

# Monitoring of Potential Freeze Susceptibility for Guidance to Forecasters

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St. Louis, MO



**MIRCC**  
Midwestern Regional Climate Center



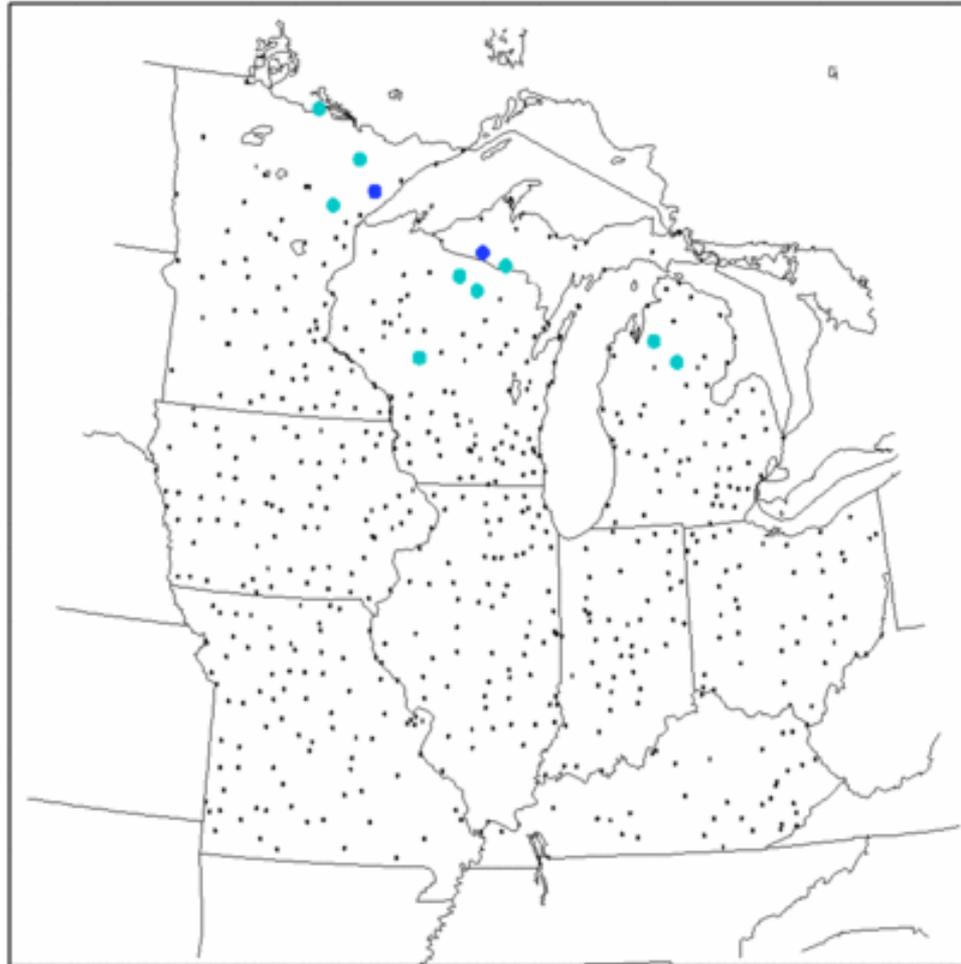
# Motivation

- 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 (especially July) slowed crop maturity
  - Late harvest so more susceptible to freeze damage
- NWS requests for products
  - 2009 fall season
  - Small changes
  - Several offices and CR HQ made requests in 2012 to improve inter-office consistency



# Where we started

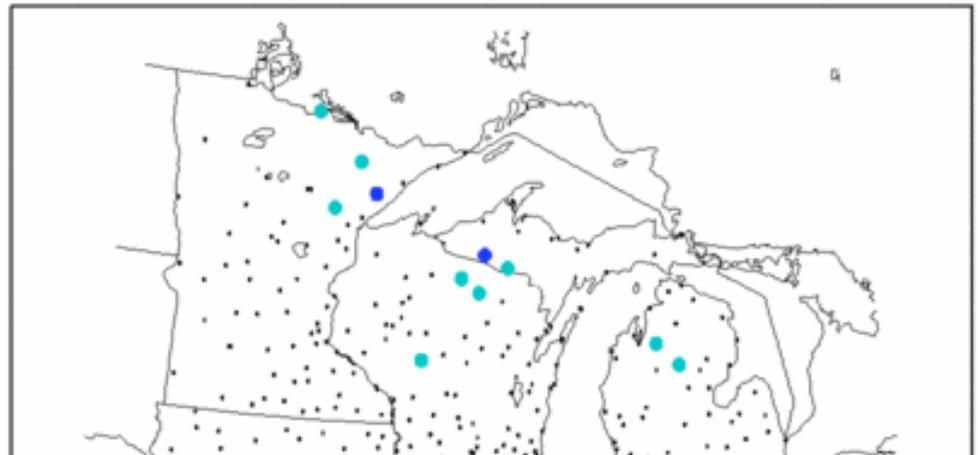
Fall Freeze Locations  
As of Sep 17, 2009



# Where we started

- Monitoring where fall freeze had occurred
  - 32 F / 28 F thresholds on one map
- Simple product
  - Update daily
  - Very popular
  - Lots of hits on web

