AgroClimate: Tools for managing climate risk in agriculture

State of the Science

March 7, 2023

AgroClimate
Tools for Managing Climate Risk and Agriculture

Clyde Fraisse
Agricultural and Biological Engineering
University of Florida

UF 100 years ABE 1923 - 2023

AgroClimate Tools for Managing Climate Risk and Agriculture mission: Increase **action** and add **value** to weather and climate data

Increasing action out of data

Descriptive Analytics

What has happened or will happen?

Monitor and forecast

Predictive Analytics

What will happen? What if scenarios.

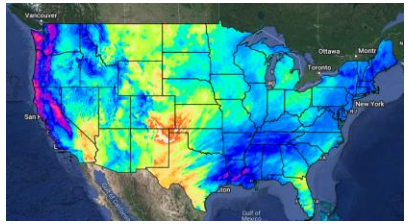
Simulate effects

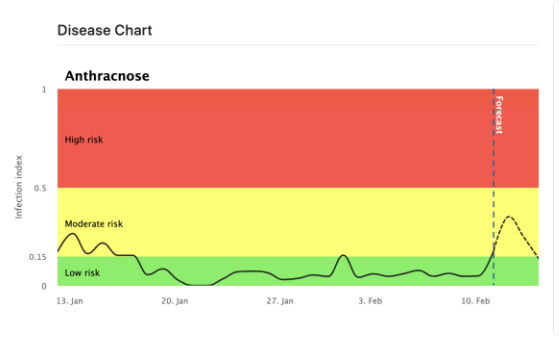
Prescriptive Analytics

What should be done? A decision is made.

Take action

Increasing value of data





Recommendation

Anthracnose

Spray fungicide!
Recommended Products: Captan (Generic) or Thiram (Generic).

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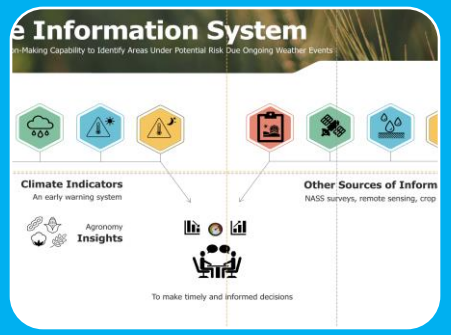
1

AgroClimate.org

- Southeast USA
- Decision and monitoring tools, educational materials

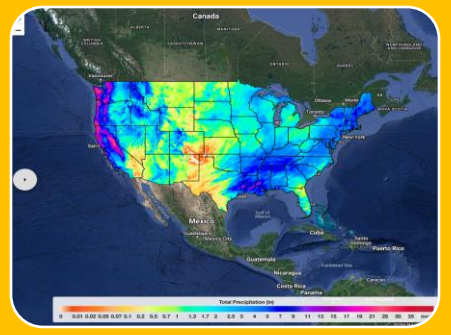
2



Climate Information System

- USDA-NASS: CONUS
- Risk monitoring

3



AgroClimate Indicators

AgroClimate Tools for Managing Climate Risk and Agriculture
ACIS Applied Climate Information System

- USDA-OEEP: CONUS - Partnership with NOAA Northeast RCC Applied Climate Information System (ACIS)
- AgroClimate indicators for decision making

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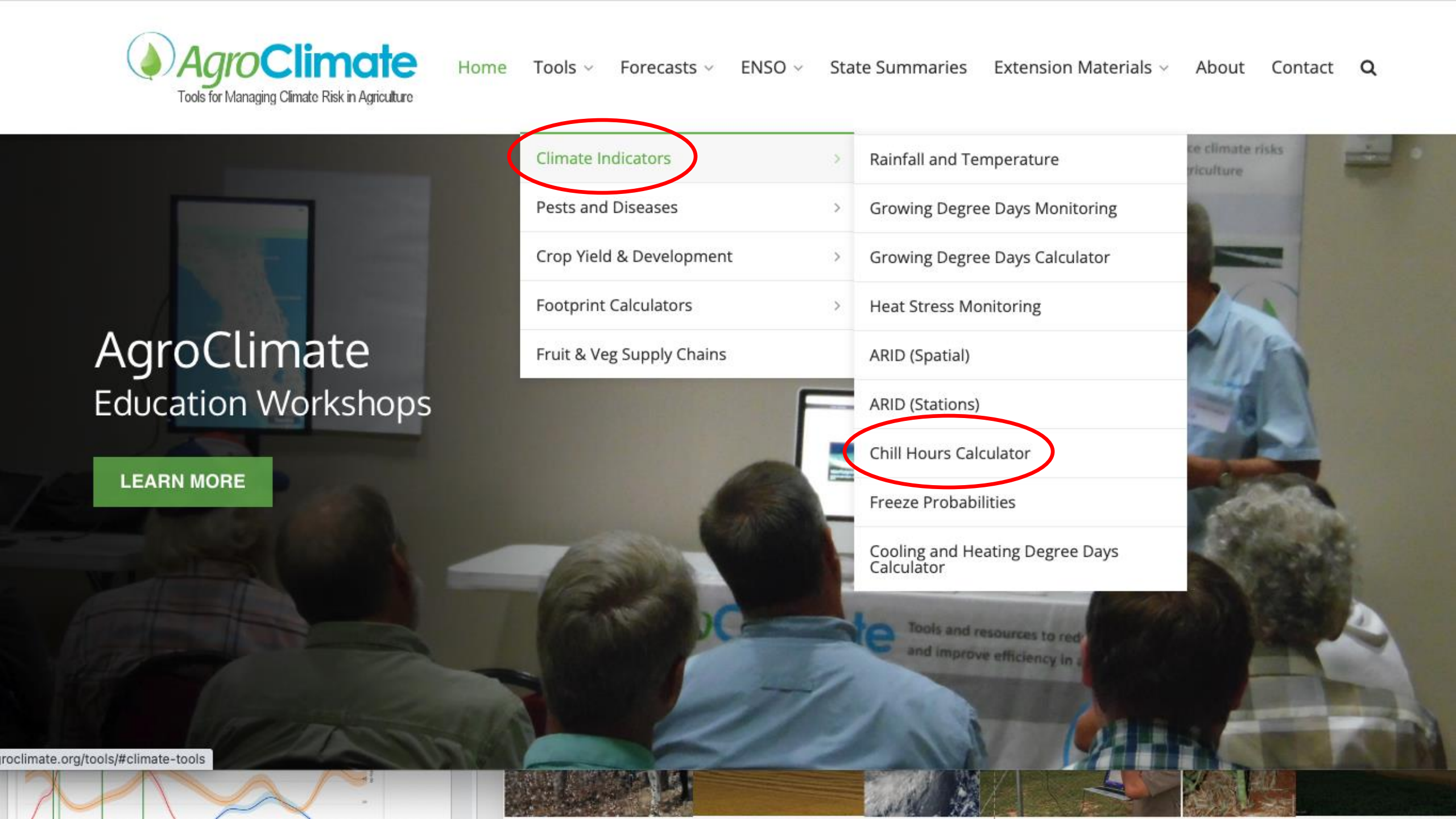
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Fruit & Veg Supply Chains
Rainfall and Temperature
Growing Degree Days Monitoring
Growing Degree Days Calculator
Heat Stress Monitoring
ARID (Spatial)
ARID (Stations)
Chill Hours Calculator
Freeze Probabilities
Cooling and Heating Degree Days Calculator
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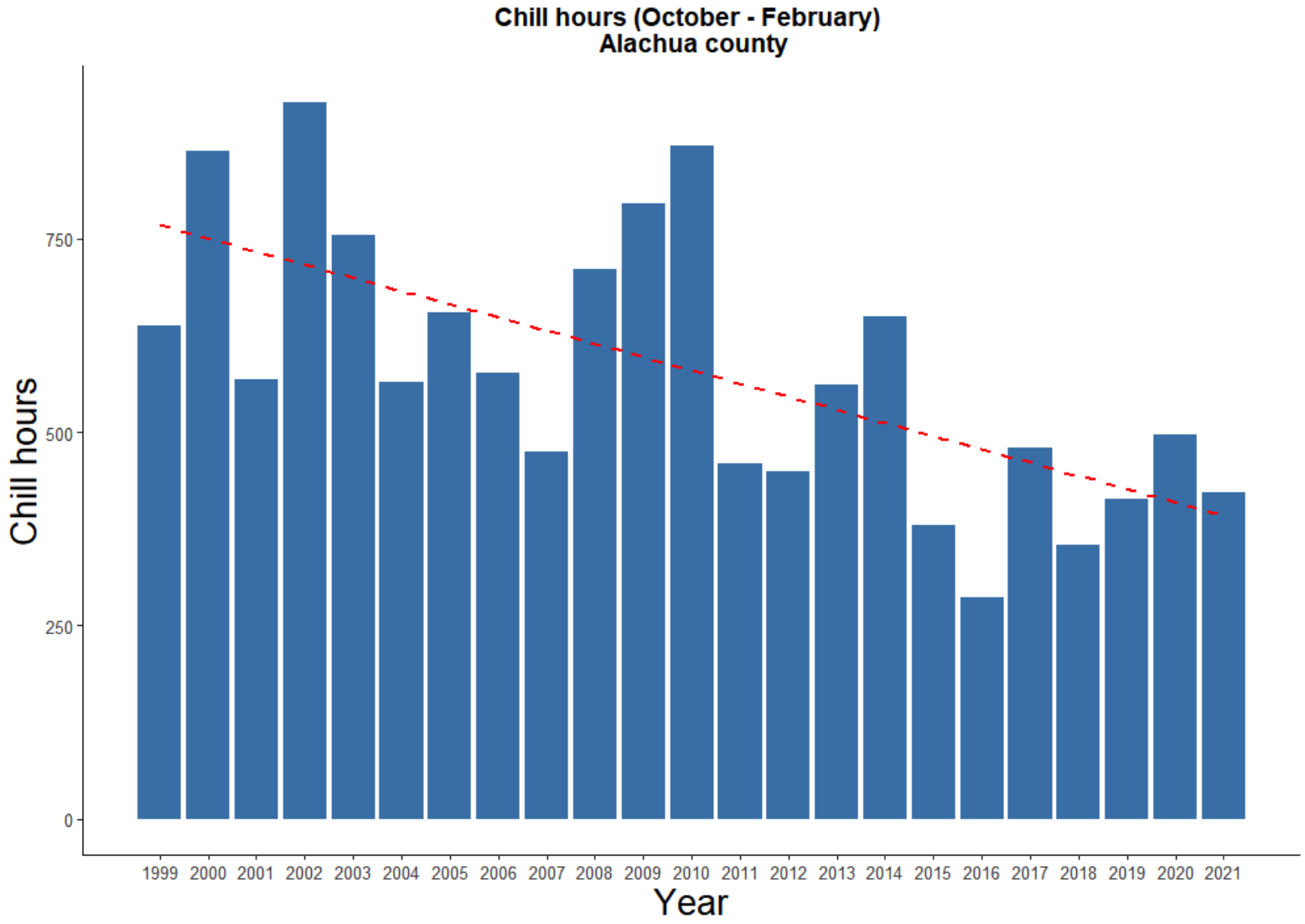
roclimate.org/tools/#climate-tools

Warm winters in the southeast are reducing chill accumulation during the winter



Chilling accumulation is already considered a major limitation for temperate fruit production in the southeast. Warm winters also accelerate bloom, making flowers vulnerable to freezes. The southeast has seen several devastating late freezes in recent years.

