Extreme Events and Climate Change: Challenges for Agricultural Landscapes

Louise Jackson, UC Davis
November 16, 2011

Photos clockwise from L to R: UC Davis; Getty Images; Michael Macor, Susan Ellsworth

What is a climate-related extreme event?

- "directly linking any one specific extreme event (e.g., a severe hurricane) to human-caused climate change is not possible. However, climate change may increase the probability of some ordinary weather events reaching extreme levels or of some extreme events becoming more extreme,"[1]

- Refer instead to *extreme weather events*

Image: *Steven Tze; http://steventze.wordpress.com/2011/10/10/self-critique-sunlight-vineyard-storm-clouds/*

[1]U.S. EPA (2011). "Extreme Events." Climate Change - Health and Environmental Impacts. Retrieved Oct. 24, 2011, http://epa.gov/climatechange/effects/extreme.html.

Managing extreme weather

"But, one thing that's unique about the crop this year is the deep color of the grapes due to the cold spring. We have the darkest grapes ever. I've never seen a year like this.

For consumers, 2011 is the year of the darkest dark reds. The cool spring made for small berries, which concentrate color. We're looking forward to bottling and releasing."

- Jim Spinetta, Amador County winegrape grower, AgAlert Oct. 19, 2011

Image: http://en.wikipedia.org/wiki/File:Wine_grapes03.jpg

Managing extreme weather

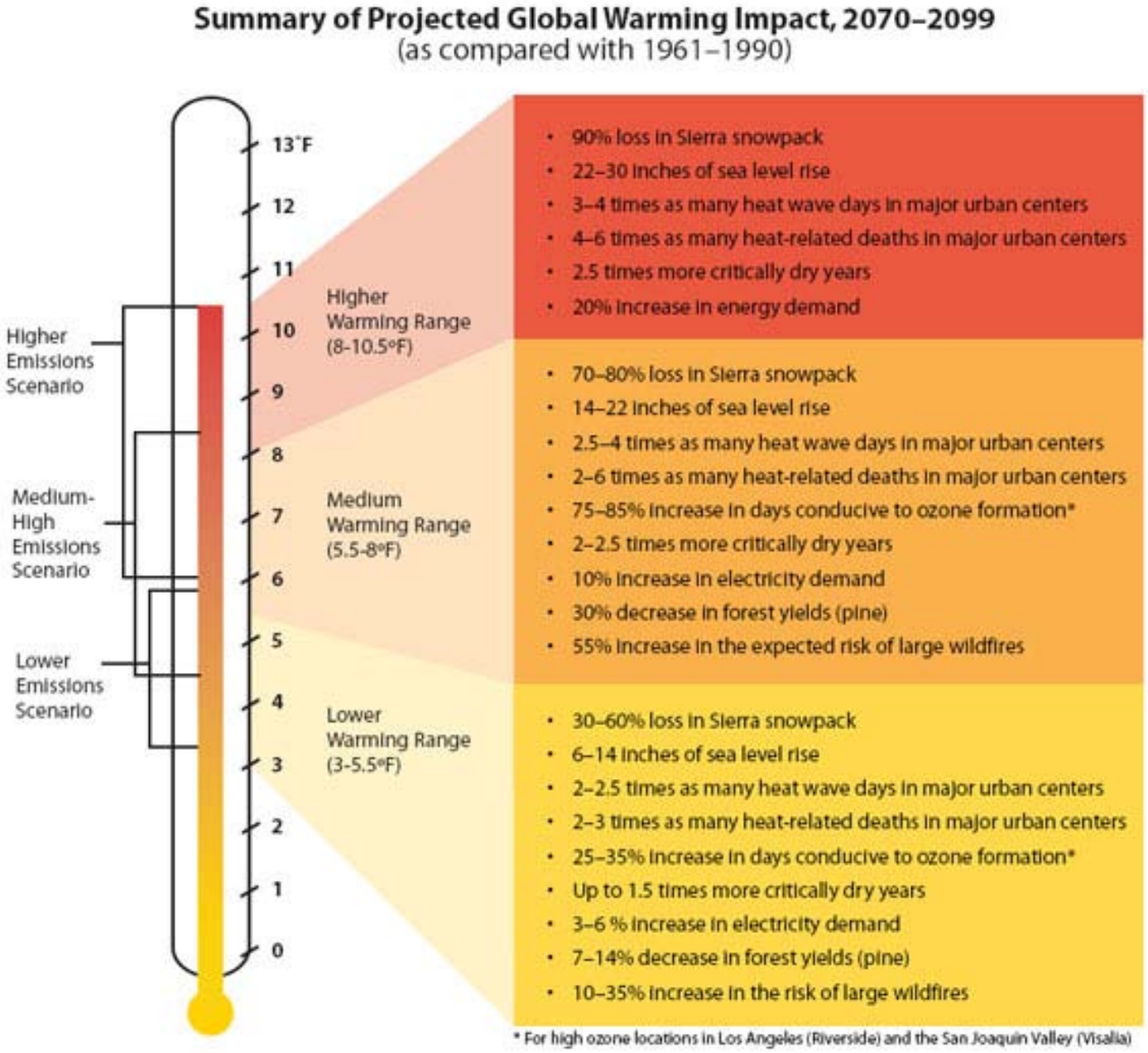
"It was unseasonably hot for us last week, but the week before that, we had an inch and a half of rain. Now it's in the 100s.