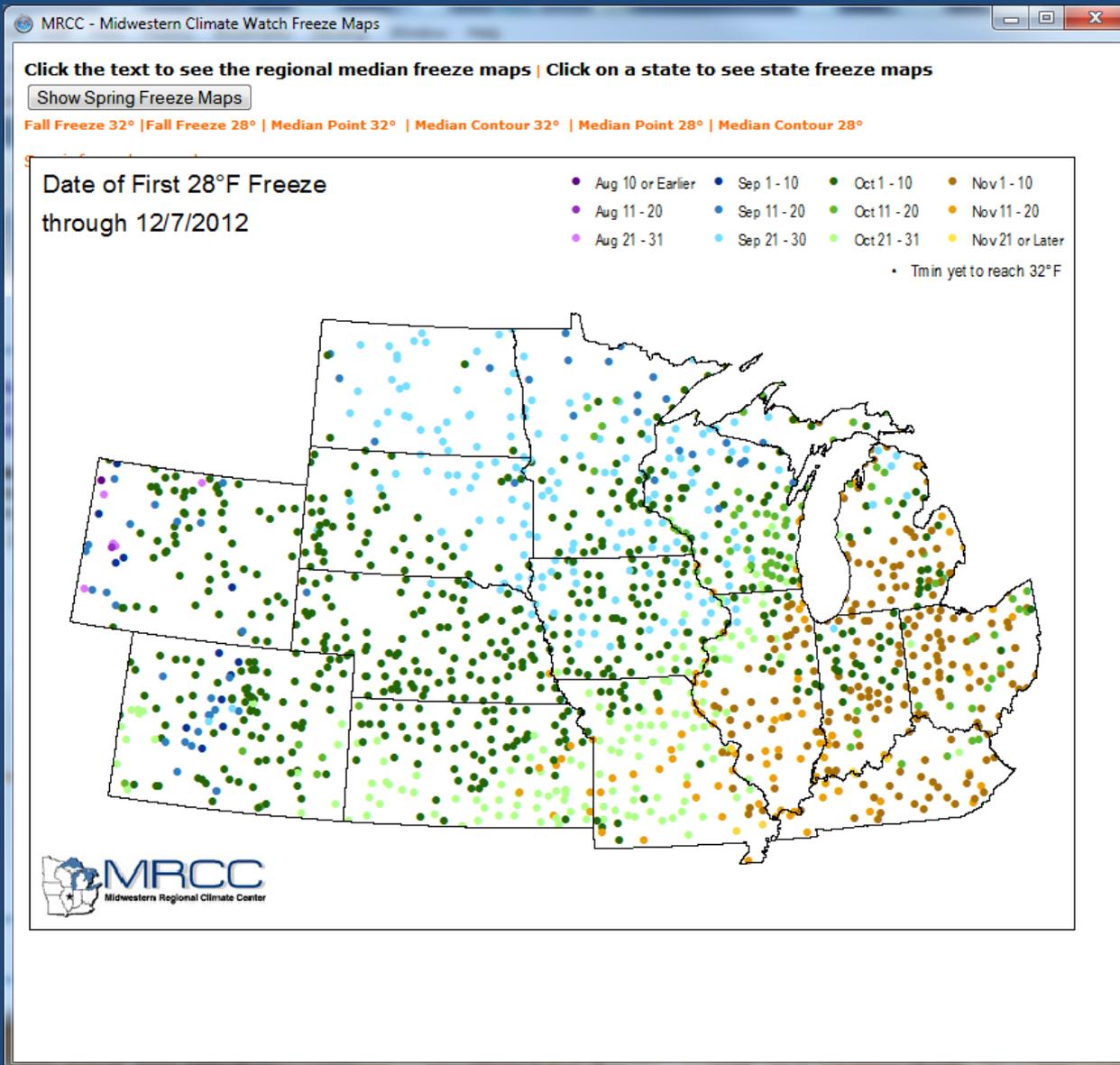
Fall Freeze Locations  
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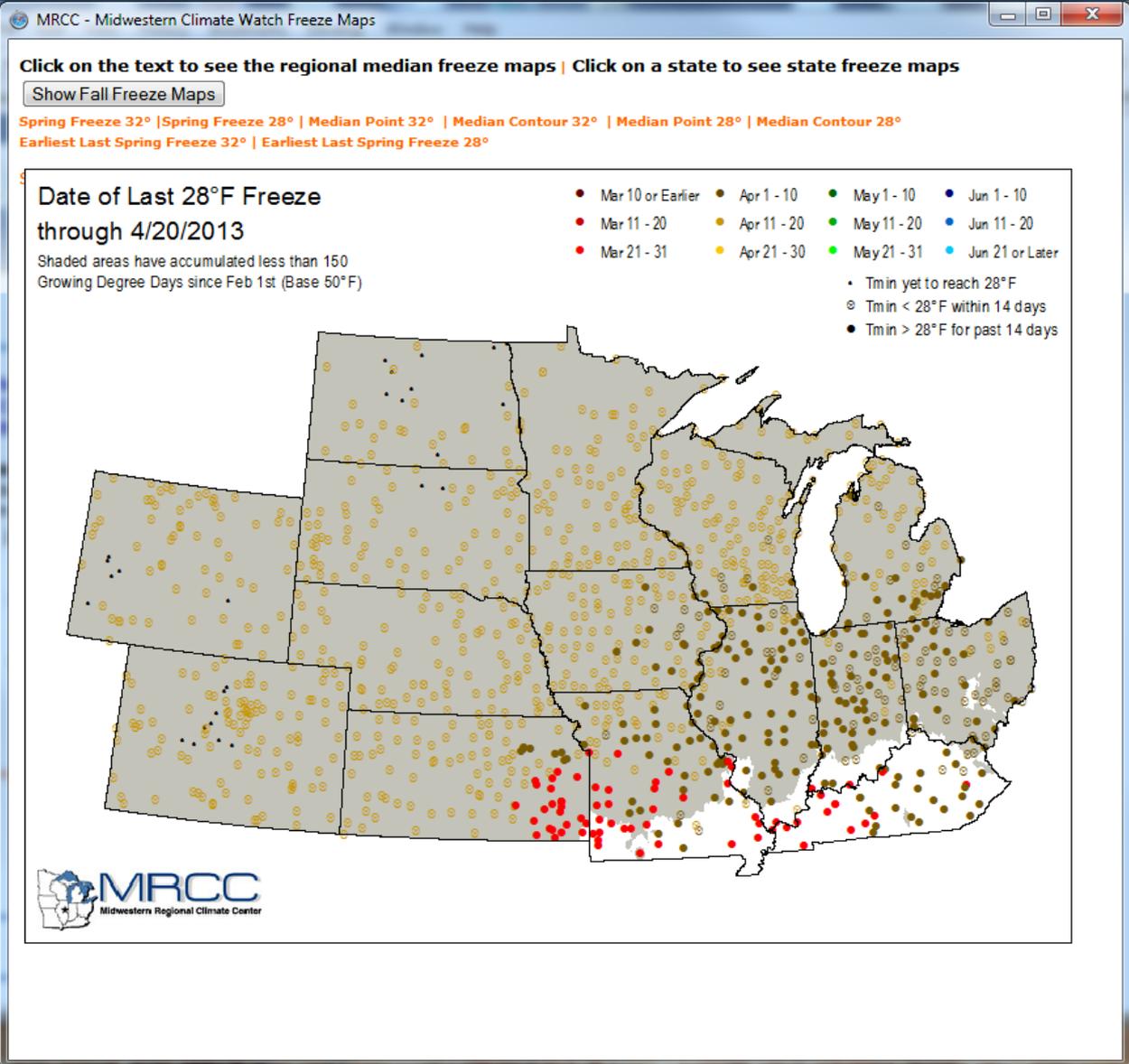


