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Eastern Promises: Appellations and Precision

By Jim Meyers

Quantifying Drivers of Diversity in Eastern New York

Viticultural diversity is central to the collective identity of eastern New York wine culture. From the viewpoint of a consumer, diversity is manifest in a broad variety of grape cultivars and wine styles ranging from local expressions of ancient Bordeaux blends in the Hudson Valley, to the recently developed and less globally recognized grapes and wine styles of the Champlain Valley. There are additional brand differentiators across the region such as local history, varying philosophies of chemical use in the vineyard, and favored enological techniques, but the products are significantly constrained by the expression of one key evolutionary force: local air temperature.

In simple terms, there is a temperature gradient from north to south in eastern NY that dictates what cultivars can be successfully grown in any particular location. In similarly simple terms, 'success' is defined by two outcomes: 1) Ripening fruit to sufficiently high sugar levels suitable for making European style wine, and; 2) Keeping dormant vine buds healthy enough during winter to reestablish production in the spring. Keeping buds healthy through winter requires that the air temperature not drop below the threshold at which buds will freeze and die. This threshold is cultivar-dependent and sensitive to patterns of temperature, not just very low temperature events, so the local temperatures expected in a vineyard dictate what can be safely planted. Meanwhile, proper ripening of fruit requires that the air temperature stay within the range of about 50-95 degrees Fahrenheit during the growing season for a sufficient period of time to support vine growth, fruit set, ripening, and the storage of reserve energy for the winter. This heat accumulation is quantified by a calculation called Growing Degree Days (GDDs).

In general, both temperatures and GDDs decrease from south to north which naturally leads to the northward trend of favoring grape cultivars that can ripen with less heat and better survive cold winters. As a benchmark, consider that the weather station closest to the Cornell Hudson Valley Research Lab in Ulster county recorded 3097 GDDs and a low temperature of 2 degrees F in 2017 while the weather station closest to the Willsboro Research Farm in Essex county recorded 2420 GDDs and a low temperature of –16 degrees F. Historically, the Hudson Valley lab has planted

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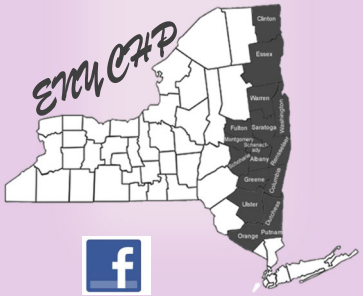

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vinifera in its research blocks, while Willsboro has planted hybrids and Minnesota cold hardy varieties. Although 2400 GDDs can be sufficient to ripen some vinifera in cool climates, the number of frost-free days decreases in a northerly direction. Thus, fruit cannot always be allowed to ripen long enough to benefit from all of the heat units. Also, that low temperature of –16 degrees F would likely cause significant bud death in most vinifera cultivars and even colder events are common in the Champlain Valley.

Importance of Quantitative Precision

Selecting cultivars that are compatible with expected winter lows and GDDs is the starting point for new vineyard establishment, but ongoing maximization of fruit quality and farm profitability requires more deliberation. Efficient pest management, for example, relies on careful attention to short term temperature and humidity patterns. While GDDs might be on track for a stellar ripening year, recent conditions might have encouraged an outbreak of Downy Mildew. And while some of these short term weather patterns are consistent across hundreds of square miles, many are not. This is why the Network for Environment and Weather Applications (NEWA) Integrated Pest Management (IPM) tools are built to report on the data of individual weather stations. What is happening on your farm might not be appropriately represented by the closest weather station some 10 kilometers away.

As with pest forecast models, vine management models intended to improve fruit quality are sensitive to local conditions and require attention to precision. Much traditional horticultural research involved the application of categorical treatments to a crop with the intention of classifying the treatment as being either helpful or unhelpful in achieving a particular goal. For example, is pulling leaves in the fruit zone good for fruit quality? Until recently, the standard advice for vine canopy management in cool climates was that increasing cluster exposure is always good for quality. But in my own research conducted on Riesling and Cabernet Franc in the Finger Lakes over the past several years, my colleagues and I discovered that ***moving beyond categorical treatments and quantifying relevant ecological and physiological variables led to the discovery of specific sun exposure thresholds that were optimal for fruit quality.*** The development of TDN in Riesling, for example, an aroma compound that smells like petrol, was found to steadily increase when cluster exposure exceeded 20% of ambient sunlight. Similarly but with a twist, total anthocyanins in Cabernet Franc were found to increase when fruit was exposed to between approximately 20-55% of ambient sunlight, but then decreased when exposure levels went above that range.

