

Frost/Freeze Project Fall 2013 Survey Summary

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Executive Summary

The key findings from the fall 2013 survey are (based on 72 responses; 56 NWS, 16 Local Contributor):

- 31% of NWS respondents felt that the FFP either “encouraged” or “strongly encouraged” communication between NWS offices.
- 31% of Local Contributor respondents felt that the FFP either “encouraged” or “strongly encouraged” communication with their local NWS office, while 24% of NWS respondents said it “encouraged” communication with local vegetation experts.
- Survey respondents indicated that The Growing Degree Day products and the GIS Interface Tool were some of the least used products during the fall 2013 season.
- 80% of Local Contributor respondents would be likely to submit an Impact Report after a damaging freeze event.
- When asked how much they consider local contributor input in making frost/freeze headlines, the most common answer among NWS respondents (32%) was that they do not receive enough input from local contributors.
- The majority of Local Contributor respondents (73%) indicated that a 1-day lead-time or longer is sufficient to take mitigation steps to reduce damage to crops if freezing temperatures are a threat in the growing season.
- The new product that survey respondents (both groups) most commonly requested is hourly climate data tools (e.g., duration of most recent freeze event; longest freeze event duration over past 7 days).
- Negative feedback for the FFP includes too many emails, not enough is known about this project by NWS forecasters, and lack of data from partners.
- Positive feedback on the FFP includes the project’s ability to make the data readily available in map form and all in one place (NWS respondents) and increased collaboration/communication between NWS offices and with outside partners.
- As of July 2014, the MRCC has geographically limited email associated with the FFP and has offered an additional training webinar for NWS on the project.
- Other products desired that are in development include a susceptibility map and incorporating National Digital Forecast data into new products.

Introduction/Background

Started by the Midwestern Regional Climate Center (MRCC) in the fall of 2012, the Frost/Freeze Project (FFP) is the inaugural project formed under the MRCC’s Vegetation Impact Program (VIP). Inspired by both recent damaging freeze events (e.g. April 2007) and the needs of National Weather Service (NWS) offices in the region, the main missions of the FFP are to (1) provide a suite of operational monitoring and climatological tools to help users track the state of the vegetation-climate environment, and (2) establish a means of communication between NWS forecasters, climatologists, and vegetation experts that provides input guidance of the state of the vegetation-climate environment and quantitative impacts from damaging freeze events.

The FFP has two main participant groups; NWS forecasters and the “local contributor”, which includes Extension agents, state climatologists, farmers, growers, and other vegetation experts. One of the major goals of the FFP is to help NWS Weather Forecast Offices communicate with each other, as well as increase communication with local contributors outside of NWS. As of late spring 2014, over 204 subscribers have enrolled in the FFP throughout the United States, with the majority from the central U.S.

The FFP subscribers are an integral part to project usefulness and success. Therefore, following the fall 2013 season, the MRCC saw value in surveying FFP subscribers for feedback. The survey focused on assessing the tools and products that are most useful for subscribers, finding out what they liked and did not like about the project, and tools/products that they would like to see added in the future. Since the two participant groups (NWS and local contributor) have slightly different roles and focus in the FFP, as well as potentially different needs, the MRCC surveyed the two groups separately. The two groups were asked similar questions, but there are differences among the surveys (the Appendix lists all questions).

The response rate for the survey was 35% (based on 204 subscribers), with NWS survey having 56 respondents and the Local Contributor survey having 16 respondents (72 total responses). The majority of NWS respondents were located in the MRCC region, with the next most common being the High Plains Regional Climate Center region. The Southeastern Regional Climate Center was the only region without a survey participant. The majority of Local Contributor respondents picked agriculture as their area of expertise (67%), while there were also respondents in horticulture (27%), home gardening (13%), and service climatology (7%).

Survey Analysis

Communication

Improving communication between neighboring NWS offices, as well as communication between NWS offices and local vegetation experts is one of the main goals of the FFP. When NWS respondents were asked if the FFP has increased communication between NWS offices, the responses were mixed but the most common answer was “somewhat encouraged” at 30%. However, 31% of NWS respondents felt that the FFP either “encouraged” (24%) or “strongly encouraged” (7%) communication among NWS offices.

