

Strategic Modernization of Enviroweather Stations Serving the  
Michigan Grape and Wine Industries

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Report to the Michigan Grape and Wine Industry Council

February 14, 2016

**Goals and Objectives:**

Michigan State University's Enviroweather program provides Michigan's agriculture with online access to weather-based pest, crop and production management information for decision-making. By providing access to local weather data and tools, Enviroweather helps Michigan grape and wine producers understand the effects of weather on their crops and enables them to make relevant pest and production management decisions mitigating negative effects.

Weather information is collected by Enviroweather's network of automated weather stations. Stations collect near real-time weather data and transmit it to a centralized server/database on campus for storage. Weather stations must operate automatically seven days a week, 24 hours a day, and 365 days a year. To ensure reliable and accurate data, stations are visited and serviced regularly. Visits are also made as needed for repair or equipment problem.

Many weather stations have been functioning for ten to fifteen years or longer. Sensors and other station components were in need of replacement and upgrade before they failed. The Michigan Tree Fruit Commission obtained funding from the Michigan Department of Agriculture and Rural Development Specialty Crop Block Grant program for replacement station components. The funding we received in 2015 from the Michigan Grape and Wine Industry Committee complemented this and was used for the labor and travel to repair, upgrade and maintain four Enviroweather stations in grape growing regions of Michigan (Northport, Old Mission, Scottsdale and Berrien Spring, MI) and also for costs of ongoing improvement, maintenance, repair, and operation of these stations.

**Literature Review:** MSU's Enviroweather program was formed in 2007 with the mandate to establish a dependable, sustainable, weather-based information system to support agricultural pest, production and natural resource management decision-making. Starting with a network of 48 weather stations and a suite of predictive models and weather summaries primarily for tree-fruit growers, Enviroweather has expanded to 81 weather stations and has more than doubled in number and diversity of on-line applications. Enviroweather now includes applications for small fruit, vegetables, field crops, Christmas trees, and landscape and nursery. New applications are continually being developed and added.

Grape and wine producers can visit the Enviroweather website ([www.enviroweather.msu.edu](http://www.enviroweather.msu.edu)) and access real-time, locally based, relevant weather-related information. They can:

- Quickly view current weather conditions across the state (air and soil temperatures, wind speed and direction, relative humidity, dew point, leaf wetness and precipitation amounts).
- Access accumulated degree-days (for predicting crop and pest development).
- Compare weather conditions and degree-day accumulations across regions and between years.

- View hourly overnight temperatures across the region and forecast predictions of low temperatures to anticipate frosts/freezes.
- Access disease (e.g., grape black rot) and insect pest (e.g., grape berry moth) model predictions to determine the need for and correct timing of pesticide applications.
- Visit linked IPM resources for information on pests, diseases and production.

Each Enviroweather station is equipped with research-quality sensors that continually collect weather data (air and soil temperature, rainfall amounts, relative humidity, solar intensity, soil moisture, wind speed and direction and leaf wetness). During the growing season stations automatically send their data every 30 to 60 minutes (via cellular IP technology) to a central server on the MSU campus. Data is checked for accuracy, then organized, stored and archived in a database. Archived data is used to produce tools, predictive models, and weather summaries that help growers make informed decisions.

The on-line tools and applications are developed by Michigan subject matter experts and are checked for validity under Michigan growing conditions before they are made available on the Enviroweather website. Tools and applications are determined by industry needs and are modified, when necessary, to improve accuracy and ease of use.

A number of tools are available to grape growers on Enviroweather. Grape-specific applications include predictive models for Concord grape berry weight, grape berry moth. Weather summaries include: current weather conditions, precipitation summaries (regional, historical), daily temperature, rainfall and degree-day summaries, overnight temperatures (regional), daily soil conditions (temperature and moisture), and a number of degree-day summaries and comparisons.

**Results and Accomplishments:** Funding for this project was used for 2015 maintenance and operation of Enviroweather stations located in Scottdale, MI; Northport, MI; Old Mission Peninsula, MI; and Berrien Springs, MI and for modernization of stations at Old Mission and Northport.

