

Enviroweather Tools for Tree Fruit Growers

2019 Tree Fruit Management School

MICHIGAN STATE UNIVERSITY | **Enviroweather**
Weather-based pest, natural resources, and production management tools

Tools for: Field crops | Fruit | Landscape & Nursery | Livestock | Trees | Turfgrass | Vegetables | More weather

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Welcome to Enviroweather!
For weather-based tools: Click on a station on the map.
For access to specific commodity tools: Select from list above.

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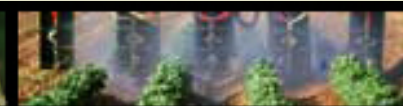
**Keith Mason, Jeff Andresen,
Tracy Aichele, Jim Brown, Steve Marquis, Aaron Pollyea,
Steve Casey, Mike Kiefer and Joy Landis**



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Outline

Introduction

Enviroweather summary

Recent work (SCBG 2016-18)

- Disease Climatologies

- Mobile ready products

- Inversion predictions

Future activities (SCBG 2018-19)

- New stations

- New website and tools

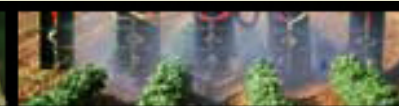
New proposals

- Microclimates in orchards

- SWD control model



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New Enviroweather Coordinator

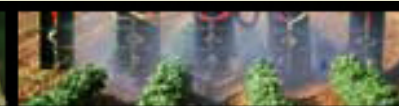
Keith Mason



- Started September 2018
- ~ 20 years in Fruit IPM
- MSU Berry Crop Entomology
- On-farm programs
- Integrated crop pollination
- PhD in Entomology
- “Factors effecting mating, monitoring and phenology in grape berry moth”
- Weather geek
- 517 432-6520 or masonk@msu.edu



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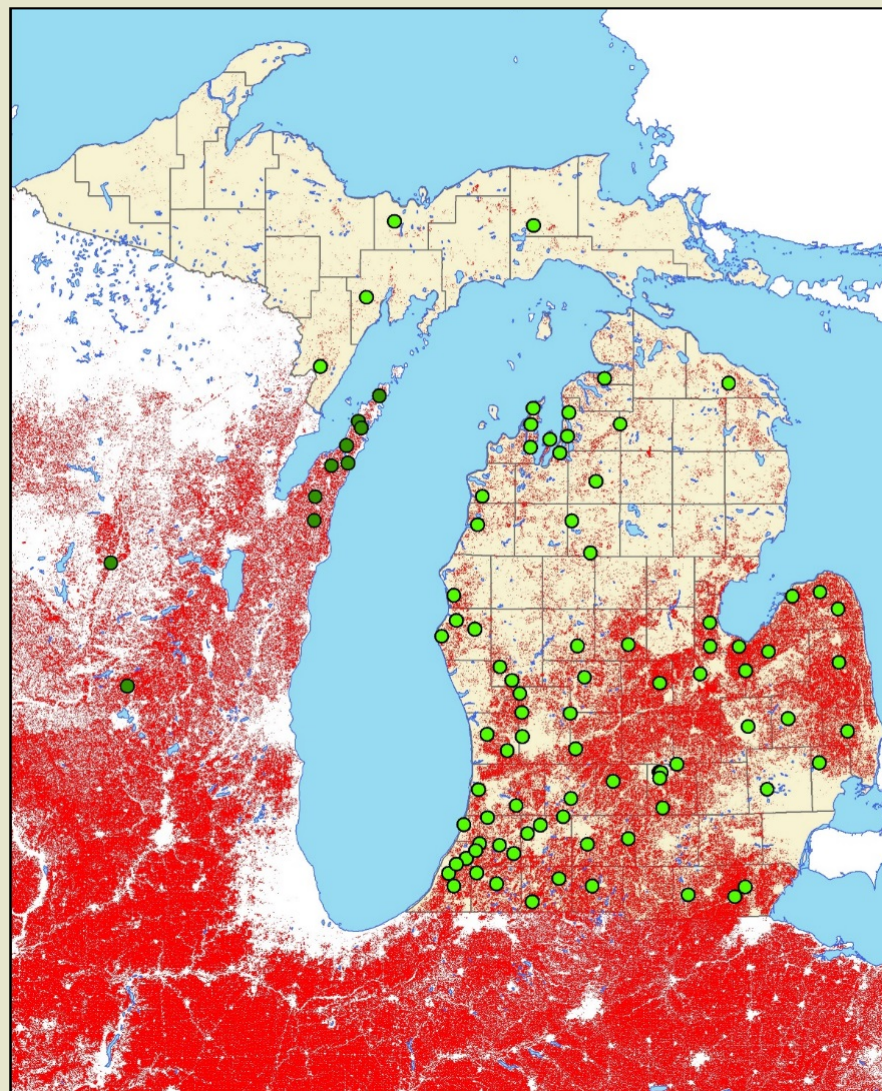


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Enviroweather Automated Weather Network

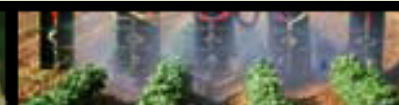
October 2018



Red indicates plant-based cropping areas including pasture/grassland from 2017 USDA/NASS Cropland Data Layers



