Monitoring for Extreme Climatological Impacts on Vegetation – The MRCC's Vegetation Impact Program

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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 (especially July) slowed crop maturity*
  - *Late harvest so more susceptible to freeze damage*

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

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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, vegetation stakeholders
- **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
- 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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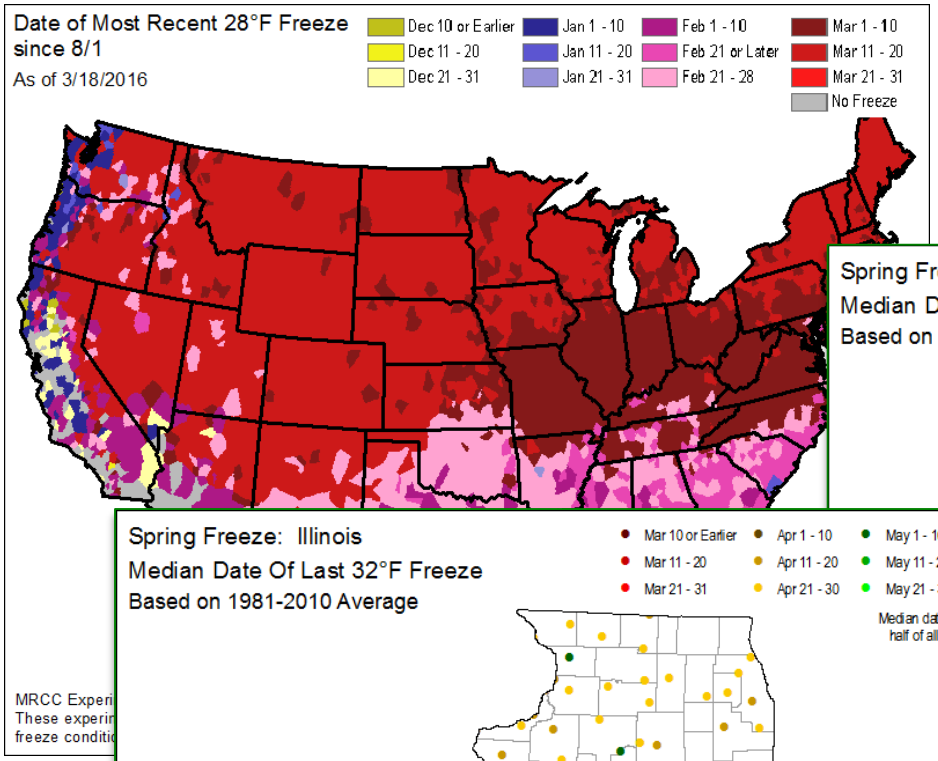
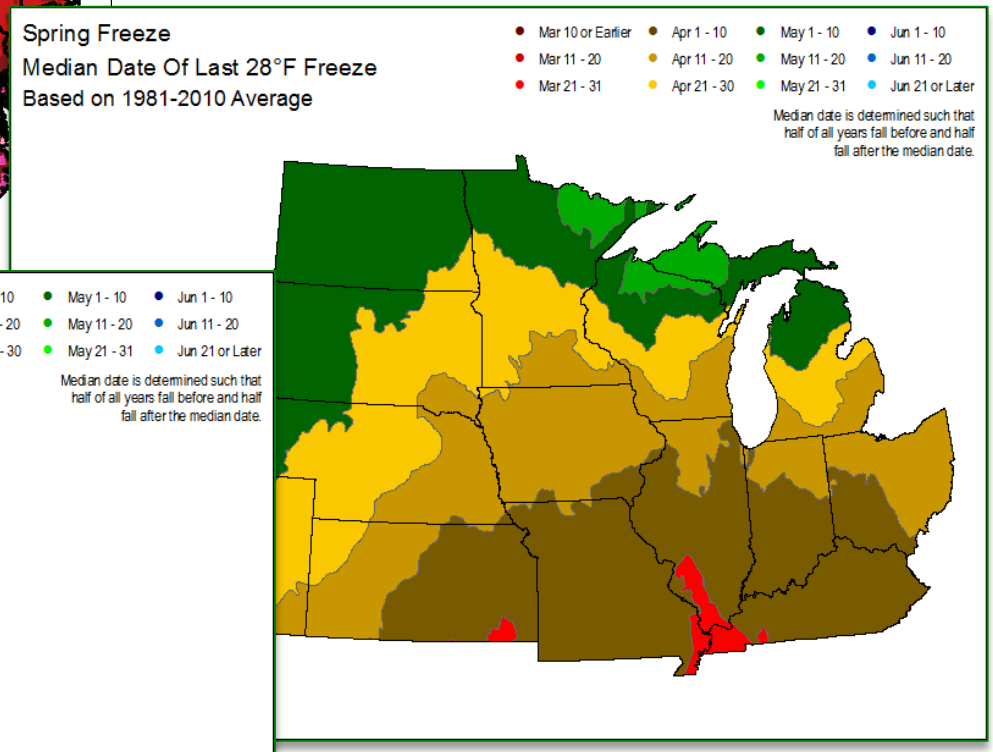
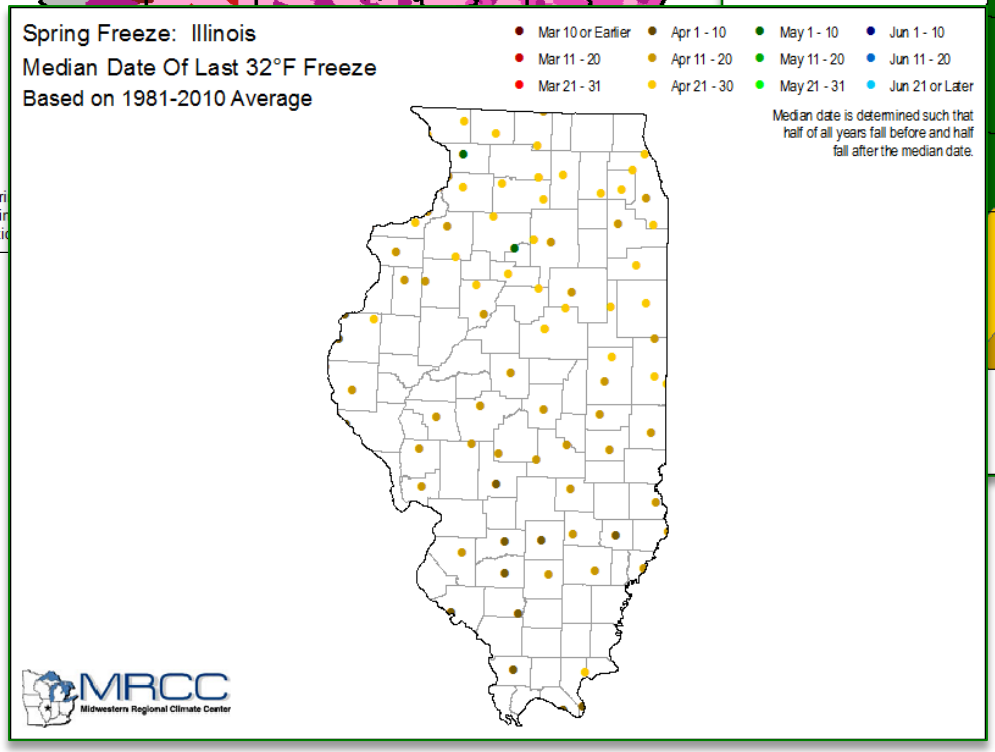
Current Products - Daily







