Regional & Future Climate Considerations for Pistachio Production

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UCCE Sacramento, Solano & Yolo Counties

UC Pistachio Day, 2024

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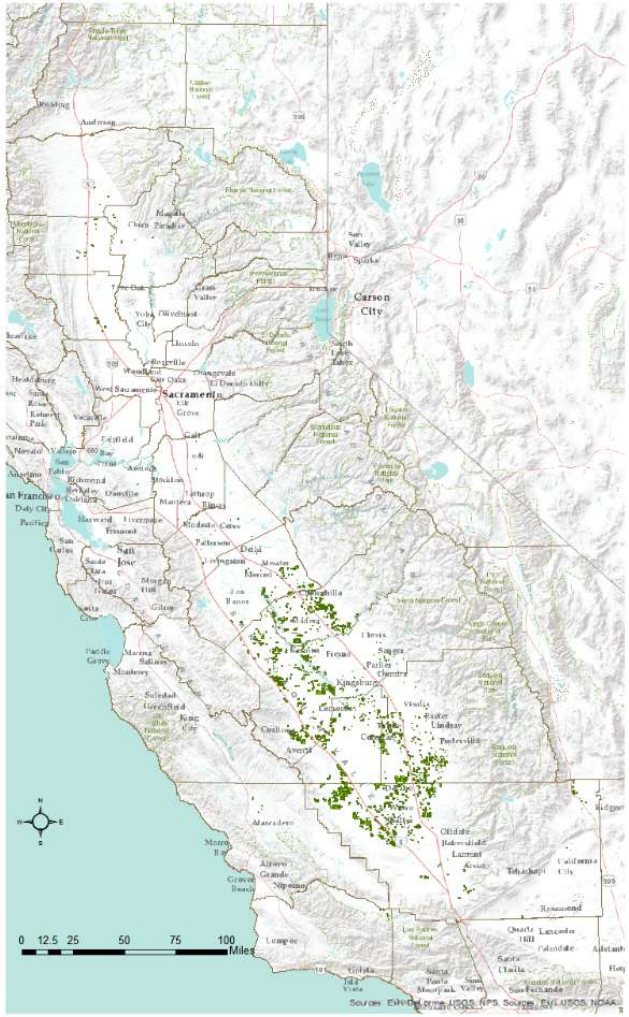
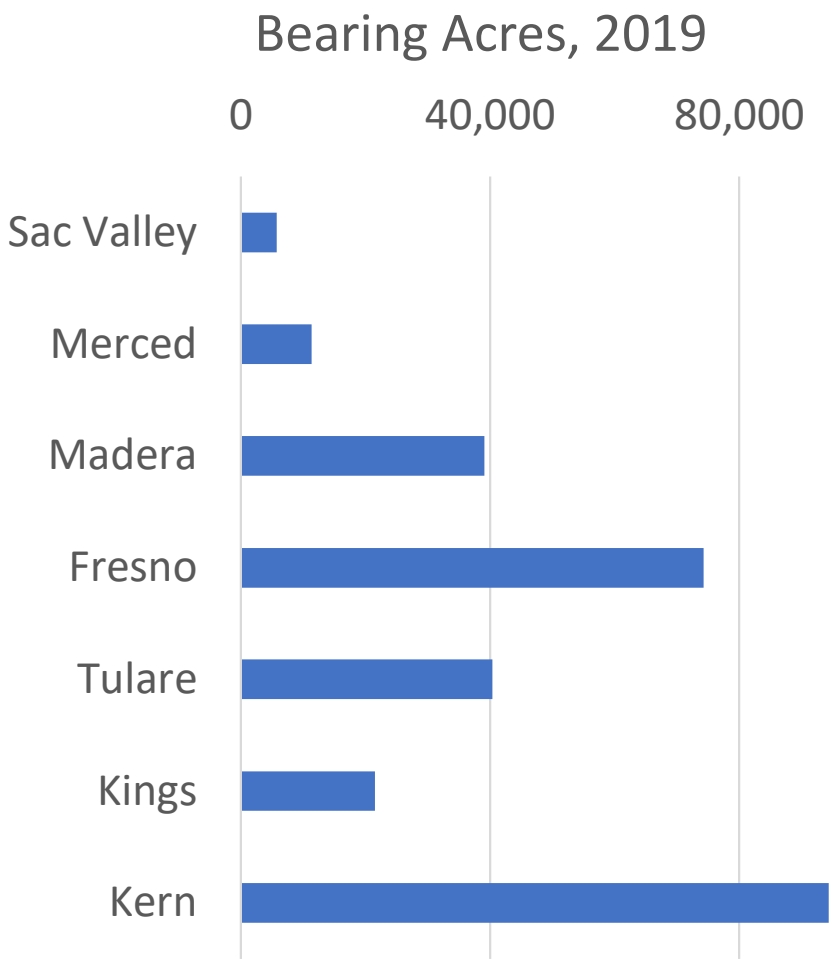
- Current Production Areas
- Annual Climatic Considerations
- Orchard Lifetime Consideration
- Future Climate Considerations

Current Pistachio Geography





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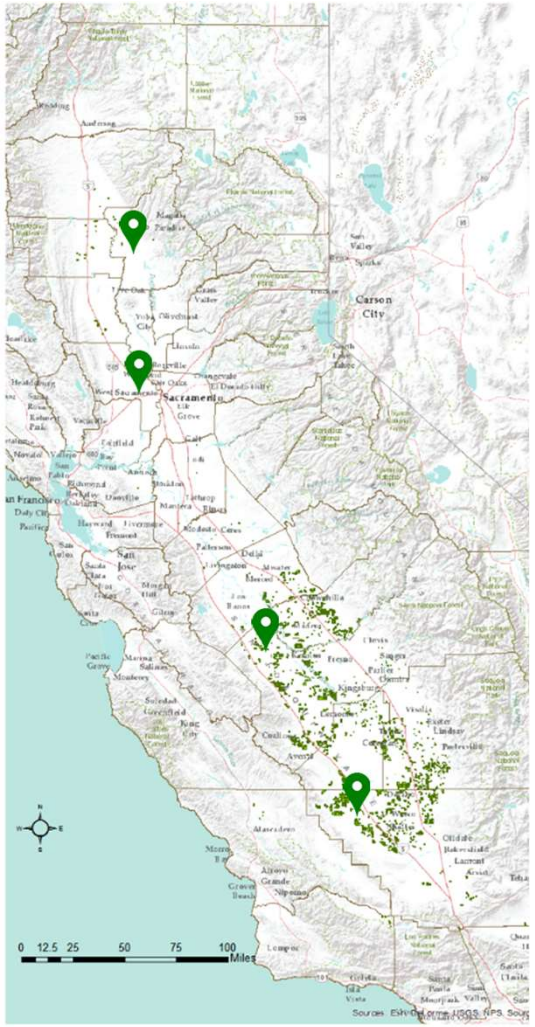
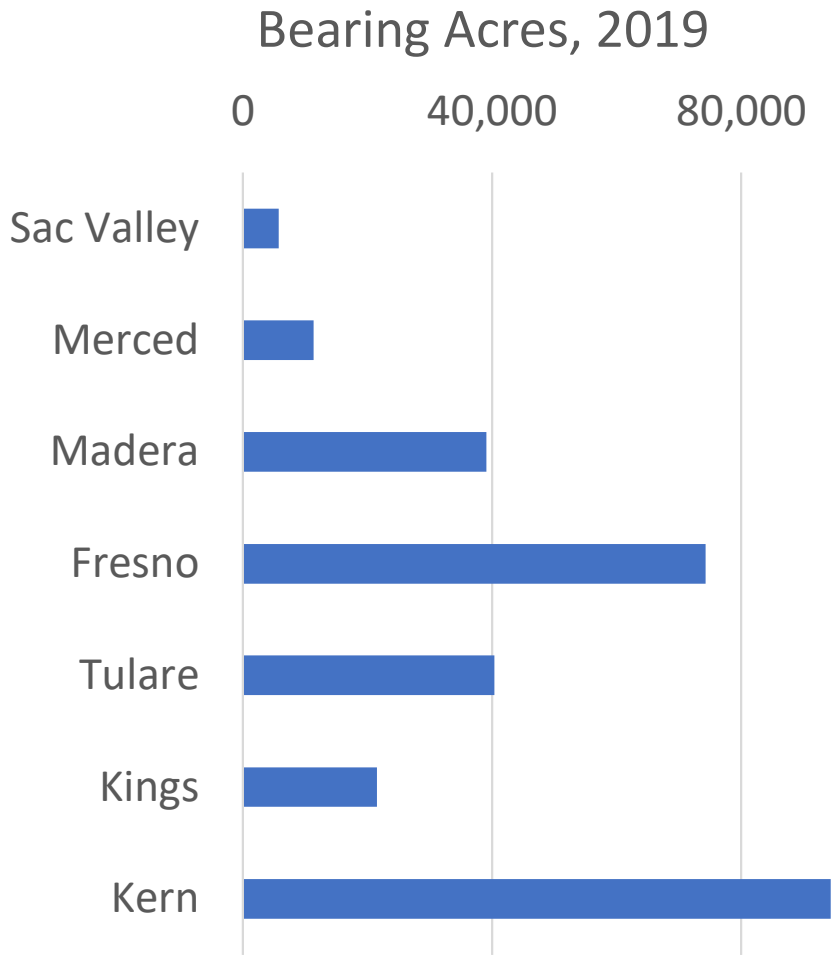
Data & Image: Admin Committee For Pistachios

Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar

Photos: Jarvis-Shean, Ferguson, UC IPM

Current Pistachio Geography





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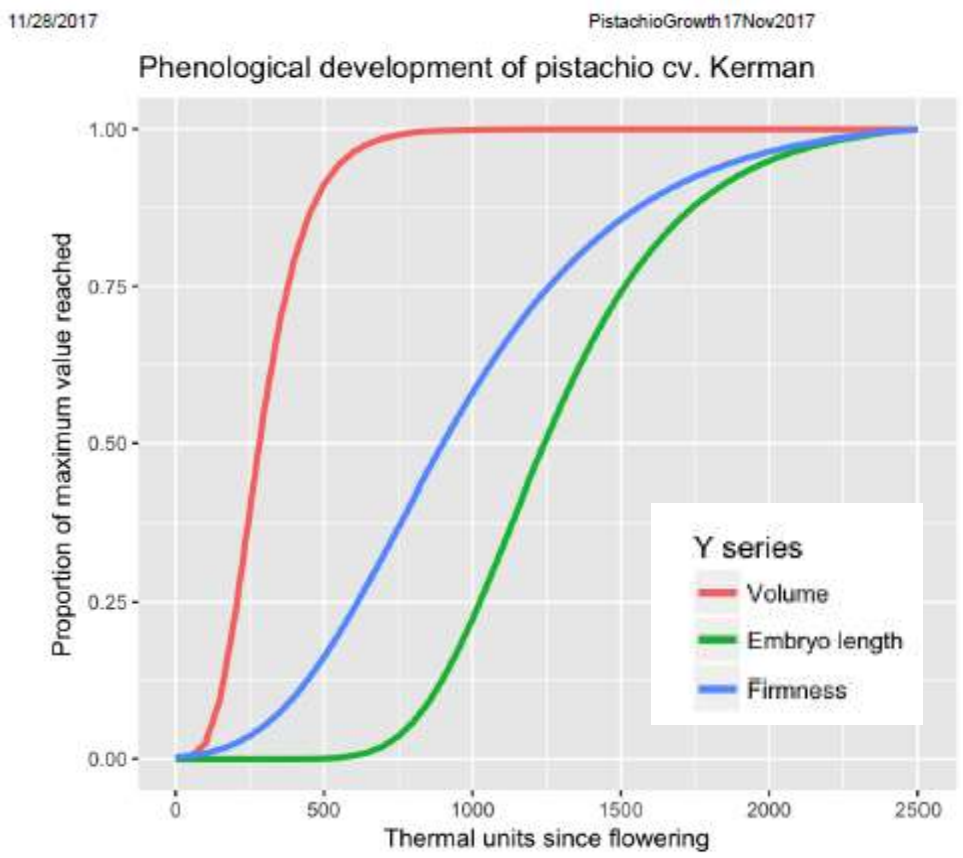
Data & Image: Admin Committee For Pistachios

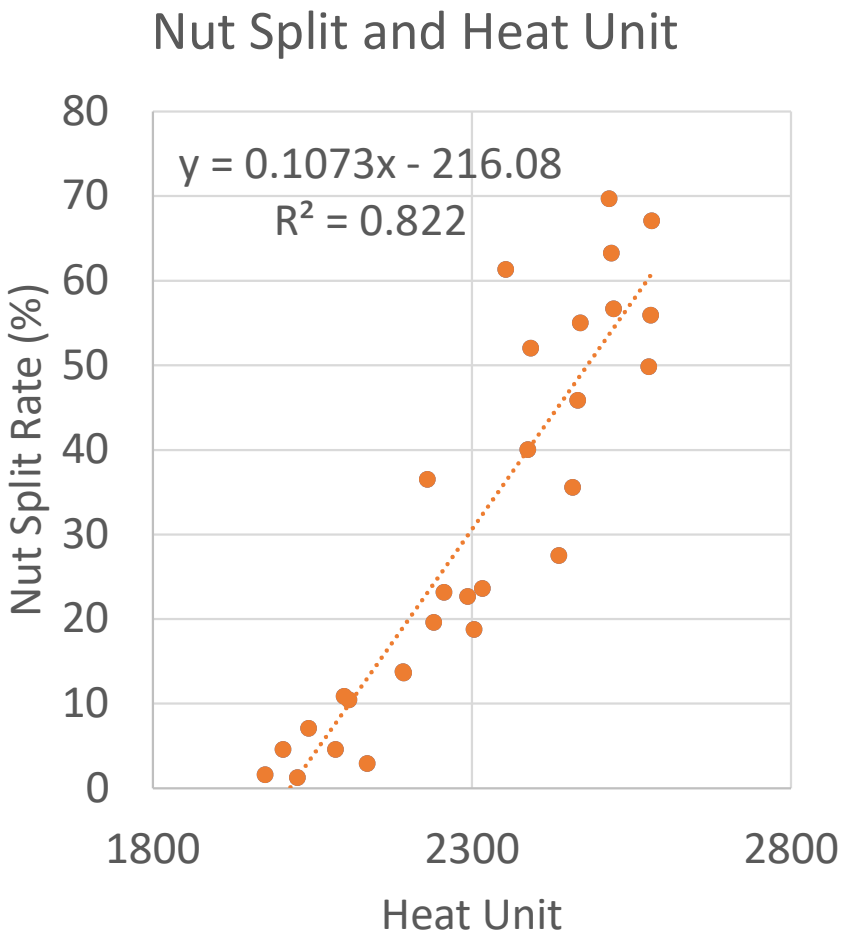
Climate: In-Season Rains

	April	May	June	July	Aug	Sept
Durham	1.5	1.1	0.3	0.0	0.0	0.1
Davis	1.2	0.5	0.1	0.0	0.1	0.1
Firebaugh	0.7	0.4	0.1	0.0	0.0	0.1
Belridge	0.6	0.3	0.0	0.1	0.0	0.0

CIMIS, 2000-2019

Climate: In-Season Heat





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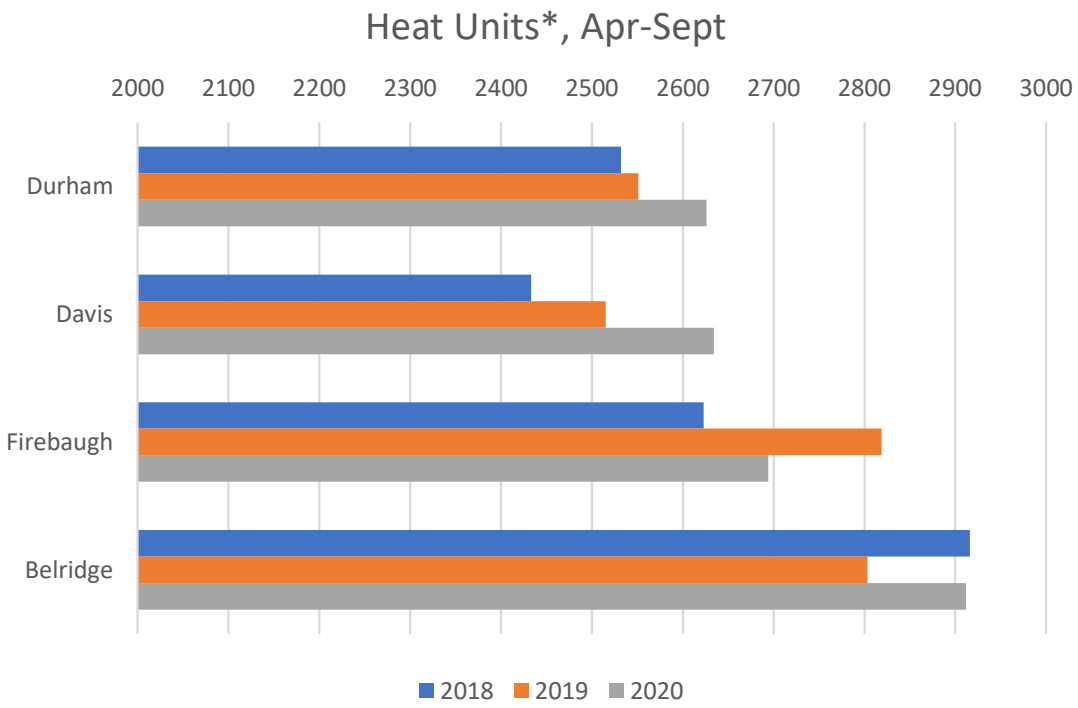
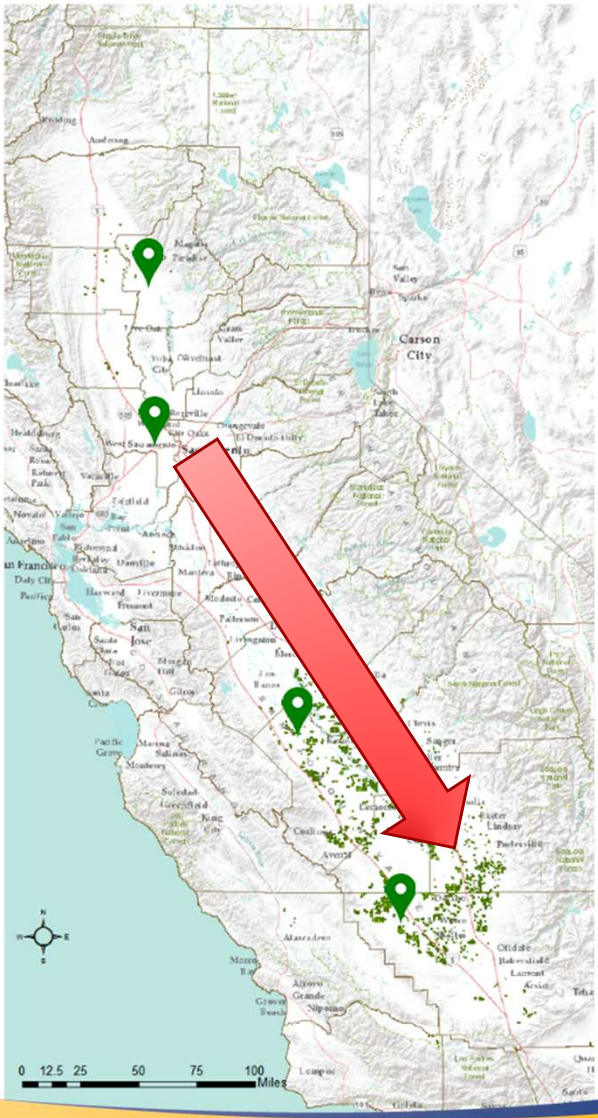
Figures: Louise Ferguson, UC Davis

