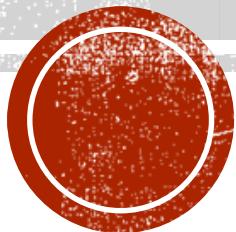


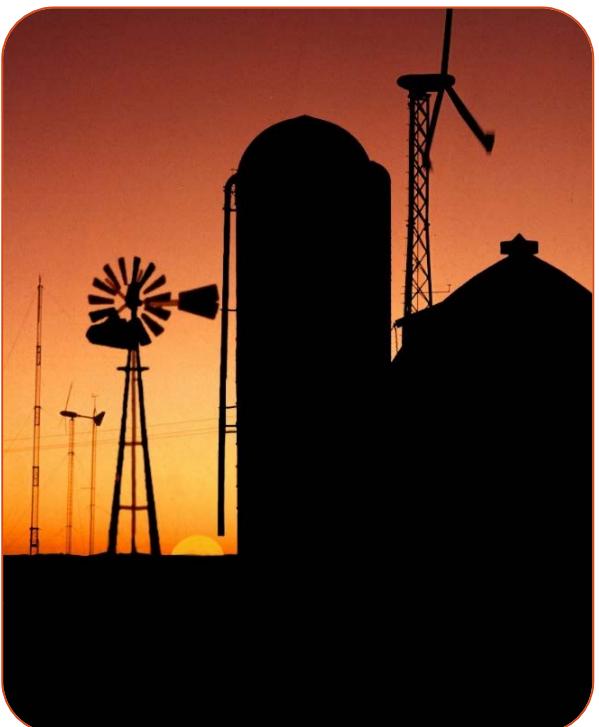
WISCONSIN'S RUNOFF RISK ADVISORY FORECAST

Mark Jenks
Nutrient Mgmt and Water Quality Section
WI Dept. of Ag, Trade and Consumer Protection