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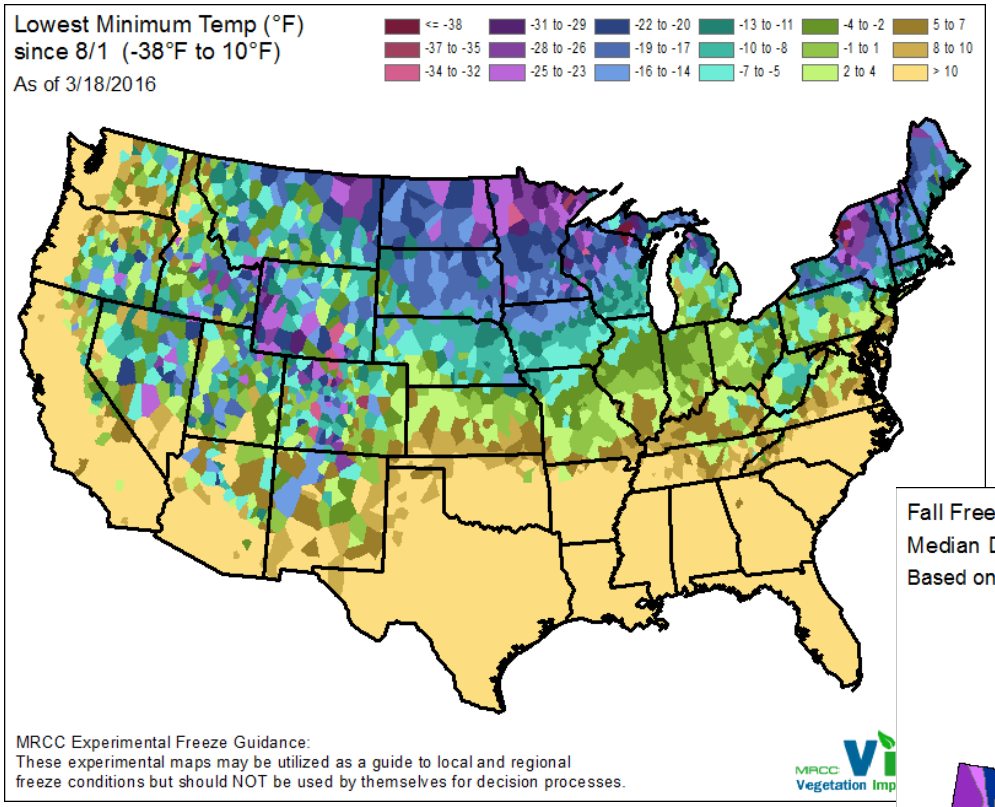
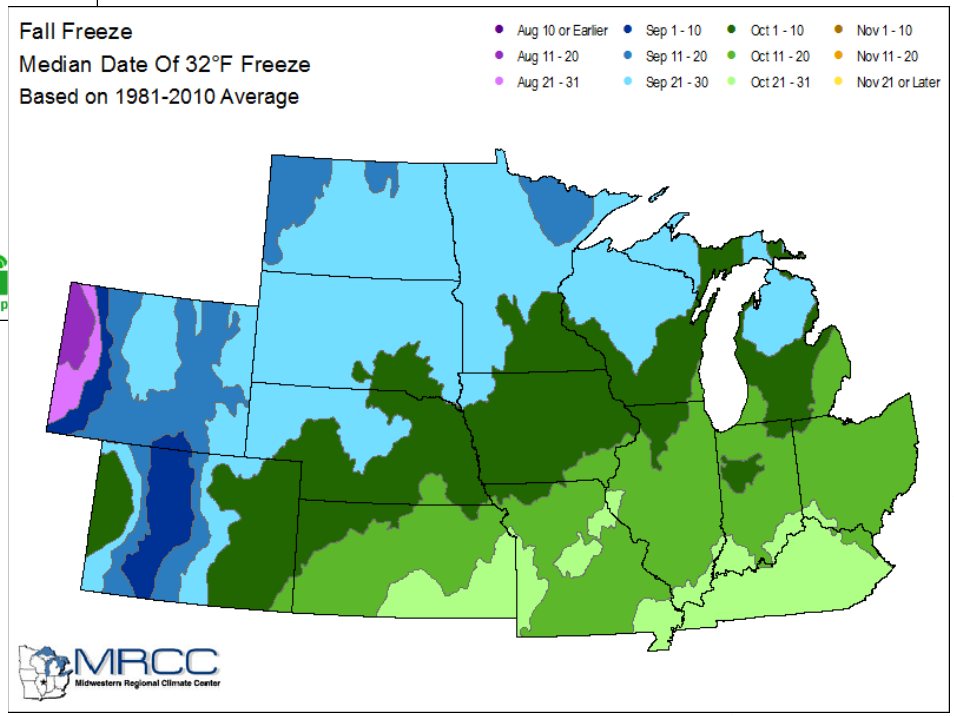
Current Products - Daily