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Map | Total Accumulated and Projected | Accumulated by Period

Chill hours calculation tool

Temperature: 32-45 °F - Alachua County (FL)

Period [Oct 1, 2022 - Feb 8, 2023]:

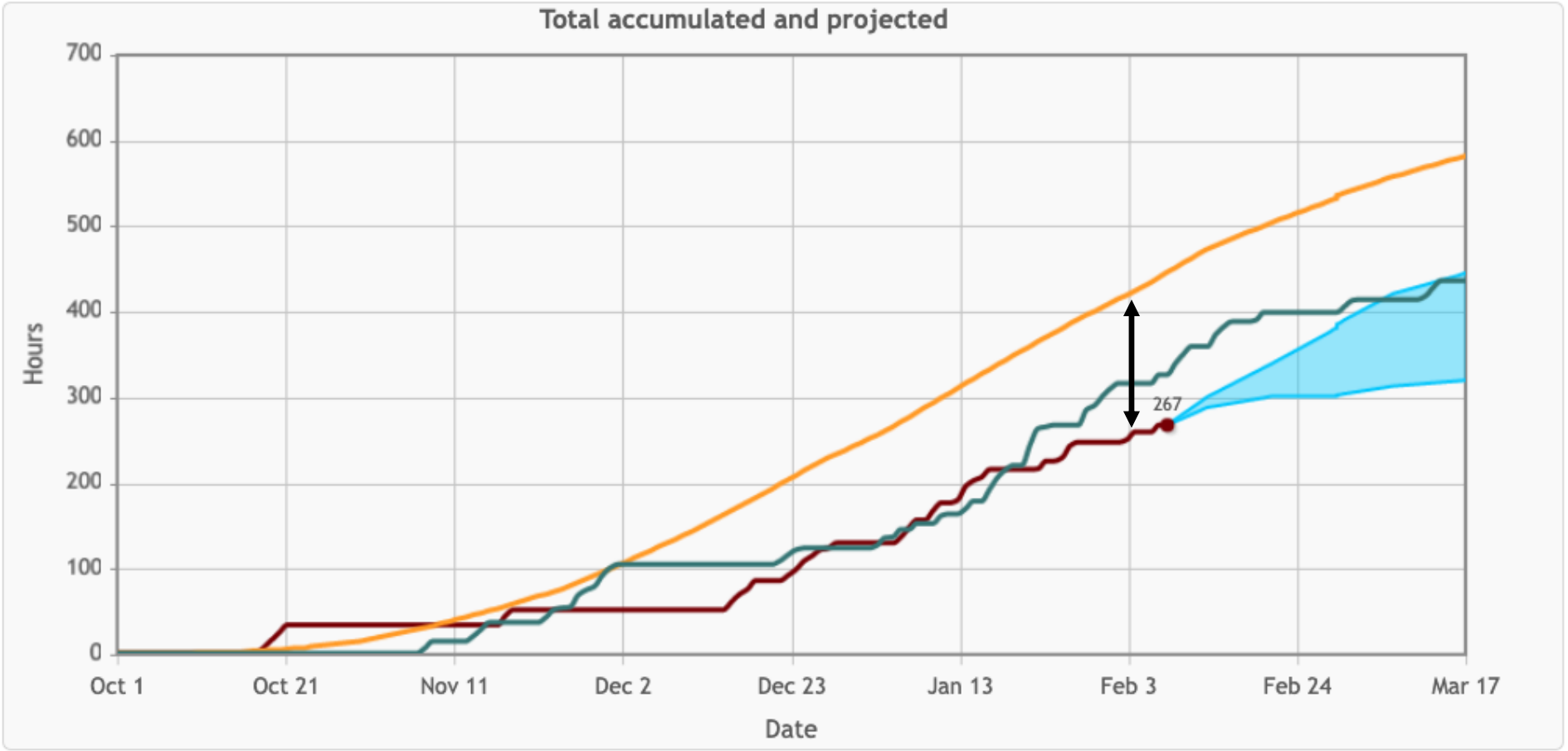
This season	267 Hours
Last season	326 Hours
Historic average	446 Hours

Current accumulation

Projection based on long-term La Niña climatology

Historic Average

Last season



Our plan for 2023:

- Redesign the tool
- Plot more years than just last year
- Add Dynamic model (chill portions)

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Tools for Managing Climate Risk in Agriculture

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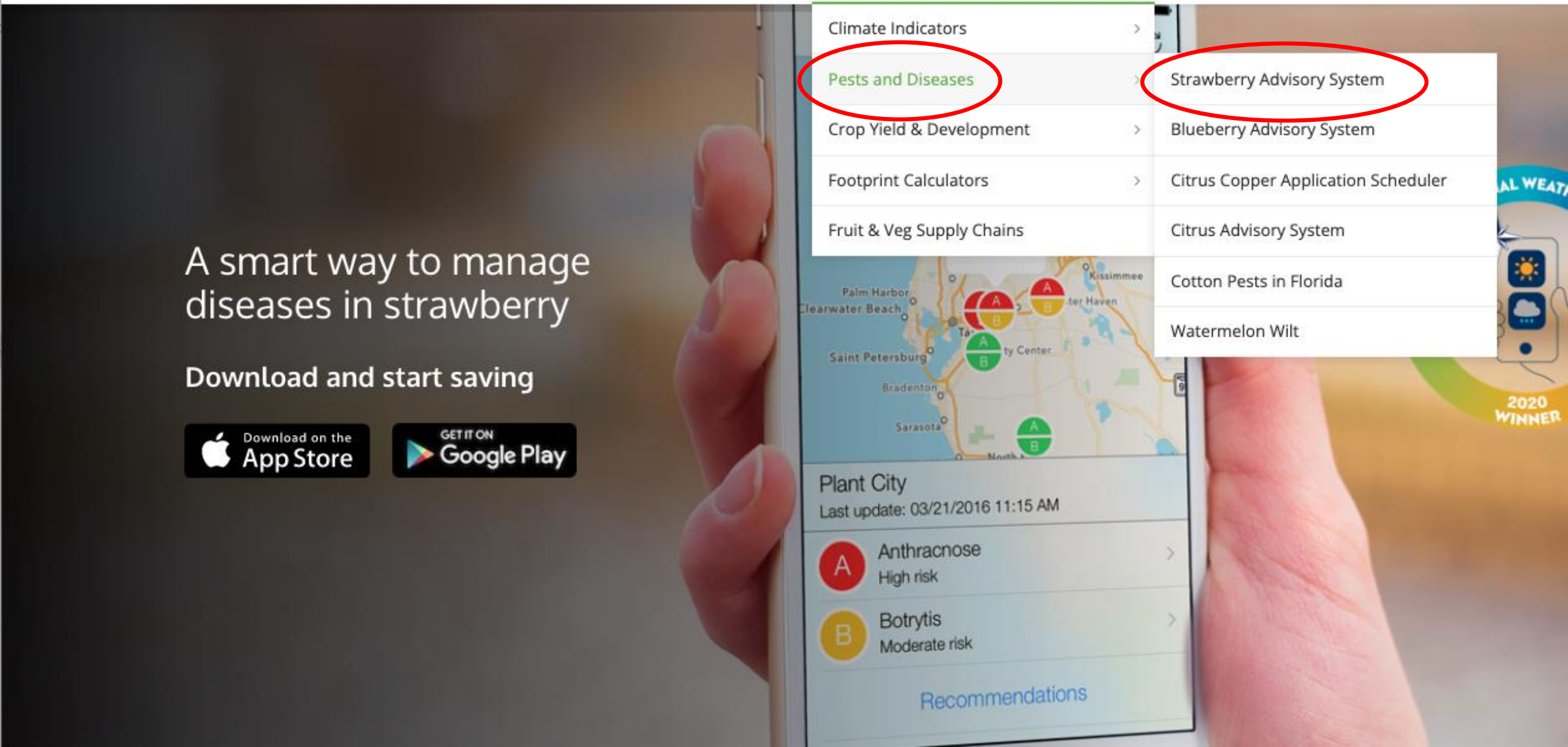
A smart way to manage diseases in strawberry

