Change is in the Air: Agriculture in a Changing Climate

Art DeGaetano
Professor, Earth and Atmospheric Science
Director, Northeast Regional Climate Center

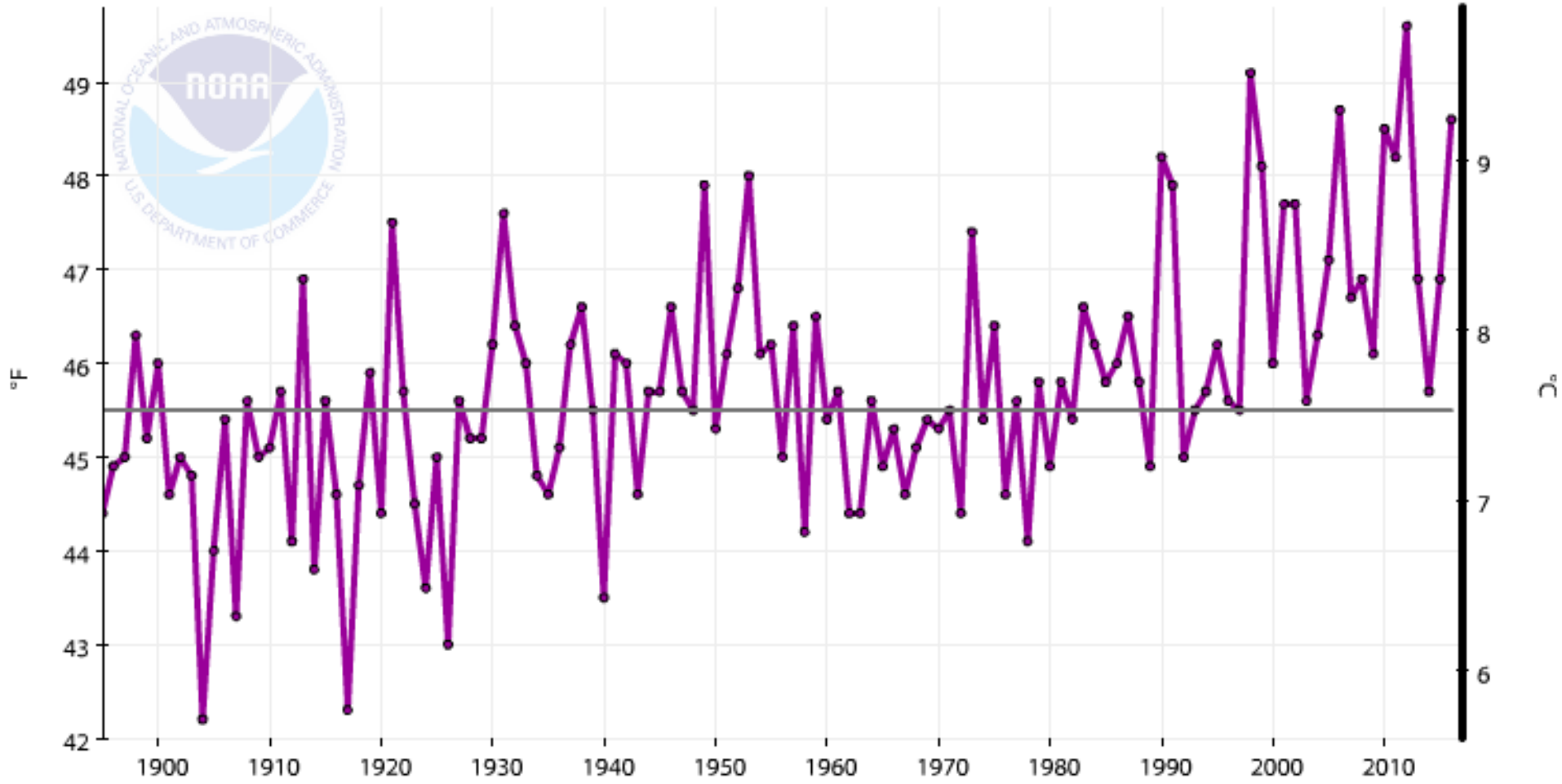
Cornell University

NRCC

Cornell University

NRCC

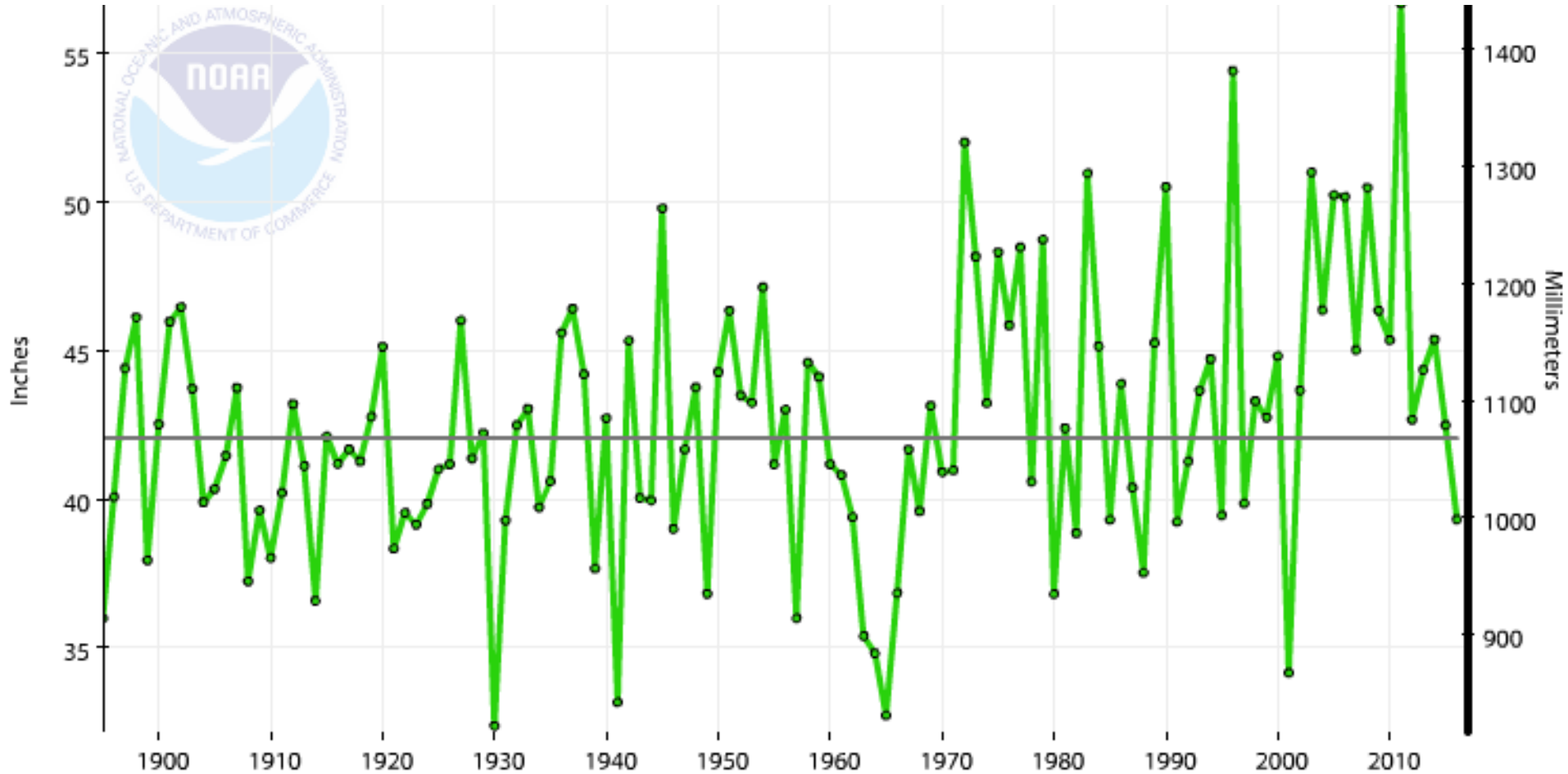
Annual Temperature Northeast U.S.



Cornell University

NRCC

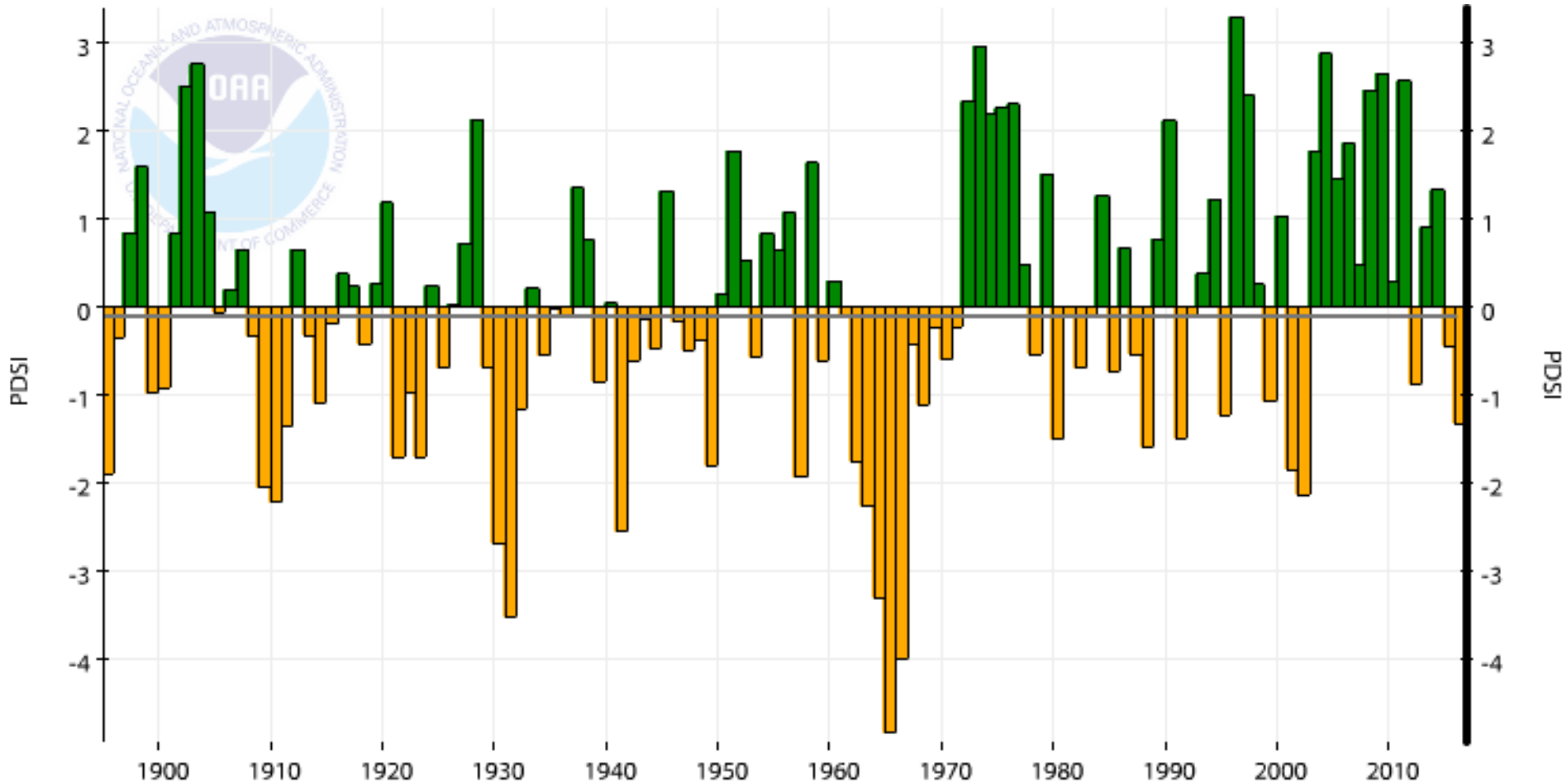
Annual Precipitation Northeast U.S.