Climate: Heat Units

- Nut Maturation
  - Delayed Development, Poor Split %
  - ~2400 HU maximum kernel weight
  - Above 2000 HU, 100 HU=1% splits





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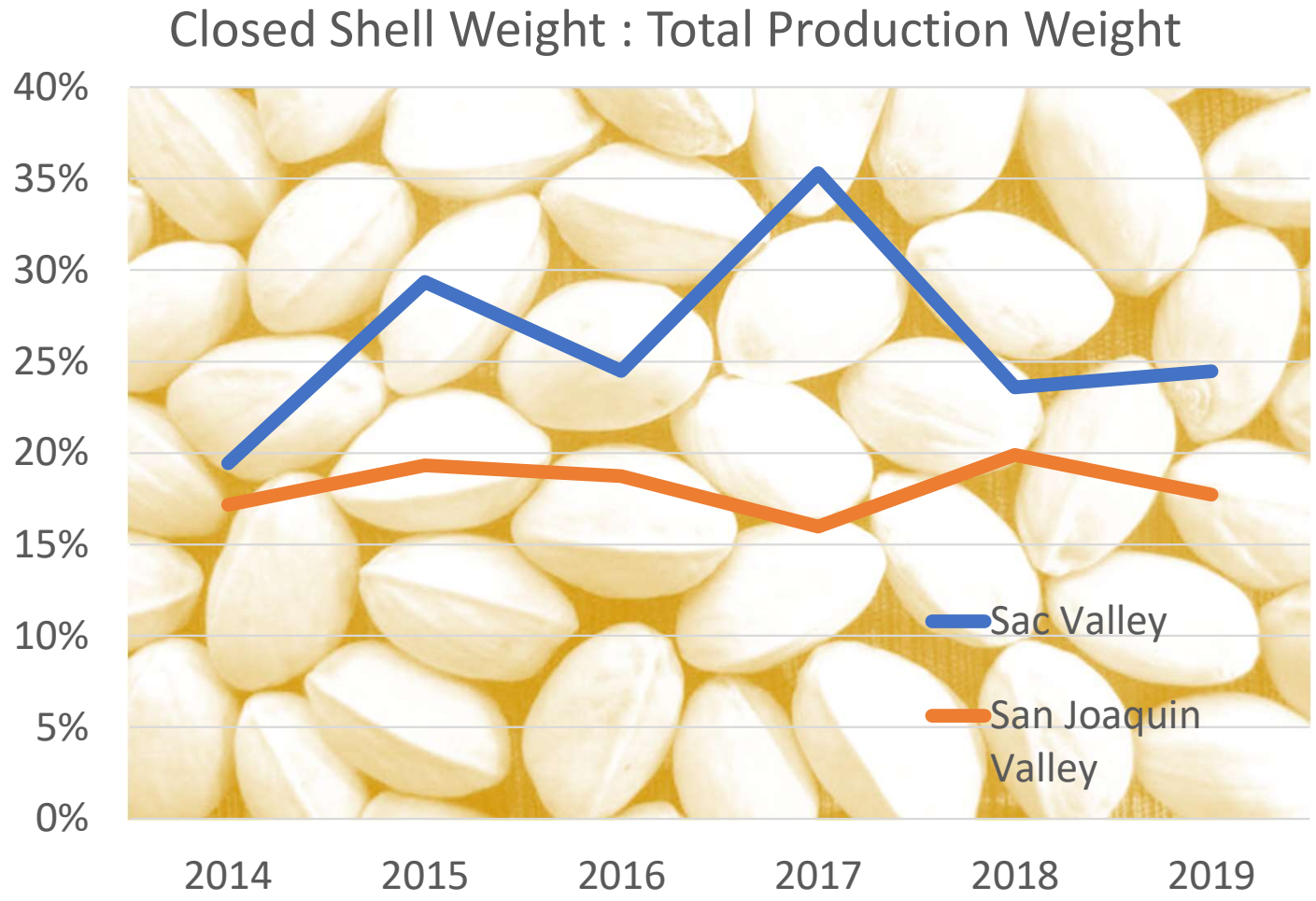
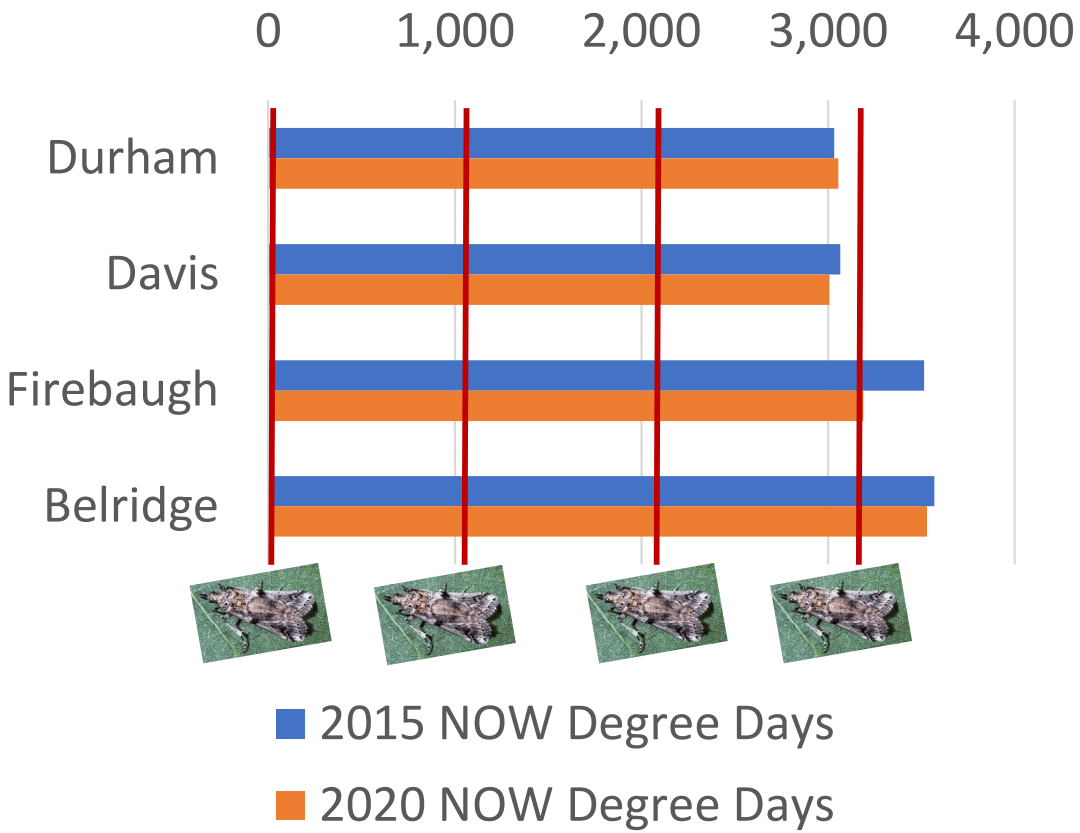
*Heat Unit= Avg daily temp – 7°C

Climate: In-Season Heat



Climate: Navel Orangeworm & Heat

- Earlier Biofix, More Generations
- Ease of Sanitation



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March 15th – Sept 30th DD accumulation