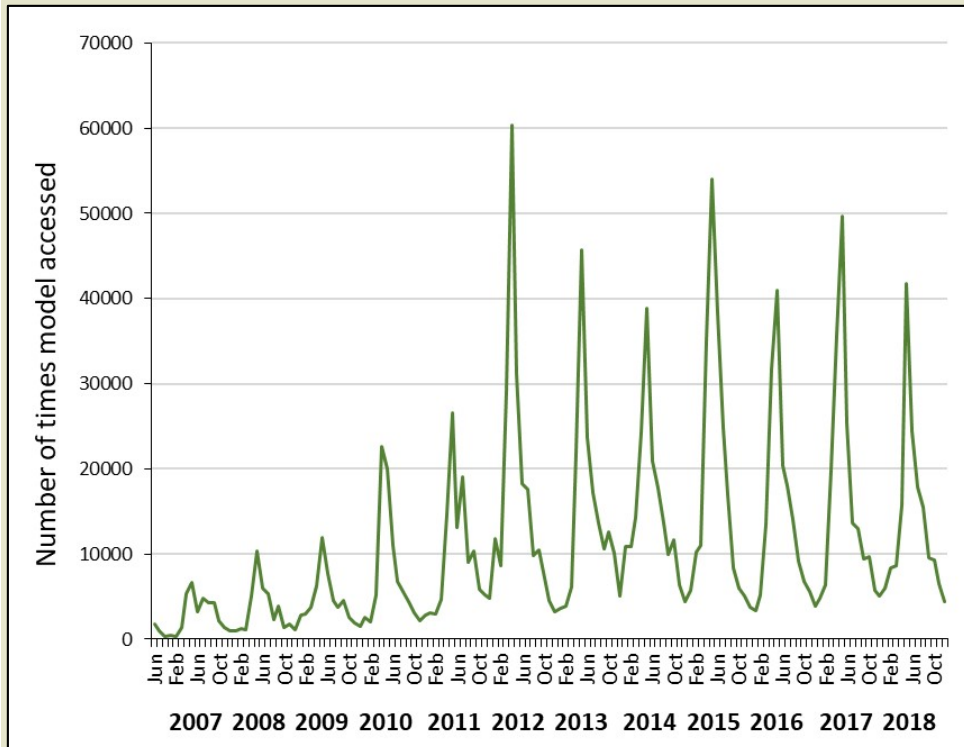
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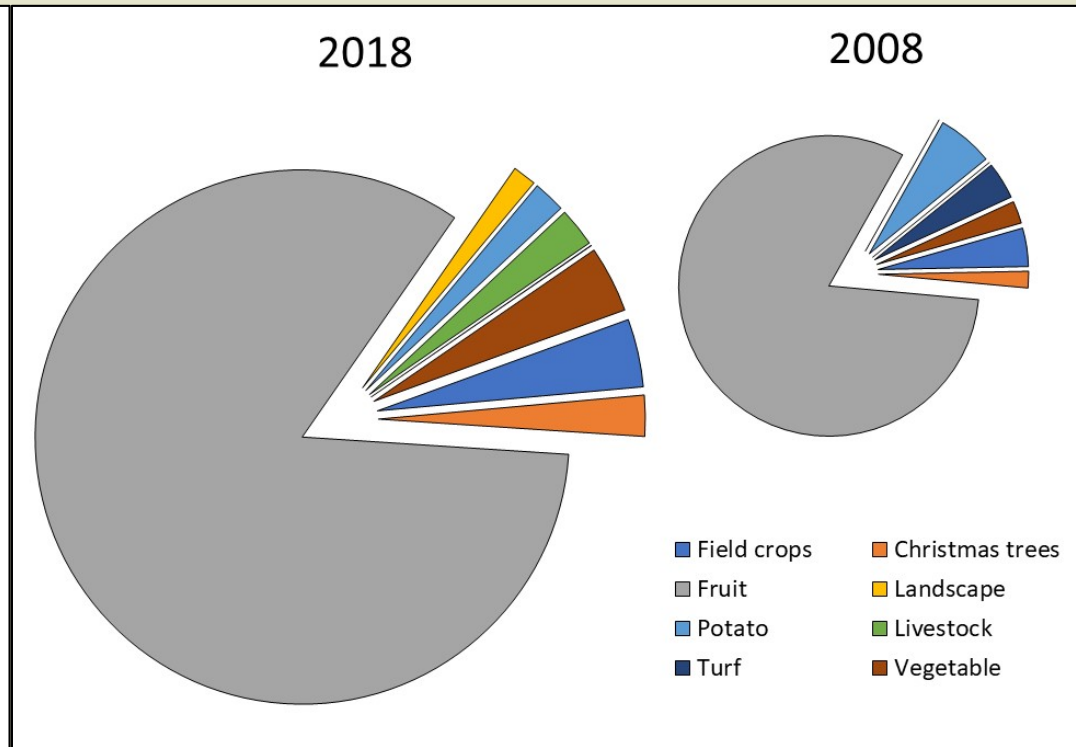
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Enviroweather User Statistics



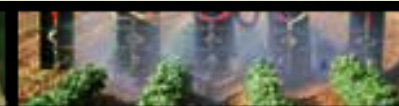
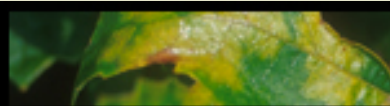
Base Usage by Month



