

"Is it Warm in Here?"

New Approaches to Gardening in our Changing Climate”

“If you can’t stand the heat, get out of the kitchen...
garden!”



Bryce Lane
brycehortlane@me.com
April 13, 2024
MGACRA Garden Symposium



Ultimate in sustainable gardening (recycle)

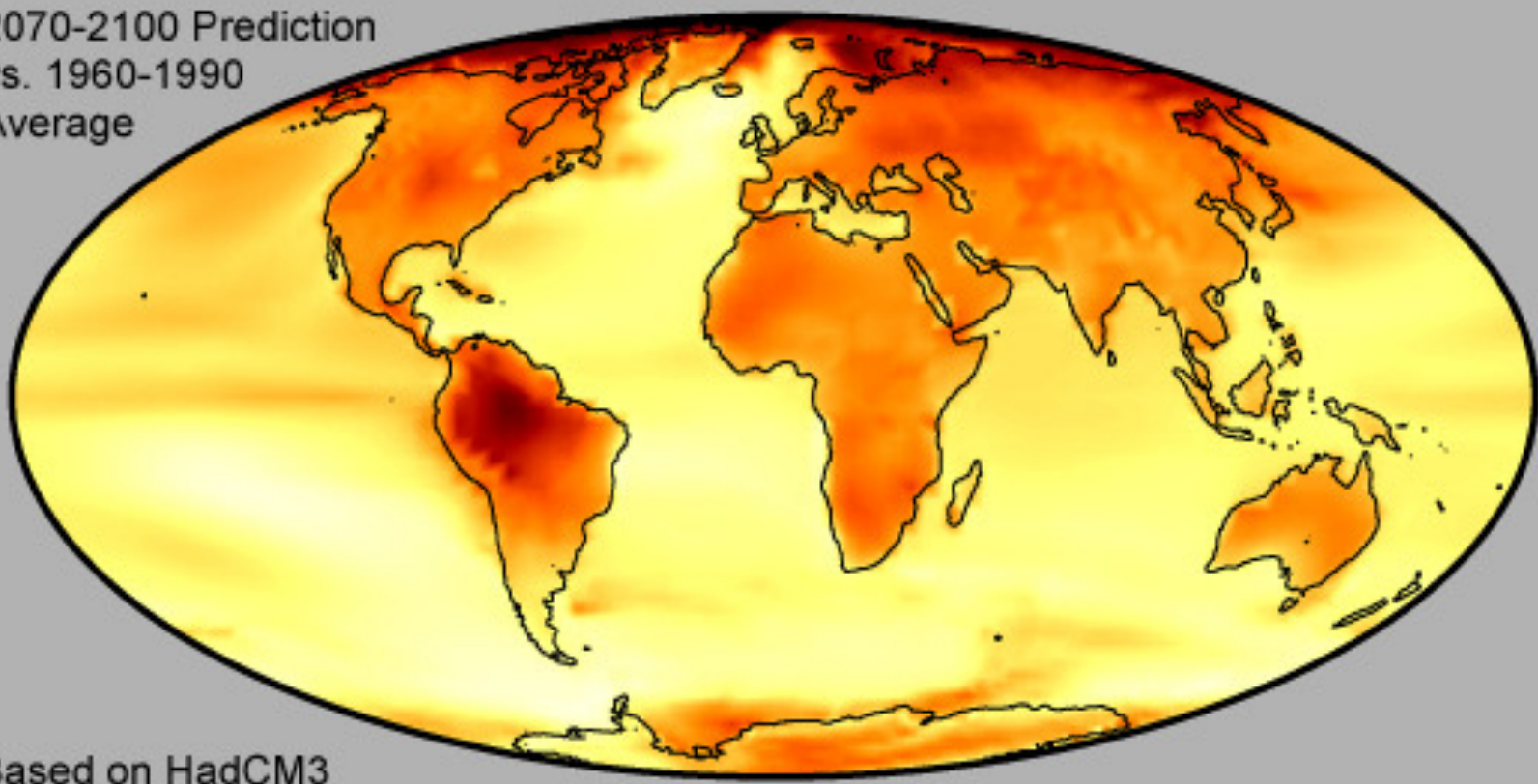


“Global Warming” Global Climate Disruption

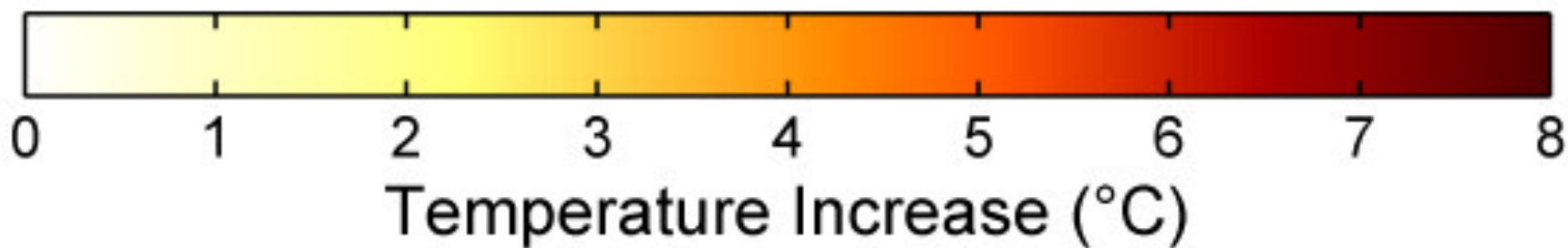


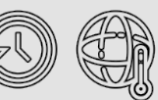
Global Warming Predictions

2070-2100 Prediction
vs. 1960-1990
Average



Based on HadCM3





GLOBAL CO₂ LEVELS

Click and drag in the plot area to zoom in



Northern Hemisphere Land Temperature Anomalies, January-December

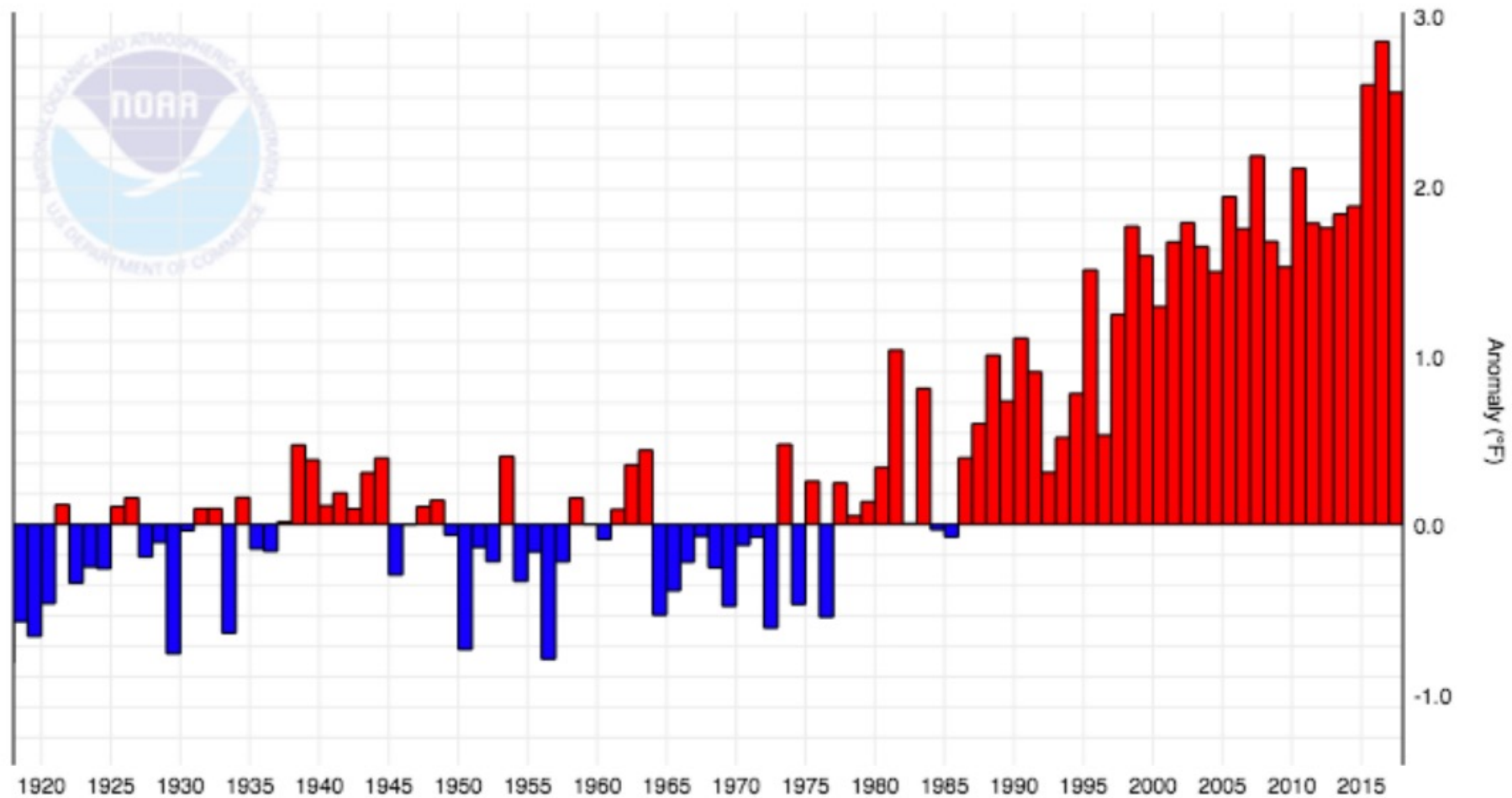


Figure 7: Graph of annual temperature anomalies - departures from the 20th century average.¹¹

“Global Climate Disruption”

Warmer temperatures

Higher concentrations of Carbon Dioxide:

Photosynthesis: Water + Carbon Dioxide =
Glucose + Oxygen

Photosynthesis: Most important process on earth!