Cornell University

NRCC

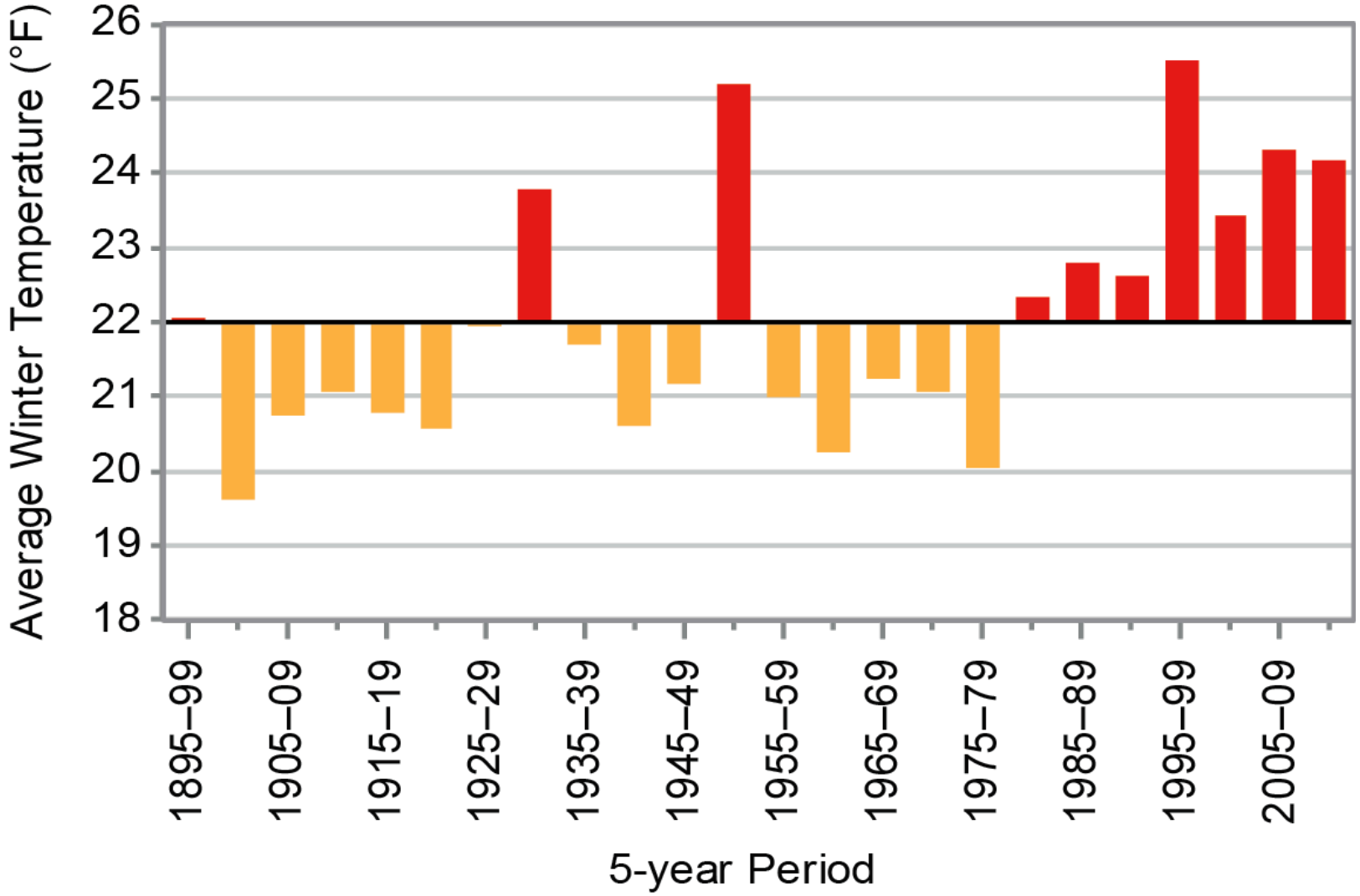
Annual PDSI Northeast U.S.



