Corn and Sorghum as Forages: Water & N Implications

Nick Clark – University of CA Extension in Kings, Tulare, & Fresno Counties
Also sharing work by Bob Hutmacher, Jeff Dahlberg, and Till Angermann

2019 Western Alfalfa and Forage Symposium
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Presentation Outline

- Corn and sorghum as forages in CA
- N and H_2O use by corn and sorghum forages
- N and H_2O availability in CA for forage production
- Future Landscape

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Corn and Sorghum in CA

Importance for CA Dairy

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Acreage, Production, and Value: 2017

- **CORN:**
  - 345,000 acres (-16% 10 year avg)
  - 9.1 million tons
- **SORGHUM:**
  - 60,000 – 90,000 acres
  - yields range 8-25 Tons/acre
- **DAIRY ANIMALS:**
  - 1.7 M cows & 1.8 M replacements
  - 1,331 dairies
- **MILK:**
  - ~ 40 B lbs/yr
  - ~ $6.7 B/yr

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Corn and Sorghum N & H_2O Use

Results from CA Literature and Recent Research

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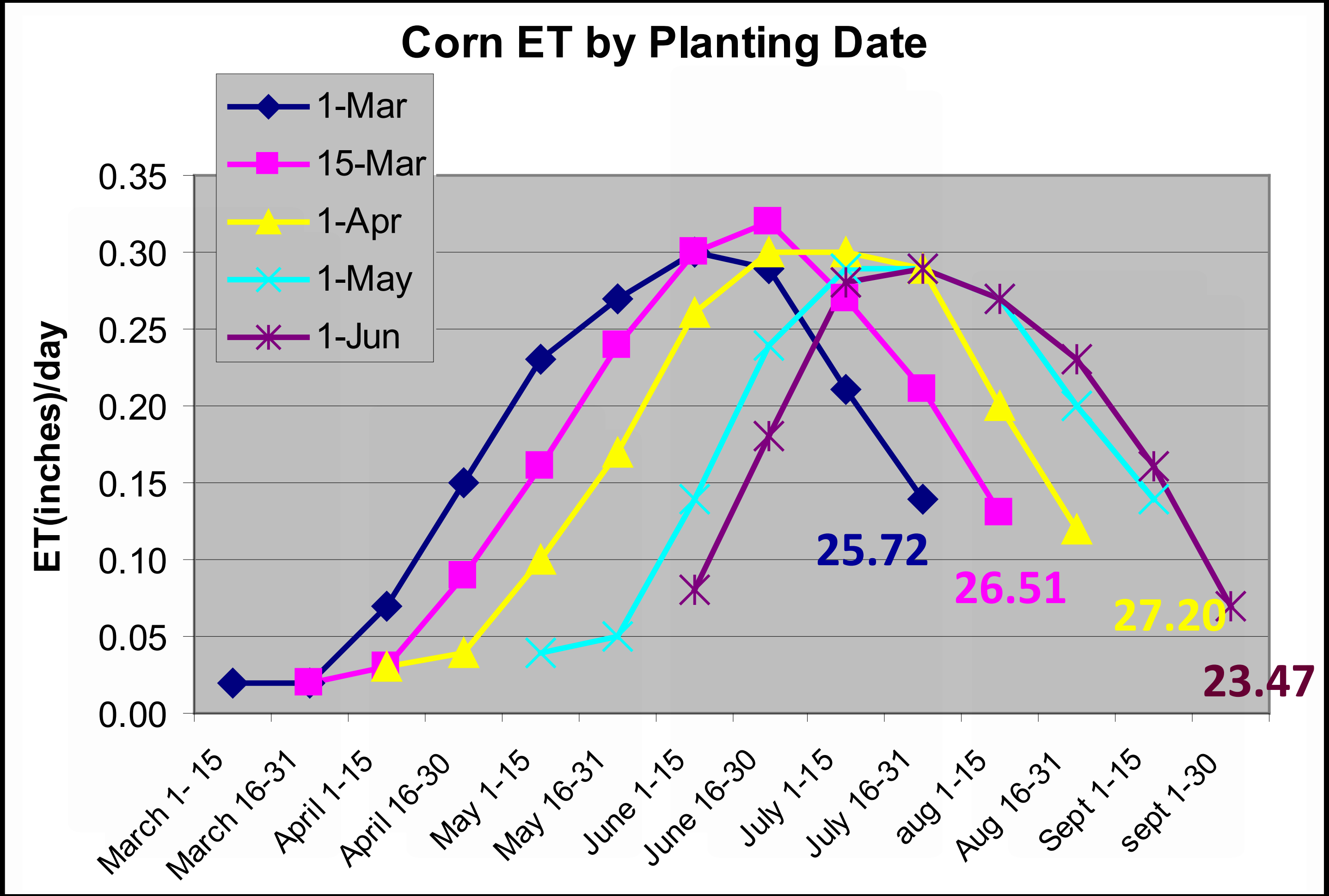
Crop N Harvested