The trees are freaking out with the temperature swings. On a brighter note, the rain meant we haven't had to irrigate because there's still enough moisture in the ground."

-David Schwabauer, Ventura County lemon grower
AgAlert Oct. 19, 2011

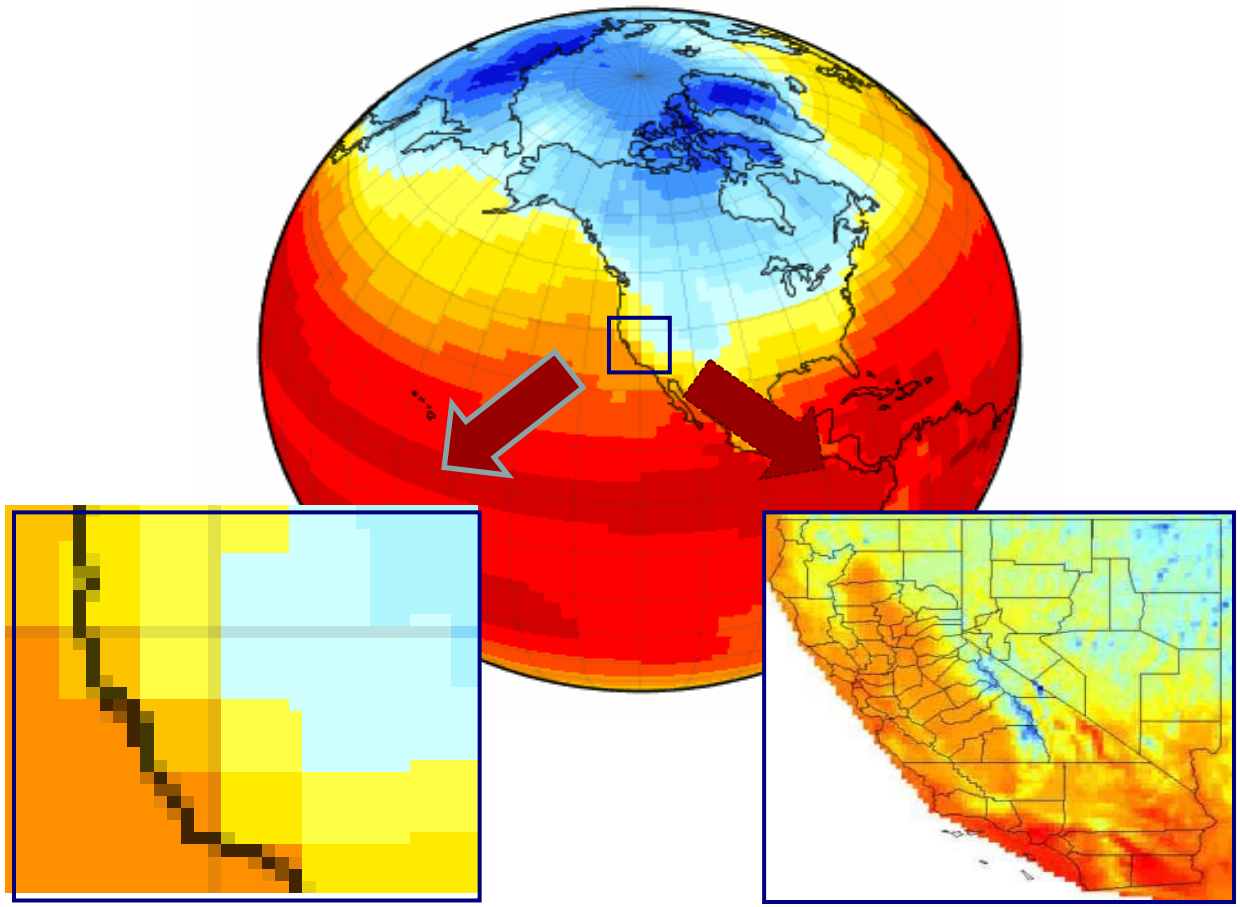
Image: https://lkthayer.wordpress.com/2011/05/09/the-lemon-tree-by-vicki-batkin/lemon-tree/

California climate change by the end of the century



California's Public Interest Energy Research Program (PIER). 2006.

