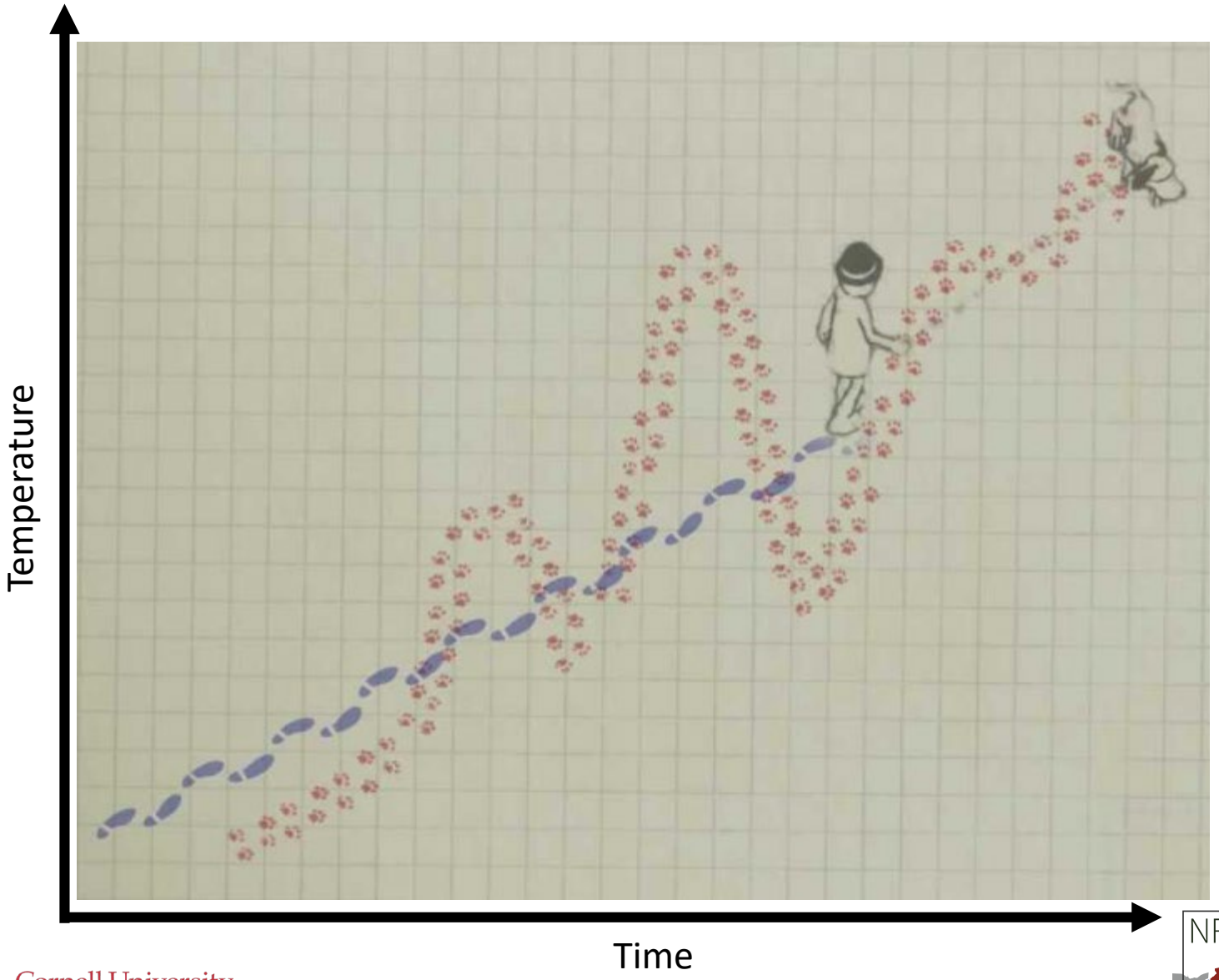
Water water everywhere and not a drop to drink: Trends, impacts and adaptation tools for Northeast Specialty Crops