100 Billion tons of sugar/year

Carl Hershner, 2019 Keynote on Climate Change VA Master Gardener College

2-5 degree C rise in temperature... > 90 degree+ days

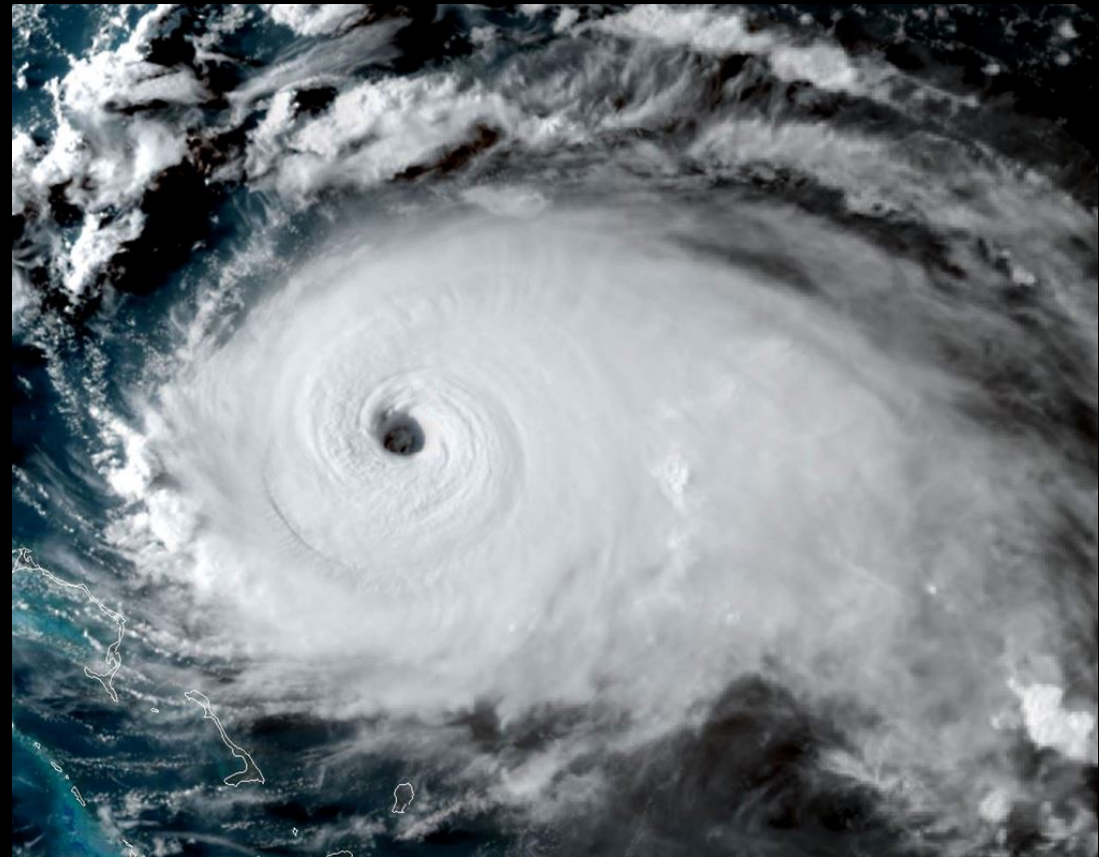
Increase in precipitation

Increase in intensity of storms...

Sea level to rise 3-7 feet by 2100

Yikes!

What should us gardeners do?





Plant



MOR



Plants

SM

Important ideas

Royal Hort. Society:
“Gardening and
Climate Change”

“Gardening for Climate Change”
New York Times, May 3, 2014
James Barilla

National Wildlife Federation
“Gardening for Climate Change”

Climate change is nothing new...
Climate is always changing!
Key is biodiversity
Contrived environments
Microclimates
Adaptive approach to gardening
Resilient gardens



Possible Impacts of Climate Change on Gardening

Hardiness zone changes

Impact on Heat zone map

Frost free season

Water: too little versus too much

Greater extremes

Not enough “Chilling Hours”?

Can be an exciting time for gardeners!