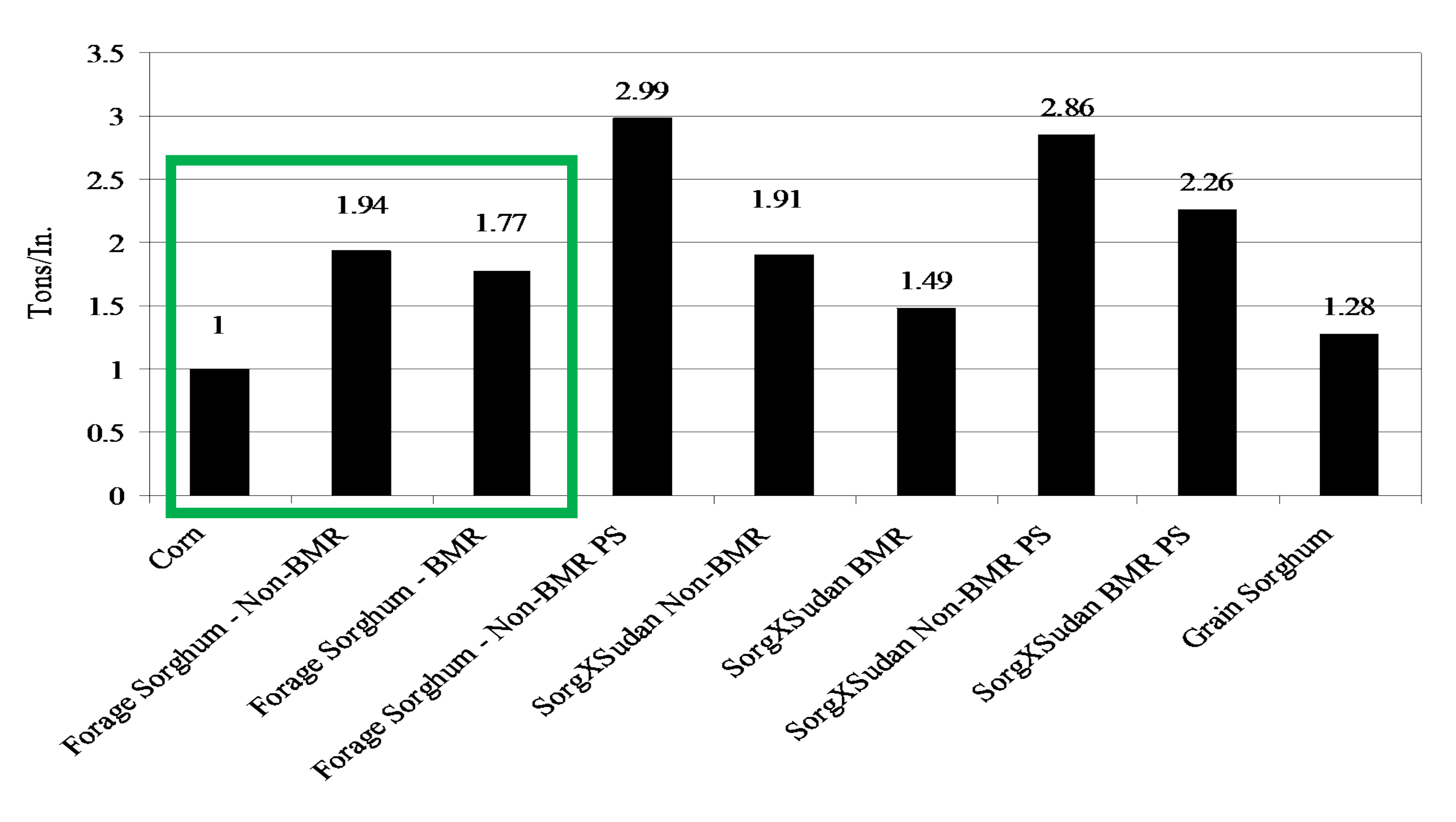
Crop	Lbs N / Ton crop	Authority
Corn	**8.3**	WFH 9th ed.
Sorghum	**10.4**	Heguy et al. (not published)
	7.3	Geisseler, 2016