WISCONSIN'S AGRICULTURAL STORY

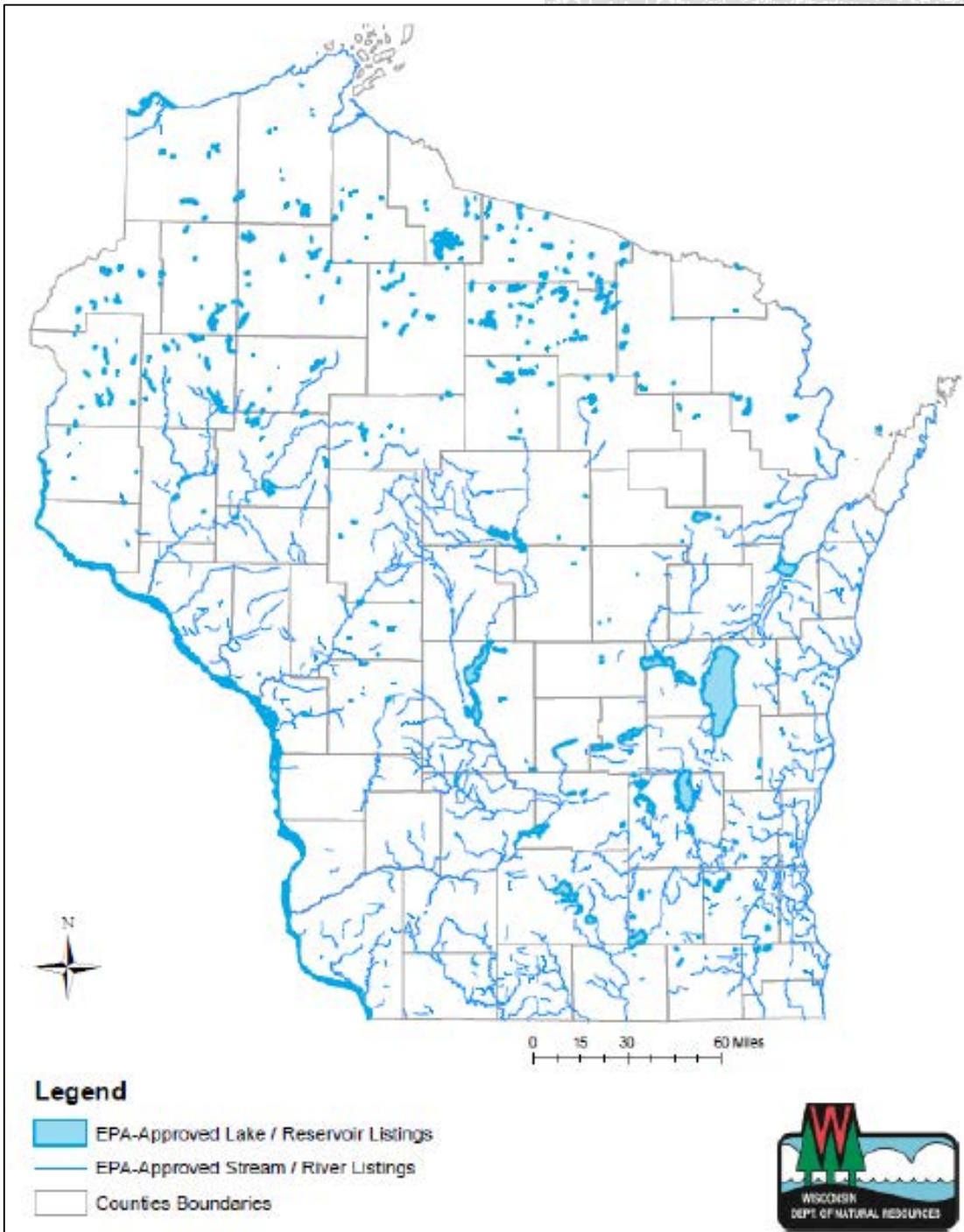
Diverse Cropping and Livestock



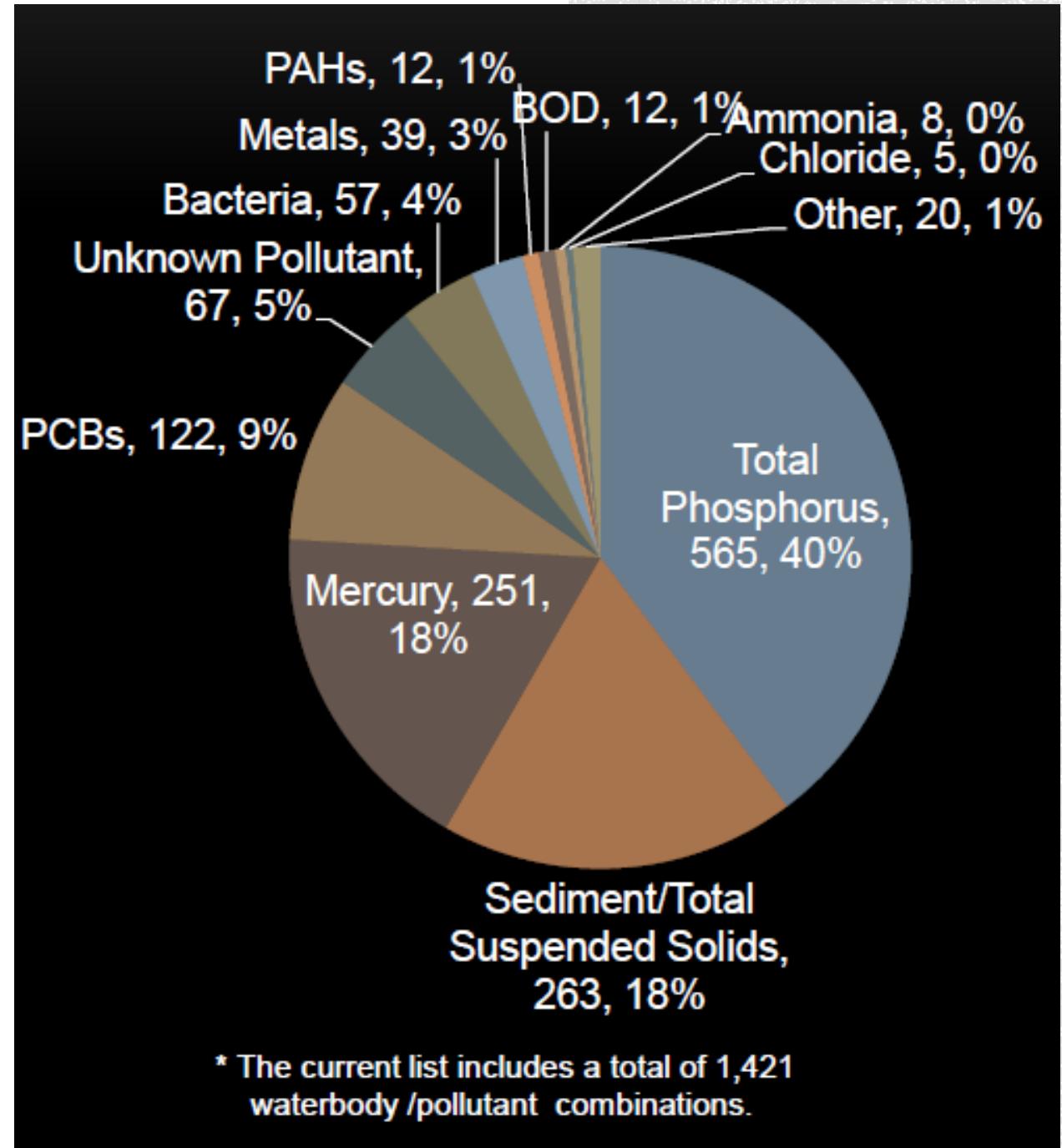
- 69,000 farms (~300 CAFO)
- ~9,500 dairy farms producing 14% of the nation's milk
- 1st in the nation for:
 - Cranberry production
 - Snap Beans
 - Corn Silage
 - Milk goats
 - Mink pelts
 - Cheese!
- 3.5 Million head of cattle, 1.27 Million of which are dairy cows
- Over 9 million acres of cropland (nearly $\frac{1}{4}$ of the state's area)
- \$88 Billion in economic impact to WI



