A New Website for Predicting Pistachio Nut Growth

Andy Lyons
Informatics and GIS Statewide Program
UC Division of Agriculture & Natural Resources

and

Lu Zhang, Cara Allan, Emilio Laca, Narges Mahvelati, Giulia Marino, Louise Ferguson

Department of Plant Sciences

University of California Davis

UCDAVIS
DEPARTMENT OF PLANT SCIENCES
College of Agricultural and Environmental Sciences

IGIS
University of California
Agriculture and Natural Resources
Informatics and GIS Program

Pistachio Nut Growth:

➡ Spring ➡ Summer

Stage I: Shell growth; irrigation

Stage II: Shell hardening and thickening; small bugs

Stage III: Kernel growth: irrigation, NOW and harvest

Manage pistachio production by:

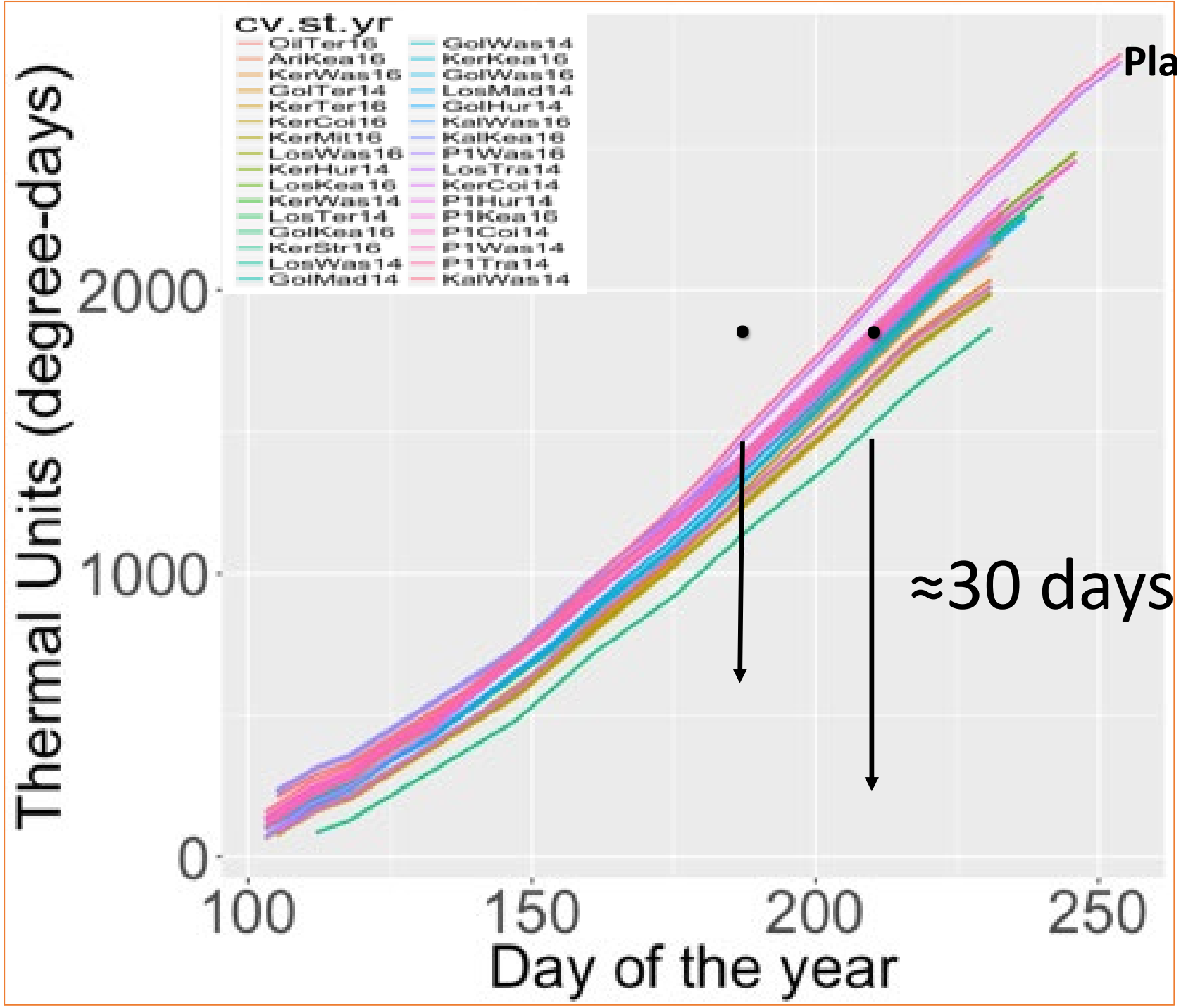
- Calendar date
- Monitoring temperatures
- Examining nuts directly
  - regulated deficit irrigation
  - pest management
  - harvest