Cornell University

NRCC

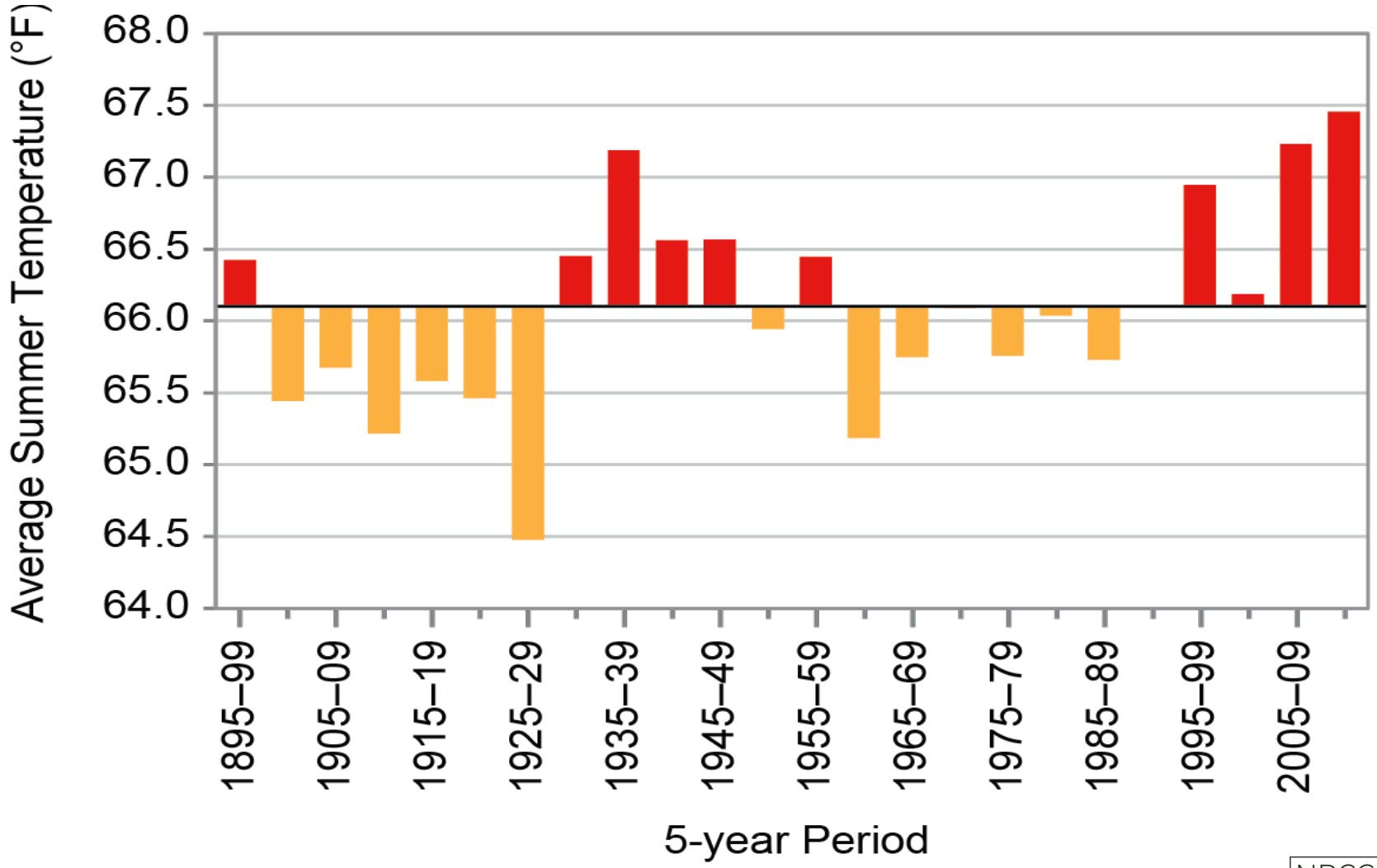
New York Winter Temperature



Cornell University

NRCC

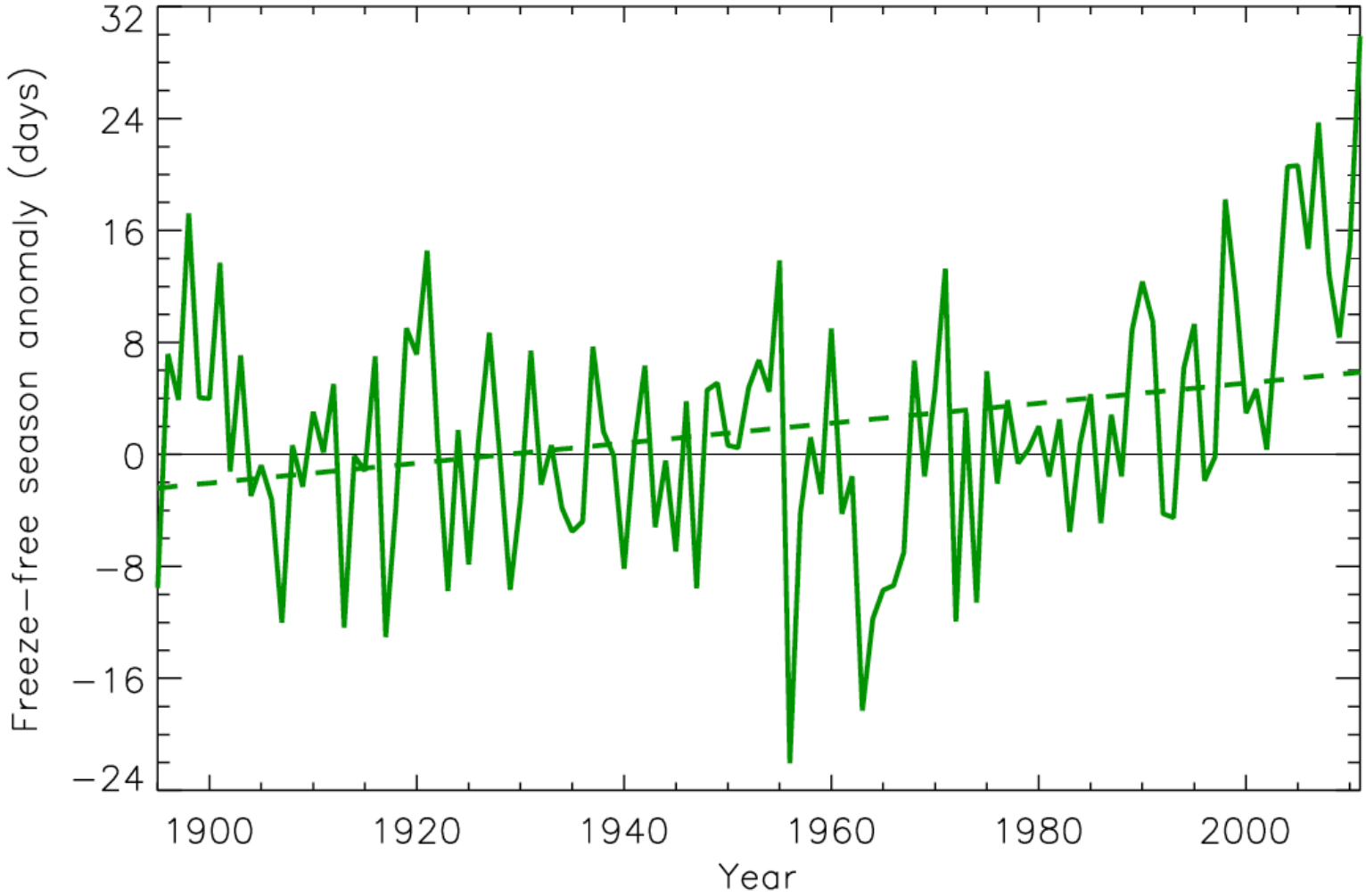
New York Summer Temperature



Cornell University

NRCC

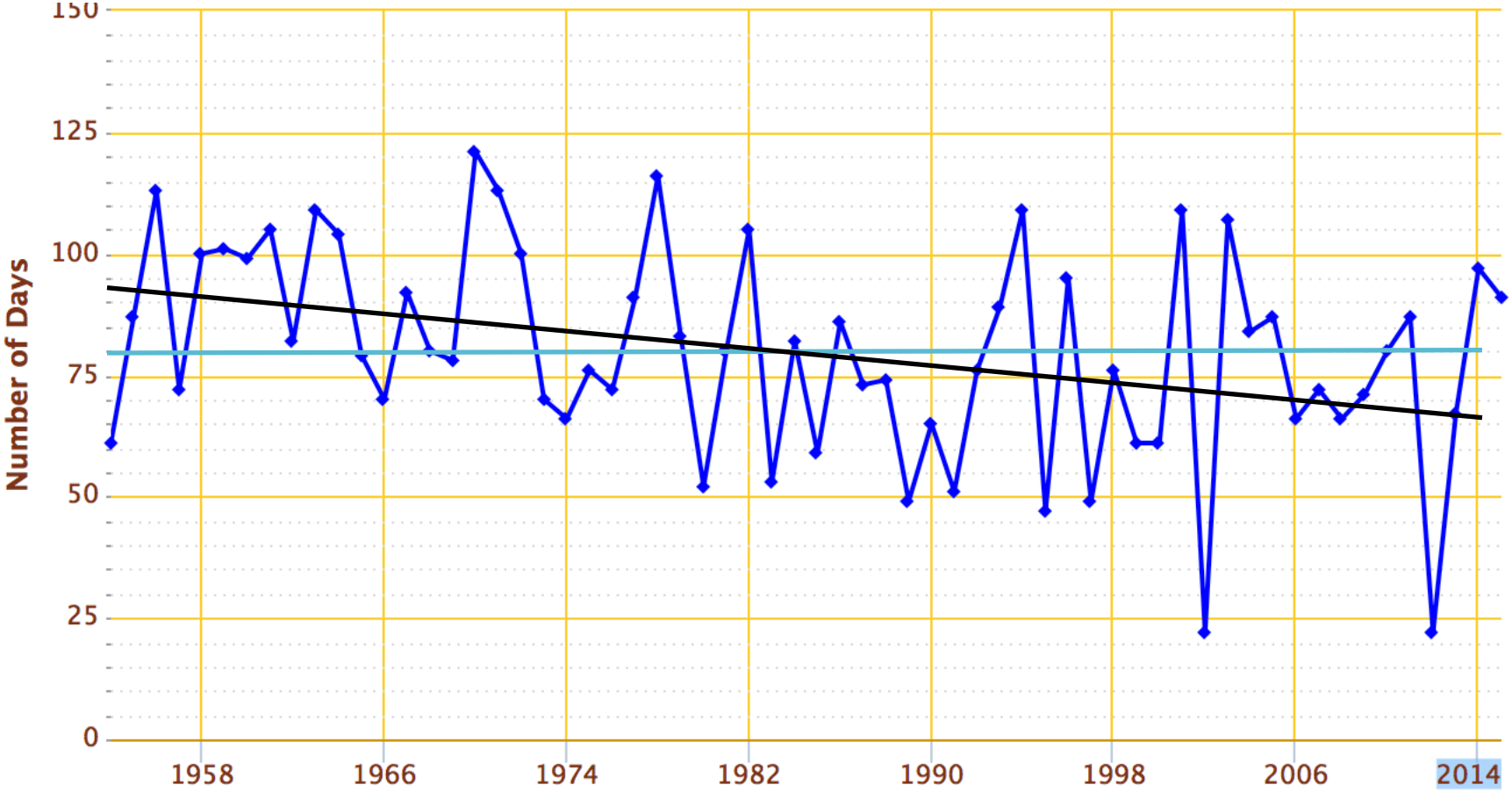
New York Frost-Free Season



Cornell University

NRCC

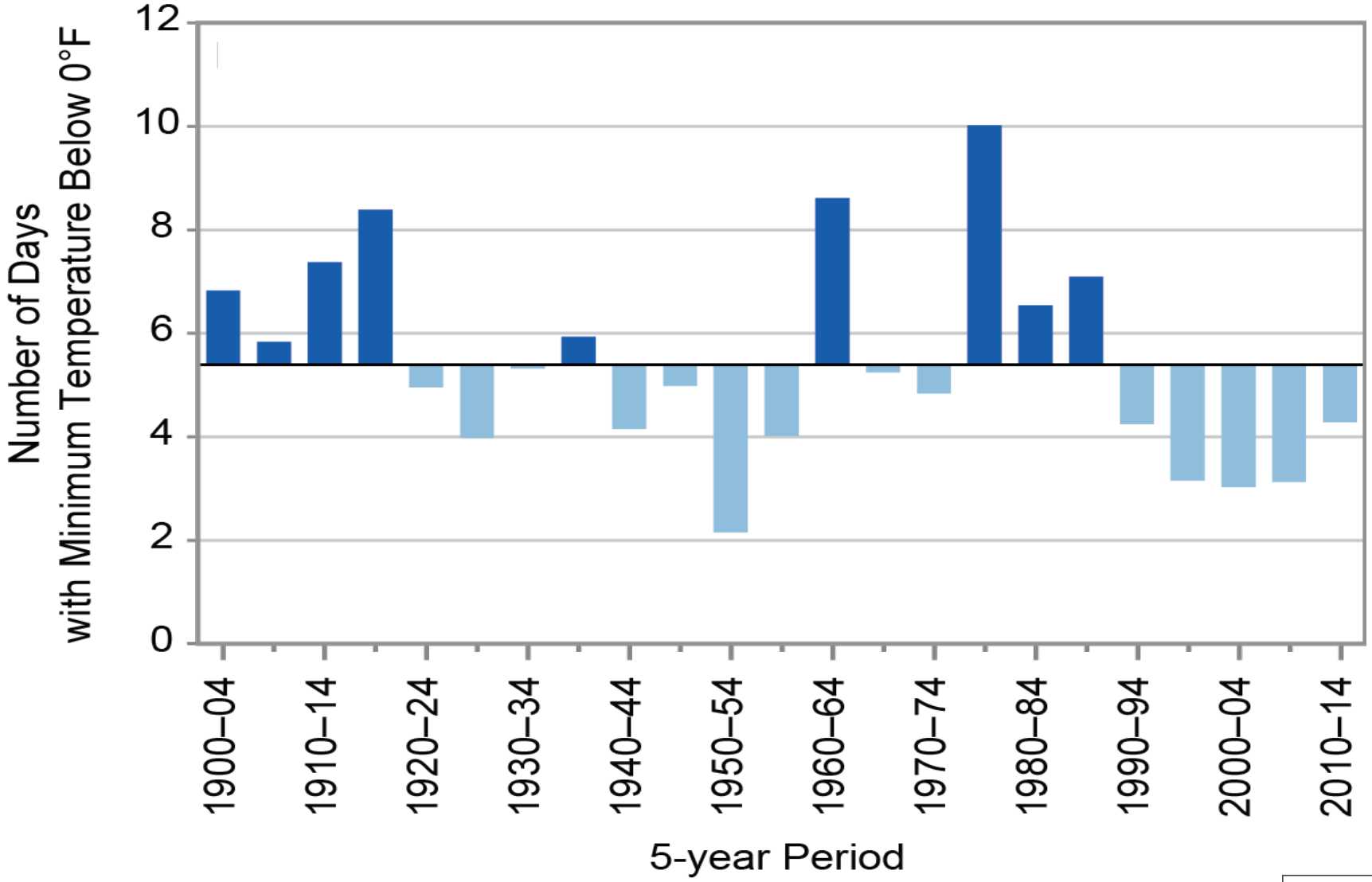
Days with Snow Cover (NY)



Cornell University

NRCC

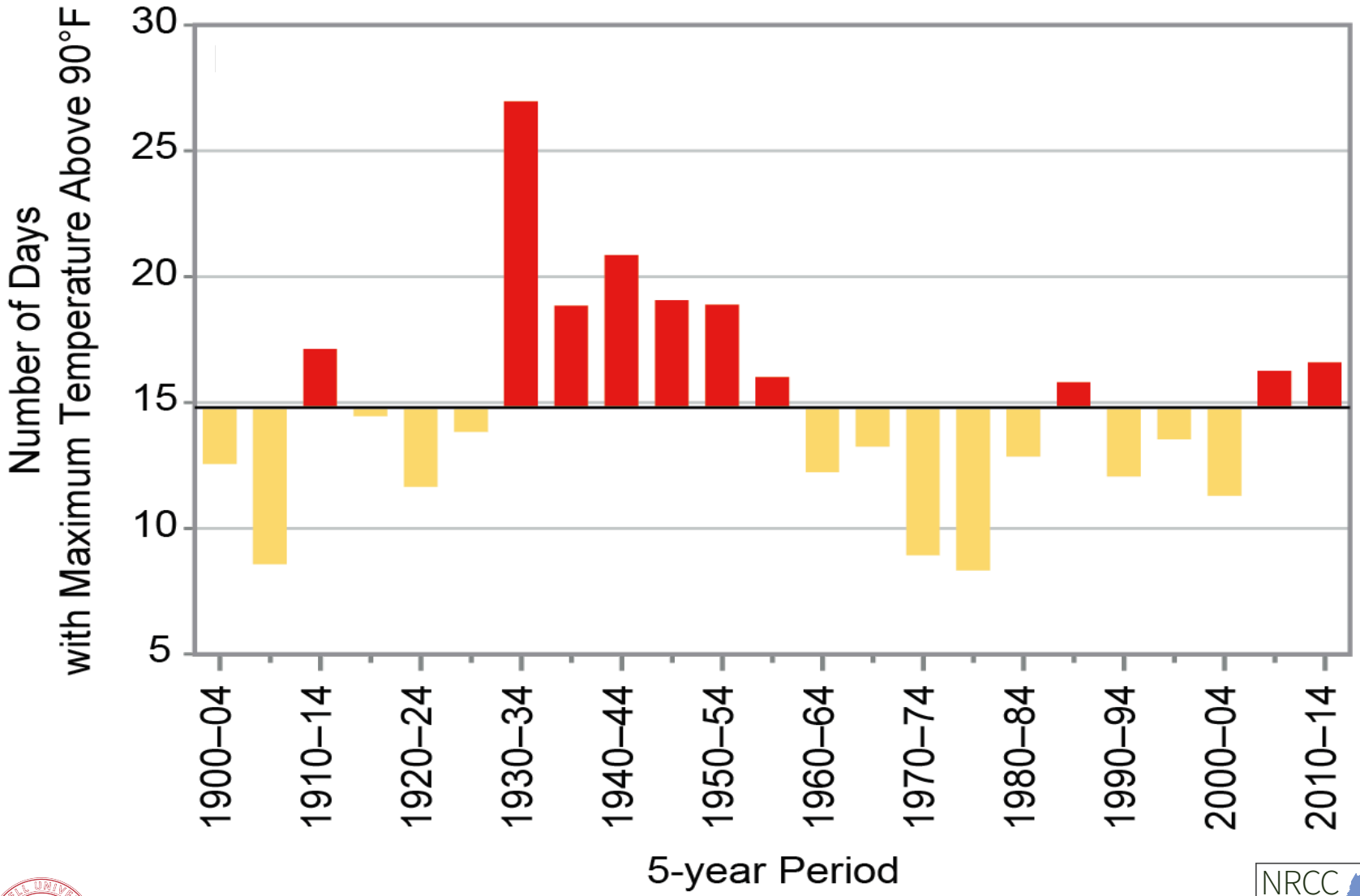
Very Cold Nights (PA)



Cornell University

NRCC

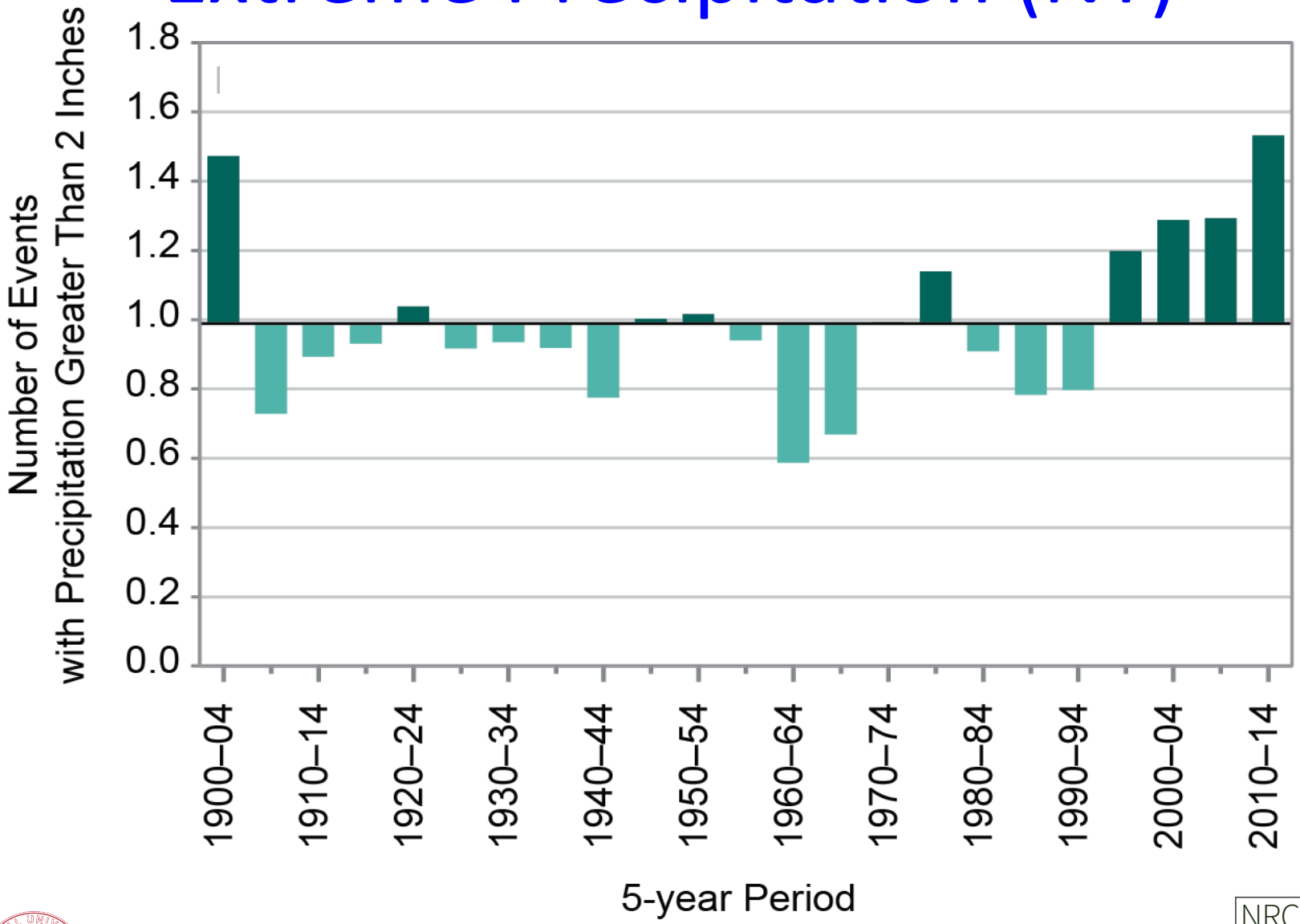
Very Hot Days (PA)