# Lots of Enhancements

- Coverage of spring season
- Expand domain to include Plains states
- Coverage of spring season (more complicated)
- Note date of first last freeze on maps
- Added climatology of median, early, late freezes
- Expanded domain to lower 48 states
- GIS interactive interface
- User input of freeze susceptibility and impacts
- Lots of additional variables (per requests)
- Mailing list for updates to users
- Year round monitoring (fall & spring not separate)







# Frost Freeze Project and Vegetative Impact Program

- Multiple groups of NWS offices approached us to provide more guidance based products
- Set up a conference call with several offices and CR HQ to request more information
- Additional product requests beyond frost freeze
- Created VIP to encompass all these products



# Goals of Frost Freeze Program

- Get more feedback from plant experts
- Improve NWS office communication
- Enhance inter office consistency
- Use same guidance when offices reconcile issues
- Static maps to link to
- Dynamic maps
  - Zoom in and out and pan domain
  - Quickly jump from one product to another
- Impact reports



# Frost Freeze Program

- Lots of new variables plotted for forecasters to use

## SHADED MAPS MENU

### CURRENT SEASON FREEZES

Date of first 28°F Freeze  
Date of most recent 28°F Freeze  
Days since most recent 28°F Freeze  
Over past 14 days, Number < 28°F  
Date of first 32°F Freeze  
Date of most recent 32°F Freeze  
Days since most recent 32°F Freeze  
Over past 14 days, Number < 32°F  
Lowest Min Temp: 10°F to 50°F  
Lowest Min Temp: -38°F to 10°F

### GROWING DEGREE DAYS

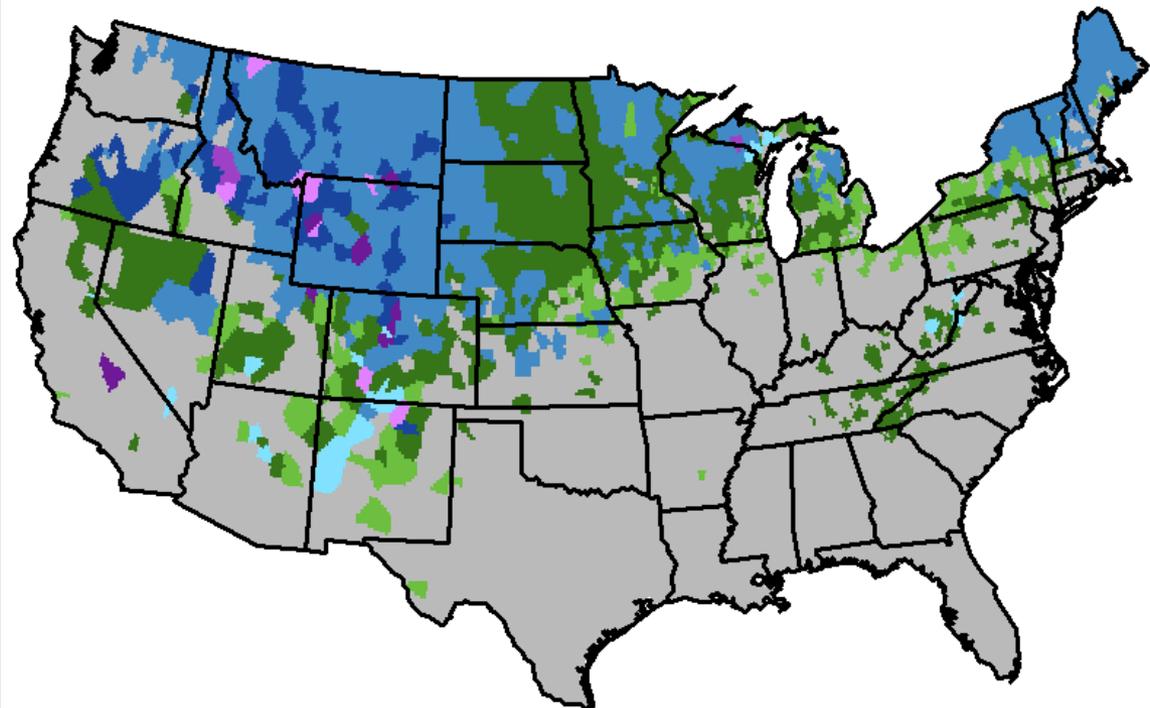
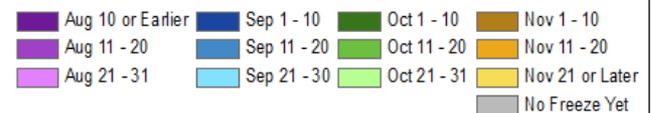
### FREEZE ADVISORY STATUS