Usage by Commodity Group



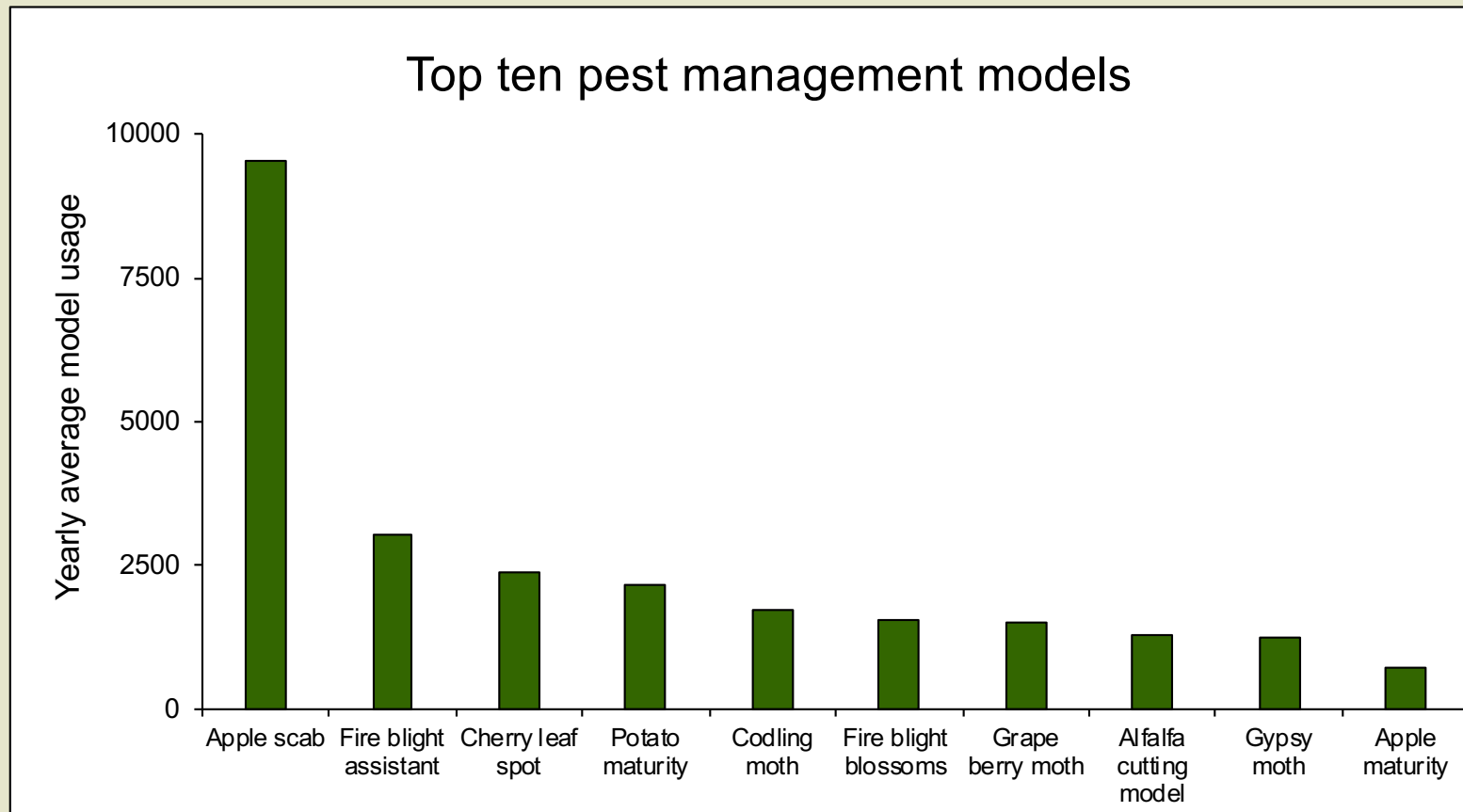
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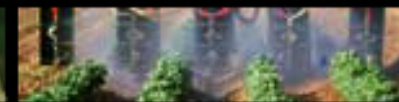
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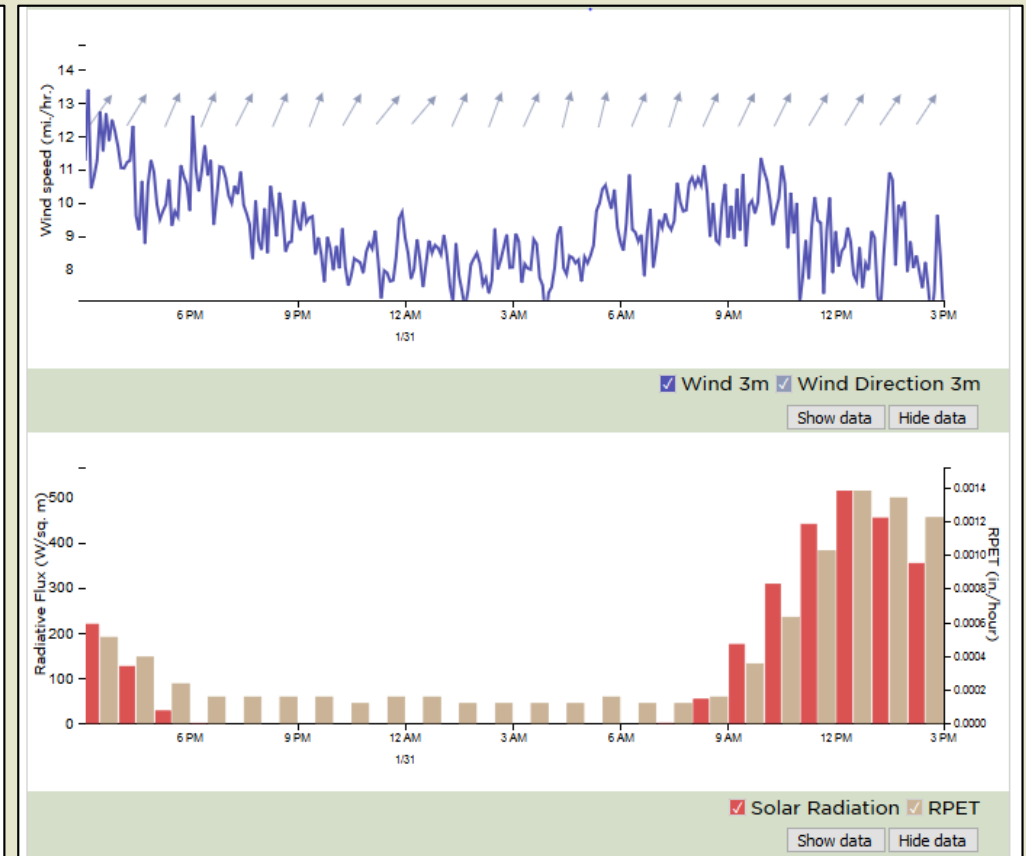
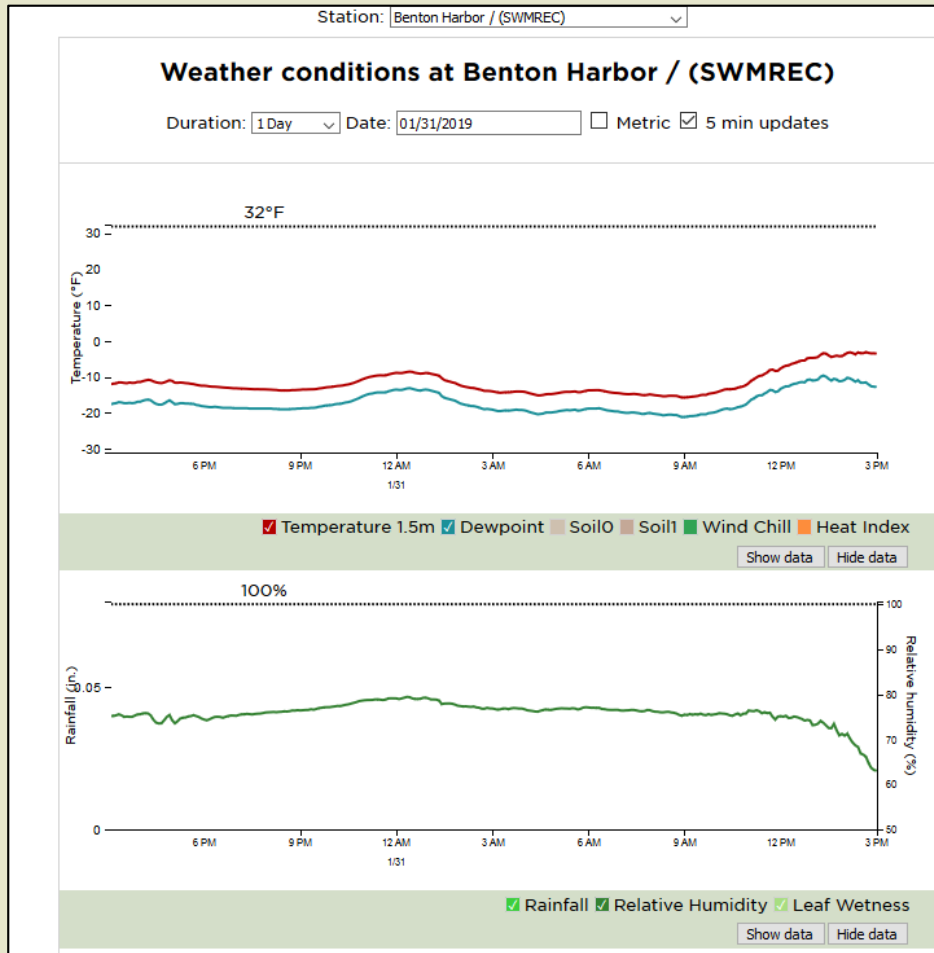


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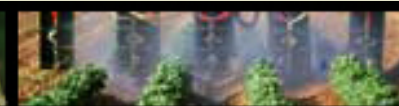
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General Weather

Weather summaries, overnight temperatures, GDD totals, meteograms, etc. are the most popular Enviroweather tools.



