# Operational MRCC Tools
# Useful and Usable by the National Weather Service

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**Vegetation Impact Program (VIP):**
**Frost / Freeze Project**
***– Beth Hall –***

**Accumulated Winter Season Severity Index (AWSSI)**
***– Steve Hilberg –***

*February 2015*

# MRCC Operational Freeze Guidance Products and Climatologies

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# Motivation

- **2007 spring freeze in early April**
  - *$2 Billion in damages*
  - *Late in season for the southern US*
  - *Not late in Midwest, but followed a warm March*

- **2009 delayed maturity of crops**
  - *Wet spring delayed planting*
  - *Cool summer (espcially July) slowed crop maturity*
  - *Late harvest so more susceptible to freeze damage*

- **NWS needs**
  - *Environmental monitoring tools*
  - *Communication between offices*
  - *Communication with vegetation experts*

*Many blooming fruit crops, like the oranges pictured, here were destroyed by the freezing temperatures in the eastern United States on April 4–10, 2007. (Source: NCDC)*

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# NWS Recommendations

**Analysis of 2007 Freeze event…**

- **NWS services and communication were good overall**

- **Recommendations for future:**
  - ***Base freeze warning / headlines on potential impacts to agriculture, horticulture, nurseries, and home gardens rather than calendar dates***

  - ***Develop and utilize ties with University Extension, state climatologists, USDA personnel, and other relevant partners to:***

    - **Determine when freezing temperatures are a threat**

    - **Gather quality, detailed post-event impact information for regional reports and even documentation (i.e., storm reports, drought monitor)**

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# An MRCC Opportunity

- **Relationship** with NWS, SCs, University Extension, etc
- **Monitors and Assess** regional climate conditions and their impacts
- **Provides high-quality, operational climate data, tools, resources** for the region and sector
- **"Neutral" party** between partners

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# The end goal

**A one-stop shop for Frost/Freeze products and forecasts**

- **Daily Products**
  - Many in production and operational or in beta phase
- **Incorporate hourly data**
  - Duration of freeze at an hourly time step
  - Chilling hours – dormancy for fruits
- **Incorporate hourly forecasts**
  - **View and prepare for upcoming forecasted freezes**
- **Reporting**
  - Along the lines of storm reports and drought monitor
    - Input from NWS, University Extension, etc… on status of crops and susceptibility for a freeze
    - Reports of freeze impacts