CICSS
Cornell Institute for Climate Smart Solutions

Observed Increases in Frost-Free Season Length

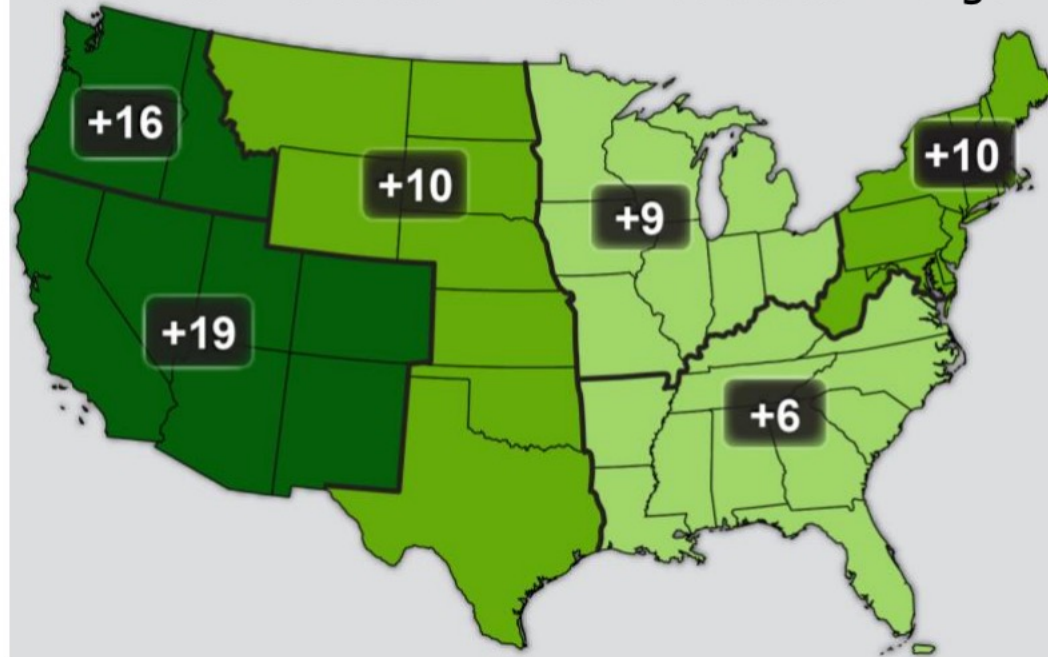
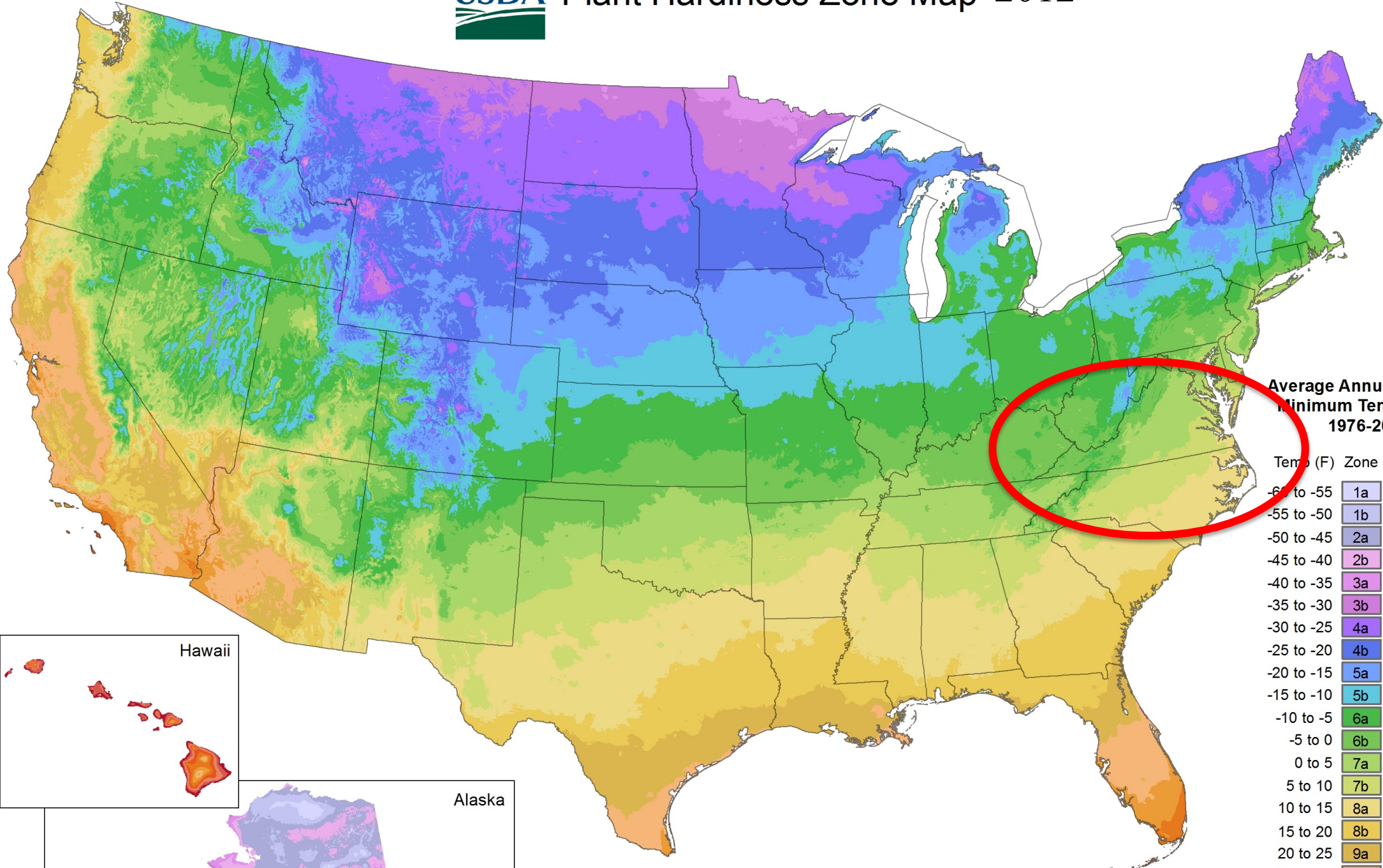


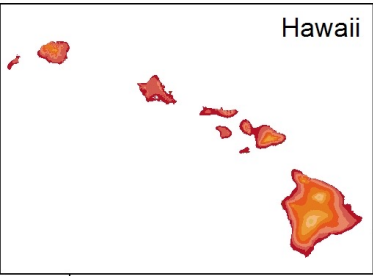
Figure 11: Observed increase in frost-free season length from 1991-2012 compared to 1901-1960.
(Source: NOAA NCDC / CICS-NC).¹⁶