The chemical responses to fruit exposure found in our Finger Lakes research were locally specific. Air temperature, ambient solar radiation, cloud cover, precipitation, row orientation, and severity of leaf pulling were all factors in achieving our results. The metaphorical implication here is that one size does not fit all. Applying these experimental treatments to vineyards in eastern NY should not be expected to achieve similar results without accounting for differences among the relevant ecophysiological variables. This concept of ***focusing on the quantitative precision of a cultural intervention is particularly important in eastern NY because there is such a wide range of climatic variability and, due to the mountainous terrain, small scale spatial differences can yield substantial climate differences.***

A Quantitative Vineyard Inventory

Last July, when I committed to serving in the role of Viticulture Specialist for eastern NY, I promised industry stakeholders that I would attempt to frame a quantitative context for each of the vineyards in the 11,000 square mile territory to aid in the evaluation of best practices and to tailor mid-season cultural recommendations to individual farms. The remainder of this article is a presentation of my initial results with respect to establishing a production inventory and the identification of potential climatic appellations meaningful to differential farm management strategies.

Spoiler alert: While I consider the initial results to be both successful and useful, the project uncovered a lack of reliability and spatial precision in publicly available weather data. Thus, ***I am recommending that growers seriously consider installing a NEWA weather station at their farms***, or at least share their existing weather station data with me, to facilitate farm-specific recommendations. Details regarding farm-specific Extension reporting will be covered in an upcoming article.

Figure 1 is a map of all of eastern NY vineyards (excluding Long Island) that I know about. The symbology is a little complicated because I tried to fit a lot of information onto one map, so let's start with a walkthrough of what is presented.

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Vineyards in Eastern New York(●, N=141) and Open-Access Weather Stations(◄|▼|►|▲|★, N=61)

Cumulative GDD for 2017, Minimum weather data: ●=89%, ◄<50%, ▼=50%, ►=75%, ▲=90%, ★=95%

Distance from farm to station: min=0.4km, max=36.0km, mean=12.4km - larger ● symbols farther from weather station

Benchmarks: Willsboro=2420,0.1km; Geneva=2734,4.8km; Lansing=2736,12.2km; Riverhead=2799,4.1km; Portland=2803,0.1km; Highland=3097,0.4km