Worked well until:

- **New cultivars were released…**

Worked well until:

- Climate started changing



Planting at different sites:

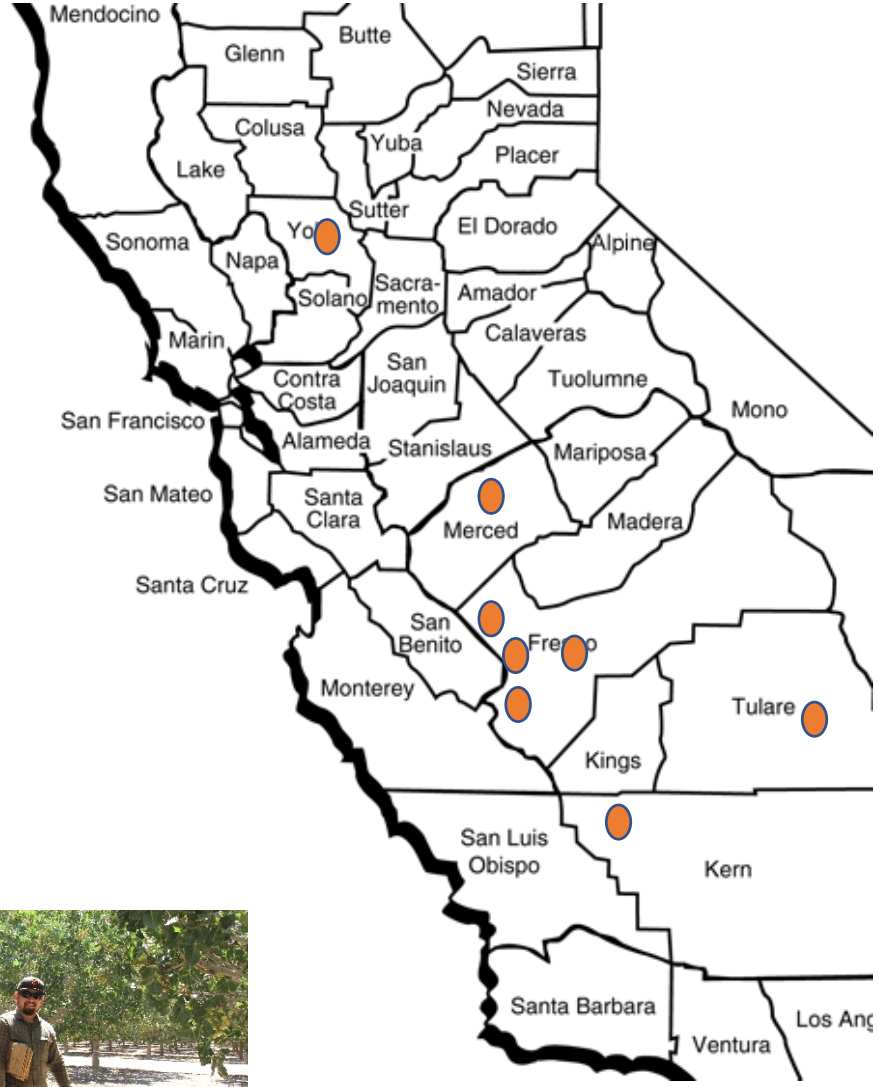
- different heat accumulations

Temperature drives tree and nut growth and ripening:

- Plants have genetically determined heat unit accumulation requirements for growth stages:
  - above a minimum temperature: 45°F (7.5°C)
  - Growing Degree Days: GDD

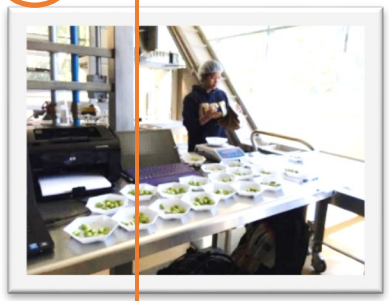
Sampling Locations and Cultivars:

- 4 years: 2013, 2014, 2016, 2017
- 8 locations:
  300 miles from south to north
- 6 cultivars:
  Kerman, Lost Hills,
  Golden Hills, Kaleghouchi,
  Pete 1 and Aria
- 7 day sampling intervals



Lab…..