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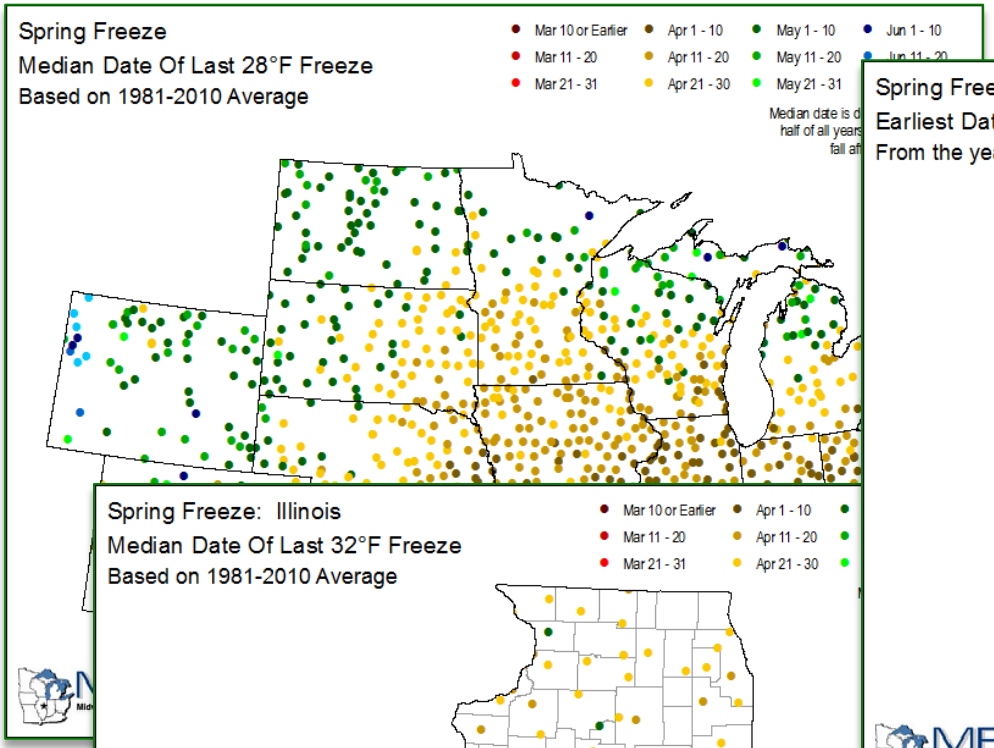
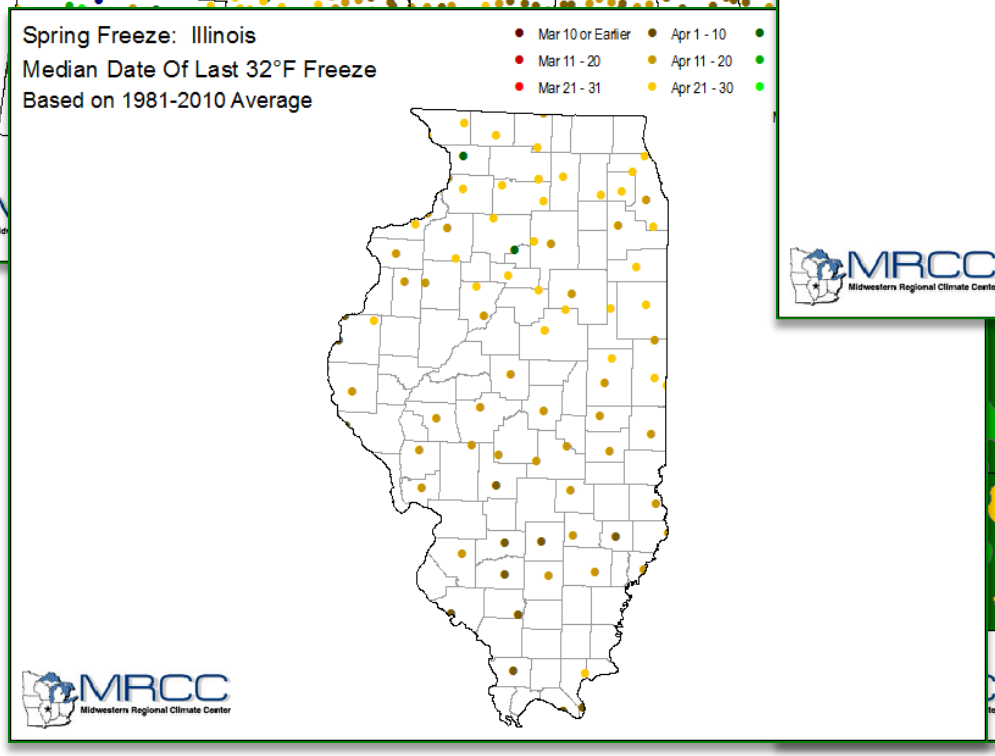
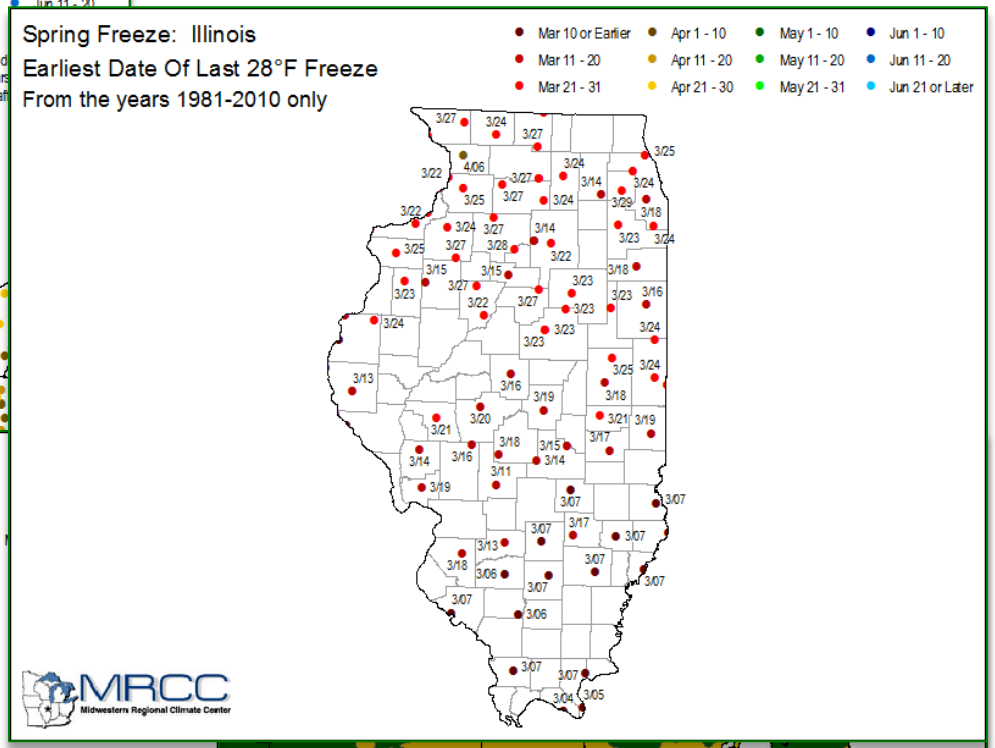
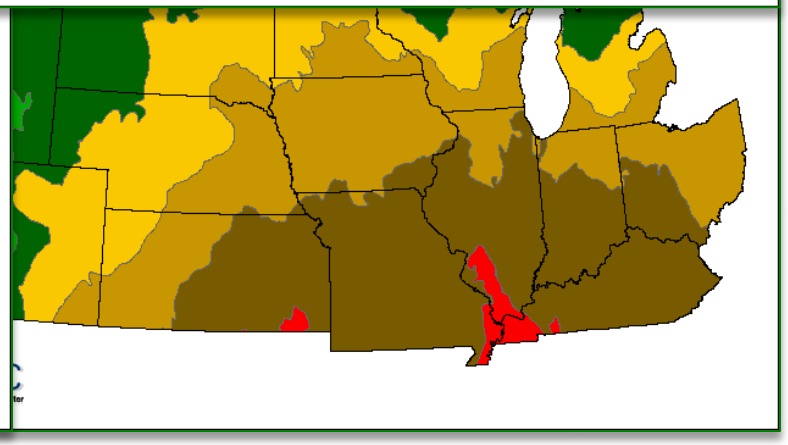
# Current Products - Daily