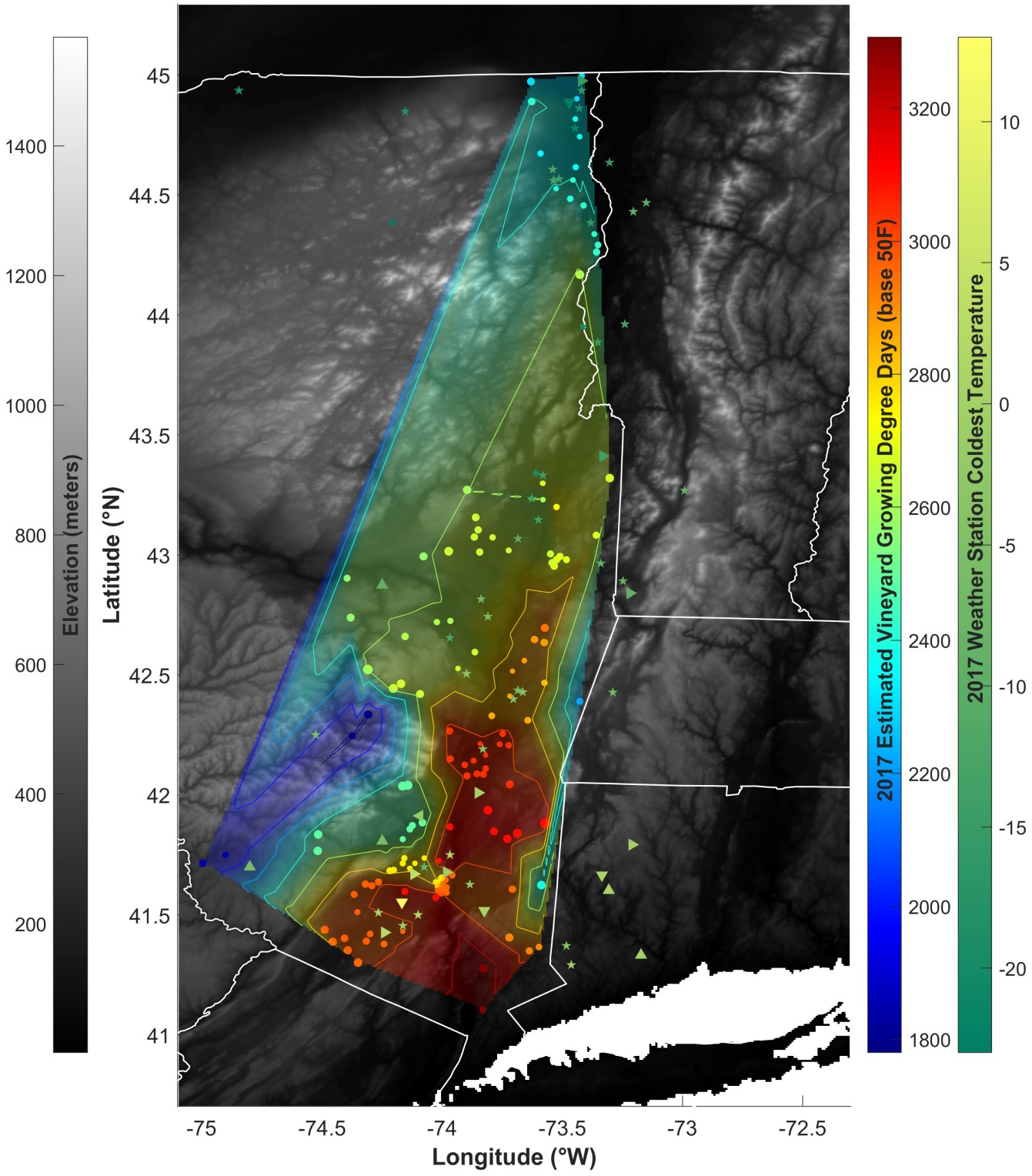

Figure 1 - Eastern NY Vineyard Inventory

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1) ***Colored circles are farms. Farm color indicates total GDDs in 2017 as indicated on the first color bar legend to the right of the map.*** The diameter of the circle is an indicator of how close that farm is to a reliable weather station. Not all weather stations are considered to be reliable (more explanation to follow) so the closest weather station might not be the one used to characterize farm conditions. A larger circle indicates that the farm is using weather data from farther away.

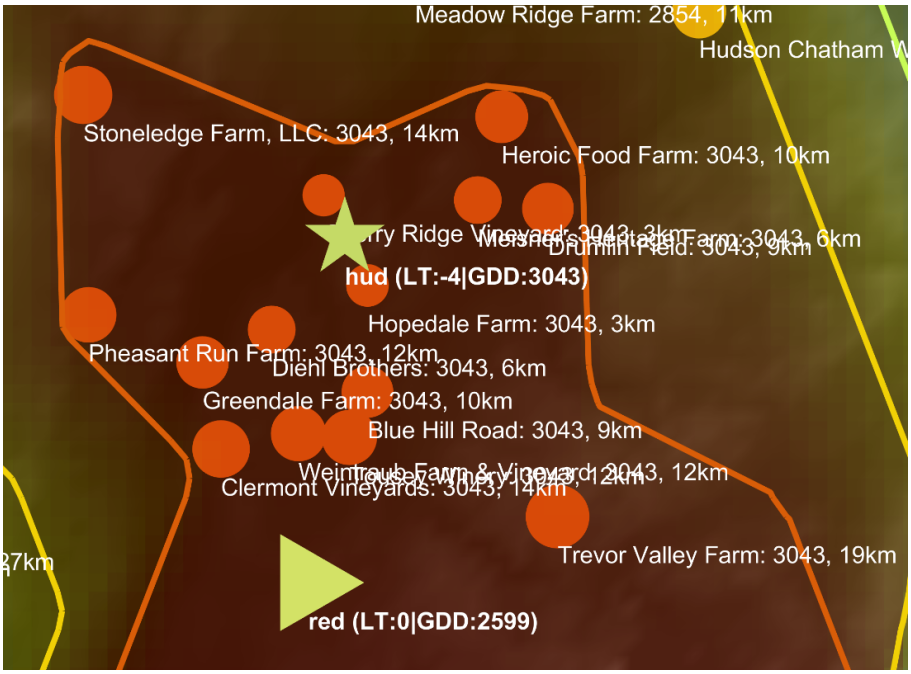

Figure 2 - Example of poor spatial coverage of weather stations in a cluster of farms that appear to share similar topography

2) ***Triangles and stars are publicly accessible weather stations.*** Leftward pointing triangles have less than 50% data coverage for 2017 (i.e., more than 50% of the data is missing or corrupted). Downward pointing triangles are stations that have between 50% and 75% data coverage for 2017. Rightward triangles have between 75% and 90% coverage. Upward triangles have 90-95% data coverage. Stars have over 95% coverage.

