Environmental Stresses Affecting *Rubus* Flowering and Fruiting on the California Coast

Mark Gaskell, Farm Advisor
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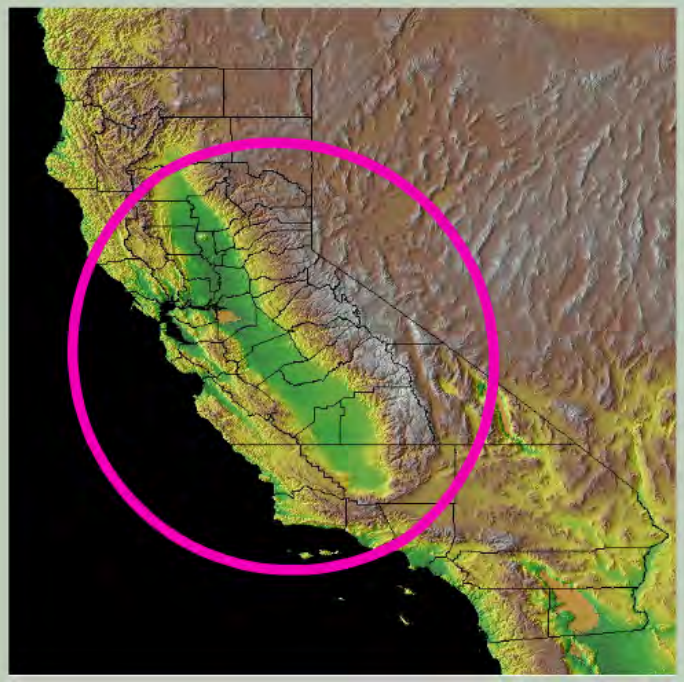

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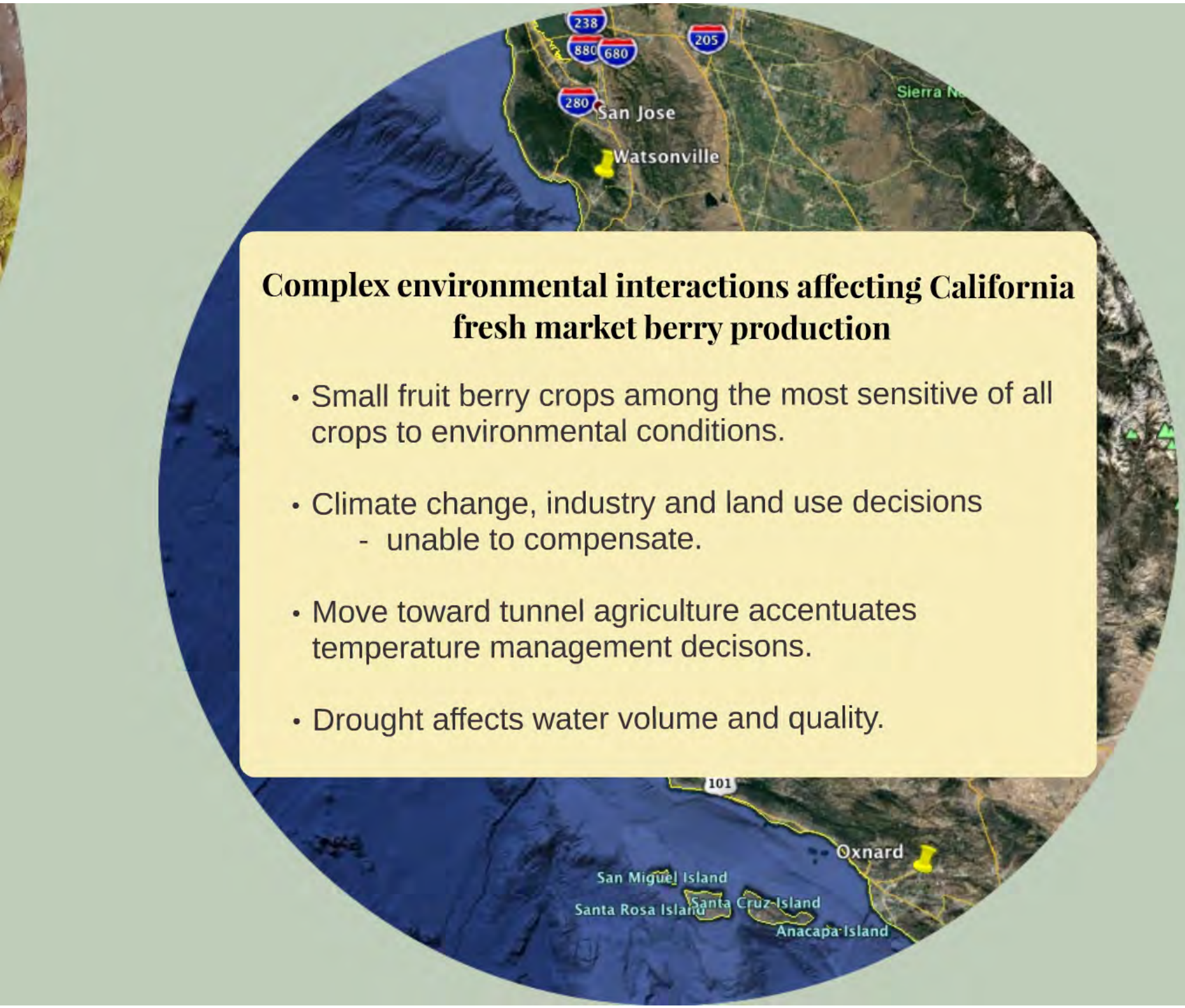
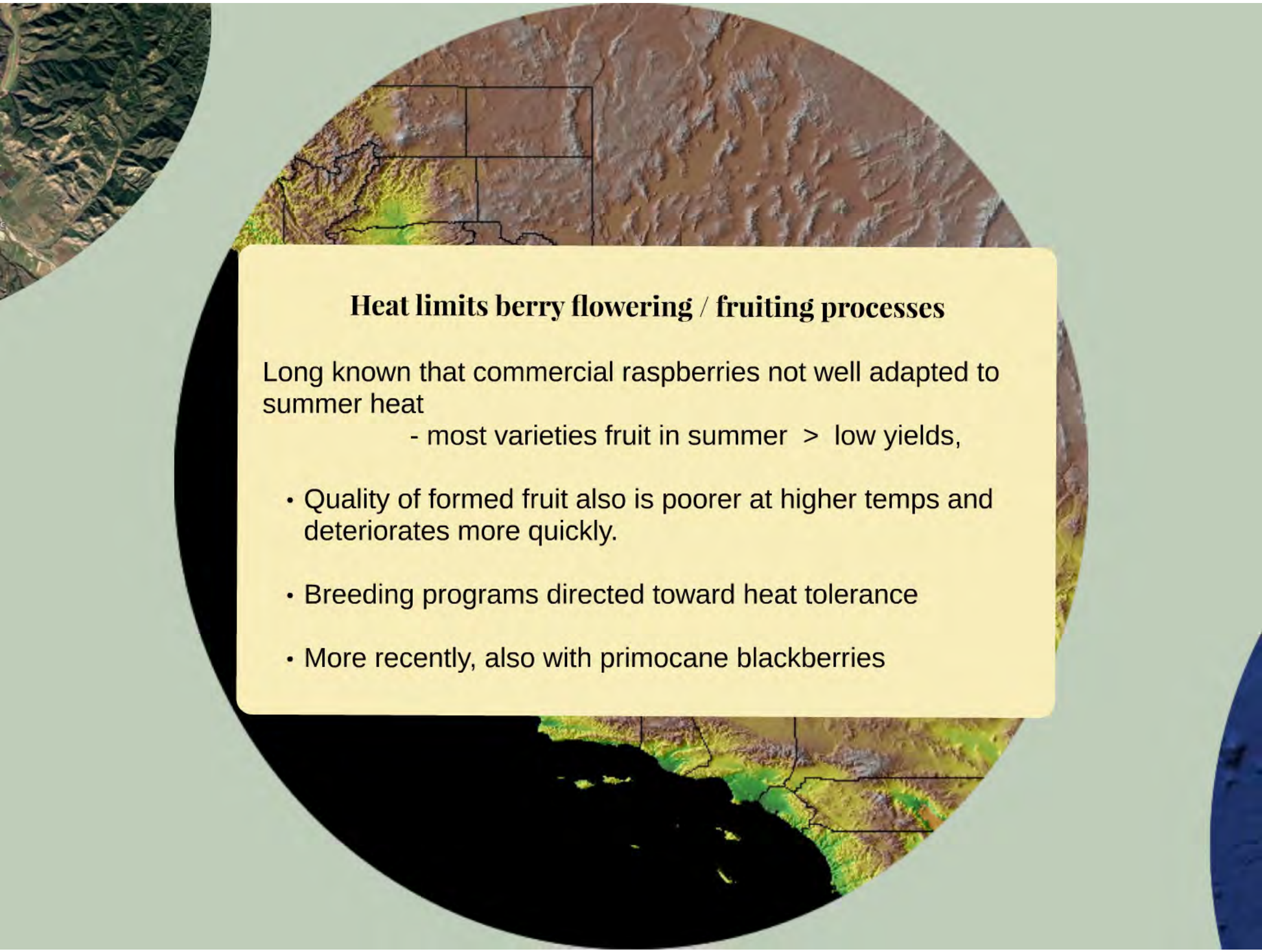
238
880
680
205
280
San Jose
Watsonville
Fresno
California
Santa Maria Valley
Bakersfield
5
101
Oxnard
San Miguel Island
Santa Rosa Island
Santa Cruz Island
Anacapa Island