Download and start saving

Download on the App Store

GET IT ON Google Play



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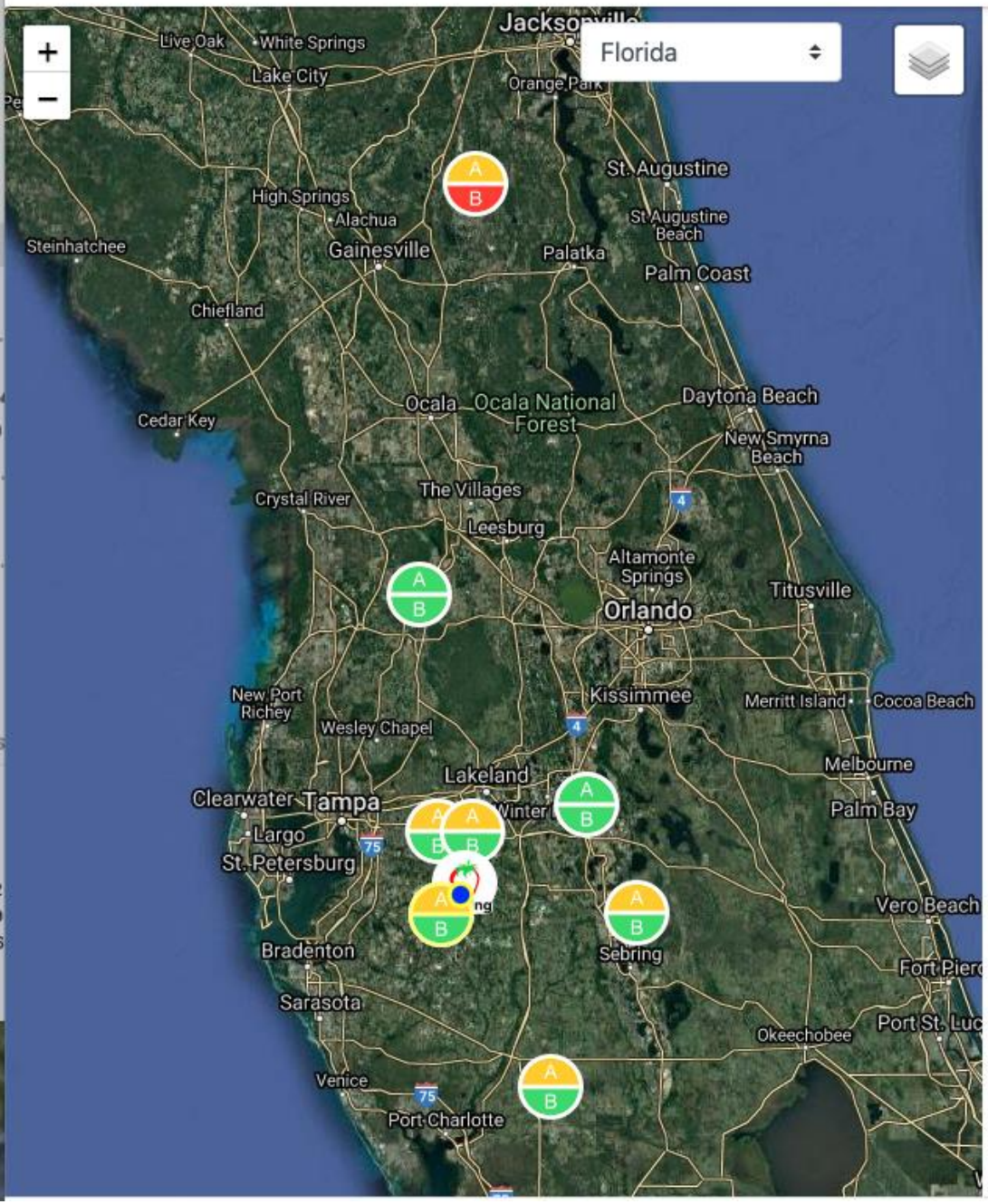
Tools for Managing Climate Risk in Agriculture

Strawberry Advisory System

Dashboard | About & publications | Manage alerts | Sign in



Balm

FAWN

27.760, -82.224
Wimauma, FL
Hillsborough county

Highest risk recorded today

Simulated at: 03/03/2021 12:15

Anthracnose
Level: Moderate

Botrytis
Level: Low

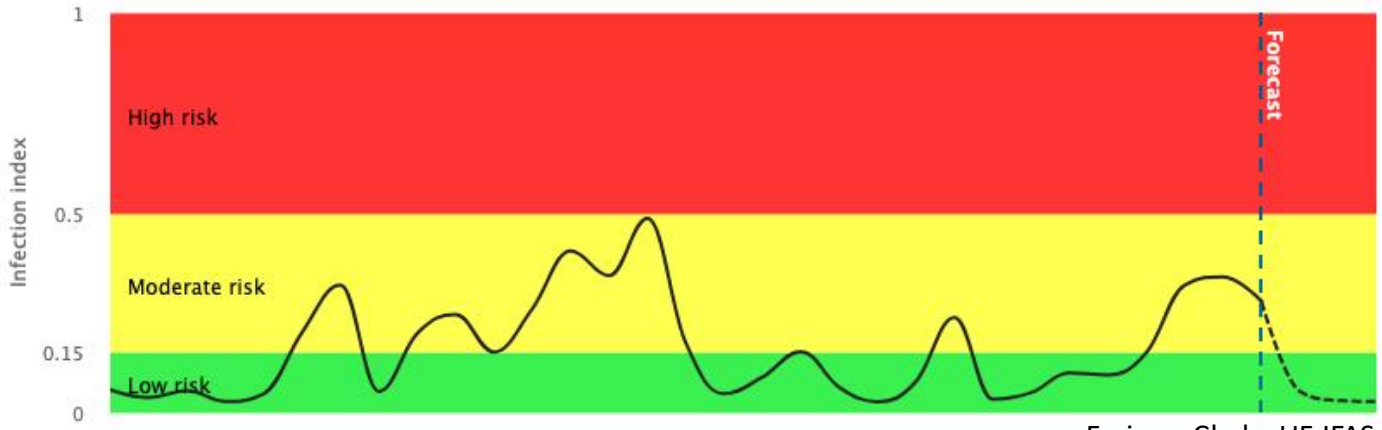
DISEASE RISK | WEATHER | RECOMMENDATIONS

Date Interval 02/01/2021 - 03/03/20

Export Chart/Table

Disease Chart

Anthracnose



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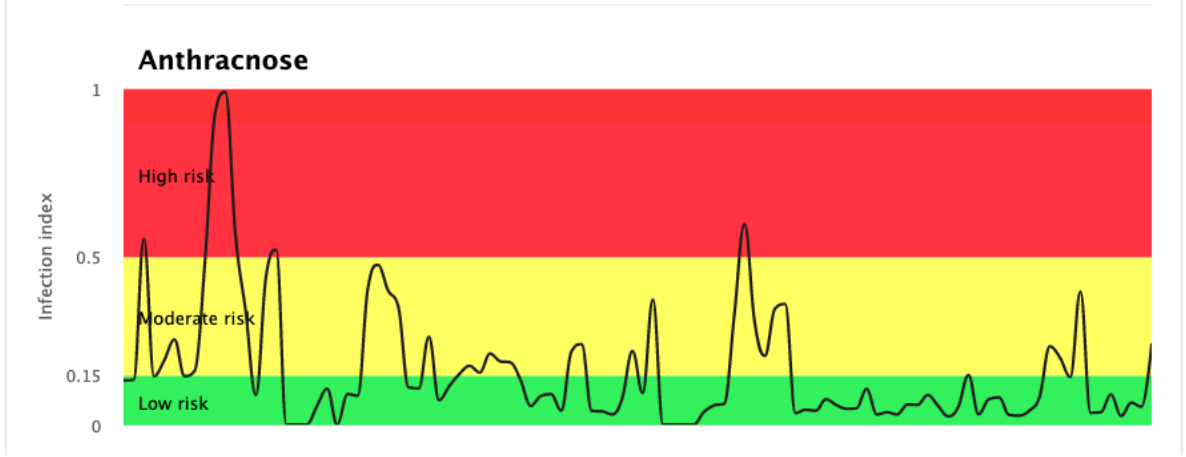
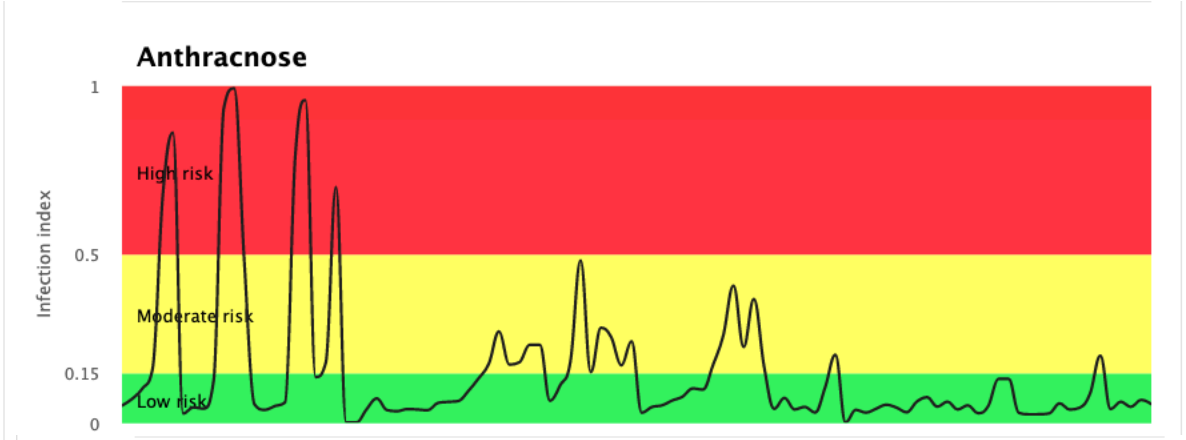
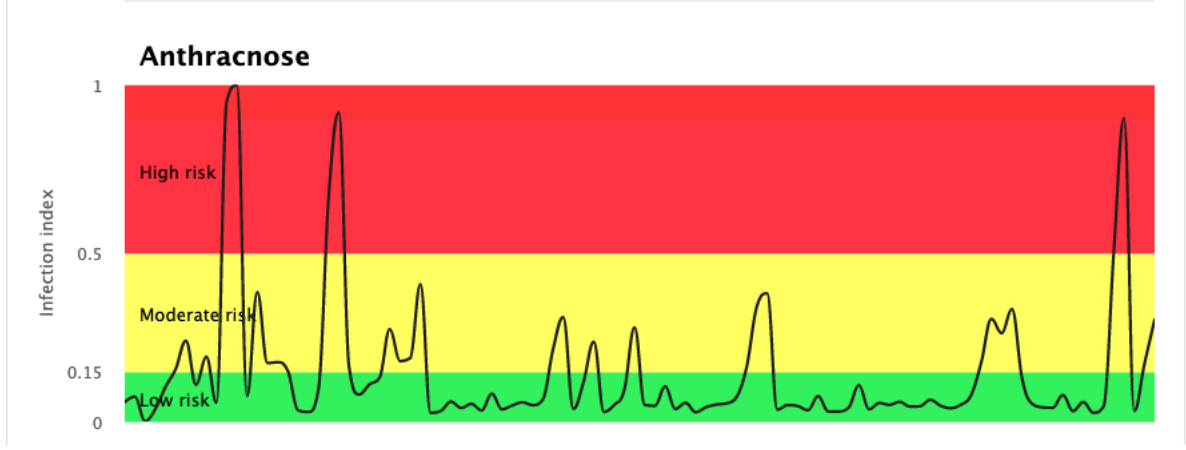