USDA Plant Hardiness Zone Map 2012

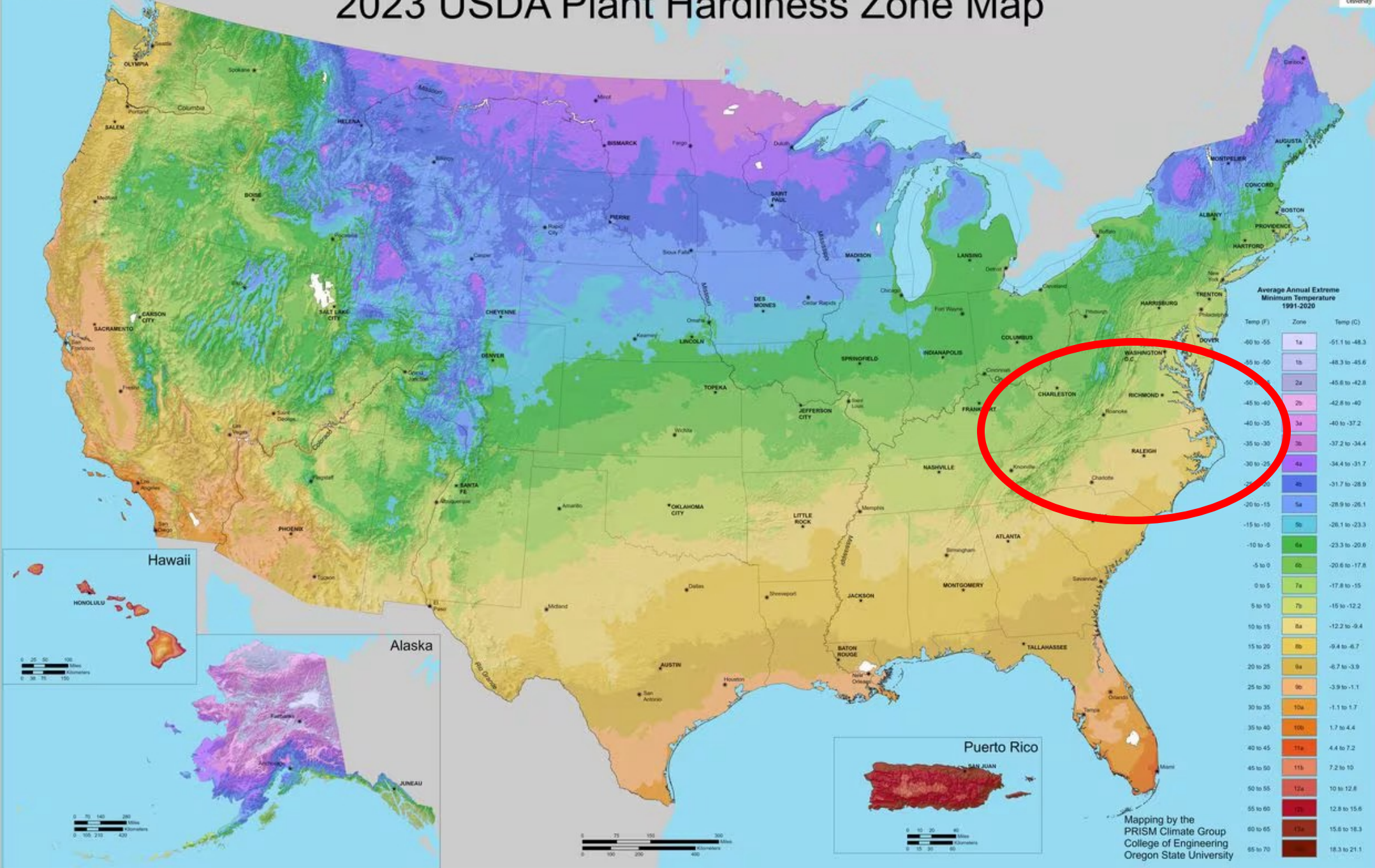


Average Annual Extreme Minimum Temperature 1976-2005

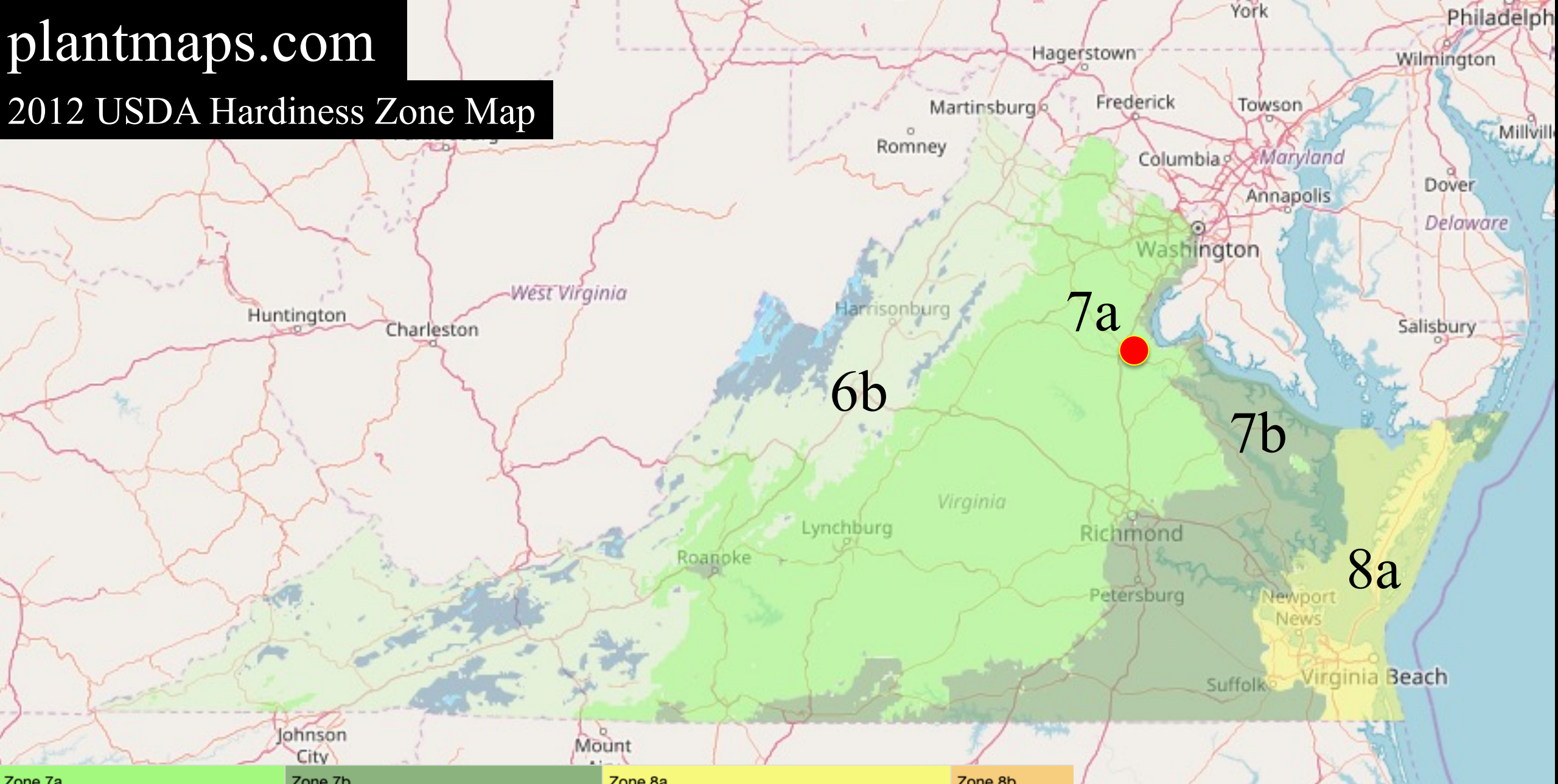
Temp (F)	Zone	Temp (C)
-65 to -55	1a	-51.1 to -48.3
-55 to -50	1b	-48.3 to -45.6
-50 to -45	2a	-45.6 to -42.8
-45 to -40	2b	-42.8 to -40
-40 to -35	3a	-40 to -37.2
-35 to -30	3b	-37.2 to -34.4
-30 to -25	4a	-34.4 to -31.7
-25 to -20	4b	-31.7 to -28.9
-20 to -15	5a	-28.9 to -26.1
-15 to -10	5b	-26.1 to -23.3
-10 to -5	6a	-23.3 to -20.6
-5 to 0	6b	-20.6 to -17.8
0 to 5	7a	-17.8 to -15
5 to 10	7b	-15 to -12.2
10 to 15	8a	-12.2 to -9.4
15 to 20	8b	-9.4 to -6.7
20 to 25	9a	-6.7 to -3.9
25 to 30	9b	-3.9 to -1.1



2023 USDA Plant Hardiness Zone Map

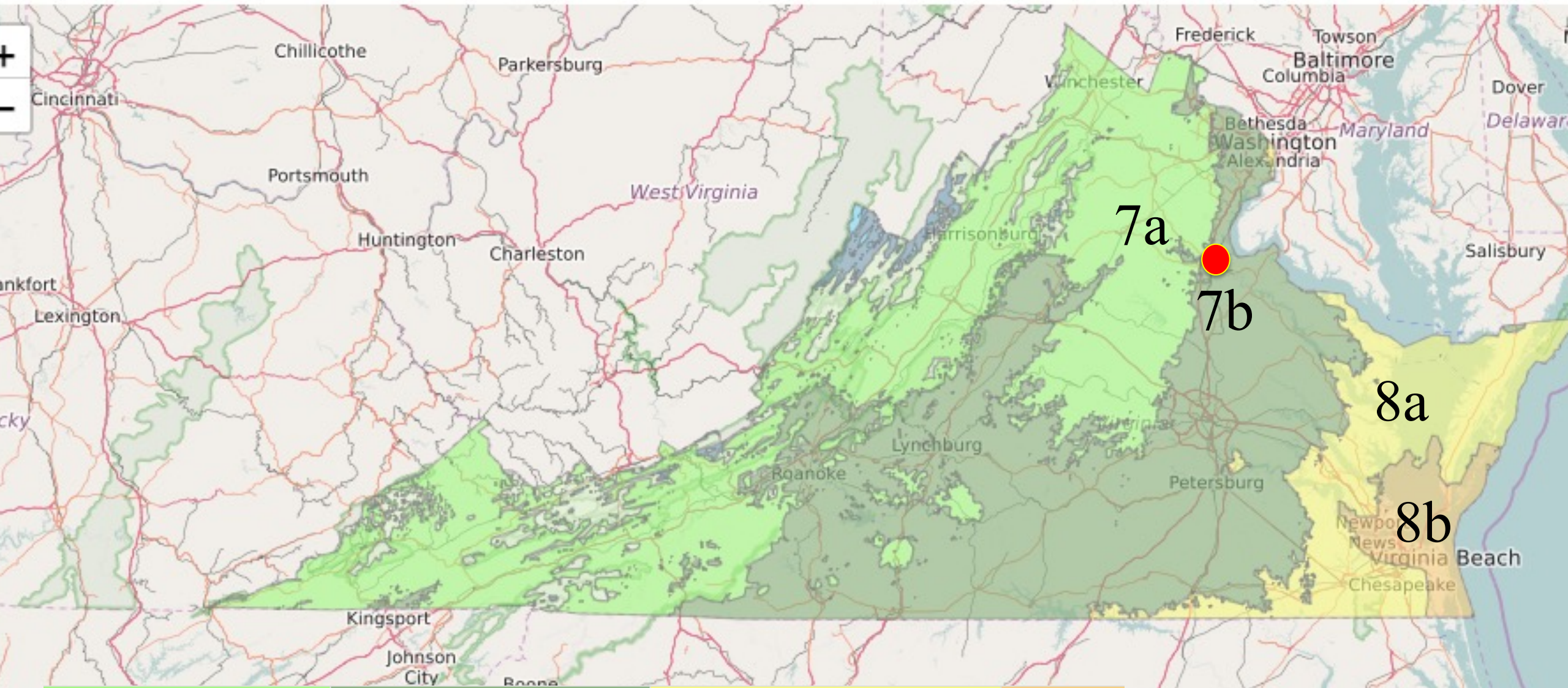


Mapping by the
PRISM Climate Group
College of Engineering
Oregon State University