Complex environmental interactions affecting California fresh market berry production

- Small fruit berry crops among the most sensitive of all crops to environmental conditions.
- Climate change, industry and land use decisions
  - unable to compensate.
- Move toward tunnel agriculture accentuates temperature management decisons.
- Drought affects water volume and quality.



Heat limits berry flowering / fruiting processes

Long known that commercial raspberries not well adapted to summer heat

- most varieties fruit in summer > low yields,

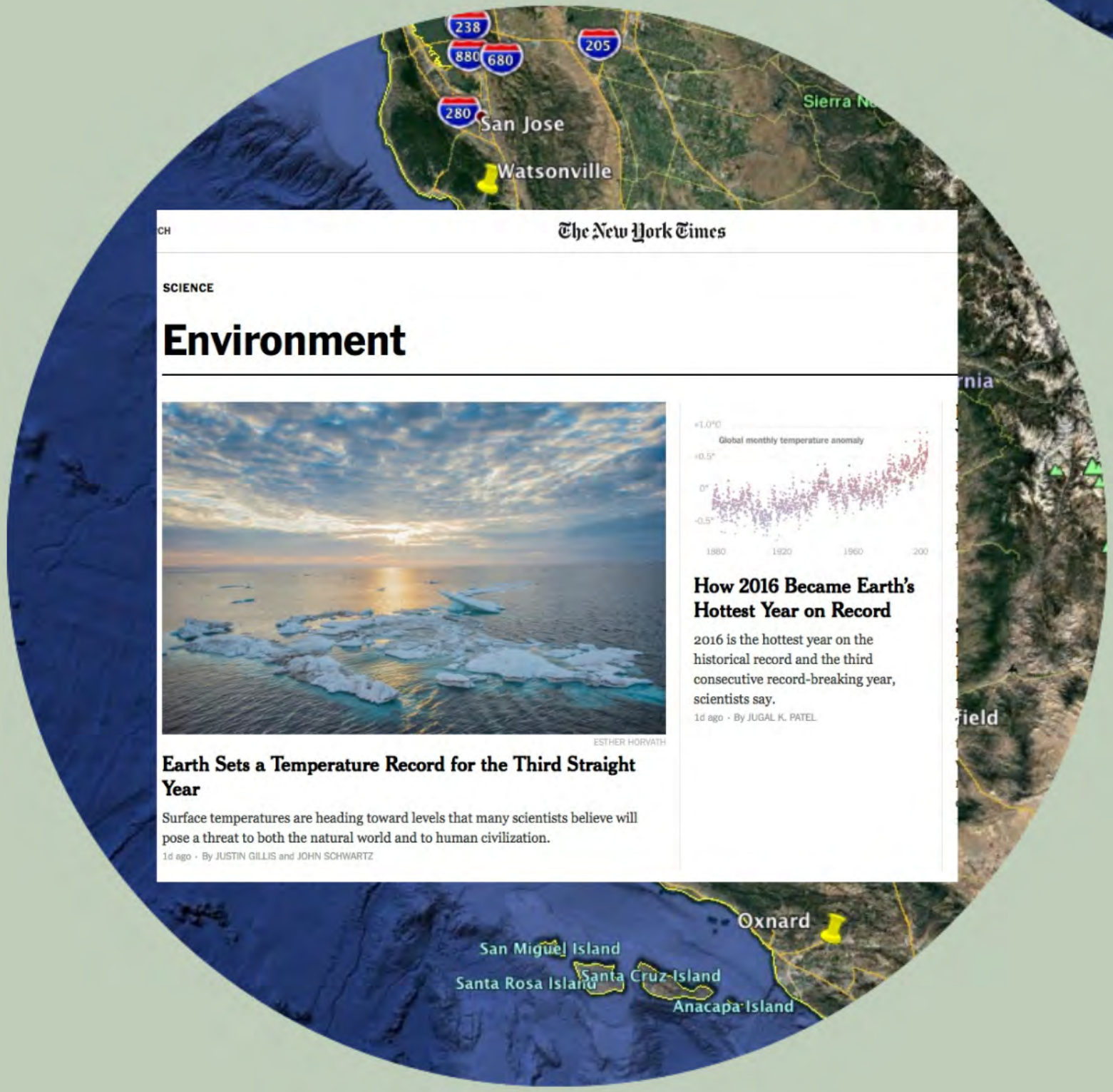
- Quality of formed fruit also is poorer at higher temps and deteriorates more quickly.
- Breeding programs directed toward heat tolerance
- More recently, also with primocane blackberries