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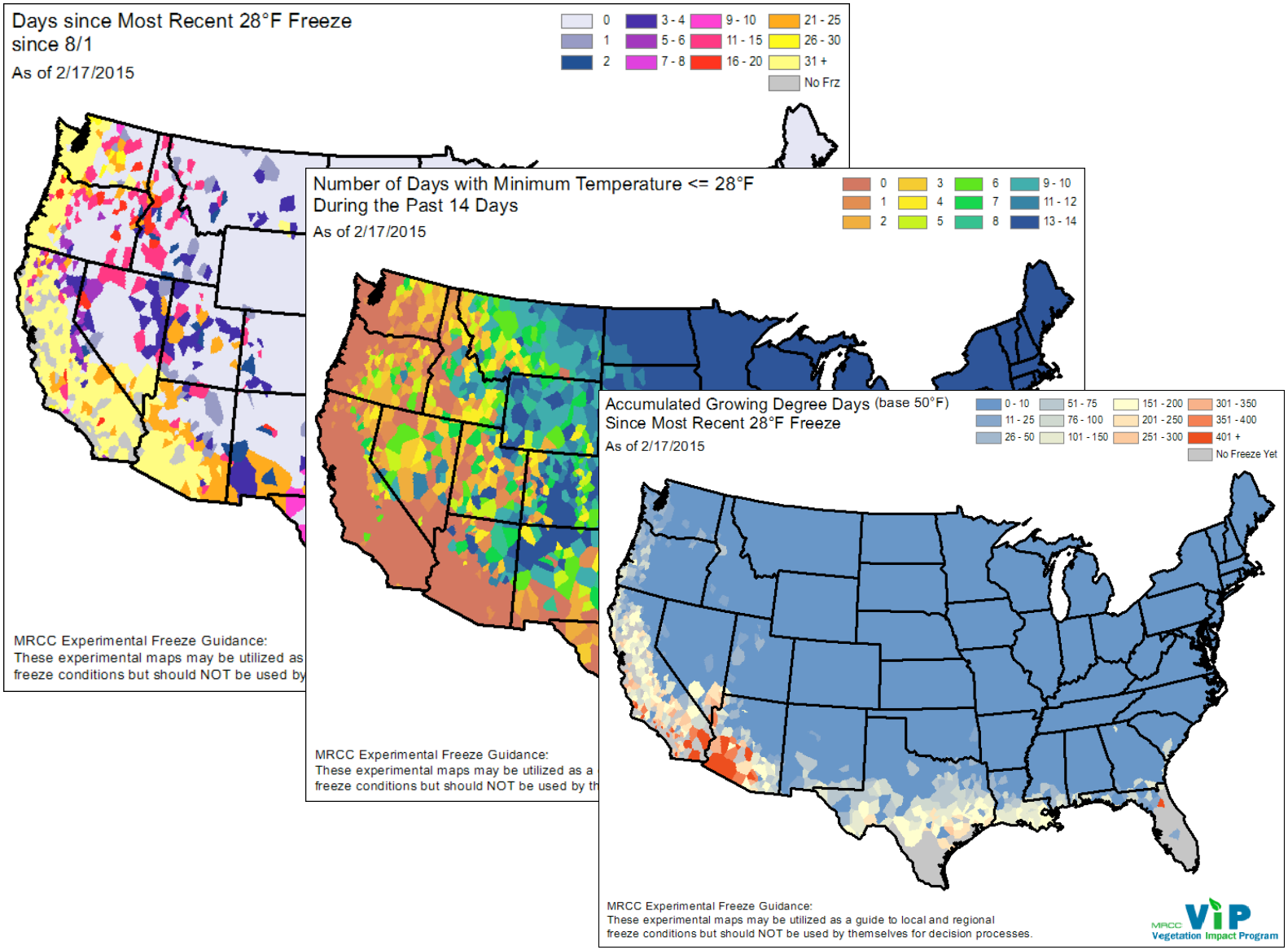
# Current Products - Daily