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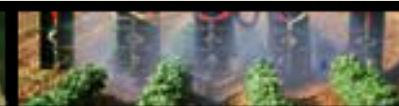
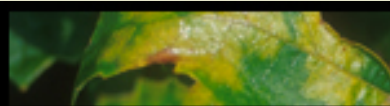
Tree Fruit Industries Making Enviroweather Better



- Weather station modernization.
- Two new weather stations Benona (DeRuiter) and Elbridge (Van Agtmael).
- Improve and refine an existing cherry leaf spot disease model.
- Initial development of a new bacterial spot disease model for peaches.
- Determining overall disease risk based on historical disease “Climatologies”.
- The development and deployment of new mobile-ready products for several key fruit pest applications in Michigan.
- Inversion monitoring capability and forecasting capabilities to support frost control activities.
- **New SCBG - Precision Decision Support Systems for Michigan Tree Fruit.**



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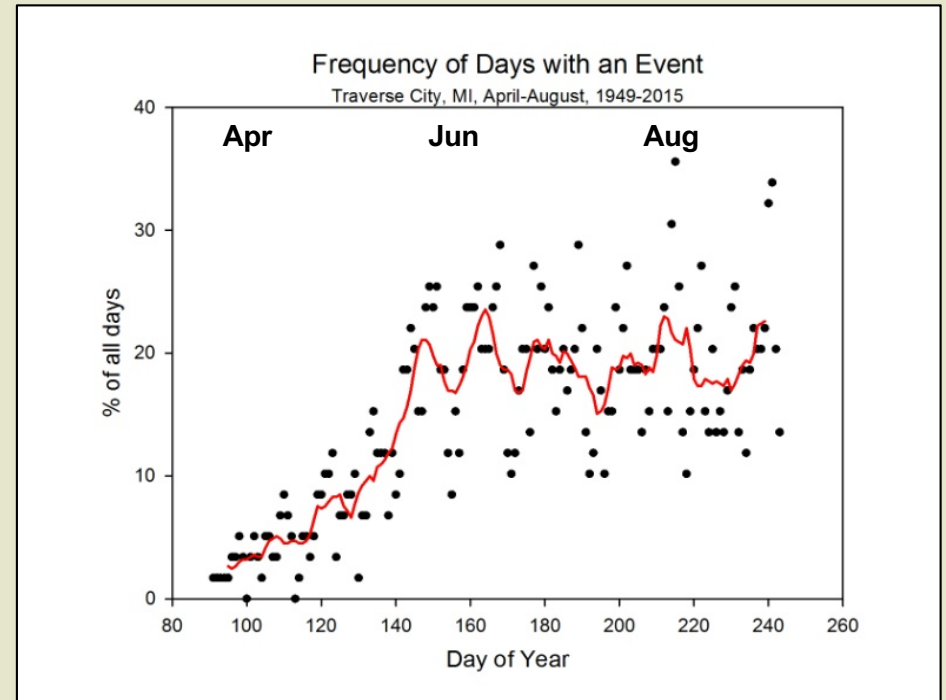
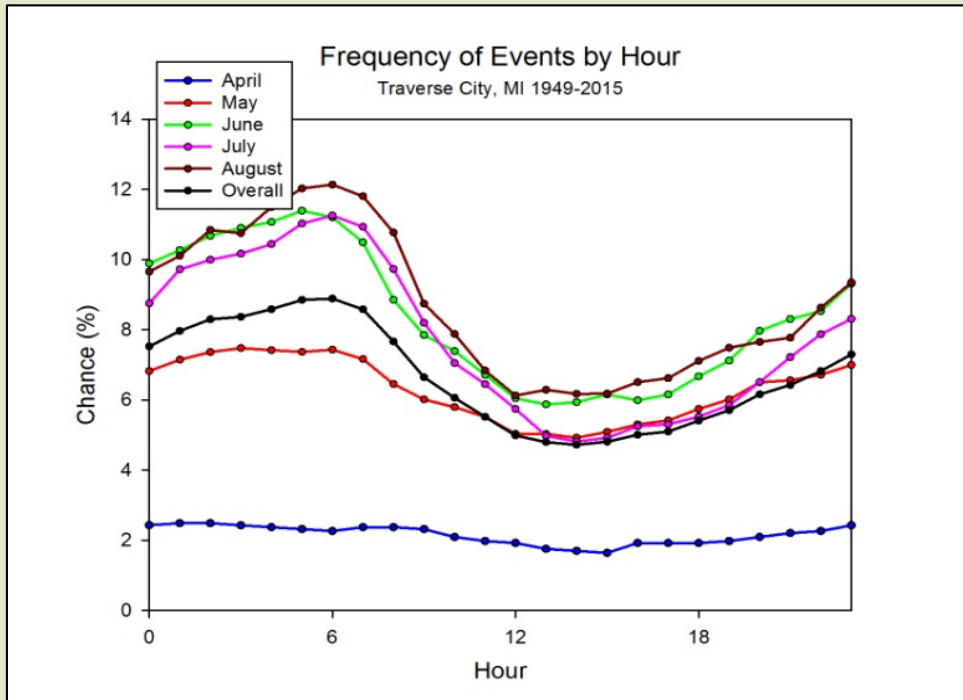


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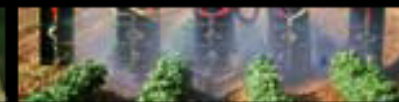
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Disease Climatologies

Frequency of Cherry Leaf Spot by Hour and Day



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Mobile Ready Products

East Lansing (MSUHort) Cherry Leaf Spot Report (Report issued 12/2/2018 11:52)

Mobile version

Wetting periods start with rainfall (at least 0.01 inch) and continue until the start of at least eight hours without moisture (rainfall, leaf wetness, high relative humidity). Wetting period is recorded (the start of the 8 hour dry period).

Montmorency bloom for East Lansing (MSUHort) estimated as 5/5/2018 (320 DD Base 42 after 1/1).

Time period assessed for wetting events: 5/5 to 6/2/2018. Events between 4/18 and 6/2/2018 shown.

Wet Period	Station	Start of wetting period	End of wetting period	Duration (Hrs.)	Avg temp (F)	Rainfall (in.)	Cherry Leaf Spot	Progress toward infection
1	East Lansing (MSUHort)	5/9 10-11PM	5/10 7-8AM	Wet: 6 Span: 10	62.4	0.16	None	92%
2	East Lansing (MSUHort)	5/11 10-11AM	5/13 10-11AM	Wet: 42 Span: 49	44	1.96	None	63%
3	East Lansing (MSUHort)	5/14 6-7AM	5/14 11AM-Noon	Wet: 6 Span: 6	56.8	0.09	None	66%
4	East Lansing (MSUHort)	5/15 1-2AM	5/15 11AM-Noon	Wet: 11 Span: 11	62.2	0.45	Low	188%
5	East Lansing (MSUHort)	5/18 9-10PM	5/23 8-9AM	Wet: 80 Span: 108	55.3	0.92	High	777%
6	East Lansing (MSUHort)	5/30 7-8PM	5/31 6-7AM	Wet: 12 Span: 12	71.9	0.83	Low	168%
7	East Lansing (MSUHort)	6/1 2-3PM	6/1 2-3PM	Wet: 1 Span: 1	73.1	0.07	None	13%

[Create CSV File From Cherry Leaf Spot Report](#)

[About cherry leaf spot](#) | [About this model](#) | [More weather data for this station](#)

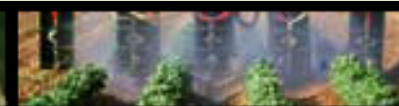
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Station:

East Lansing (MSUHort) ▼

Model:

Cherry Leaf Spot ▼

Date:

06/01/2018

Get Report

Cherry Leaf Spot Risk, East Lansing (MSUHort), 2018, Montmorency Bloom estimated as 5/5 (320 DD Base 42 after 1/1).