The Scottdale, MI Enviroweather station was visited for routine maintenance on May 27, 2015. The station battery was replaced on May 29, 2015.

Routine maintenance of the Berrien Springs, MI Enviroweather station equipment and site was performed on May 27, 2015. The leaf wetness sensors and the precipitation sensors were cleaned and calibrated and weeds were removed from the site.

The Northport, MI and Old Mission stations were modernized on July 9, 2015 and June 30, 2015, respectively. The following components were replaced: air temperature/relative humidity sensor, solar radiation sensor, leaf wetness sensors (2), soil moisture probes (2), soil temperature probes (2) and data logger. Technicians also replaced the waterproof enclosure, mounting tripod, solar charging panel and battery systems for each station. Technicians calibrated the precipitation bucket, cleaned exposed technology and replaced all degraded items at the sites. In addition, the location of the Old Mission station was moved at the request of the landowner.

Old Mission was visited on July 20, 2015 to repair the precipitation bucket and again on August 26, 2015 to replace a faulty temperature/RH sensor.

Enviroweather used the funds provided by the Michigan Grape and Wine Industry Council for travel to and from the station sites, and technician salaries to perform the tasks described above.

The funds were also used to pay for communications charges for these stations (the cost of transmitting data from station to campus via cell modem), which is approximately \$20 per month per station.

**Impacts:** Use of Enviroweather has increased steadily since its formation in 2006/7. Stations supported by the Michigan Grape and Wine Industry Council have been accessed regularly and the use has increased dramatically from 2007 to 2015 (Figure 1). There was a spike in 2012, due to the unusual early and warm growing season. Most of the increase in access in 2012 occurred in March and April. Notwithstanding the extreme weather in 2012, Figure 1 shows consistent yearly use of these stations.