1



Sorted

2 Photographed

3 Measured

6 Weighed

5

Separated (kernel)

4

Punctured (shell firmness)

Growing Degree Day Requirements:

	Kerman	Golden Hills	Lost Hills
Stage I	756	705	751
Stage II	2583	2830	3157
Stage III	Starts at 1000, ends at 2111	Starts at 931, ends at 1904	Starts at 982, ends at 2021

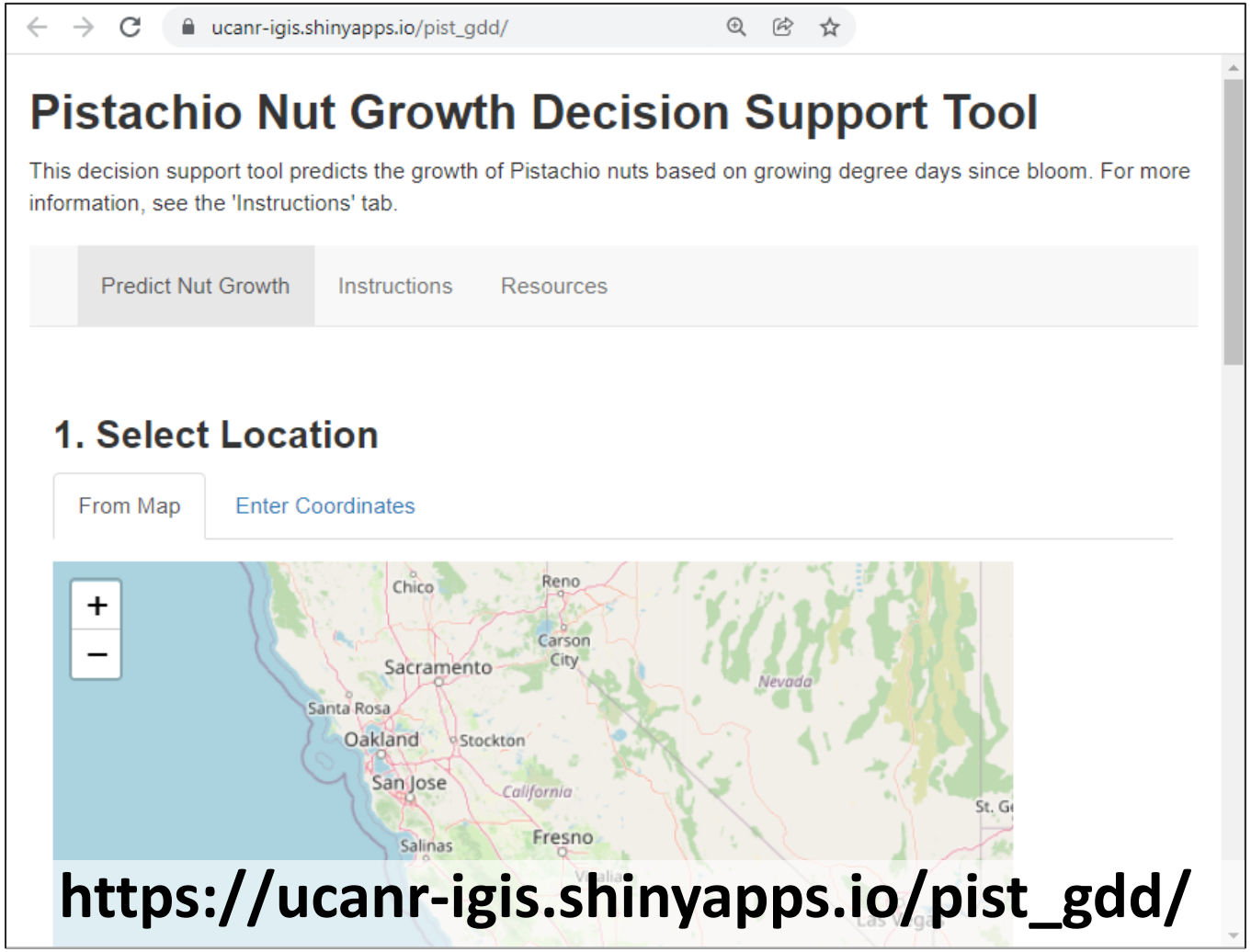
Decision Support Tool:

You provide the:

- location
- cultivar
- bloom date

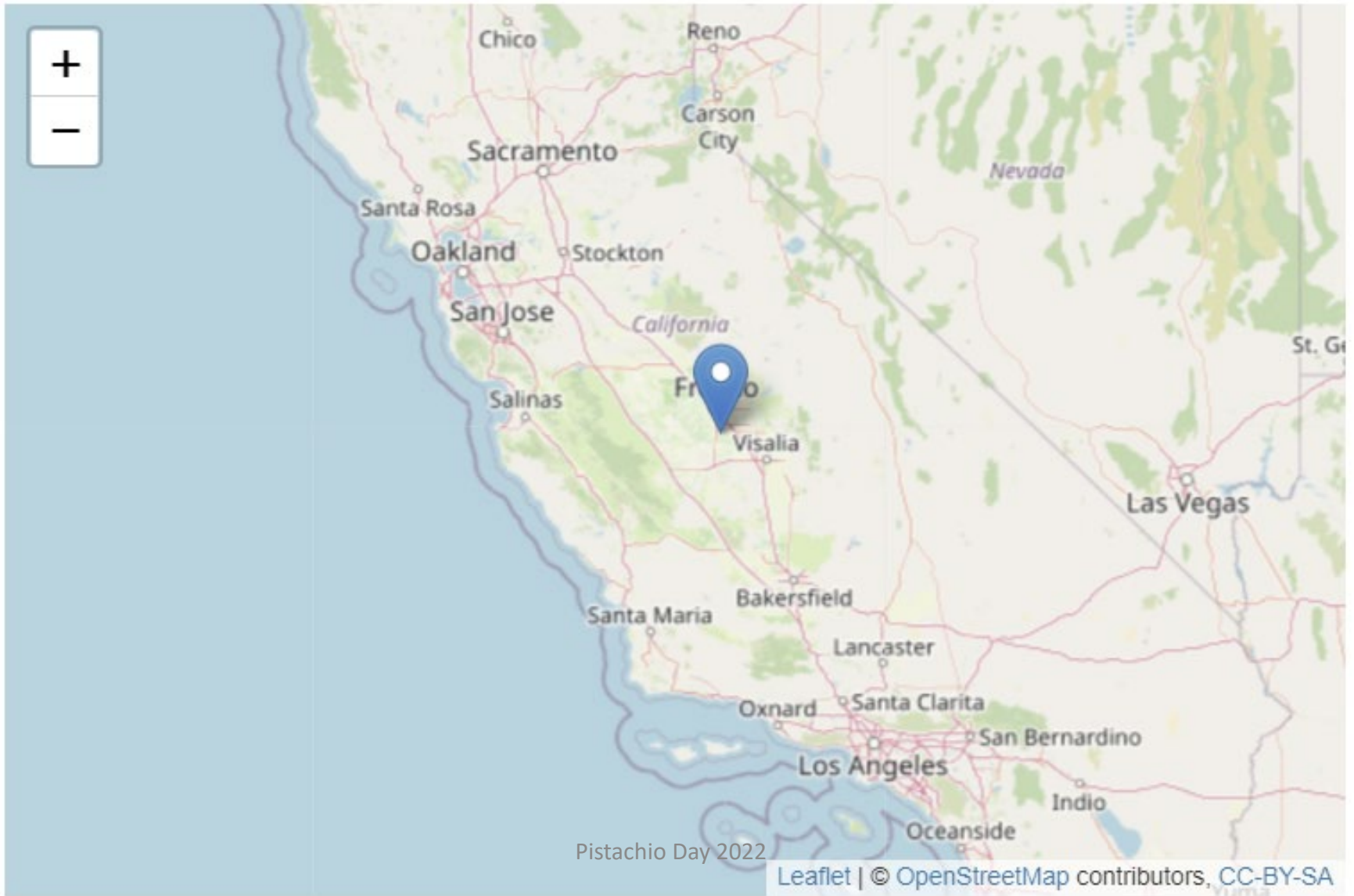
The website will:

- lookup weather data
- compute the GDD
- estimate nut development dates



1. Select Location

From Map | Enter Coordinates



2. Pistachio options

Cultivar:

Kerman

Date range:

2021-03-15 to 2021-10-31

Percent of maximum to flag:

90

3. Weather data

Start date to yesterday:

World Weather Online

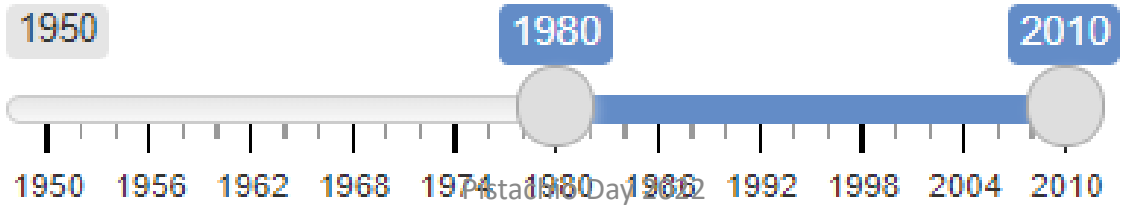
Next 10 days:

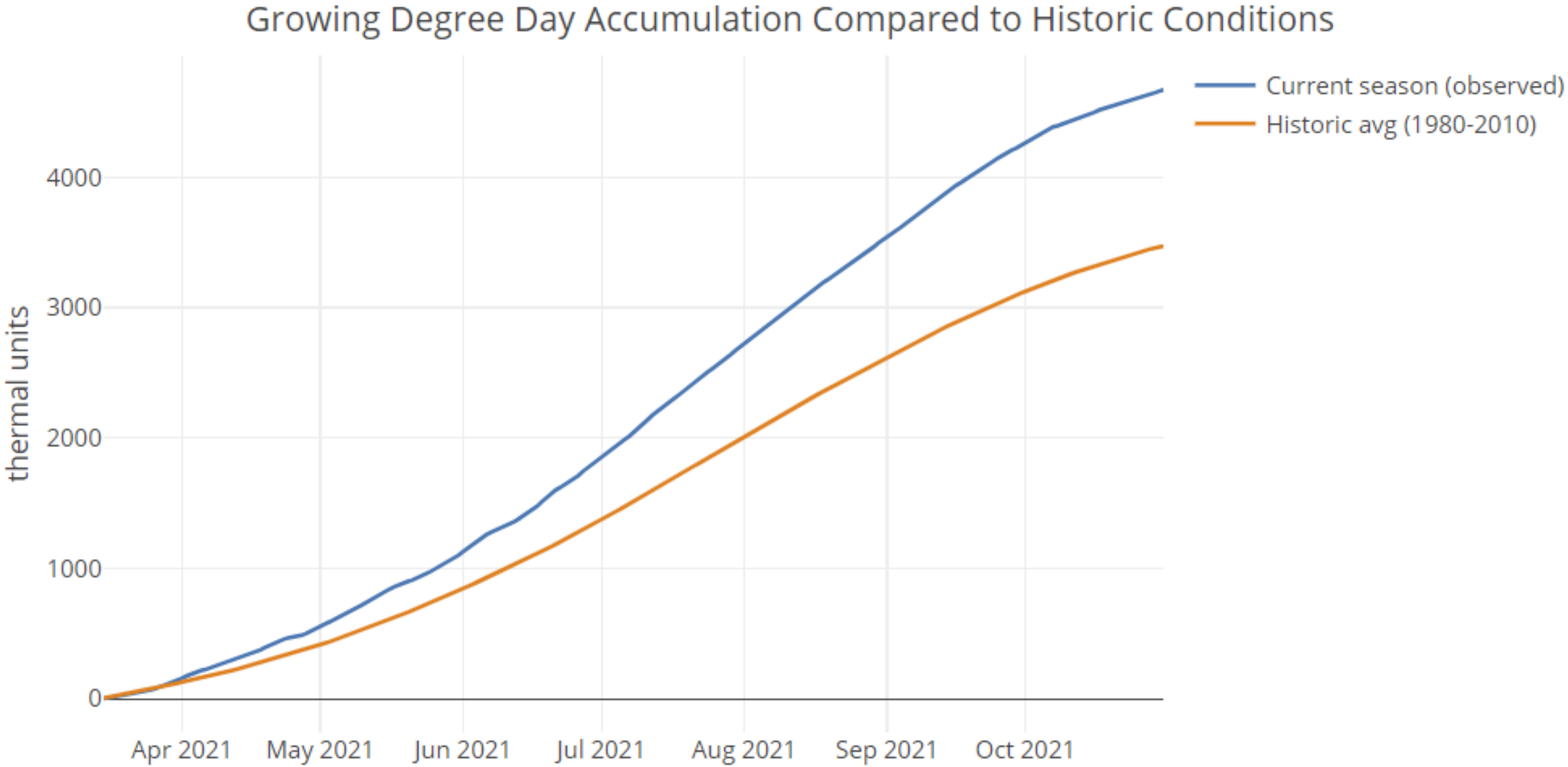
World Weather Online

Historical reference:

CalAdapt (Livneh)