Santa Maria Valley


Ventura
Fillmore
Santa Paula
Oxnard
Ventura
Saticoy
El Rio
Somis
Moorpark
Oxnard
Camarillo
Simi Valley
Port Hueneme
Thousand Oaks
Mugu Canyon
© 2016 Google
Data CSUMB SFML, CA OPC

Oxnard

Santa Maria Valley


238
880
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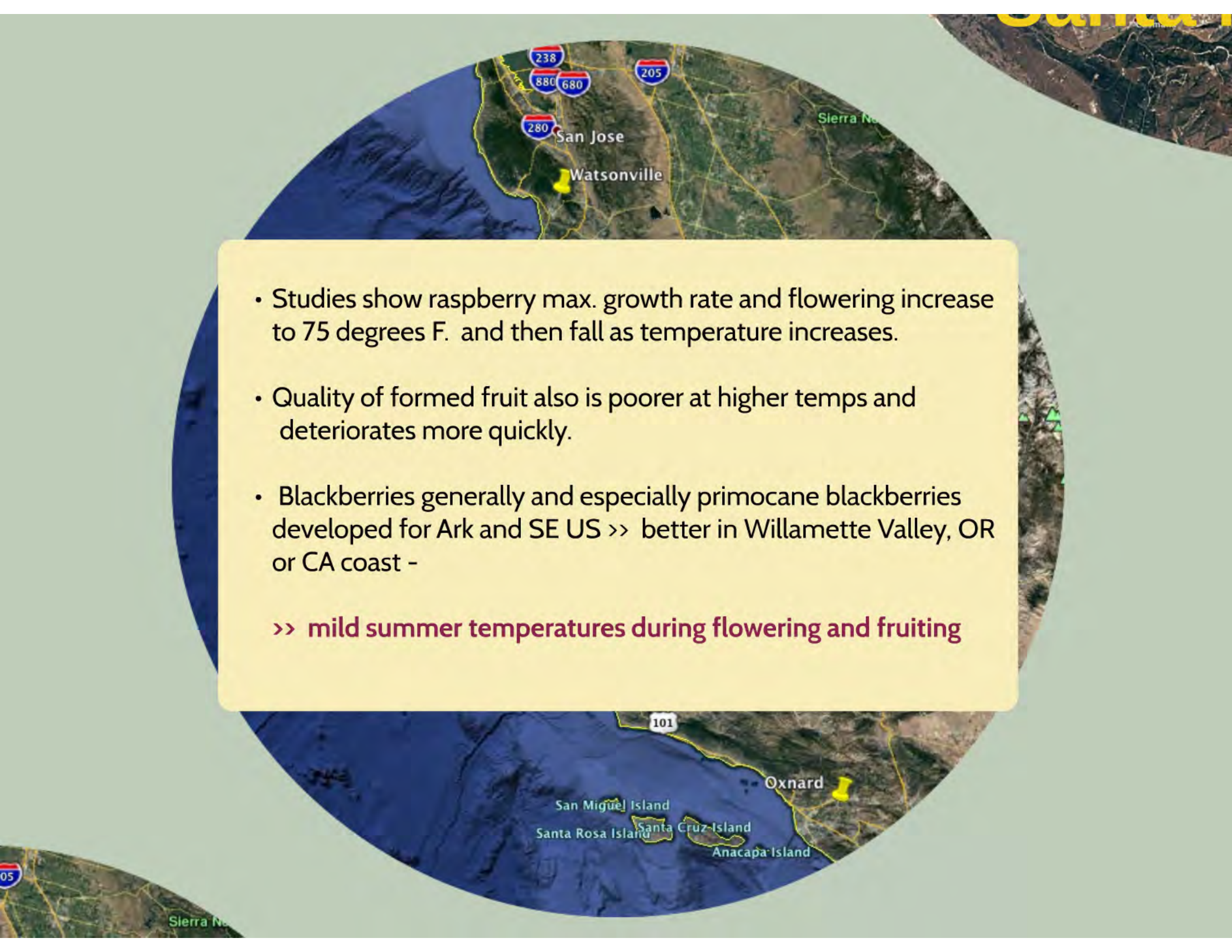
San Jose
Watsonville
Sierra N
CH
The New York Times
SCIENCE
Environment
ESTHER HORVATH
Earth Sets a Temperature Record for the Third Straight Year
Surface temperatures are heading toward levels that many scientists believe will pose a threat to both the natural world and to human civilization.
1d ago · By JUSTIN GILLIS and JOHN SCHWARTZ
+1.0°C
Global monthly temperature anomaly
+0.5°
0°
-0.5°
1880
1920
1960
200
How 2016 Became Earth's Hottest Year on Record
2016 is the hottest year on the historical record and the third consecutive record-breaking year, scientists say.
1d ago · By JUGAL K. PATEL
Oxnard
San Miguel Island
Santa Rosa Island
Santa Cruz Island
Anacapa Island