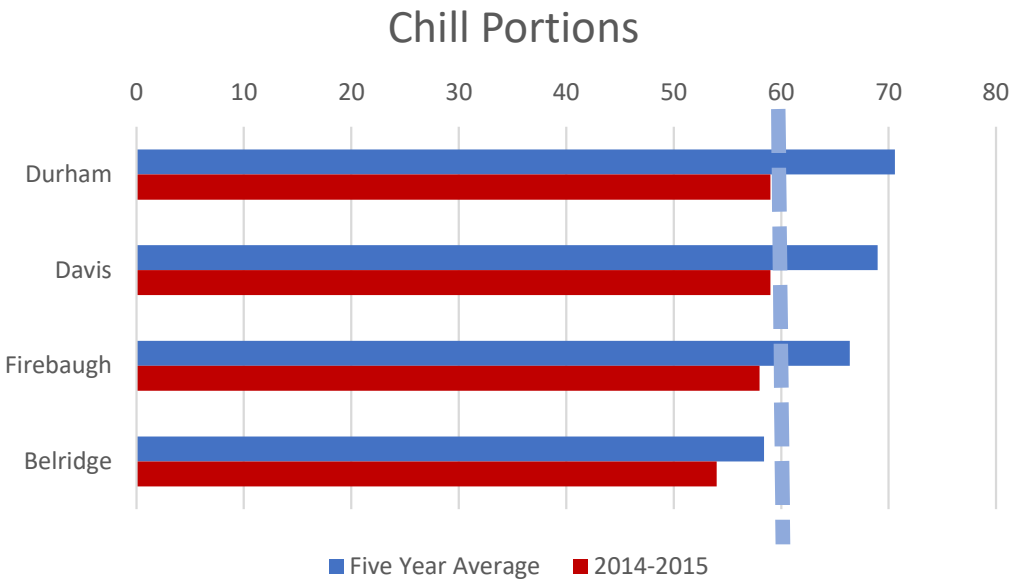
Climate: Winter Chill

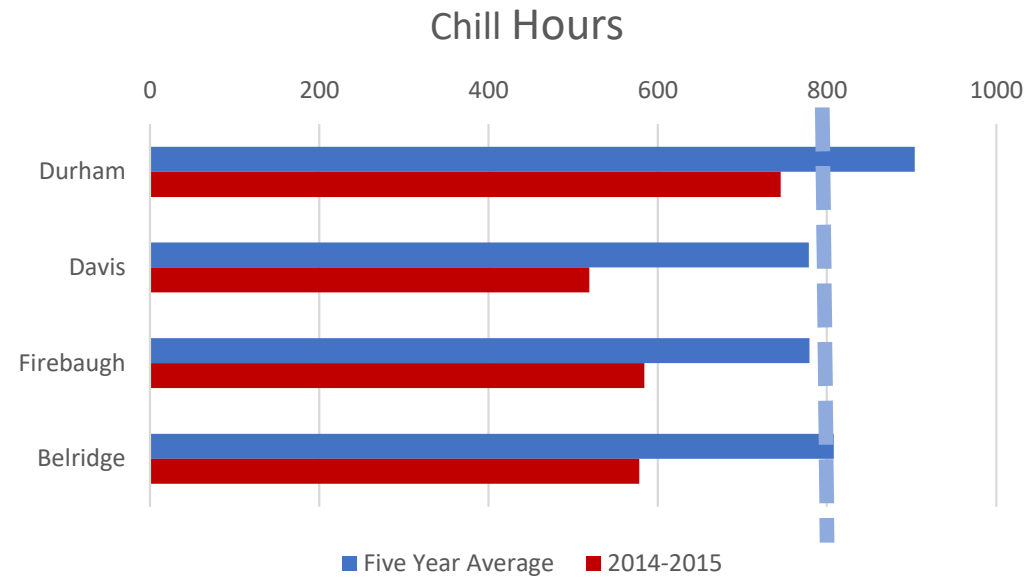
- Impacts of Chill
  - Delayed bloom
  - Poor male overlap, increased blanks
  - Multiple shakes

Scattered ‘Kerman’ bloom observed in 2014

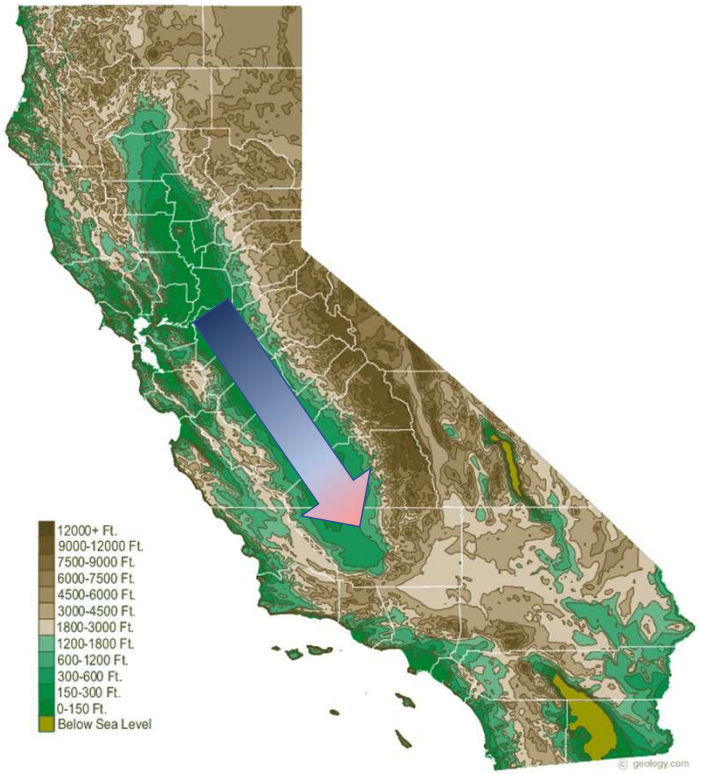
Photo: D. Doll

Climate: Chill Accumulation





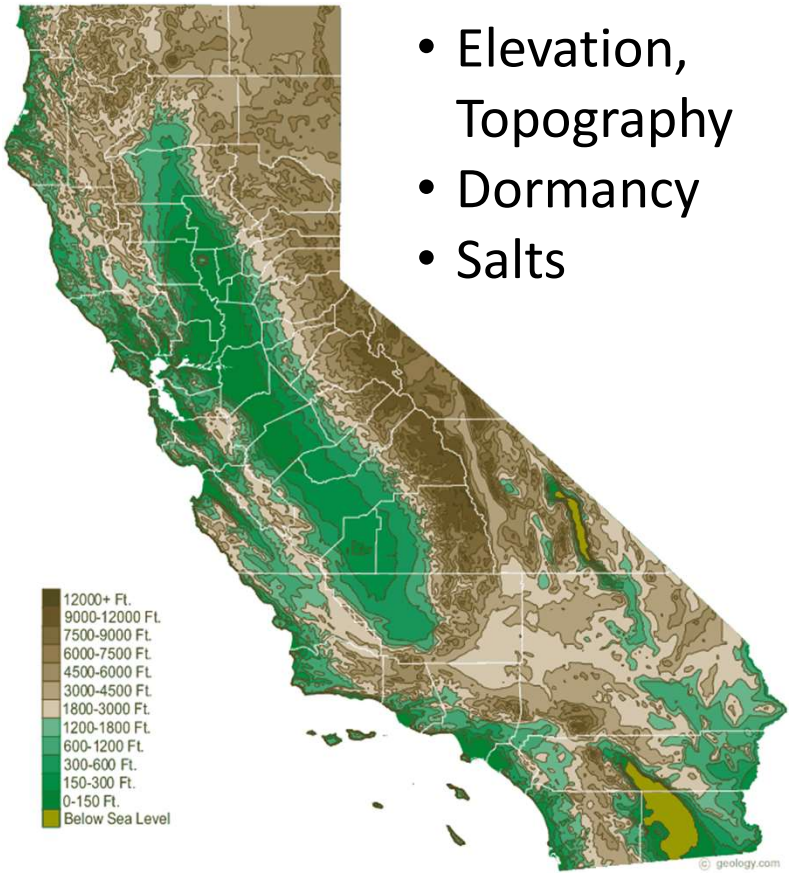
- Cultivar important, esp. males
- Fog helps chill



UC Davis Fruit & Nut Center

Climate: Freeze

Winter Juvenile Tree Dieback



- Elevation, Topography
- Dormancy
- Salts

Photo: C. Kallsen

- Current Production Areas
- Annual Climatic Considerations
- **Orchard Lifetime Consideration**
- Future Climate Considerations

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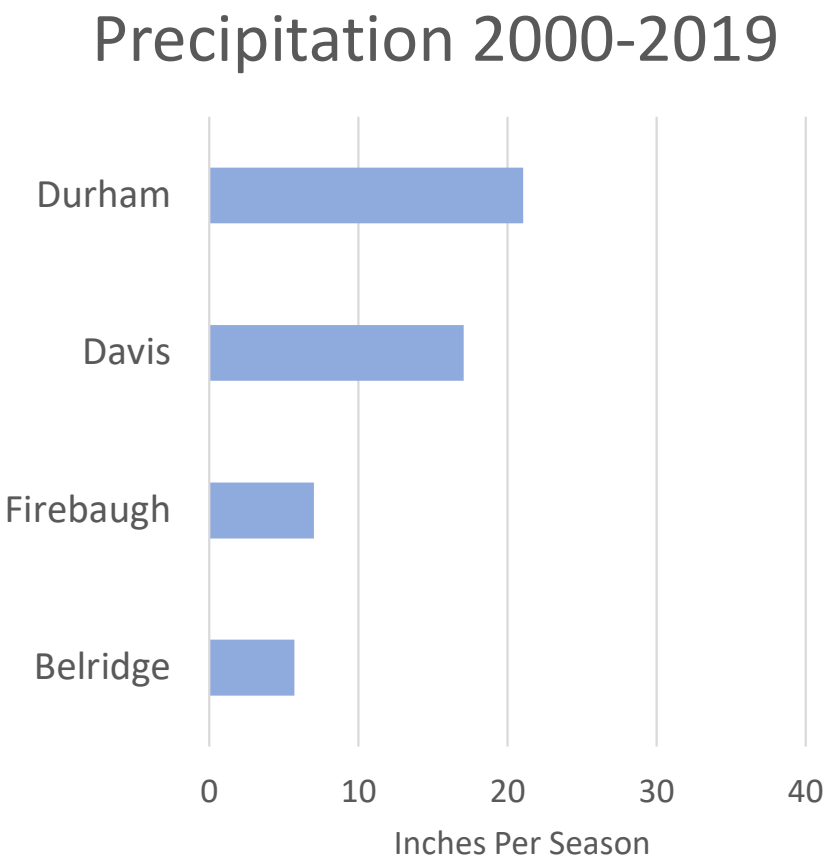
Water Quantity and Quality