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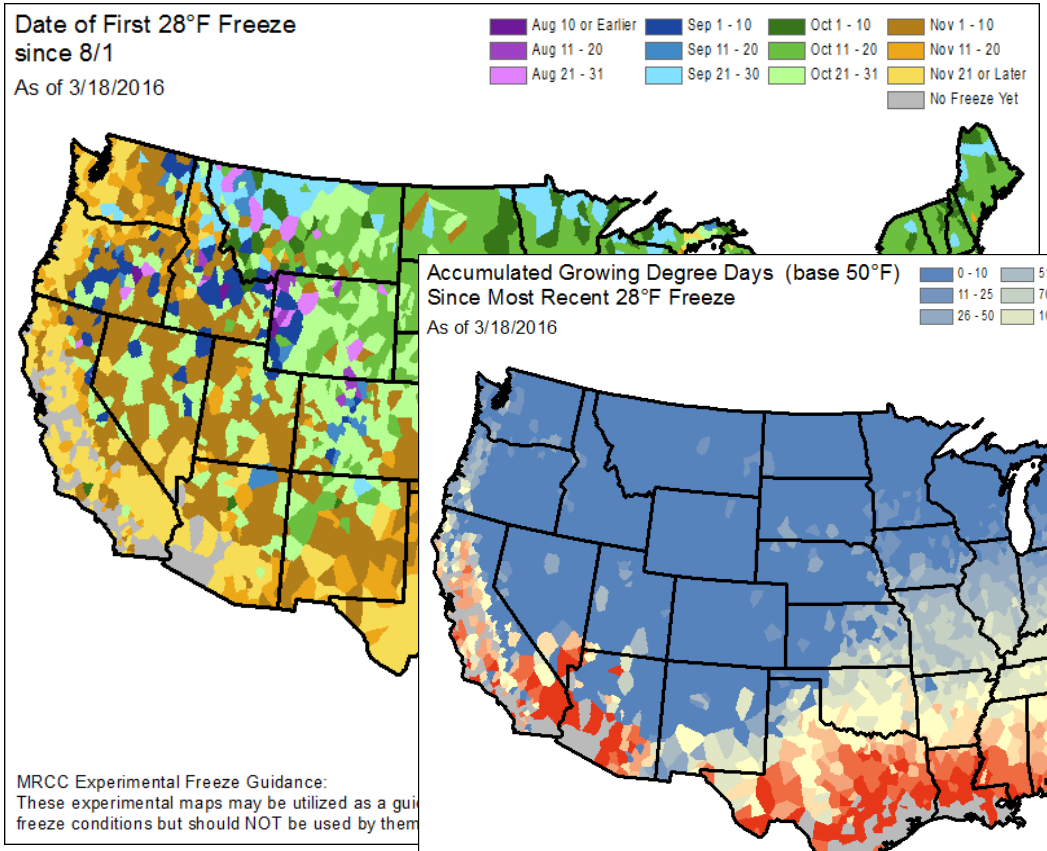

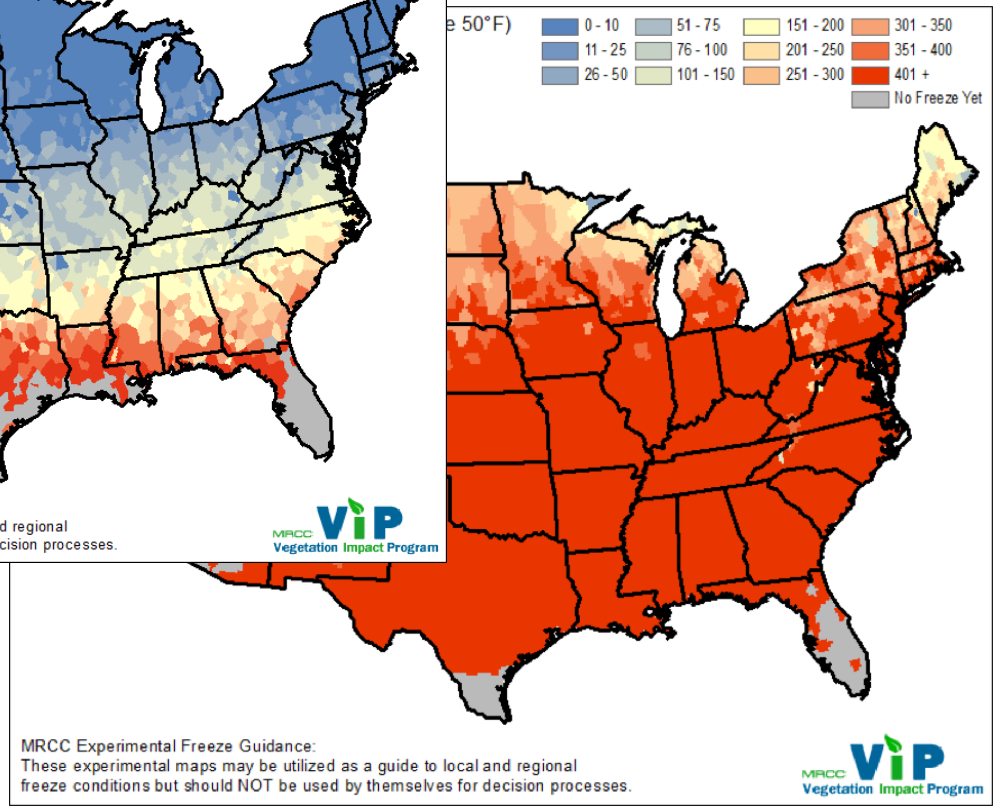

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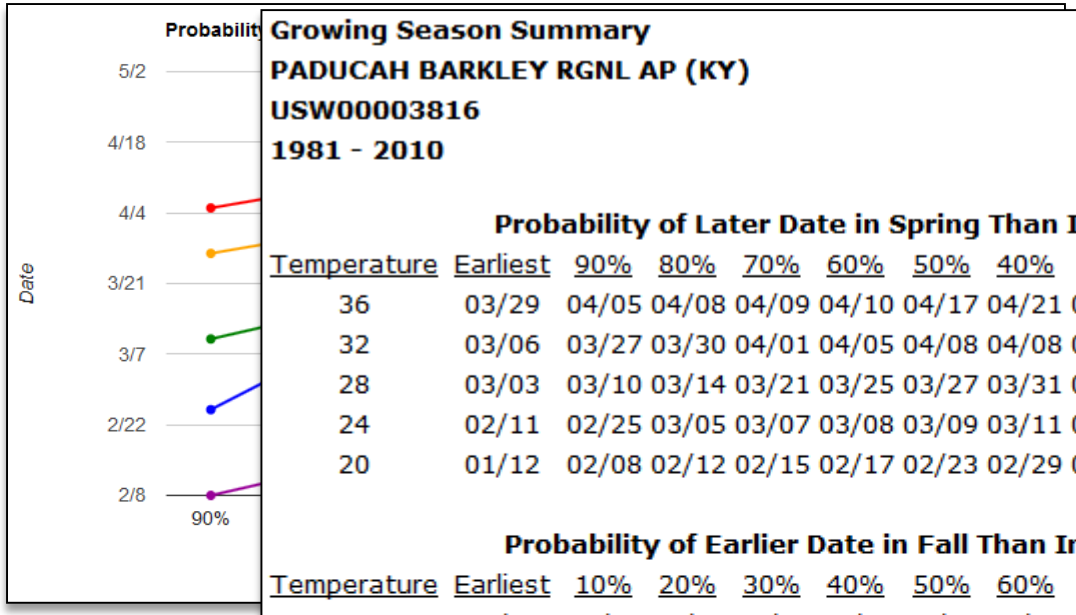
Current Products - Daily