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

Cornell University

NRCC

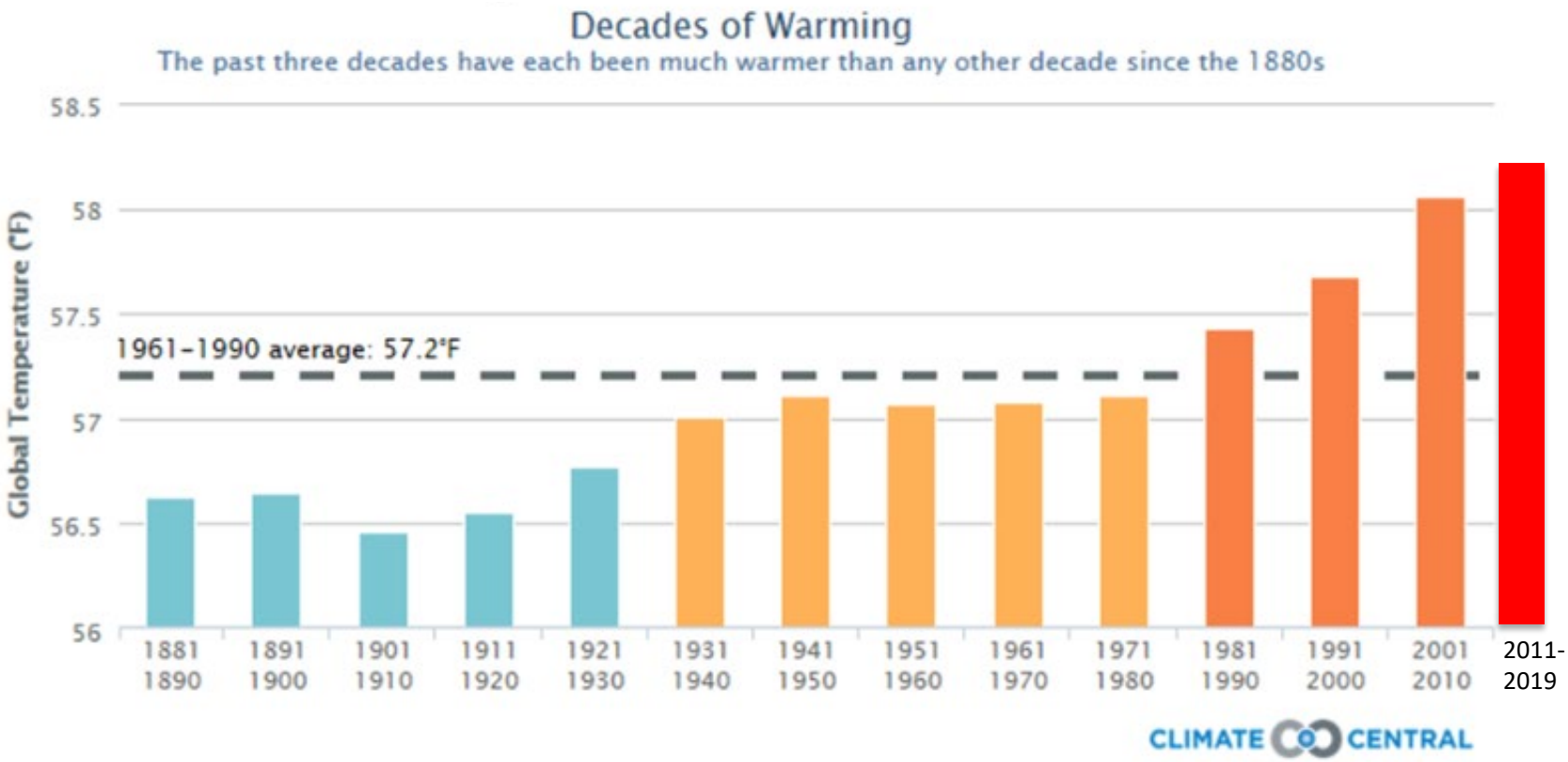
Climate and Weather



Cornell University

NRCC

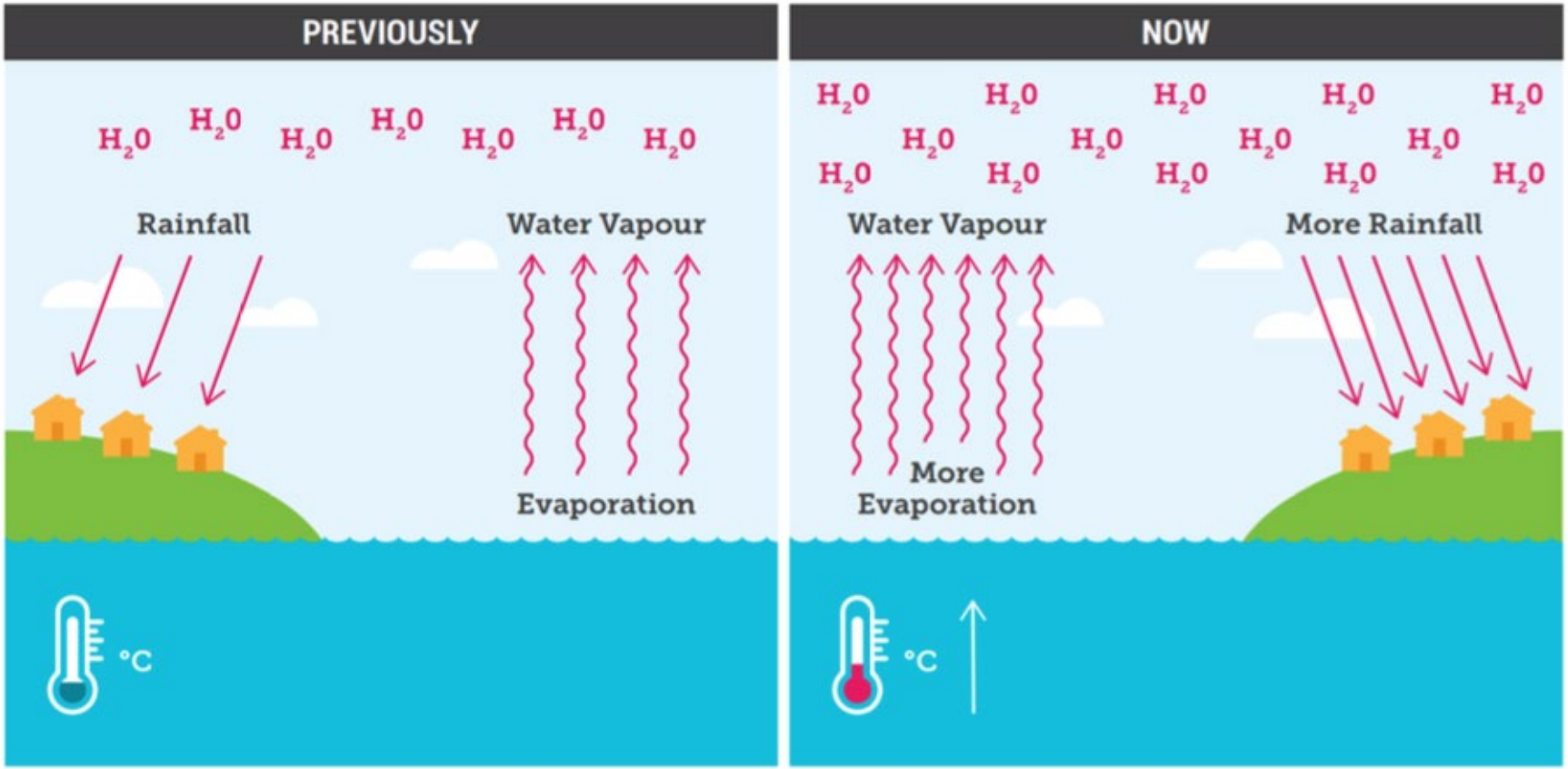
Global Surface Temperature by Decade



Cornell University

NRCC

Temperature ⟶ Rainfall

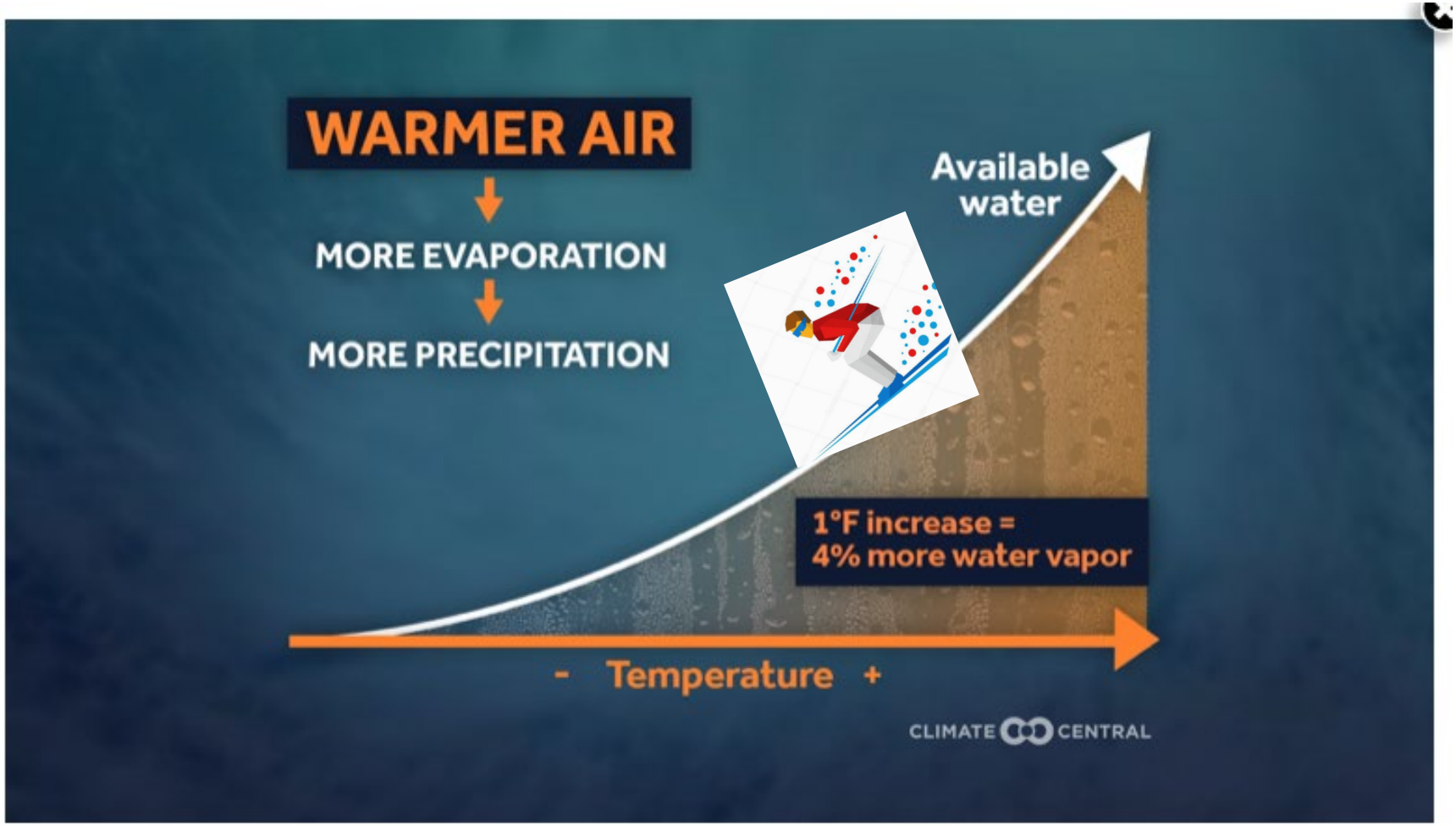


Australian Climate Council

Cornell University

NRCC

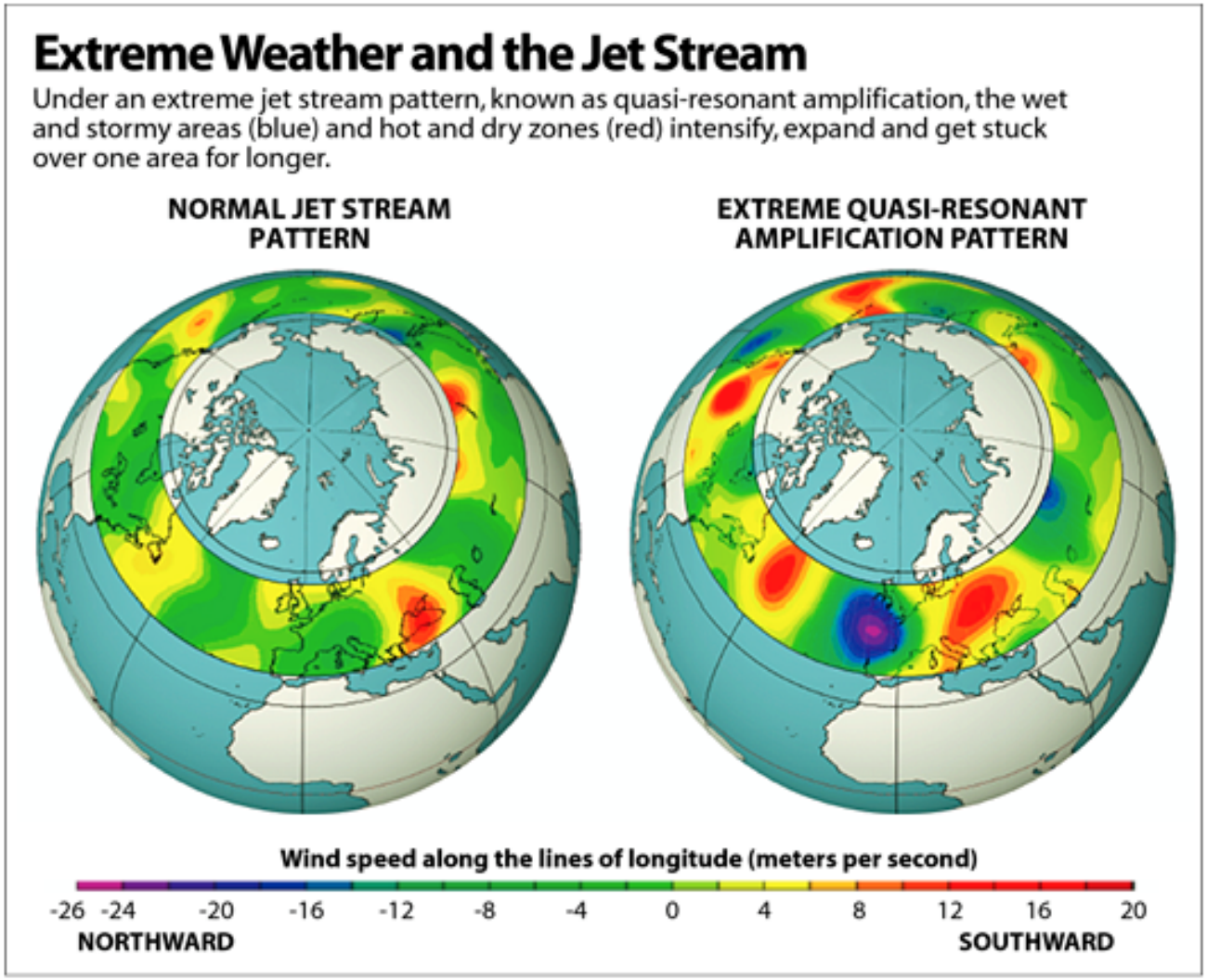
Higher Temperature = Bigger Bucket



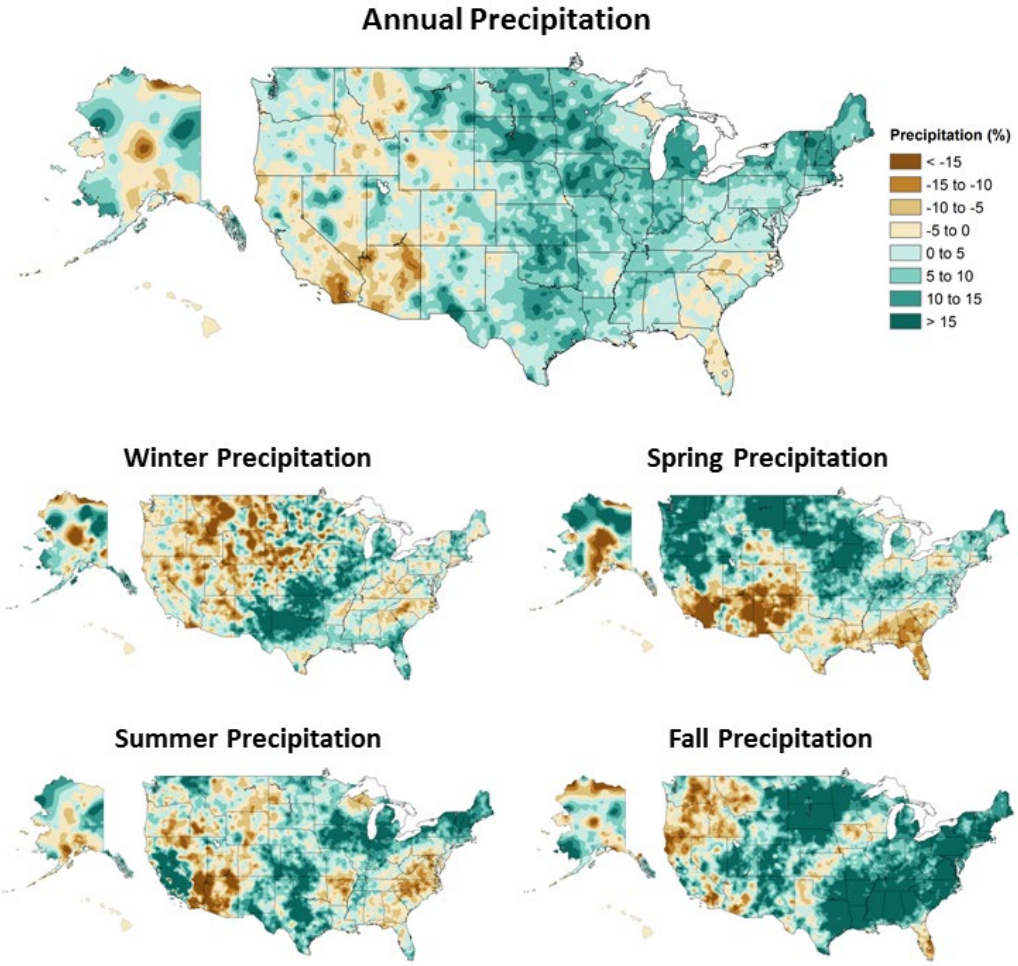
Cornell University

NRCC

The Role of the Jet Stream



Total Precipitation today (1986-2015) – past (1901-1960)