Cornell University

NRCC

Extreme Precipitation (NY)



Cornell University

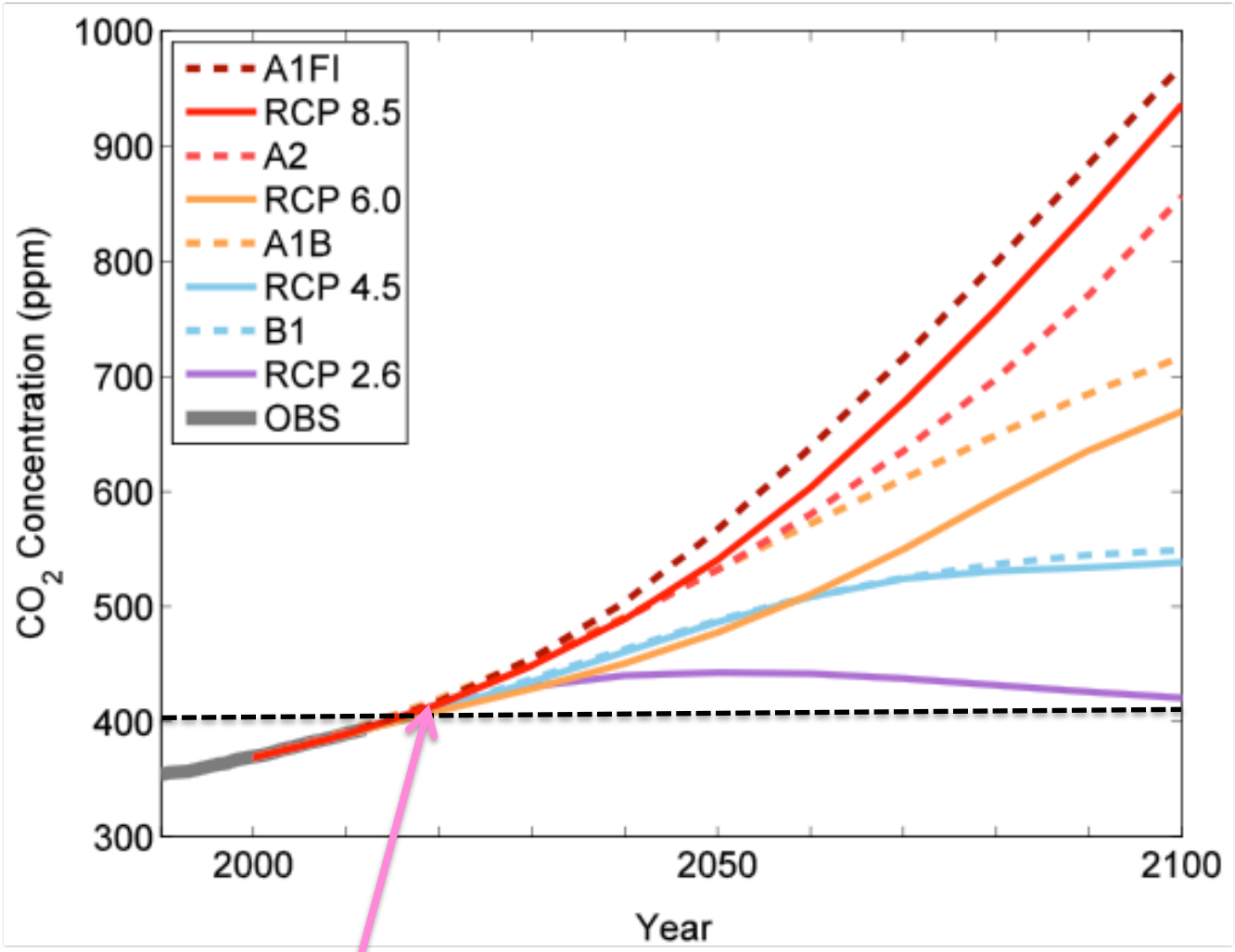
NRCC

So What Does the FUTURE Hold ?

