NYWGF RESEARCH - FINAL REPORT

Funding for fiscal year: 2022-2023

SECTION 1:

Project title: Tracking grapevine cold hardiness across New York; 2022-2023

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Amount Funded $ 29,436

SECTION 2:

Project Summary Impact Statement:

Winter low temperatures are a challenge for grapevine production in New York State. Though the industry is diverse in climate and cultivar choice, cold temperatures can impact grapevine production across New York through freezing damage during winter. This project continues and updates a long-term monitoring program developed by Dr. Tim Martinson (retired) designed to provide timely grapevine cold hardiness data to growers and industry personnel. The results of this data collection have been the development of two different cold hardiness prediction models, which are now hosted on an updated web interface. These models extend the monitoring program across the state, far beyond the sites we can directly access and monitor.

Objectives: The objectives of this study were to conduct cold hardiness assays for multiple cultivars and in multiple locations, to determine the variability in cold hardiness between vineyards for Concord and Riesling, and to provide updated field cold hardiness and cold hardiness predictions for the New York grapevine industry.

1: Monitor winter cold hardiness of standard varieties over the winter season of 2022-2023 using differential thermal analysis of dormant bud tissue from the Finger Lakes, Hudson Valley, and Portland NY growing regions.

2: Deploy field temperature loggers to measure lake effect microclimate impact on cold hardiness development and budbreak timing.

3: Process data and provide summary cold hardiness data to the industry through extension presentations, Appellation Cornell, and the Cornell Grapevine Cold Hardiness web page.

Materials & Methods:

Plant Material: Throughout the 2022-2023 season, multiple grapevine cultivars were tracked for changes in cold hardiness by the project team. In Geneva, NY, twelve cultivars were assayed weekly, beginning October 31, 2022, through April 11, 2023. Starting on December 6, 2022, through March 14, 2023, five cultivars were sampled every two weeks from various Finger Lakes vineyards. In Portland, NY, eighteen cultivars were assayed weekly, beginning November 10, 2022, through April 3, 2023. Plant collection for all sites and cultivars were the same. At each location, cuttings of dormant cane and bud tissue were collected in the field, bundled, and transported to Cornell AgriTech in Geneva, NY or the CLERL laboratory in Portland, NY. The number of bud replicates used differed with twenty-four buds assessed in Geneva per collection point, and 10 buds assessed in Portland per collection point. At the cold hardiness labs, dormant buds were excised from canes and placed onto Peltier plates seated into sample trays. After all samples were processed for a given collection date, the sample trays were placed in programmable freezers and a controlled freezing assay was conducted.

Differential Thermal Analysis: Differential thermal analysis (DTA) is a standard method for determining the temperature that results in a lethal freezing event inside the dormant grapevine buds. To conduct these tests, the programmable freezers were cooled to 32°F/0°C and held for two hours to synchronize temperatures across all sample trays and buds. Then temperatures are decreased at -°7.2F/-4°C per hour to a minimum temperature of -40°F/-40°C. Cold hardiness is measured during these assays by monitoring the voltage produced on Peltier plates in the sample plates. When water within the dormant bud freezes, the state transitions from liquid water to ice releases a small amount of heat. This heat causes an alteration in the voltage produced across the surface of the Peltier plate, and we record this change as the temperature where lethal freezing has occurred. Following these cold hardiness freezer experiments, we manually record the voltage peaks caused by lethal freezing, and report that information as the field temperature that is expected to cause lethal bud damage in vineyards. DTA data were collected in this project for the cultivar monitoring (Obj. 1) and microclimate (Obj. 2) portions of this study.

Microclimate tracking: In addition to the weekly and biweekly monitoring project (Obj. 1), we conducted two microclimate studies. The first of the two studies were conducted in the Finger Lakes region and targeted eighteen different Riesling vineyards. Vineyards were selected to create six different transects encircling the southern end of Seneca Lake. Each transect included vineyards with varying distance from the lakeshore to measure any potential impacts of microclimate warming associated with elevation or proximity to the Lake. The second of the two studies were conducted in the Portland, NY region and targeted fifteen different Concord vineyards. The general concept was similar, with five transects extending from the shoreline of Lake Erie up the escarpment. Ultimately, the distribution of vineyards in this region resulted in two clusters of vineyard sites. Seven sites were located to the southwest of Portland, NY and eight sites were located to the northeast. The distribution resulted in a total of four lakeshore, eight middle, and three escarpment sites. At each vineyard location, two Bluetooth sensors (Sensor Push) were attached to vineyard trellis posts with one sensor at the height of the vine head, and a second near the base of the trunk. The two sensors were deployed in this pattern to try and assess the impacts of temperature differences at the vine level. Each sensor records temperature, humidity, and barometric pressure in one-minute increments, as well as derived measures of vapor pressure deficit and dewpoint. To correlate variation in microclimate conditions with variation in vine cold hardiness, dormant bud tissue was collected from all sensor sites every two weeks and examined with DTA methods to determine cold hardiness. Riesling sites were sampled beginning on December 6, 2022, and ending on April 12, 2023. Concord sites were sampled beginning on November 22, 2022, and ending on April 3, 2023.