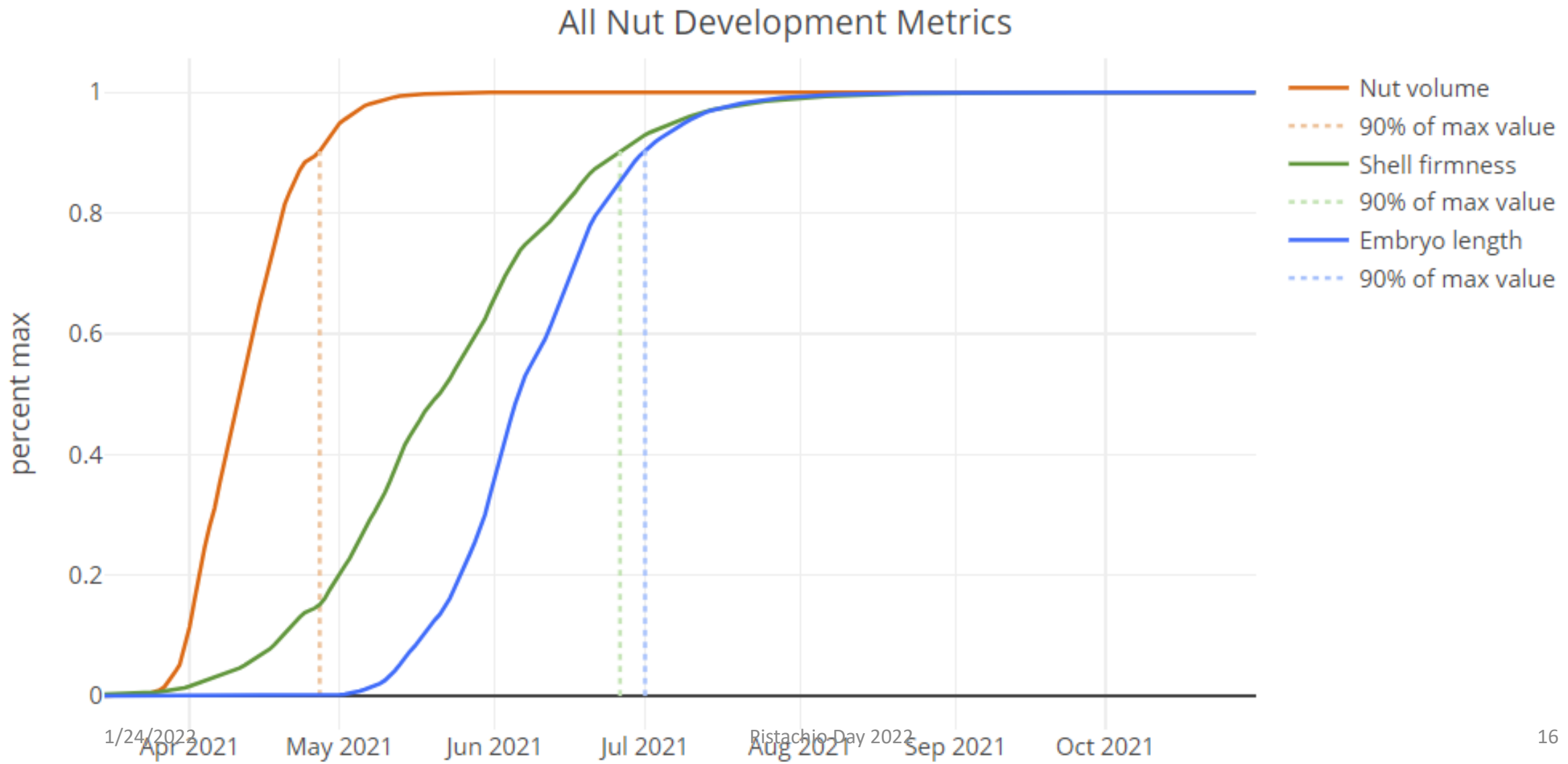
Historical date range



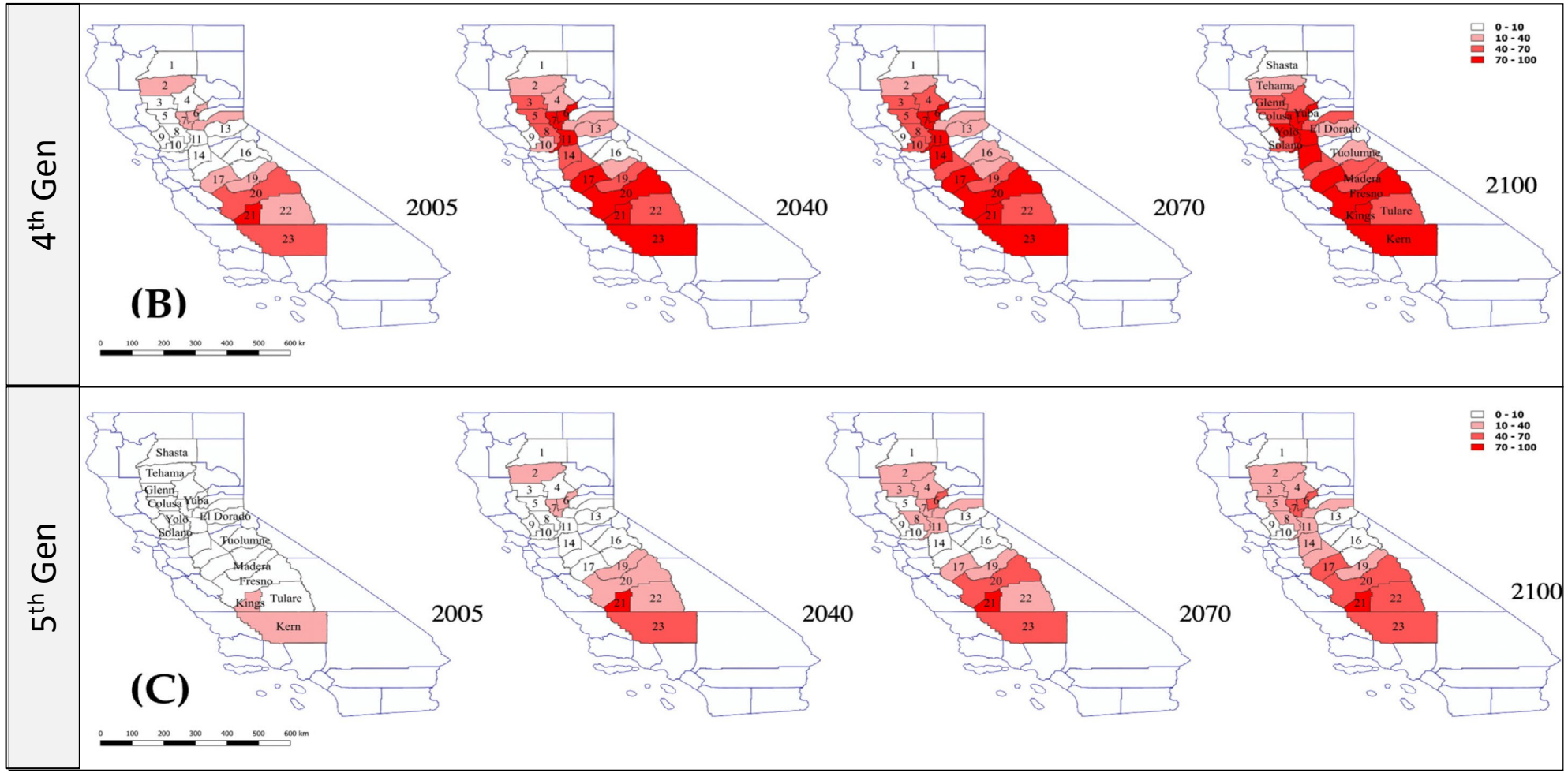

Growing Degree Day Accumulation Compared to Historic Conditions
Current season (observed)
Historic avg (1980-2010)
thermal units
4000
3000
2000
1000
0
Apr 2021
May 2021
Jun 2021
Jul 2021
Aug 2021
Sep 2021
Oct 2021

Results

GDD (2021) | GDD (historical) | Nut Development Metrics (all) | Volume | Firmness | Embryo Length