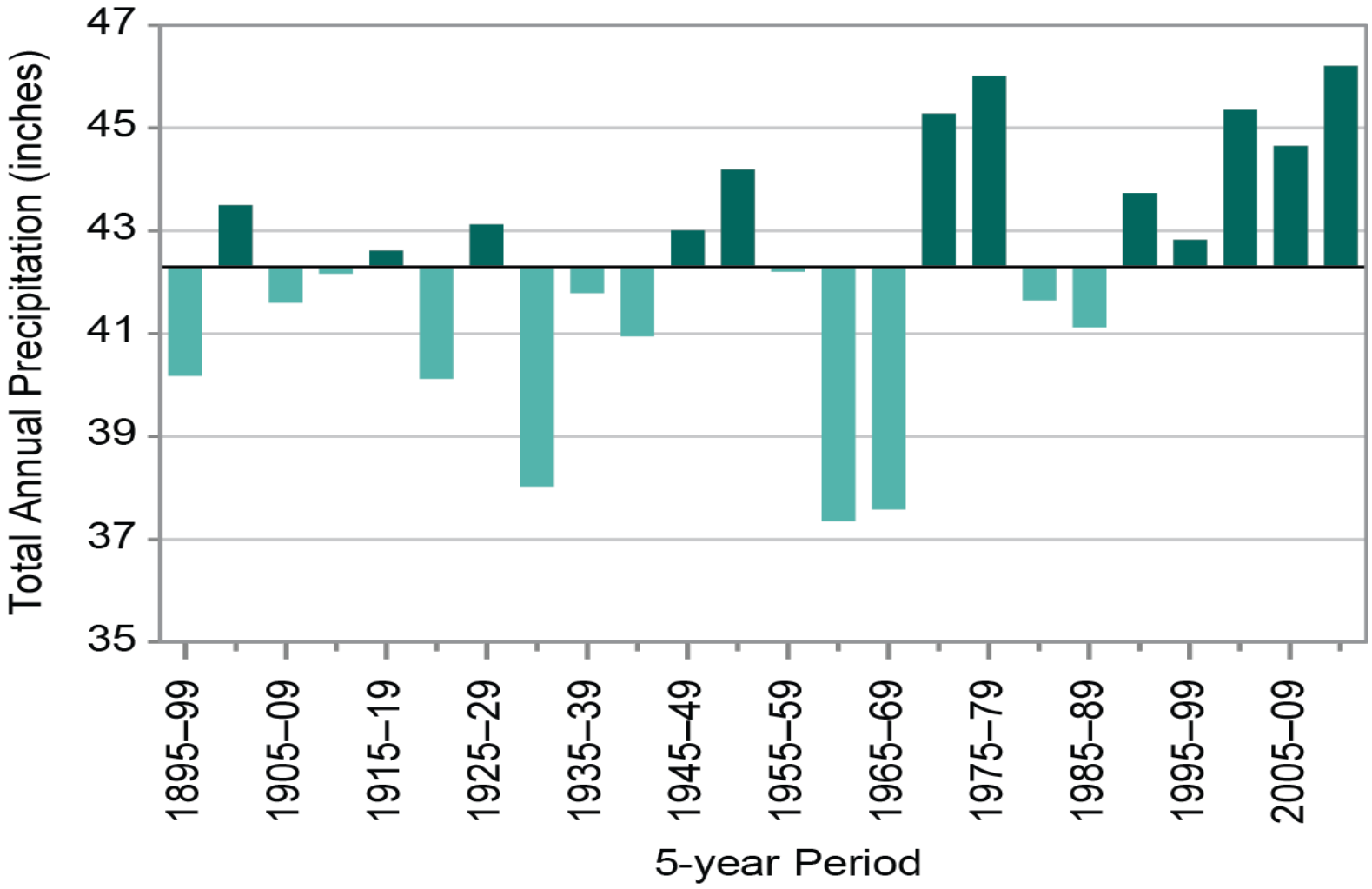


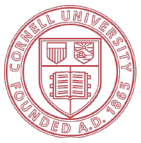
Cornell University

Credit: Peterson et al. 2013,

NRCC

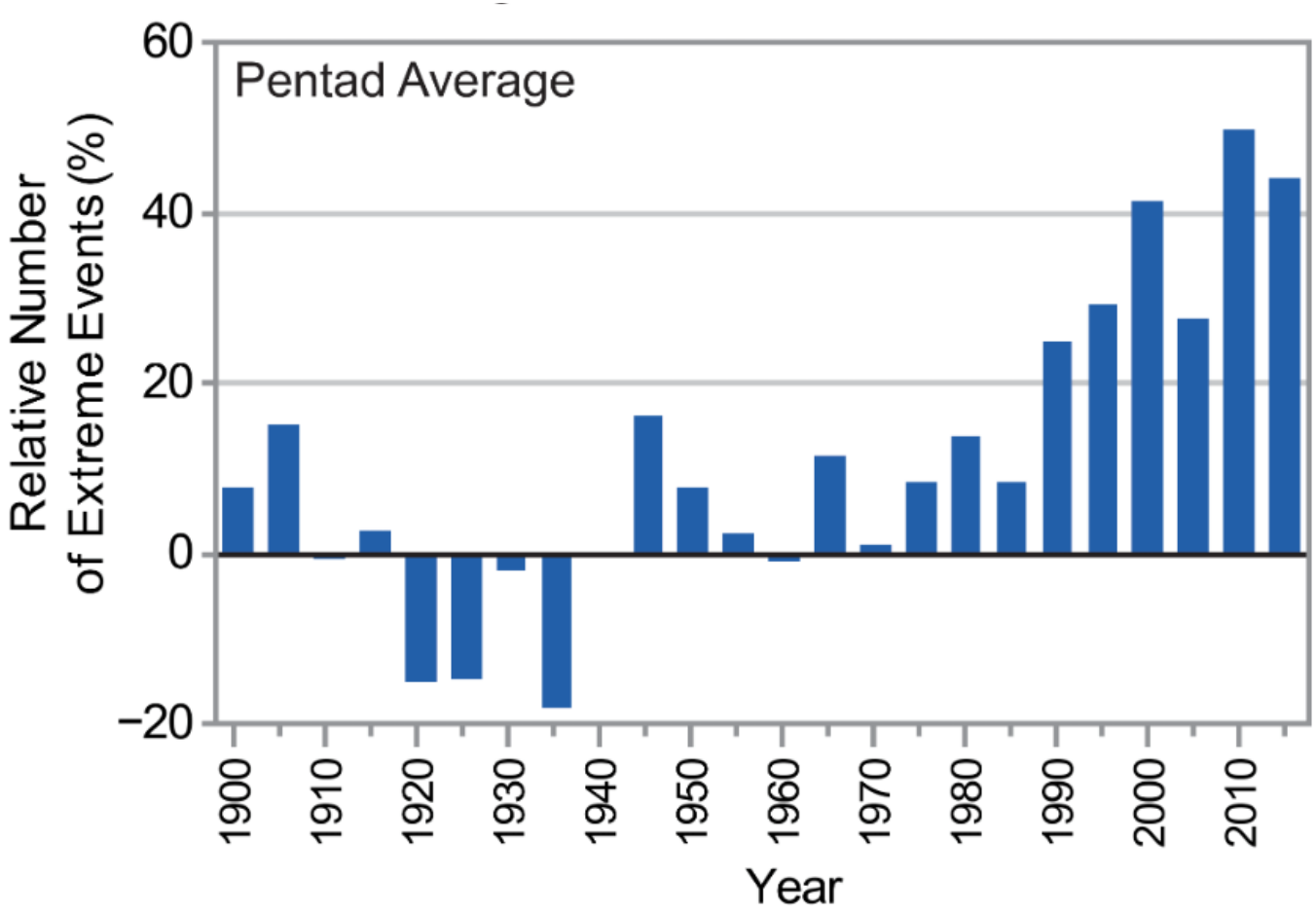
Northeast Annual Precipitation





Cornell University

2-Day Precipitation > 20% Annual Recurrence ("5-year storm")

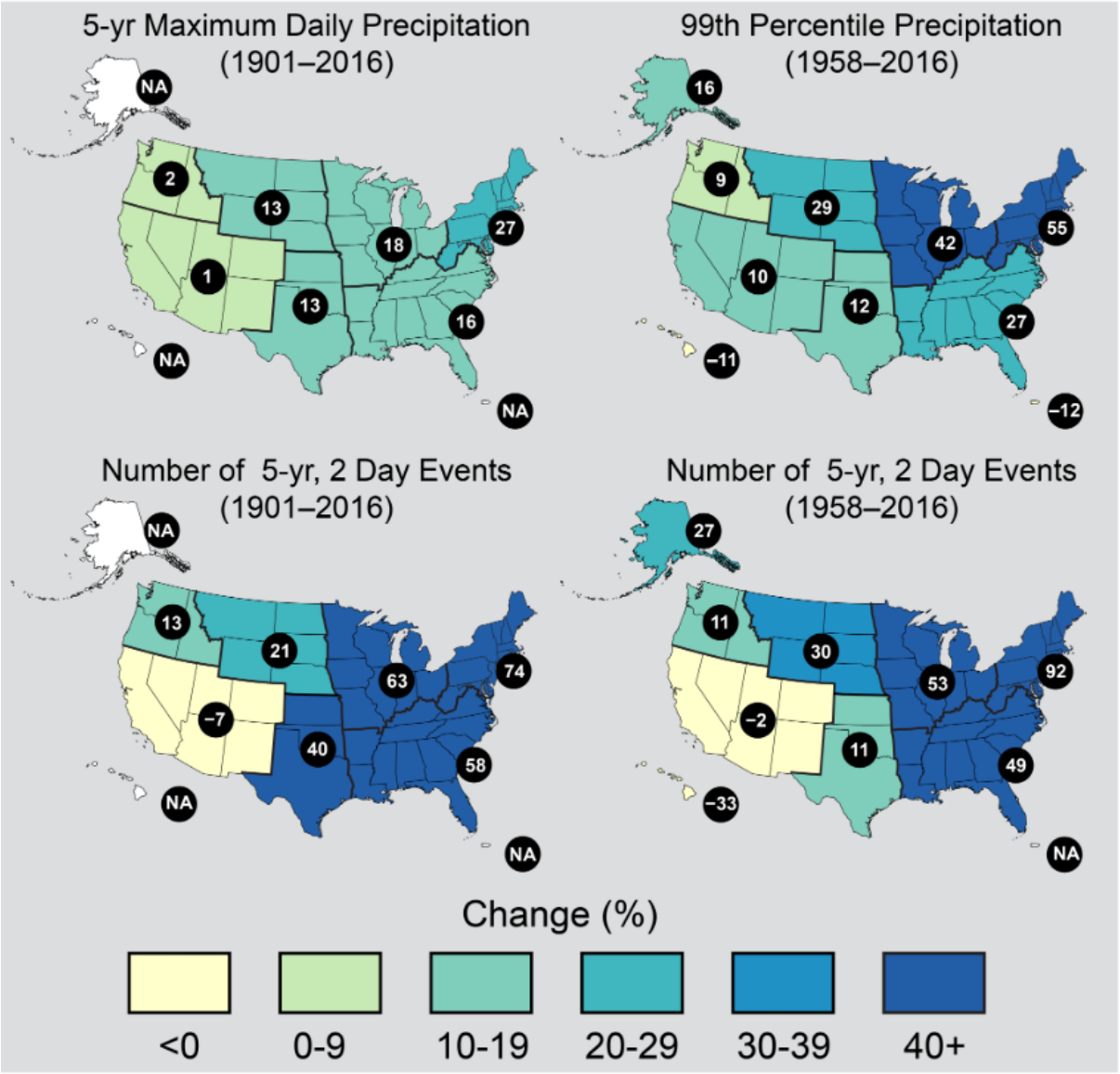


Cornell University

Figure source: CICS-NC and NOAA NCEI

NRCC

Extreme Rainfall

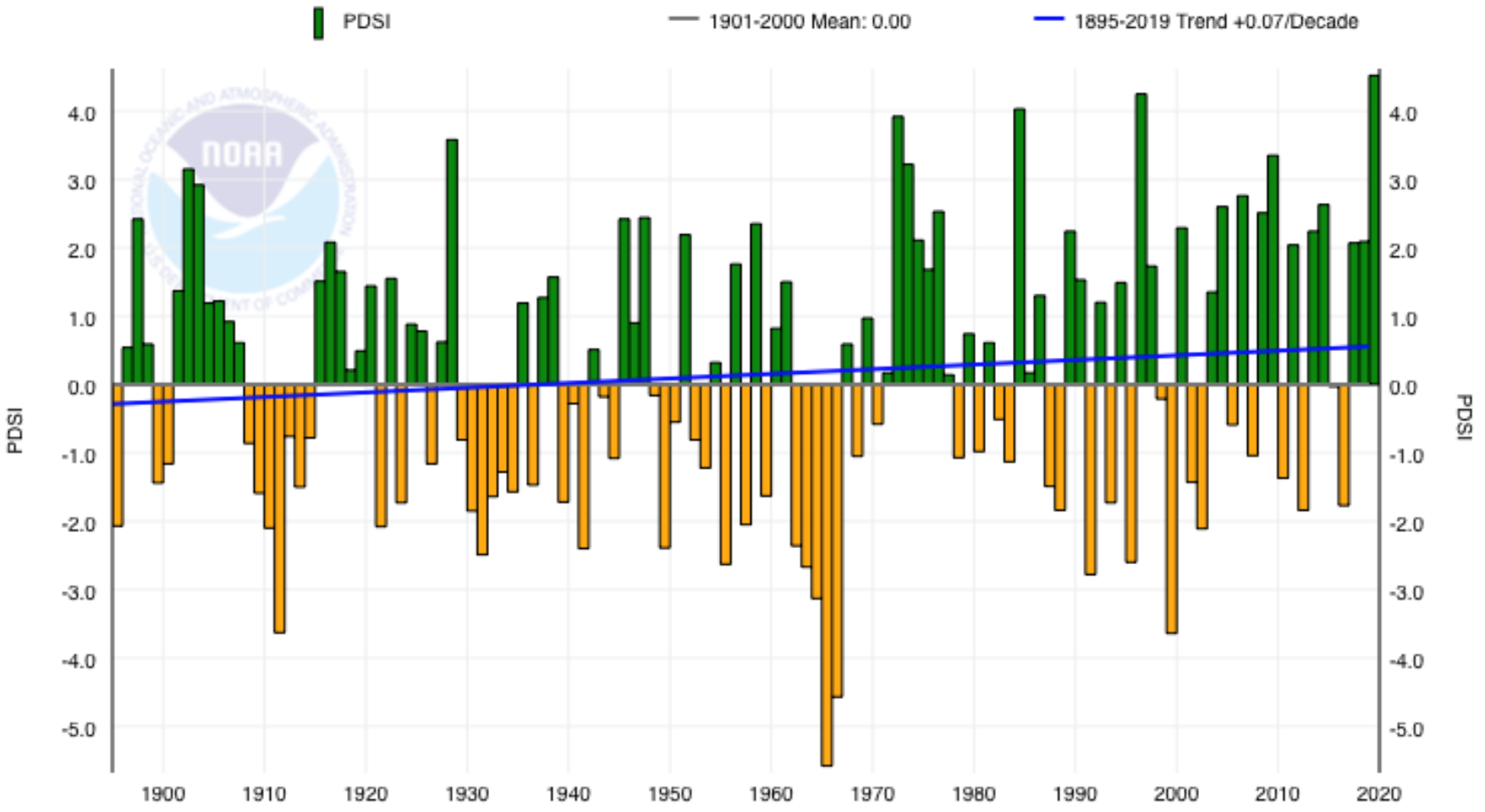


Cornell University

Figure source: CICS-NC and NOAA NCEI)