Results/Outcomes/Next Steps:

Objective 1: A total of twenty-five different cultivars were monitored for cold hardiness during the winter of 2022-2023 (Table 1; Figure 1, Figure 2). Cold hardiness is a dynamic trait, it changes throughout winter. Thus, maximum cold hardiness values are not particularly useful for interpreting cultivar performance in any single year. However, it is useful to see when various cultivars achieved maximum cold hardiness, and to compare across sample locations. The date of the deepest cold hardiness for each cultivar, as represented by the temperature which killed 50% of the sampled buds (LT50), are reported in Table 2. In Geneva, Concord, Marquette, and Riesling attained the greatest cold hardiness, while Merlot, Gewurztraminer, Sauvignon Blanc, Cabernet Sauvignon, and Cayuga White attained the least cold hardiness. In Portland, maximum cold hardiness levels were far less than Geneva as noted for cultivars that overlap between the two sites (Concord, Riesling, Gewurztraminer, Cabernet Franc). Given the warmer overall winter temperatures, this result is not particularly surprising. However, the difference between Concord in the two sites, with Geneva Concord achieving 10F more cold hardiness than Portland Concord, was surprising. The greatest cold hardiness in Elvira, Delaware, and Traminette, while the least cold hardiness was attained in Gewurztraminer, Cabernet Franc, Pinot gris, and the Italian cultivars Fleuratai and Sorelli.

Minimum air temperatures across the state varied, but in general, the winter was mild. Much of November and December saw low temperatures around the freezing point. On December 23-24, 2022, a major cold front moved through the state, dropping the temperature 42°F/23°C in Portland, NY and 36°F/19°C in Geneva, NY in a span of just a few hours. This event produced the lowest temperature recorded for the winter in Portland, NY at 0°F/-17°C. Despite the drastic change in temperature and previously warm winter, grapevines across the state had acquired sufficient cold hardiness to escape freeze injury. Following this acute temperature change, the winter produced several prolonged days of very warm daytime temperatures. These warm temperatures essentially halted any further cold hardiness development in the cultivars tested, and evidence of loss of cold hardiness (deacclimation) was noted in hybrid and labruscana cultivars. A second acute cold event occurred on February 4, 2023. Based in part on the proximity to Lake Erie, and weather patterns, this second cold event was not sufficient to cause any damage to vines in Western New York. In the

Finger Lakes region, however, this acute cold event produced the lowest minimum temperature of the winter recorded for Geneva at -7.2°F/-21.8°C. Areas to the South and West of Geneva reached colder temperatures. As a result of the mild winter and post-Christmas warming, this cold event is expected to have produced freeze damage in the more cold sensitive vinifera cultivars grown in the Finger Lakes, such as Merlot, Gewurztraminer, and Sauvignon Blanc. Other cultivars may have incurred damage in areas where temperatures were lower, but direct measures of those sites were unavailable. Despite the prediction of damage, the level of damage was not expected to be extreme, <30%. At these levels, there is little need to adjust pruning methods to allow additional buds for spring growth.

The results of our monitoring program were updated throughout winter on a weekly basis at the Cornell Grapevine Cold Hardiness website (https://grapecoldhardiness.shinyapps.io/grape_freezing_tolerance/), providing growers with a view into the potential for freeze damage in their vines (Figure 3). This was the first year where the data was presented in an interactive interface. Several positive and negative comments were shared from interested growers and the website is in the process of being updated to accommodate as many requests as possible. This is the first year that our cold hardiness prediction models have been released to the public. Though not a component of this funded study, we added our models to the user interface to start familiarizing growers to this sort of data. The idea behind deploying field validated prediction models is to increase knowledge transfer to growers who have vineyards far from our cold hardiness laboratories. By demonstrating the fit of prediction models with real collected data, we can provide estimates of cold hardiness across a much larger area than we can currently serve. The next steps of this research are to continue providing fast and up to date cold hardiness data to growers as we transition from growing season to winter. As we build up dataset sizes for newly released and trialed cultivars, we will continue to develop cultivar specific models to broaden the scope of our data collection.

Objective 2: The microclimate study is in its first year of data collection. As such, discussion of the results of the winter will be generalized as replicate years are needed to identify trends in the data that are resistant to annual variation. During the 2022-2023 winter, we deployed temperature/humidity/pressure sensors at eighteen different vineyard blocks for Riesling in the Finger Lakes, and fifteen different vineyard blocks for Concord in Western New York. Unfortunately, a batch issues associated with the lithium-ion batteries that power the sensors resulted in large blocks of missing data from the Concord transects such that season wide differences in temperature between the head and trunk portions of the vines was unreliable. In the Riesling transects, temperature varied between the paired sensors at all sites. The seasonal average difference between head and graft sensors ranged from 0.005 to 0.64°F difference with a max difference of up to +/-18°F. Large variation in temperatures between the paired sensors is assumed to represent time periods where the top sensor is in full sunlight while the graft zone sensor is not.

Riesling microclimates. A surprisingly high amount of cold hardiness variation was observed when comparing the cold hardiness values of the eighteen different Riesling vineyards. Samples were collected ten times, beginning in early December, and continuing through mid-April (Table 3, Figure 4). Differences in cold hardiness measured between the sites at each sample timepoint ranged from a minimum difference of 4.7°F to a maximum difference of 18.4°F. During midwinter (Dec-early Mar), the average difference between least cold hardy and most cold hardy was 7.2°F. With the resumption of warming spring temperatures, differences between the least and most cold hardy sites increased dramatically to 11.1°F and 18.4°F for the last two collection timepoints. Winter long cold hardiness curves for each of the 6 transects are shown in Figure 4 and sites with the greatest and least cold hardiness are shown in Table 3. Data analysis is ongoing, but a much higher degree of local variation in cold hardiness occurs across the sites measured in this study than previously assumed. In addition, variation in cold hardiness did not neatly correlate with lakeside proximity or elevation, as previously hypothesized. In general, sites located on the Western side of Seneca Lake tended to be colder than sites on the East side. The large degree in cold hardiness variation during late winter deacclimation demonstrates a potential for large differences in late winter freeze and frost risk.