### 28° FREEZE CLIMATOLOGIES

### 32° FREEZE CLIMATOLOGIES

## Date of First 32°F Freeze since 8/1

As of 10/18/2014

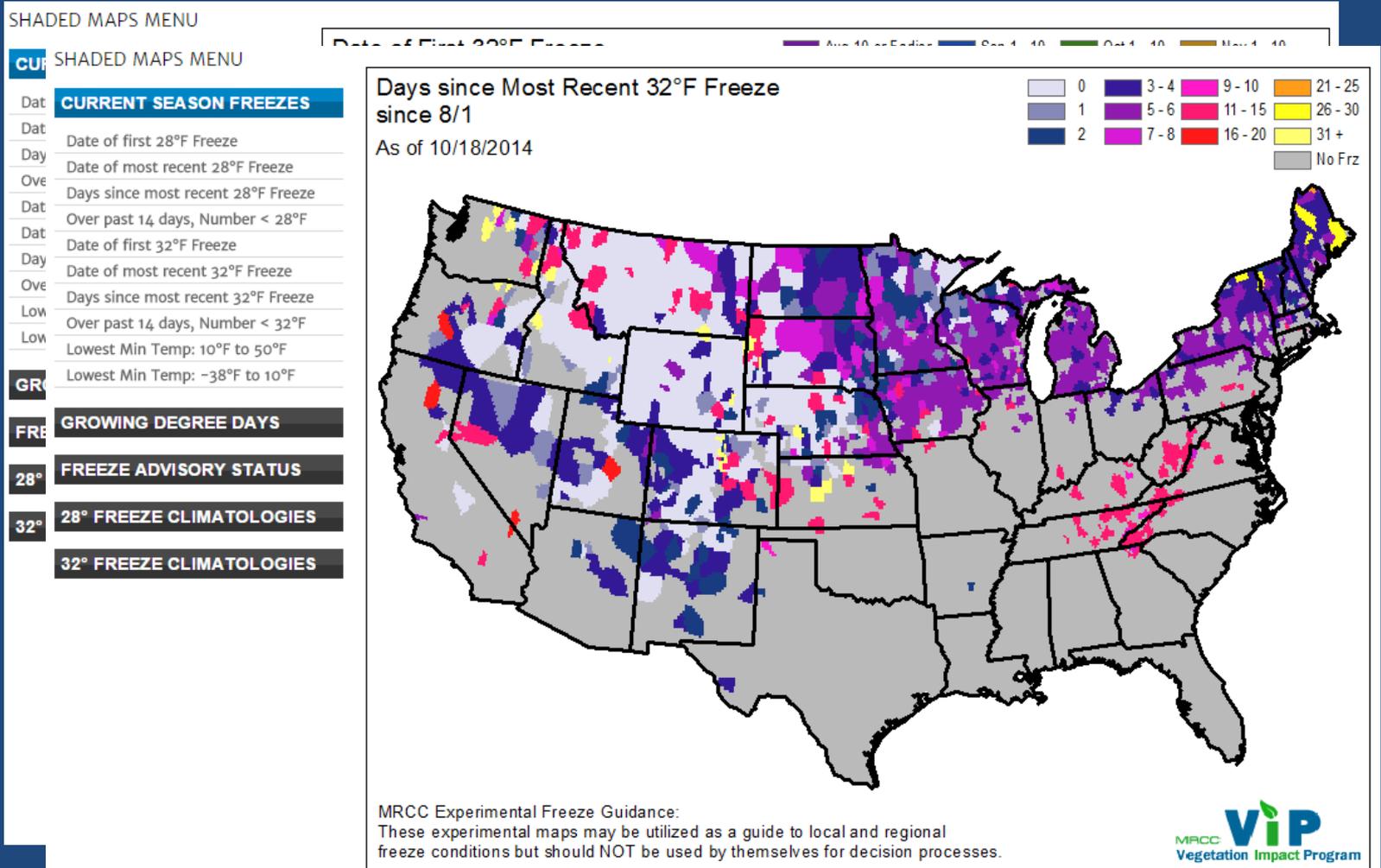


MRCC Experimental Freeze Guidance:  
These experimental maps may be utilized as a guide to local and regional freeze conditions but should NOT be used by themselves for decision processes.



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## SHADED MAPS MENU

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#### CURF

#### CURRENT SEASON FREEZES

Date:	Date of first 28°F Freeze
Days:	Date of most recent 28°F Freeze
Over:	Days since most recent 28°F Freeze
Date:	Over past 14 days, Number < 28°F
Date:	Date of first 32°F Freeze
Days:	Date of most recent 32°F Freeze
Over:	Days since most recent 32°F Freeze
Lower:	Over past 14 days, Number < 32°F
Lower:	Lowest Min Temp: 10°F to 50°F
	Lowest Min Temp: -38°F to 10°F