NRCC

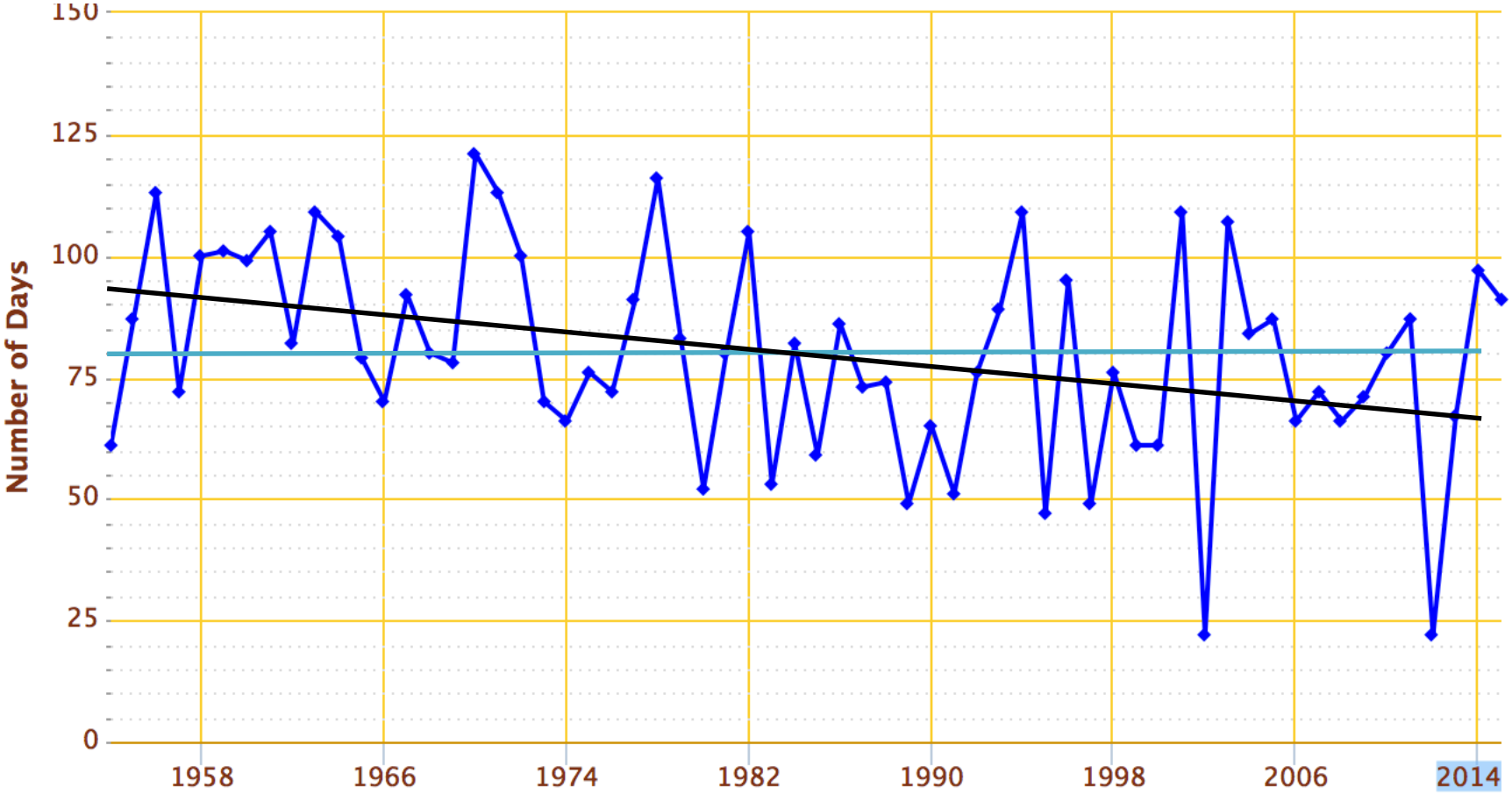
Northeast July PDSI



Cornell University

NRCC

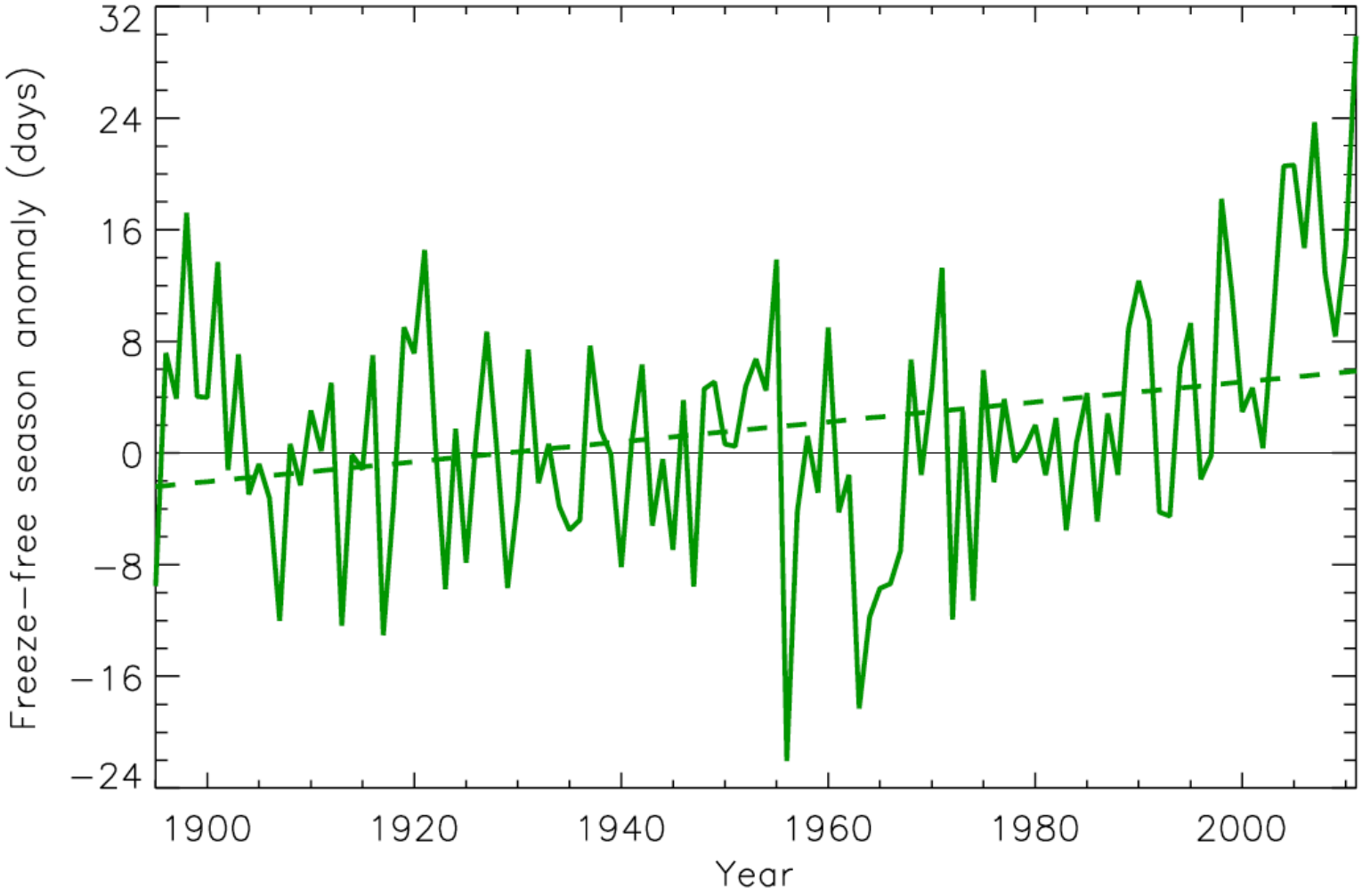
NY Days with Snow Cover



Cornell University

NRCC

NY Frost-Free Season

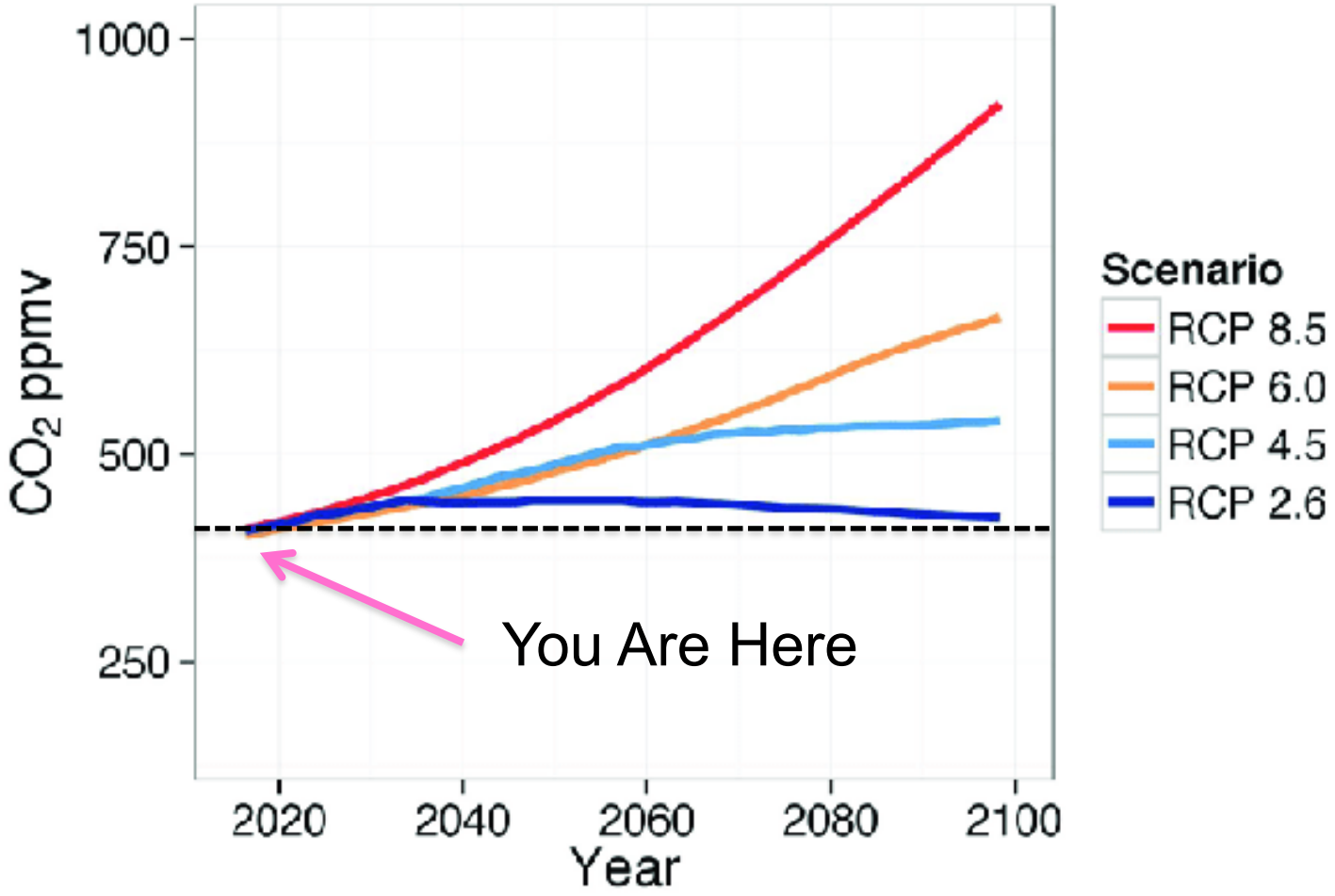


So What Does the FUTURE Hold ?