Growing Season Summary

PADUCAH BARKLEY RGNL AP (KY)

USW00003816

1981 - 2010

Probability of Later Date in Spring Than Indicated

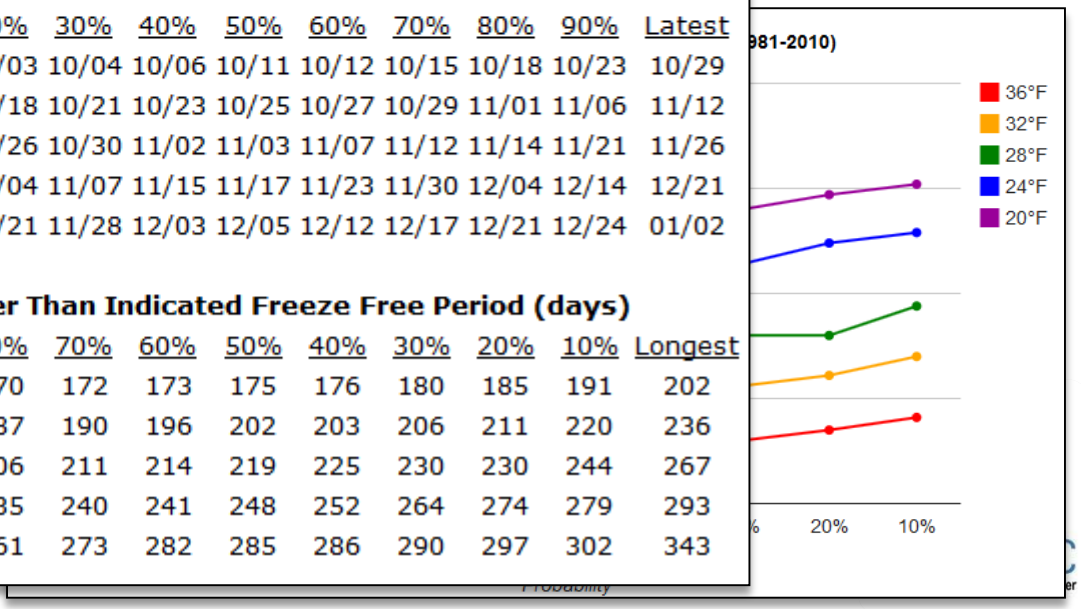
Temperature	Earliest	90%	80%	70%	60%	50%	40%	30%	20%	10%	Latest
36	03/29	04/05	04/08	04/09	04/10	04/17	04/21	04/23	04/27	05/01	05/15
32	03/06	03/27	03/30	04/01	04/05	04/08	04/08	04/11	04/15	04/20	04/27
28	03/03	03/10	03/14	03/21	03/25	03/27	03/31	04/06	04/08	04/09	04/19
24	02/11	02/25	03/05	03/07	03/08	03/09	03/11	03/13	03/21	03/26	04/07
20	01/12	02/08	02/12	02/15	02/17	02/23	02/29	03/02	03/10	03/13	03/26

Probability of Earlier Date in Fall Than Indicated

Temperature	Earliest	10%	20%	30%	40%	50%	60%	70%	80%	90%	Latest
36	09/24	10/02	10/03	10/04	10/06	10/11	10/12	10/15	10/18	10/23	10/29
32	10/04	10/09	10/18	10/21	10/23	10/25	10/27	10/29	11/01	11/06	11/12
28	10/08	10/23	10/26	10/30	11/02	11/03	11/07	11/12	11/14	11/21	11/26
24	10/24	11/03	11/04	11/07	11/15	11/17	11/23	11/30	12/04	12/14	12/21
20	11/04	11/16	11/21	11/28	12/03	12/05	12/12	12/17	12/21	12/24	01/02

Probability of a Longer Than Indicated Freeze Free Period (days)

Temperature	Shortest	90%	80%	70%	60%	50%	40%	30%	20%	10%	Longest
36	152	162	170	172	173	175	176	180	185	191	202
32	174	181	187	190	196	202	203	206	211	220	236
28	188	199	206	211	214	219	225	230	230	244	267
24	213	229	235	240	241	248	252	264	274	279	293
20	237	251	261	273	282	285	286	290	297	302	343