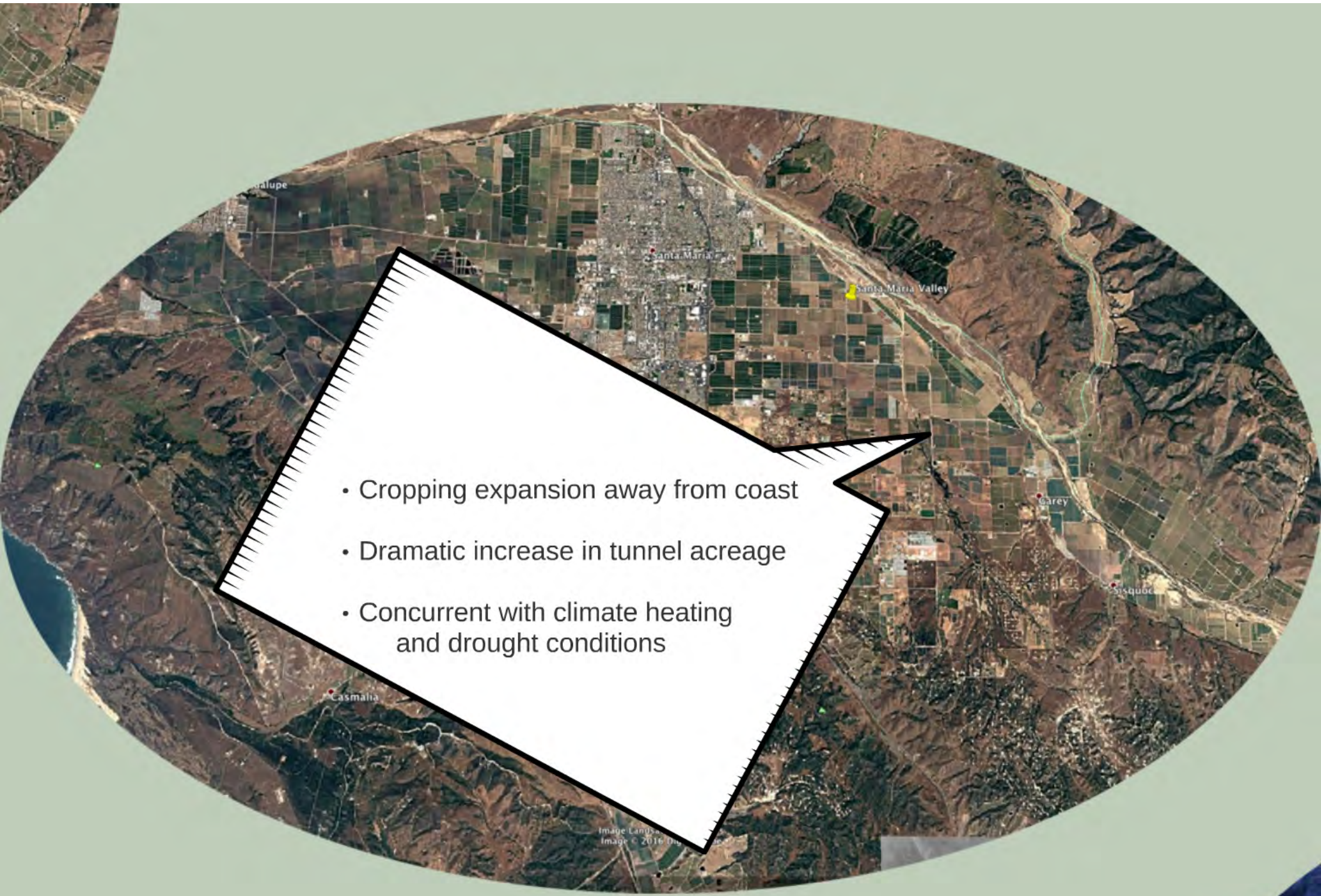


- Studies show raspberry max. growth rate and flowering increase to 75 degrees F. and then fall as temperature increases.
- Quality of formed fruit also is poorer at higher temps and deteriorates more quickly.
- Blackberries generally and especially primocane blackberries developed for Ark and SE US >> better in Willamette Valley, OR or CA coast -

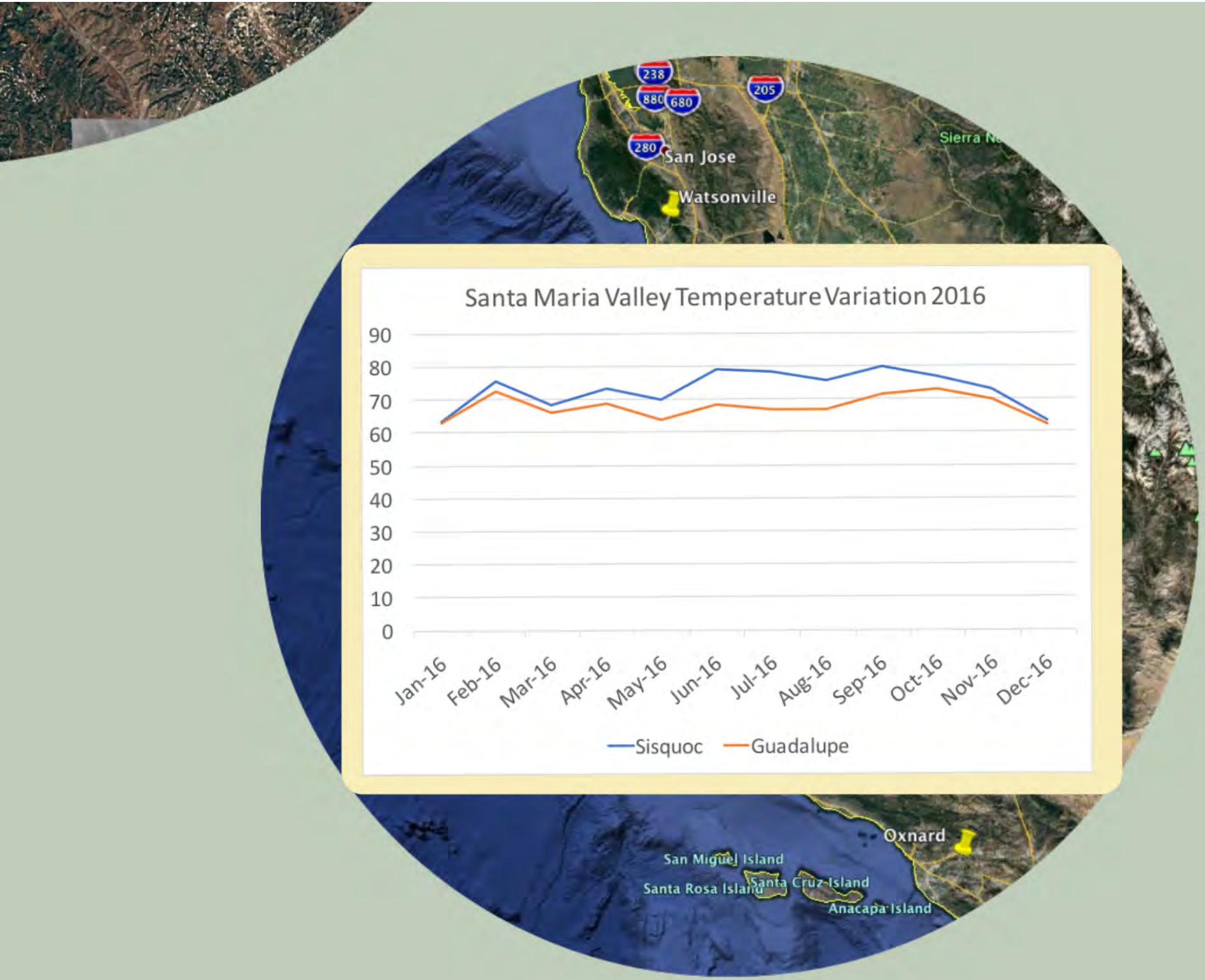
>> **mild summer temperatures during flowering and fruiting**