Wet period	24 of 48
Start of wet period	6/1 2-3PM
End of wet period	6/1 2-3PM
Progress toward infection	13%
Wet hours needed for infection	7 hours more
Cherry leaf spot infection	None
Average temperature (°F)	73.1
Rainfall (in.)	0.07



Most recent period shown: 3/1 11PM - Midnight to 8/30/2018 10-11AM; Hourly data missing for: 6/4/2018 Noon-1PM - 6/4/2018 1-2PM (2 hours); 7/3/2018 10-11AM (1 hour); Total of 3 missing hours
Hourly data estimated for: 6/4/2018 Noon-1PM - 6/4/2018 1-2PM (2 hours); Total of 2 estimated hours
[Full site](#)



Station:

East Lansing (MSUHort) ▼

Model:

Cherry Leaf Spot ▼

Date:

06/15/2018

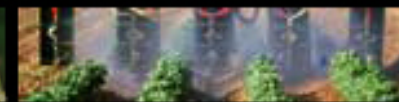
Get Report

Cherry Leaf Spot Risk, East Lansing (MSUHort), 2018, Montmorency Bloom estimated as 5/5 (320 DD Base 42 after 1/1).

Wet period	26 of 48
Start of wet period	6/4 11PM - Midnight
End of wet period	6/5 7-8AM
Progress toward infection	105%
Wet hours needed for infection	0 hours more
Cherry leaf spot infection	Low
Average temperature (°F)	57.7
Rainfall (in.)	0.17



Most recent period shown: 3/1 11PM - Midnight to 8/30/2018 10-11AM; Hourly data missing for: 6/4/2018 Noon-1PM - 6/4/2018 1-2PM (2 hours); 7/3/2018 10-11AM (1 hour); Total of 3 missing hours
Hourly data estimated for: 6/4/2018 Noon-1PM - 6/4/2018 1-2PM (2 hours); Total of 2 estimated hours
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Mobile Ready Products

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Weather-based pest, natural resources, and production management tools

Tools for: Field crops | Fruit | Landscape & Nursery | Trees | Turfgrass | Vegetables | More weather

Return to station page

Region: Station: Model:

Select Start Date: Select End Date:

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Wet Period	Station	Start of wetting period	End of wetting period	Duration (Hrs.)	Avg temp (F)	Rainfall (in.)	Apple Scab (leaf)	Wet hrs @ avg temp for 1st infection	Progress toward infection
1	East Lansing (MSUHort)	5/10 11PM - Midnight	5/11 4-5AM	Wet: 5 Span: 6	47.1	0.17	None	15	31%
2	East Lansing (MSUHort)	5/11 1-2PM	5/11 1-2PM	Wet: 1 Span: 1	59.8	0.01	None	10	10%
3	East Lansing (MSUHort)	5/16 2-3AM	5/16 6-7AM	Wet: 4 Span: 5	53.9	0.05	None	12	34%
4	East Lansing (MSUHort)	5/20 2-3PM	5/21 Noon-1PM	Wet: 16 Span: 23	57.5	0.99	Moderate (Symptoms appear: 5/31)	10	152%

Apple scab model normal view

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Tools for: Field crops | Fruit | Trees | Turfgrass | Vegetables | Landscape and Nursery | Advanced weather

Station: Year:

Apple Scab

Location: East Lansing (MSUHort)
McIntosh Green Tip estimated as 3/24 (110 DD Base 42 after 1/1).

Wet period	26 of 36
Start of wet period	4/29 5-6PM
End of wet period	5/1 8-9AM
Progress toward infection	195%
Needed for infection	0 hours more
Apple scab infection	Moderate (Symptoms appear: 5/16)
Average temperature (°F)	46.3
Rainfall (in.)	1.45

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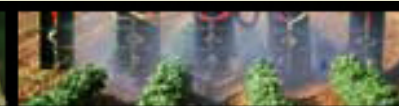
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Apple scab model mobile view



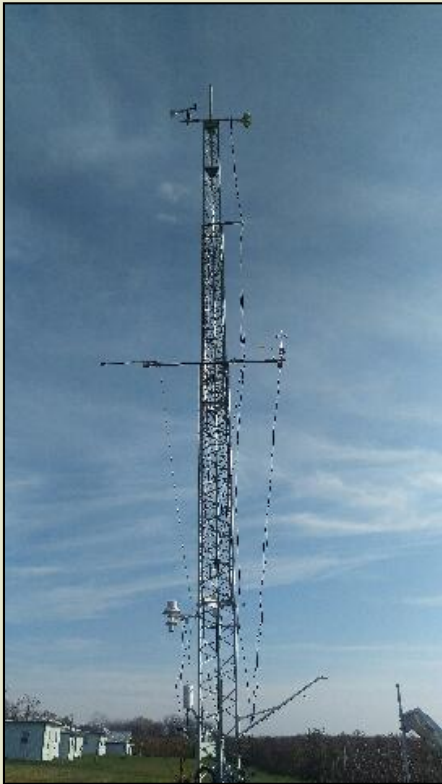
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Inversion-Monitoring Towers



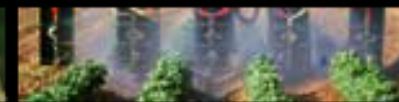
Sparta



Williamsburg



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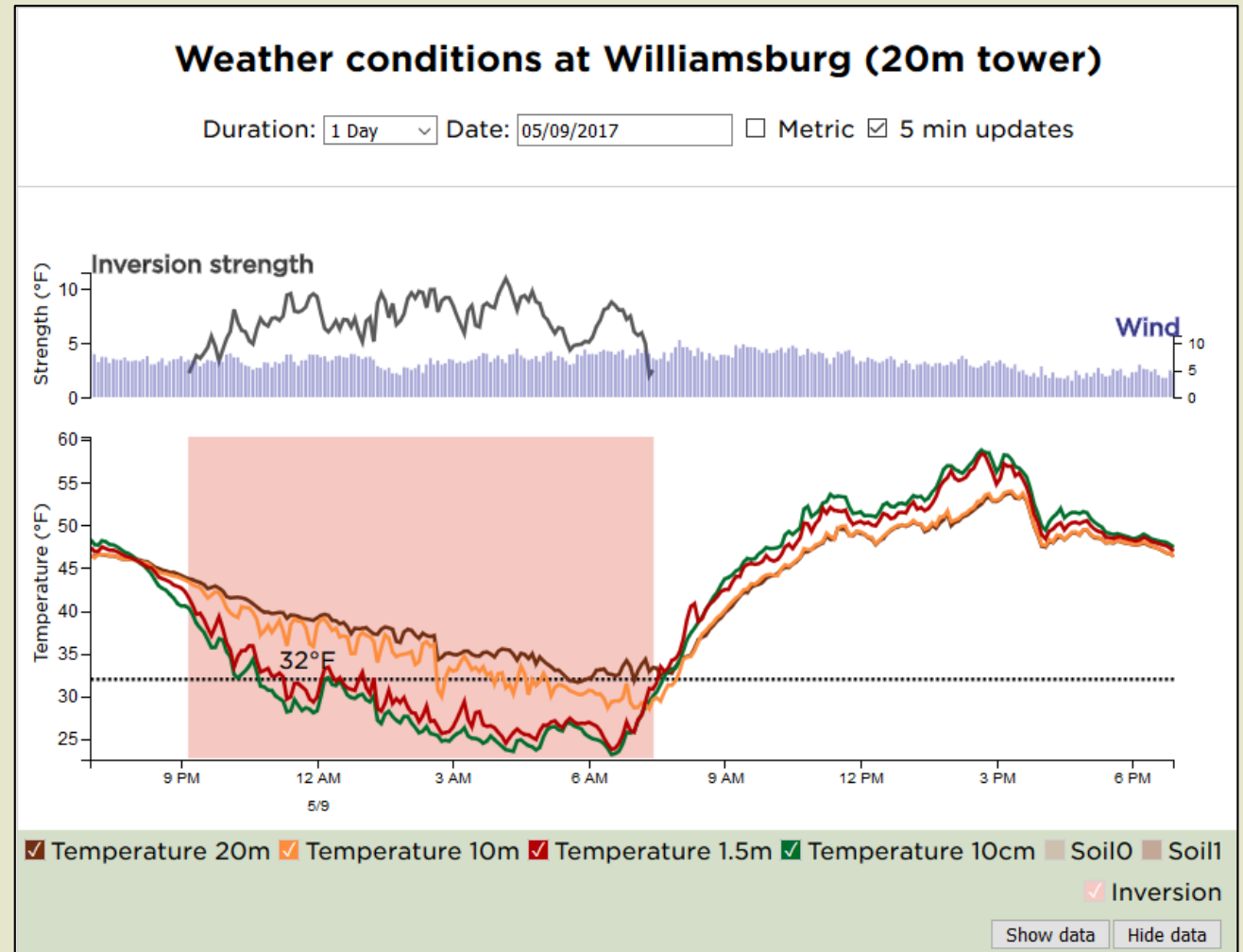