Was the FFP effective at encouraging communication between NWS offices and local vegetation experts? The most common response for both NWS respondents (32%) and Local Contributor respondents (38%) was that it “neither encouraged nor discouraged” communication with each other. Fortunately, 31% of Local Contributor respondents said that the FFP “encouraged” (19%) or “strongly encouraged” (12%) communication with their local NWS office while 24% of NWS respondents said that it “encouraged” communication with the local vegetation experts (none said that it “strongly encouraged”). Local Contributors were asked if the FFP encouraged communication with fellow vegetation experts, and the two most common answers were that it “somewhat encouraged” (44%) or “encouraged” (38%) communication.

The FFP was also somewhat effective in improving communications with the media, public, or other partners/customers. For the NWS respondents, 9% felt that the FFP “definitely” improved communication while 30% felt that there was “some” improvement. For the local contributor, 44% said there was “some” improvement in this type of communication.

Technical Products

The FFP offers a variety of technical products and tools to aid NWS forecasters in the decision-making process of issuing frost/freeze headlines for their County Warning Area (CWA) and for Local Contributors, these technical products and tools assist them in deciding the risk of vegetation to a freeze. We asked survey respondents several questions about the technical products and tools to gauge the usefulness of all tools to project members.

When asked how often they accessed the FFP web page or products in Fall 2013, the majority of Local Contributors (80%) and NWS respondents (45%) said “as needed (3 times or less per month)”. The NWS respondents were more likely to use the page and products on a more regular basis, with 30% saying they use it weekly and 6% daily.

According to NWS respondents, the products they tended to use the most were the Freeze Advisory Status per NWS Input (42%), Climatology Summary Products (38%), Date of Most Recent 28°F/32°F Freeze (36%), and Freeze Advisory Status per non-NWS Input (36%) (respondents could select more than one product). According to Local Contributor respondents, the products they tend to use the most were by far the Date of First 28°F/32°F and the Climatology Summary Products (40% each).

According to NWS respondents, the products they tended to use the least were the Growing Degree Day Products, which is similar to the response from the Local Contributor respondents as well. In addition, Local Contributor respondents also indicated that they did not use the “over past 14 days, number of days with minimum temperature 28°F/32°F” or the “days since most recent 28°F/32°F freeze” very much.

The FFP offers a unique GIS interface to view the same information that is available in the static maps. However, the majority of NWS respondents (40%) and Local Contributor respondents (40%) indicated they “never” used the GIS interface tool. There were 27% of NWS respondents that indicated they used it “sometimes” and 15% “regularly”.

The FFP also offers a place for project members to report impacts following a damaging freeze event. While this Impact Report has not been utilized much thus far, survey respondents were asked how likely they are to provide an Impact Report after a damaging freeze event. While the results were mixed among NWS respondents, 67% of Local Contributor respondents indicated they would be “somewhat likely” to report, and 13% would be “very likely”, making a total of 80% of Local Contributors that would be likely to report an impact should there be any in upcoming seasons.

Local contributors were also asked which climate products are most useful for them in the spring and fall seasons. For the spring season, 47% indicated that Growing Degree Day products are most important, while the Average Date of Last Spring Freeze is second (33%). Only one respondent (7%) found Chilling Hours products to be important in the spring. For the fall season, 67% indicated that the Average Date of First Fall Freeze is most important and Growing Degree Days are second (33%). There were no respondents that indicated Stress Degree Days products are important in the fall.

Decision-Making Process

How do NWS offices decide to issue frost/freeze headlines in their CWA? And how do local vegetation experts decide when vegetation is at risk, or whether they have time to take mitigation steps to reduce damage to crops? The survey respondents were asked questions along these lines in order for the MRCC to take these important factors into consideration when developing new FFP products or tools.

For the NWS, the most common response for how much they consider agriculture, horticulture, home gardens, and nurseries in their decision to issue a frost/freeze headline was that they are “always considering” the freeze risk/impacts to these sectors (ranged from 31%-39%). When asked how much they consider local contributor input in making frost/freeze headlines, the most common answer among NWS respondents (32%) was that they do not receive enough input from local contributors and the second most common was that they are “always considering” (26%).