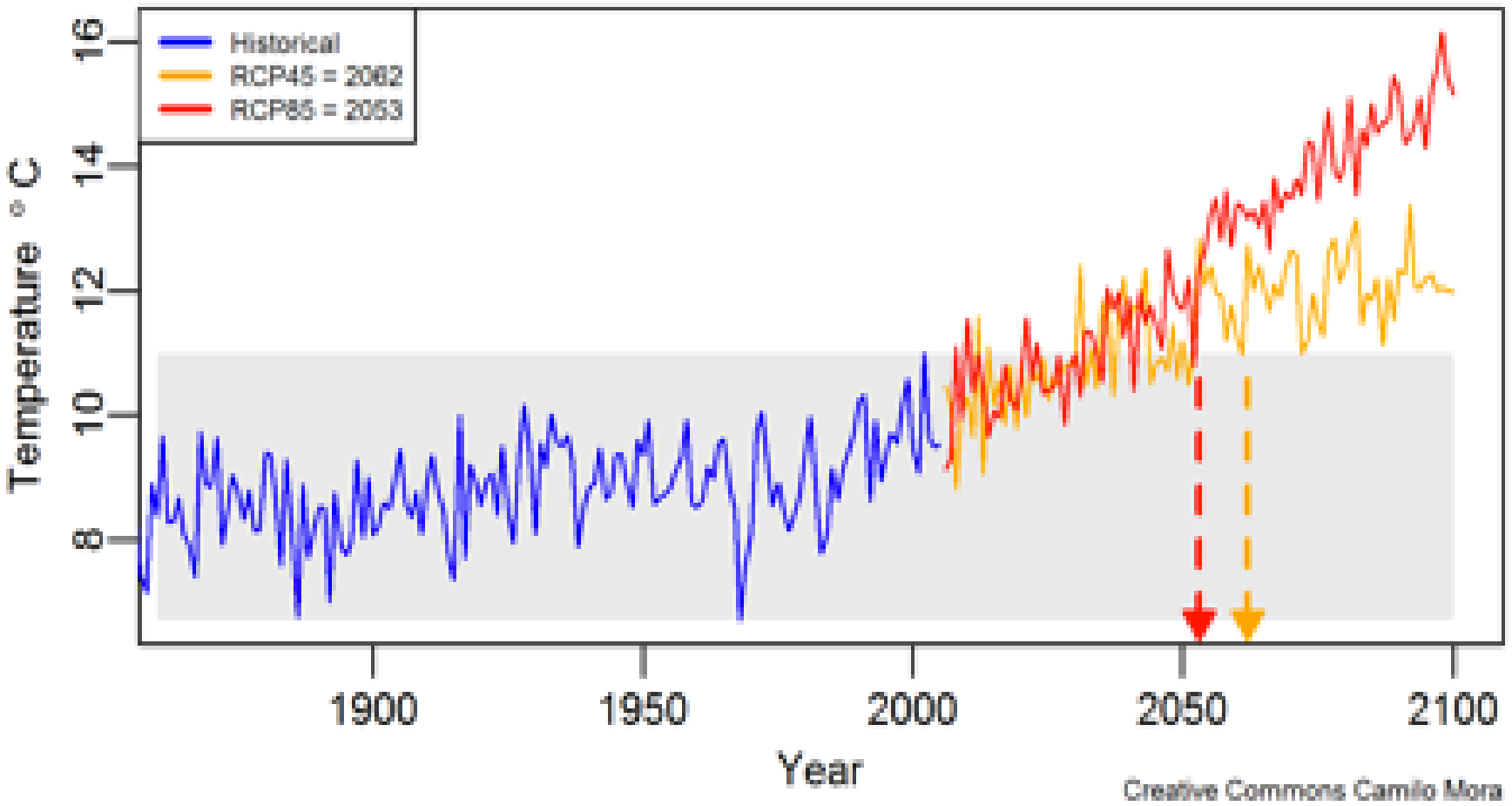
Cornell University

NRCC

Setting the Stage



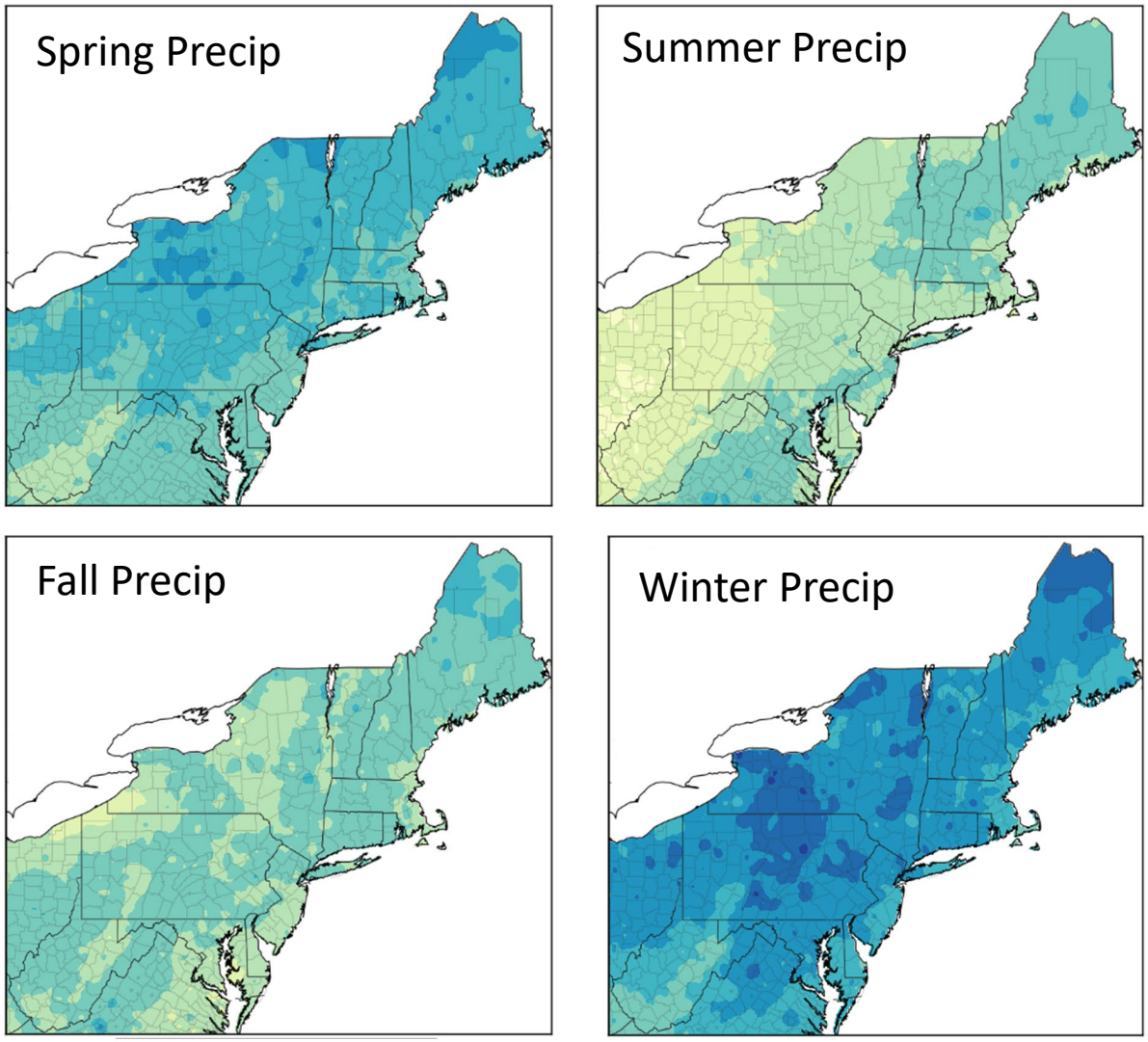
A Climate Unprecedented in the Last 100+ Years