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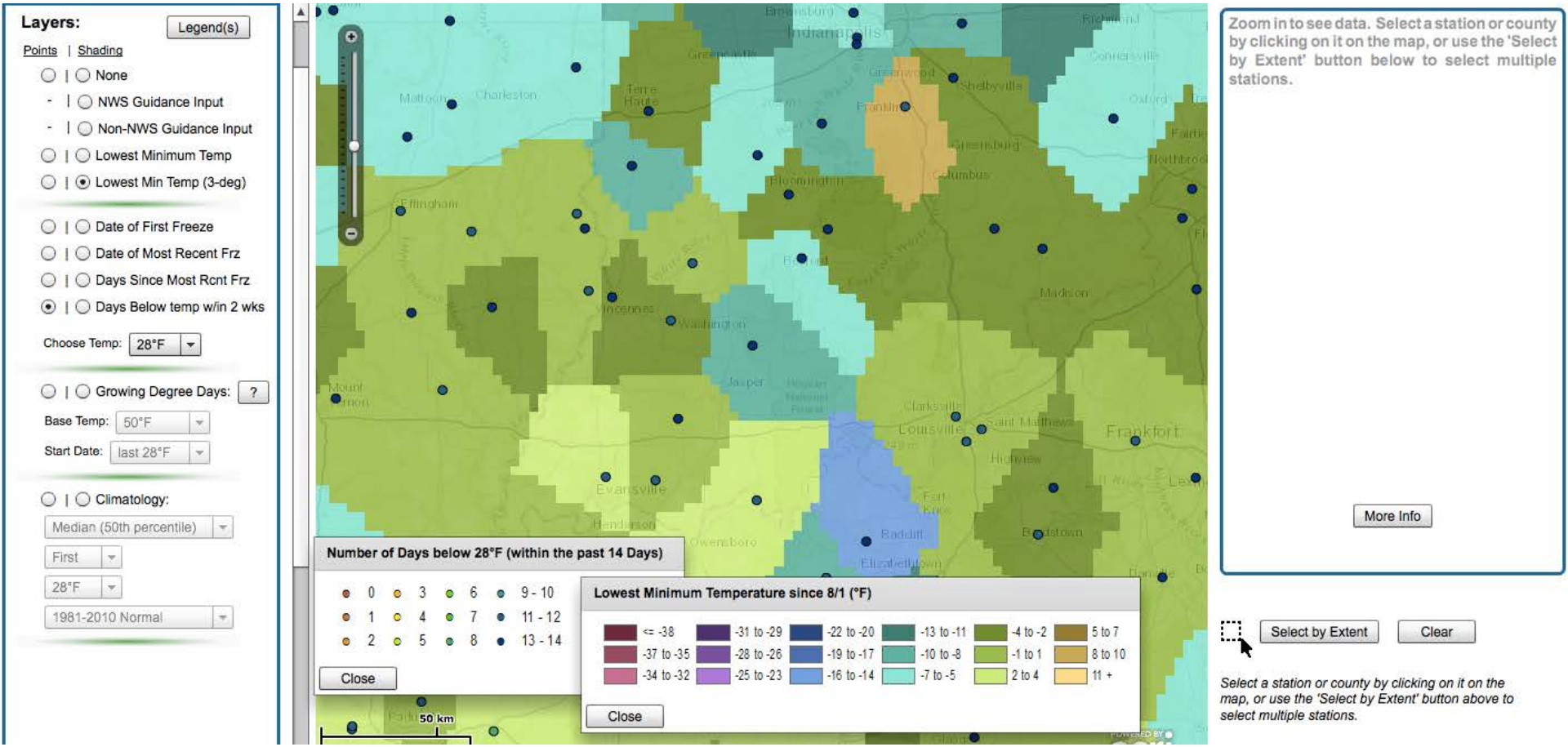
# Current Products - GIS

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# Current Products – Guidance Input

## Frost/Freeze Portal: Forms

Select Different Area | Return to All Frost/Freeze Products

**Freeze Advisory Guidance Form - By Crop Reporting District: KY_10/Purchase**

**Freeze Advisory Guidance (select one):**

- ○ No freeze advisory needed (no growth)
- ○ Possible freeze advisory needed (some vegetation susceptible)
- ○ Yes - Issue freeze advisory (most vegetation susceptible)