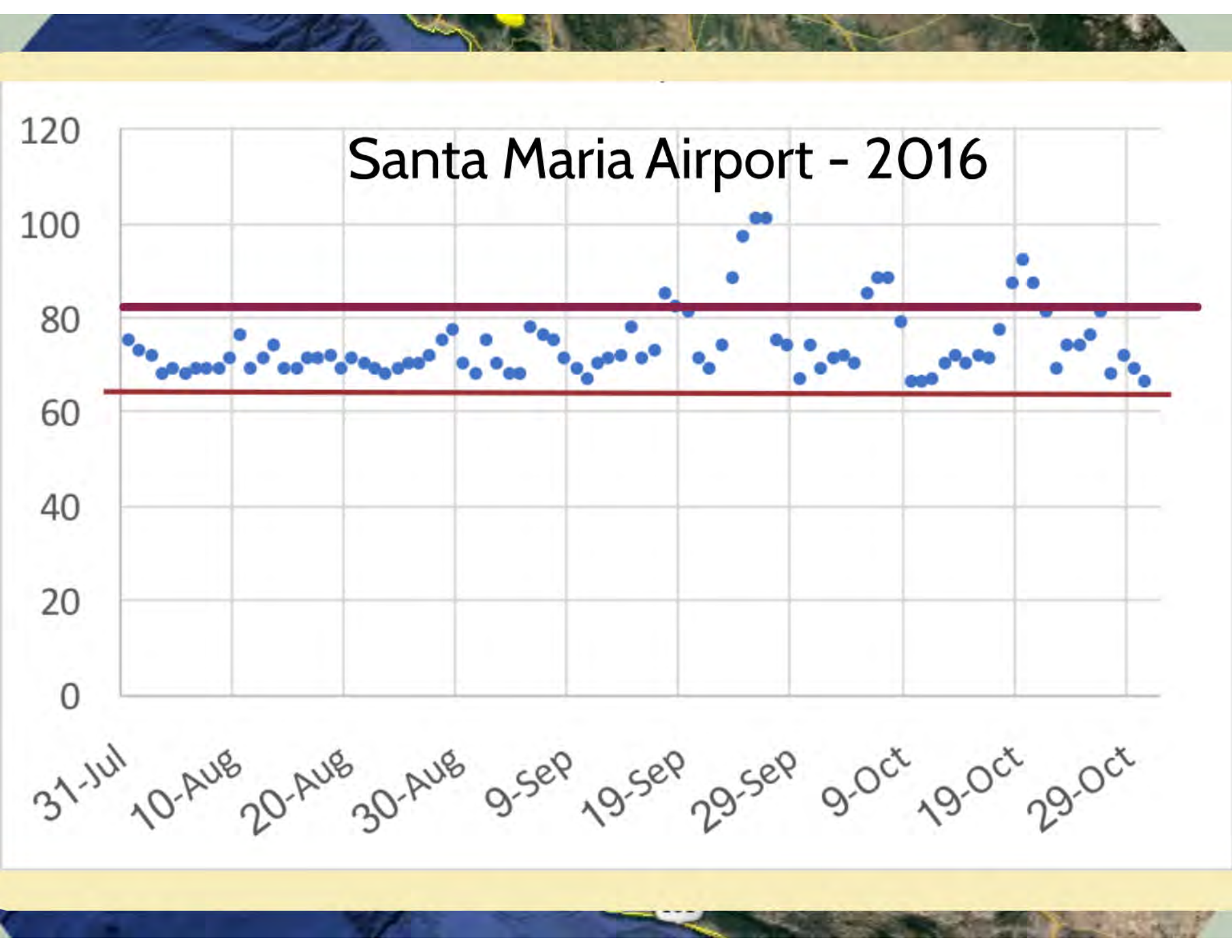
Santa Maria Valley 2000

Santa Maria Valley 2016

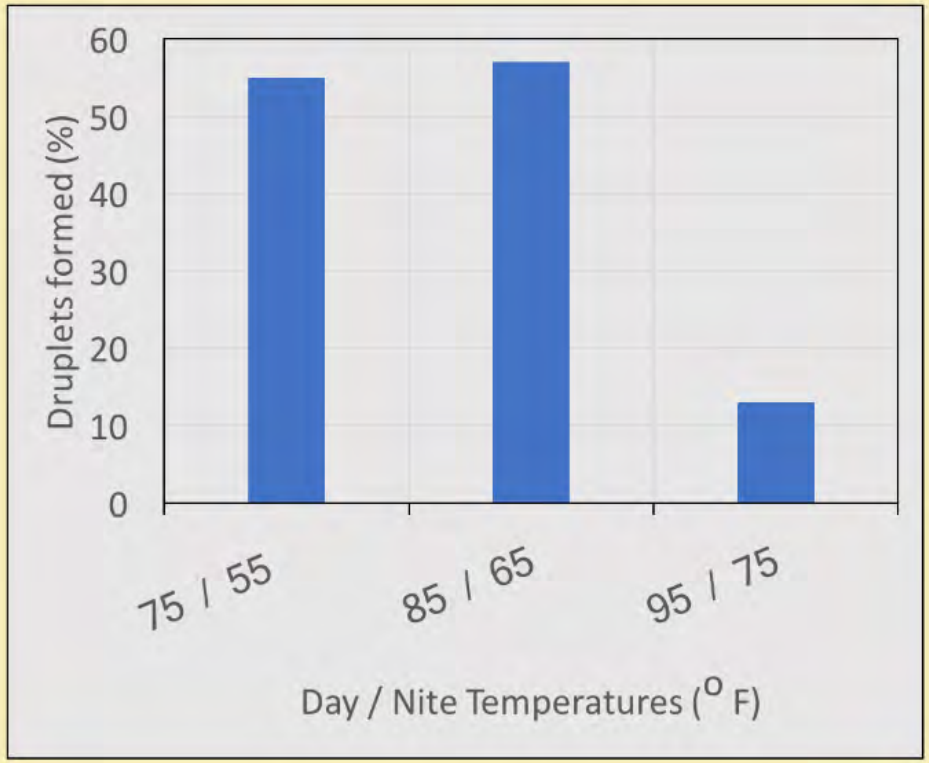


- Cropping expansion away from coast
- Dramatic increase in tunnel acreage
- Concurrent with climate heating and drought conditions


238
880
680
205
280
San Jose
Watsonville
Santa Maria Valley Temperature Variation 2016
90
80
70
60
50
40
30
20
10
0
Jan-16
Feb-16
Mar-16
Apr-16
May-16
Jun-16
Jul-16
Aug-16
Sep-16
Oct-16
Nov-16
Dec-16
Sisquoc
Guadalupe
Oxnard
San Miguel Island
Santa Rosa Island
Santa Cruz Island
Anacapa Island