NWS respondents were asked to describe the process they took as a forecaster in deciding whether to start issuing frost/freeze (or stop issuing) headlines in the spring (or fall). The majority of respondents indicated that they consider recent temperatures and impacts as well as climatological dates of first/last freeze. In the fall, headlines were often stopped once a certain temperature was reached (or repeated freezes) or a particular date (most common was November 1st). In the spring, headlines were typically issued after vegetation entered the growing season (based on local input or a stretch of recent mild weather).

Local Contributor respondents were asked what lead-time is sufficient to take mitigation steps to reduce damage to crops if freezing temperatures are a threat in the growing season. The majority of respondents (73%) indicated that a 1-day lead time or greater is necessary.

Feedback/Wish List

It was very important to the MRCC to solicit feedback during the survey to give project members the opportunity to comment on the FFP in general. Survey participants were asked what new product they would be most interested in, what they like most and least about the FFP, and whether they would like to add any other comments, questions, or concerns.

In terms of new products that survey respondents would like offered, the most common answer among NWS (51%) and Local Contributor (50%) respondents was hourly climate data tools (e.g., duration of most recent freeze event; longest freeze event duration over past 7 days). Both survey groups were also interested in crop-specific tools (e.g., for small fruit, six consecutive hours below 28°F during budding phase) and the NWS respondents were also interested in the incorporation of digital forecast data (e.g., mapping 72-hour freeze susceptibility). NWS respondents also indicated (via open-ended answer) that other products desired include:

- A measure of how much crop remains to be affected
- The probability of a particular temperature being reached
- Mapping for the hours of less than 28°F, 32°F, and 35°F for the next 72 hours from the digital forecast database
- High-resolution single and multi-member hourly temperature, wind, dew point, and cloud cover forecasts out to 72 hours
- Participation from agencies outside of the NWS such as field/nurseries and more participation from Northeast NWS offices

When asked what they like least about the FFP, 88% of Local Contributor respondents that answered this question said that there is too much email (tendency towards spamming). On the other hand, while there were a handful of NWS respondents that had no complaints (19%) about the FFP, the other top NWS responses on what they liked least about the project included:

- Not enough is known about this project by forecasters (16%)
- Too many emails (12%)
- Lack of data from partners (12%)
- Does not help with NWS office to office communication (9%)
- Too complicated (there are too many options for products; it would be useful to have a limited number of products that work for the majority) (6%)

There was also a lot of positive feedback on the FFP by survey respondents. The NWS respondents most appreciate the project's ability to make the data readily available in map form and all in one place (44%). In addition, NWS respondents appreciate the increased collaboration with neighboring offices and outside partners (35%). The majority of Local Contributor respondents indicated that the improved communication with NWS offices was their most favorite part about the FFP (56%).

Final comments about the FFP by respondents included:

- This project needs to do a better job promoting its existence
- Try to limit the emails
- There needs to be more commitment between NWS offices to make this more useful
- In the maps section, offer maps at state level rather than just national
- Make the GIS interface easy to copy/print to share on social media or use in other projects

Action Steps: What Has Been Done Since the Survey?

Since the fall 2013 FFG survey closed in January 2014, there have been several changes and improvements to the FFP.

Email Limitation

The MRCC had received much feedback from project members (prior to and as part of the survey) that they received too many emails from the FFP. Therefore, as of spring 2014, the MRCC has geographically restricted who receives project member guidance reports. If the project member selects the geographic area by CWA, then everyone associated with 1) that CWA, 2) all adjacent CWAs, and 3) the state the CWA is home to, will receive the report. If the project member selects the geographic area by county or crop reporting district, then anyone affiliated with the associated state (as noted in each user's registration profile) will receive the report.

We realize that some CWA's are in multiple states, and some folks might want to receive these reports even if they don't fall within these rules, so it is on the to-do list to continue to polish this geographically limited email system. In the meantime, just know that all project members will not receive every guidance report that is submitted across the country. If project members would like to receive this information outside of their area, they can always do so by either going through the [GIS interface](#) or by pulling up the list of reports from the main [Guidance/Impact Report form](#) webpage.