Corn Evapotranspiration



Schwankle

Comparing Corn and Sorghum WUE



Dahlberg

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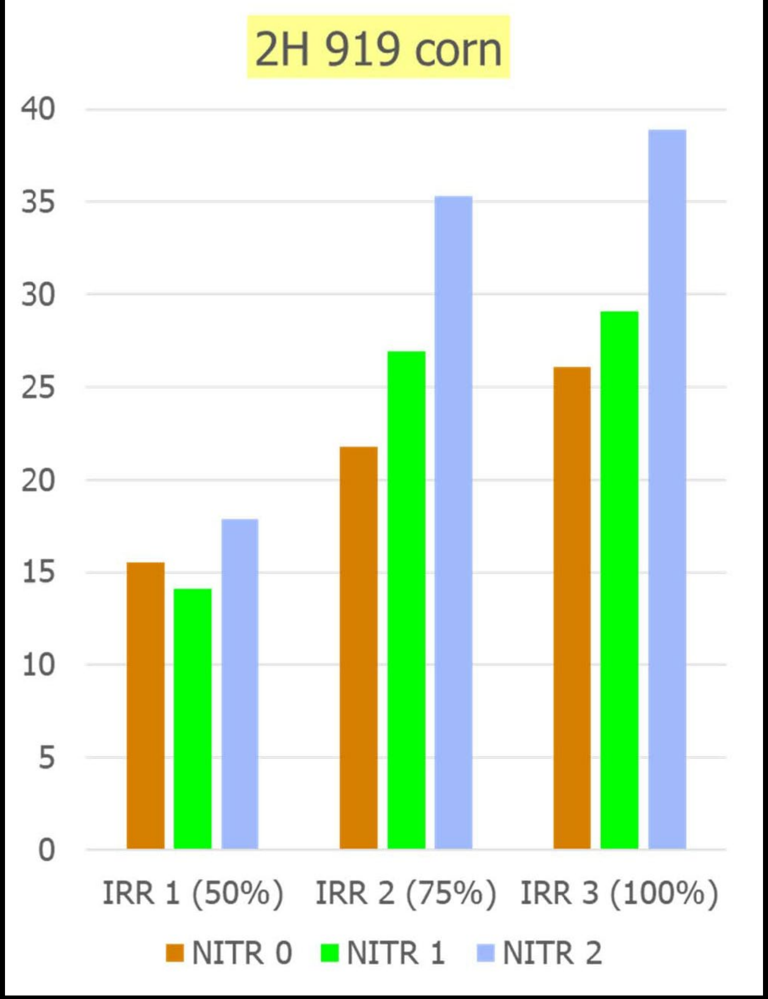
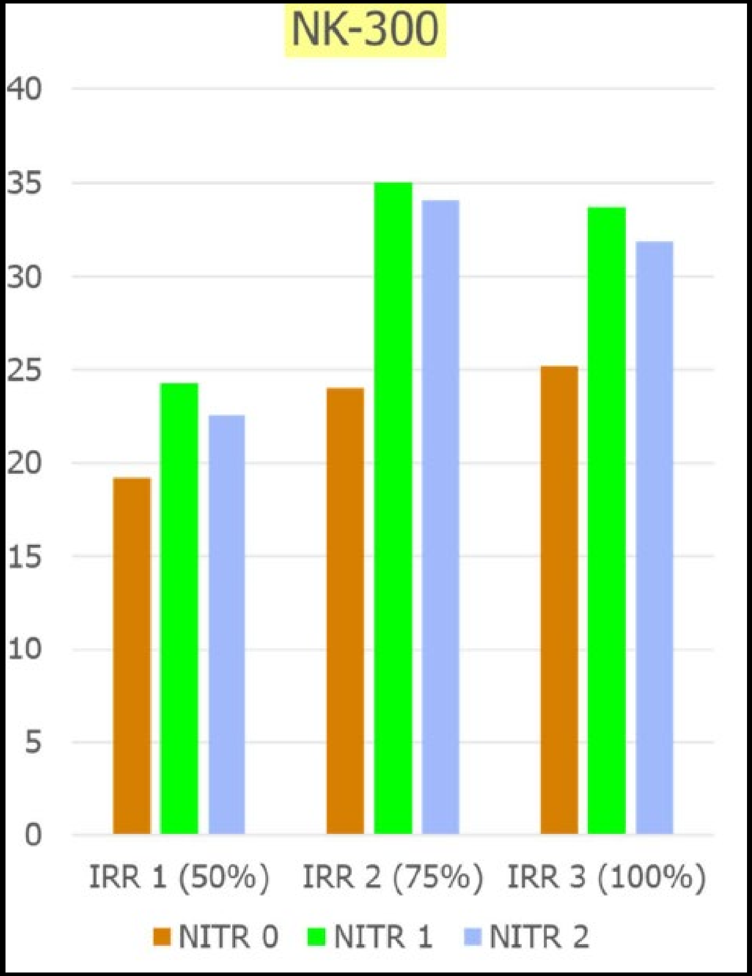
Long-Season Corn & Dual Purpose Sorghum