WI'S 303D IMPAIRED WATERS



CAUSES OF WATERBODY IMPAIRMENTS



REDUCING CHRONIC RISK



Thru Nutrient Management Planning

- Managing the source, rate, timing and placement of nutrient applications to cropland (the 4 R's!)
- Protecting water quality and reducing risks of nutrient/sediment loss to surface water, well contamination and fish kills

The top screenshot displays the 'Nutrient Application Planner' software. It includes a table for 'Farm nutrient source availability' showing data for Bio Solid, Graze, and Pit Manure Dairy slurry. It also shows field application restrictions like 'Winter Slope SWQMA' and fertilizer applications for Fall 2015 thru Summer 2016.

Source name	Nutrient type	Units	N	N Incor	N Inject	P2O5	K2O	S	Available annual volume	Planned applications	Remaining volume
Bio Solid	Biosolid, liquid	Gallons	37.3	72.1	72.1	54.3	48	0	0	0	0
Graze	Dairy, grazing	Tons	3	0	0	3	6	0.7	0	205	-205
Pit Manure Dairy slurry	[Dairy, slurry]	Gallons	7	10	12	6	17	1.2	180,000	130,000	41,000

The bottom screenshot shows the 'SnapMaps 16.1' software interface. It features a map of land parcels with various restriction layers applied, such as 'Township/Range', 'Roads', 'Soils', and 'SWQMA' zones. A legend on the left details these layers and their descriptions.



In Wisconsin, farms may be required to develop a Nutrient Management Plan (NM) if:

1. Offered NM cost share \$ (~\$1.7 million/year)
2. Caused a significant **discharge**
3. Regulated by **DNR WPDES** permit or **local ordinance** (manure storage permit or livestock siting permit)
4. Accepted manure storage cost share
5. Participating in the **Farmland Preservation Program** (annual income tax credits for keeping ag land in production and meeting the soil and water standards)

NUTRIENT MANAGEMENT IN WISCONSIN

SNAPPLUS
WISCONSIN'S NUTRIENT MANAGEMENT PLANNING SOFTWARE

HOME ABOUT SNAPPLUS DOWNLOADS SUPPORT PLANNING INFO MAPS

SNAPPLUS NUTRIENT MANAGEMENT SOFTWARE

SnapPlus (Soil Nutrient Application Planner) is Wisconsin's nutrient management planning software. The program helps farmers make the best use of their on-farm nutrients, as well as make informed and justified commercial fertilizer purchases. By calculating potential soil and phosphorus runoff losses on a field-by-field basis while assisting in the economic planning of manure and fertilizer applications, SnapPlus provides Wisconsin farmers with a tool for protecting soil and water quality.