Cornell University

NRCC

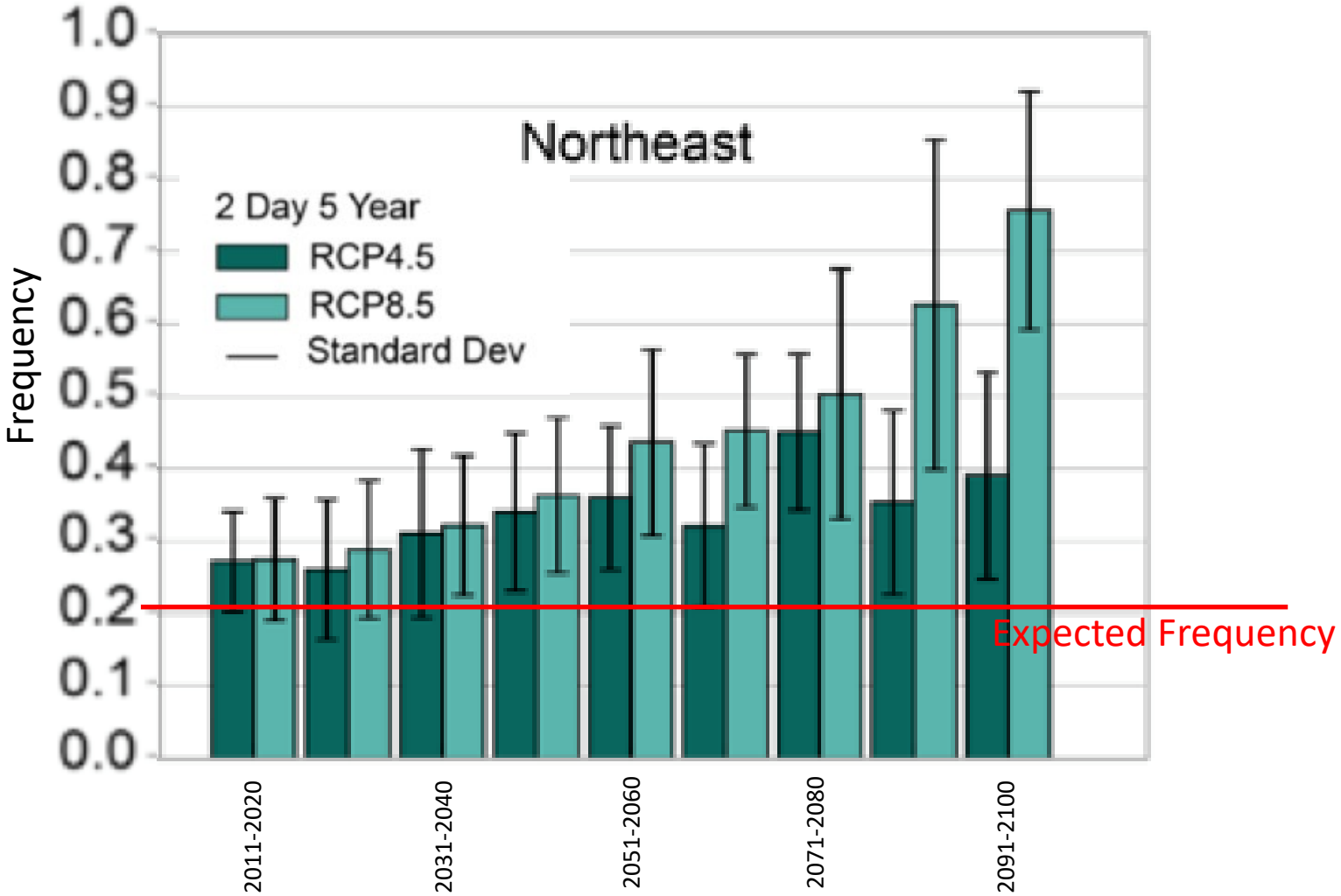
2040-2069 High Emission



Cornell University

NRCC

2-Day 5-Year Storm

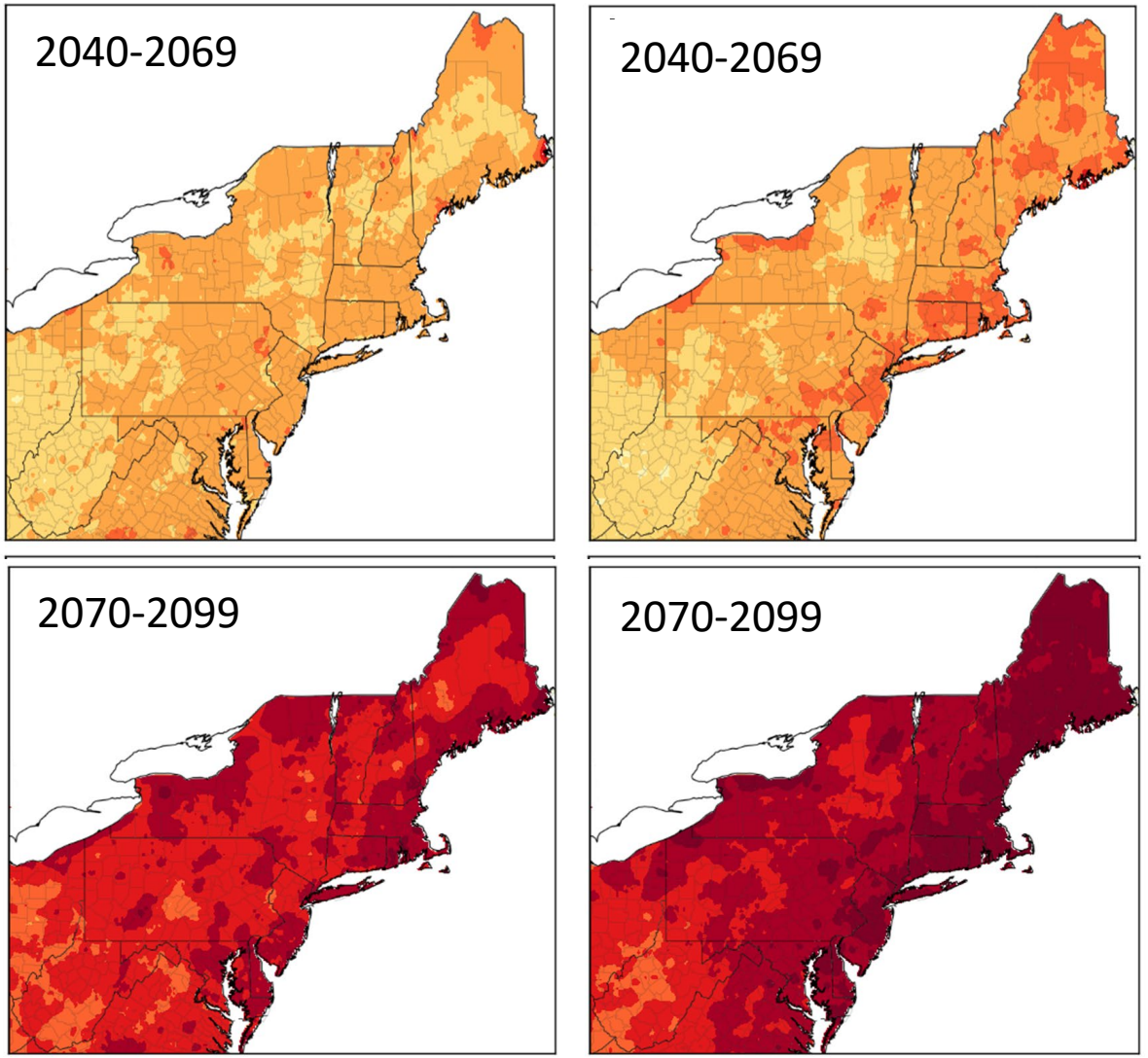


Cornell University

Figure source: Janssen et al. 2014

NRCC

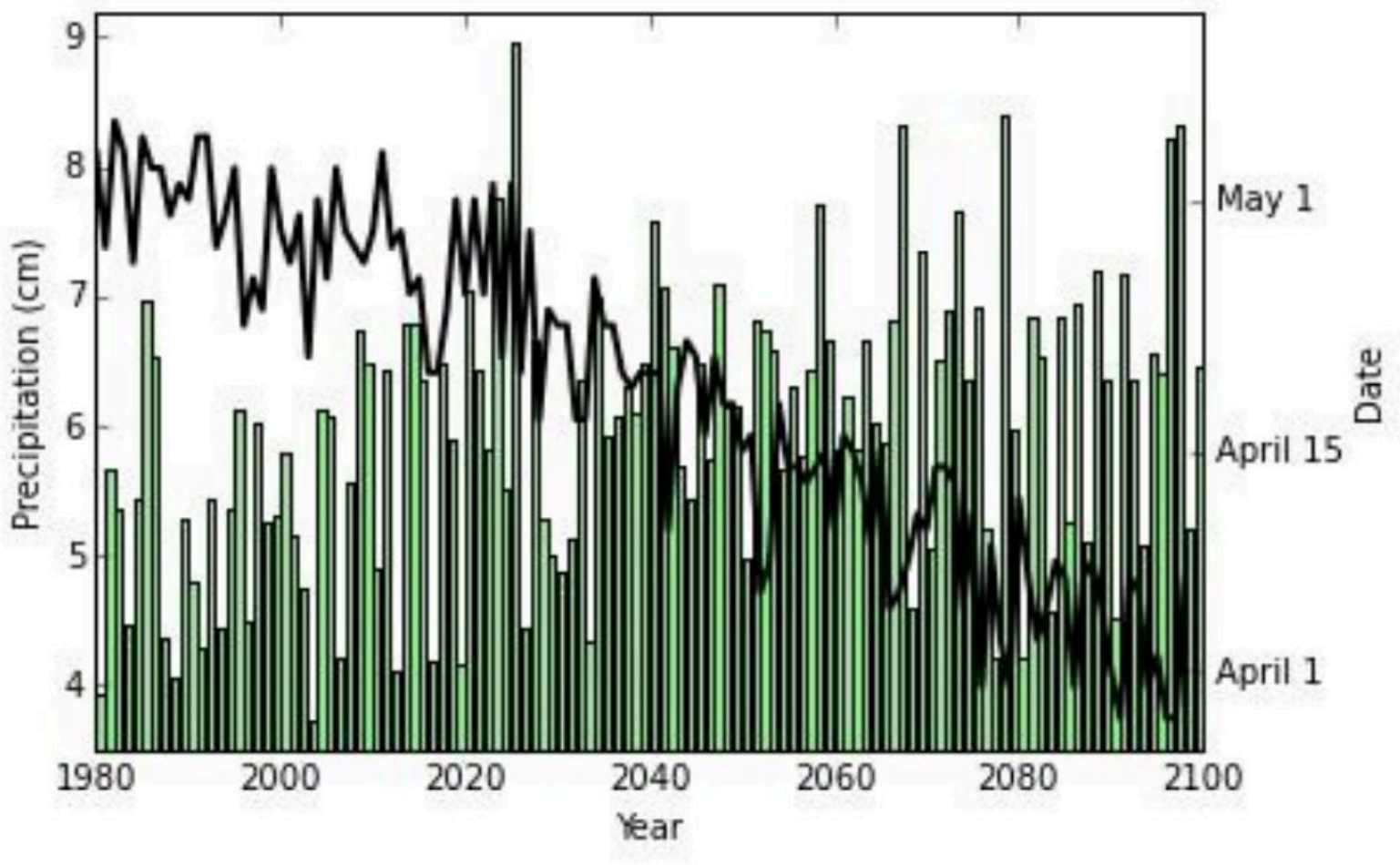
Last Spring - First Fall 32° F



Cornell U

NRCC

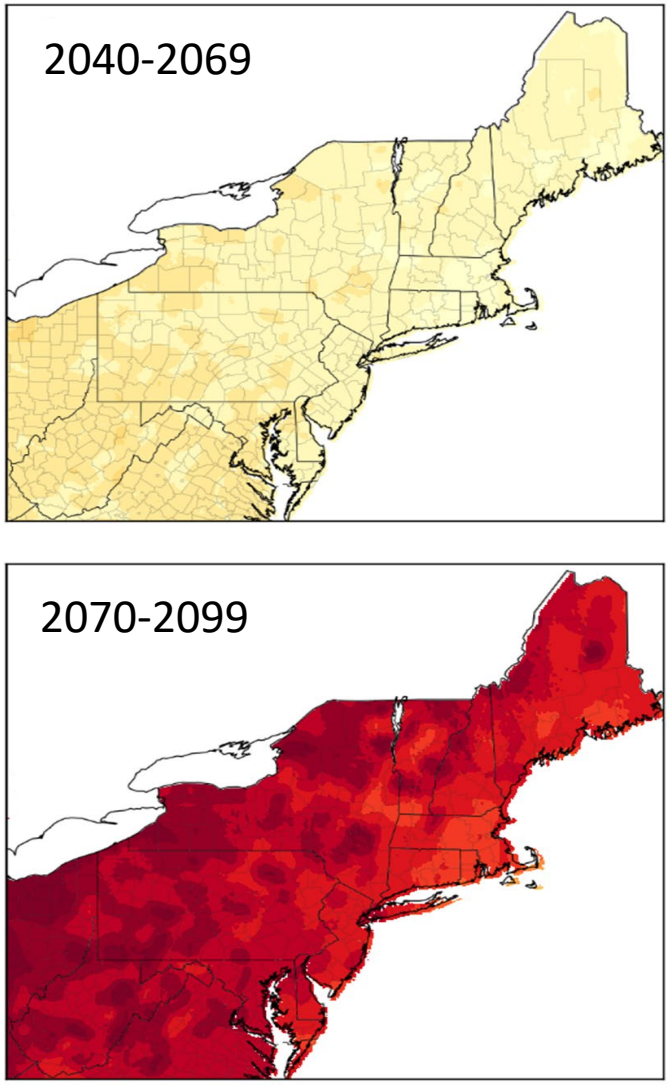
Precip 3 Weeks Prior to Last Frost



Cornell University

NRCC

Summer Potential Evap High Emission



Cornell University

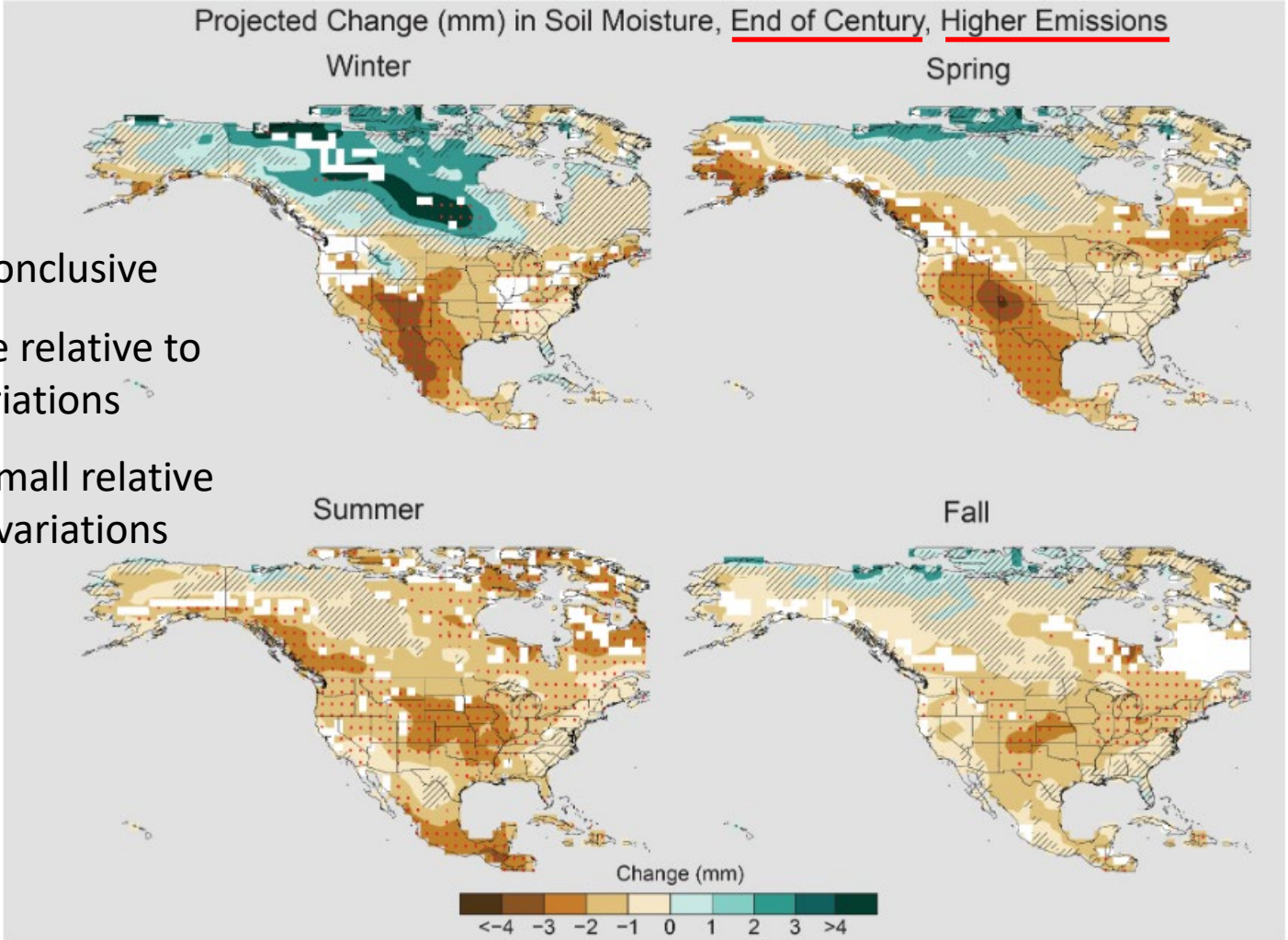
NRCC

Seasonal Soil Moisture

White: Inconclusive

Dots: Large relative to natural variations

Hashing: Small relative to natural variations

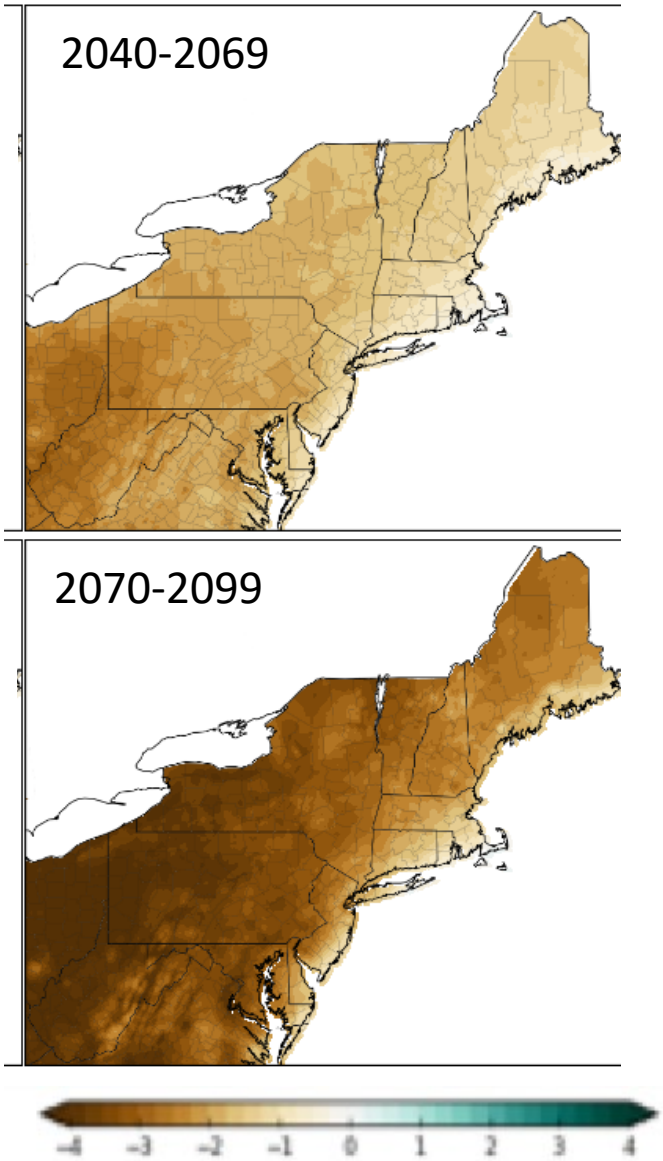


Cornell University

Figure source: NOAA NCEI and CICS-NC

NRCC

Summer RH High Emissions



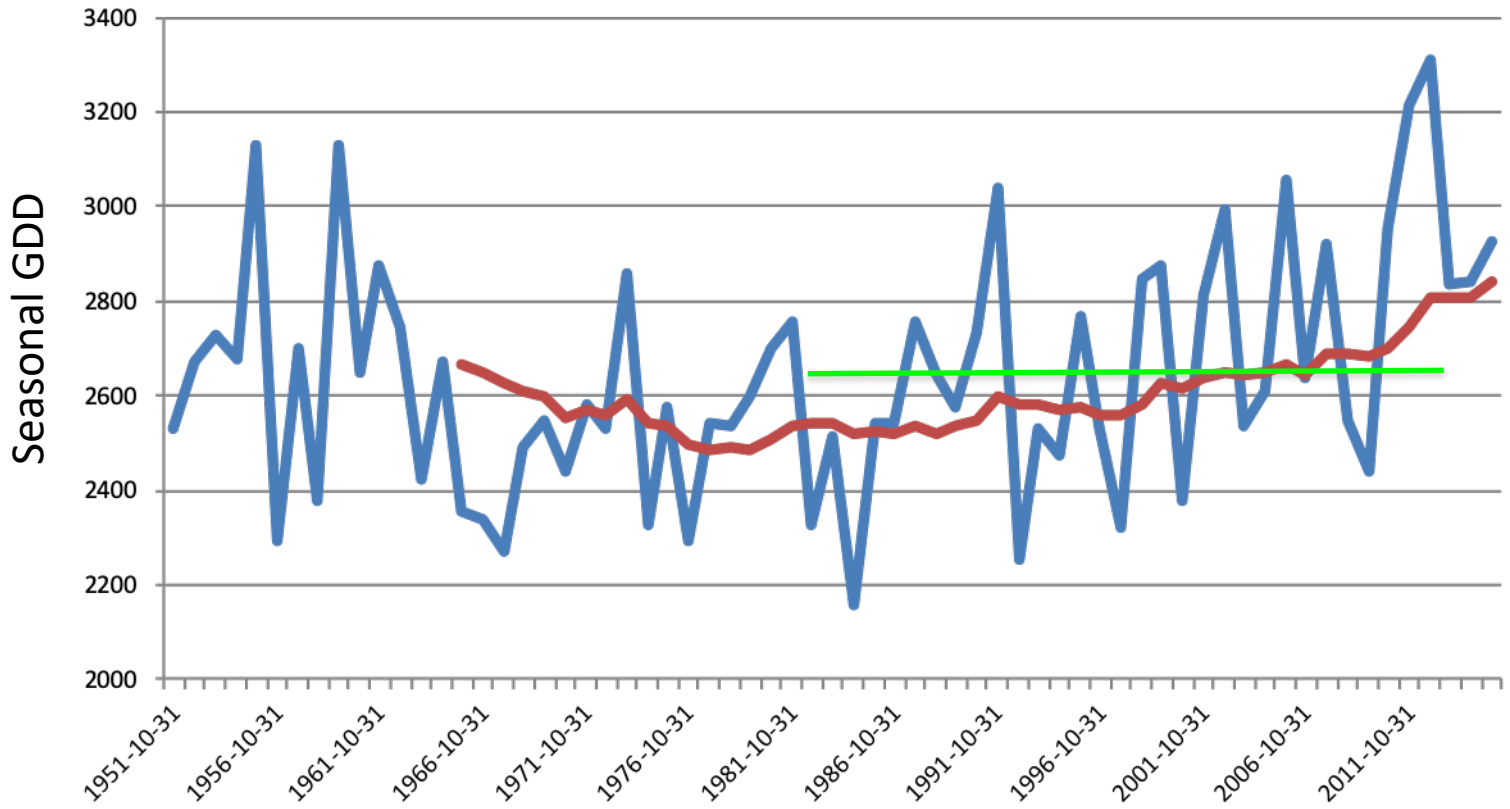
Cornell University

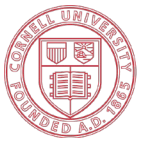
NRCC

Regardless of Reason for the Change

How can the IMPACT be lessened

Rethink the convention of 30-years defining “normal” climate





Cornell University

Throw Away the Calendar

Cornell University

NRCC

Embrace Technology- Research- and Data-Driven Decisions

New York State Integrated Pest Management Program
NEWA Network for Environment and Weather Applications

Website status:
No issues reported
12/11/2019 1:40:27 PM

Apple Irrigation Model

Weather Data | Pest Forecasts | Station Pages | Crop Management | Weather Stations | Help

National Weather Service Forecast | Welcome to the NEWA Home Page

Weather station: Dummerston

Select Date: 07/02/2019

Continue

Change green tip date or tree density and click "Calculate" to recalculate results. Changing "Age of Orchard" will automatically recalculate table.

Green tip date	In row spacing	Between row spacing	Trees per acre	Age of orchard	Water balance
4/15/2019	20 feet	40 feet	54	Mature	

Apple Evapotranspiration Model Results

Date	Orchard ET (gallons)		Rainfall		Irrigation	Water Balance (gallons/acre)	