2022-23



2021-22



2020-21

Plant City, Florida
Anthracnose risk
Nov 1 – Feb 10

We have experienced reduced disease pressure during the last 3 years due to La Niña cycles

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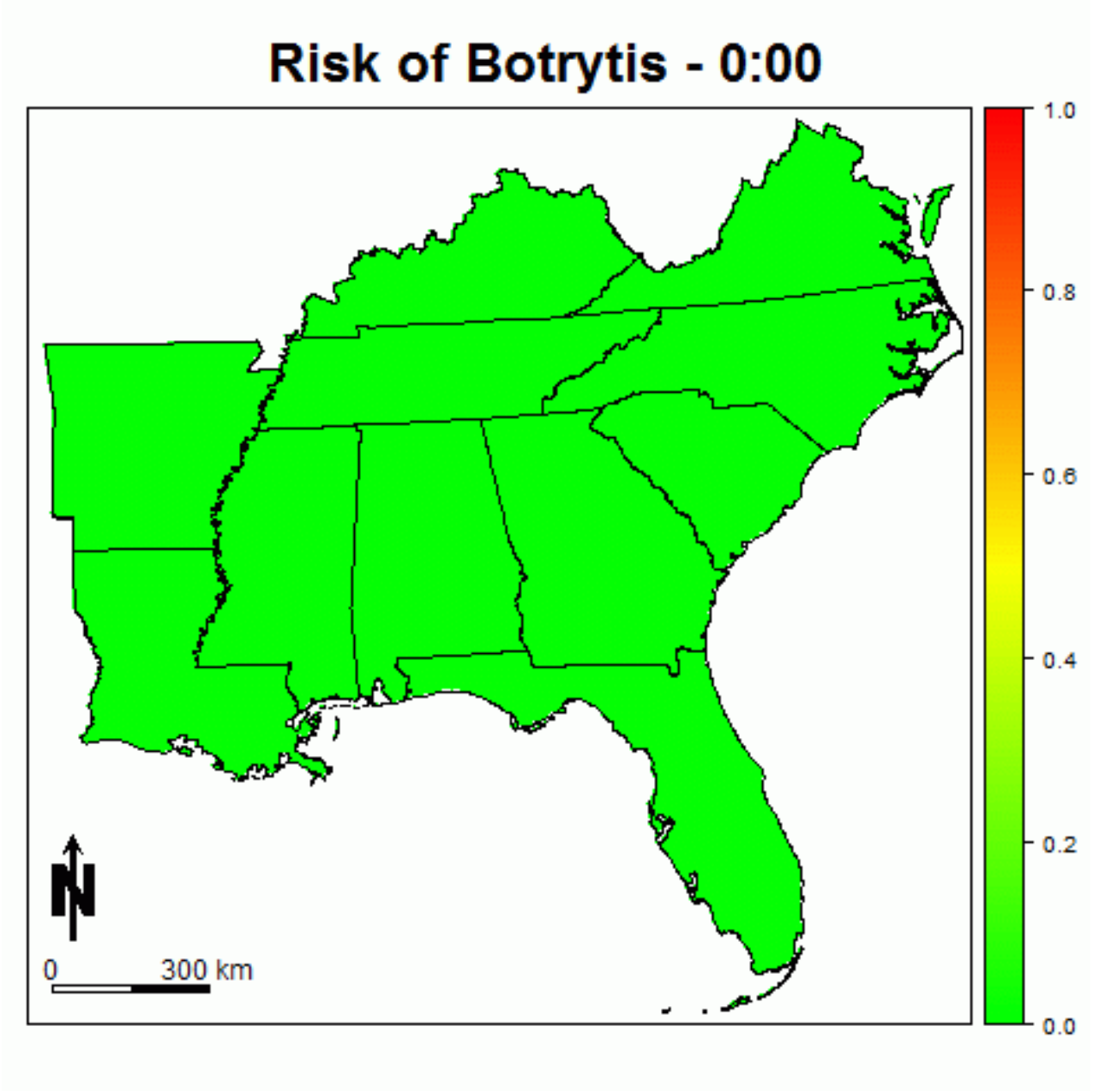
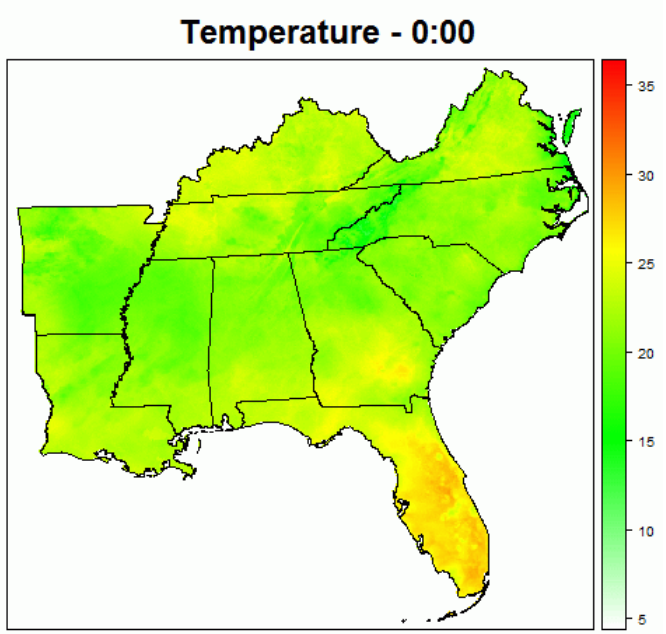
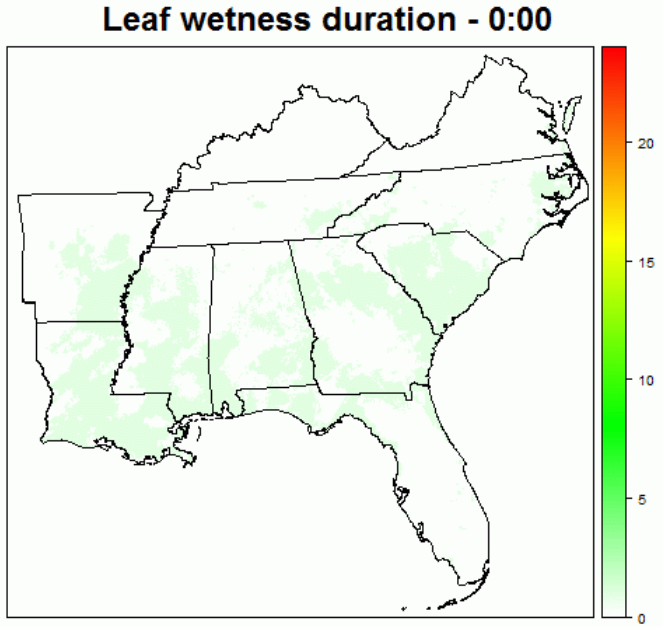
Our plan for 2023 is to evaluate the use of gridded weather products to monitor and forecast disease risk.