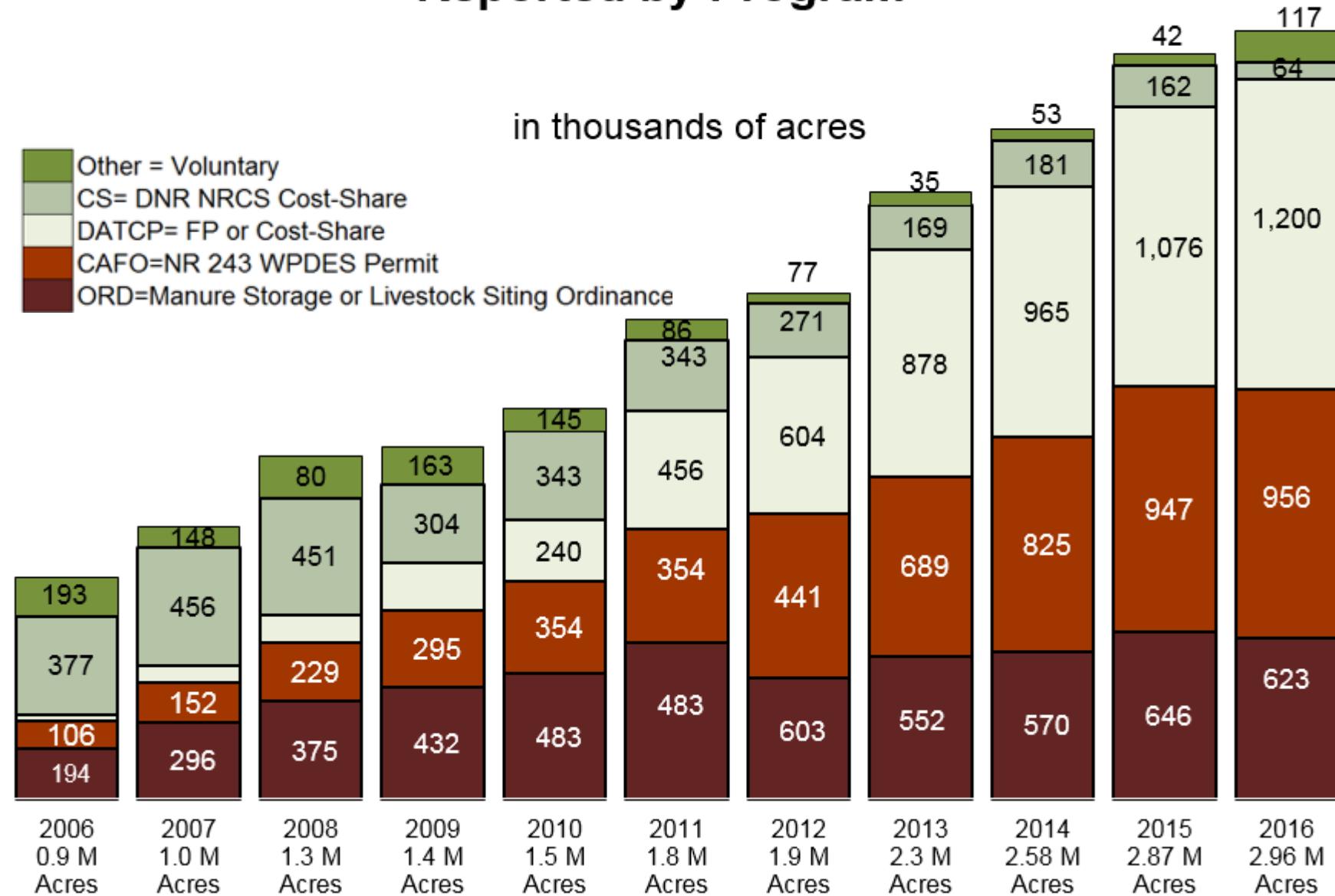
MAKING PROGRESS IN NUTRIENT MANAGEMENT PLANNING