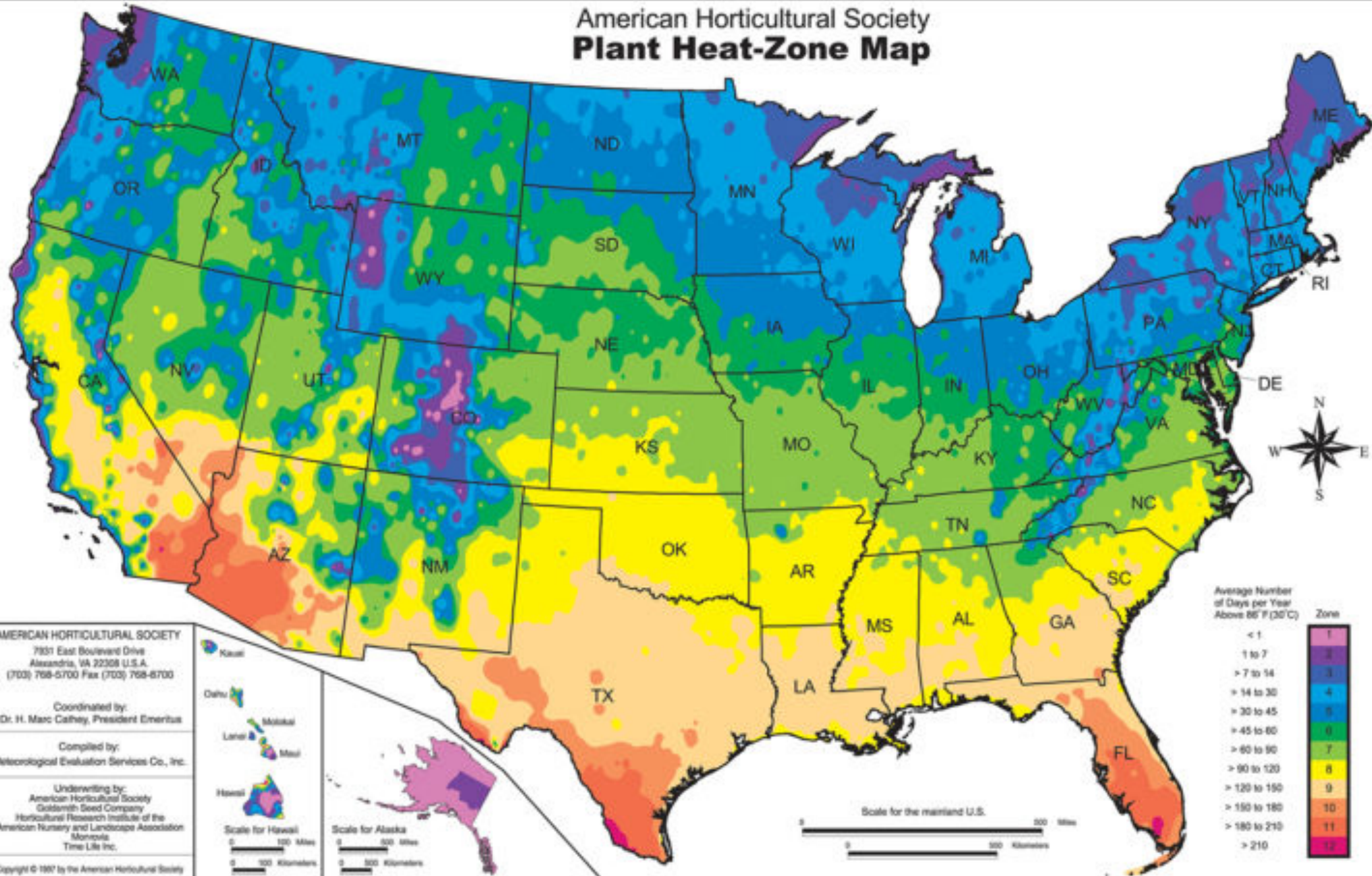
Zone 7a 0°F to 5°F	Zone 7b 5°F to 10°F	Zone 8a 10°F to 15°F	Zone 8b 15°F to 20°F
Zone 5a -20°F to -15°F	Zone 5b -15°F to -10°F	Zone 6a -10°F to -5°F	Zone 6b -5°F to 0°F

Click on the map for more information. Click on the icon in the lower right to view the map legend. Add additional data layers using the layer manager.



Zone 7a 0°F to 5°F	Zone 7b 5°F to 10°F	Zone 8a 10°F to 15°F	Zone 8b 15°F to 20°F
Zone 5a -20°F to -15°F	Zone 5b -15°F to -10°F	Zone 6a -10°F to -5°F	Zone 6b -5°F to 0°F

American Horticultural Society Plant Heat-Zone Map



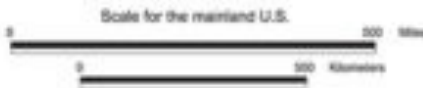
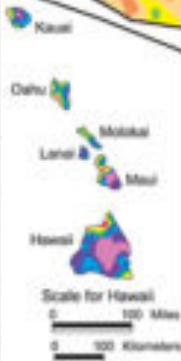
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Monrovia
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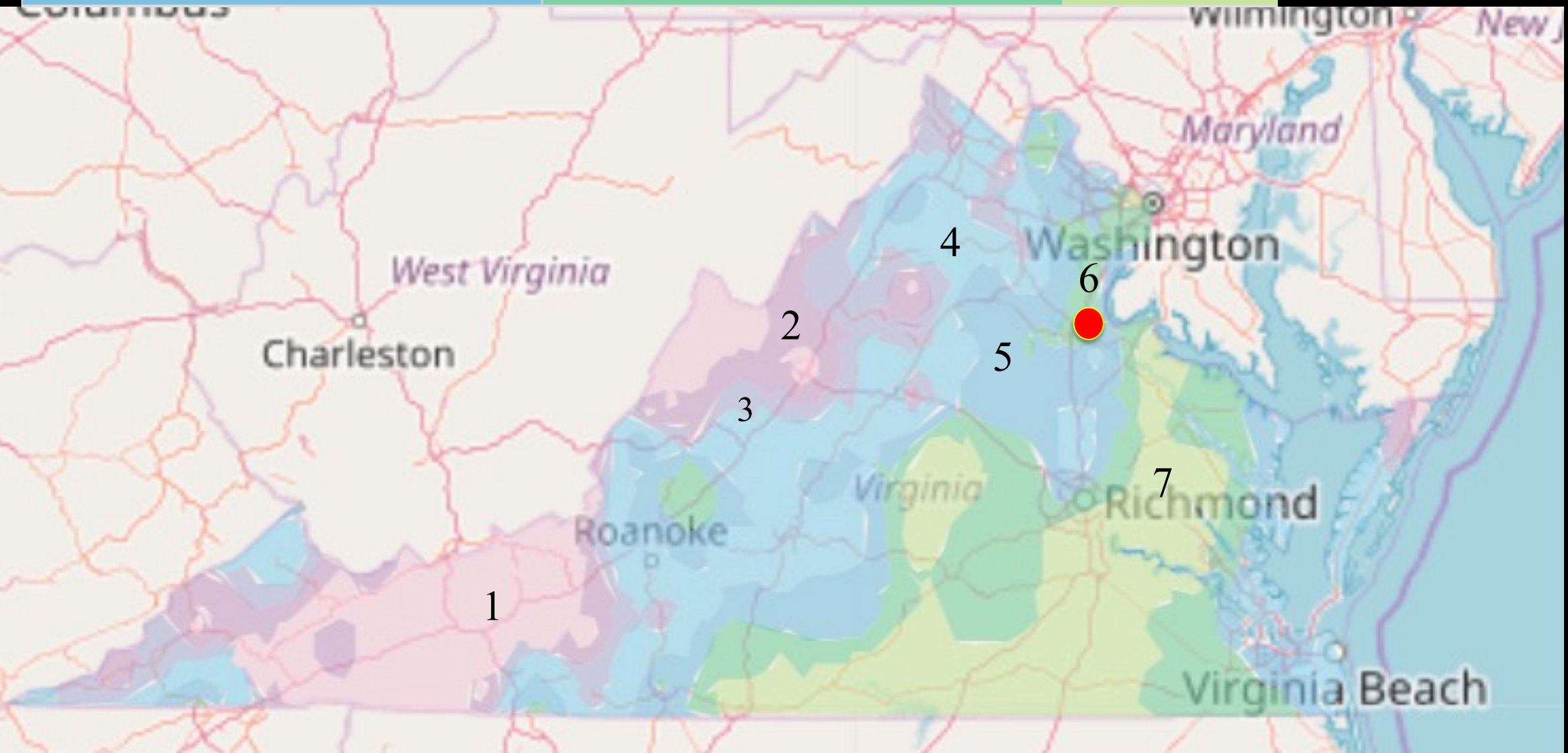
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Average Number of Days per Year Above 66°F (30°C)	Zone
< 1	1
1 to 7	2
> 7 to 14	3
> 14 to 30	4
> 30 to 45	5
> 45 to 60	6
> 60 to 90	7
> 90 to 120	8
> 120 to 150	9
> 150 to 180	10
> 180 to 210	11
> 210	12