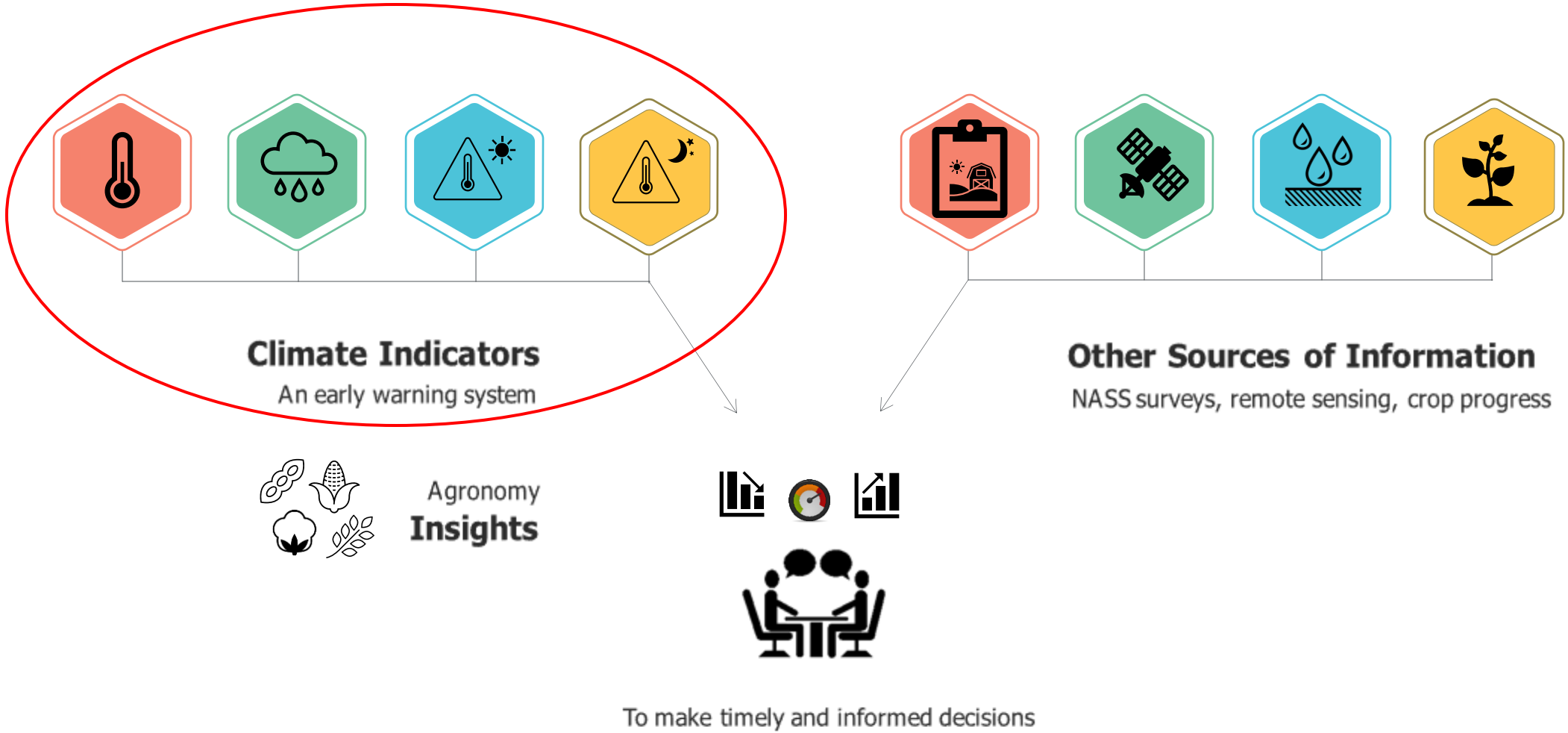






Climate Information System

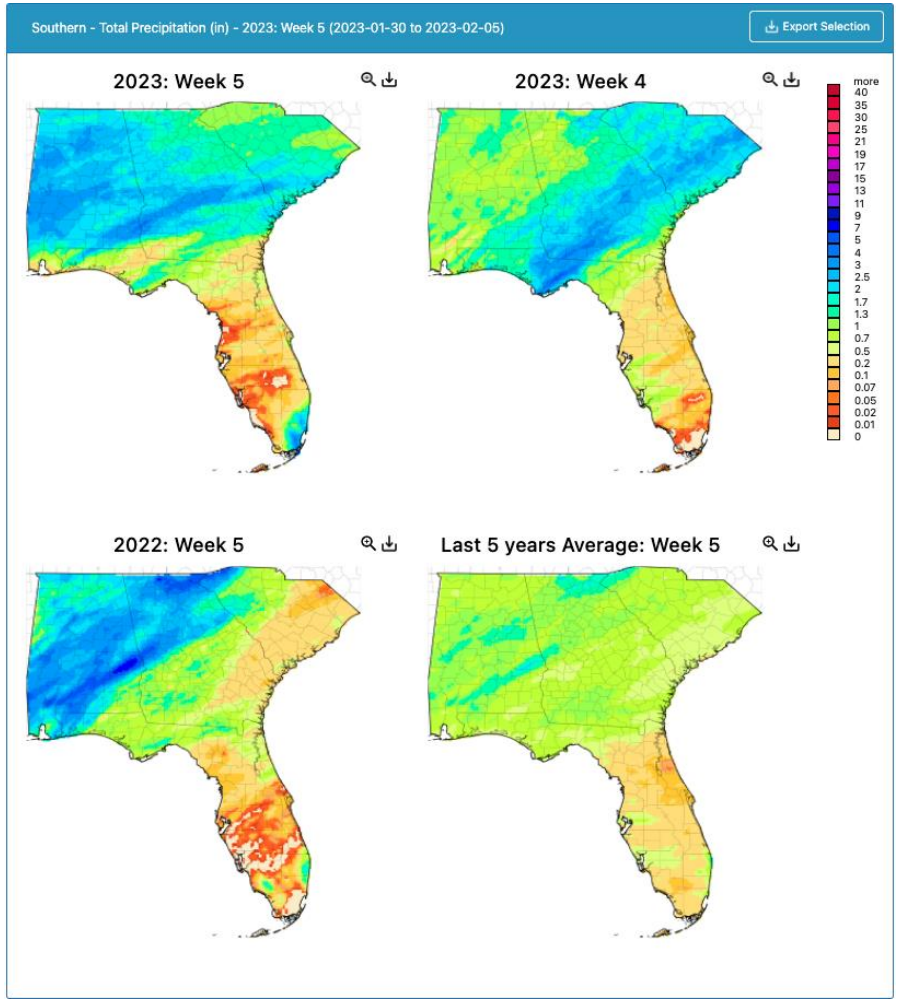
Enhancing NASS's Decision-Making Capability to Identify Areas Under Potential Risk Due Ongoing Weather Events



Courtesy Noemi Guindin, USDA-NASS

Climate Indicators available in the system

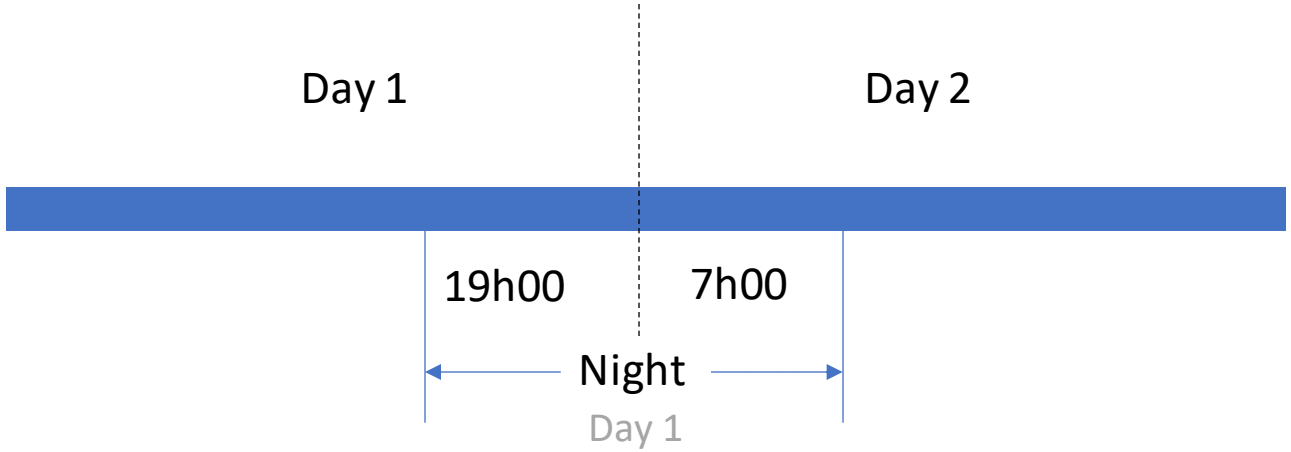
- Precipitation
- Water Stress (ARID)
- Night Temperature accumulated (above 4 thresholds)
- Degree days (different T_{base})
- Air Temperature (max, min, mean, amplitude)
- Heat stress (daily max temperature above 5 thresholds)



Maps can be generated for individual states or regional offices

Climate Indicators available in the system

Nighttime Temperature



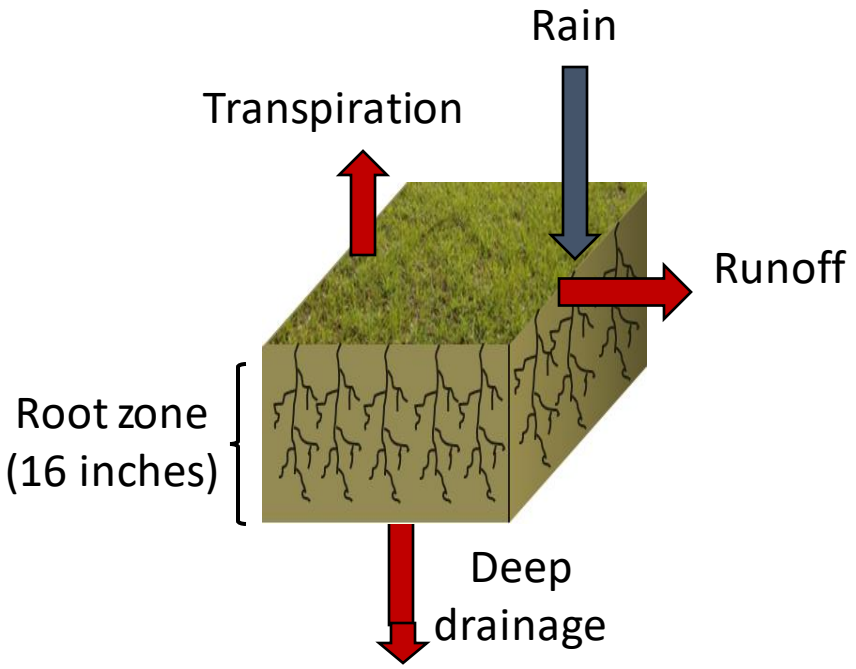
$$NTDH = T_h - T_{hth}$$

NTDH = Nighttime degree-hours

T_h = Observed temperature

T_{hth} = Temperature thresholds (68°F, 72°F, 73°F, and 79°F)

Agricultural Reference Index for Drought (ARID)



$$ARID = 1 - \frac{TR}{ETo}$$

Report

Export

Florida - Districts Report

Time period of **07/01/2022** to **07/31/2022**

District Code	District Name	Total Precipitation (inches)				Temperature Amplitude (˚F)				Max Temp. > 93˚F			
		Observed	Percentile of all long-term observations (%)	Deviation from long-term Avg	5-year Avg	Observed	Percentile of all long-term observations (%)	Deviation from long-term Avg	5-year Avg	Observed	Percentile of all long-term observations (%)	Deviation from long-term Avg	5-year Avg
10	Northwest	10.01	85.3	2.58	8.53	16.6	4.8	-2.5	17.2	5.6	24.3	-13.8	9.5
30	Northeast	8.42	85.3	1.44	8.58	18.2	12.1	-1.5	17.9	11.6	39.0	-9.1	13.2
50	Central	8.14	60.9	0.64	9.01	18.2	43.9	-0.4	17.1	12.1	63.4	-0.2	8.4
80	Southern	6.24	21.9	-1.13	7.76	16.9	26.8	-1.0	16.4	8.4	58.5	-0.4	7.8

USDA

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Export

Accumulated Night Temperature Index > 79˚F					
Observed	Days of occurrence	Percentile of all long-term observations (%)	Deviation from long-term Avg	5-year Avg	Percentage of the observations (%)
244.9	31	81.8	49.8	212.6	100
245.1	31	63.6	5.5	230.3	100
262.6	31	72.7	46.3	229.1	100
391.3	31	100.0	134.3	319.5	100

AgroClimate

This tool can generate tabular reports of selected climate indicators during any period of time and aggregate at the state, district or county level.