2006-2016 Nutrient Management Plan Acres Reported by Program

in thousands of acres

- Other = Voluntary
- CS= DNR NRCS Cost-Share
- DATCP= FP or Cost-Share
- CAFO=NR 243 WPDES Permit
- ORD=Manure Storage or Livestock Siting Ordinance



DEALING WITH THE ACUTE RISK?



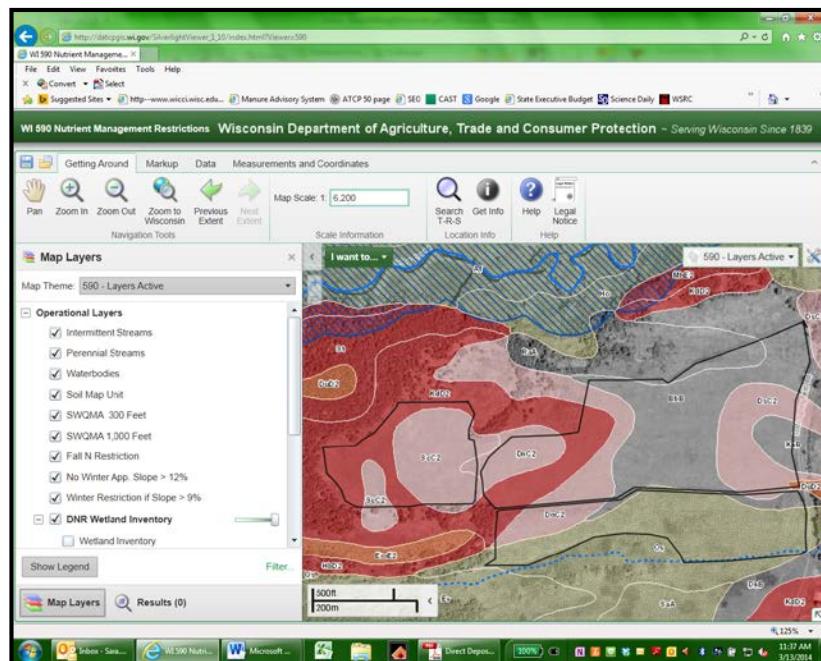
Precipitation, Timing and Soil Moisture Drive Runoff

“On average, 47% of the annual surface runoff occurs as snowmelt in February and March.”
– UW Discovery Farms, 2015

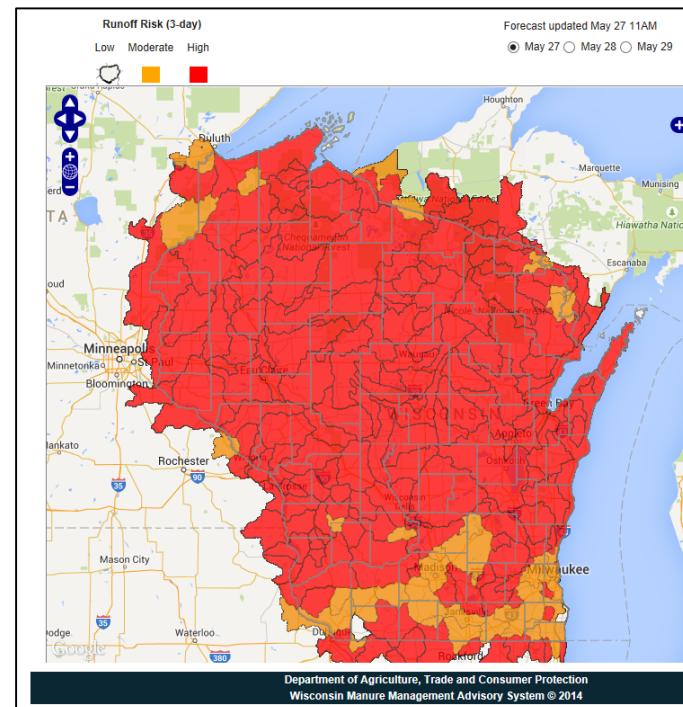
“During the growing season, the nutrient loss was linked to runoff following heavy rainfall events”
– Michigan State University Extension, 2016