Concord microclimates. As was observed with the Riesling transects, a surprising amount of cold hardiness variation was measured across the fifteen Concord vineyards in Western New York (Table 3, Figure 5). As mentioned above, the Concord sites did not fit into five equally distributed transects, but instead into two clusters of vineyards. Eight vineyards were in the Northeastern cluster and included two escarpment sites, two lakeshore sites, and four intermediate sites. Seven vineyards were in the Southeastern cluster and included one escarpment site, two lakeshore sites, and four intermediate sites. Samples were collected nine times during the winter season, beginning in late November 2022-April 2023. Differences in cold hardiness measured between the sites at each sample timepoint ranged from a minimum difference of 4.5°F to a maximum difference of 10.9°F. Similar to the range in variation in Riesling, the average difference between least cold hardy and most cold hardy Concord sites was 7.1°F. Additionally, variation in cold hardiness increased during late winter deacclimation. Winter long cold hardiness curves for the two main vineyard clusters are shown in Figure 5 and sites with the greatest and least cold hardiness are shown in Table 3. Data analysis is ongoing, but initial results demonstrate a very clear microclimate effect of Lake Erie, with lakeside vineyards having much lower cold hardiness than inland and escarpment vineyards. However, a surprising second microclimate was observed between the two major clusters with vineyards in the Northeastern cluster being more cold hardy than the Southeastern cluster. As noted above, the large degree in cold hardiness variation during late winter deacclimation demonstrates a potential for large differences in late winter freeze and frost risk.

In conclusion, there are considerable differences in microclimate cold hardiness in both Finger Lakes Riesling and Western New York Concord vineyards and these differences are only partially explained by our current understanding of lake effect impacts. We plan to repeat the study for at least one additional winter to determine if these patterns are repeatable across years. The data collected here will also be used to fine tune cold hardiness prediction models that have been developed in the PI's research program.

Technology Transfer Plan: The primary method of transferring the results of this study is the goal of Objective 3, sharing of results through extension presentations, Appellation Cornell and through the Cornell Grapevine Cold Hardiness website. During the 2022-2023 season, the results of our monitoring program have been shared through three episodes of the "Between the vines" podcast, three Cornell Cooperative Extension newsletters, three crop updates, and two in person extension presentations: the LERGP winter grower conference and BEV NY. The primary transfer of our results has been through the newly updated Cornell Cold Hardiness website. With changes in website accessibility requirements at Cornell, the previous format for presenting winter hardiness data was no longer available. As a component of this study, we developed and deployed a new web interface. This new interface is accessible through the previous landing page (https://cals.cornell.edu/viticulture-enology/research-extension/bud-hardiness-data) which now links to an interactive application running through the R shiny interface (https://grapecoldhardiness.shinyapps.io/grape_freezing_tolerance/).This interface allows for user interaction with a number of different parameters including selection of weather station/location and cultivar. For sites that are tied to the Geneva and Portland, NY monitoring programs (Obj. 1), users can see up to date cold hardiness data for the temperatures expected to cause 10, 50, and 90% of bud damage (LT10, LT50, LT90). Though not supported through this study, the Londo lab has also developed two cold hardiness prediction models using past cold hardiness data collection supported by NYWGF (2009-2021). These cold hardiness models are posted on the new web interface, allowing growers to compare the field collected data with model predictions. For weather station sites that are not located in Geneva or Portland, these models allow the user to see what the predicted cold hardiness is for sixteen different cultivars. Over five hundred user interactions were tracked with the website between November 2022 and February 2023. In an interactive poll conducted at BEV NY, it became apparent that much of the grower industry is not aware of this website and the associated data availability. Future work to promote and increase engagement with the site will be implemented through future extension events. In addition, the web interface and data sharing template presented here has led to the initial establishment of an Eastern and Northeastern United States cold hardiness viticulture collaboration with multiple states (PA, MI, WI) and Canadian provinces (QUE, NS). Through leveraging the data collected across this wider region, model predictions will increase in accuracy and allow for a much wider data sharing capacity for both new and traditional grapevine cultivars in New York. Our hope is to continue collecting this data to improve the prediction models, particularly as winter climate becomes less stable due to climate change. In addition, as new cultivars enter the market, several years of monitoring data is required before the prediction models can be calibrated.

Acknowledgements: It is critical to acknowledge the important work of technical staff associated with our research programs as well as the vineyard growers who enable this work. We would like to acknowledge Hanna Martens, Erik Verdehem, and Maria Mott from the Londo program, Don Caldwell from the Walter-Peterson program, and Kim Knappenberger from the Russo program. We also want to thank the following vineyards: Ravines vineyard, Prejean vineyard, New Vines vineyard, Miles vineyard, Anthony Road vineyard, Glenora vineyard, Tabora vineyard, Lakewood vineyard, Sawmill Creek vineyard, Hillick and Hobbs vineyard, Boundary Breaks vineyard, Dalrymple farms, Boom Point, Rooster Hill, and growers: Young, Gage, Hicks, Tones, Ortolano, Bell, Jordan, Betts, Mobilia, Cross, Rak, Sprague, Sprague Sr., Schneider, Szumigala, and McGuinn.

Attachments:

Table 1: List of cultivars monitored during the 2022-2023 winter season by the project PI's.