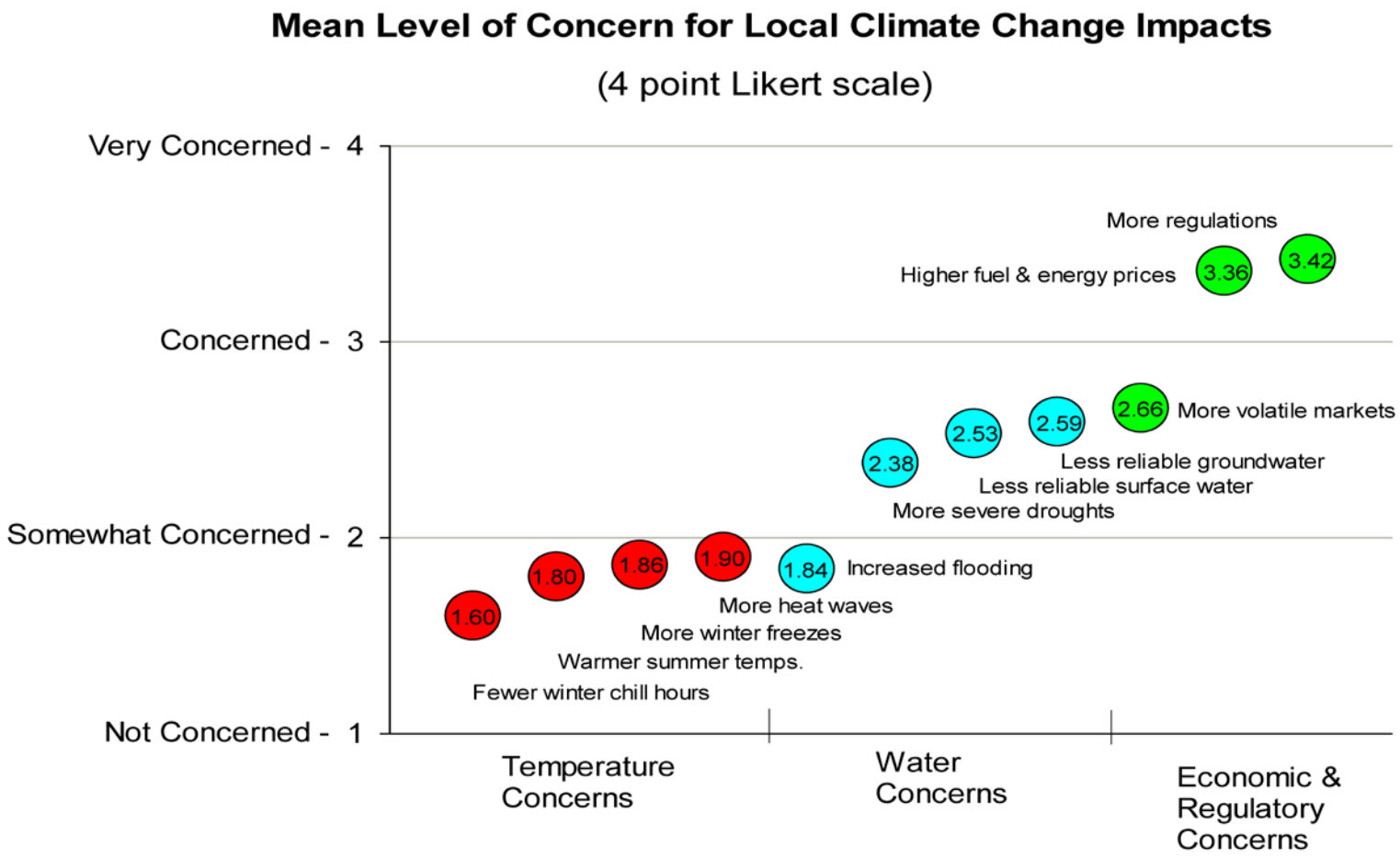
PIER Climate Program: downscaling regional climate models



Research needs: responses to higher temperatures and CO_2

- Higher CO_2 may slightly increase total vegetative growth
- Many fruit, nut and vegetable commodities are harmed by high temperatures and heat waves
- Less rainfall predicted -- Water use efficiency?
- Ozone phytotoxicity will increase (VOCs + NO_X)
- Crop pests--unknowns
  - Diseases increase with warm/wet compared to warm/dry scenarios?
  - Insect pests will survive winter?
  - Weeds: new species?
- Cattle and dairy cows
  - Higher winter pasture production if wetter
  - Lower summer milk yield

Survey of Yolo Co. farmers: Are they concerned about extreme events and how to adapt?