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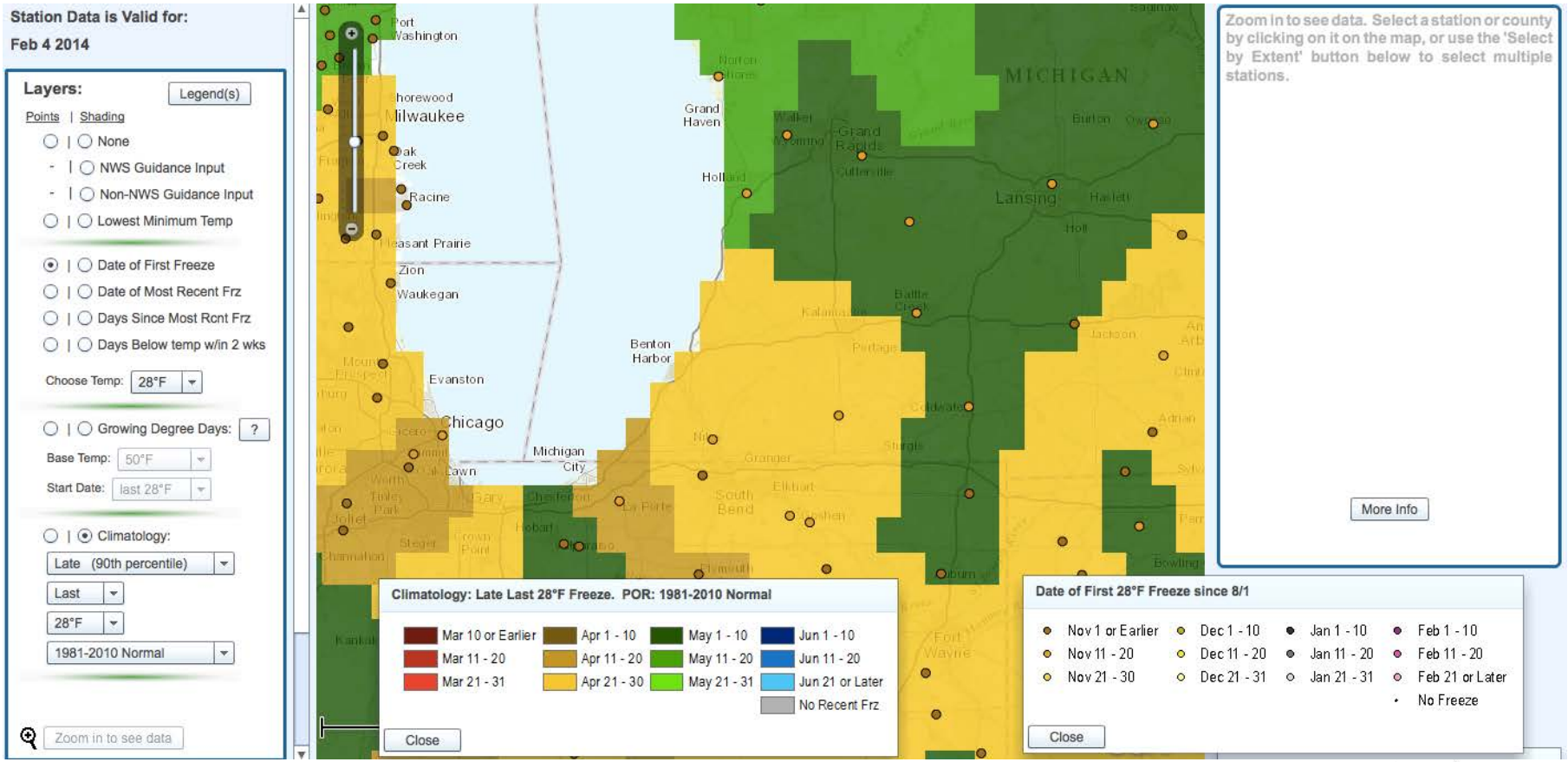
Current Products - GIS



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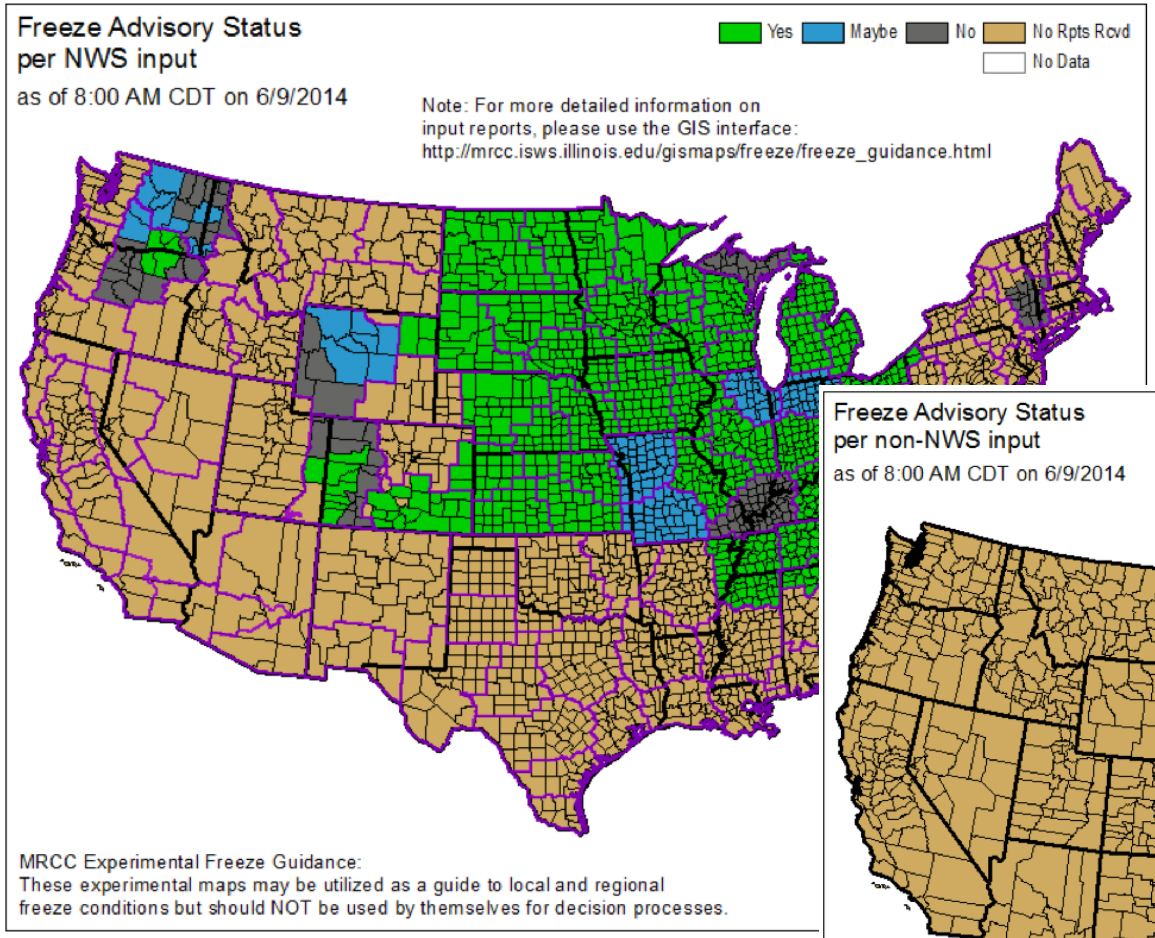
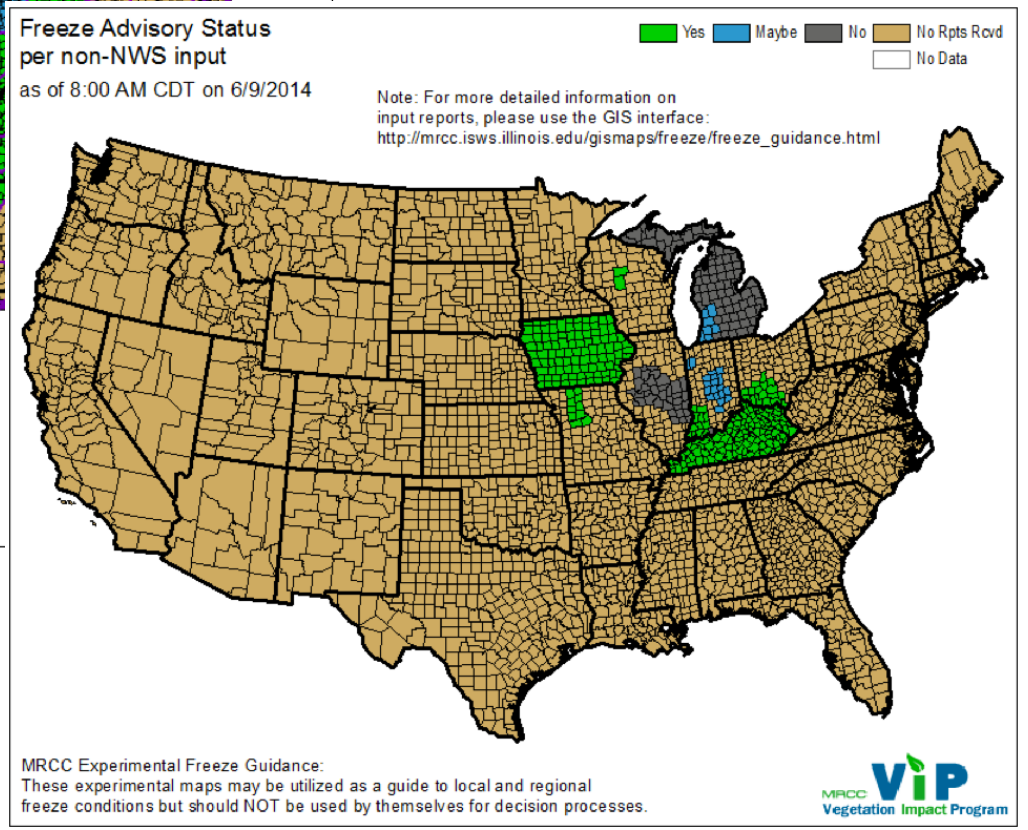
Current Products – Expert Input