	Geneva, NY	Finger Lakes Region	Portland, NY
Aravelle	x		
Aurore			x
Cabernet Franc	x	x	x
Cabernet Sauvignon	x		
Caminante blanc			x
Cayuga White	x	x	
Chardonnay	x		
Concord	x	x	x
Delaware			x
Elvira			x
Fleuratai			x
Gewurztraminer	x		x
Ives			x
Lemberger	x	x	
Marquette	x		
Merlot	x		
Niagara			x
Pinot gris			x
Riesling	x	x	x
Sauvignon blanc	x		
Seyval			x
Sorelli			x
Traminette			x
Vignoles			x
Vincent			x

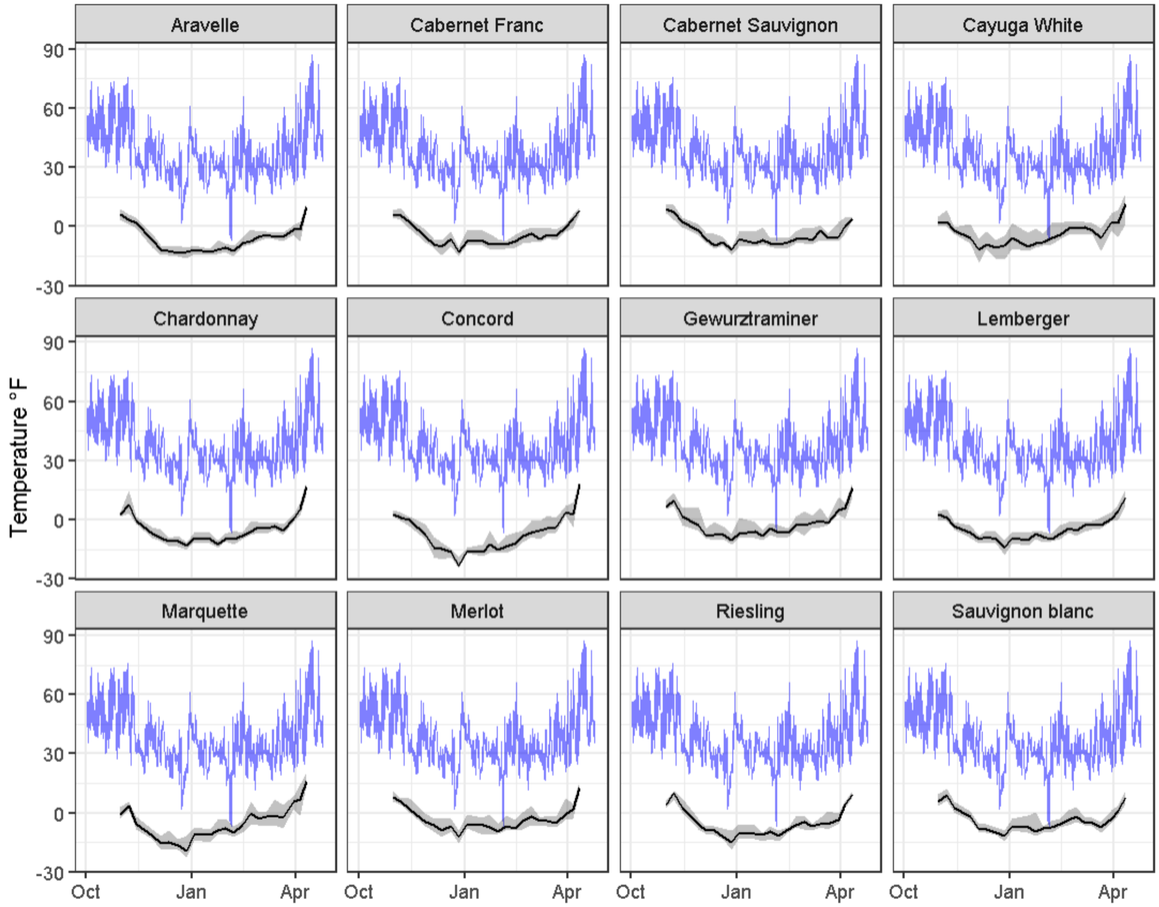

Figure 1: Cold hardiness curves for twelve genotypes sampled in the Figure Lakes region. Black line indicates the LT50, or temperature which was observed to kill 50% of the sampled buds at each collection time point. The gray shading indicates the range in temperature between the LT10 and LT90 temperatures.