Cornell University

NRCC

Setting the Stage

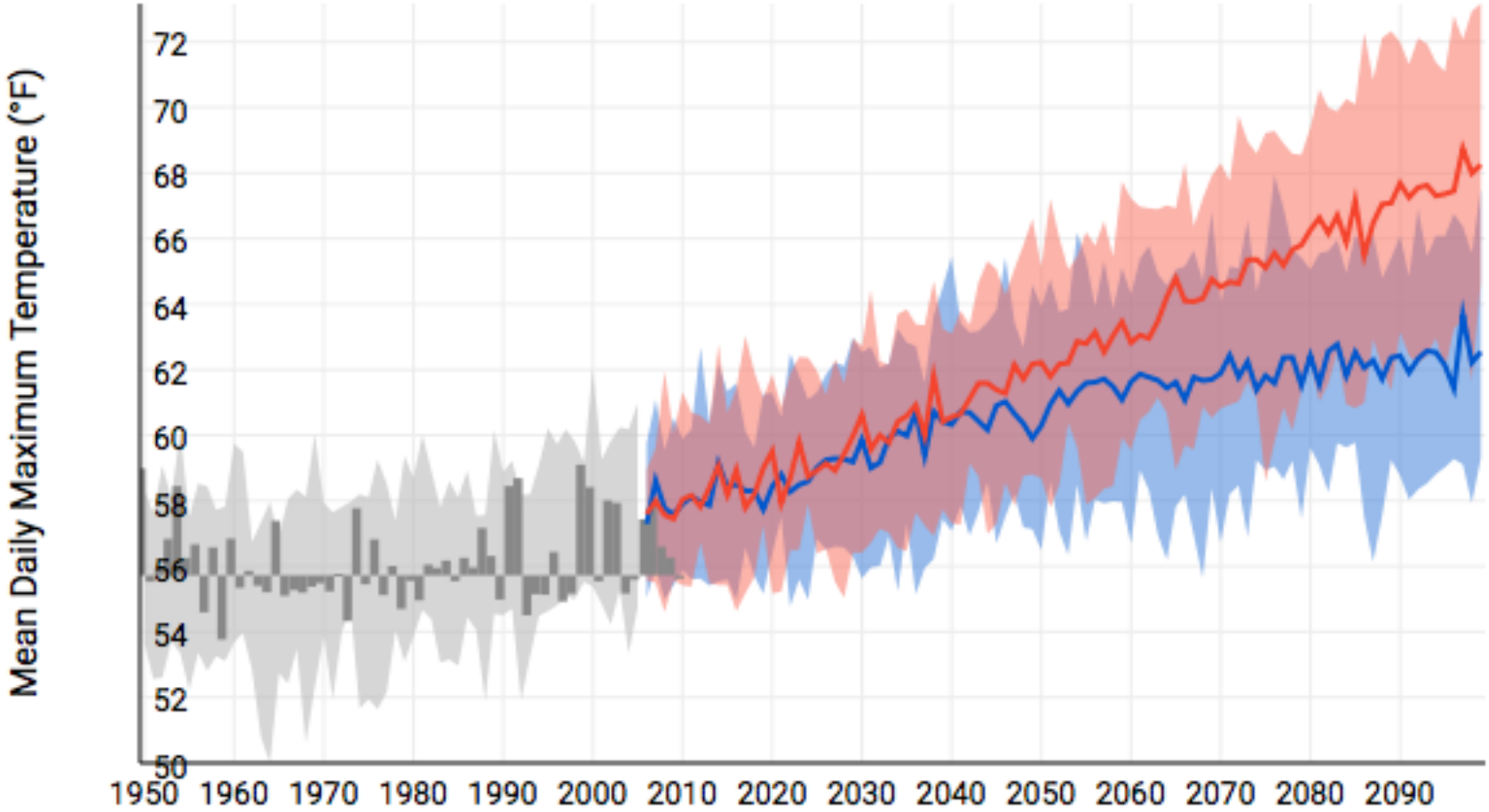


You Are Here

Cornell University

NRCC

Observed and Projected Annual Temp Onondaga County

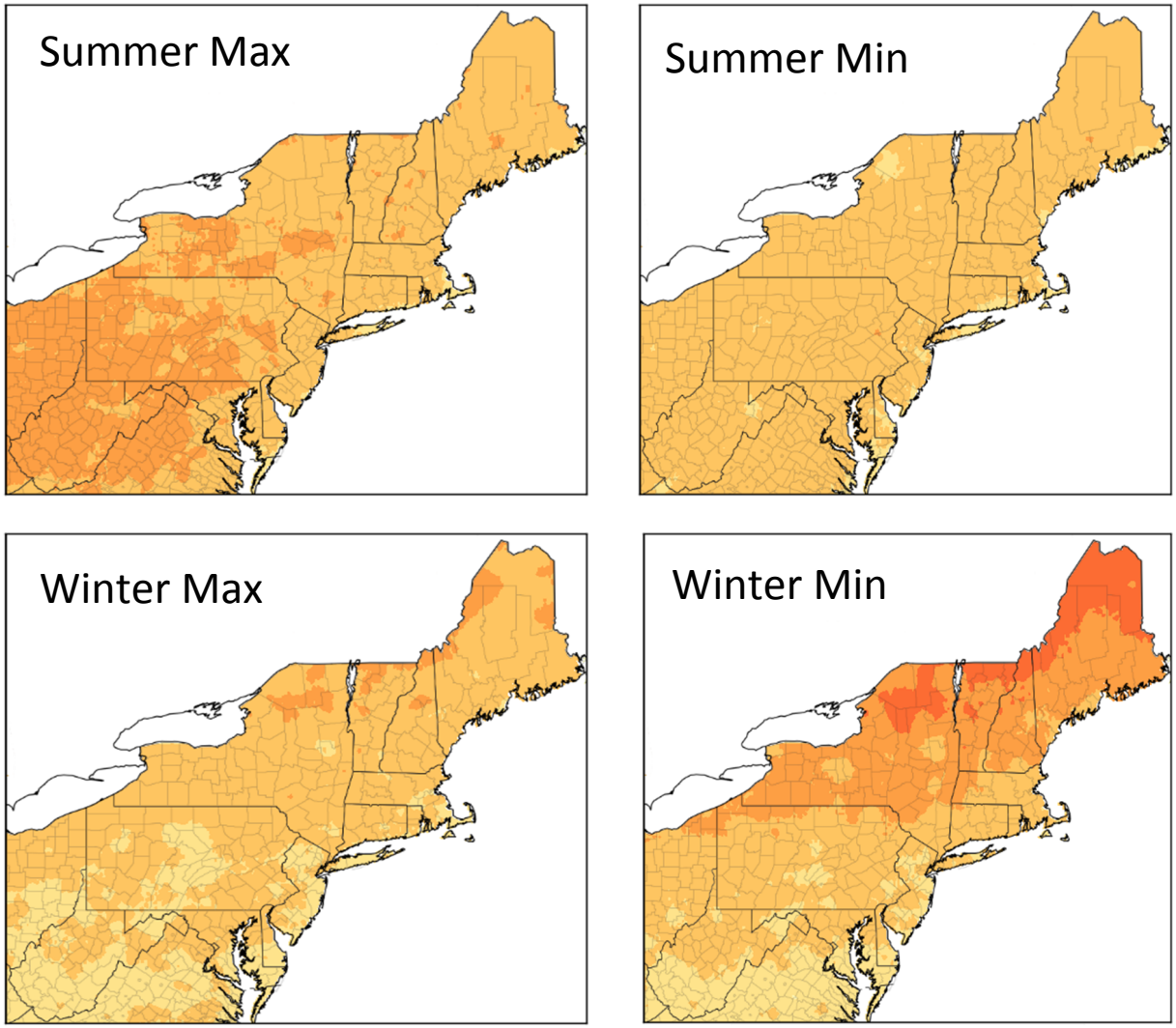


Cornell University

https://toolkit.climate.gov/climate-explorer2/

NRCC

2040-2069 High Emission

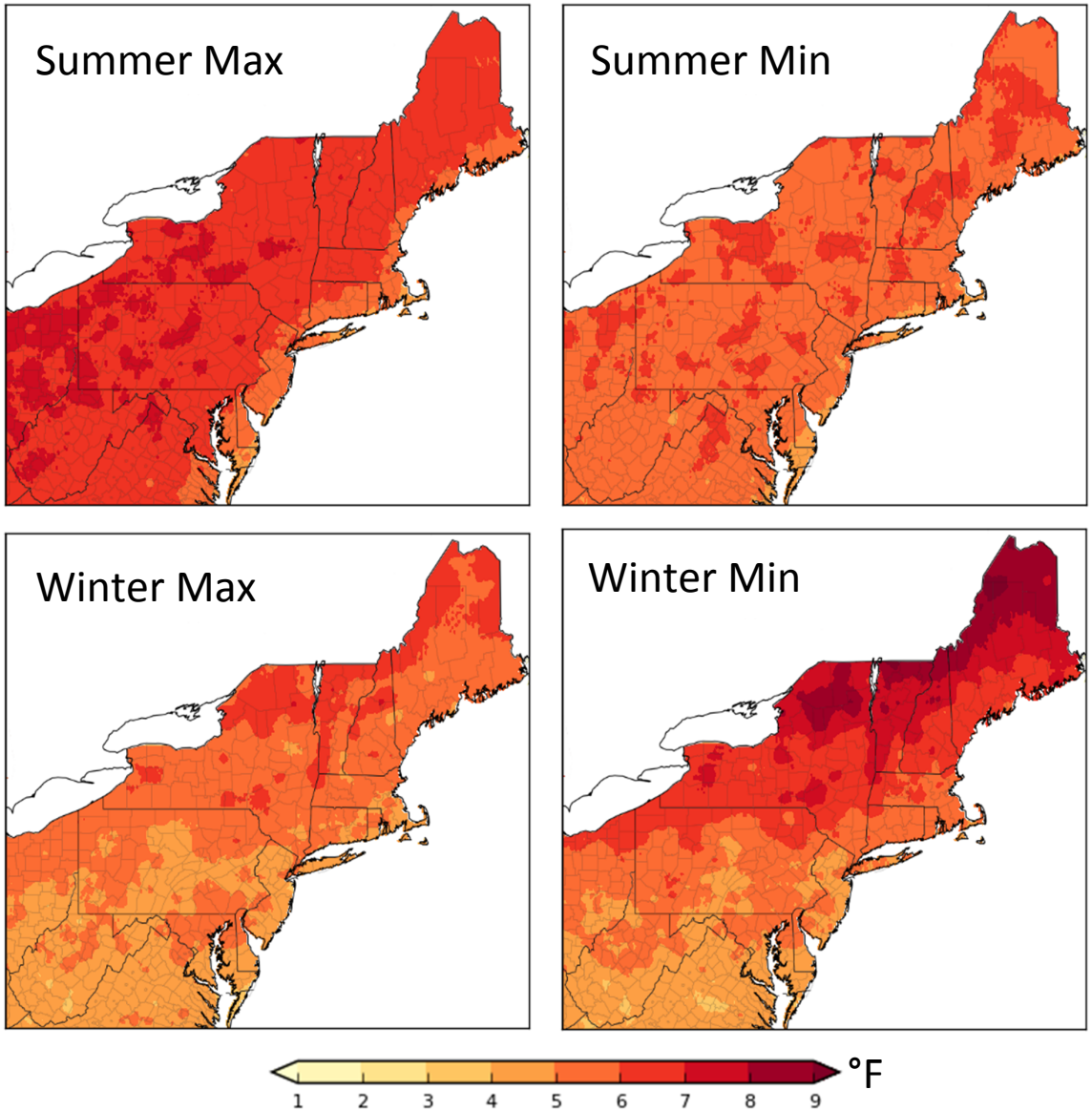


Difference from 1979-2008

Cornell University

NRCC

2070-2099 High Emission

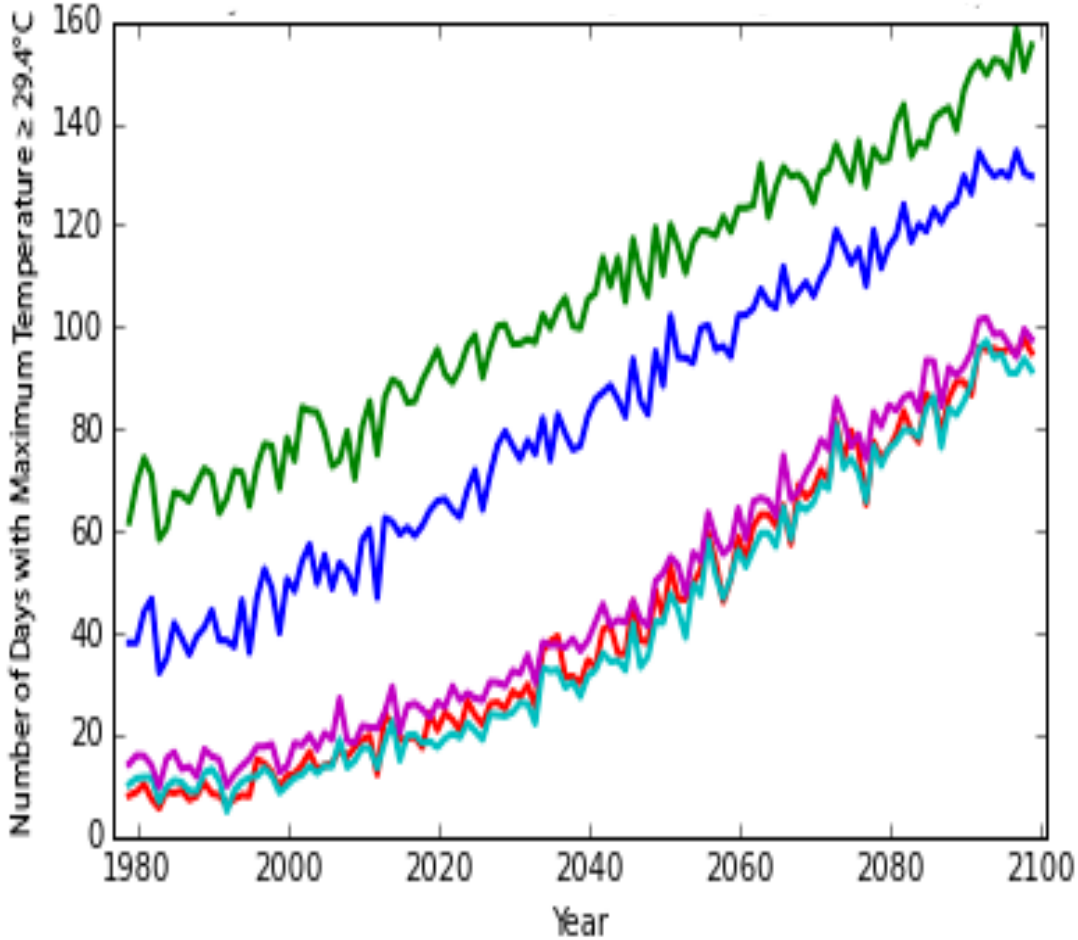


Difference from 1979-2008

Cornell University

NRCC

Days with Max > 85°F High Emissions



Cornell University

NRCC

Impact on Dairy Production

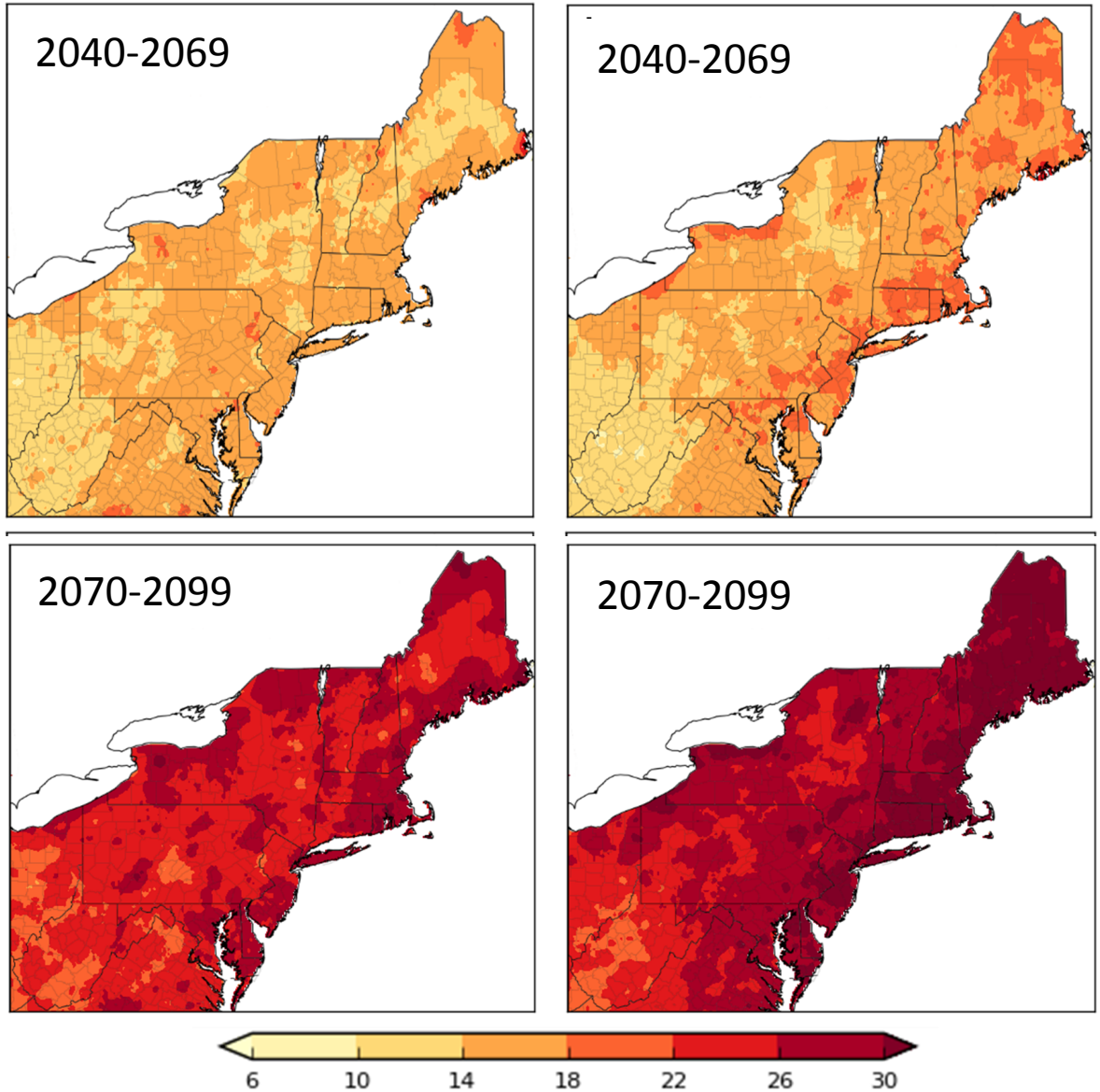
Item	Historical	2050 RCP4.5	2050 RCP8.5	2100 RCP4.5	2100 RCP8.5
Temperature (April-October), °C					
Average maximum	24.3	28.2	28.9	28.6	30.8
Relative average humidity, %					
Average minimum	48.7	47.8	46.8	47.5	45.9
Days with average maximum temperature ≥ 25°C	67	102	111	112	130
Additional milk loss, t/year	-	75,258	111,740	105,124	286,041
As % of projected milk production[2]	-	0.38	0.40	0.53	1.02
Additional economic loss,[3] $1,000/year	-	33,113	49,166	46,255	125,858
Economic loss, $/cow/year	-	23	35	33	88

Hristov, A.N., DeGaetano, A.T., Rotz, C.A. et al. Climate Change Effects on Livestock in the Northeast US and Strategies for Adaptation, *Climatic Change* (2017). https://doi.org/10.1007/s10584-017-2023-z