Training Webinar

Based on feedback from the NWS respondents, it appeared necessary to continue to offer training sessions on the FFP. Therefore, in March 2014, another training webinar was hosted by the MRCC, geared towards NWS contributors. The March 2014 training webinar covered a brief background on the VIP FFP's motivation and purpose, a discussion on the role of an NWS contributor and how the FFP can benefit the forecaster, and a tour of the FFP website, highlighting important products and tools useful for NWS contributors. A recording of this training session can be found on our [VIP Training and Materials](#) webpage.

Webpage Improvements/Function

The MRCC continues to improve the function of the FFP website. Recently, the MRCC has implemented a new, exciting way to select for which counties project members want to submit their guidance and impact reports. Project members can still select counties from the list, but now they can also use an interactive map tool by simply clicking on the map to the right of the list of the counties. A separate pop-up window of the map will appear and users can either 1) click on the county polygons, 2) click and drag of a rectangular area, or 3) click and freehand draw around and select the counties.

New Products

New maps offered within the Frost/Freeze Guidance Project are the *Lowest Minimum Temperature* maps (http://mrcc.isws.illinois.edu/VIP/frz_maps/freeze_maps.html). One lowest minimum temperature map highlights minimum temperatures that fell between 10°F and 50°F, while the second includes minimum temperatures between -38°F to 10°F. These maps were

produced in response to feedback from VIP horticulture members that said some crops are damaged if temperatures meet an *extreme* cold threshold during the winter. The *Lowest Min Temp: -38°F to 10°F* map is a way of tracking the extreme cold felt during the winter months.

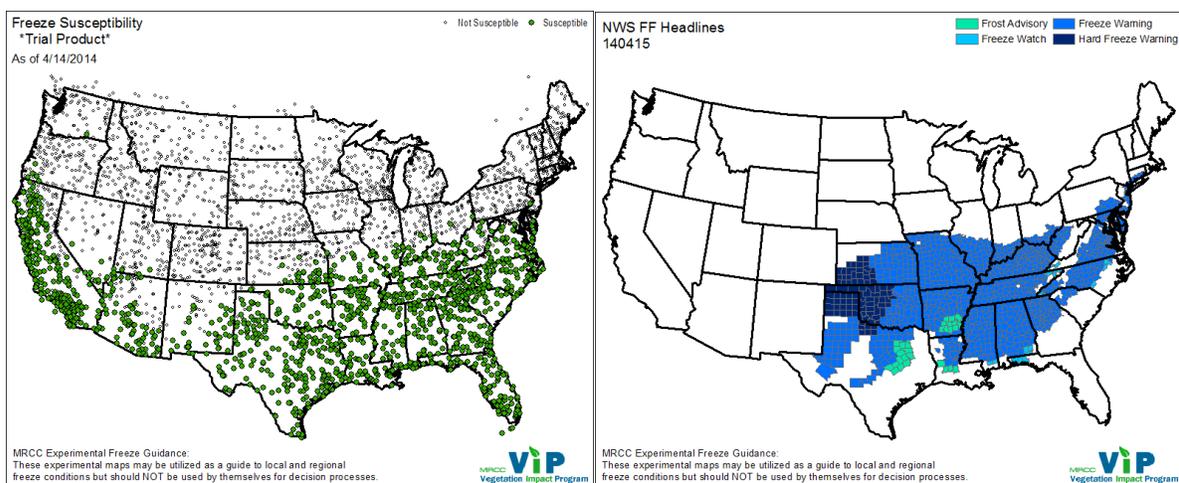
The MRCC has launched a new [Chilling Hours](#) product on the VIP website. On this new page, the accumulated number of chilling hours (defined as hours when the average hourly temperature was between 35°F and 45°F, inclusive, since October 1st) along with the departure from the 1998/1999-2012/2013 average. Like growing degree-day units, chilling hours offer a way to track length of exposure to optimum dormancy temperatures.

The MRCC also recently released a [Stress Degree Day \(SDD\)](#) product on the VIP website as well. SDD's are a way of tracking how much stress a type of plant has been subjected to within its growing season. The current VIP page focuses on providing modified SDD for corn, and provides maps for accumulated SDD and departure from normal SDD for the Midwest, central U.S., and contiguous U.S.