#### GRO

#### GROWING DEGREE DAYS

#### FREE

#### FREEZE ADVISORY STATUS

#### 28° F

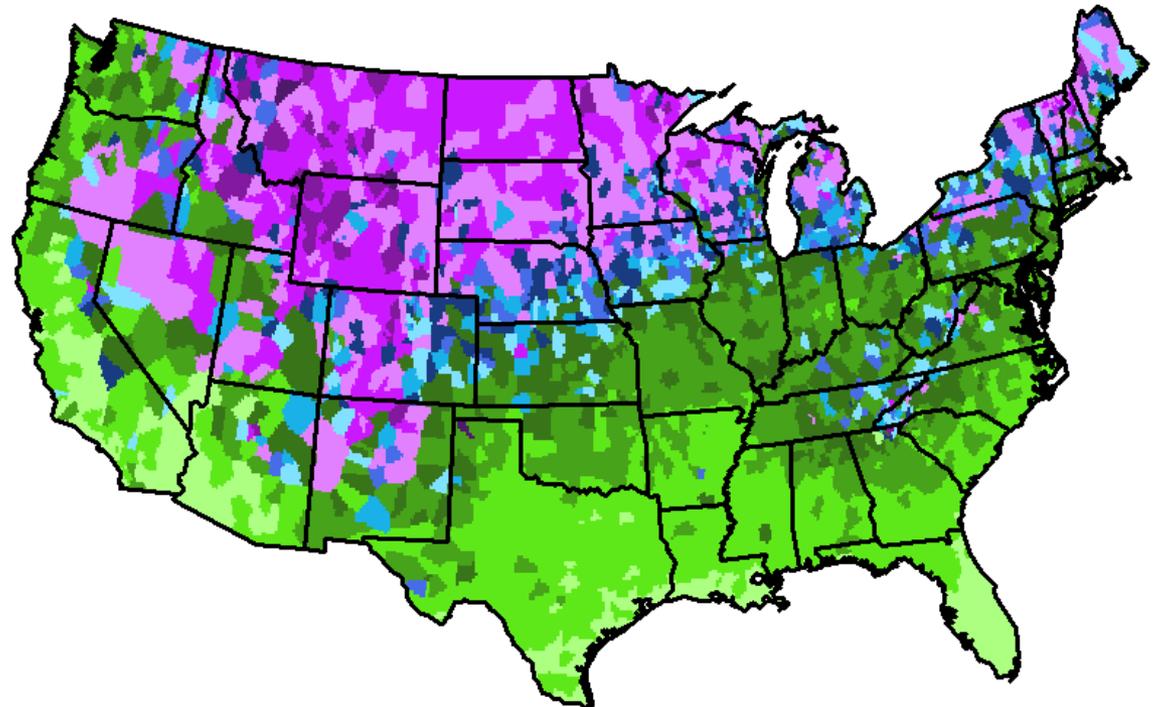
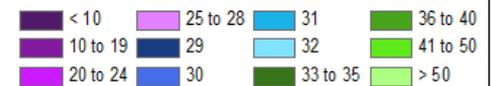
#### 28° FREEZE CLIMATOLOGIES

#### 32° F

#### 32° FREEZE CLIMATOLOGIES

### Lowest Minimum Temperature (°F) since 8/1 (10°F to 50°F)

As of 10/18/2014



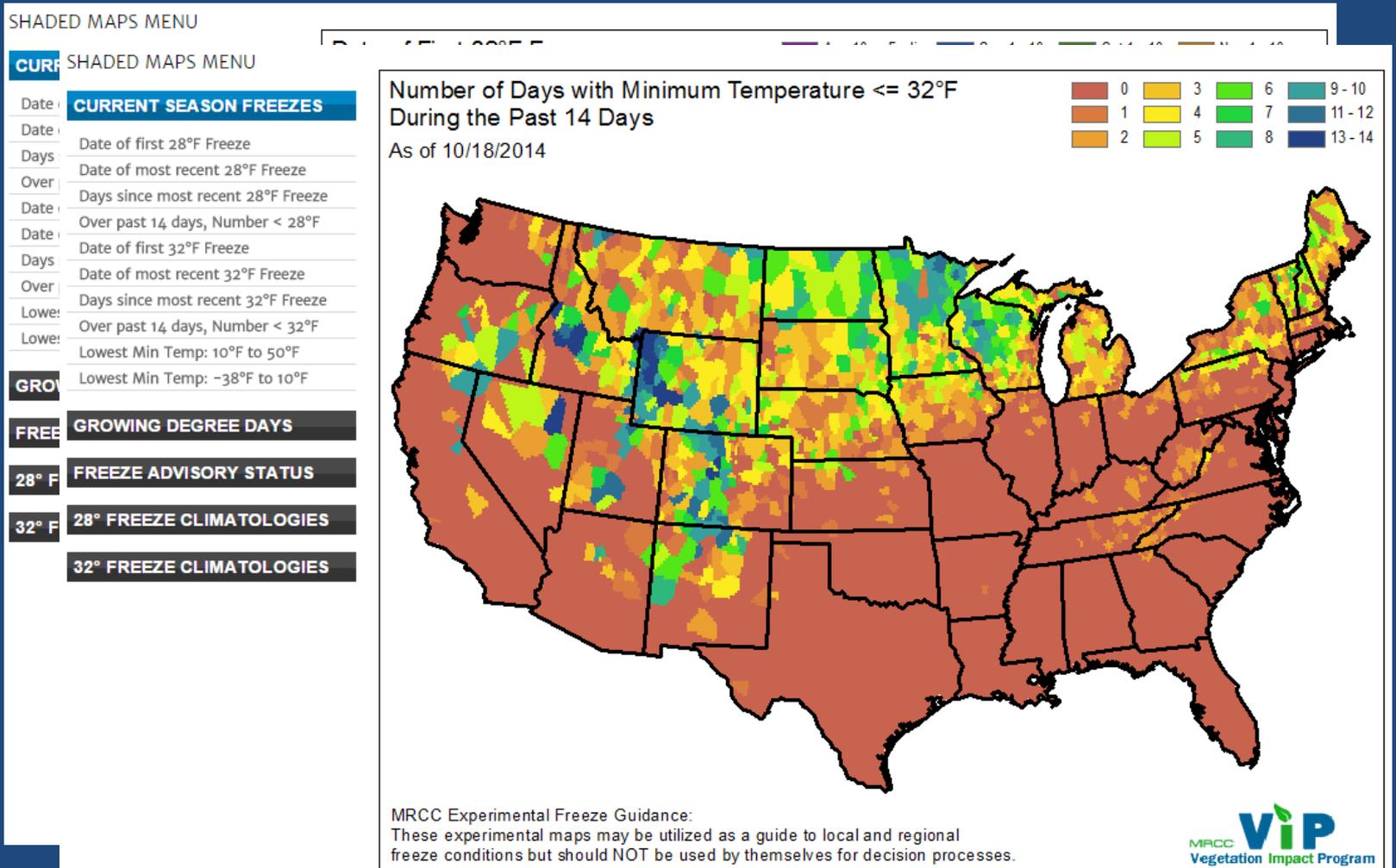
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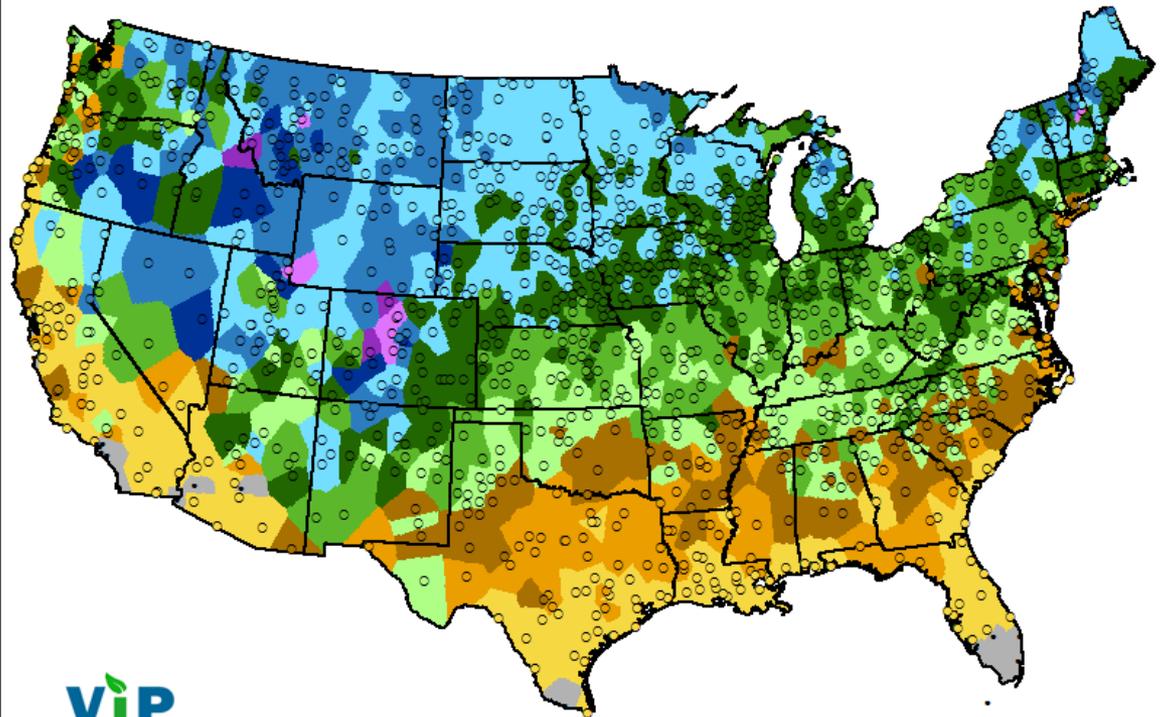
## SHADED MAPS MENU