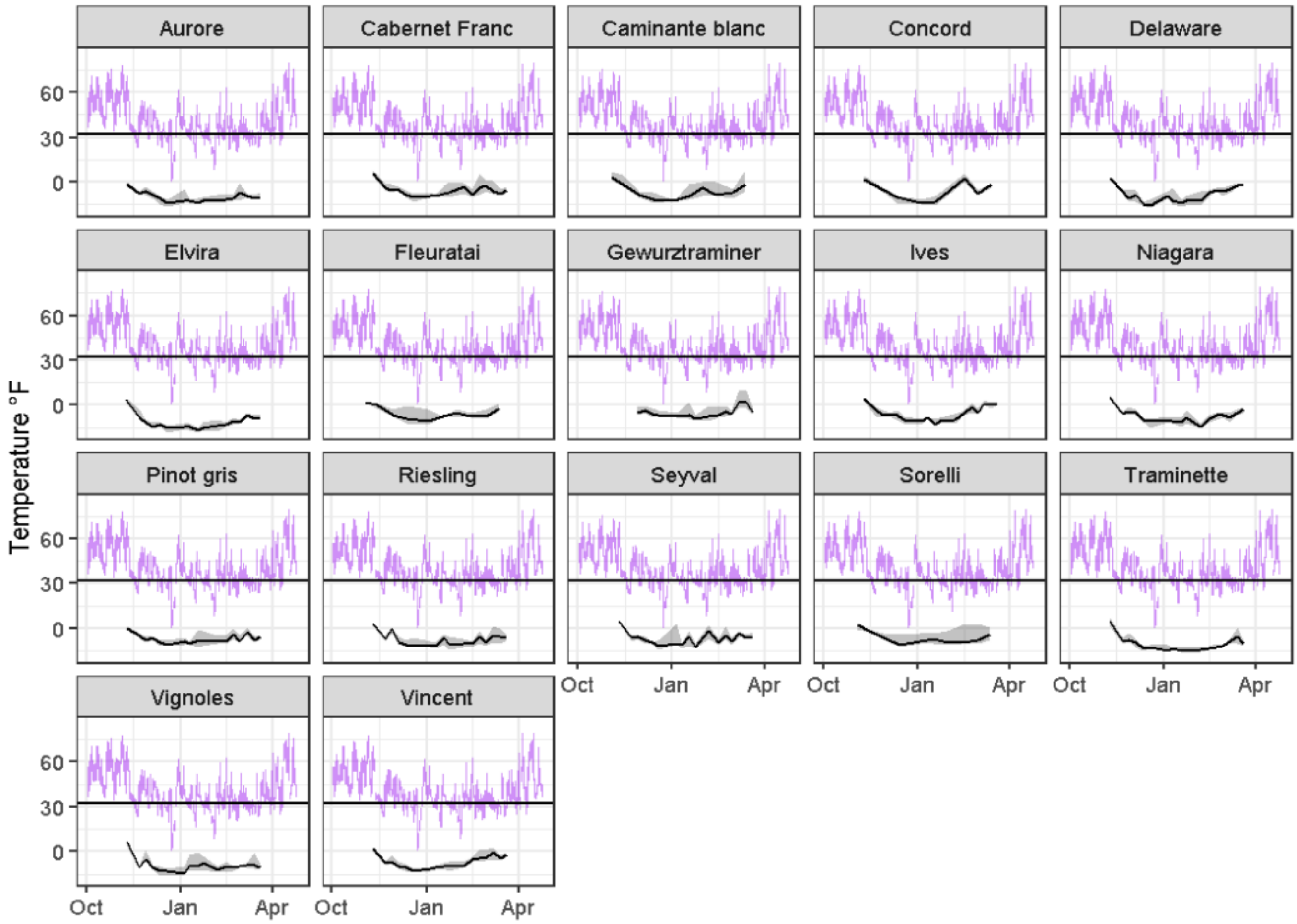

Figure 2: Cold hardiness curves for 17 genotypes sampled in the Portland NY region. Black line indicates the LT50, or temperature which was observed to kill 50% of the sampled buds at each collection time point. The gray shading indicates the range in temperature between the LT10 and LT90 temperatures.

Table 2. Date of maximum cold hardiness measured (°F) from the cultivars monitored in the Geneva and Portland cold hardiness programs. LT10/50/90 measures indicate the temperature expected to kill 10%, 50%, and 90% of primary buds.

Location	Cultivar	Date	LT10	LT50	LT90
Geneva	Aravelle	12/20/2022	-9.4	-13.1	-14.8
Geneva	Cabernet Franc	12/27/2022	-10.5	-12.5	-14.8
Geneva	Cabernet Sauvignon	12/27/2022	-10.8	-11.6	-14.4
Geneva	Cayuga White	12/5/2022	-6.3	-11.7	-18.3
Geneva	Chardonnay	12/27/2022	-11.3	-13.3	-15.1
Geneva	Concord	12/27/2022	-19.2	-23.2	-24.6
Geneva	Gewurztraminer	12/27/2022	-7.1	-10.1	-12.6
Geneva	Lemberger	12/27/2022	-10.1	-14.2	-17.6
Geneva	Marquette	12/27/2022	-11.6	-19.2	-22.5
Geneva	Merlot	12/27/2022	-9.1	-11.9	-15.5
Geneva	Riesling	12/27/2022	-9.0	-14.9	-18.5
Geneva	Sauvignon blanc	12/27/2022	-8.7	-11.5	-14.1
Portland	Aurore	12/19/2022	-12.0	-14.4	-16.3
Portland	Cabernet Franc	12/19/2022	-7.7	-10.0	-12.9
Portland	Caminante blanc	1/3/2023	-12.2	-12.2	-12.2
Portland	Concord	1/5/2023	-11.4	-13.8	-15.1
Portland	Delaware	12/19/2022	-11.8	-15.6	-17.3
Portland	Elvira	1/18/2023	-15.5	-17.1	-18.1
Portland	Fleuratai	1/3/2023	-2.5	-10.6	-12.6
Portland	Gewurztraminer	1/23/2023	-6.8	-9.0	-10.4
Portland	Ives	1/18/2023	-8.6	-12.5	-13.8
Portland	Niagara	2/6/2023	-12.4	-14.7	-15.5
Portland	Pinot gris	12/19/2022	-7.7	-10.6	-12.1
Portland	Riesling	12/19/2022	-6.5	-11.5	-12.8
Portland	Seyval	1/23/2023	-10.2	-12.4	-13.6
Portland	Sorelli	12/14/2022	-4.1	-10.6	-12.5
Portland	Traminette	1/18/2023	-11.6	-15.1	-15.9
Portland	Vignoles	1/5/2023	-9.5	-14.3	-15.0
Portland	Vincent	12/19/2022	-11.1	-12.9	-14.0