3) Note that in the figure title, the 'minimum weather data' for farms was 89%. This means that ***farm conditions were quantified by the closest weather station that had at least 89% data coverage.*** Closer weather stations with less data were ignored.

4) The gray scale background is a digital elevation map of eastern NY and bordering state territory. Elevation is indicated on the color bar legend to the left of the map.

5) The color of the weather station symbol indicates the lowest recorded temperature in 2017, as indicated on the second color bar legend to the right of the map.

Initial Uses and Limitations

The immediate usefulness of this vineyard inventory is that it provides spatial and climatic context for each farm. ***The colormap gradient and contour lines indicate approximate appellations that can serve to increase the precision with which cultural models are developed and implemented, leading to improved vineyard performance.*** I will be using these zones to guide vineyard scouting and data collection during the growing season to better understand and report on how conditions vary across the region.

Although this map is GDD-centric, most of the weather stations used in its creation collect data on wind speed/direction, precipitation, solar radiation, humidity, and an approximation of leaf wetness. This additional information will be integral to upcoming and ongoing reporting throughout the growing season. As alluded to earlier, I plan to soon begin farm-specific reporting for vineyards in eastern New York. Initially, these reports will focus on available weather data and historical context but are intended to evolve into more comprehensive management guides.

Currently, there are two fundamental limitations to this inventory: 1) Some weather stations are missing data; and, 2) Weather station spatial coverage is limited. In the first case, missing data can sometimes be reconstructed or ignored. For example, where temperature or humidity data is missing for a few hours in a given day, it was filled in with a continuation of the daily trend established on either side of the outage. Additionally, longer outages can sometimes be ignored. For example, temperature data missing from January and February can be ignored when computing GDDs, but not when predicting ecodormancy and budburst dates. However, compensation for the limited number of weather stations is not something that can be easily accomplished. This is why I am encouraging growers to seriously consider installing a NEWA station at their farm. For $1890, you will get years of benefits both for your farm and for the broader wine industry in eastern