Virginia Interactive Heat Zones Map

Zone 1 < 1 days > 86°F	Zone 2 1 - 7 days > 86°F	Zone 3 8 - 14 days > 86°F	Zone 4 15 - 30 days > 86°F
Zone 5 31 - 45 days > 86°F	Zone 6 46 - 60 days > 86°F	Zone 7 61 - 90 days > 86°F	



Additional Gardening Related Climate Data for ZIP Code 22401 - Fredericksburg, Virginia

2023 Hardiness Zone:	Zone 7b: 5°F to 10°F Zone 7a: 0°F to 5°F
2012 Hardiness Zone:	Zone 7a: 0°F to 5°F
1990 Hardiness Zone:	Zone 7a: 0F to 5F
Average First Frost Date:	October 11 - 20
Average Last Frost Date:	April 21 - 30
Koppen-Geiger Climate Zone:	Cfa - Humid Subtropical Climate
Ecoregion:	65m - Rolling Coastal Plain
Current Drought Status:	Exceptional Drought
Heat Zone Days:	46 - 60 days Over 86°F

Annual Climate Data for ZIP Code 22401 - Fredericksburg, VA

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Avg Min Temp (°F)	24	26	34	42	52	61	66	64	57	44	36	28	44
Avg Max Temp (°F)	45	49	58	68	77	85	89	87	81	70	59	49	68
Avg Precip (In.)	3.57	2.92	4	3.15	3.96	3.48	4.17	3.55	3.93	3.67	3.35	3.29	43.04

Good news / Bad news

Zone 7/8 plants: more selection!
Earlier Vegetable planting dates...
Longer frost-free season
Pest management challenges
Weedier weeds: thrive in higher CO₂
Poison Ivy
Honeysuckle
Kudzu



Virginia Tech Weed I.D. Guide





Tibouchina



Pest Management Issues

Overwintering
New challenges



Plectris aleina and Sweet Potatoes: Columbus County NC, 2006



Bag worms in Ohio...



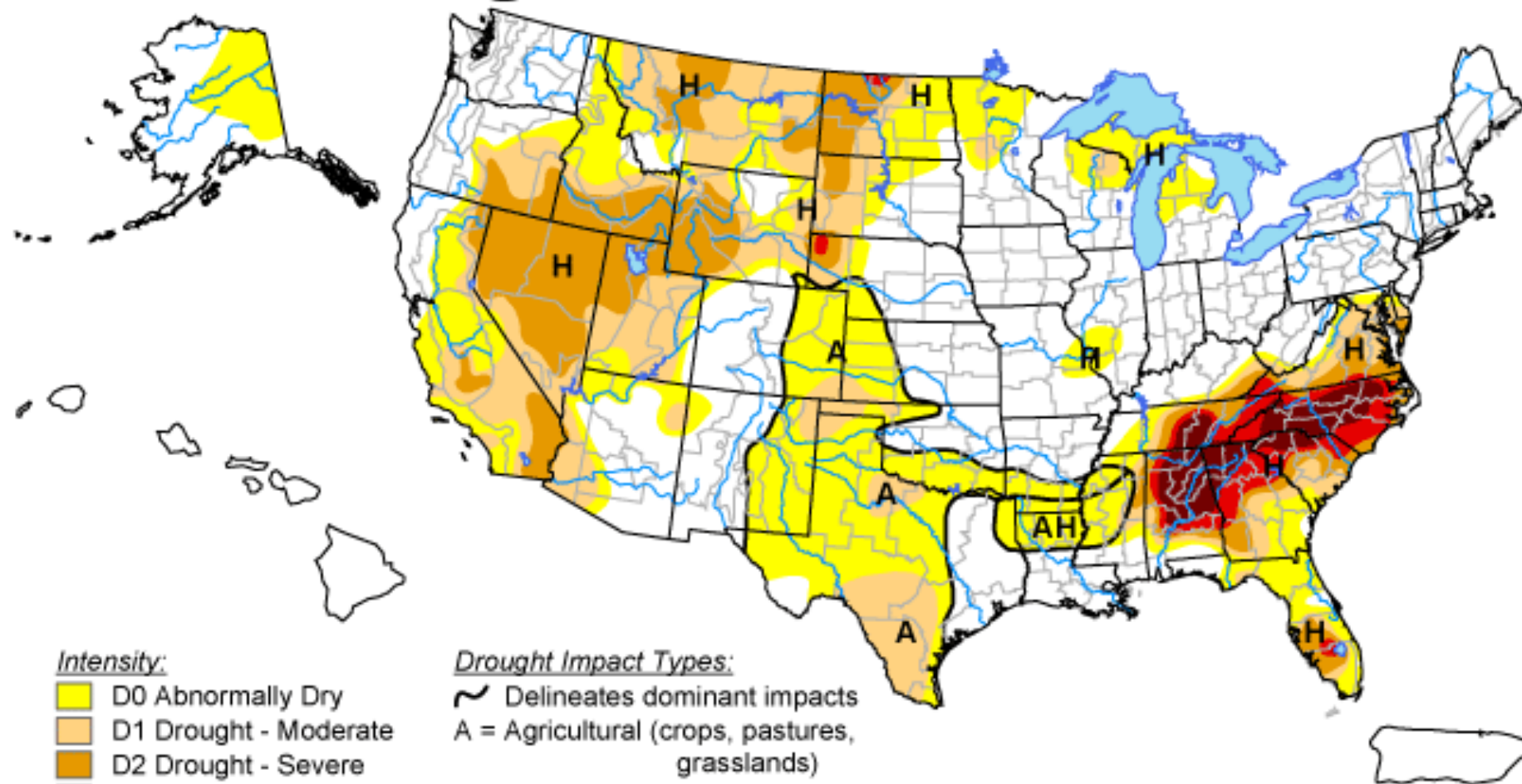
Water!








U.S. Drought Monitor

January 29, 2008


Valid 7 a.m. EST



Intensity:

-  D0 Abnormally Dry
-  D1 Drought - Moderate
-  D2 Drought - Severe
-  D3 Drought - Extreme
-  D4 Drought - Exceptional

Drought Impact Types:

-  Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://drought.unl.edu/dm>

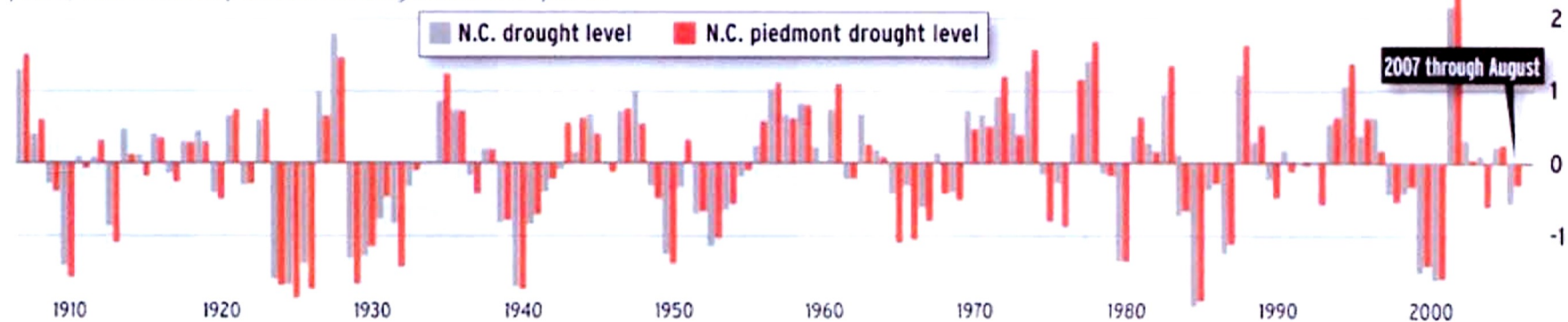


Released Thursday, January 31, 2008

Author: David Miskus, JAWF/CPC/NOAA

COULD MORE DRY WEATHER LIE AHEAD?