The example above shows the results for 4 indicators aggregated for Florida districts during the month of July 2022. Above average precipitation in the NW and NE districts, low daily temperature amplitude, and above average nighttime temperature.

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Generate Report

Report

Export

Iowa - Report for counties in district 1930 - Northeast

Time period of 08/10/2016 to 08/31/2016

IOWA, August 2016
Low water stress, average nighttime temperature

Counties	Average ARID				Accumulated Night Temperature Index > 73°F					
	Observed	Percentile of all long-term observations (%)	Deviation from long-term Avg	5-year Avg	Observed	Days of occurrence	Percentile of all long-term observations (%)	Deviation from long-term Avg	5-year Avg	Percentage of the observations (%)
Allamakee	0.02	9.7	-0.29	0.44	63.7	14	63.6	16.8	37.2	100
Black Hawk	0.04	7.3	-0.31	0.41	117.1	18	72.7	20.8	127.7	100
Bremer	0.04	7.3	-0.29	0.36	79.1	14	54.5	6.0	89.5	100
Buchanan	0.11	14.6	-0.22	0.38	77.3	17	63.6	2.1	98.9	100
Chickasaw	0.01	2.4	-0.31	0.36	57.6	11	54.5	11.9	45.8	100
Clayton	0.04	9.7	-0.28	0.36	91.6	17	54.5	14.9	70.6	100
Delaware	0.12	21.9	-0.20	0.34	58.9	16	45.4	-17.7	85.4	100
Dubuque	0.08	19.5	-0.22	0.28	115.8	19	54.5	13.4	113.0	100
Fayette	0.03	9.7	-0.29	0.35	65.2	15	54.5	8.1	57.4	100
Howard	0.01	4.8	-0.28	0.40	43.4	9	72.7	10.8	32.0	100
Winneshiek	0.01	7.3	-0.29	0.45	54.7	12	54.5	11.3	35.9	100

USDA

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Generate Report

Report

Export

Iowa - Report for counties in district 1930 - Northeast

Time period of **08/10/2020** to **08/31/2020**

IOWA, August 2020
High water stress, high nighttime temperature

Counties	Average ARID				Accumulated Night Temperature Index > 73°F					
	Observed	Percentile of all long-term observations (%)	Deviation from long-term Avg	5-year Avg	Observed	Days of occurrence	Percentile of all long-term observations (%)	Deviation from long-term Avg	5-year Avg	Percentage of the observations (%)
Allamakee	0.75	97.5	0.45	0.44	98.3	14	100.0	54.5	37.2	100
Black Hawk	0.57	87.8	0.23	0.41	209.9	19	90.9	122.0	127.7	100
Bremer	0.58	85.3	0.25	0.36	161.7	16	100.0	96.1	89.5	100
Buchanan	0.63	87.8	0.29	0.38	171.6	16	90.9	105.0	98.9	100
Chickasaw	0.56	87.8	0.25	0.36	103.1	14	100.0	61.6	45.8	100
Clayton	0.64	95.1	0.33	0.36	169.2	19	100.0	99.4	70.6	100
Delaware	0.59	92.6	0.27	0.34	164.9	16	100.0	97.8	85.4	100
Dubuque	0.55	90.2	0.25	0.28	222.8	21	100.0	130.0	113.0	100
Fayette	0.59	92.6	0.28	0.35	136.1	16	100.0	85.4	57.4	100
Howard	0.53	85.3	0.25	0.40	85.8	12	100.0	57.1	32.0	100
Winneshiek	0.70	97.5	0.41	0.45	93.3	13	100.0	53.5	35.9	100

USDA

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Crop

Crop: Corn

Utilization: Grain

Management: All Production Pra...

Region of Interest

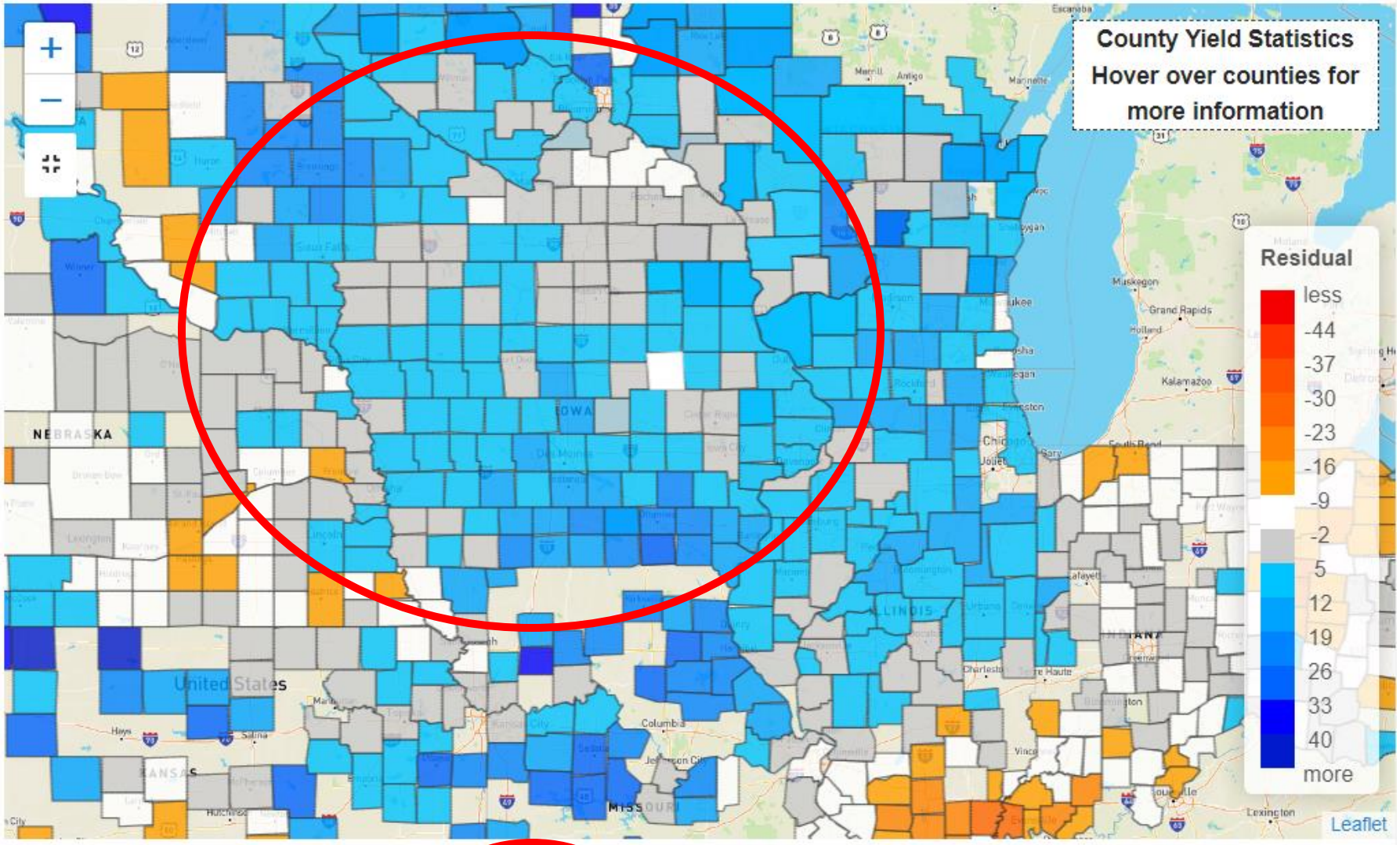
**Select state / county below or on the map

State: Iowa

County:

LOAD DATA

Map Data Layer



Map Layer Settings

Year: 2016

Variable: Residual

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Crop

Crop: Corn

Utilization: Grain

Management: All Production Pra...