**Enter rationale for guidance:**

**Select your user group:**

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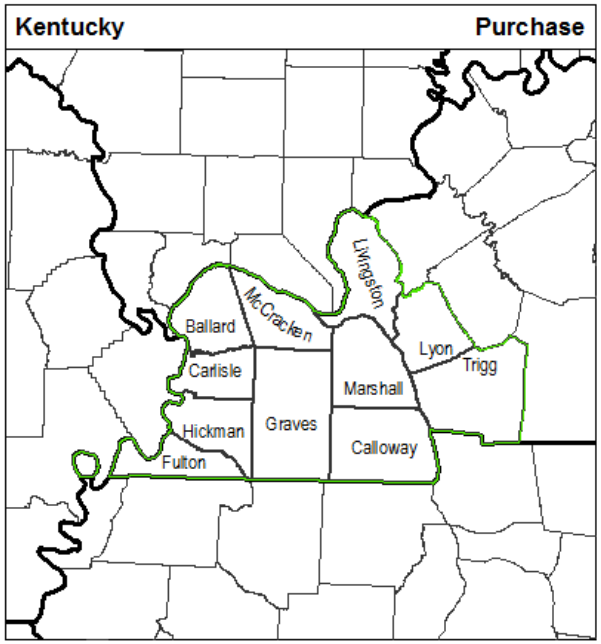
**Counties:**

Check All
Uncheck All

- ☐ Ballard, KY
- ☐ Calloway, KY
- ☐ Carlisle, KY
- ☐ Fulton, KY
- ☐ Graves, KY
- ☐ Hickman, KY
- ☐ Livingston, KY
- ☐ Lyon, KY
- ☐ Marshall, KY
- ☐ McCracken, KY
- ☐ Trigg, KY

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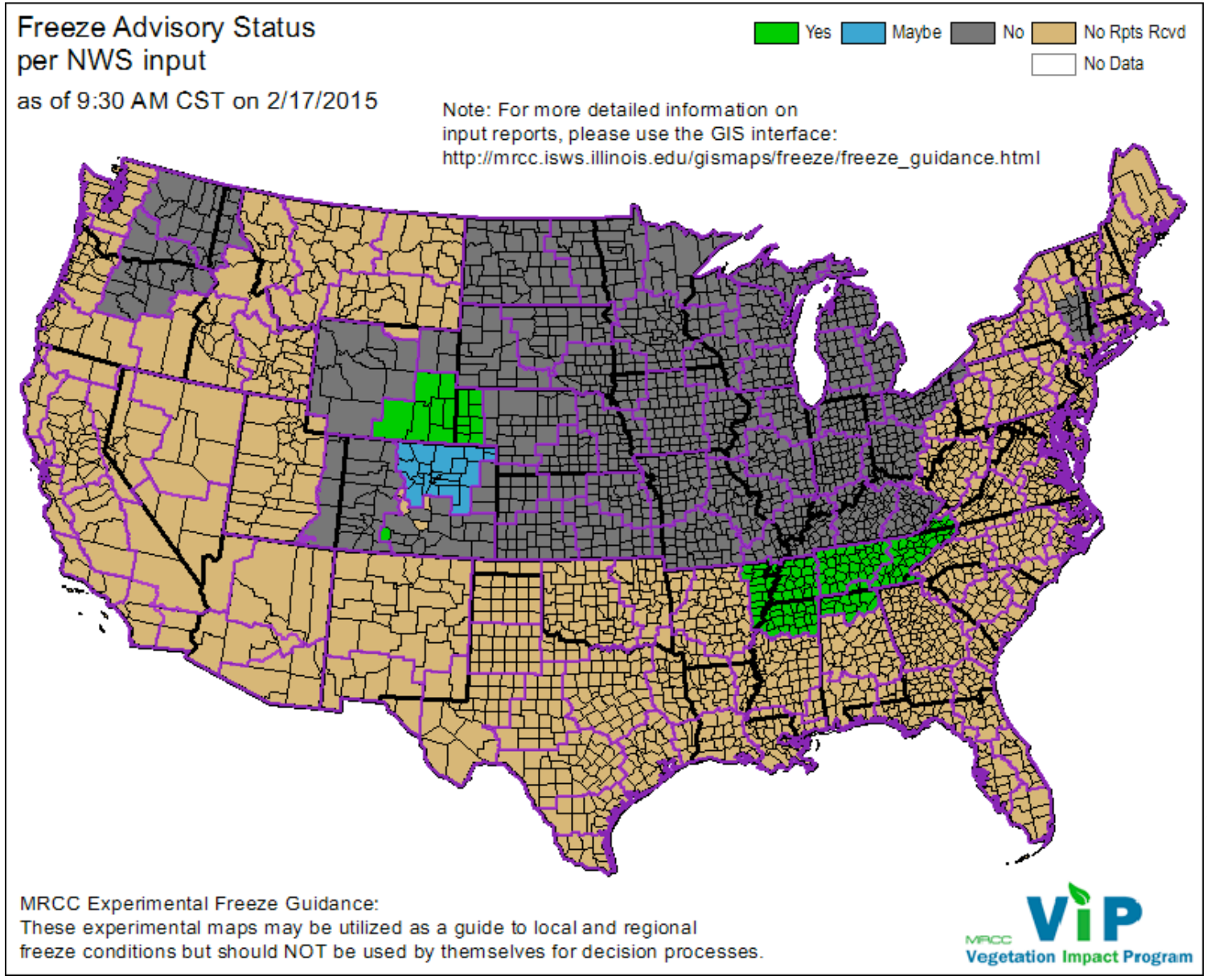
# Interoffice Communication