Products in Development

Potential Freeze Susceptibility Maps

The MRCC is attempting to construct an index that, from recent weather conditions, indicates where conditions are potentially susceptible to freeze impacts. This new index would produce what are called the *Potential Freeze Susceptibility* maps, which would be available as part of the Frost/Freeze Guidance project. This index would indicate that no forecaster input would be needed if the index indicates “not susceptible” and that forecasters would use their expert knowledge to determine whether or not to issue freeze warnings if the index indicates “potentially susceptible”. Therefore, we want all marginal cases to be categorized as potentially susceptible so that marginal cases would lead to further inspection by the forecasters. An example case study from spring 2014 is shown below:



Currently, the *Potential Freeze Susceptibility* maps are in trial mode and need further adjustments before they are made live on the VIP website.

Hourly Map Products

The MRCC is working to develop hourly products within the VIP website. Currently, one map that has been developed in trial mode is the *greatest consecutive hours below freezing – past 24 hours*. We are hoping to offer this map for the past 24 hours, 48 hours, 72 hours, and the last 7 days on the VIP website.

Other Products

- The MRCC now has access to the National Digital Forecast Database (NDFD) data. We are working in-house to develop ideas as to what products to develop using NDFD data.
- New climatology maps based on the 25th and 75th percentile are being developed for the static maps and interactive GIS page.
- The GIS interface now allows the user to select the shading technique of their preference using different geo-processing techniques (i.e. Thiessen polygons, inverse distance weighted (IDW) interpolation, natural neighbor interpolation).
- Interactive maps of Stress Degree Days, Keetch-Byram Drought Index, and Chilling Hours are being developed that will allow users to see a time series graph of the product at specific stations.

Appendix: List of Survey Questions

Frost/Freeze Fall 2013 Evaluation – NWS

Question 1: How much did the Frost/Freeze Guidance project encourage communication between NWS/Forecasting offices?

- a) Did not encourage
- b) Somewhat encouraged
- c) Neither encouraged nor discouraged
- d) Encouraged
- e) Strongly encouraged

Question 2: How much did the Frost/Freeze Guidance project encourage communication with vegetation experts?

- a) Did not encourage
- b) Somewhat encouraged
- c) Neither encouraged nor discouraged
- d) Encouraged
- e) Strongly encouraged

Question 3: How much did the Frost/Freeze Guidance project change or improve communications with the media, public, and other partners/customers?

- a) Did not change or improve
- b) Some change or improvement
- c) Definitely changed or improved

Questions 4-7: How much are you considering freeze risk/impacts to AGRICULTURE/HORTICULTURE/NURSERIES/HOME GARDENS in your decision to issue a frost/freeze headline?

- a) Not considering at all
- b) Sometimes considering
- c) Often considering
- d) Always considering

Question 8: How much do you consider the input from local contributors (Extension, farmers, growers, etc.) in making frost/freeze headlines?

- a) Not considering at all
- b) Sometimes considering
- c) Often considering
- d) Always considering
- e) Not enough input received

Question 9: Did you ever use the GIS interface tool (http://mrcc.isws.illinois.edu/gismaps/freeze/freeze_guidance.html) when seeking guidance on whether or not to issue a frost/freeze headline?

- a) Never

- b) Rarely
- c) Sometimes
- d) Regularly

Question 10: Did you ever experience technical issues (e.g. significant delay in loading) with the GIS interface tool?

- a) Never
- b) Rarely
- c) Sometimes
- d) Regularly
- e) Not applicable

Question 11: How often did you access the Frost/Freeze Guidance web page or products this past season?

- a) Never
- b) As needed (3 times or less per month)
- c) Weekly
- d) Daily

Question 12: Which product did you tend to use the MOST?

- a) None/Never looked at tools
- b) Date of first 28F/32F freeze
- c) Date of most recent 28F/32F freeze
- d) Days since most recent 28F/32F freeze
- e) Over past 14 days, number of days with $\text{mint} > 28\text{F}/32\text{F}$
- f) Lowest minimum temperature
- g) MGDD since most recent 28F/32F freeze
- h) GDD42 since most recent 28F/32F freeze
- i) GDD45 since most recent 28F/32F freeze
- j) GDD50 since most recent 28F/32F freeze
- k) GDD54 since most recent 28F/32F freeze
- l) Freeze advisory status per NWS input
- m) Freeze advisory status per non-NWS input
- n) Climatology summary products (e.g. date of median first 28F freeze)

Question 13: Which product did you tend to use the LEAST?