Region of Interest

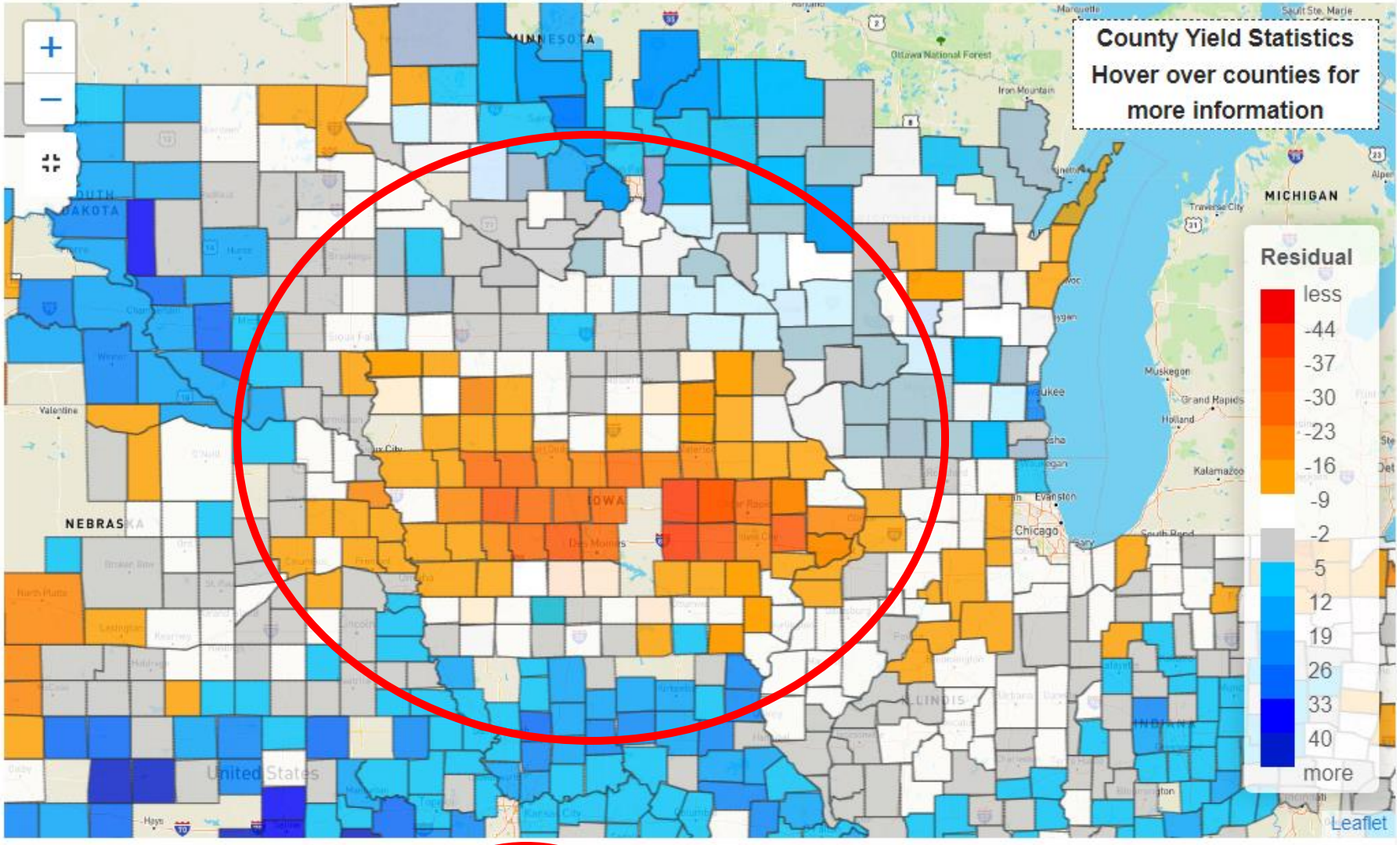
**Select state / county below or on the map

State

County

LOAD DATA

Map Data Layer



Map Layer Settings

Year: 2020

Variable: Residual

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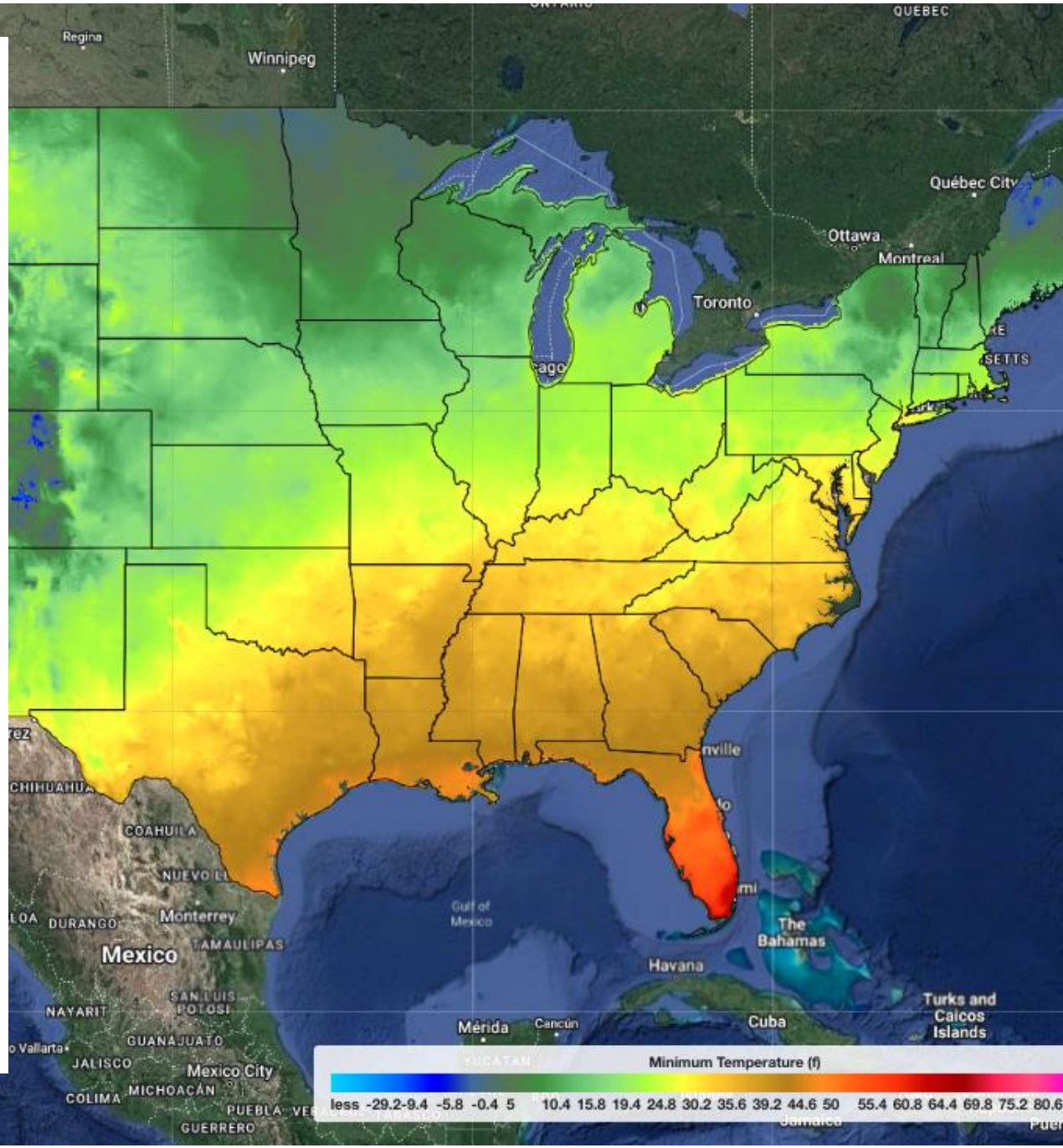
Department of Agriculture