Cornell University

NRCC

Last Spring - First Fall 32°F



Cornell U

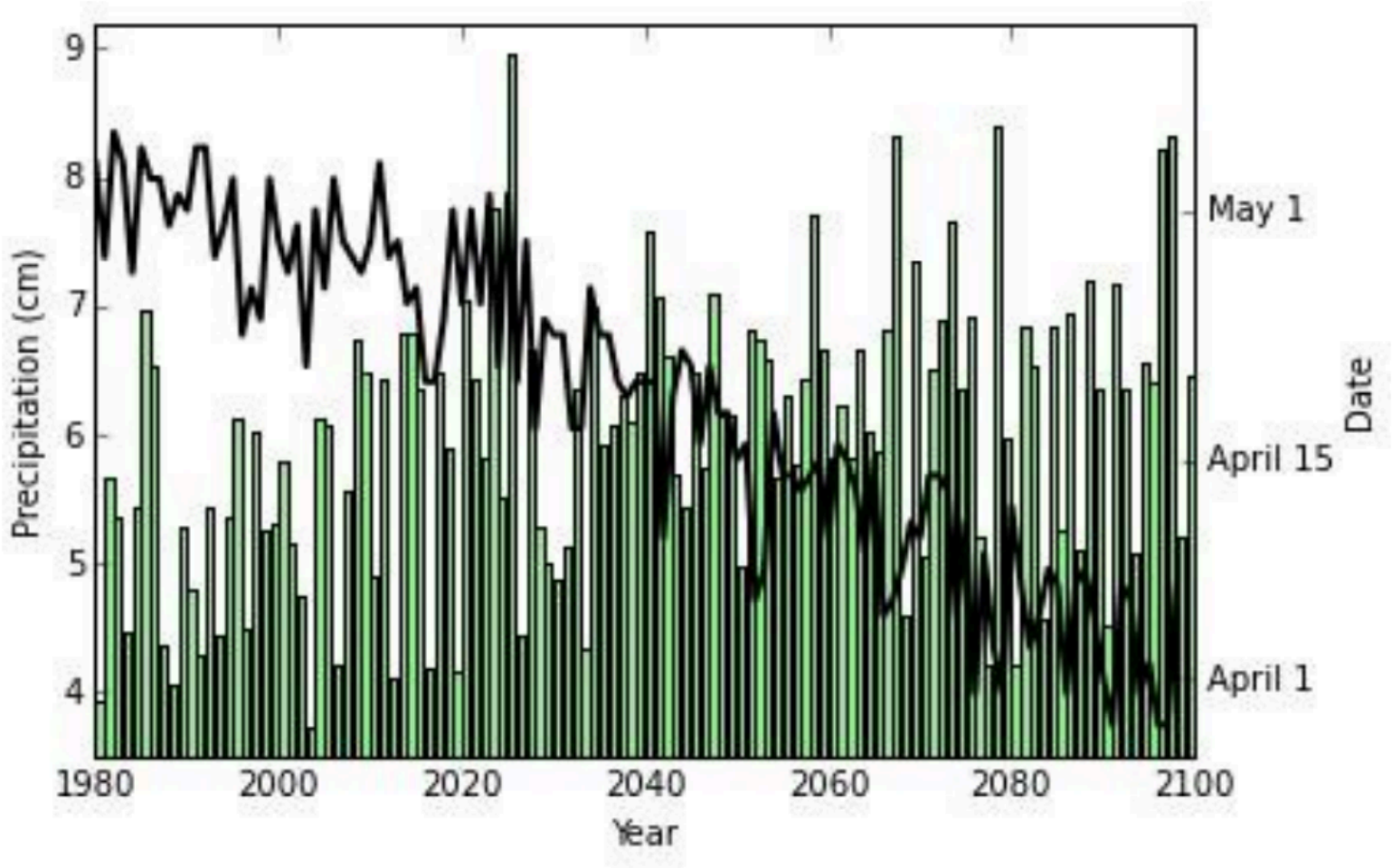
NRCC

Implications for Agriculture

- ✓ Earlier Insect Appearance
- ✓ Additional Insect Generations
- ✓ Earlier Weed Appearance
- ✓ Accelerated Crop Development
- ✓ Enhanced Heat Stress

- ✓ Extended Management Season
- ✓ New Pest/Weeds

Precip 3 Weeks Prior to Last Frost



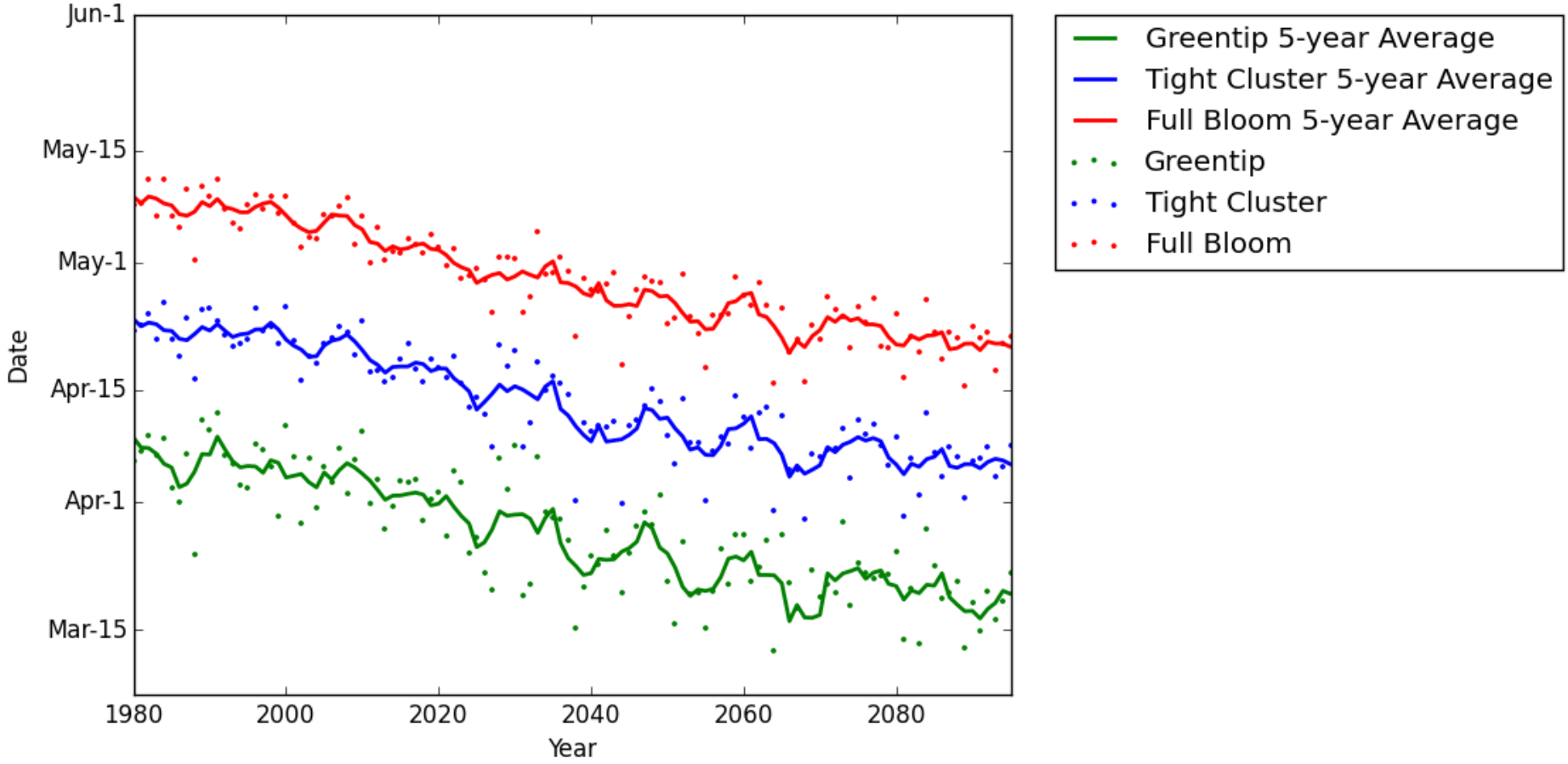
Cornell University

NRCC

Implications for Agriculture

- ✓ Despite extended season and warmer springs….will fields be workable?

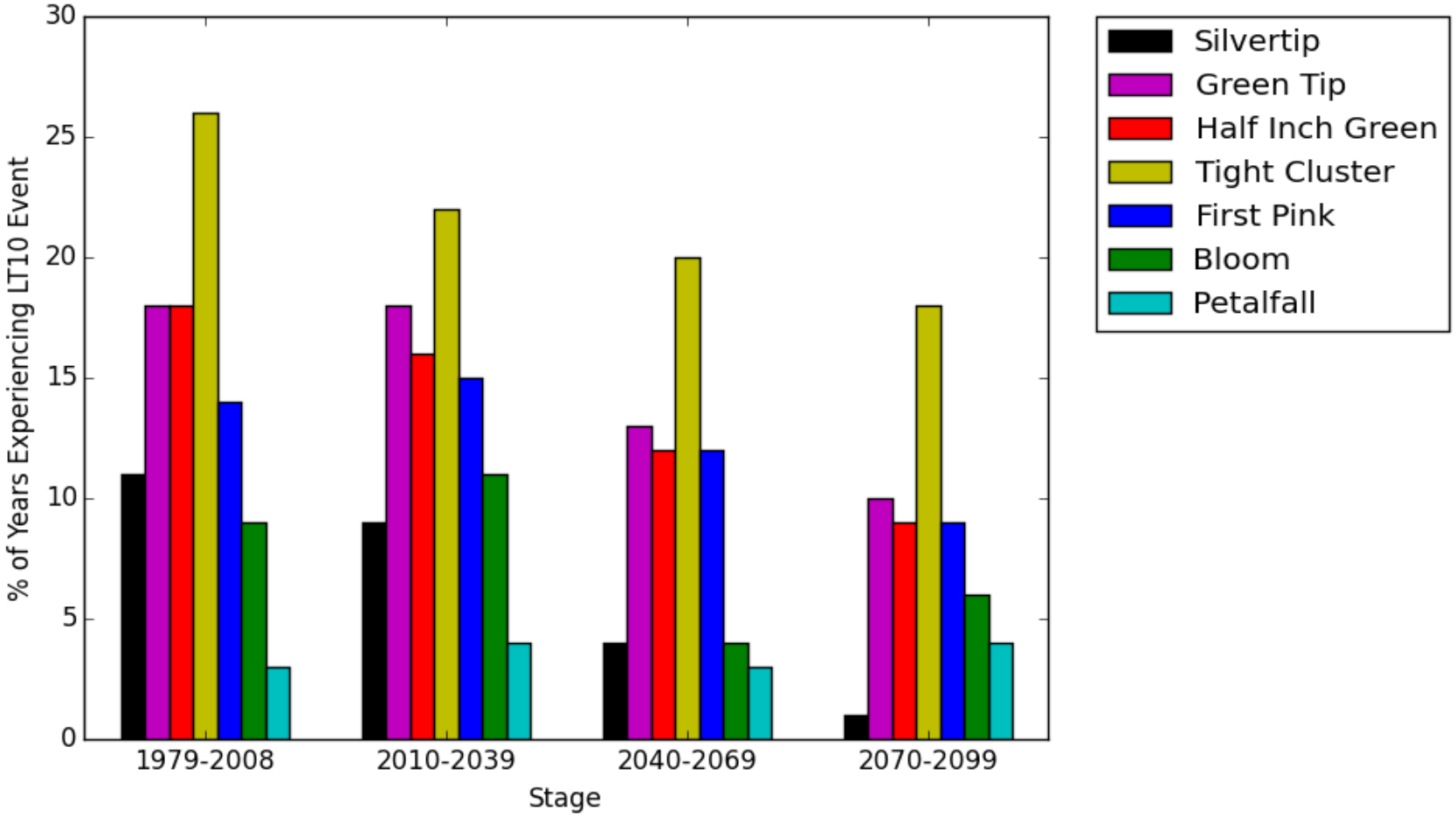
Apple Phenology Dates



Cornell University

NRCC

Apple Blossom Freeze Risk



Cornell University

NRCC

Implications for Agriculture

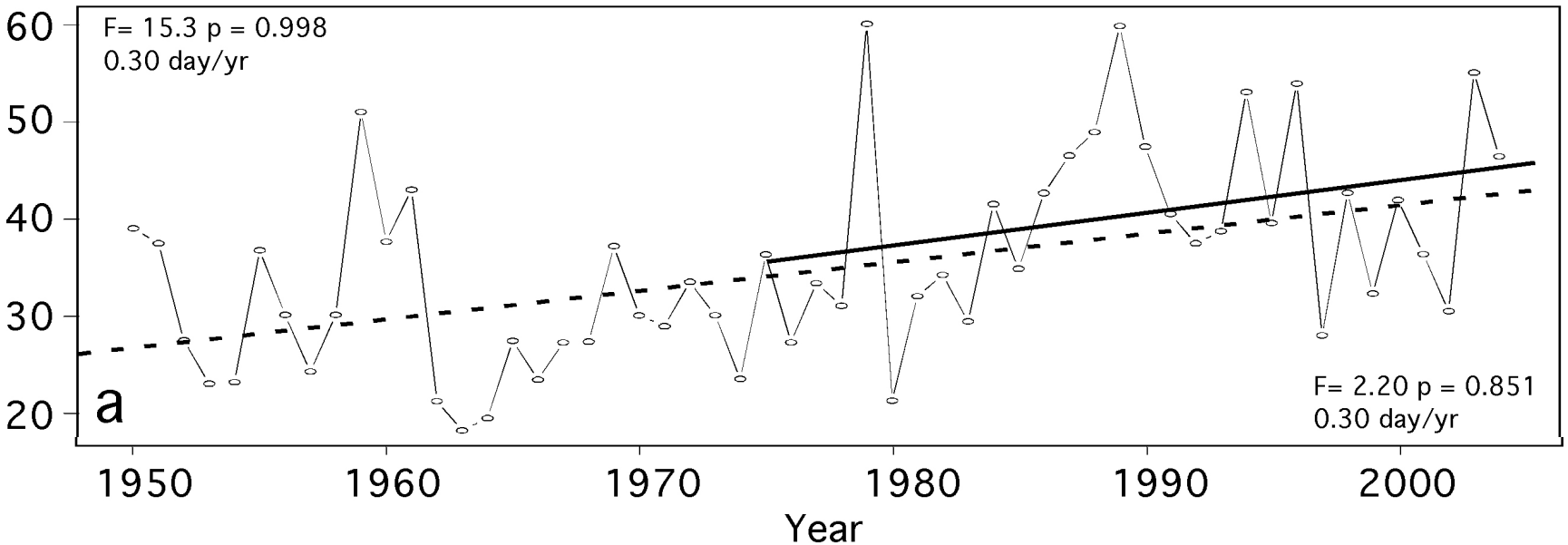
- ✓ Spring Freeze Risk does not appear to increase in the long term