An average of drought indices compiled by the State Climate Office shows cycles of dry and wet going back more than 100 years, with each dry stretch lasting about five years.



A statewide average of four drought indices compiled by the State Climate Office since 1895. Zero indicates normal conditions; positive numbers are wetter than normal, negative numbers are drier than normal.

Sources: State Climate Office of North Carolina, U.S. Geological Survey

JUDSON DRENNAN /The News & Observer

Greater extremes:

Fredricksburg: 60 inches in 2018 (Average is 42 inches)



Figure 7: Graph of annual temperature anomalies - departures from the 20th century average.¹¹

Observed Change in Very Heavy Precipitation

1958 to 2012

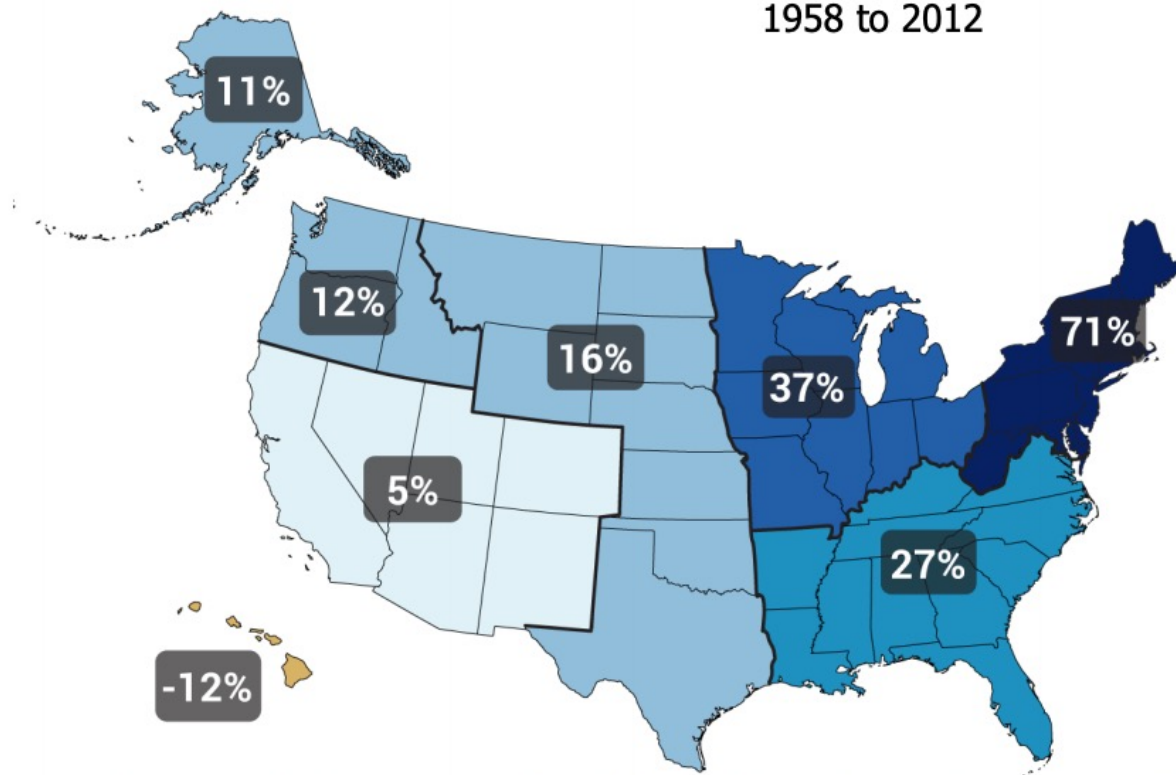


Figure 8: Map of percent increases in the amount of precipitation falling in very heavy events for regions of U.S.¹²

As gardeners what can we do?

Plants help environment

We have always been green!

We can be greener...



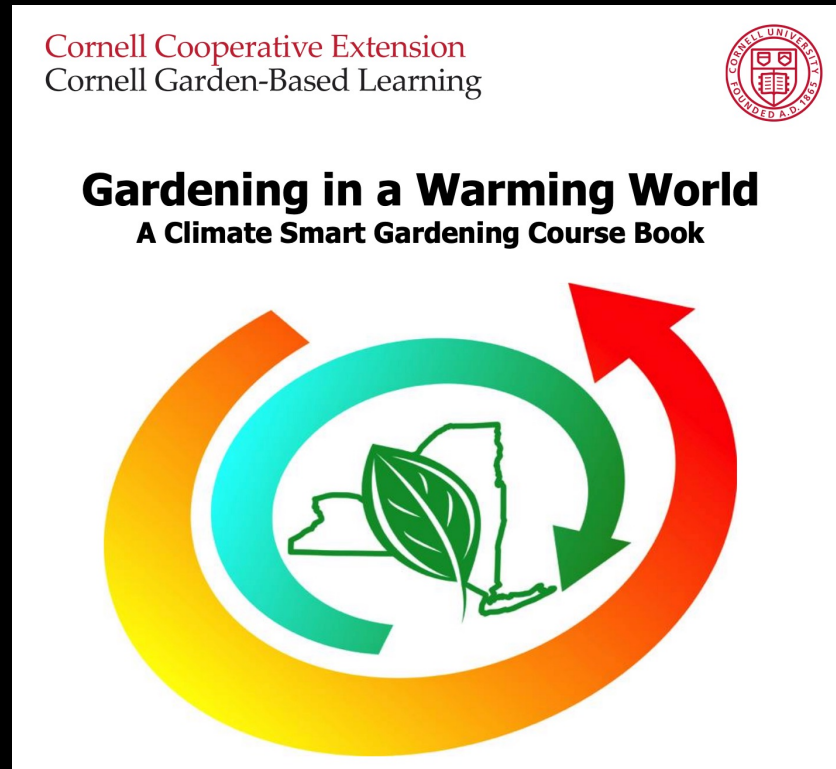
Climate Smart Gardening

We have been pretty climate smart gardeners!

We can do better...

“Gardening in a Warming World”

Cornell Cooperative Extension publication, 2018



Climate Smart Gardening

Promote biodiversity

Soil building and nutrition management

Water management and conservation

Pollinator promotion & protection

Plant selection and garden design

Equipment and material selection



Biodiversity

Variability among living organisms

Supports a **balance** in the environment (wildlife)

Critical input for contrived environments as well as natural

Supports local food chain

Supports natural soil microbes and biological balance



A huge need to mix it up



Importance of biodiversity in Gardening

Strength in ability to adapt to changing environment

“Global climate disruption”

Sustainable concept: “Mix it up”

Monocultures can be dangerous (Dutch Elm Disease)

Establishing balanced ecosystems

Pollinators

Wildlife



Environmental Stewardship

Plants absorb carbon from atm. (40yrs./1 ton)

Plants purify air (indoors and out) and soil

Well designed landscapes reduce erosion (20%)

Reduce noise pollution

Benefit and encourage pollinators

Attract beneficial wildlife...reduce pesticides



Trees and the Environment

Carbon dioxide scrubbers: 1 ton in typical lifetime

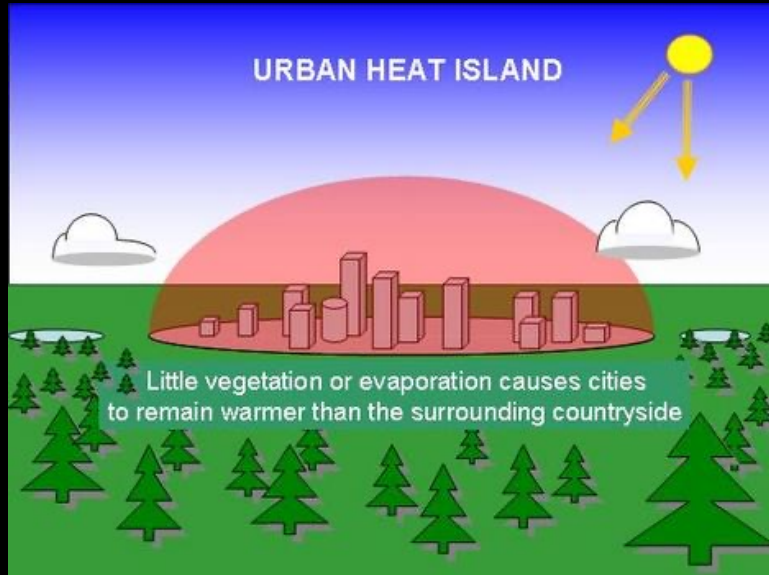
Plant 7 trees per year (equivalent) per person

Pollution absorbers: inside and out

Shade provider... cooling effect

Passive solar in the winter

Reduces “Heat Island” effect



We know that plants suck up Carbon...