<b>CUR</b>	SHADED MAPS MENU
Date:	<b>CURRENT SEASON FREEZES</b>
Date:	<b>GROWING DEGREE DAYS</b>
Days:	<b>FREEZE ADVISORY STATUS</b>
Over:	<b>28° FREEZE CLIMATOLOGIES</b>
Date:	<b>32° FREEZE CLIMATOLOGIES</b>
Days:	
Over:	
Low:	Date of Earliest First 32° Freeze
Low:	Date of Early First 32° Freeze
<b>GRO</b>	Date of Median First 32° Freeze
	Date of Late First 32° Freeze
<b>FREE</b>	Date of Latest First 32° Freeze
	Date of Earliest Last 32° Freeze
<b>28° F</b>	Date of Early Last 32° Freeze
	Date of Median Last 32° Freeze
<b>32° F</b>	Date of Late Last 32° Freeze
	Date of Latest Last 32° Freeze

Climatological Date of Median First 32°F Freeze  
For the years from 1980-81 to 2009-10

Median Defined as 50th Percentile

Aug 10 or Earlier	Sep 1 - 10	Oct 1 - 10	Nov 1 - 10
Aug 11 - 20	Sep 11 - 20	Oct 11 - 20	Nov 11 - 20
Aug 21 - 31	Sep 21 - 30	Oct 21 - 31	Nov 21 or Later
			No Recent Frz



# Remaining Needs

- With numerous variables plotted, not clear where to begin
  - Depends on location
  - Depends on time of year
- Forecasters want to quickly move on to other duties if freeze is not a concern
- We already have user input of freeze susceptibility
  - Not always updated (especially prior to freeze concerns)
  - Lacks complete coverage (voluntary)
  - Need something more uniform as a starting point