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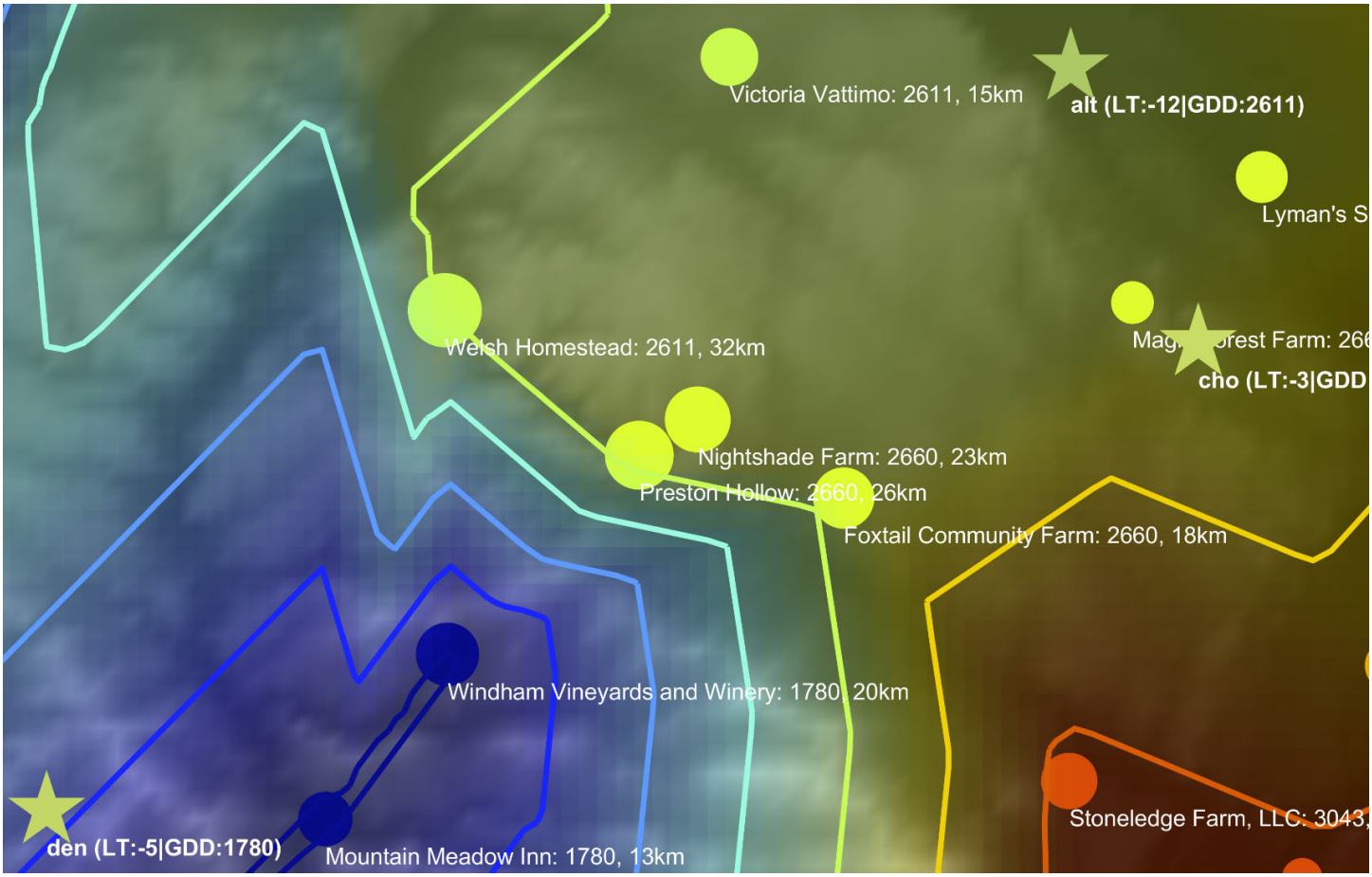

Figure 3 - Example of poor spatial coverage of weather stations in a cluster of farms with substantial topographical differences. The existing stations have good data coverage but the large distances create uncertainty.

New York. See additional information on pages 8 and 9 of this newsletter.

Figure 2 illustrates an example where 14 farms are relying on the same weather station, despite being as far away as 19 kilometers from the station. Notice that the circles are larger the farther away the farm is from the 'hud' NEWA station. Also note that the 'red' station was not used because it has too much missing data and is erroneously underreporting GDDs.

Given the apparent lack of topographical differences among the farms in Figure 2, one might argue that there is a good chance that the local conditions are very similar at each farm. If any of these were my farm, I still would want my own weather station. Are all fourteen of those farms really experiencing the same conditions and subject to the same low temperature events during winter? In this particular example, I am aware of at least one new NEWA station coming online soon in the northeast corner of the cluster. It will be interesting to see how that new source of data ultimately alters the appellation contours.

Figure 3 demonstrates a similar situation, but in which topography is clearly more of a factor. The figure includes a cluster of farms that are approximately equidistant to three weather stations and are on the boundary between two substantially different climatic appellations. The underlying detail of the elevation map also reveals significant topographical variability. The four vineyards in the center of the figure are between 18 and 32 kilometers from their nearest weather station. If Welsh Homestead were a kilometer to the south, it would be reporting 1780 GDDs from the 'den' station rather than 2611 from the 'alt' station. I think it is fair to say that the potential appellation boundary defined by these four farms should not be taken too seriously at this point.

Although I did not have many specific expectations about what the map would reveal when it came together, it was a little surprising to see that the Champlain Valley has the best weather station coverage (**Figure 4**). A few more stations in the northwest and southeast would be nice, but the coverage is good even though the stations are generally not located at the vineyard sites.

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Figure 4 - Champlain Valley vineyards and weather stations

Looking Ahead

It is my intention to build upon the inventory and tools presented here with additional data sources, vineyard management models, and farm reports. I hope that this article and the soon-to-be unveiled farm reporting will serve to facilitate productive conversations and an improved understanding of eastern New York viticulture. Please share your ideas and feedback!

I will end this article with a request: ***Please email me at jmm533@cornell.edu with an email address to which I can send your upcoming farm reports.*** I have emails for some farms, but not for most.