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# Future Work

- **Integrate digital forecast data**
  - *Map susceptibility vs. Risk*
- **Encourage more plant experts to participate**
- **Continue expansion across 48 states**
- **Determine how to best show impact reports**

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# Conclusion

***Demand for …***

- *Improved communication between experts*
- *Operational monitoring tools to minimize impacts*

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# The Accumulated Winter Season Severity Index (AWSSI)

*memolition.com*

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# Background

- **Characterizing "winter season"**
  - *Temperature?*
  - *Precipitation (snow)?*


- **Goal**
  - *Objectively integrate, index winter conditions*
  - *Commonly available data:*
    - *Max/Min temperature*
    - *Snowfall*
    - *Snow depth (or precipitation)*
  - *Establish baseline to scale subjective impacts*
    - *Snow removal*
    - *Commerce*
    - *Transportation*

- **Intent**
  - *Characterize and compare historical winters (e.g., 1880-1881)*

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AWSSI

# Method

- **Start Accumulation**
  - *First measurable snowfall (>- 0.1")*
  - *Maximum temperature at or below 32F*
  - *December 1*

- **End Accumulation (last occurrence of any):**
  - *Last measurable snowfall*
  - *Last day with 1" snow depth*
  - *Last day with max temperature <= 32F*
  - *February 28/29*

- **Accumulate points daily**
  - *Temperature*
  - *Snowfall*
  - *Snow depth*

**AWSSI Point Thresholds**

| | Temperature (°F) | | Snow (in) | |
|---|---|---|---|---|
| Points | Max | Min | Fall | Depth |
| 1 | 25 to 32 | 25 to 32 | 0.1 to 0.9 | 1 |
| 2 | 20 to 24 | 20 to 24 | 1.0 to 1.9 | 2 |
| 3 | 15 to 19 | 15 to 19 | 2.0 to 2.9 | 3 |
| 4 | 10 to 14 | 10 to 14 | 3.0 to 3.9 | 4 to 5 |
| 5 | 5 to 9 | 5 to 9 | - | 6 to 8 |
| 6 | 0 to 4 | 0 to 4 | 4.0 to 4.9 | 9 to 11 |
| 7 | -1 to -5 | -1 to -5 | 5.0 to 5.9 | 12 to 14 |
| 8 | -6 to -10 | -6 to -10 | - | 15 to 17 |
| 9 | -11 to -15 | -11 to -15 | 6.0 to 6.9 | 18 to 23 |
| 10 | -16 to -20 | -16 to -20 | 7.0 to 7.9 | 24 to 35 |
| 11 | - | -21 to -25 | - | - |
| 12 | - | - | 8.0 to 8.9 | - |
| 13 | - | - | 9.0 to 9.9 | - |
| 14 | - | - | 10.0 to 11.9 | - |
| 15 | <-20 | -26 to -35 | - | 36+ |
| 18 | - | - | 12.0 to 14.9 | - |
| 20 | - | <-35 | - | - |
| 22 | - | - | 15.0 to 17.9 | - |
| 26 | - | - | 18.0 to 23.9 | - |
| 36 | - | - | 24.0 to 29.9 | - |
| 45 | - | | >=30.0 | - |

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# Benefits of AWSSI


- **Historical database qualifying winters**
  - *Daily temperature*
  - *Daily snow*
  - *Daily precipitation*

- **Season-to-season comparisons**
  - *At individual locations*
  - *Climatological context*
    - *Quintiles*
    - *Descriptive categories*

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# Limits of AWSSI

- **Lack of other significant, historical parameters**
  - *Wind*
  - *Freezing precipitation*