- Varies across the state
  - 42” of water use for maximum production
  - Can get by on less, but affects yield
  - May need more if poor quality
- Source Issues
  - Groundwater
  - Surface Water

Water Quantity



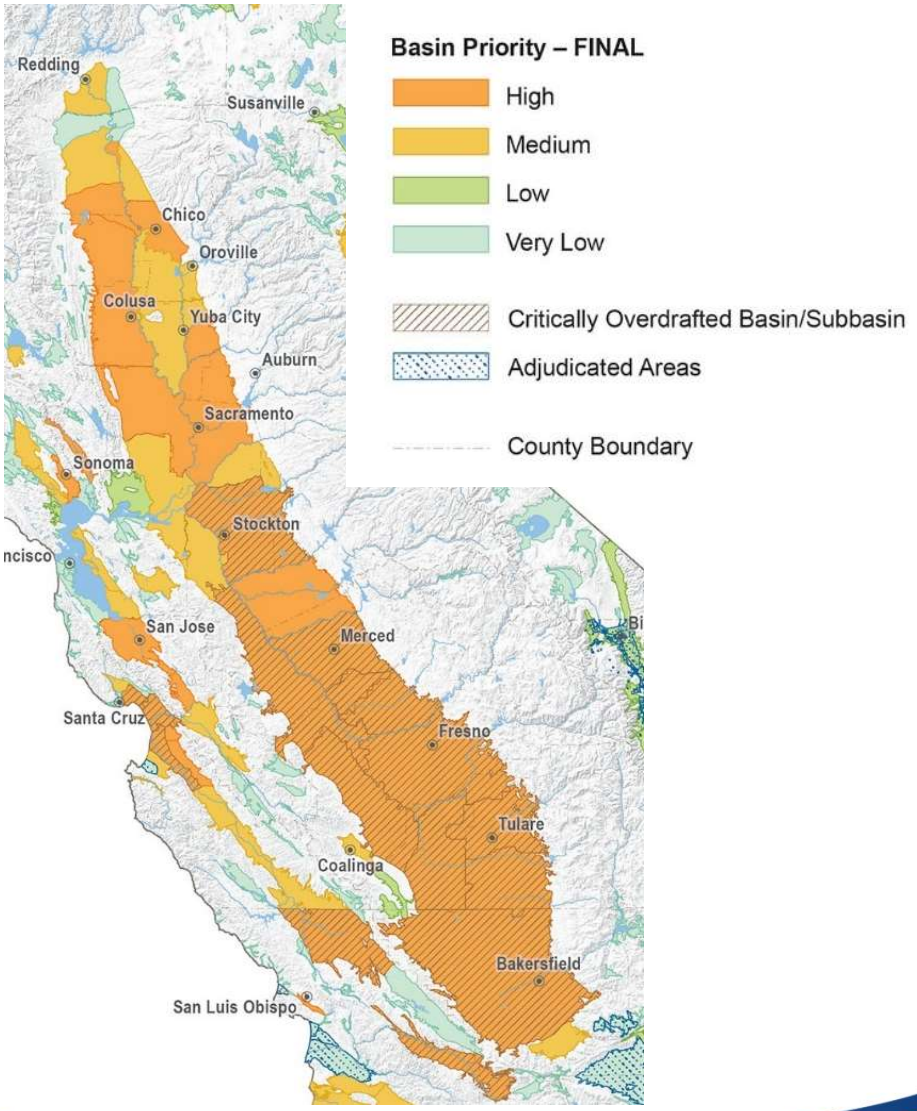


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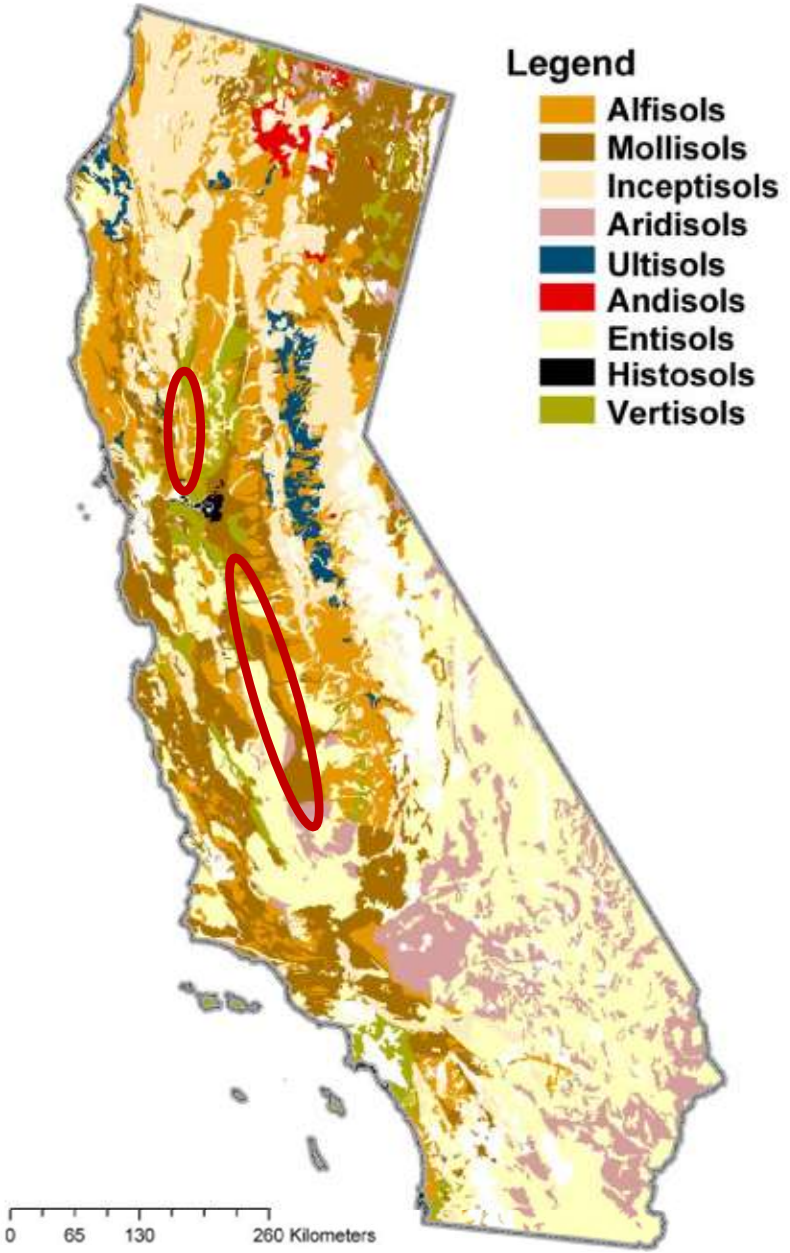
Image: CA Dept Water Resources

Soil Quality

- Saturated or easily saturated soils
  - River bottoms
  - High water table (quality and quantity)
- Saline, Alkaline soils
  - Toxicity of sodium, chloride, and boron



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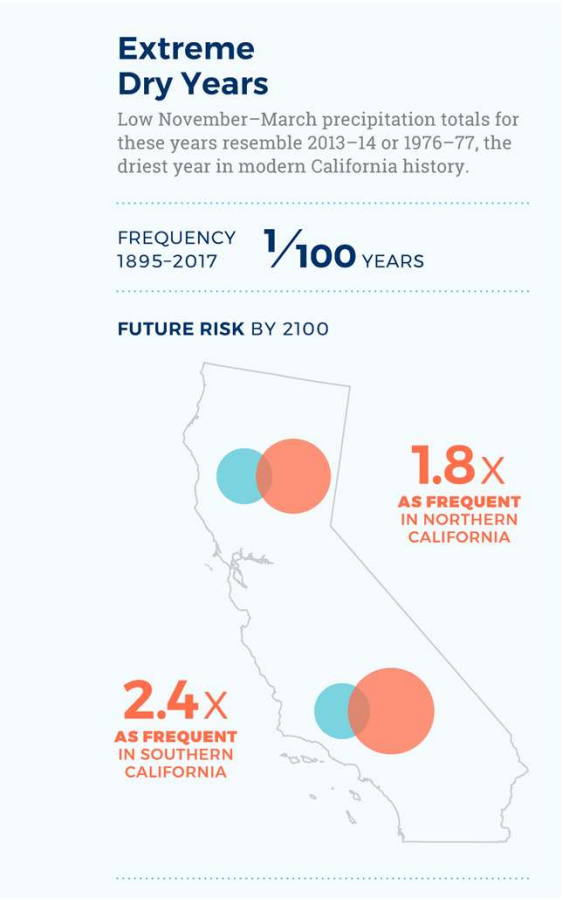
Changing Conditions?

Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar

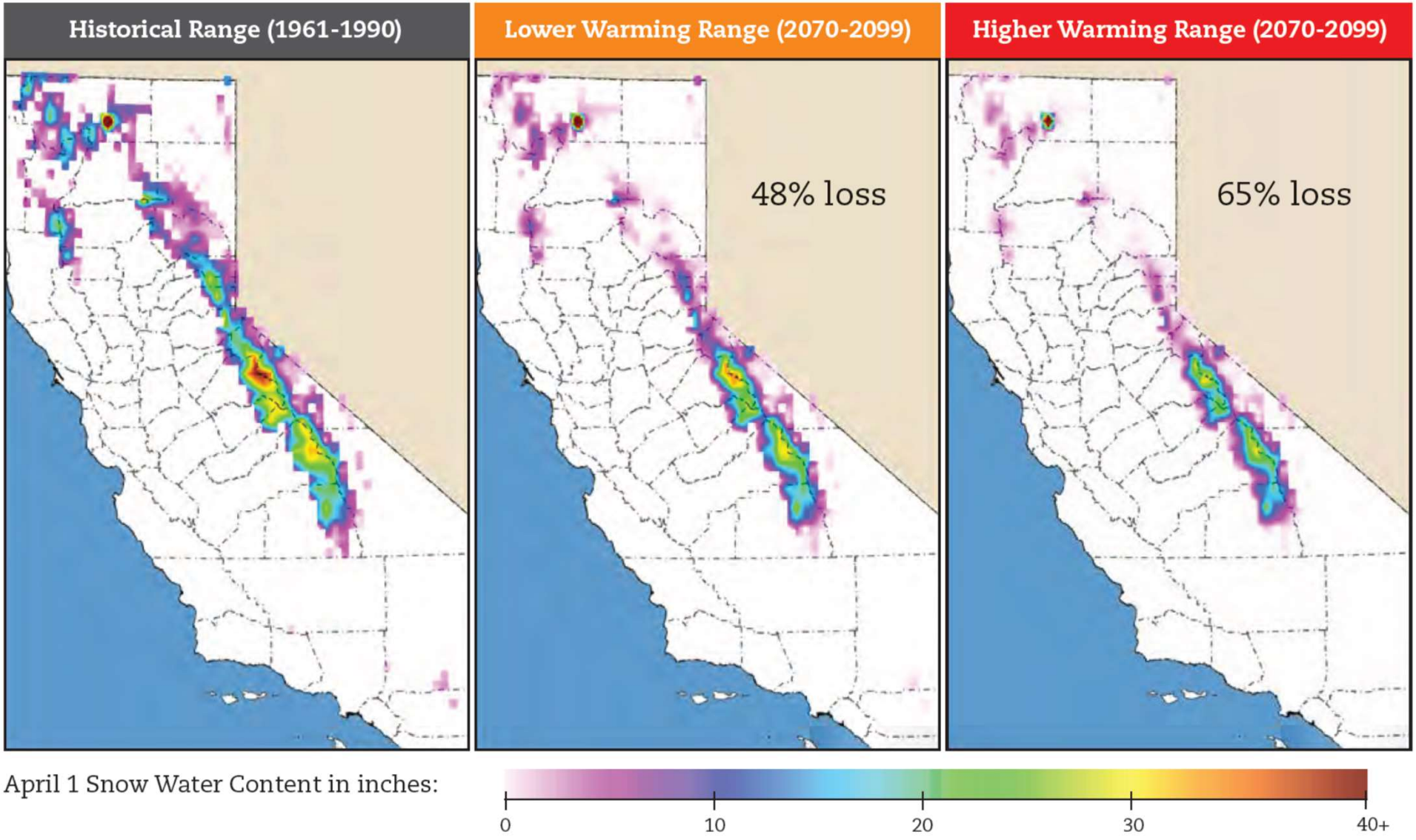
Photos: Jarvis-Shean, Ferguson, UC IPM

Changing Precipitation



Prepared for both feast & famine, water-wise. Drought resilient & resilient to saturated soils.

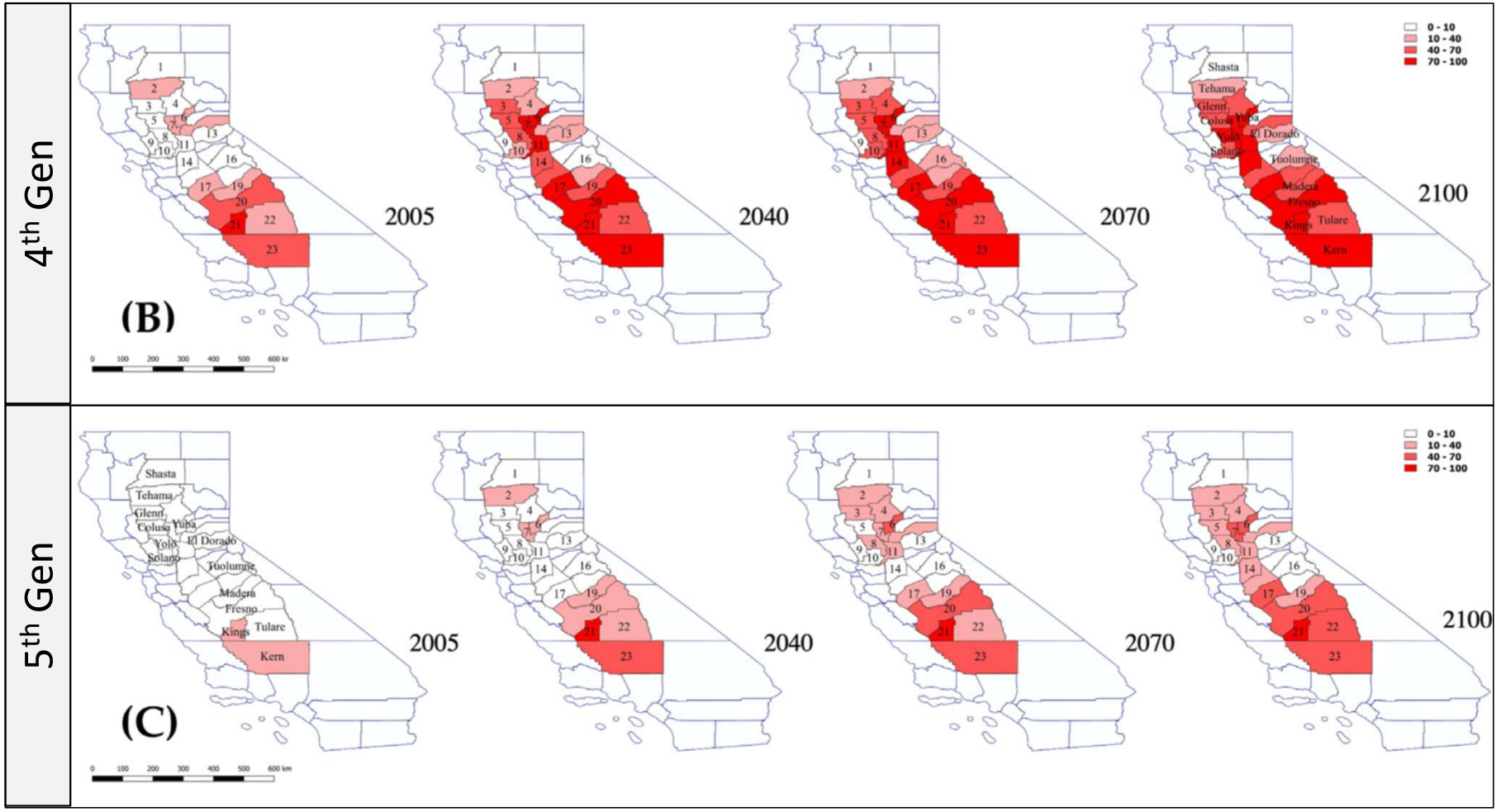
Increase Temps → Decrease Snowpack



Crop, soil management, irrigation & water infrastructure for water stress resilience.

DWR 2015

↑ Heat → ↑ NOW Generations



Percent of years in which 4th (B) or 5th (C) generation occurred. Dark = More frequent. Middle of the road warming scenario (RCP 4.5)

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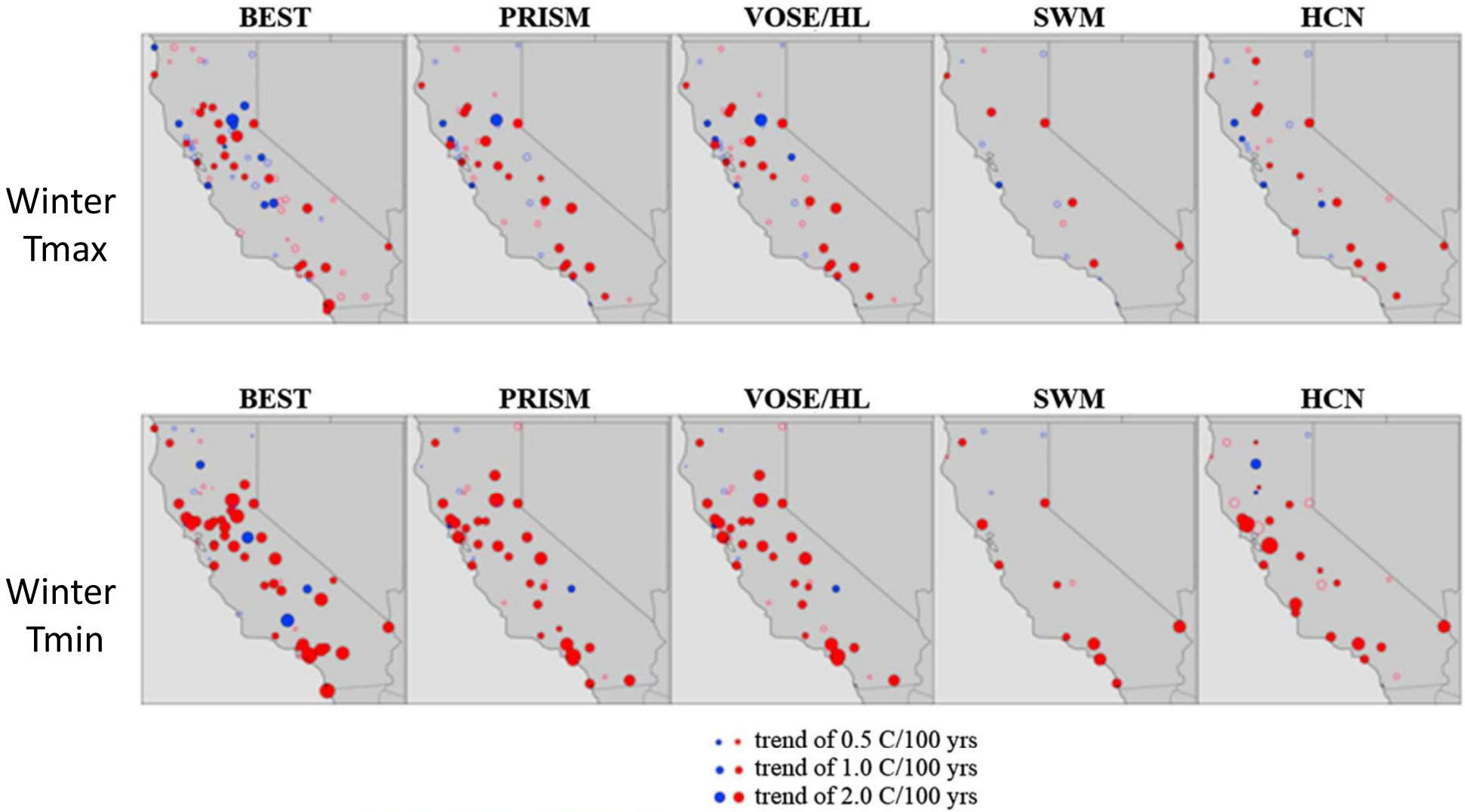
Pathak et al, 2020