Climate Change Program Office

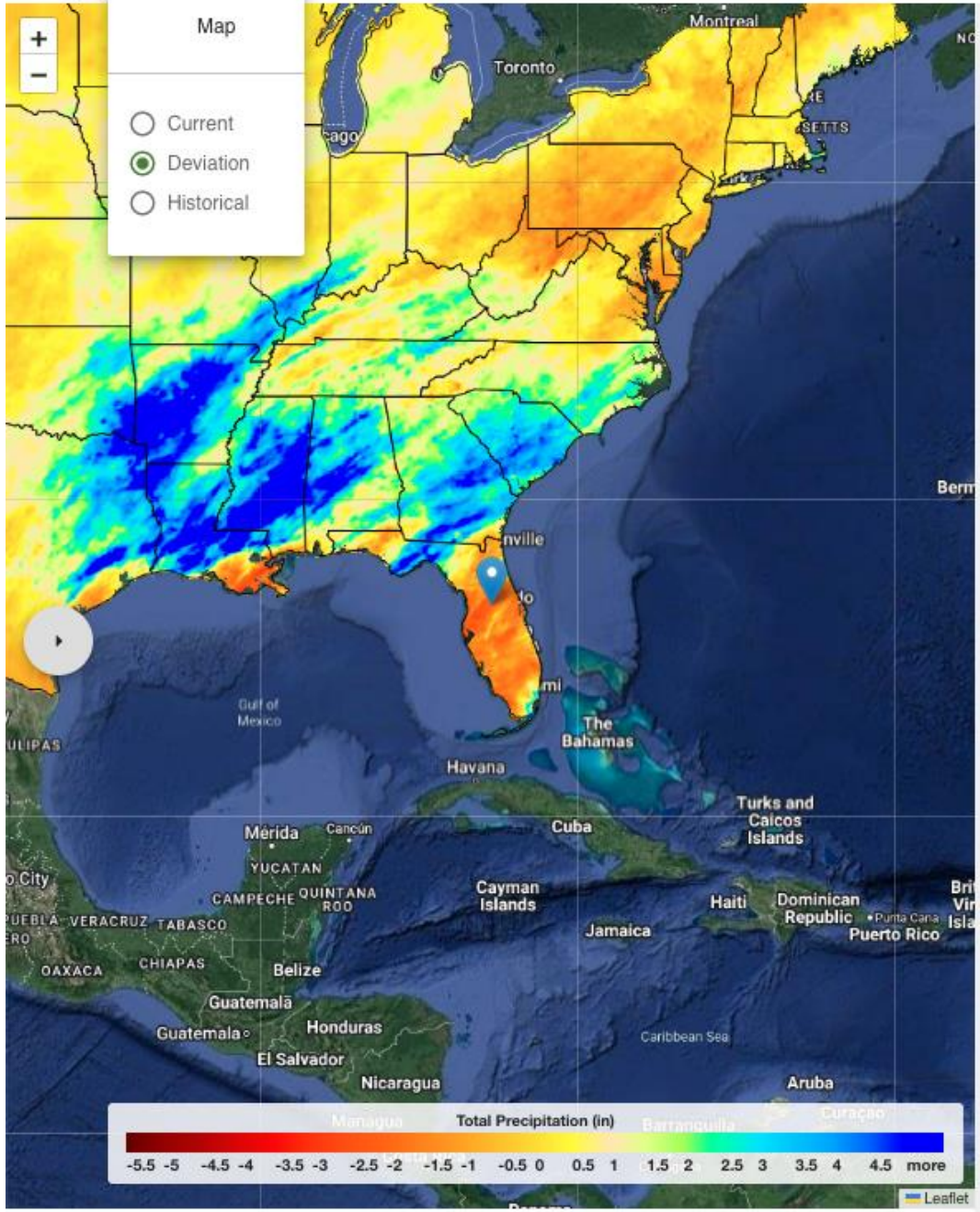
Technical Bulletin 1953

CLIMATE INDICATORS for AGRICULTURE



Climate Indicators for Agriculture

DROP A PIN VIRTUAL WS



Climate Indicator Analytics

Lat: 28.6842 - **Lon:** -81.8422

Start Date (MM/DD/YYYY) 2023-01-20

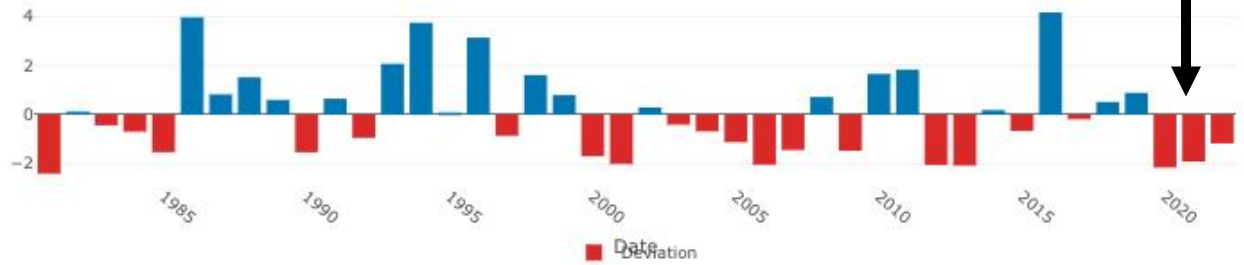
End Date (MM/DD/YYYY) 2023-02-17

LOAD DATA

OVERVIEW | DEVIATION | INDICATORS

Historical data: Total Precipitation (in)

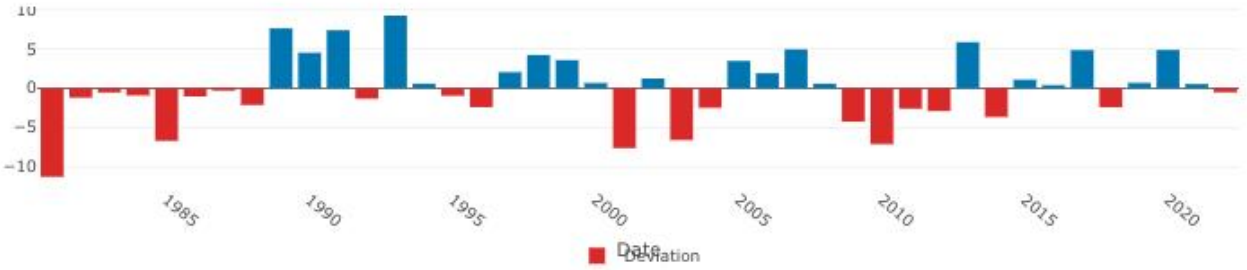
1981-2023



3 La Niña years!

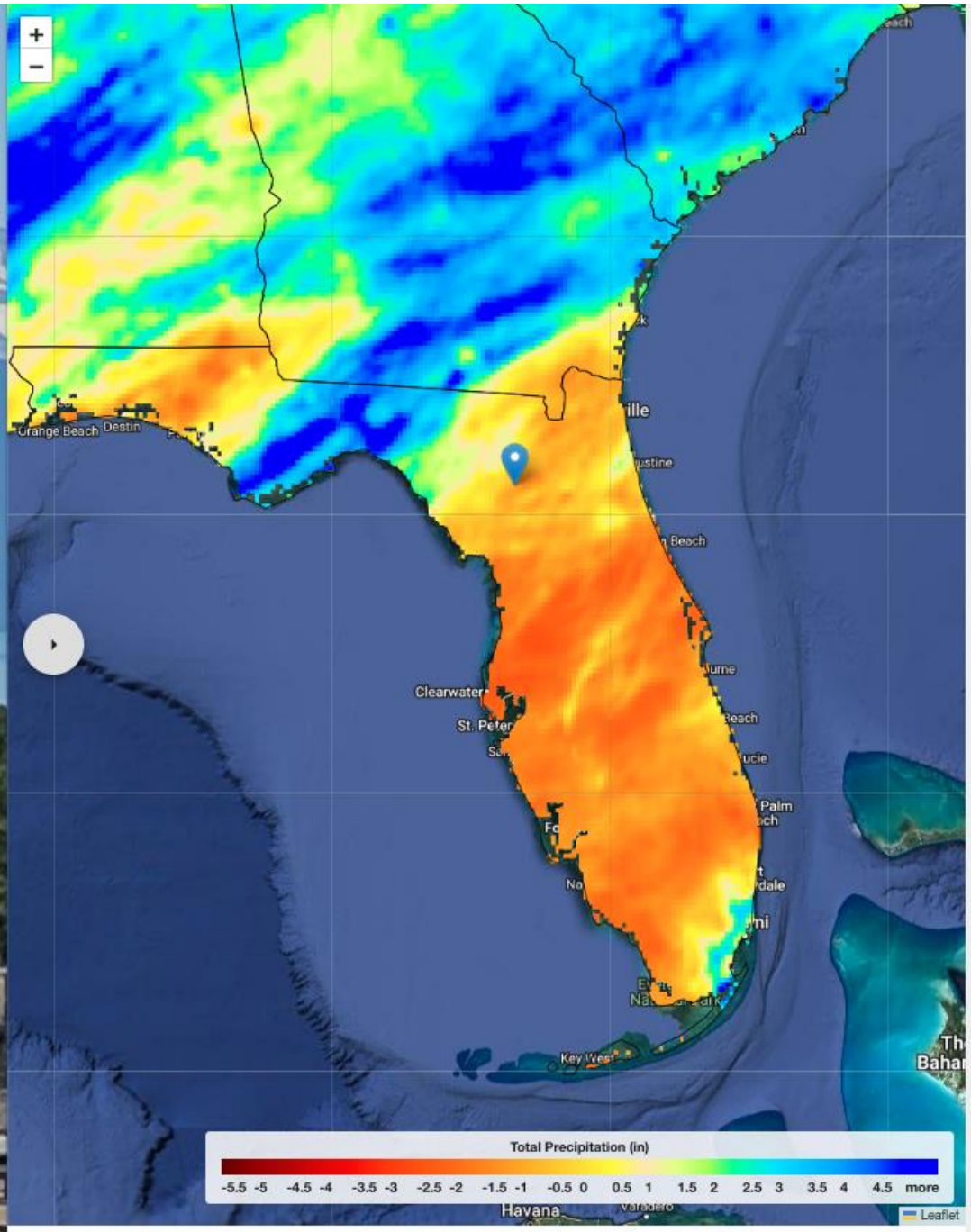
Historical data: Minimum Temperature (°F)

1981-2023



Historical data: Max Temperature (°F)

1981-2023



Climate Indicator Analytics

Lat: 29.7837 - **Lon:** -82.5292

Start Date (MM/DD/YYYY) 2022-10-01

End Date (MM/DD/YYYY) 2023-02-18

LOAD DATA

OVERVIEW | DEVIATION | INDICATORS

Chill Hours

Physical

- [ ] Total Precipitation (in)
- [ ] Minimum Temperature (°F)
- [ ] Max Temperature (°F)
- [ ] Average Temperature (°F)
- [ ] Dry Spell
- [ ] Wet Spell

Phenological

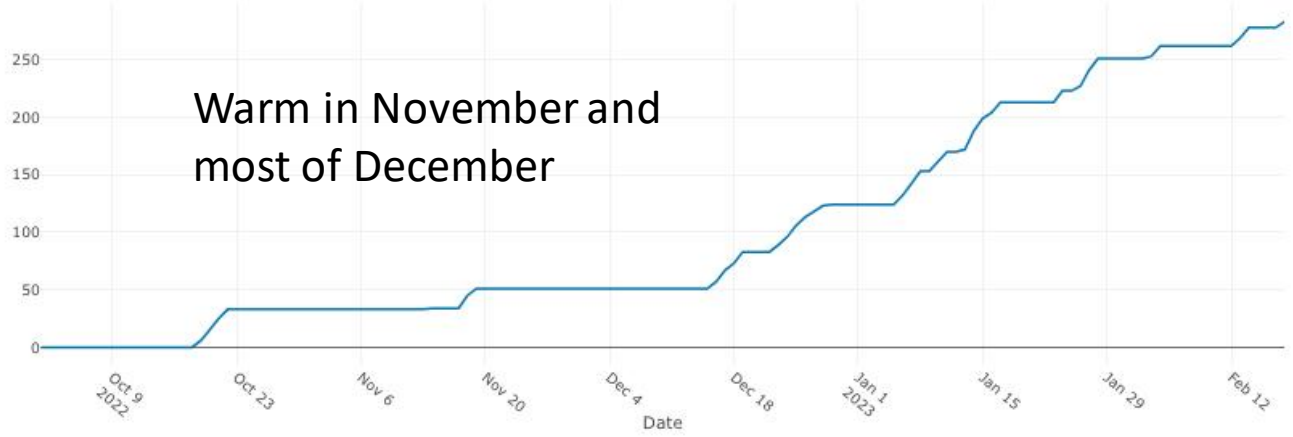
- [x] Chill Hours
  - Temperature: 32
  - Temperature °F: 45
- [ ] Chill Portions
- [ ] Chill Units
- [ ] Growing Degree Days

Stress

- [ ] Temperature-Humidity Index
- [ ] Heat Stress Degree Days

Daily Observation

[x] Selected Period [ ] Long Term Average [●] Accumulated



Warm in November and most of December

Thank You!

Clyde Fraisse
cfraisse@ufl.edu

UF | UNIVERSITY of FLORIDA
IFAS Extension

AgroClimate
Tools for Managing Climate Risk in Agriculture

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