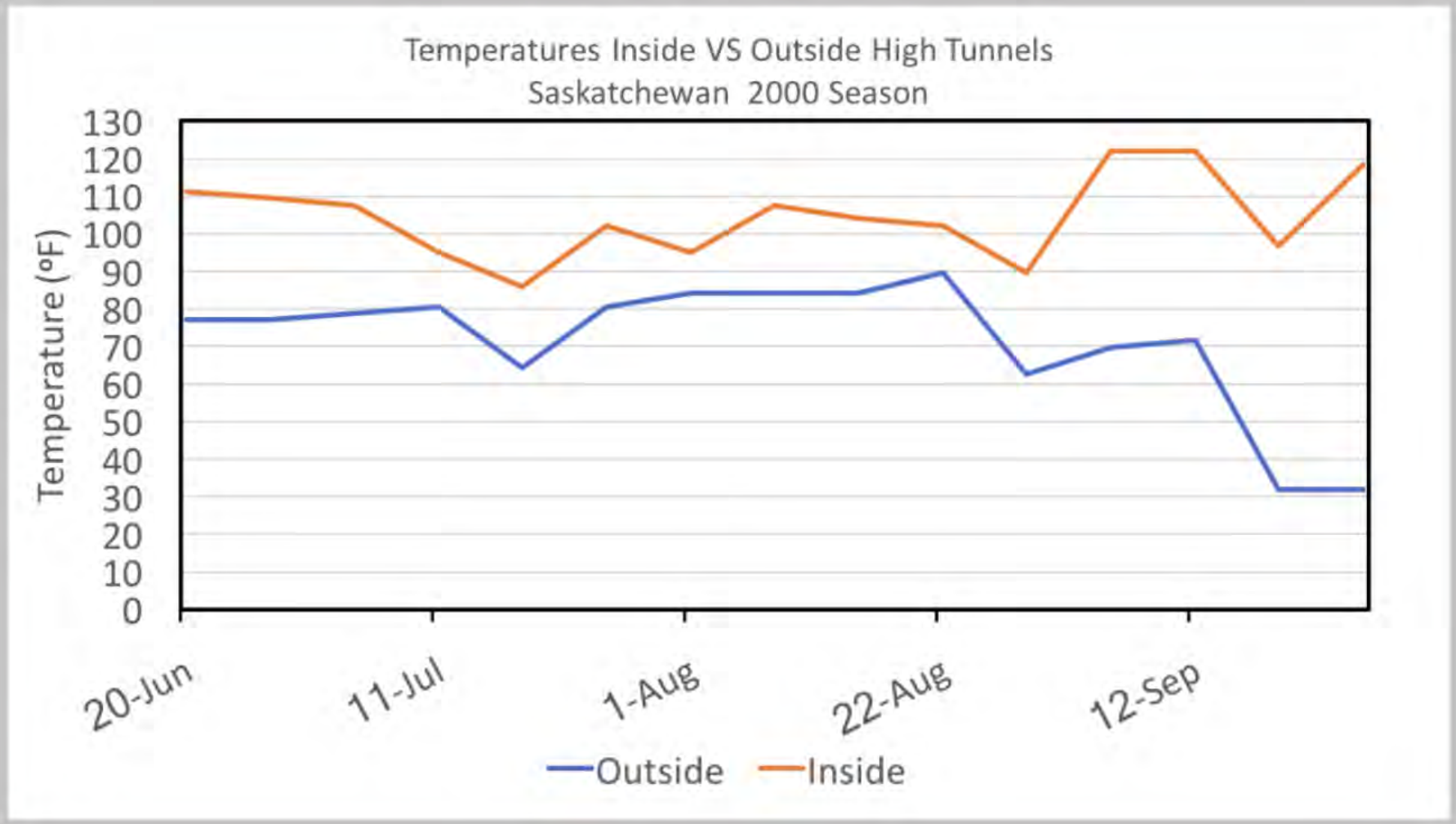

Santa Maria Airport - 2016
120
100
80
60
40
20
0
31-Jul
10-Aug
20-Aug
30-Aug
9-Sep
19-Sep
29-Sep
9-Oct
19-Oct
29-Oct

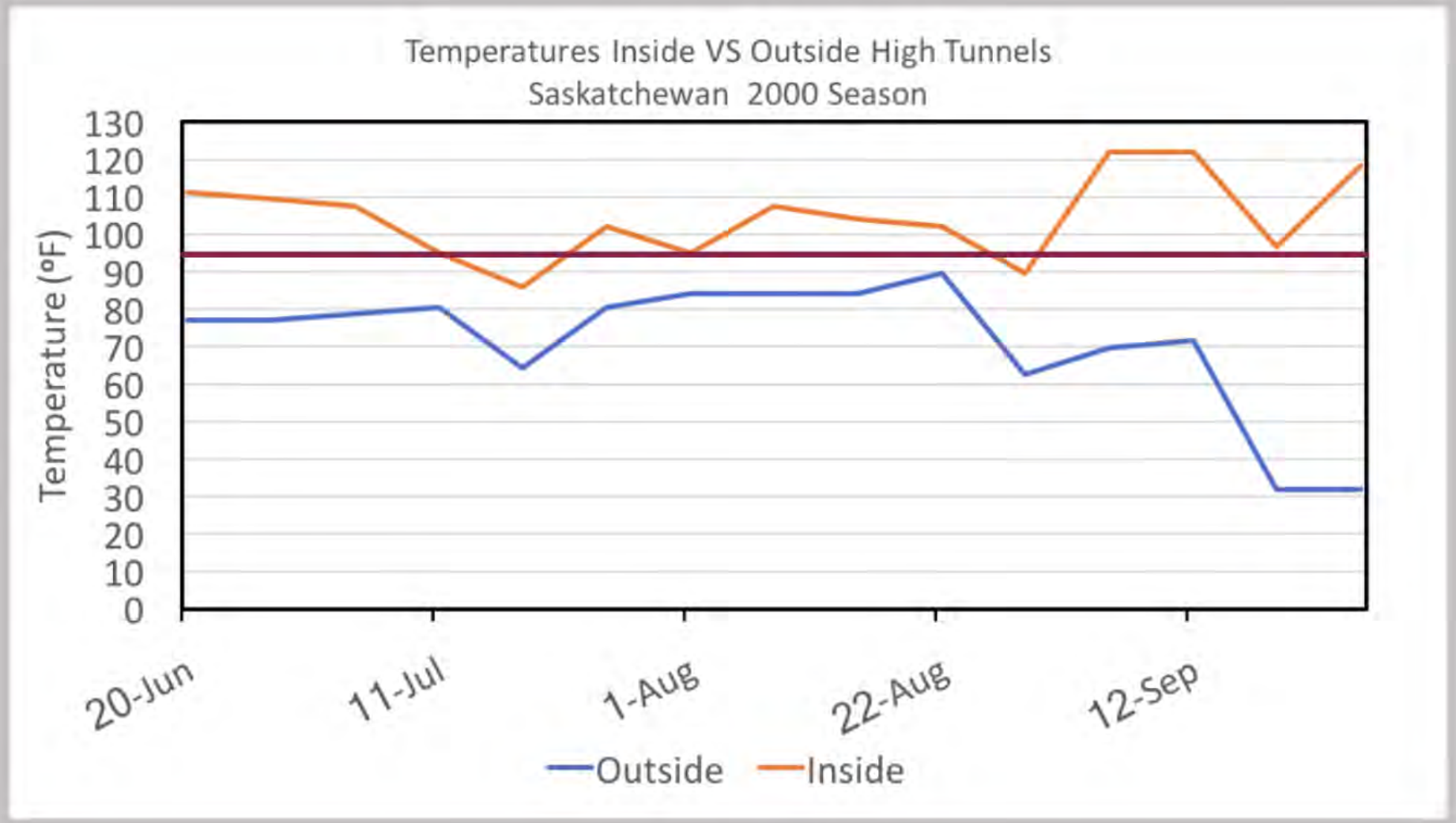
Fruiting response to temperature
Primocane blackberry



Overall:

- Fruit size negatively related to temperature
- Flower structure malformation at medium, high temperatures
- Abnormal flower structures in 41% and 98% of flowers at MT and H