- a) None/Never looked at tools
- b) Date of first 28F/32F freeze
- c) Date of most recent 28F/32F freeze
- d) Days since most recent 28F/32F freeze
- e) Over past 14 days, number of days with $\text{mint} > 28\text{F}/32\text{F}$
- f) Lowest minimum temperature
- g) MGDD since most recent 28F/32F freeze
- h) GDD42 since most recent 28F/32F freeze
- i) GDD45 since most recent 28F/32F freeze

- j) GDD50 since most recent 28F/32F freeze
- k) GDD54 since most recent 28F/32F freeze
- l) Freeze advisory status per NWS input
- m) Freeze advisory status per non-NWS input
- n) Climatology summary products (e.g. date of median first 28F freeze)

Question 14: Which product would you be most interested?

- a) Hourly climate data tools (e.g. duration of most recent freeze event; longest freeze event duration over past 7 days)
- b) Incorporation of digital forecast data (e.g. mapping 72-hour freeze susceptibility)
- c) Chilling hour accumulation (i.e. how many hours during dormant season temperature were within a pre-defined cool range)
- d) Crop-specific tools (e.g. for small fruit X, 6 consecutive hours below 28F during budding phase)
- e) Other: please specify

Question 15: How likely are you to provide an Impact Report after a damaging freeze event?

- a) Not likely at all
- b) Somewhat unlikely
- c) Neutral
- d) Somewhat likely
- e) Very likely

Question 16: List and/or describe any other products that you might find useful to help decide whether or not to issue a frost/freeze headline.

Question 17: How much do you consider RECENT climatology (e.g. most recent freeze, growing degree-days) when deciding to issue a frost/freeze headline?

- a) Never
- b) Rarely
- c) Sometimes
- d) Regularly

Question 18: How much do you consider HISTORICAL climatology (e.g., date of median first freeze or date of latest late freeze from 30 years of data) when deciding to issue a frost/freeze headline?

- a) Never
- b) Rarely
- c) Sometimes
- d) Regularly

Question 19: Describe the process you took as a forecaster in deciding whether to start issuing (and/or stop issuing) frost/freeze headlines in the spring (or fall).

Question 20: What do you like LEAST about the Frost/Freeze Guidance project?

Question 21: What do you like MOST about the Frost/Freeze Guidance project?

Question 22: Within which Regional Climate Center (RCC) area are you located?

- a) MRCC
- b) HPRCC
- c) NRCC
- d) SRCC
- e) SERCC
- f) WRCC
- g) Don't know

Question 23: Please list anyone you think would be interested in being included in this project, including their email address.

Question 24: Any other comments, questions, or concerns you would like to add?

Frost/Freeze Fall 2013 Evaluation – Local Contributors

Question 1: How much did the Frost/Freeze Guidance project encourage communication with local NWS/Forecasting offices?

- a) Did not encourage
- b) Somewhat encouraged
- c) Neither encouraged nor discouraged
- d) Encouraged
- e) Strongly encouraged

Question 2: How much did the Frost/Freeze Guidance project encourage communication with fellow vegetation experts?

- a) Did not encourage
- b) Somewhat encouraged
- c) Neither encouraged nor discouraged
- d) Encouraged
- e) Strongly encouraged

Question 3: How much did the Frost/Freeze Guidance project change or improve communications with the media, public, and other partners/customers?

- a) Did not change or improve
- b) Some change or improvement
- c) Definitely changed or improved

Question 4: Did you ever use the GIS interface tool (http://mrcc.isws.illinois.edu/gismaps/freeze/freeze_guidance.html) when deciding the risk of vegetation to a freeze?

- a) Never
- b) Rarely
- c) Sometimes

- d) Regularly

Question 5: Did you ever experience technical issues (e.g. significant delay in loading) with the GIS interface tool?

- a) Never
- b) Rarely
- c) Sometimes
- d) Regularly
- e) Not applicable

Question 6: How often did you access the Frost/Freeze Guidance web page or products this past season?