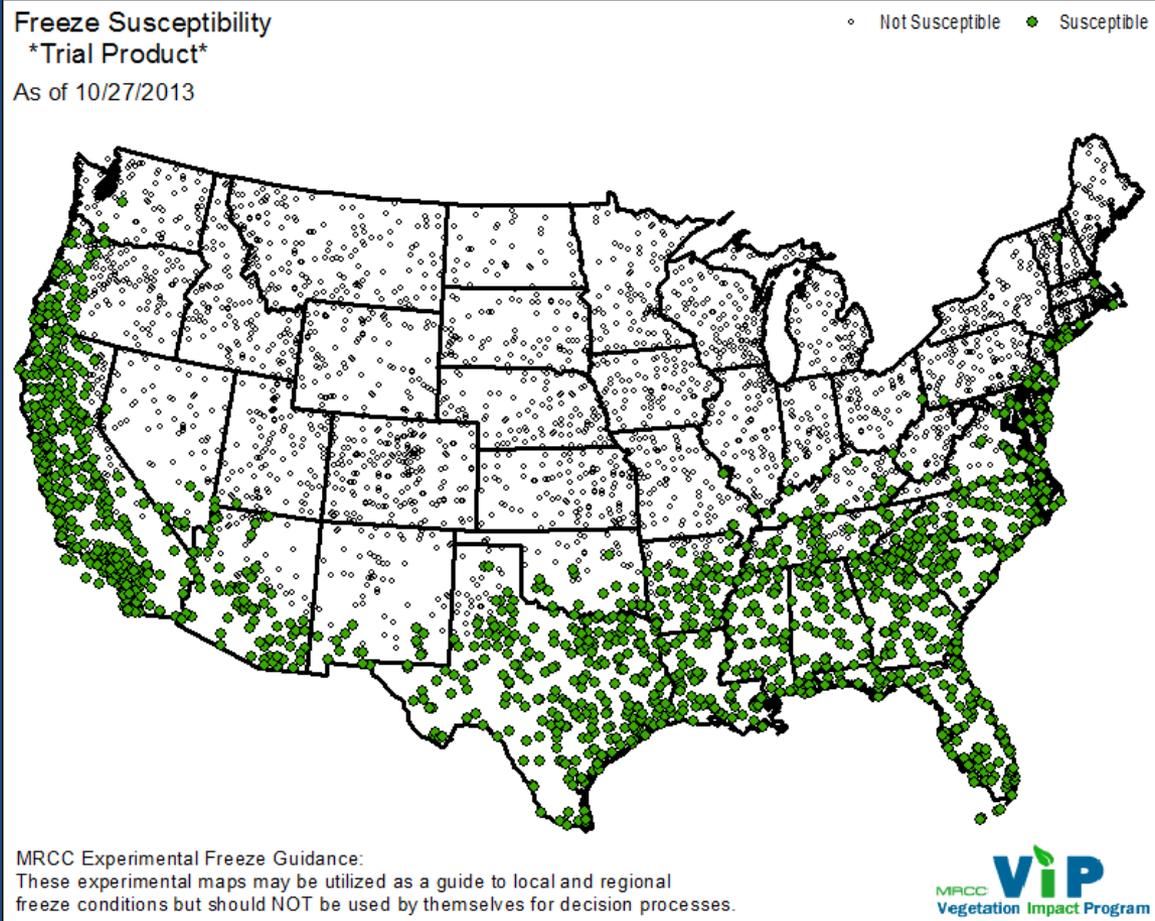


# Potential Freeze Susceptibility

- If in doubt, call it susceptible
  - Not susceptible means forecaster may not evaluate
- Limited data as this needs to be near real-time
  - Use just recent weather conditions (past 14 days)



# Potential Freeze Susceptibility

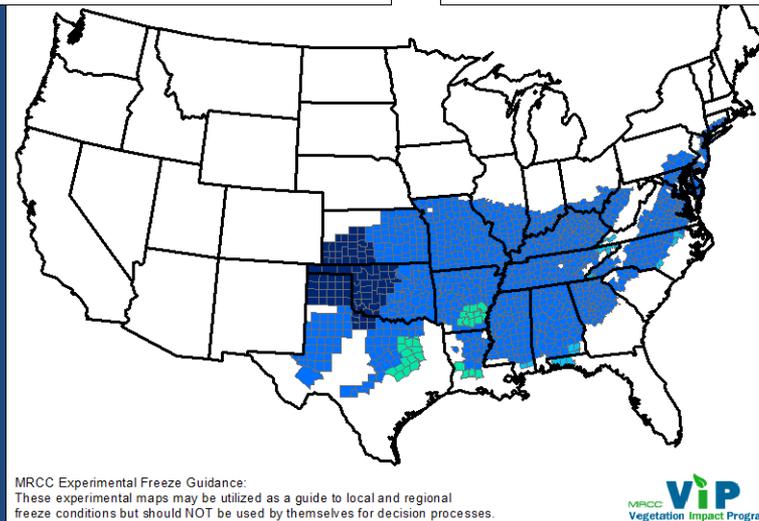
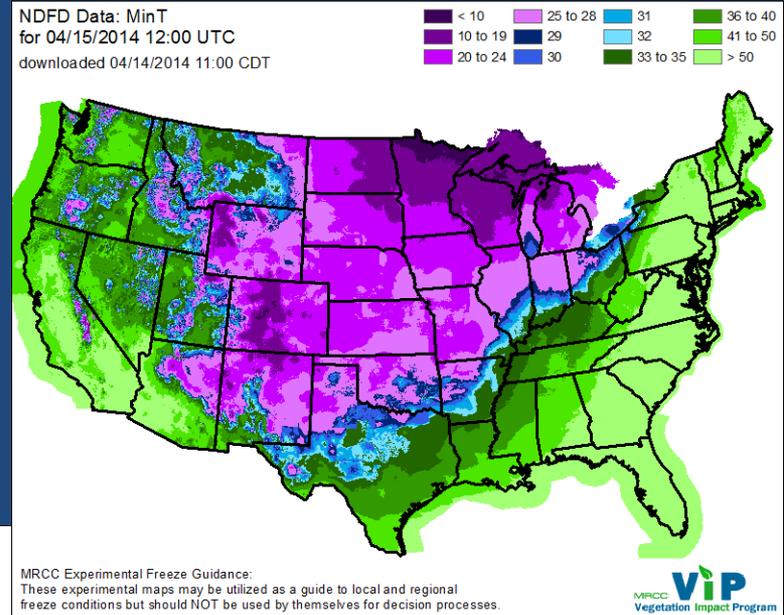
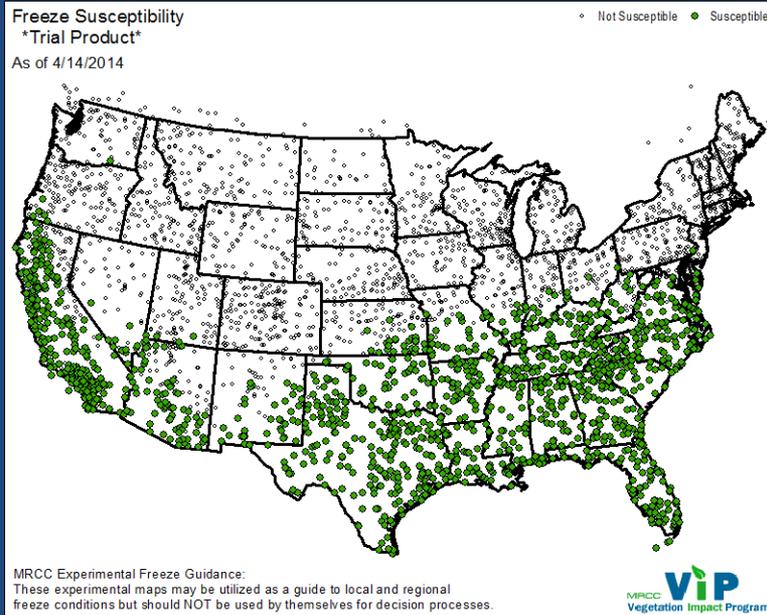