	per tree	per acre	inches	gallons/acre	gallons/acre	Daily	Cumulative
Jun 25	31.4	1698	1.22	23190	0	21491	0
Jun 26	101.8	5498	0.01	190	0	-5308	-5308
Jun 27	91.2	4924	0.00	0	0	-4924	-10232
Jun 28	102.6	5538	0.00	0	0	-5538	-15770
Jun 29	60.8	3283	0.04	760	0	-2523	-18292
Jun 30	56.1	3031	0.03	570	0	-2461	-20753
Jul 1	98.5	5319	0.00	0	0	-5319	-26072
Jul 2	73.8	3985	0.00	0	0	-3985	-30057
Jul 3	106.7	5760	0.00	0	0	-5760	-35816
Jul 4	92.4	4988	0.00	0	0	-4988	-40804
Jul 5	107.5	5806	0.00	0	0	-5806	-46611
Jul 6	95.3	5144	0.00	0	0	-5144	-51754
Jul 7	100.5	5428	0.00	0	0	-5428	-57183

Cornell University

NRCC

Embrace Technology- Research- and Data-Driven Decisions

New York State Integrated Pest Management Program
NEWA Network for Environment and Weather Applications

Website status:
No issues reported
12/11/2019 1:40:27 PM

Weather Data | Pest Forecasts | Station Pages | Crop Management | Weather Stations | Help

National Weather Service Forecast | Welcome to the NEWA Home Page

State: Vermont

Weather station: Dummerston

Select Date: 07/02/2019

Continue

Map | Results | More info

Apple ET Model for Dummerston

Change green tip date or tree density and click "Calculate" to recalculate results. Changing "Age of Orchard" will automatically recalculate table.

Green tip date	In row spacing	Between row spacing	Trees per acre	Age of orchard	Water balance
4/15/2019	20 feet	40 feet	54	Mature	

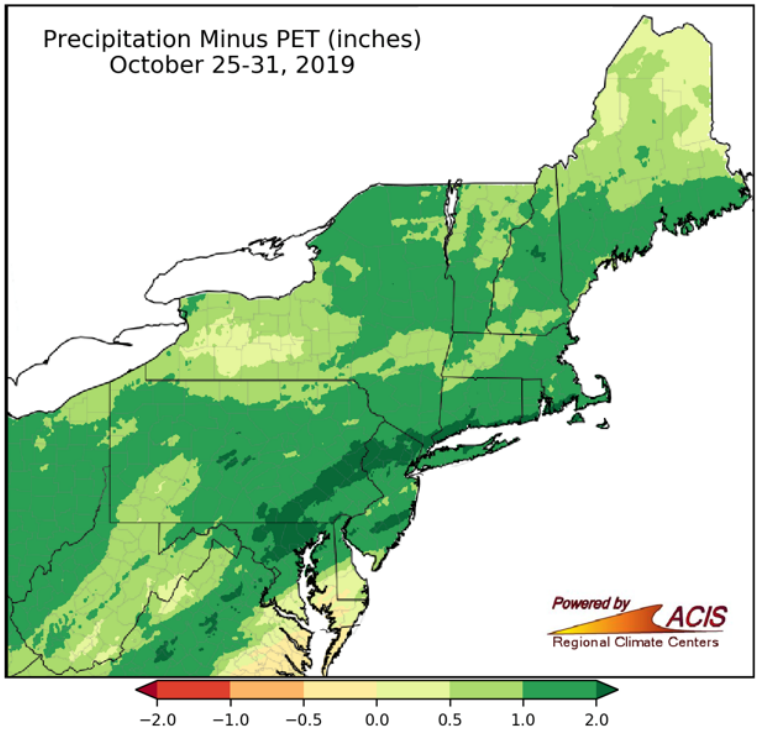
Apple Evapotranspiration Model Results

Date	Orchard ET (gallons)		Rainfall		Irrigation	Water Balance (gallons/acre)	
	per tree	per acre	inches	gallons/acre	gallons/acre	Daily	Cumulative
Jun 25	31.4	1698	1.22	23190	0	21491	0
Jun 26	101.8	5498	0.01	190	0	-5308	-5308
Jun 27	91.2	4924	0.00	0	0	-4924	-10232
Jun 28	102.6	5538	0.00	0	5500	-38	-10270
Jun 29	60.8	3283	0.04	760	0	-2523	-12792
Jun 30	56.1	3031	0.03	570	0	-2461	-15253
Jul 1	98.5	5319	0.00	0	0	-5319	-20572
Jul 2	73.8	3985	0.00	0	0	-3985	-24557
Jul 3	106.7	5760	0.00	0	0	-5760	-30316
Jul 4	92.4	4988	0.00	0	0	-4988	-35304
Jul 5	107.5	5806	0.00	0	0	-5806	-41111