- **Extended periods of missing data**


*www.snopes.com*

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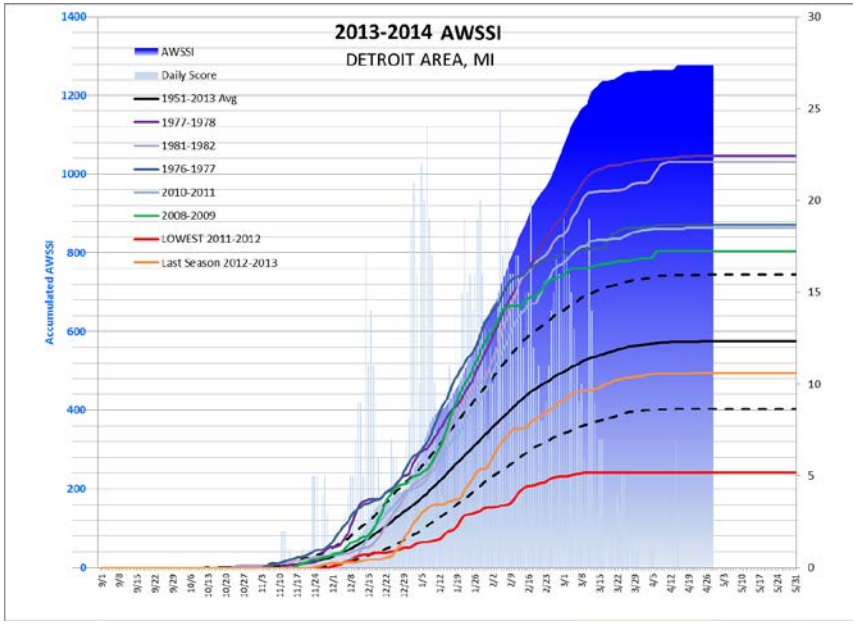
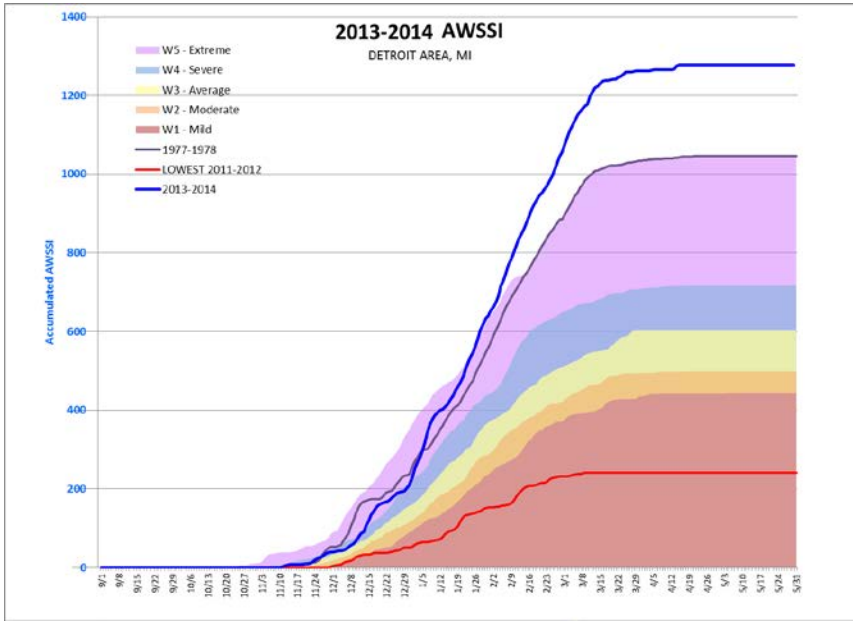
# AWSSI Examples

## Detroit, MI – 2013-2014




| PERCENTILE | CATEGORY |
|---|---|
| 20th | W1 - Mild |
| 40th | W2 - Moderate |
| 60th | W3 - Average |
| 80th | W4 - Severe |
| 99th | W5 - Extreme |

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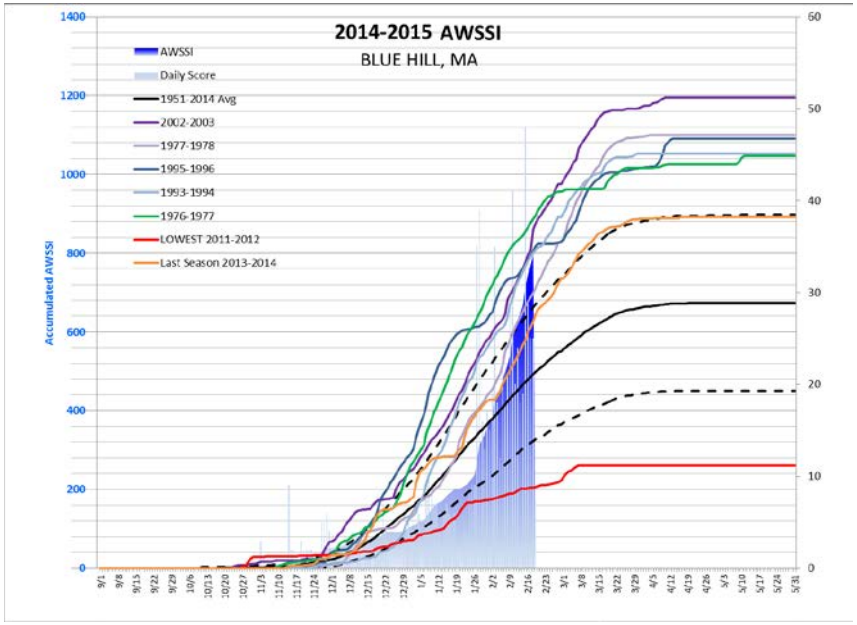
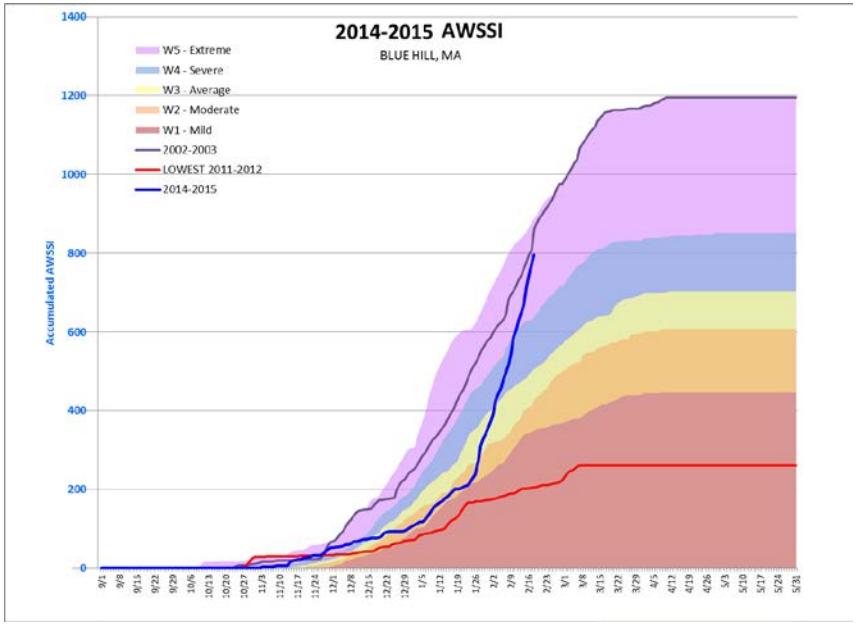
# AWSSI Examples