Temperatures Inside VS Outside High Tunnels
Saskatchewan 2000 Season
Temperature (°F)
130
120
110
100
90
80
70
60
50
40
30
20
10
0
20-Jun
11-Jul
1-Aug
22-Aug
12-Sep
Outside
Inside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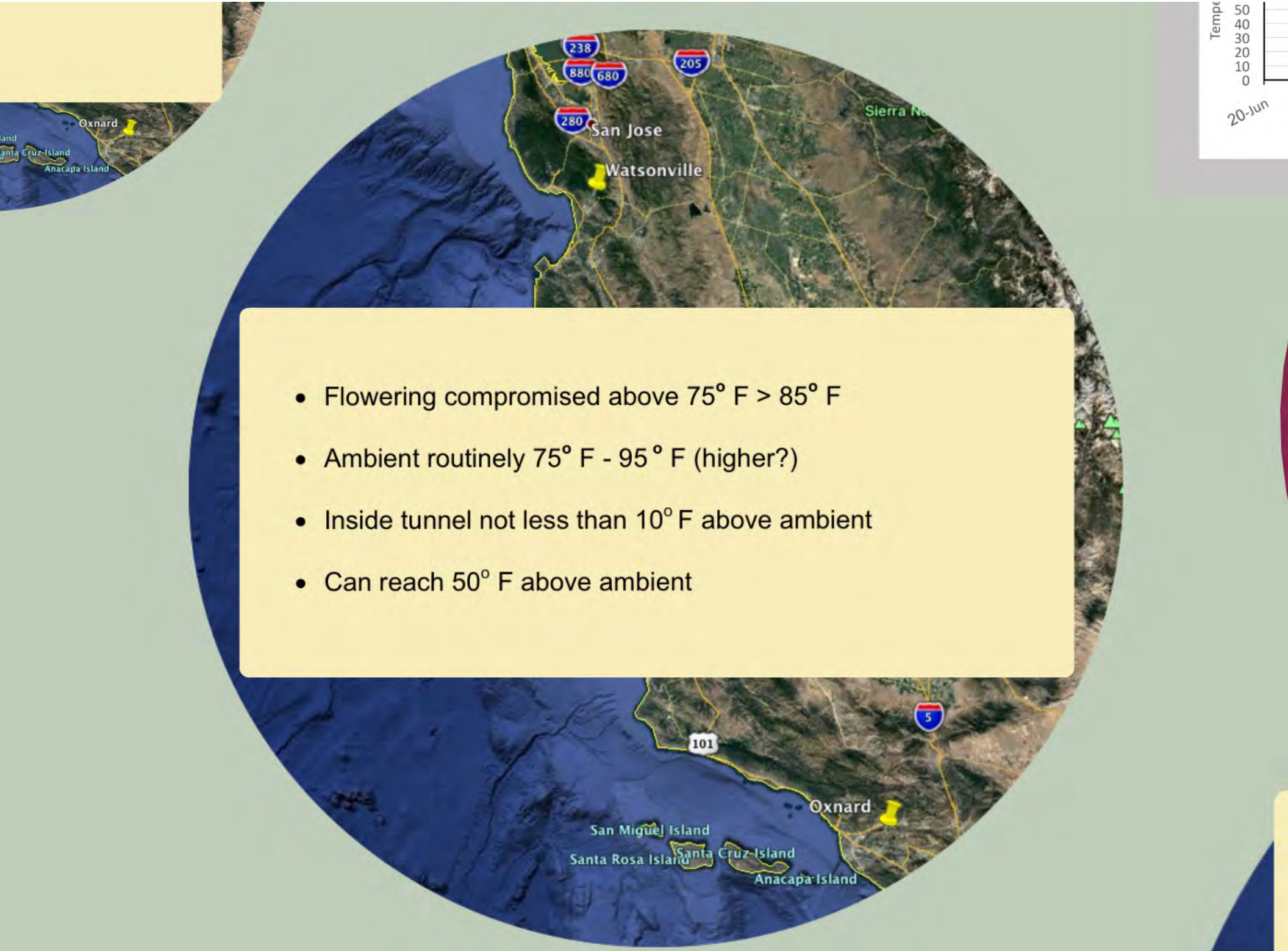
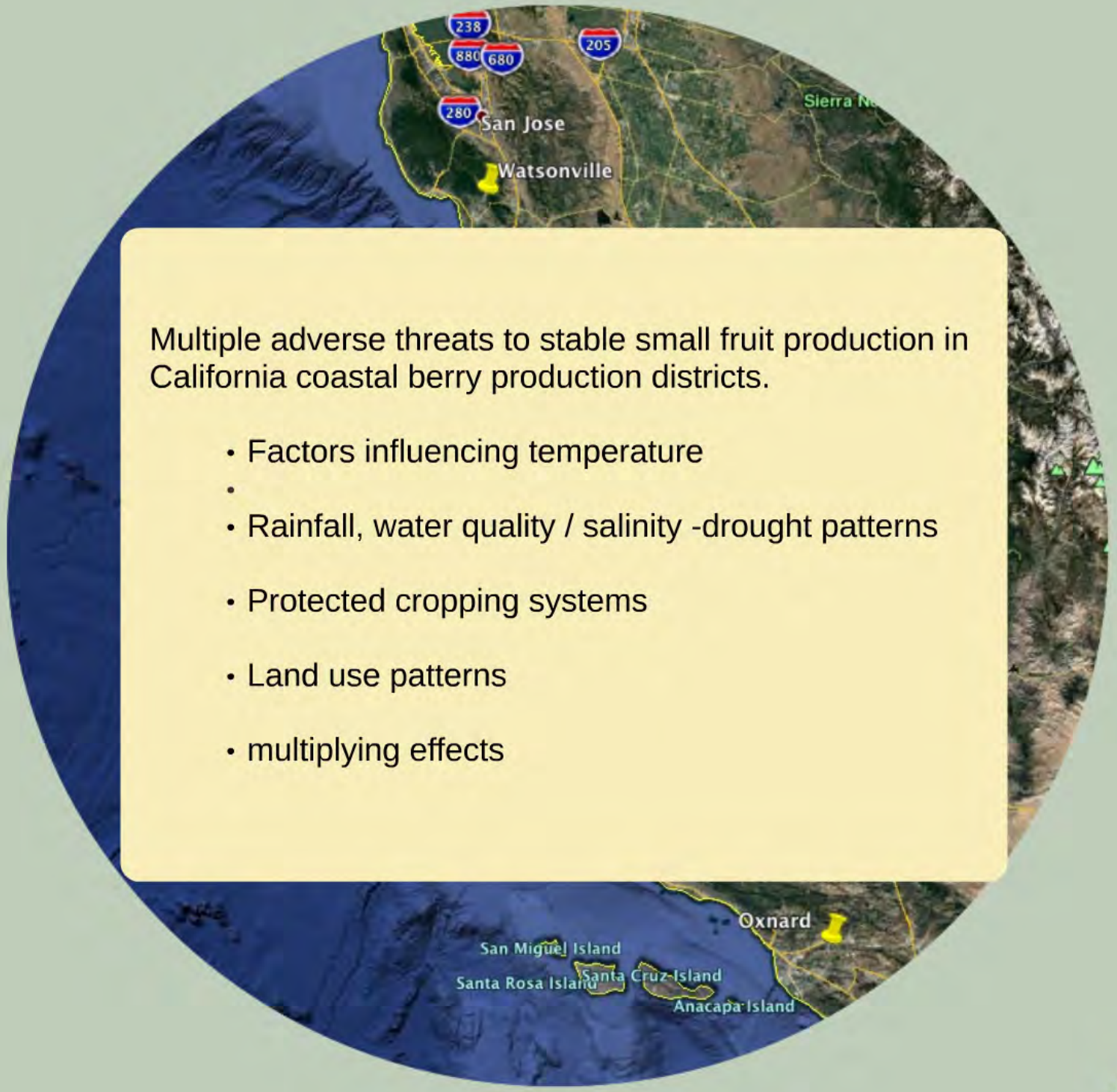
12-Sep
Outside
Inside