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Current Products – Listserv

- Currently have a listserv populated with 200+ experts
  - *State Climatologists*
  - *NWS Forecasters*
  - *University Extension*
  - *NCDC and the RCCs*

- Ever expanding
  - *Private sector (e.g., Master Gardeners, growers, farmers)*
  - *USDA*

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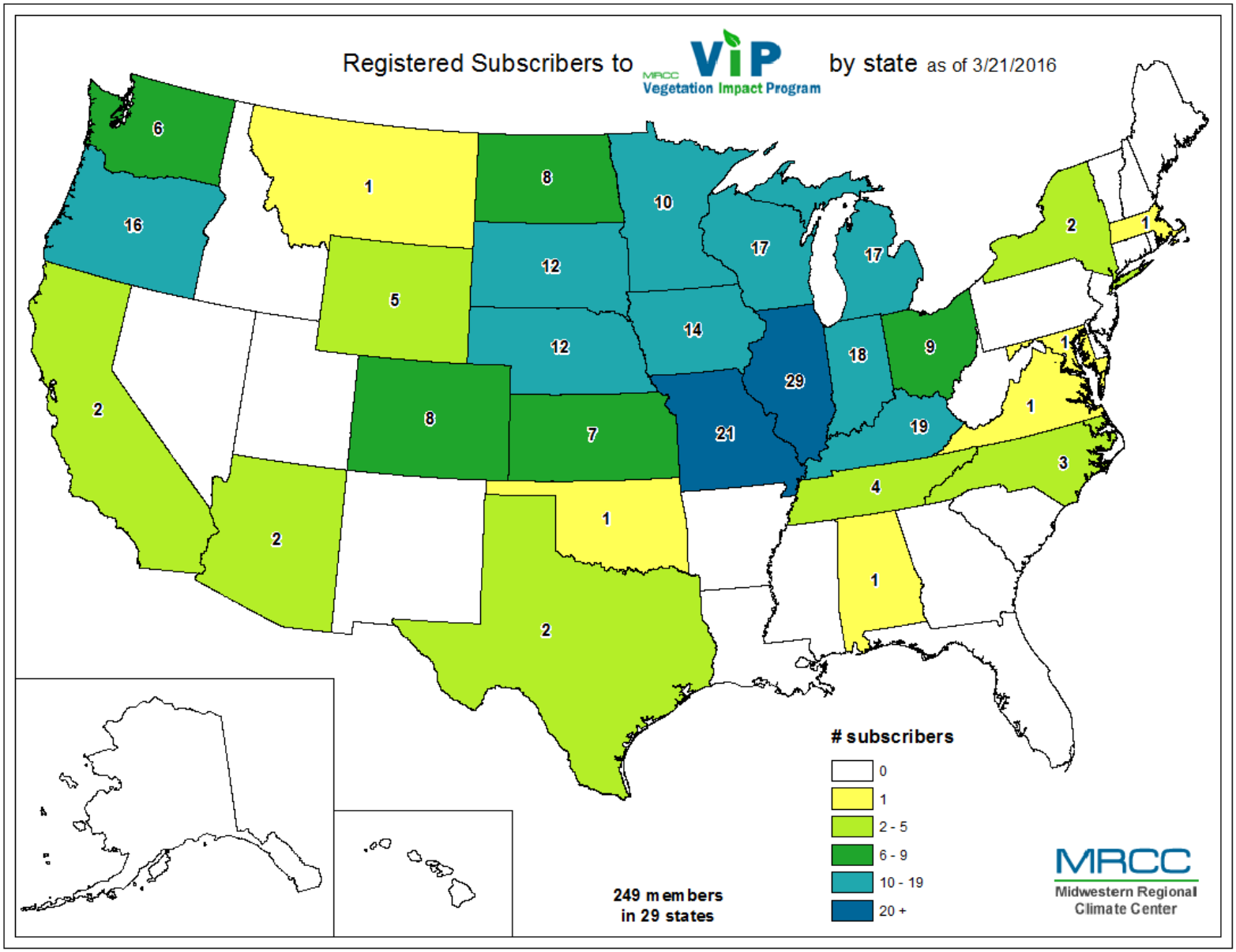
Current Products – Listserv



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Recent Enhancements

- **Bigger domain**
  - *Products are now national*
- **Combine spring and fall**
  - *Separate seasons in Midwest but not in South*
- **Incorporate hourly data**
  - *Information about hours below freezing*
- **[Future plan] Integrate digital forecast data**
  - *Map susceptibility vs. Risk*

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Birth of "VIP"