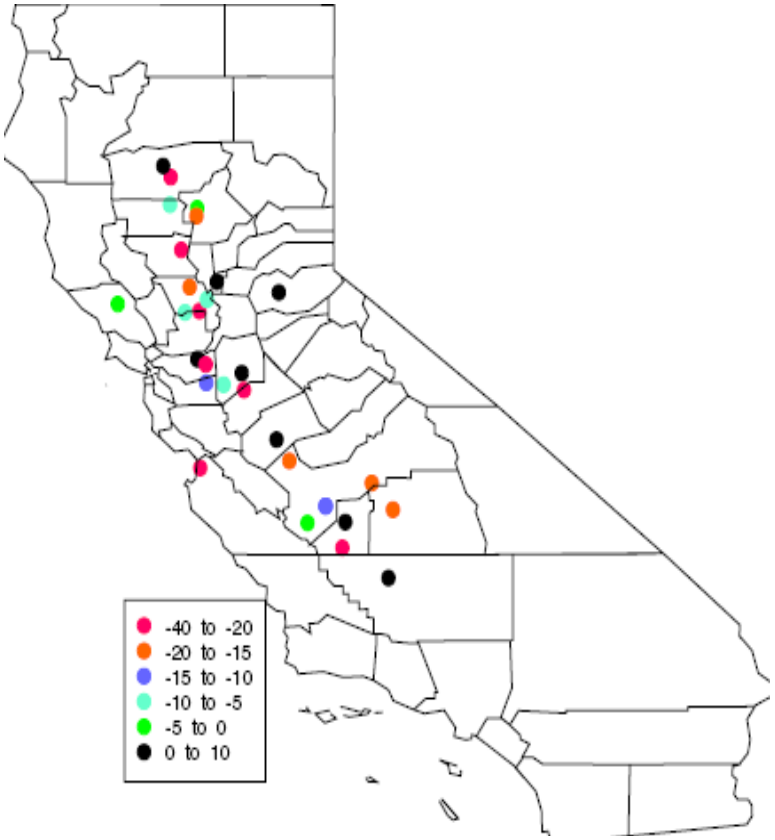


Haden et al., ms. in preparation. Grower perceptions of climate change in Yolo Co., CA.

Insufficient chill hours

- Chill hours are hours below 45° needed for a successful crop
  - 3 million acres of orchards with chilling requirements
- Chill hours on decline and predicted to continue declining[1]
  - Reduction seen for all climate change scenarios[2]
- Potential for complete crop failure especially for cherries, apricots and other stone fruit

Map of trends in chill hours/year since 1950[3]



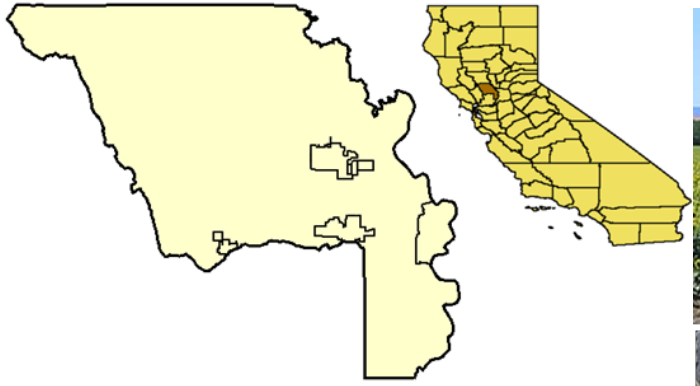
[1-2]Leudeling, E. et al. 2009. [3] Moser, S. et al. 2009.

What is needed?

- Emphasize renewable resources and inputs
- Develop more flexible markets
- Avoid infrastructure breakdown

- Prioritize ag research for climate change
  - Drought preparedness
  - Crop breeding and IPM
  - Diversification strategies

Images: Susan Ellsworth, California Agriculture, Uncle Kick Kack

California case study on climate change and agriculture

- Funded by CEC PIER Climate Change Project
- "*Adaptation Strategies for Agricultural Sustainability in Yolo Co., California*"
- Louise Jackson, Ryan Haden, Allan Hollander, Hyunok Lee, Mark Lubell, Vishal Mehta, Toby O'Geen, Meredith Niles, Josh Perlman, David Purkey, William Salas, Dan Sumner, Mihaela Tomuta, Michael Dempsey, and Stephen Wheeler
- To be published in Jan, 2012