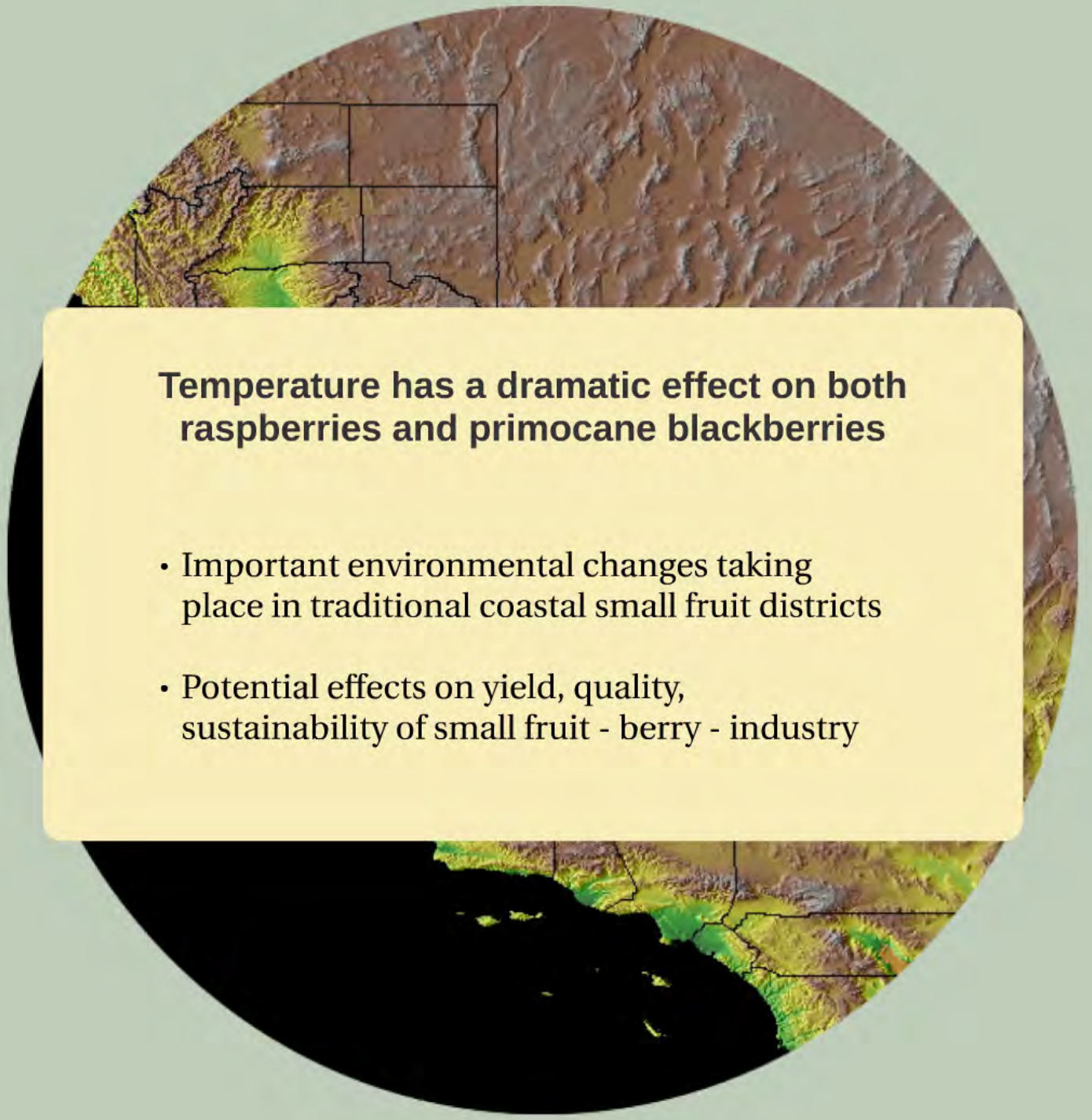


- Flowering compromised above 75° F > 85° F
- Ambient routinely 75° F - 95 ° F (higher?)
- Inside tunnel not less than 10° F above ambient
- Can reach 50° F above ambient



Multiple adverse threats to stable small fruit production in California coastal berry production districts.

- Factors influencing temperature
-
- Rainfall, water quality / salinity -drought patterns
- Protected cropping systems
- Land use patterns
- multiplying effects



Temperature has a dramatic effect on both raspberries and primocane blackberries

- Important environmental changes taking place in traditional coastal small fruit districts
- Potential effects on yield, quality, sustainability of small fruit - berry - industry

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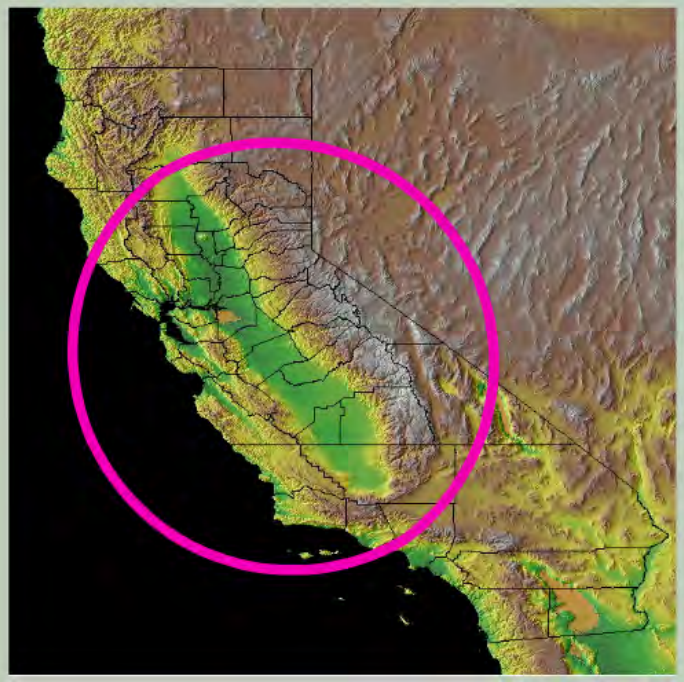

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