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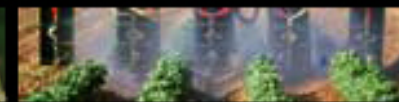
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Inversion-Monitoring Sites

Inversion Strength and Frost Control



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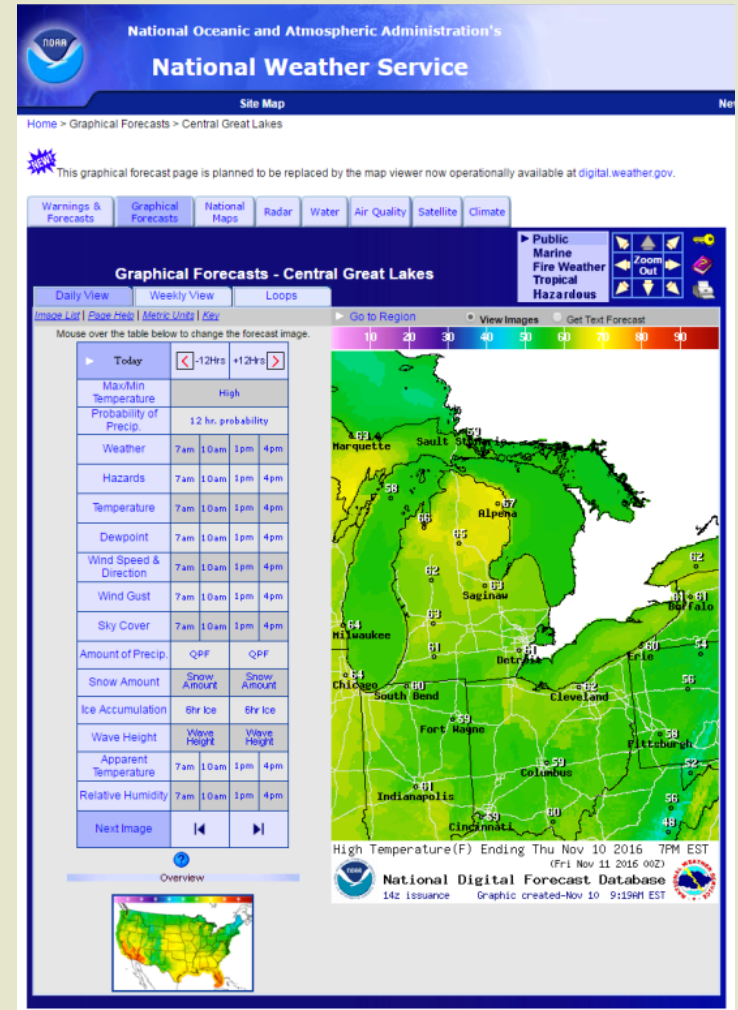


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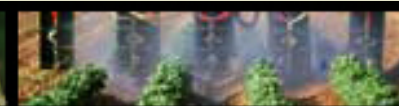
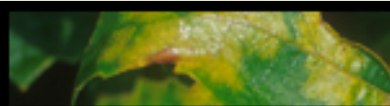
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Inversion forecasting

- Inversion detection is “real-time” – based on 5 minute data.
- Need forecast of when inversions will occur to plan for frost protection.
- National Digital Forecast Database (NDFD).
- Digital forecasts from NWS working in collaboration with the National Centers for Environmental Prediction (NCEP).
- 7 Days: Day 1-3 forecasts (updated hourly) and day 4-7 forecasts (updated four times per day).
- Strategic collaborations to add these types of data for forecasting in Enviroweather models.



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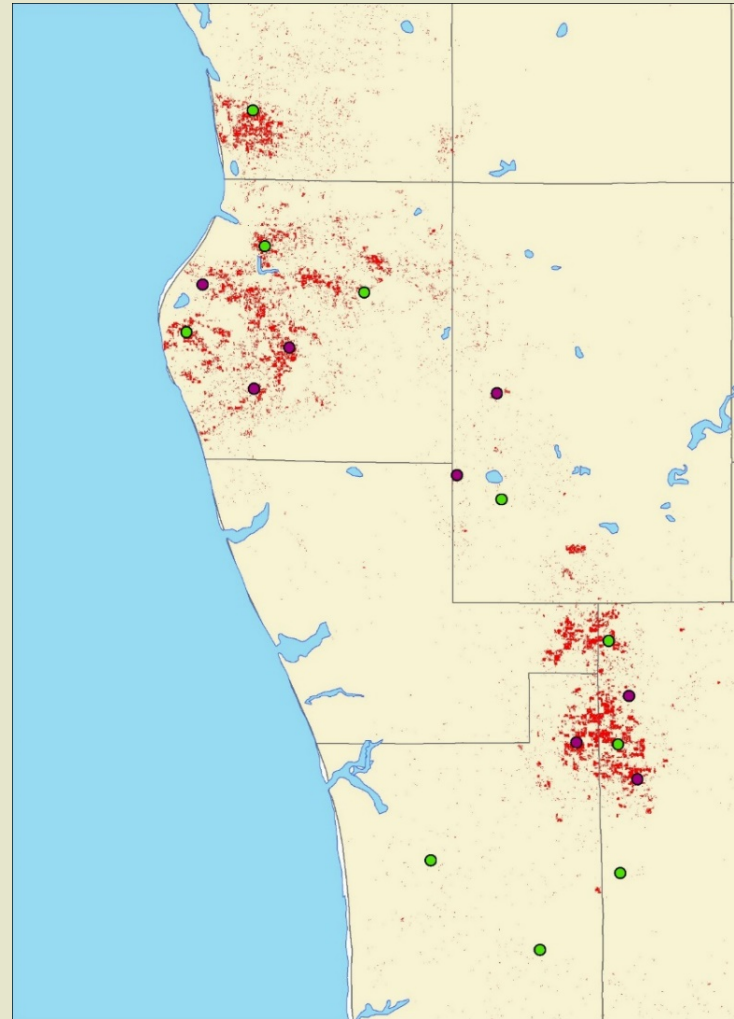
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Proposed New Station Sites (8), 2018/2019

MTFC Specialty Crop Block Grant



- Red stippling indicates tree fruit cropping areas from 2017 USDA/NASS Cropland Data Layers



Two standard stations due to be installed before the end of February.