# Potential Freeze Susceptibility

- Start assuming all stations susceptible
- If any of following criteria met, not susceptible
  - Max Temp  $\leq 32$  (1 day in past 7)
  - Min Temp  $\leq 28$  (3 days in past 7)
  - Min Temp  $\leq 24$  (1 day in past 7)
  - GDD50  $\leq 75$  (in past 14 days)
  - Start assuming all stations susceptible
- After last season, made one change
  - Changed GDD50 criteria
  - Now checks for  $>75$  GDD50 since last 28F min Temp
    - If so, susceptible

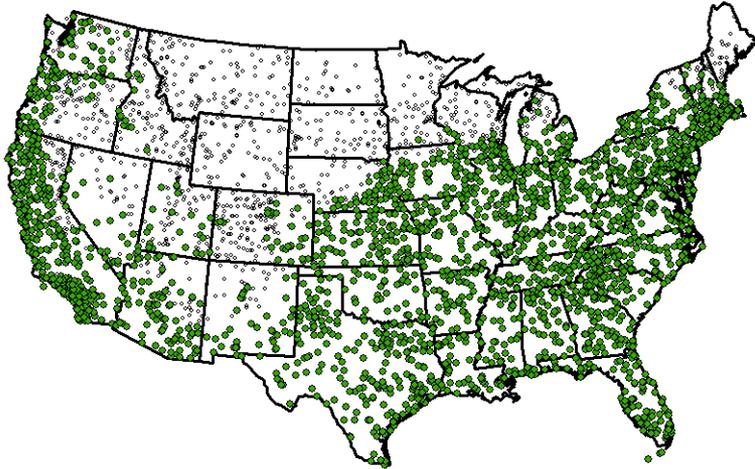


# Potential Freeze Susceptibility



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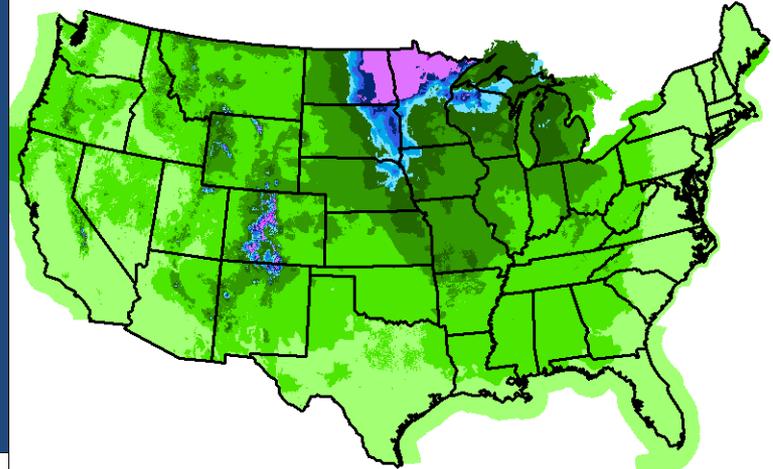
Freeze Susceptibility  
 \*Trial Product\*  
 As of 5/15/2014



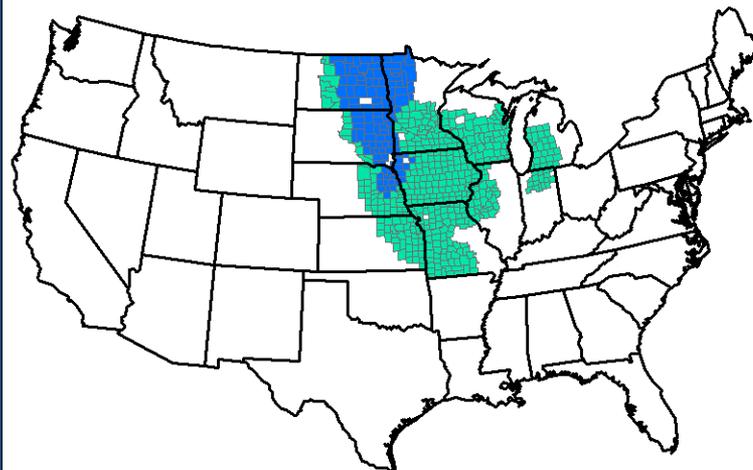
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NDFD Data: Forecast MinT  
 for 05/16/2014 12:00 UTC  
 downloaded 05/15/2014 11:00 CDT



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# Potential Freeze Susceptibility

- Needed a change in GDD50 criteria
- Monitor forecast min Temps  $\leq 36\text{F}$
- Climatology is important to forecasters
  - Early fall and late spring warnings are issued under more conditions
  - Impacts greater and more unexpected





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# Future work

- Fine tune the algorithm to match the forecasters' decisions
- Use both recent conditions and seasonal climatology
  - % of years with freeze on this date
  - % of years with a freeze before/after this date
- Combine NDFD forecast temperatures and potential freeze susceptibility onto a single map
  - Use as first map
  - Highlight areas of overlap of freezing temperatures and susceptibility
  - Feedback to forecasters to evaluate situation further



# Thanks

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<http://mrcc.isws.illinois.edu/VIP/>