Cornell University

NRCC

Embrace Technology- Research- and Data-Driven Decisions



Last Week's Conditions

Daily Forecast for the Next 3 Days

Boston, MA

Dandelion Control Recommendations

Early Marginal Favorable

Amine										
Ester										
Dates	07-14	07-15	07-16	07-17	07-18	07-19	07-20	07-21	07-22	07-23

Map Updates Will Resume March 15th

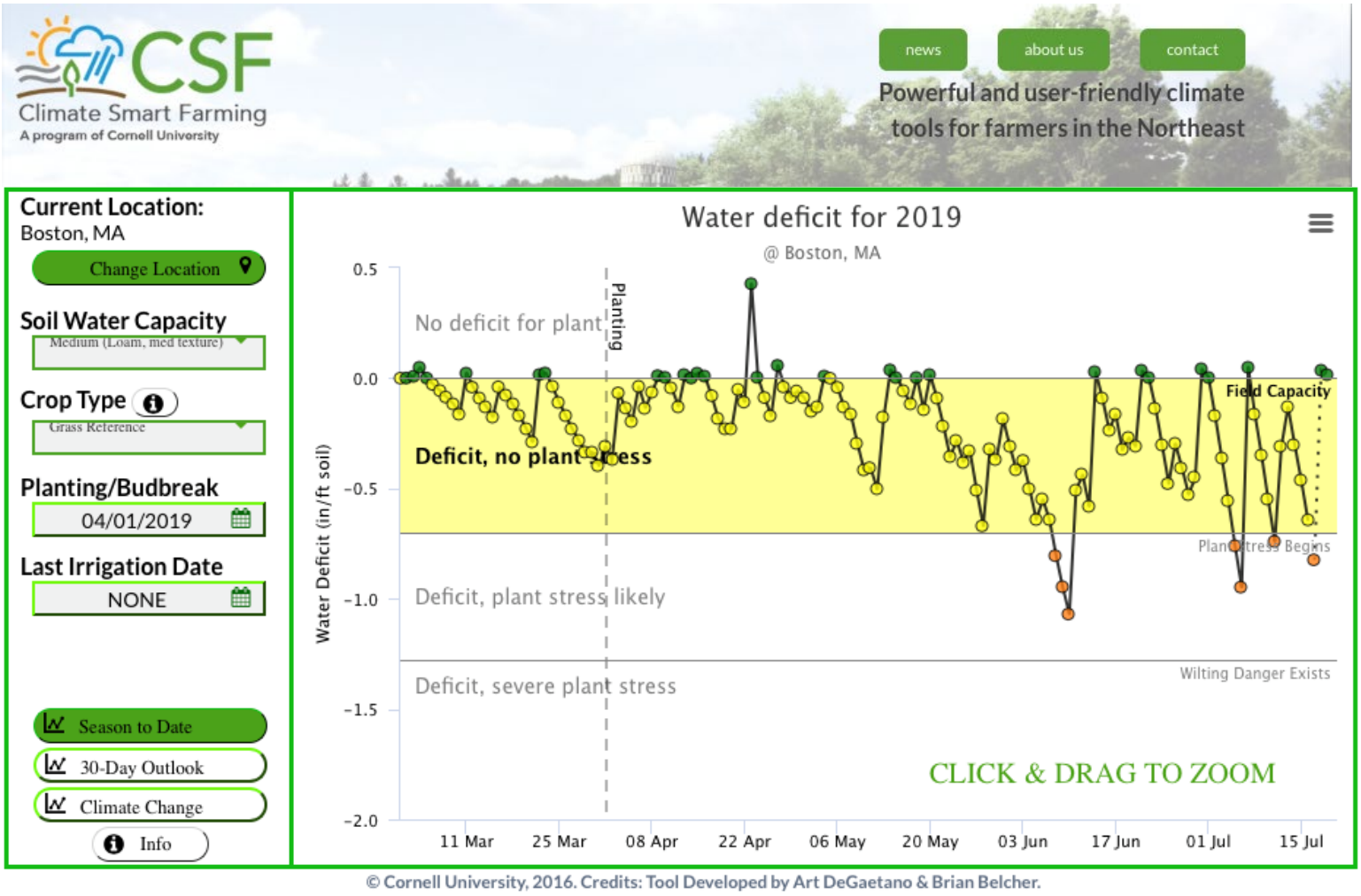
Cornell University

http://turf.eas.cornell.edu

http://www.nrcc.cornell.edu/industry/grass/

NRCC

Embrace Technology- Research- and Data-Driven Decisions

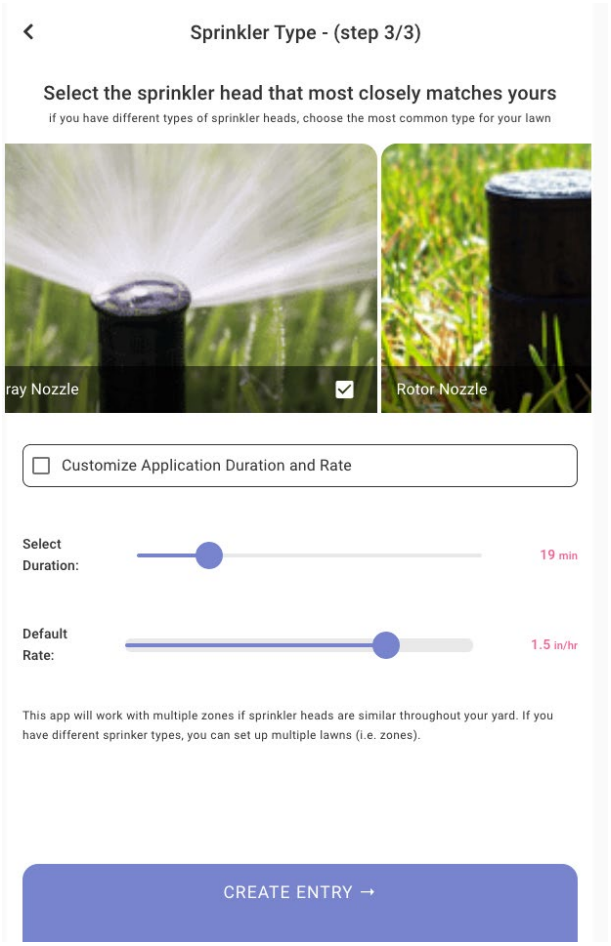


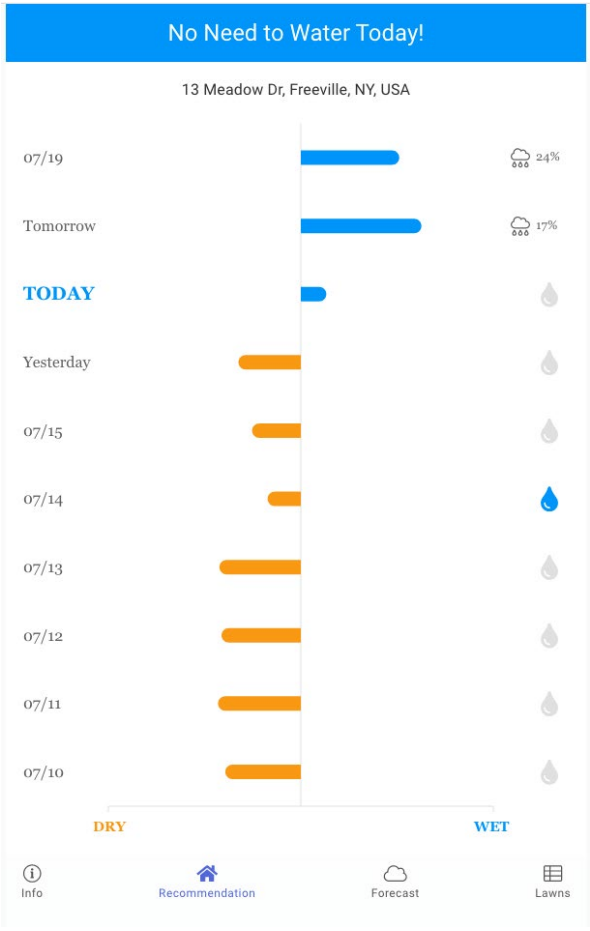
http://climatesmartfarming.org/tools/csf-water-deficit-calculator/

Cornell University

NRCC

Embrace Technology- Research- and Data-Driven Decisions

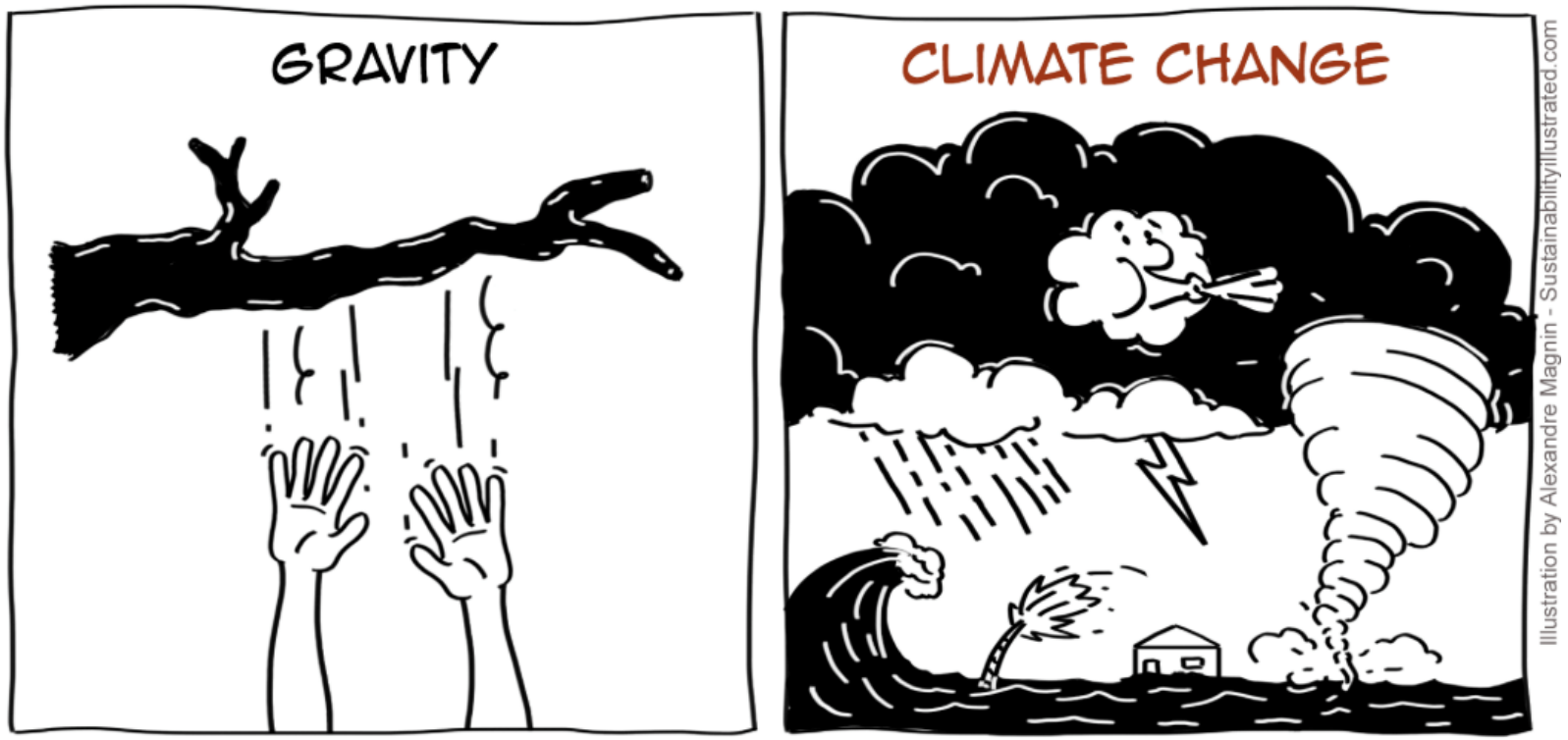




Cornell University

https://lawnwatering.org/

NRCC



LAWS OF NATURE DON'T CARE WHETHER YOU BELIEVE IN THEM OR NOT

Any Questions??

Cornell University

NRCC