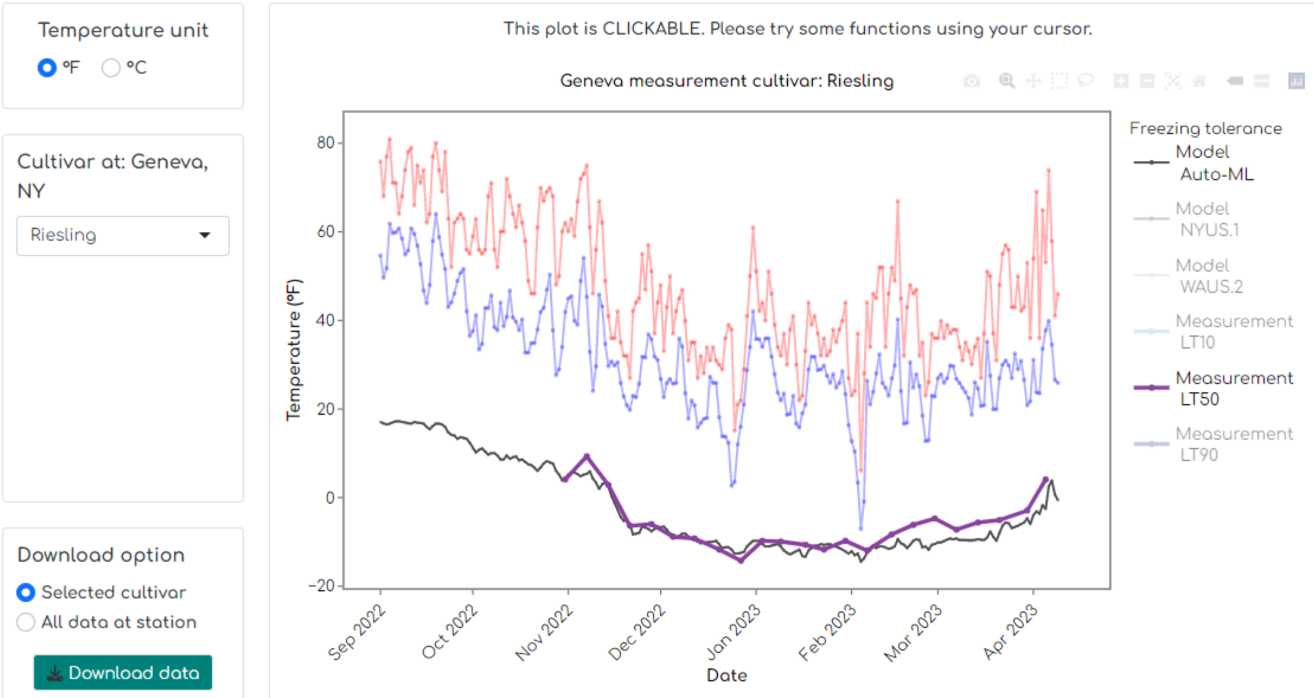

Figure 3. Screenshot of the Cornell Grapevine Cold Hardiness website developed by the project PI and affiliated research staff. The website offers interactive and selectable data types to allow growers to view various grapevine cultivars, cold hardiness measurements, and predication models. Screenshot shows cold hardiness measured for Riesling in Geneva, NY and a recently developed machine learning based prediction model.