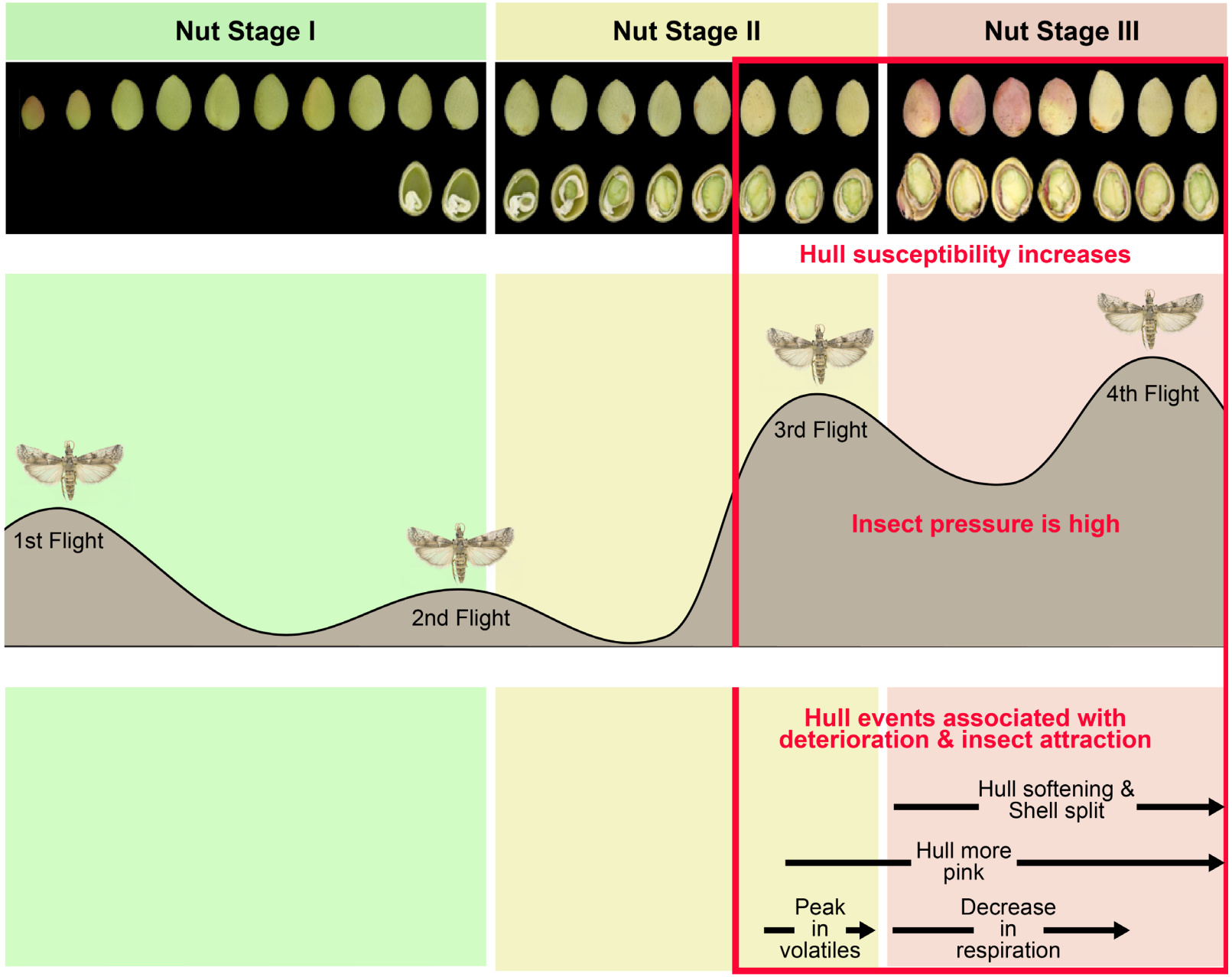


More Heat → More NOW generations:



Percent of years in which 4th (B) or 5th (C) generation occurred.
Dark = More frequent.

Pathak et al, 2020



Coordinate Nut development:

- function of GDD
  - NOW generations
  - hull susceptibility

Slide: Courtesy of B. Blanco-Ulate and Houston Wilson

Conclusion:

- **This website is a decision support tool based on this research:**

Nonlinear Model Selection for Fruit and Kernel Development as a Function of Heat in Pistachio

Lu Zhang, Emilio Laca, Cara J. Allan, Narges M. Mahvelati, and Louise Ferguson

https://doi.org/10.21273/HORTSCI15722-21 HortScience Volume 56: Issue 7

- **West Coast Nut Magazine: February 1st**

- **Feed back from you will improve it!!**

We thank…

- ***California Pistachio Research Board.***
- ***Alan Scroggs, Bill Seaman, Charlie Rose, Chris Couture, Dave Peterson, Gary Robinson, Gary Weinberger, Ali and Hamid Orandi, Jeff Gibbons, Jeff Schmeidrer, Jonathan Battig, Mitchell Coit, Setton Farms and Vahid Salehi***
- *We also thank* ***Craig Kallsen and Dr. Themis Michailides*** *for providing plant materials from experimental orchards*

Dedicated to the memory of Ali Orandi…

- *……a pioneer in the California's pistachio industry and dear friend with whom we spent many hours learning in his orchards and enjoying lunches in "Ali's Kitchen".*

Questions:

- Lferguson@ucdavis.edu
- 559-737-3061

UCDAVIS
DEPARTMENT OF PLANT SCIENCES
College of Agricultural and Environmental Sciences