Hutmacher, Dahlberg, Clark

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Water and Nitrogen in CA

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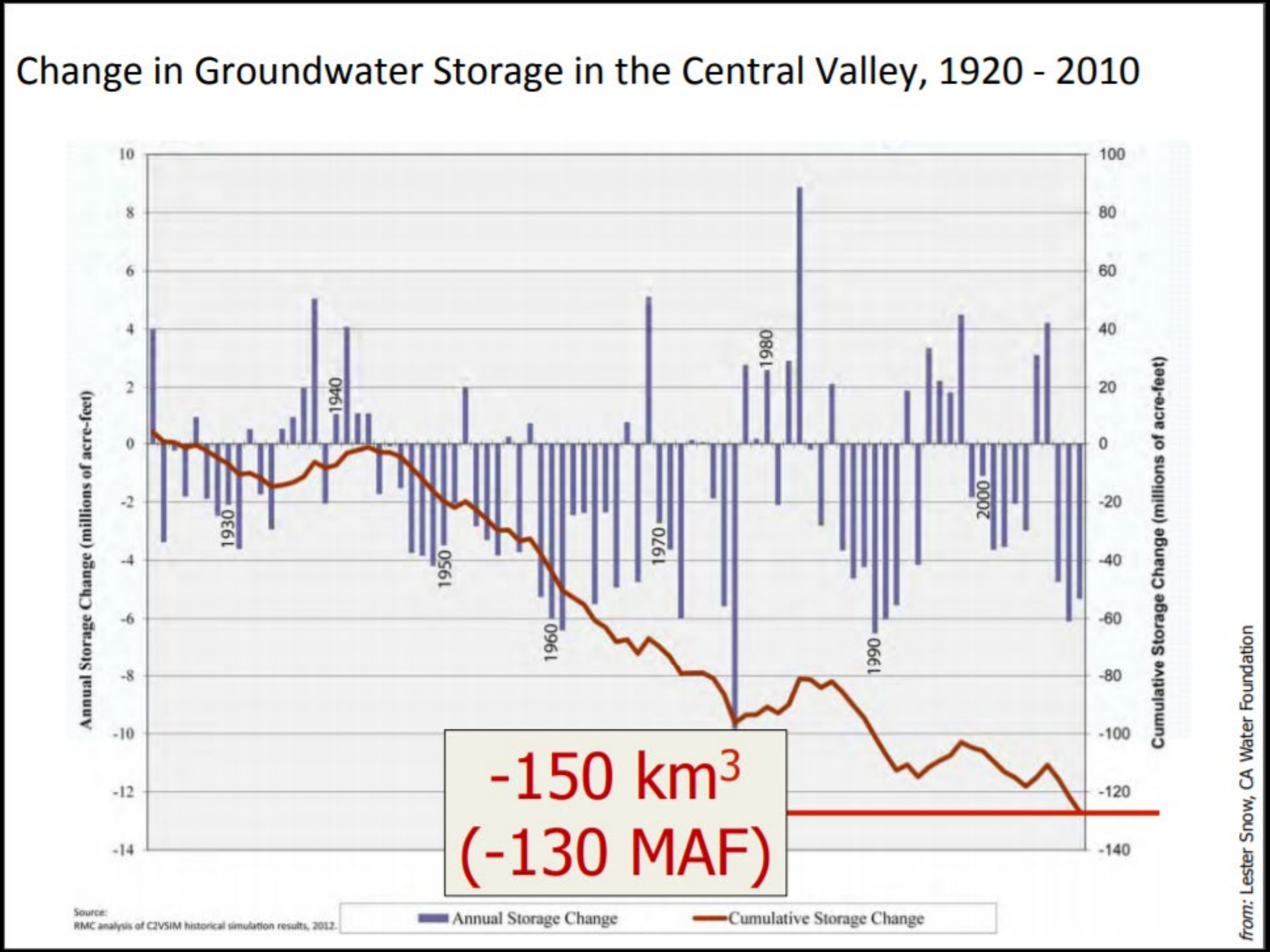
CA Change in GW Storage – 90 years



Presented in Harter, 2015. *CA Agricultural Regions Gear up to Actively Manage Groundwater Use and Protection*. 2015 Western Alfalfa & Forage Symposium, Reno, NV.