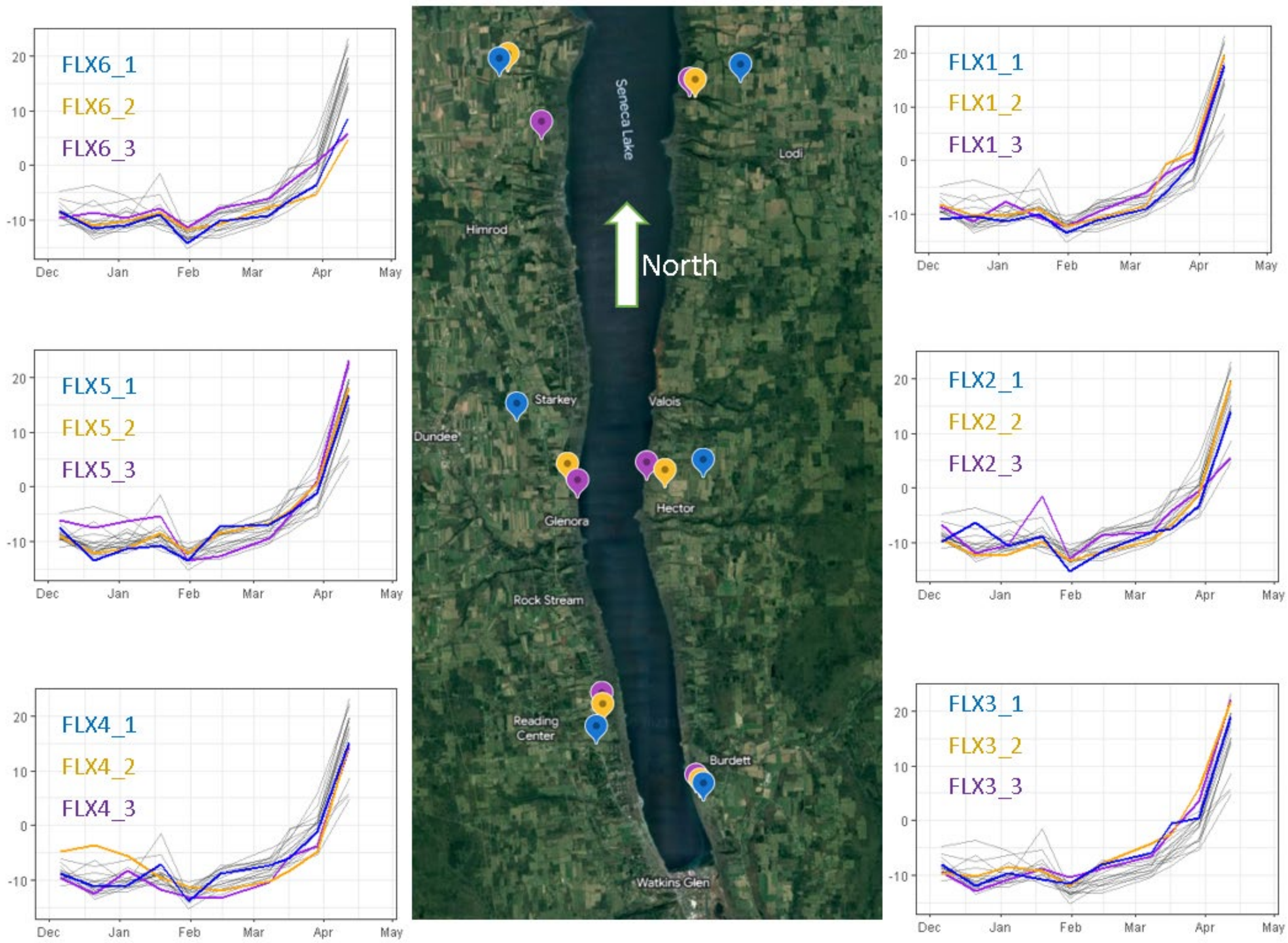

Figure 4. Results of microclimate cold hardiness study in the Finger Lakes. Eighteen Riesling vineyards were tracked for variation in cold hardiness From December 2022-April 2023. The eighteen sites were arranged into six transects of three vineyards each and designed to capture effects of proximity to the lake shore, as well as elevational differences. In each set, the purple line designates the cold hardiness, as measured by LT50 values, for the closest vineyard to the lake, the blue line the farthest from the lake, and the yellow line intermediate. Temperature in °F is represented on the y-axis of each cold hardiness graph.