- ✓ Some indication of increased risk in the short term

Cornell University

NRCC

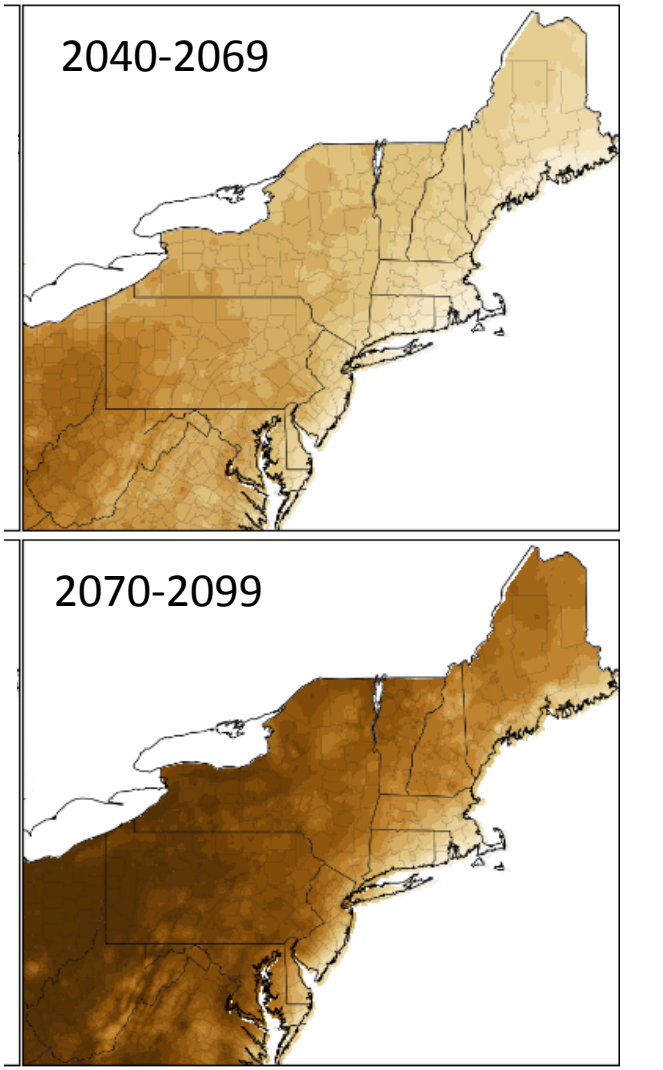
Modeled Dollar Spot Risk



Cornell University

NRCC

Summer RH High Emissions

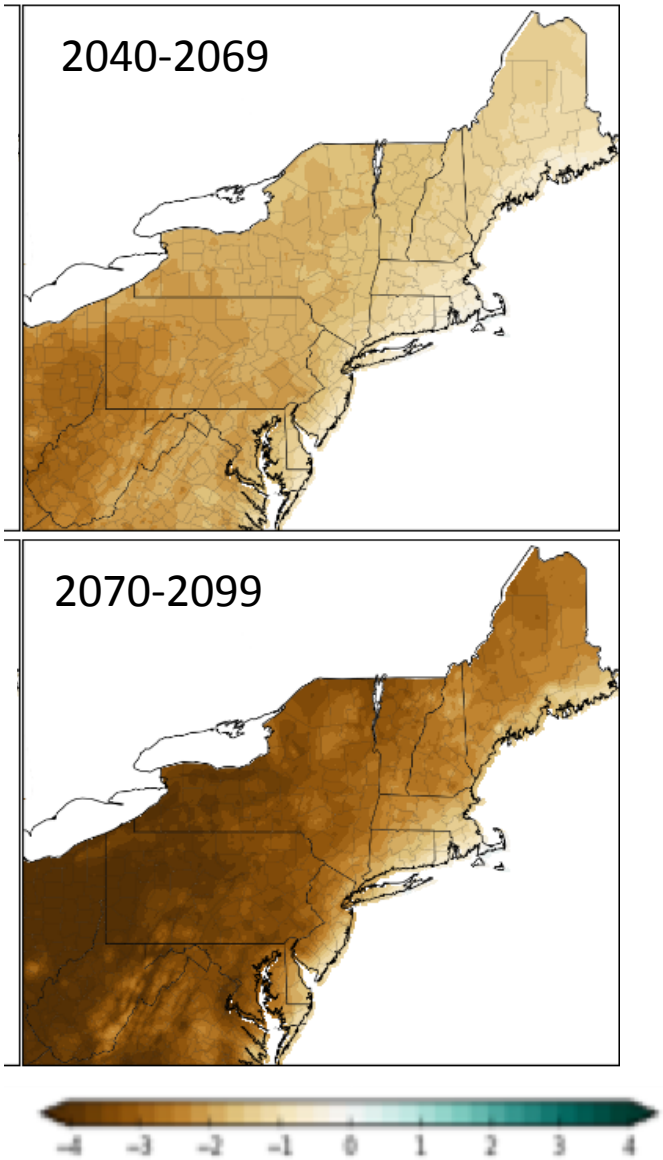


Cornell University

NRCC

Summer RH High Emissions

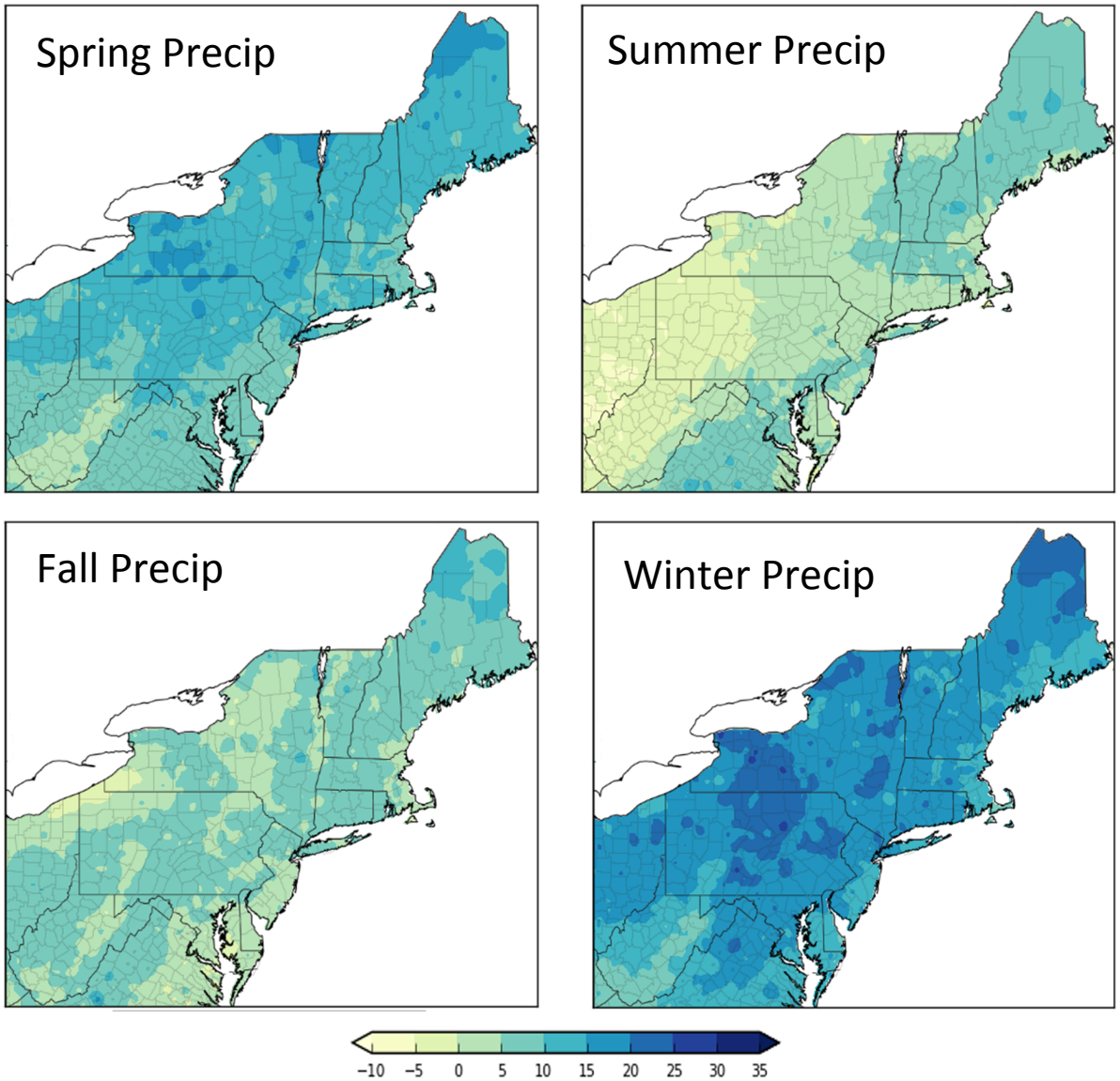
Temper Summer Disease that Occurrence that Requires Leaf Wetness?