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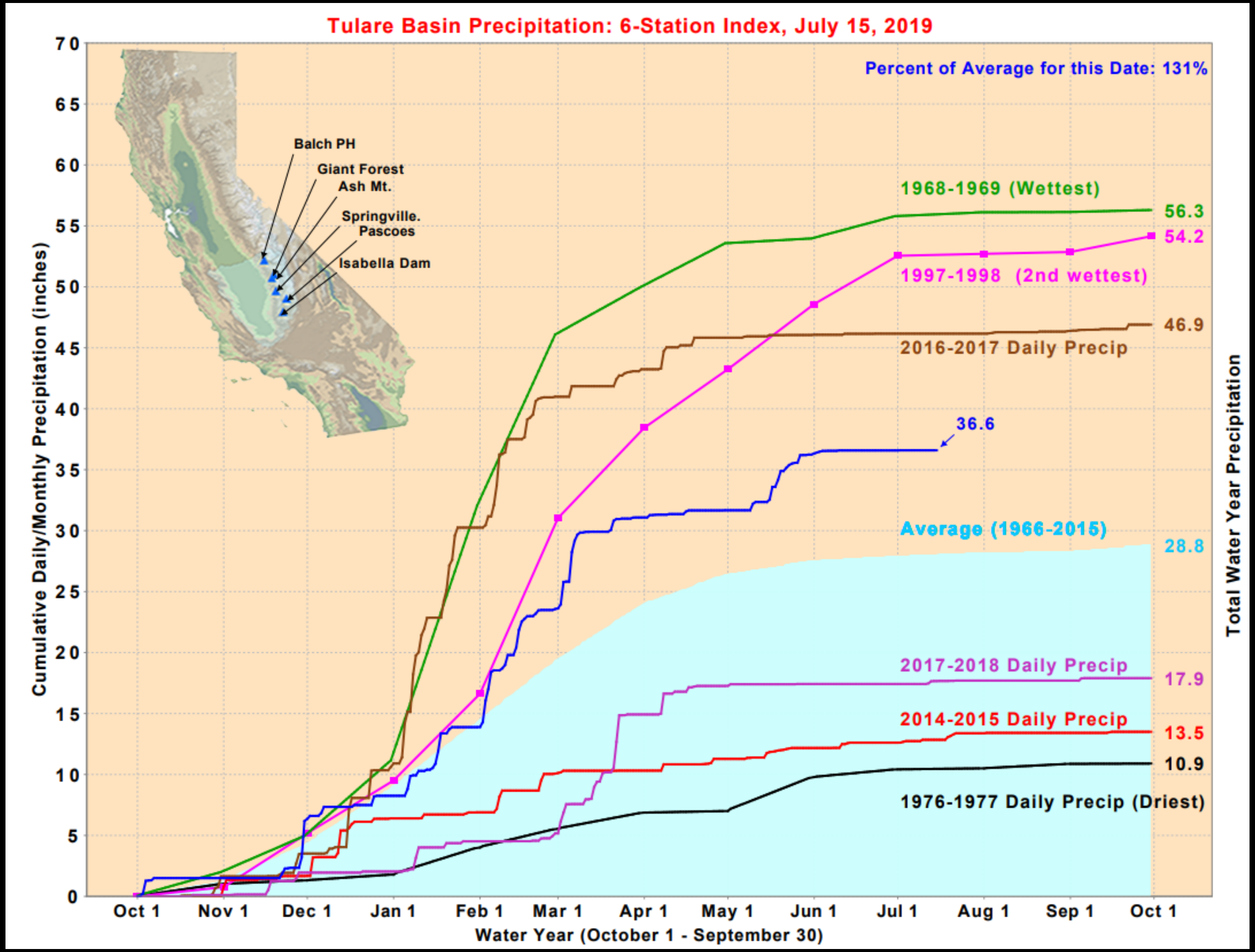
SGMA – Critical Overdraft

Continued "water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts."

