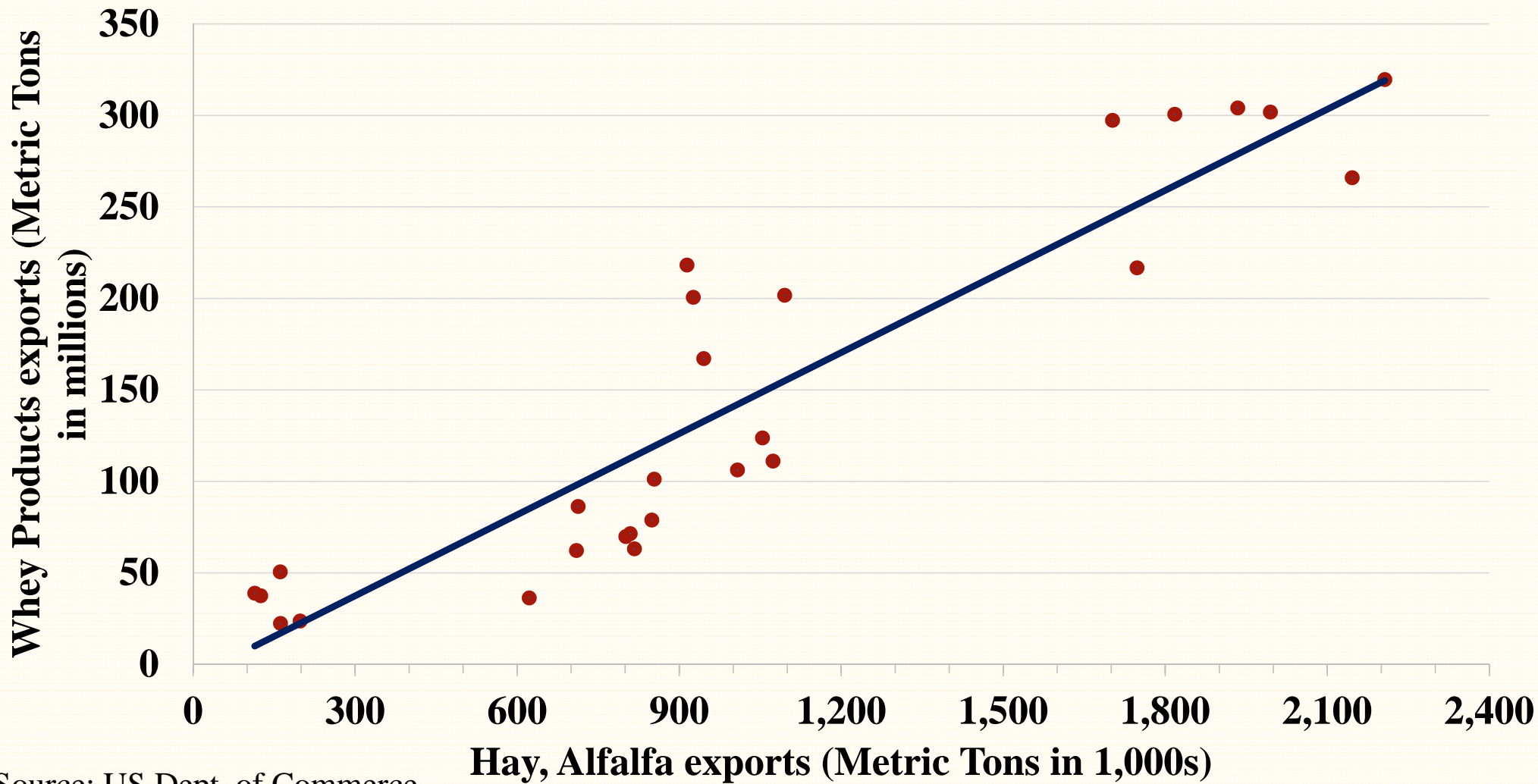


# West Coast Ports export volume of Milk based products from 1990 to 2015



Source: US Dept. of Commerce

## West Coast Ports: Whey Products exports and Alfalfa exports

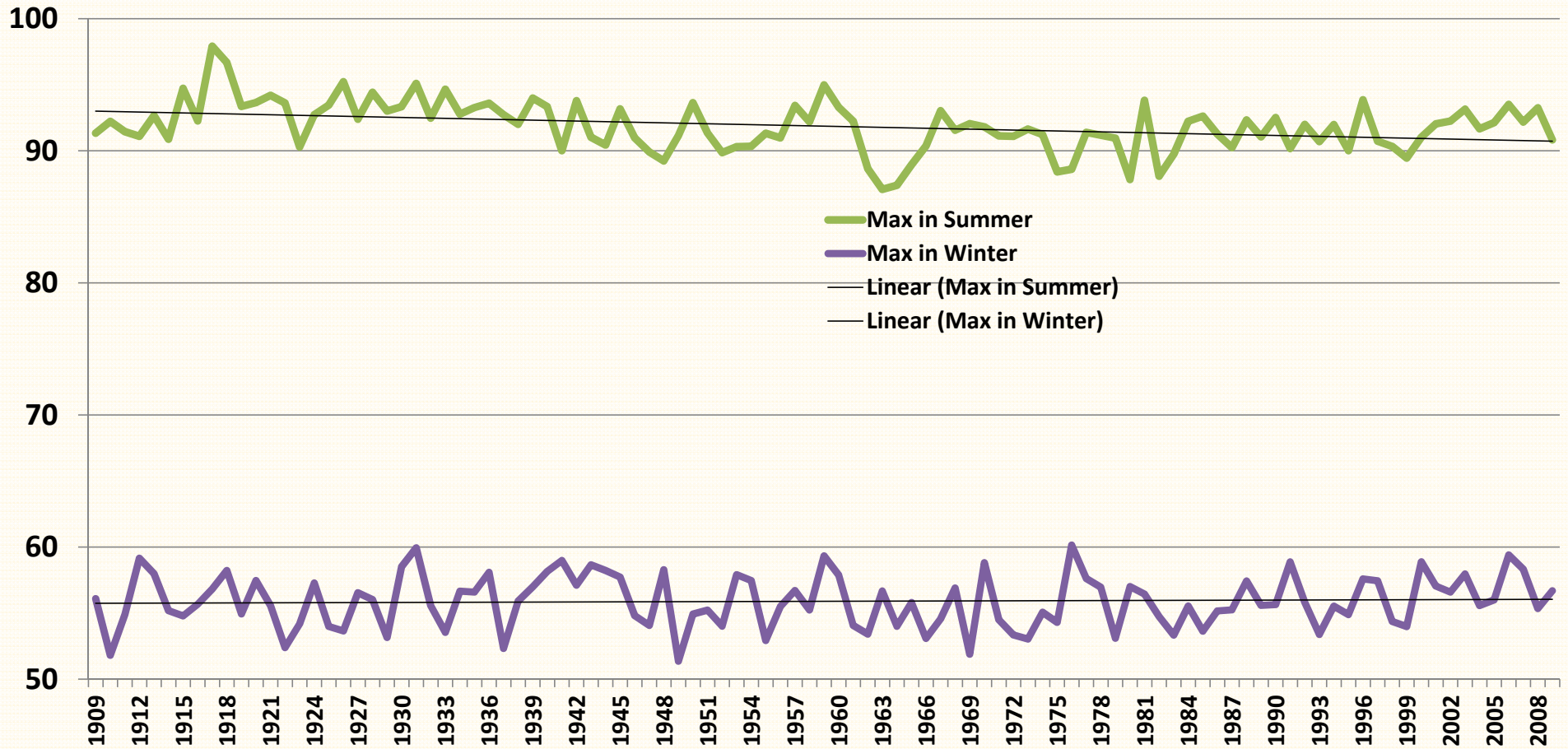


Source: US Dept. of Commerce

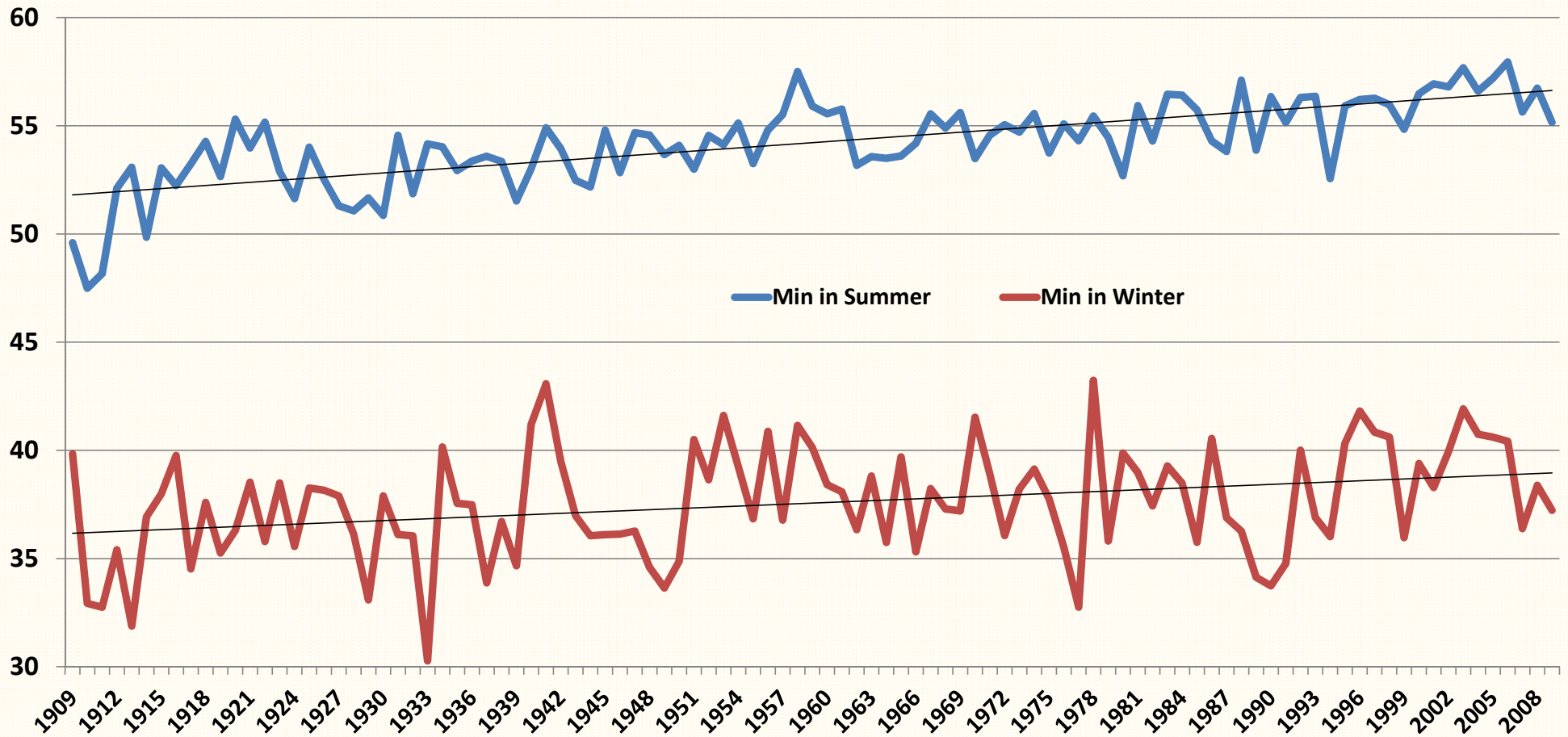
# Climate change and water in California agriculture

- **Climate has been changing systematically in regions important to California agriculture**
- **This interacts with drought and irrigation**
- **Probably not less precipitation, but likely less snow and earlier melt**
- **Water storage becomes more expensive**
- **Storage as groundwater seems crucial**

## Historical maximum average temperature in summer and winter months for the period of 1909-2008 for Davis, CA



## Historical minimum average temperature in summer and winter months for the period of 1909-2008 for Davis, CA





## **Global Water and Trade in Hay and Milk**

- **Hay moves to places with expensive land or expensive water East Asia and the Middle East**
- **Milk moves to the same places and to the rest of the US**
- **Trade adjustment has mitigated drought impacts**
- **Global market forces have been more important than drought in driving milk and hay prices**
- **California faces many restrictions to expand cows and costly water is only one of them**
- **Climate change may make costs elsewhere and for other crops rise even faster than here and create newly opened markets**
- **Intra-season water use, vulnerability of trees to availability flux, and long-term dynamics in global markets make the modeling interesting**

**Thank you**