Winters have been getting warmer



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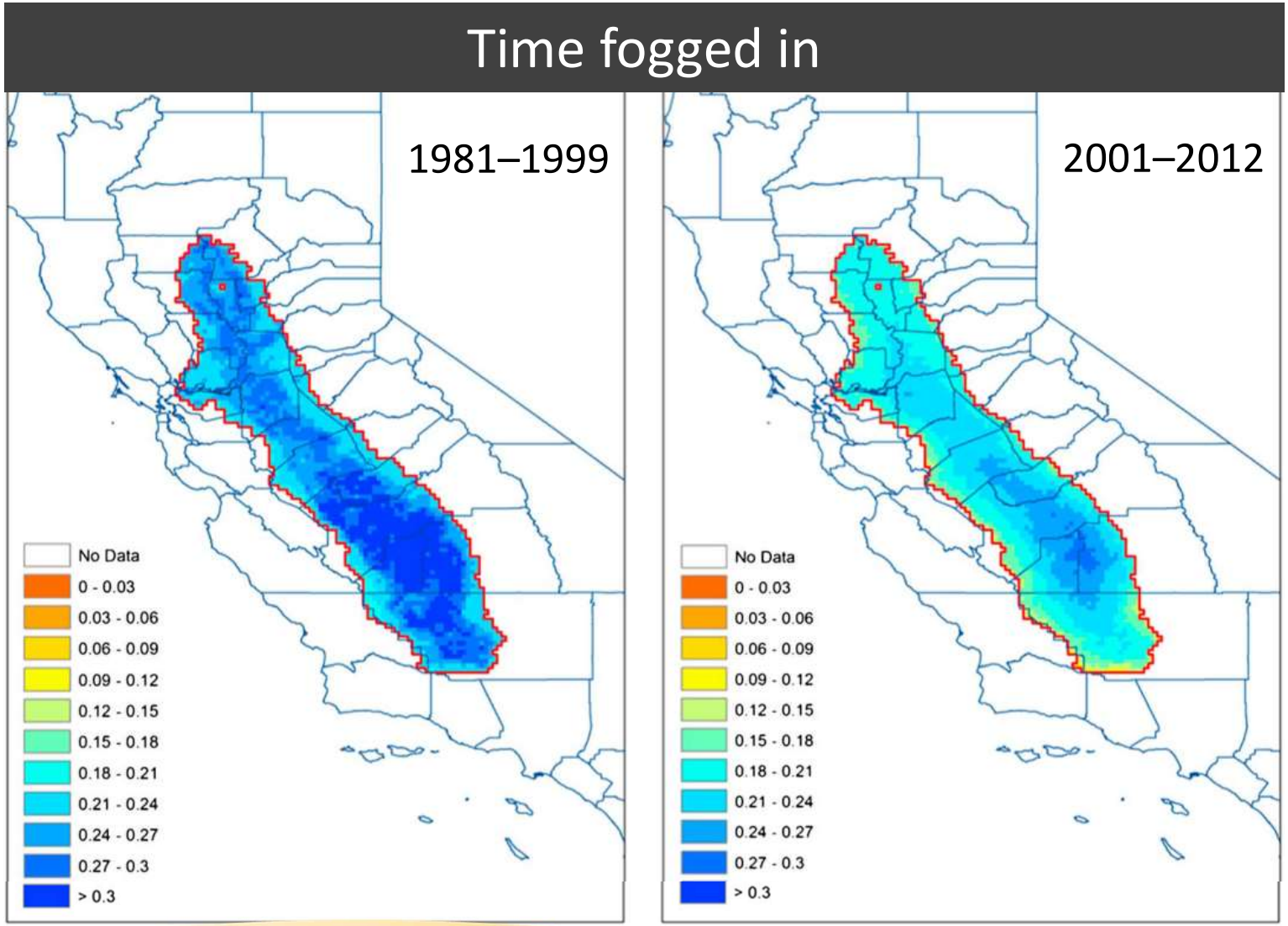
Wang et al. (2017)

…And less foggy



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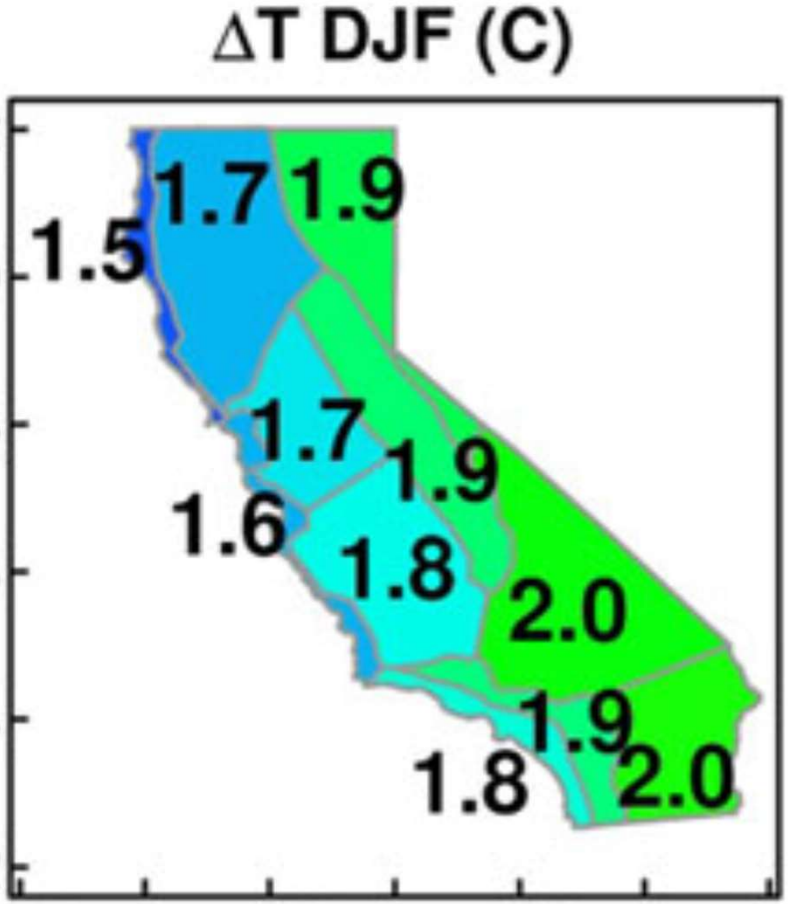
Baldocchi & Waller (2014)