AKA: No business as usual allowed

S. Central Valley (Tulare Lake Basin) Precipitation



- 28.8" annual "average"
- 45.7" range

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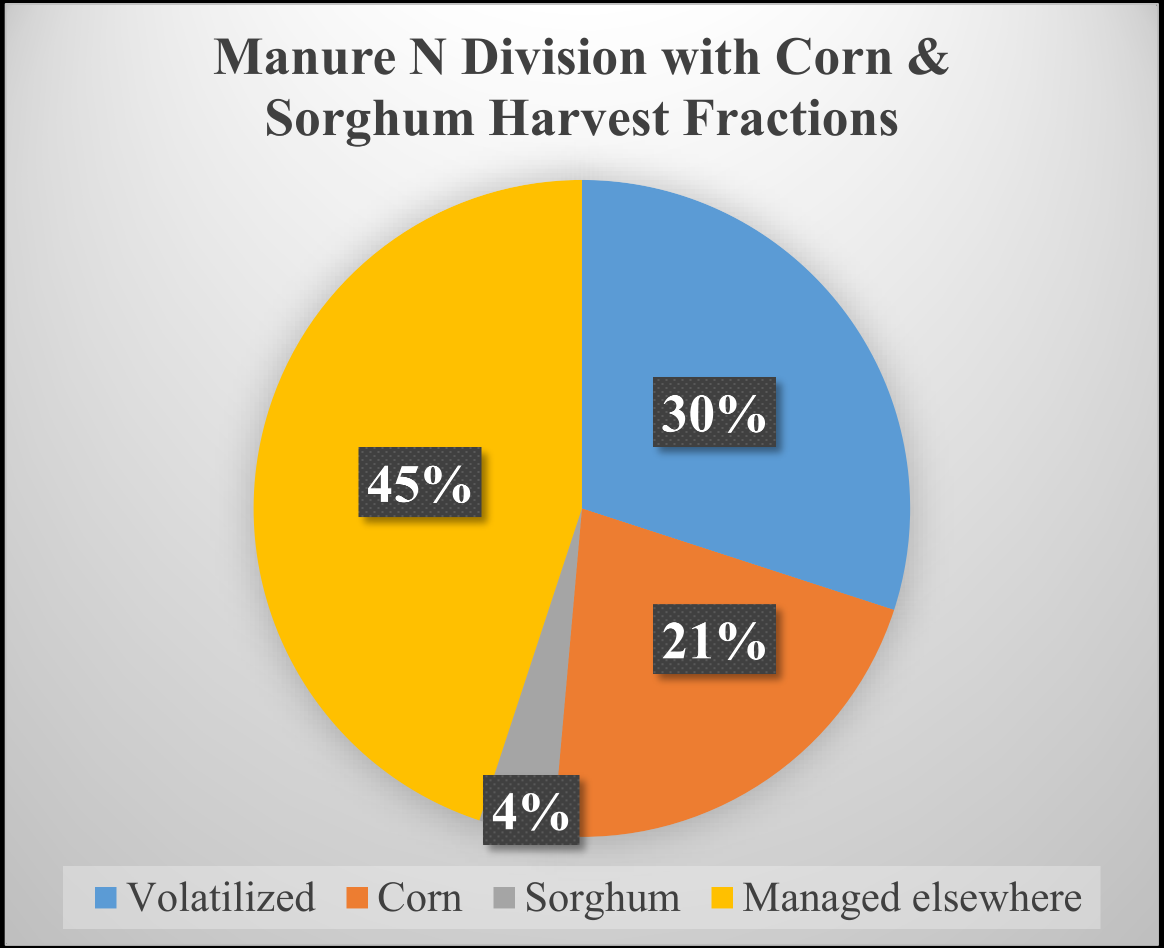
N (and P & K) from Manure Only

Element	Tons excreted/year
N	170,000
P	27,000
K	64,000
Estimated using CDFA production stats and ASABE manure nutrient excretion standards	

Corn and Sorghum Harvest of Manure N

- **170,000** tons N/year excreted
- 30% volatilized (**51,000** tons N/year)
- **119,000** tons N/year remain to be managed
- **36,400** tons N/year harvested in corn
- **6,200** tons N/year harvested in sorghum
- **119,000 – (36,400 + 6,200) = 76,400** tons N/year to be utilized elsewhere