ABC News article

SUNY Syracuse research

Tree selection can increase carbon removal by 300%!

However: increased volatile chemical release

31 species do both: 86% increase in C removal

Atlanta: nine million trees= 46,345 tons of C/year



Trees can contribute to pollution

VOC's (Volatile Organic Compounds)

Monoterpenes

Isoprenes

Ozone & Carbon monoxide

Choose diverse selection



Plant more trees!

Not just trees: Shrubs, vines, ground covers, herbaceous annuals and perennials

Know your plants!



Carbon Sequestration

One tree absorbs 22-40 lbs. of CO₂/year

25-70 year old trees sequester more CO₂ than older trees

Older trees store more CO₂

One tree sequesters 1/2 metric ton of CO₂ in it's lifetime

Average American lifetime carbon footprint:

20 metric tons!

Worldwide average carbon footprint: 3 tons

Plant 40+ trees in your lifetime!



Carbon Emissions from plants

3 Processes:

1. Cellular plant respiration (burning sugars)
2. Combustion (fire)
3. Decomposition (microbial breakdown)



Use Natives & Decent Exotic Relatives

Restores natural habitat...plants and animals

Once established, can use less water

Plenty of desirable cultivars

Beware of native invasives...



Chionanthus retusus, Chinese fringetree









Hydrangea arborescens 'Annabelle'









Invincibelle Spirit, Invincibelle Spirit II, Ruby, Mini Mauvette, Limetta



Hydrangea quercifolia, oakleaf hydrangea





‘Snowflake’



“Healthy” soil: Win Win

Improves water infiltration (20%)

Reduces and slows runoff and erosion

Excellent nutrient and water storage

Filters pollutants and sediment

Improves soil biology and attracts wildlife promotes biodiversity

Human health and well being



Bed Preparation is key to good soil fertility

Soil Building is the key to success!

Cultivate

Incorporate

Invigorate

(mulch)





Establishment is the key!

Factors that affect establishment time:

Species

Soil (bed prep)

“Stop thinking about the hole...

Start thinking about the whole!”

Light (honest assessment)

Water (#1 killer of transplanted shrubs)







Re-think use of turf

US Home Lawn Area: 22+ million acres on 50 million lawns!

80% of American homes have private lawn

#1 water user in landscape, 3-6x / sq. ft.



Use Turf as a groundcover











Wanna see my lawn?













“Waterwise” Gardening”

Waterwise: Gardening practices that conserve moisture

Xeriscaping: Landscaping for efficient water use

Landscape planning

Soil preparation

Plant selection

Plant placement

Cultural practices



Plan Your Landscape With Water in Mind

Match plants to the site...

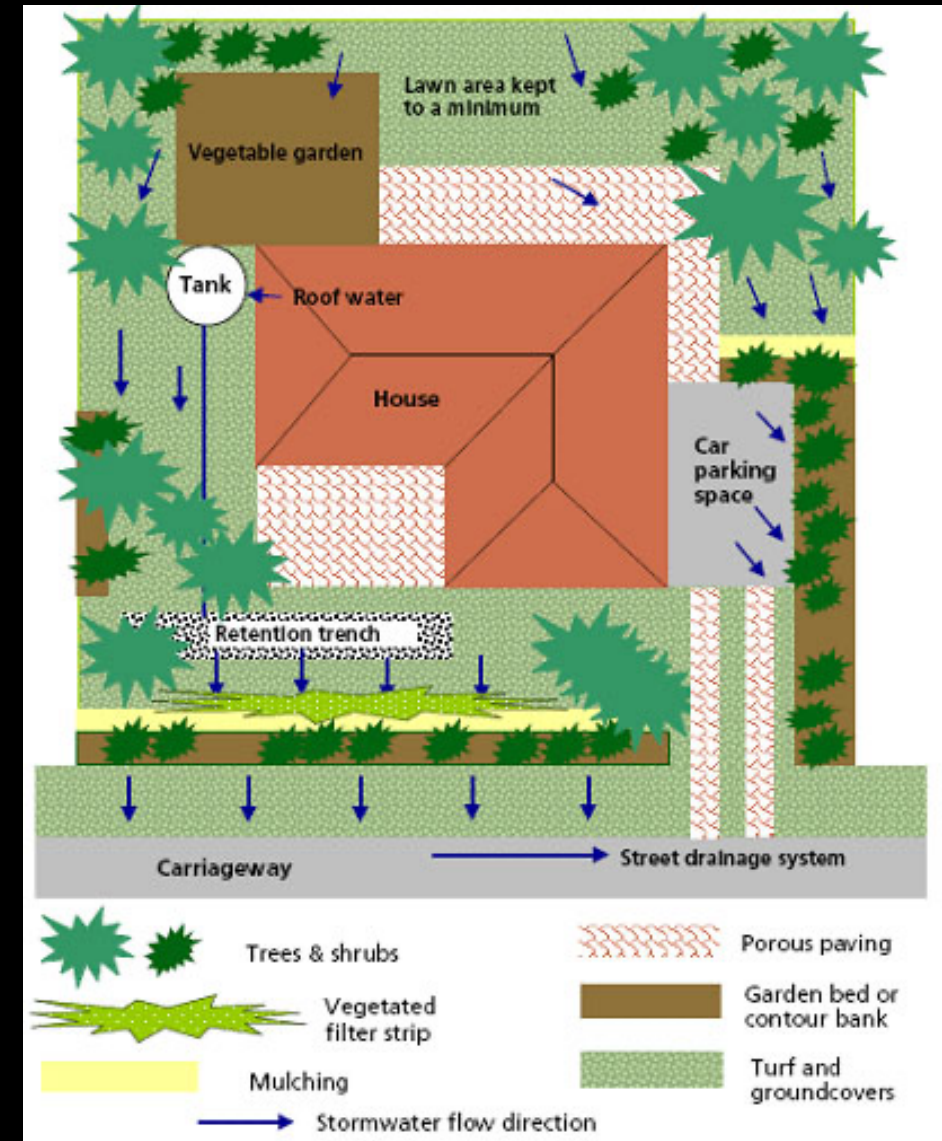
And to each other (heavy drinkers)

Hydrozone Gardening:

Oasis Zone

Transitional Zone

Xeric Zone



Amsonia hubrichtii & *Solidago rugosa* 'Fireworks'







Efficient Irrigation Practices

Know rainfall (rain gauge)

Know application rates

Localize watering

Water early in AM

Water slow and deep



Irrigation Practices

Use a timer

Use drip irrigation

Soaker hoses

Collect free water



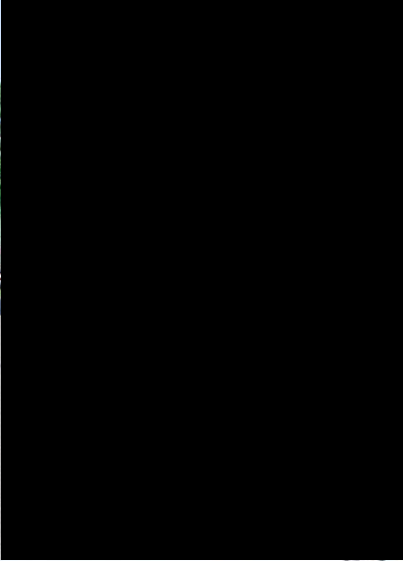
Rain barrels can capture and store rain that falls on roofs and then irrigate landscapes when they need water again. As a rule of thumb...

1,000 sq feet of roof surface captures 625 gallons for every 1 inch of rainfall.

SoCalWaterSmart offers rebates for rain barrels and cisterns.







Reduce or change use of gas-powered tools



A white t-shirt is hanging over the back of a metal chair on a paved patio. The t-shirt has two lines of text printed on it. The background shows a garden with green plants and a white utility pole. The scene is brightly lit, suggesting it is daytime.

I love to
play in the dirt!

**Thanks for your
attention!**