## Blue Hill, MA – 2014-2015

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# Current Work

- **Interactive Online Tool**
  - *http://mrcc.isws.illinois.edu/research/awssi/indexAwssi.jsp*
  - *15 locations*
  - *HighCharts interface*
  - *Coming soon:*
    - *Station selection via map interface*
    - *Map displays of:*
      - *AWSSI category, relative score*

| | | |
|---|---|---|
| Blue Hill, MA | Champaign-Urbana, IL | Chicago, IL |
| Denver, CO | Detroit, MI | Duluth, MN |
| Indianapolis, IN | Madison, WI | Minneapolis, MN |
| New York, NY | Omaha, NE | Philadelphia, PA |
| Portland, ME | Rapid City, SD | Washington, DC |

- **Challenges**
  - *Quintile derivation*
  - *Missing data thresholds*
    - *pAWSSI*

- **Publication of work**
  - *"The Accumulated Winter Season Severity Index (AWSSI)", Mayes Boustead et al. In review, AMS Journal of Applied Meteorology and Climatology.*

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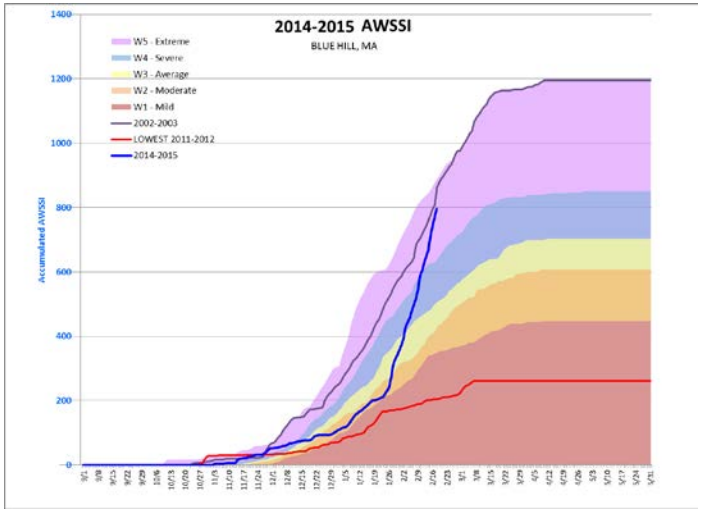
# Questions?

AWSSI

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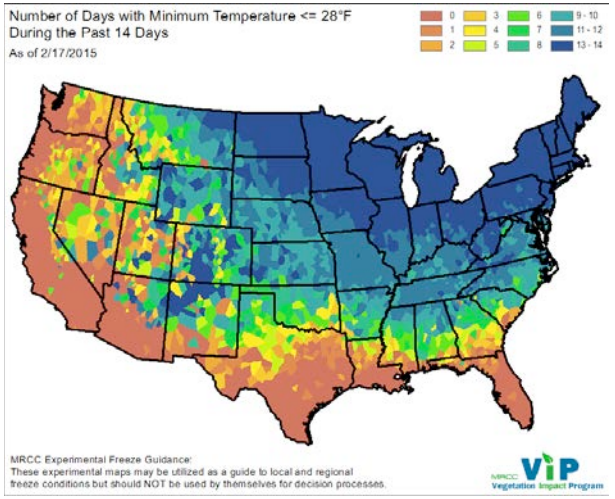


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http://mrcc.isws.illinois.edu/VIP/indexFFG.html

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