- ***Demand for more than just frost/freeze monitoring***
- ***Partnership with mesonets for more diversified tools***
  - *Disease*
  - *Pests*
  - *High Resolution*
- ***Stress Degree-Day Tools; Chilling Hour monitoring***
- **Keetch-Byram Drought Index**
- **VIP – Vegetation Impact Program**
  - *Climate monitoring of vegetation impacts*
  - *Partnership between:*
    - *MRCC / RCC*
    - *NWS*
    - *SCs*
    - *University Extension*
    - *Private Sector*
    - *USDA*

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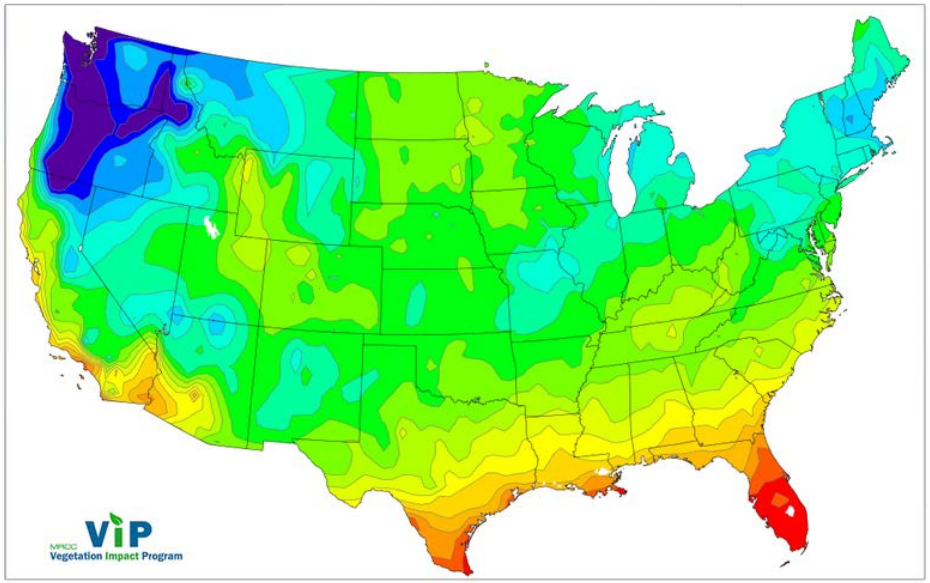
Chilling Hours

Accumulation of hours throughout dormant season within an ideal temperature range

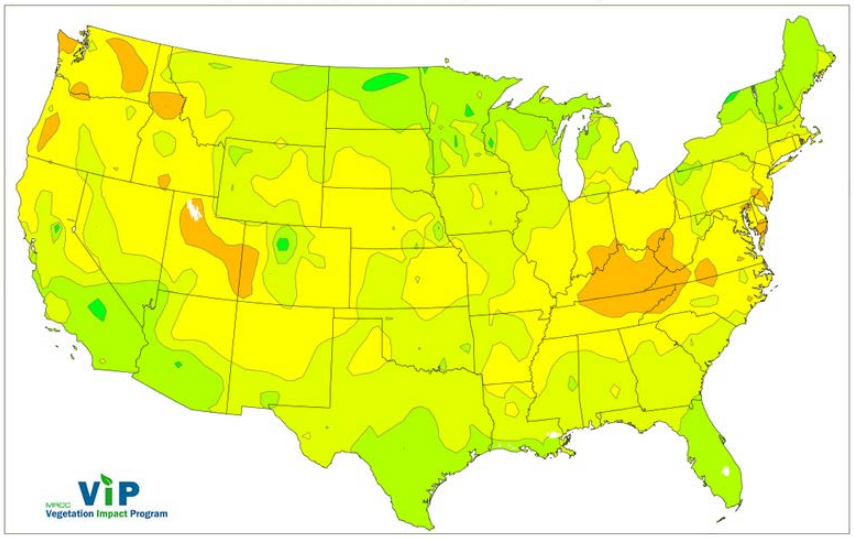
Accumulated Chilling Hours (Between 35°F and 45°F)

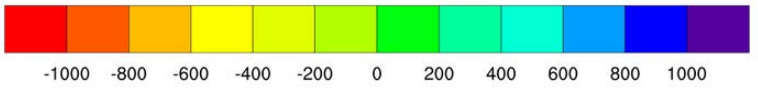
September 1, 2015 through March 17, 2016



Accumulated Chilling Hours Departures (1998/99-2012/13 Average)