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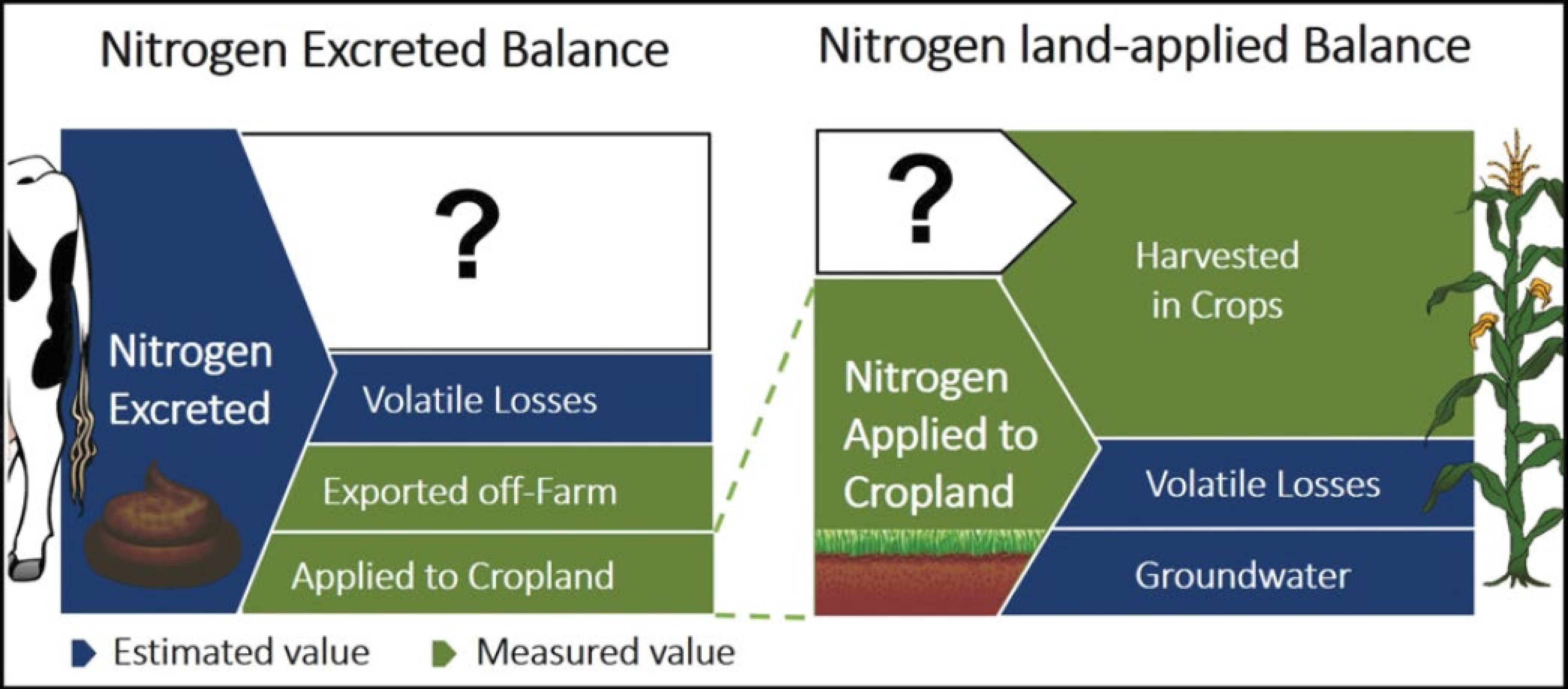
Mass Balance Inconsistencies



Christine M.F. Miller, Patricia L. Price, Deanne Meyer

Science of the Total Environment 579 (2017) 37–46

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Moving Forward

Some Recommendations by CVDRMP to CV-RWQCB

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CVDRMP Recommendations & Meaning

Recommendations	Probable Change
Focus on whole-farm N balance	Identify generated manure N that cannot be used efficiently by crops.
Improve industry NUE	Increase precision of N application regarding crop demand.
Increase manure N exports	Build industry capacity and market demand for manure. Remove manure that cannot be agronomically applied
Better technical recommendations	Modify specific monitoring, reporting, and N management practices on dairy and associated cropland.
Increased education	Require education to support dairy operators' and farmers' practice of the above recommendations.
New role of CVDRMP	CVDRMP would additionally act as a 3rd party coalition for members.
Changes to Dairy Order	Create revised, parallel General Orders for individual & "Coalition" dairies to reflect recommended changes above.

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Take Away

- Dairy is driving corn and sorghum production in CA
- Water for forage production is predicted to be limited
- Manure nutrients are already in excess of what can be agronomically applied
- Regulatory and producer recommendations are insinuating more innovations & restrictions on manure nutrient applications

Thanks

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