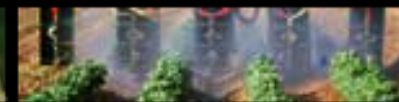
Remaining six sites should be up and running in Spring 2019.

Include new technology.
New temp/RH
Leaf bud temp
New loggers

Also working to get funding for additional sites for 20m tower stations for inversion forecasting.



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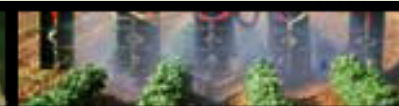
Website Modernization

msu.leaf0.inc.php

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"rainfallAccum":null,"consecutiveDryHours":8,"durationFwer":"Wet: 1<br />Span: 1","durationFwerCsv":null,"appleScabRisk":"None","appleScabRiskFwerCsv":null,
"wetHrsAvgTemp":"--","appleScabAccumulator":0,"appleScabProgress":"0%","cherryLeafSpotRisk":"None","cherryLeafSpotRiskFwerCsv":null,"cherryLeafSpotAccumulator":0,
"cherryLeafProgress":"0%","blackRotRisk":"No risk until pre-bloom period","blackRotRiskFwerCsv":null,"blackRotAccumulator":0,"blackRotProgress":"0%","timePeriod":"Most
recent period shown: 3\\1 11PM - Midnight to 4\\18\\2018 10-11AM<br />Hourly data missing for: 4\\18\\2018 1-2PM (1 hour); Total of 1 missing hours","timePeriodCsv":"Most
recent period shown: 3\\1 11PM - Midnight to 4\\18\\2018 10-11AM; Hourly data missing for: 4\\18\\2018 1-2PM (1 hour); Total of 1 missing hours",
```



Enviroweather



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www.enviroweather.msu.edu

New Website

The screenshot shows the top portion of the website. At the top left is the Michigan State University logo and name. Below it is the 'Enviroweather' title. A dark green navigation bar contains 'Home', 'Maps', and 'Crops' on the left, and 'Login' and 'Register' on the right. A large black and yellow striped banner with the text 'UNDER CONSTRUCTION' is centered over the main content area. To the left of this banner is a white box with the text: 'Enviroweather is a weather-based natural resource and production management system'. Below the banner, a white bar contains the text 'Welcome to Enviroweather'. Underneath that, another white bar says 'Enviroweather is a collaboration of...'. At the bottom of this section are three logos: Michigan State University Extension, Michigan State University AgBioResearch, and Project GREEN.

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Enviroweather

Home | Maps | Crops

Login | Register

UNDER CONSTRUCTION

Enviroweather is a weather-based natural resource and production management system

Welcome to Enviroweather

Enviroweather is a collaboration of...

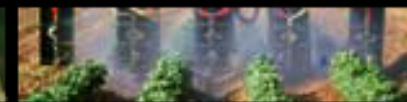
MICHIGAN STATE UNIVERSITY
Extension

Michigan State University
AgBioResearch

Project GREEN



Enviroweather



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www.enviroweather.msu.edu

New Website “Dashboard”

The screenshot shows the Enviroweather dashboard for user Keith Mason. The header includes the Michigan State University logo and navigation links (Home, Maps, Crops, About, SDL). A welcome message reads "Welcome to your Dashboard, Keith Mason". The dashboard is organized into several sections:

- My Stations:** A list of weather conditions for a specific station, including Air Temperature (00.0F), Rainfall (0.0 in), Relative Humidity (00.0%), Dewpoint (00.0F), Wind Direction (WSW), and Windspeed (0.0 mph). A "More" link is available.
- Result Models for [activeStation]:** A table of model results for a selected crop, listing various metrics like Day, Date, Min Temp, Max Temp, GDD Today, GDD since 5/1, Percent Total Growth, Reference PET (in.), PET Today (in.), and PET Since 5/1. A "More" link is also present.
- Other Resources:** A section for additional links, currently showing "[nameOfLink]".
- Weather Models for [activeStation]:** A line graph titled "[name of weather model]" showing temperature over time. The y-axis is "Temperature (°F)" ranging from -10 to 30. The x-axis shows time from 12 PM to 9 AM on 1/28. A red line represents "Temperature 1.5m", which fluctuates around 0°F. A legend at the bottom identifies other models: Dewpoint (blue), Soil0 (grey), Soil1 (brown), Wind Chill (green), and Heat Index (orange).

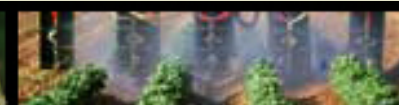
Users that log in can save preferences

“Watched” crops, stations, maps and models

Remain logged in and save time




Enviroweather