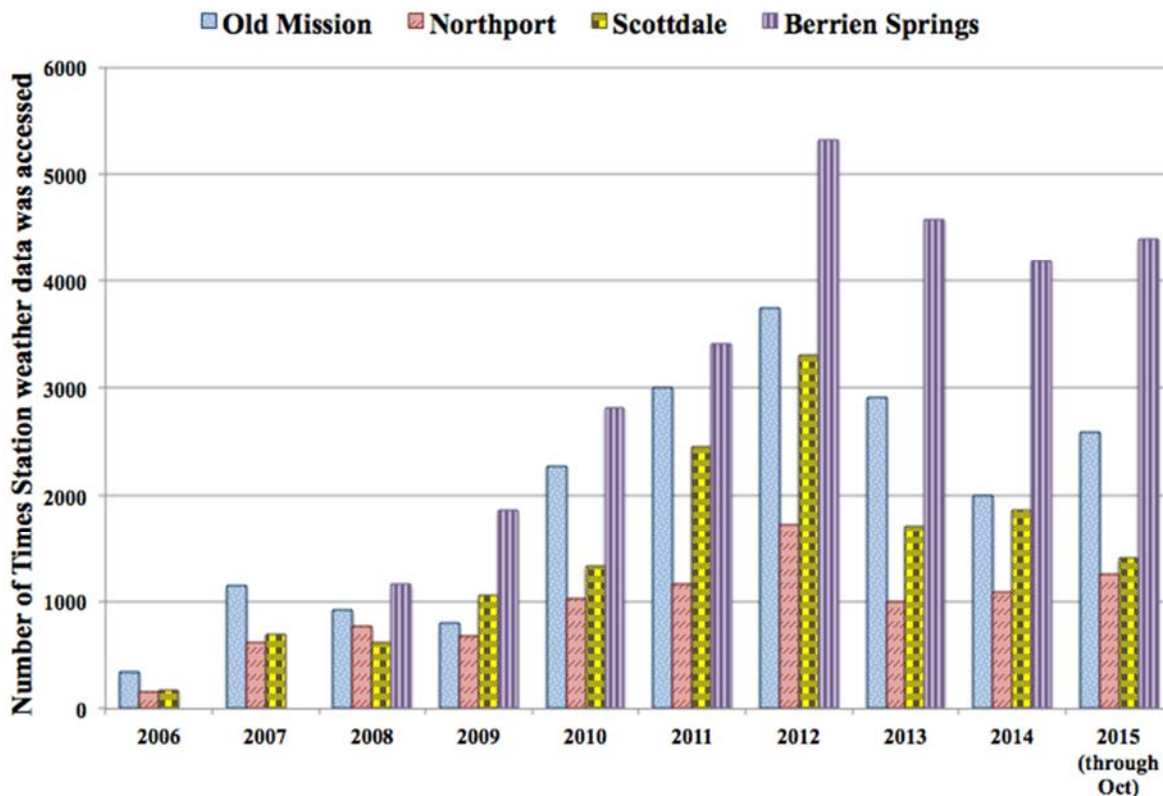


Figure 1. The number of times each station was used to access Enviroweather tools each year from 2006 through Oct 2015.

Specific weather-based tools relevant to the grape and wine industry (grape berry moth, grape black rot, and Concord grape berry weight) are accessed yearly (Figure 2). Users accessed the grape black rot model approximately 300 to 800 times per year and the Concord grape berry weight model approximately 200 to 700 times each year. The grape berry moth model was added in 2009 and its use has increased from approximately 800 times per year (in 2009) to between 1500 and 2000 times each year (from 2012 - 2015).

Use of Enviroweather's general weather tools (not specific to any particular crop) of particular interest to grape growers has also increased. For example, use of the 'temperature, rainfall and degree-day summary' tool has increased every single year. This tool is Enviroweather's most "popular" tool and is applicable to a large diversity of agricultural and natural resources needs. In 2015 this tool was accessed over 50,000 times.

Enviroweather's 'overnight temperatures' tool (used to help predict freezing temperatures) has been accessed at least 10,000 times per year since 2010. The usefulness of this tool is very

dependent on current weather conditions. For example, in 2012 because of the very early start of the growing season and subsequent frost potential, this tool was accessed approximately 45,000 times; it was used over 30,000 times in April 2012 alone.