Cornell University

NRCC

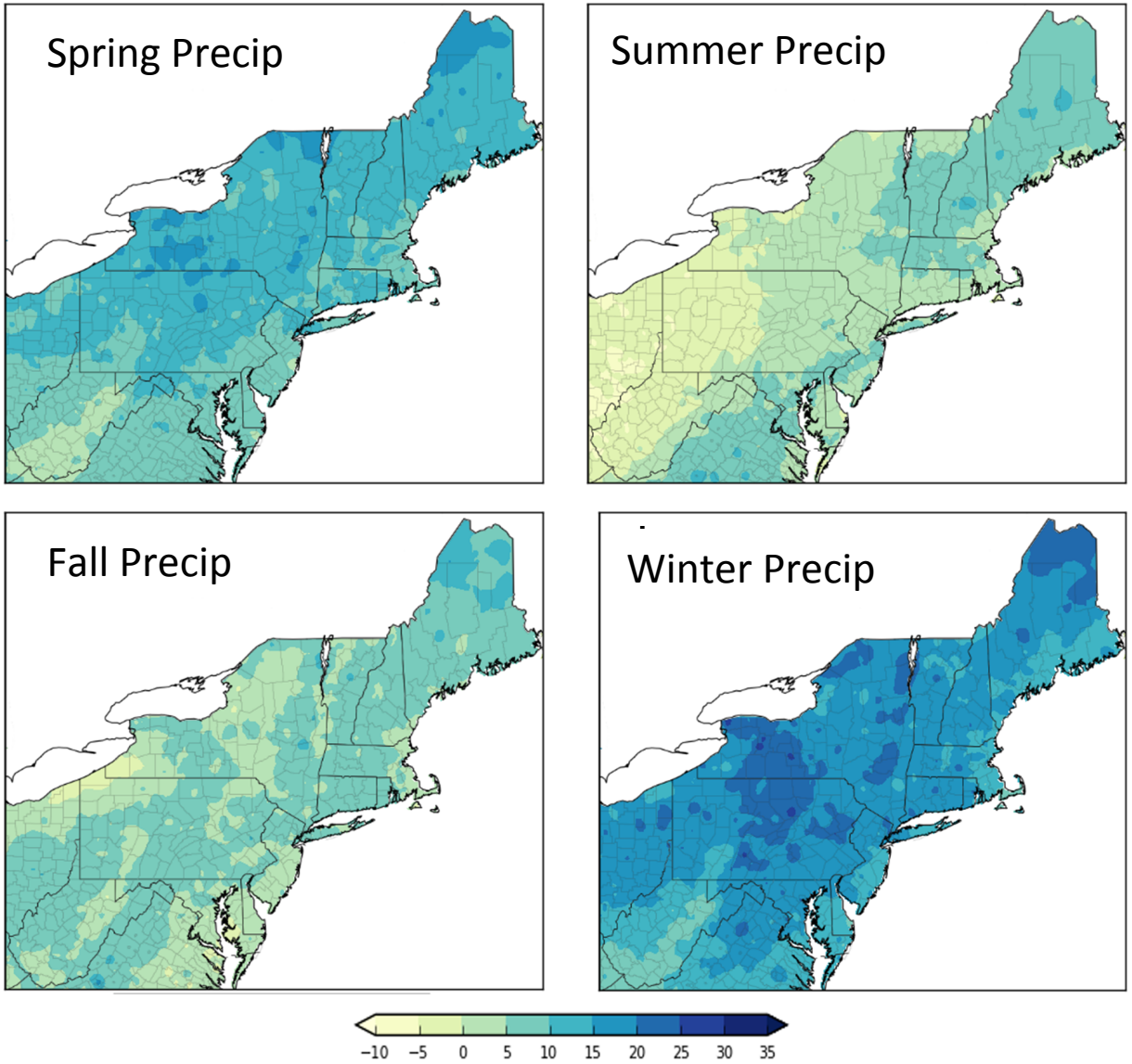
2040-2069 High Emission



Cornell University

NRCC

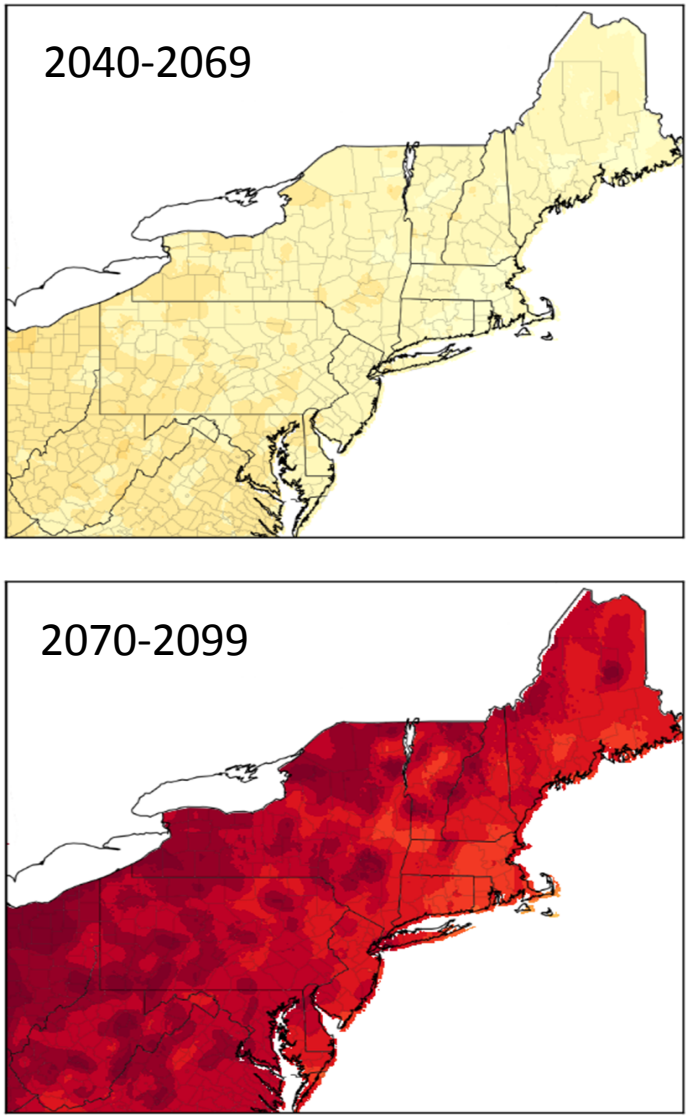
2070-2099 High Emission



Cornell University

NRCC

Summer Potential Evap High Emission



Cornell University

NRCC

Implications for Agriculture

Summer/Fall Precipitation projected to be less or steady

Summer ET increases

✓ Increased need for irrigation. Think last summer!

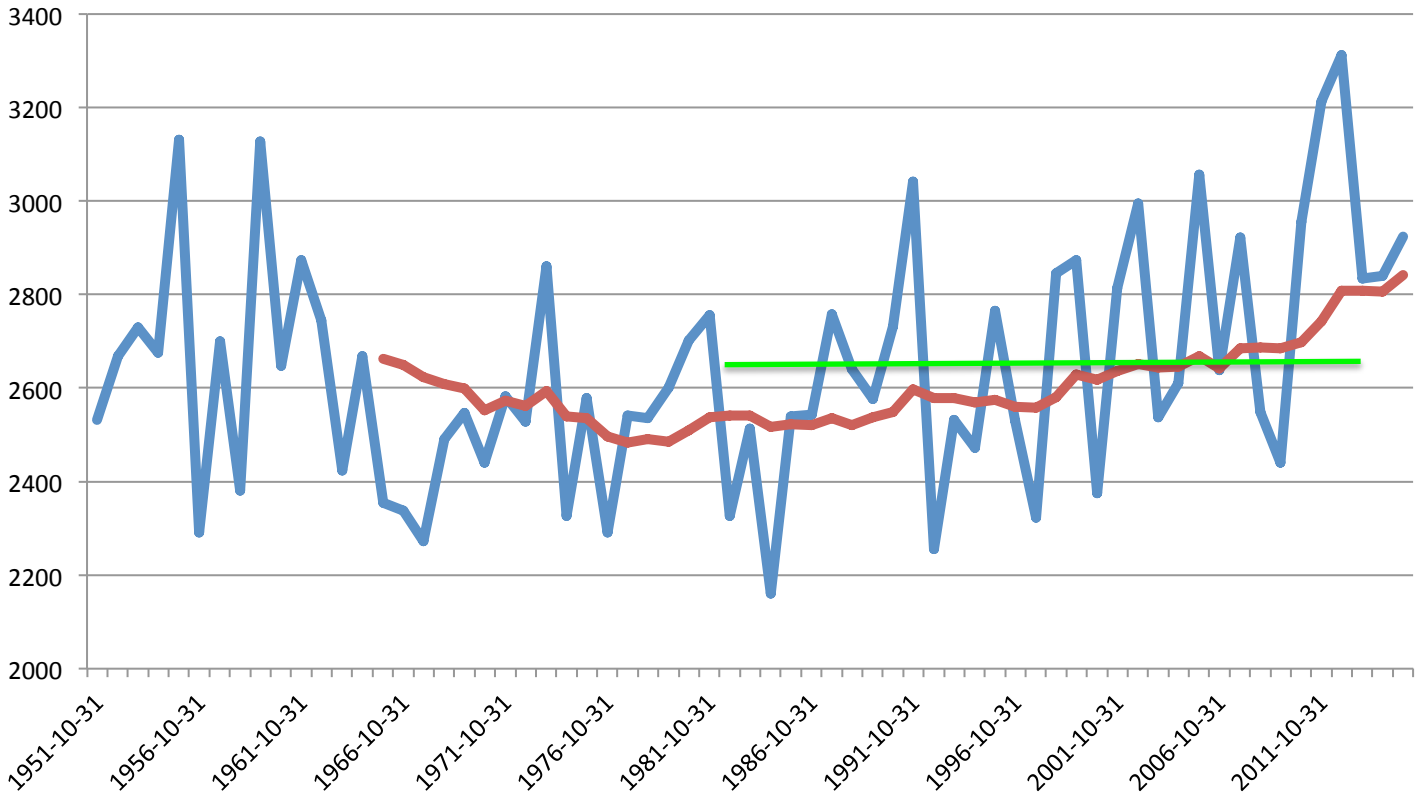
Cornell University

NRCC

Effective Agricultural Management in a Changing Climate

- ✓ Realize the climate is changing
- ✓ Recognize that many practices are really based on the historical climate
- ✓ Use all the data and info that are available to maximize the ability to adapt to the changing climate

Rethink the convention of 30-years defining "normal" climate



Cornell University

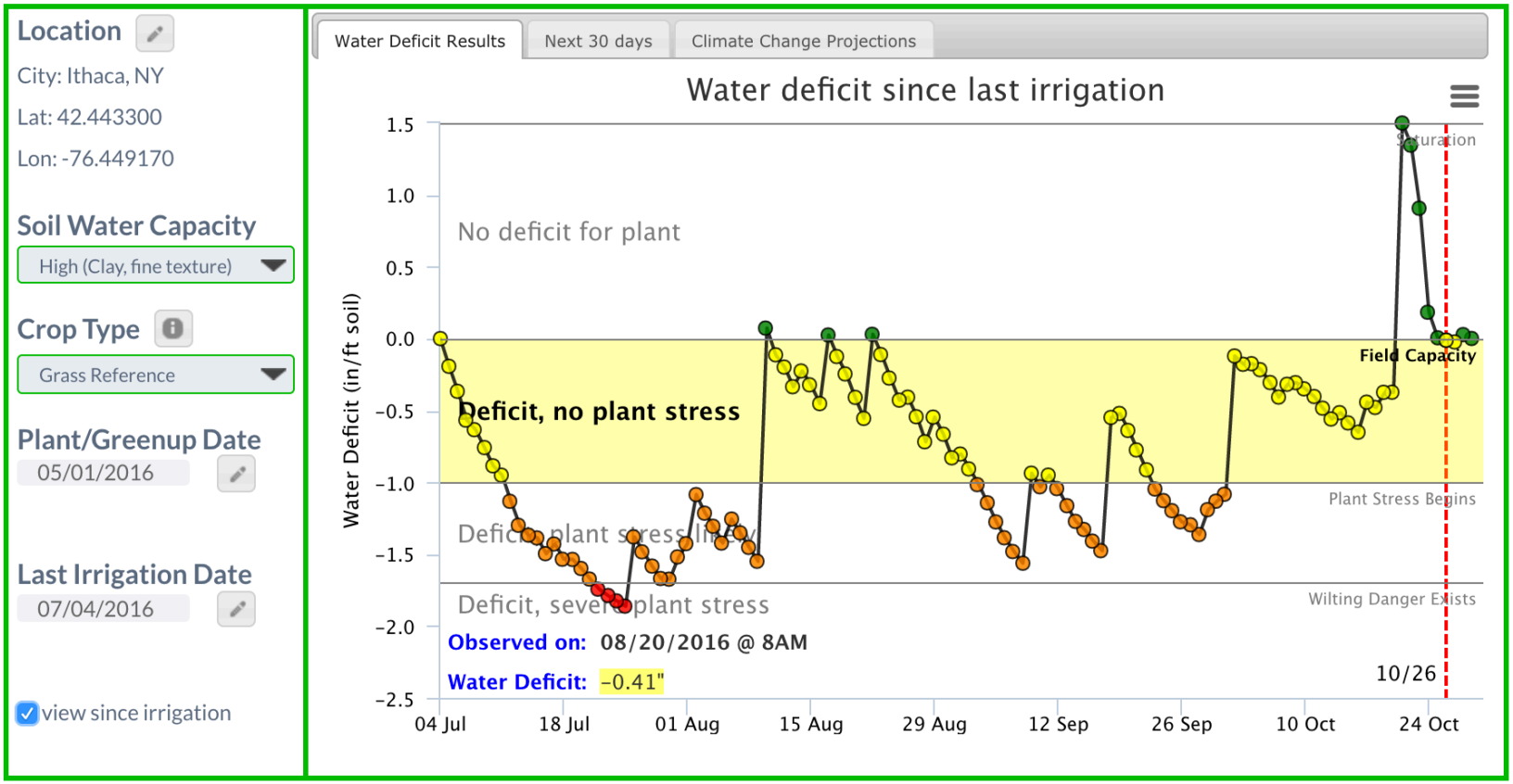
NRCC

Throw Away the Calendar

Cornell University

NRCC

Embrace Technology Research and Data Driven Decisions



http://climatesmartfarming.org/tools/csf-water-deficit-calculator/

Cornell University

NRCC

Any Questions??

Cornell University

NRCC