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Dashboard watched stations

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Enviroweather

Home | Maps | Crops | About | SDL Keith Mason

Here are your settings, Keith Mason ←

Weather Stations -

Discover stations within 50 miles using an address/zip/LatLon:

Discover stations in a selected county:

[Apply Filters](#) [Clear Filters](#) [Watch Selected](#)

Select	Distance	Name	Code	County	Latitude	Longitude
<input checked="" type="checkbox"/>	NA	Albion	alb	NA	42.2619	-84.7741
<input checked="" type="checkbox"/>	NA	Allegan	alg	NA	42.4865	-85.804
<input type="checkbox"/>	NA	Arlene	arl	NA	44.3966	-85.2935
<input type="checkbox"/>	NA	Arlington	alt	NA	43.296391	-89.38736

[Use my location?](#)
Latitude: 44.2345
Longitude: -86.4556

My Stations
No watched stations

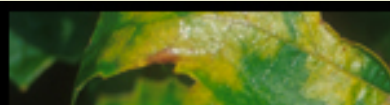
Result Models +

Weather Models +

Other Resources +



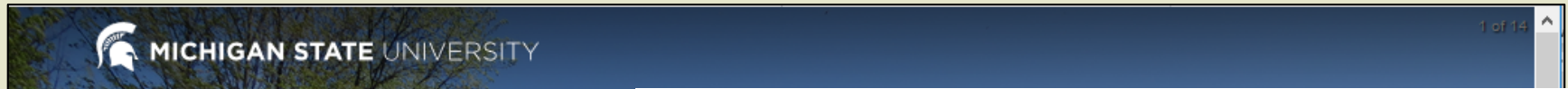
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Mega Menus



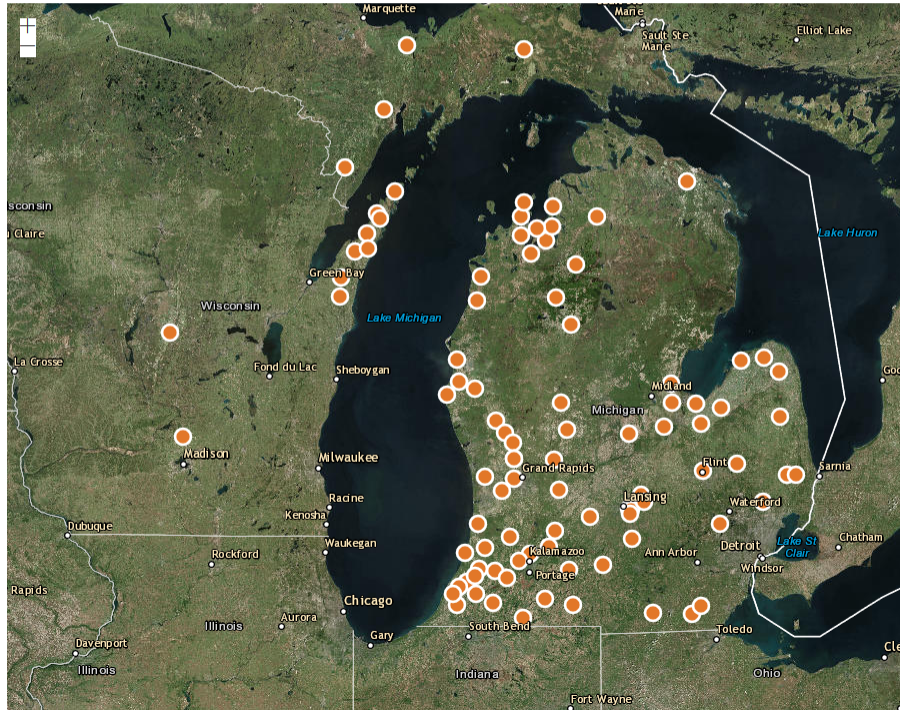
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Enviroweather

Home | Maps | Crops | About | SDL

Login | Register

Weather Stations



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All Stations

Search

Name	Code	Latitude	Longitude
Albion	alb	42.2619	-84.7741
Allegan	alg	42.4865	-85.804
Arlene	arl	44.3966	-85.2935
Arlington	alt	43.296391	-89.38736
Bainbridge / Watervliet	bbc	42.1267	-86.2677
Bath (2001-2014)	bat	42.8269	-84.365
Bear Lake	blk	44.3719	-86.1627
Belding	bel	43.1125	-85.3122
Benona / Shelby	bna	43.6304	-86.4931
Benton Harbor (SWMREC)	swm	42.0841	-86.357
Benzonia	bnz	44.5593	-86.1172
Berrien Springs	brs	41.9352	-86.3797

Enviroweather is a collaboration of...

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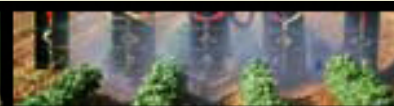
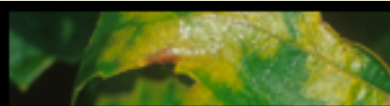
Project GREEN

Michigan State University
AgBioResearch

Project GREEN



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Mega Menu

The screenshot displays the Michigan State University Enviroweather website. At the top left is the MSU logo and the text "MICHIGAN STATE UNIVERSITY". Below it is the "Enviroweather" title. A navigation bar contains links for "Home", "Maps", "Crops" (which is highlighted with a green underline), "About", and "SDL". On the right side of the navigation bar are "Login" and "Register" links. The main content area is a dark green mega menu with the following categories and items:

- Fruit**
 - Other
 - Grape
 - Blueberry
 - Other
 - Peach
 - Pear
 - Cherry
 - Apple
- Vegetables**
 - Other
 - Cucurbits
 - Sweet Corn
 - Cole Crops
 - Snap Beans
 - Asparagus
 - Potato
- Field Crops**
 - Wheat
 - Soybean
 - Potato
 - Corn
 - Alfalfa
- Turfgrass**
 - Turfgrass
- Landscape & Nursery**
 - Deciduous Plants
 - Other
 - Christmas Trees
- Livestock**
 - Oder Management
 - Nutrient Management
- Trees**
 - Other
 - Christmas Trees

At the bottom right of the page, the Michigan State University logo and the text "su.edu" are visible.



Apple

Watch

Management tools

Development

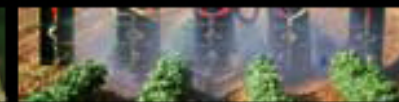
- Apple Carbohydrate Thinning [Watch](#)
- Apple Irrigation [Watch](#)
- Apple Maturity Model [Watch](#)

Pests

- Codling Moth [Watch](#)
- Obliquebanded Leafroller [Watch](#)
- Oriental Fruit Moth [Watch](#)
- Apple Scab [Watch](#)
- Fire Blight [Watch](#)
- Sooty Blotch and Flyspeck [Watch](#)
- Fireblight Interactive Predictor [Watch](#)
- Fruit Fly Monitoring [Watch](#)
- Current status of McIntosh and apple pests [Watch](#)
- Seasonal history of McIntosh and apple pests [Watch](#)
- Daily Summary of Weather and Disease Risk for Station [Watch](#)
- Station Disease Report: Seasonal History of Wetting Events [Watch](#)

Resources

- IPM Resources [Watch](#)
- MSUE News for Fruit [Watch](#)
- Apples [Watch](#)



Future Projects

Microclimates in apple orchards

Codling moth and apple scab

GREEN, MAC, MSHS

SWD Control model

Insecticide wash off/efficacy

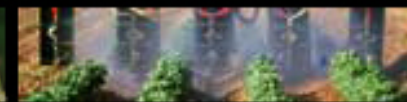
Cherry ripening (Rothwell)

SWD phenology (Rothwell and Gut)

GREEN, MCC



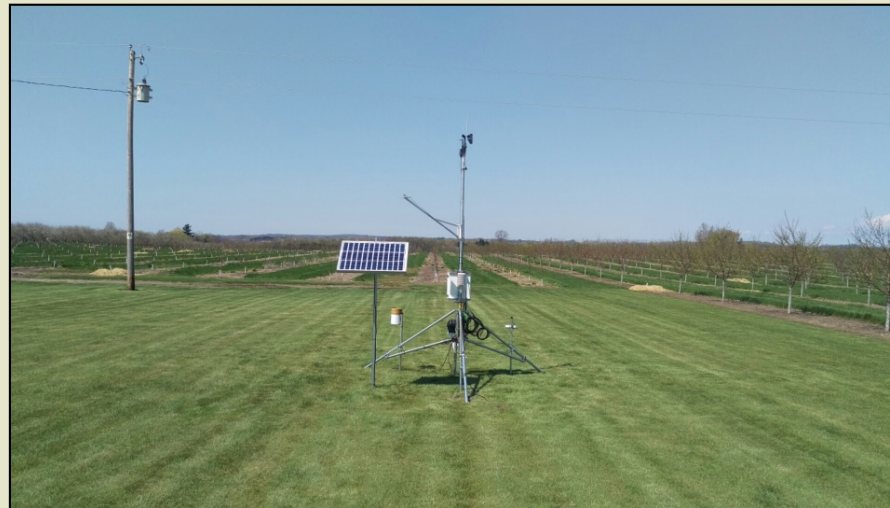
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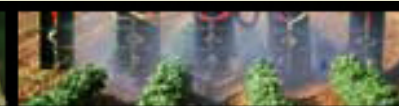
Thanks!



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