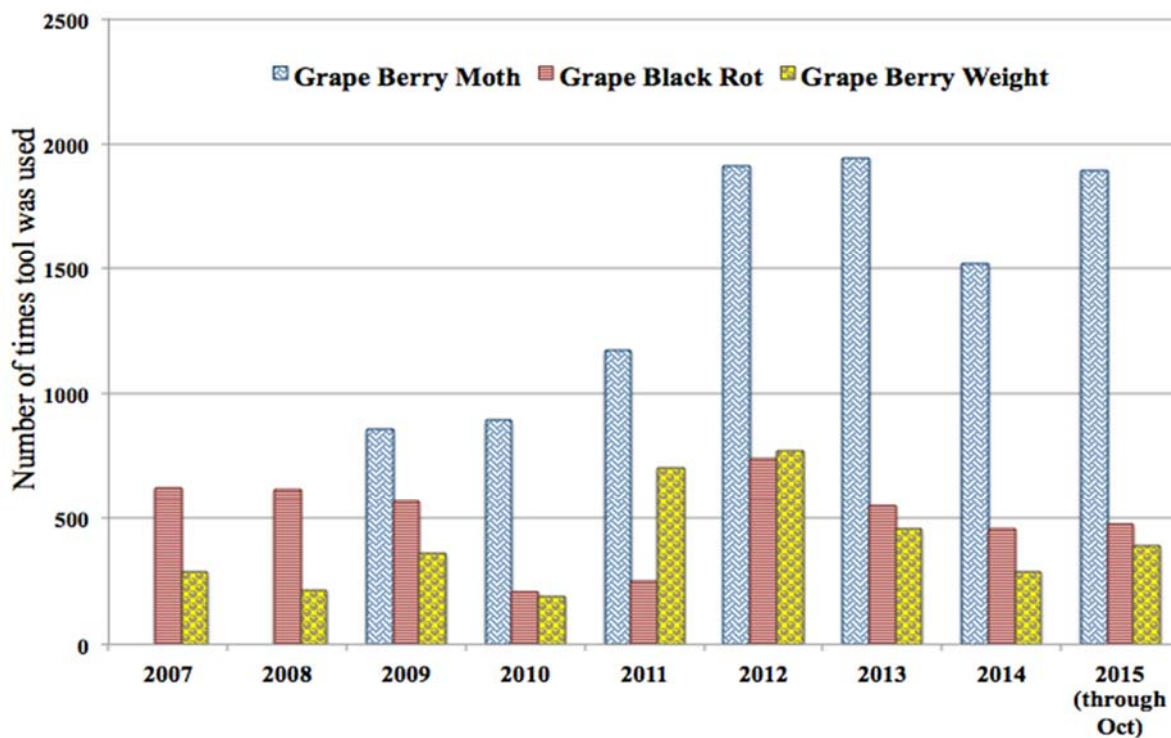


Figure 2. Number of times grape-specific Enviroweather applications were used each year from 2007 through October 2015.

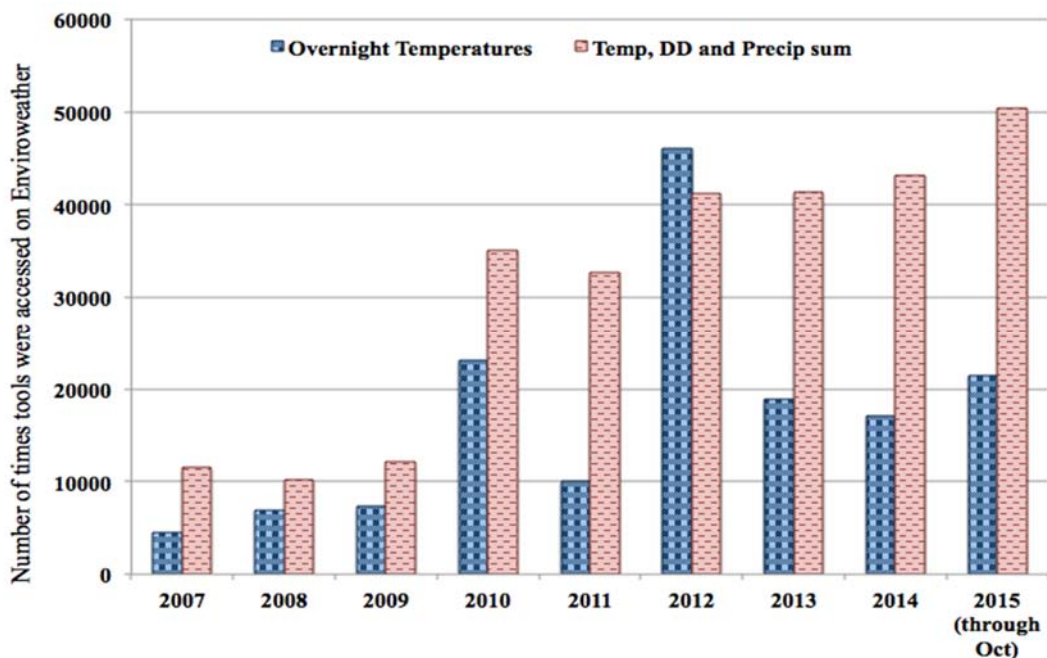


Figure 3. Number of times Enviroweather general weather applications (Daily temperature, precipitation and degree-day summary and Overnight temperatures) were accessed each year from 2007 through October 2015.

We know from survey results and supporter feedback that Enviroweather provides valuable information that helps users make informed management decisions that ultimately affect crop yield, quality and profitability. Enviroweather is grateful to its commodity and industry partners for providing essential funds for station operation and upgrades that ensure quality weather data now and in the future.

**Funding Partners:** MSU's Enviroweather project is made possible through contributions from a number of sources, including MSU Extension, MSU AgBioEnergy, Project GREEN, private industry, private donors, and Michigan commodity groups such as the Michigan Wine and Grape Industry Council. A MDARD Specialty Block Grant provided funding for the equipment used in the modernization effort.