- a) Never
- b) As needed (3 times or less per month)
- c) Weekly
- d) Daily

Question 7: Which product did you tend to use the MOST?

- a) None/Never looked at tools
- b) Date of first 28F/32F freeze
- c) Date of most recent 28F/32F freeze
- d) Days since most recent 28F/32F freeze
- e) Over past 14 days, number of days with mint>28F/32F
- f) Lowest minimum temperature
- g) MGDD since most recent 28F/32F freeze
- h) GDD42 since most recent 28F/32F freeze
- i) GDD45 since most recent 28F/32F freeze
- j) GDD50 since most recent 28F/32F freeze
- k) GDD54 since most recent 28F/32F freeze
- l) Freeze advisory status per NWS input
- m) Freeze advisory status per non-NWS input
- n) Climatology summary products (e.g. date of median first 28F freeze)

Question 8: Which product did you tend to use the LEAST?

- a) None/Never looked at tools
- b) Date of first 28F/32F freeze
- c) Date of most recent 28F/32F freeze
- d) Days since most recent 28F/32F freeze
- e) Over past 14 days, number of days with mint>28F/32F
- f) Lowest minimum temperature
- g) MGDD since most recent 28F/32F freeze
- h) GDD42 since most recent 28F/32F freeze
- i) GDD45 since most recent 28F/32F freeze
- j) GDD50 since most recent 28F/32F freeze
- k) GDD54 since most recent 28F/32F freeze

- l) Freeze advisory status per NWS input
- m) Freeze advisory status per non-NWS input
- n) Climatology summary products (e.g. date of median first 28F freeze)

Question 9: Which product would you be most interested?

- a) Hourly climate data tools (e.g. duration of most recent freeze event; longest freeze event duration over past 7 days)
- b) Incorporation of digital forecast data (e.g. mapping 72-hour freeze susceptibility)
- c) Chilling hour accumulation (i.e. how many hours during dormant season temperature were within a pre-defined cool range)
- d) Crop-specific tools (e.g. for small fruit X, 6 consecutive hours below 28F during budding phase)
- e) Other: please specify

Question 10: How likely are you to provide an Impact Report after a damaging freeze event?

- a) Not likely at all
- b) Somewhat unlikely
- c) Neutral
- d) Somewhat likely
- e) Very likely

Question 11: List and/or describe any other products that you might find useful to help decide whether or not to issue a frost/freeze headline.

Question 12: How much do you consider RECENT climatology (e.g. most recent freeze, growing degree-days) when deciding the risk of vegetation to a freeze?

- a) Never
- b) Rarely
- c) Sometimes
- d) Regularly

Question 13: How much do you consider HISTORICAL climatology (e.g., date of median first freeze or date of latest late freeze from 30 years of data) when deciding the risk of vegetation to a freeze?

- a) Never
- b) Rarely
- c) Sometimes
- d) Regularly

Question 14: If freezing temperatures are a threat in the growing season, what lead time is sufficient to take mitigation steps to reduce damage to crops?

- a) 1-5 hours
- b) 6-10 hours
- c) 11-15 hours
- d) 16-20 hours
- e) 1 day

- f) 2 days or more

Question 15: Which climate product do you think is most important in the SPRING?

- a) Chilling hours
- b) Growing degree-days
- c) Drought indices (e.g. PDSI, SPI, KBDI)
- d) Average dates of last spring freeze
- e) Number of days below freezing in past two weeks
- f) Others (please specify)

Question 16: Which climate product do you think is most important in the FALL?

- a) Stress degree-days
- b) Growing degree-days
- c) Drought indices (e.g. PDSI, SPI, KBDI)
- d) Average dates of first fall freeze
- e) Number of days below freezing in past two weeks
- f) Others (please specify)

Question 17: What do you like LEAST about the Frost/Freeze Guidance project?

Question 18: What do you like MOST about the Frost/Freeze Guidance project?

Question 19: If you had to pick a particular area of expertise, what would it be?

- a) Agriculture
- b) Horticulture
- c) Nurseries
- d) Home gardening
- e) Other (please specify)

Question 20: Please list anyone you think would be interested in being included in this project, including their email address.

Question 21: Any other comments, questions, or concerns you would like to add?