September 1, 2015 through March 17, 2016





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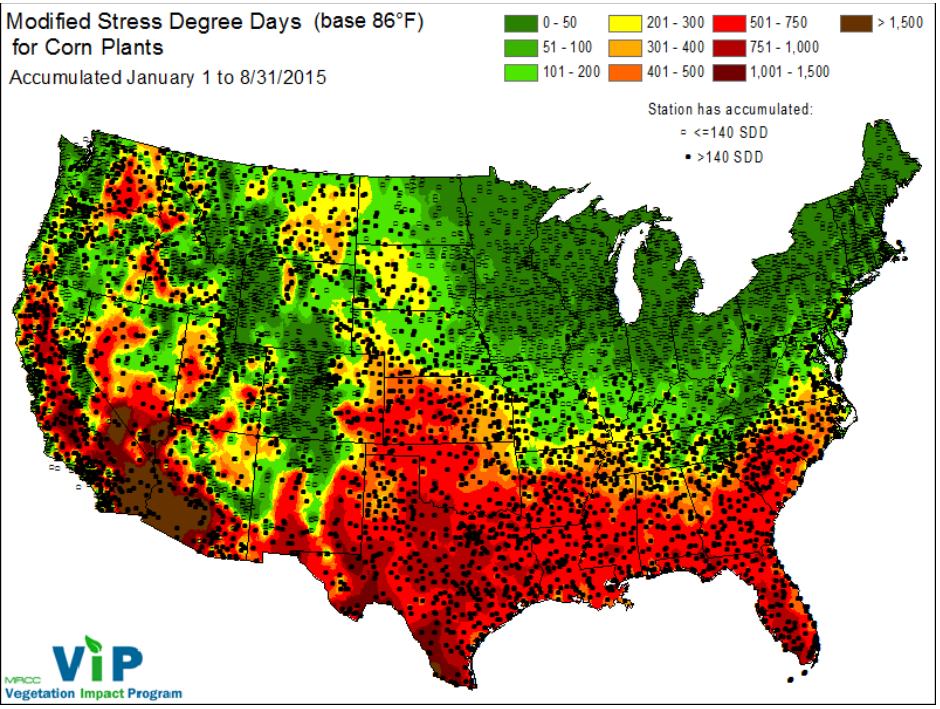
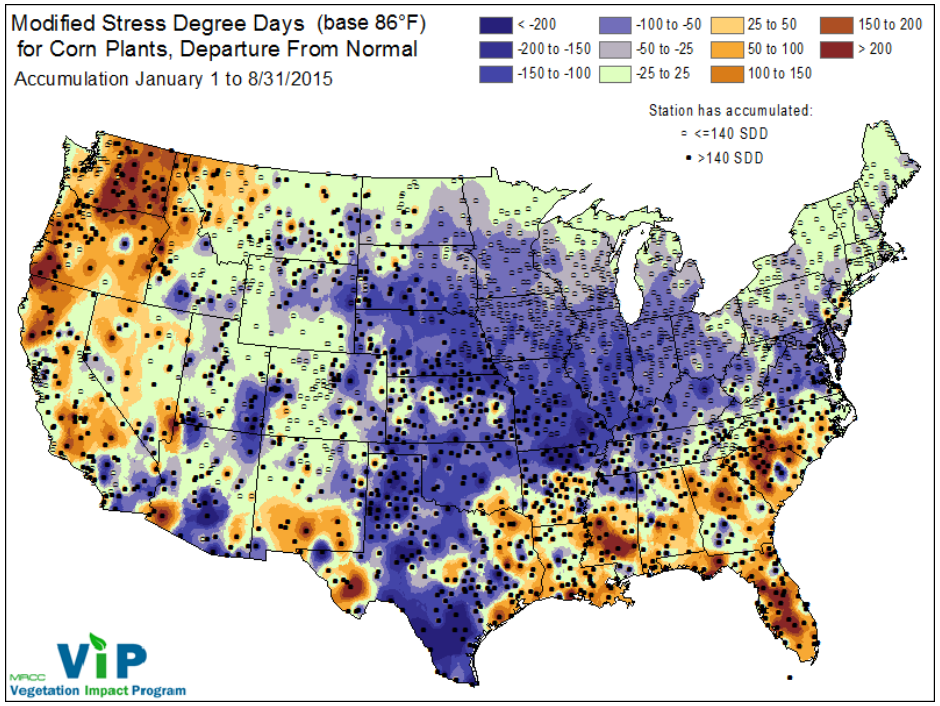
Stress Degree Days

When temperatures get too warm, corn growing process shut down





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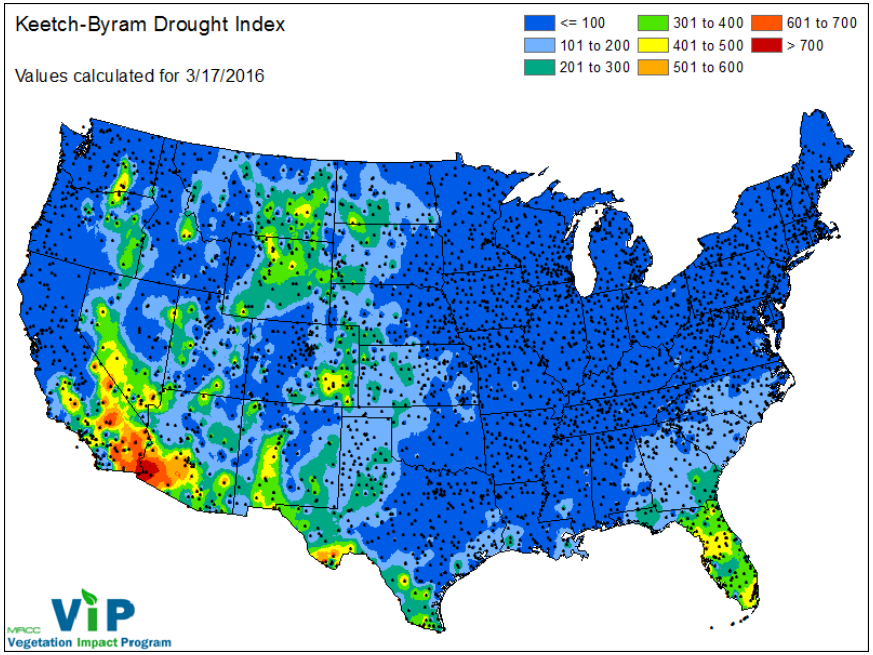
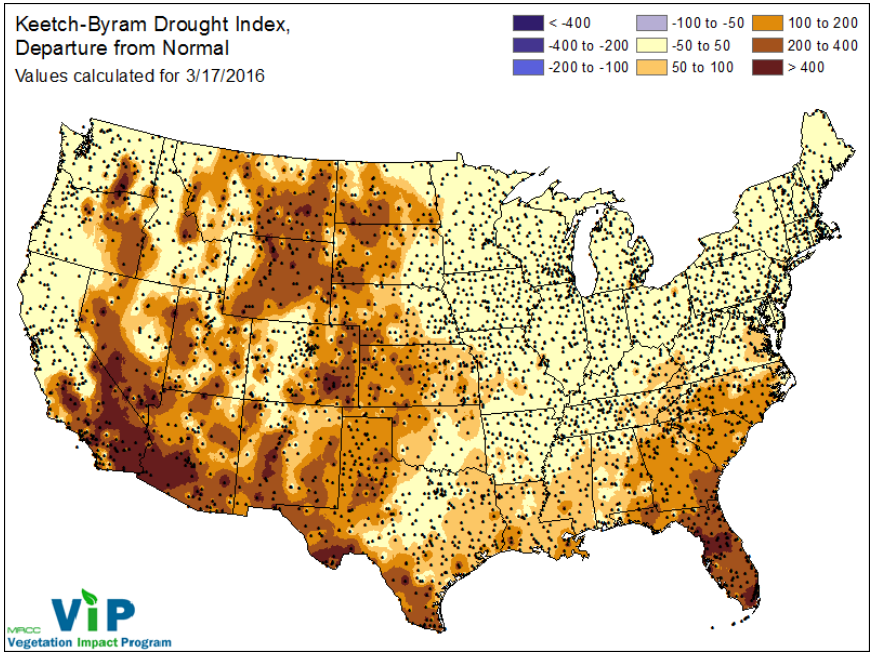
Keetch-Byram Drought Index

Daily updated drought index based upon temperature and precipitation





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Conclusion

Demand for …

- *Improved communication between experts*
- *Operational monitoring tools to minimize impacts*
- *High resolution climate and forecast tools*

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