Expect continued winter warming…



From 1980s to 2060s

- Sac Valley: ↑ 3.1° F
- San Joaquin Valley: ↑ 3.2° F

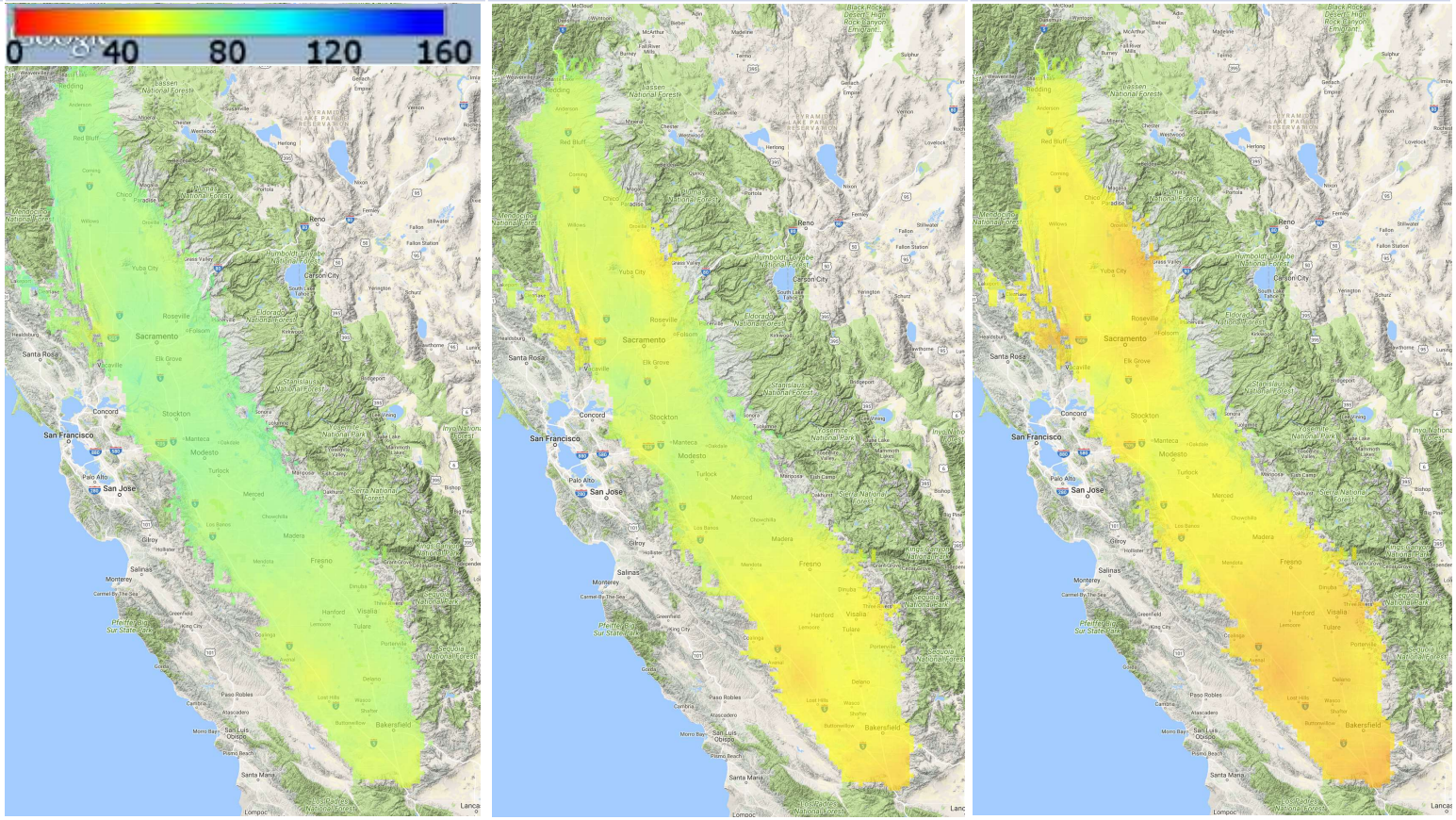
But continued variability

- Still some cold winters, and winters that we now consider average.
- But more "low chill" winters **AND** lower chill winters than before.

Pierce et al. (2013)

Chill Projections for 9/10 years

	Turn of the Century	Mid 21st Century	End 21st Century
Sac Valley	70	59 (↓ 16%)	49 (↓ 30%)
N. San Joaquin	71	61 (↓ 14%)	51 (↓ 28%)
S. San Joaquin	64	51 (↓ 20%)	42 (↓ 34%)



Luedeling et al. (2009)

If Kerman needs 55-60 chill portions…

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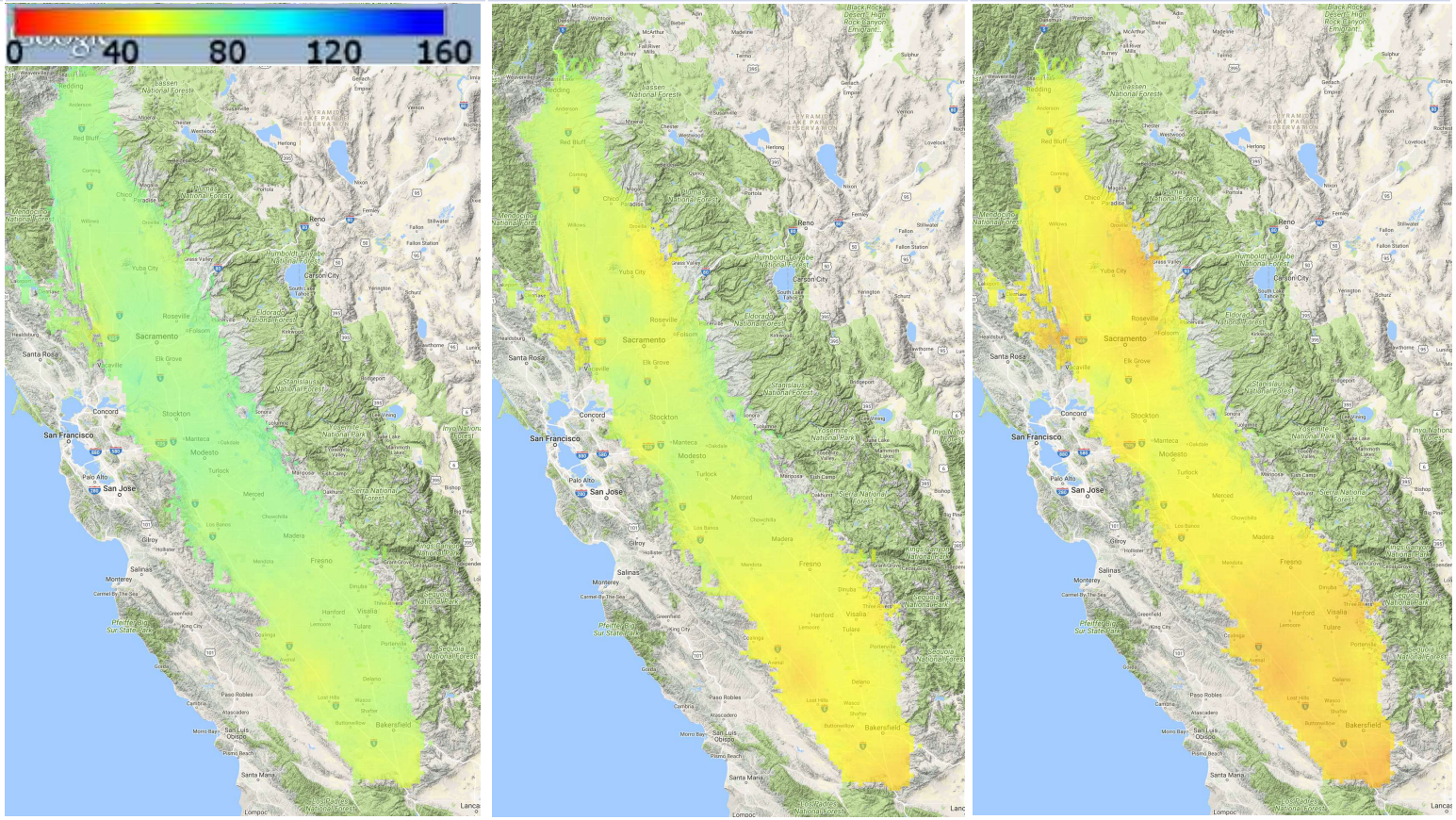


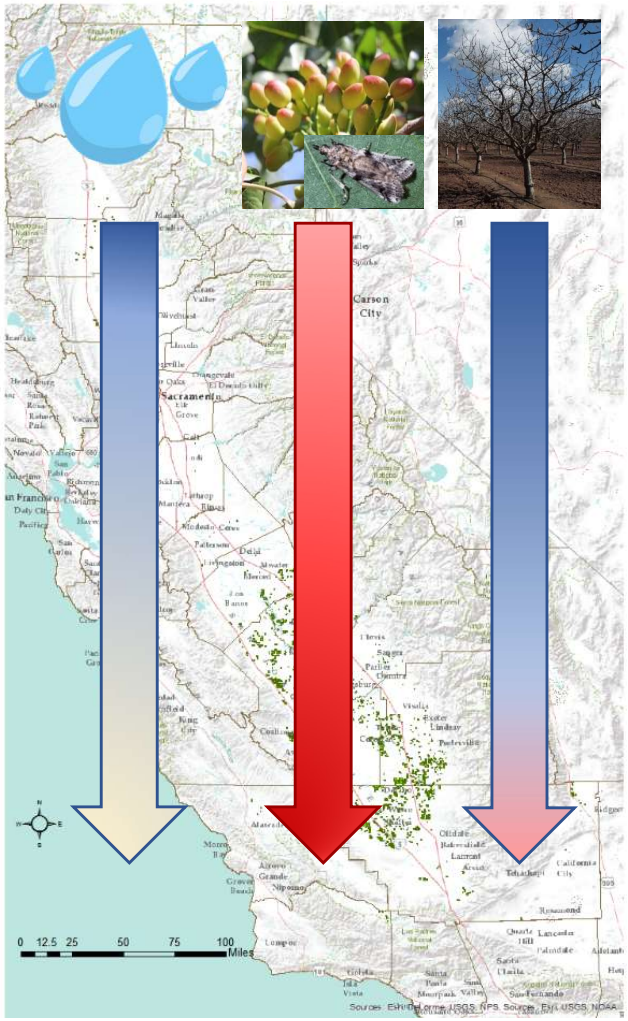
Luedeling et al. (2009)

Dormancy breaking products *can potentially* compensate 10-20% chill

- Kaolin clay, calcium carbonate - Decreases bud, shoot heat (Doll, Culumber)
- Dormant/Horticultural Oil – Increased, earlier budbreak (Beede, Ferguson)
- Hydrogen Cyanamide – Increased, earlier budbreak. Dormex is now labeled for pistachio use
- New research on the physiology of dormancy (Dr. Z)

Regional Conclusions for The Future

- No perfect site
- Management of many of these issues is possible
- For heat, chill, water & soil, early decisions are key
- Decisions must be made on current and future conditions



Plan for…

- *Great water challenges*
  - *Too much*
  - *Too little*
  - *Poor quality*
- *More insect pressure*
- *Lower chill*