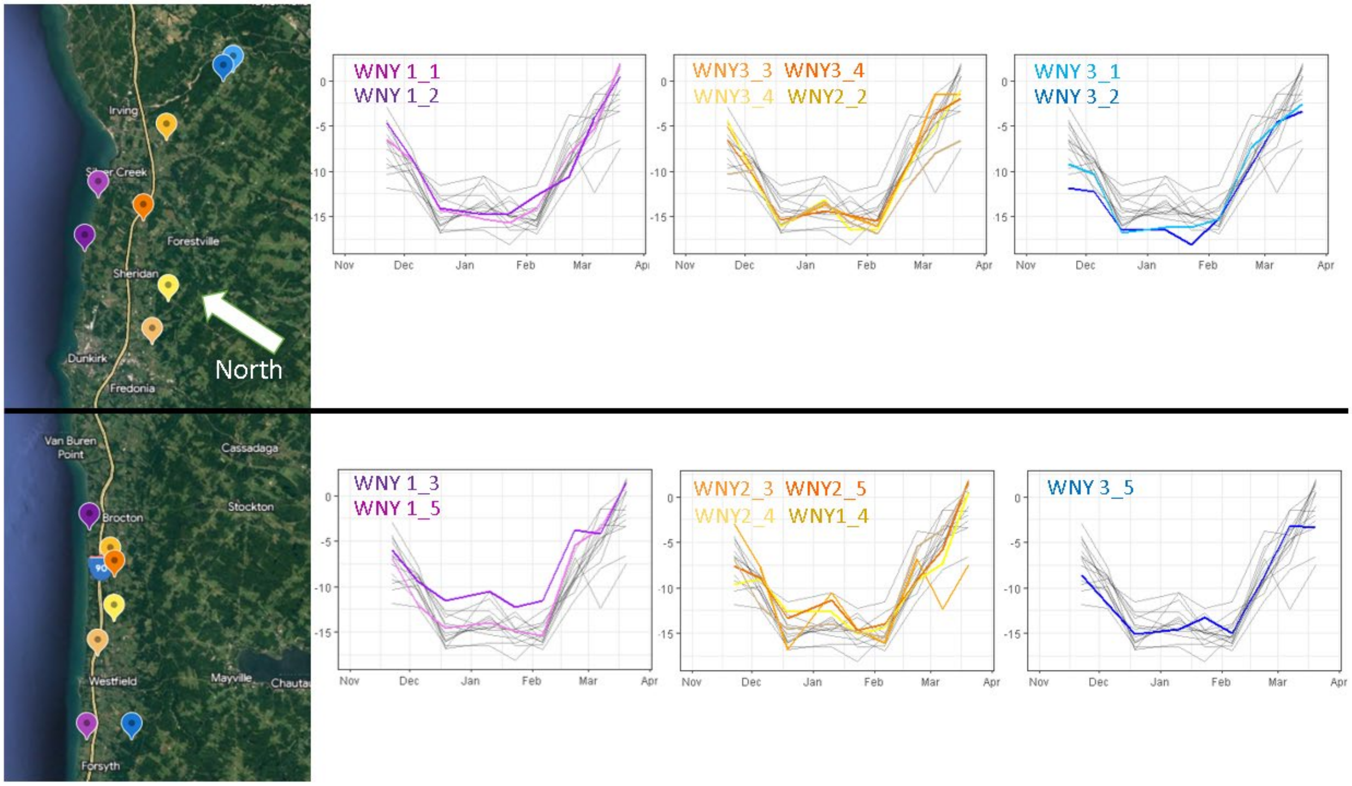

Figure 5. Results of microclimate cold hardiness study in Western New York. Fifteen Concord vineyards were tracked for variation in cold hardiness From December 2022-April 2023. Due to the narrow distribution of vineyards across the region, the fifteen sites were arranged into two large clusters and designed to capture effects of proximity to the lake shore, as well as elevational differences. Sites marked in purple represent low elevation sites with high proximity to Lake Erie, blue designate those sites distant to the lakeshore and with higher elevation, yellow and orange sites are intermediate. The colored lines in each graph represent the cold hardiness of sample collected in each vineyard, as determined by LT50 measurements. Temperature in °F is represented on the y-axis of each cold hardiness graph. The black line denotes a gap in our vineyard distribution, but also captures a new microclimate for cold hardiness. Sites to the Southwest of this line were in general, less cold hardy, than sites to the Northeast of this demarcation.

Table 3. Cold hardiness results for the Riesling and Concord microclimate study. Vineyard sites with the greatest LT50 and lowest LT50 at each sampling date are shown, with the difference between these extremes represented in °F.

Riesling					
Date	Vineyard	Max LT50	Vineyard	Min LT50	Difference
12/6/2022	FLX1_1	-11.0	FLX4_2	-4.6	6.3
12/21/2022	FLX5_1	-13.3	FLX4_2	-3.6	9.8
1/4/2023	FLX2_2	-12.1	FLX4_2	-5.6	6.5
1/19/2023	FLX4_3	-11.7	FLX2_3	-1.5	10.2
1/31/2023	FLX2_1	-15.1	FLX3_3	-10.4	4.7
2/14/2023	FLX4_3	-13.2	FLX5_1	-7.3	5.9
3/8/2023	FLX4_3	-10.4	FLX3_2	-4.2	6.2
3/17/2023	FLX4_2	-8.3	FLX3_1	-0.5	7.8
3/29/2023	FLX6_2	-5.3	FLX3_2	5.8	11.1
4/12/2023	FLX6_2	4.7	FLX5_3	23.1	18.4

Concord					
Date	Vineyard	Max LT50	Vineyard	Min LT50	Difference
11/22/2022	WNY3_1	-11.8	WNY2_3	-3.0	8.8
12/5/2022	WNY3_1	-12.3	WNY2_3	-7.8	4.5
12/19/2022	WNY3_2	-16.9	WNY1_5	-11.6	5.3
1/10/2023	WNY3_1	-16.5	WNY1_5	-10.5	6.0
1/23/2023	WNY3_1	-18.1	WNY1_5	-12.2	5.9
2/6/2023	WNY2_2	-17.0	WNY1_5	-11.6	5.4
2/22/2023	WNY2_2	-11.4	WNY1_5	-3.8	7.7
3/7/2023	WNY2_3	-12.4	WNY1_3	-1.4	10.9
3/20/2023	WNY2_3	-7.5	WNY1_1	1.9	9.4

SECTION 3:

Project summary and objectives: This project examined the cold hardiness of grapevine cultivars from multiple locations across New York State and shared the results with the grower community through extension presentations, newsletters, and through a newly developed interactive cold hardiness website. In addition, the project examined the potential impact of lake effect microclimate variation on cold hardiness in Concord and Riesling vineyards.

Importance of research to the NY wine industry: Grapevine production in New York state is directly limited by the seasonal pattern and depth of winter cold. Understanding the capacity of different cultivars to respond to winter temperatures and increase cold hardiness is essential to current vineyard production, as well as for choosing appropriate vineyard sites and cultivars for future industry expansion. This research is important in two critical ways, it provides up to date cold hardiness information for growers during winter so they can assess the potential for vineyard damage and potential pruning mitigation, as well as providing the base data needed to develop predictive models for grapevine cold hardiness. The outcomes of this research will better position the New York industry to adapt and succeed in the face of changing climate.

Project Results/next steps: This project produced cold hardiness data for a total of 25 different cultivars across three grape growing regions in New York and shared that data with the grower community through extension presentations, newsletters, and the Cornell Cold Hardiness website. In addition, the project conducted the first ever investigation into the potential impact of lake effect microclimates on cold hardiness development in Concord and Riesling. It is hard to say that the 2022-2023 winter was weird, this may be the new “normal” as climate change is contributing to greater winter instability. Vines did not take major damage as conditions were mostly mild, though temperatures did get close to causing damage during two acute cold events, one on December 24, 2022, and the other on February 4, 2023. Some cold sensitive cultivars, such as Merlot, Gewurztraminer, and Sauvignon Blanc, experienced temperatures low enough to cause primary bud damage, but not at levels that required growers to alter pruning practices. Microclimate variation demonstrates that there are expected effects of lake proximity on the development of cold hardiness, with sites near Lake Erie or Seneca Lake being warmer, and with lower cold hardiness than inland sites. However, variation across the region was also evident with clear indications of different levels of cold hardiness that do not fit proximity or elevation expectations. In particular, the cold hardiness differences measured in Concord vineyards near Lake Erie suggest the presence of two microclimates affecting cold hardiness. One is the expected proximity microclimate, the second was observed to occur when comparing Southwestern vs. Northeastern vineyard sites. Northeastern sites were as a group, more cold hardy than Southwestern sites. Future work to investigate these microclimate differences are planned as well as a continuation of the monitoring program. In addition, this work has led to a regional collaboration between cold hardiness programs in NY, PA, MI, WI and the Canadian provinces of QUE and NS. Going forward, these various programs will work together to combine data and improve prediction models for newly released or trialed cultivars.