590 Nutrient Application Restriction Maps - statewide



Runoff Risk Advisory Forecast



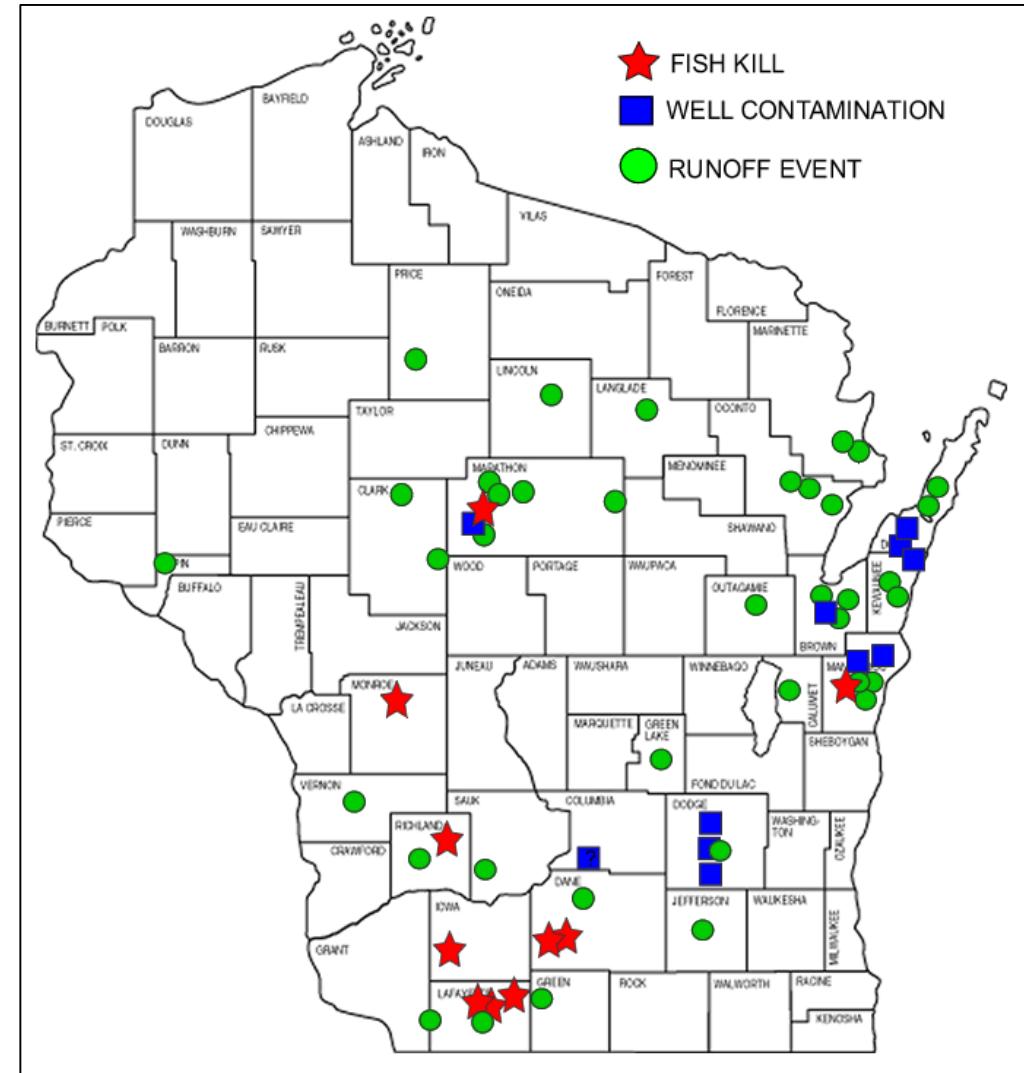
www.manureadvisorysystem.wi.gov

WISCONSIN'S MANURE ADVISORY SYSTEM

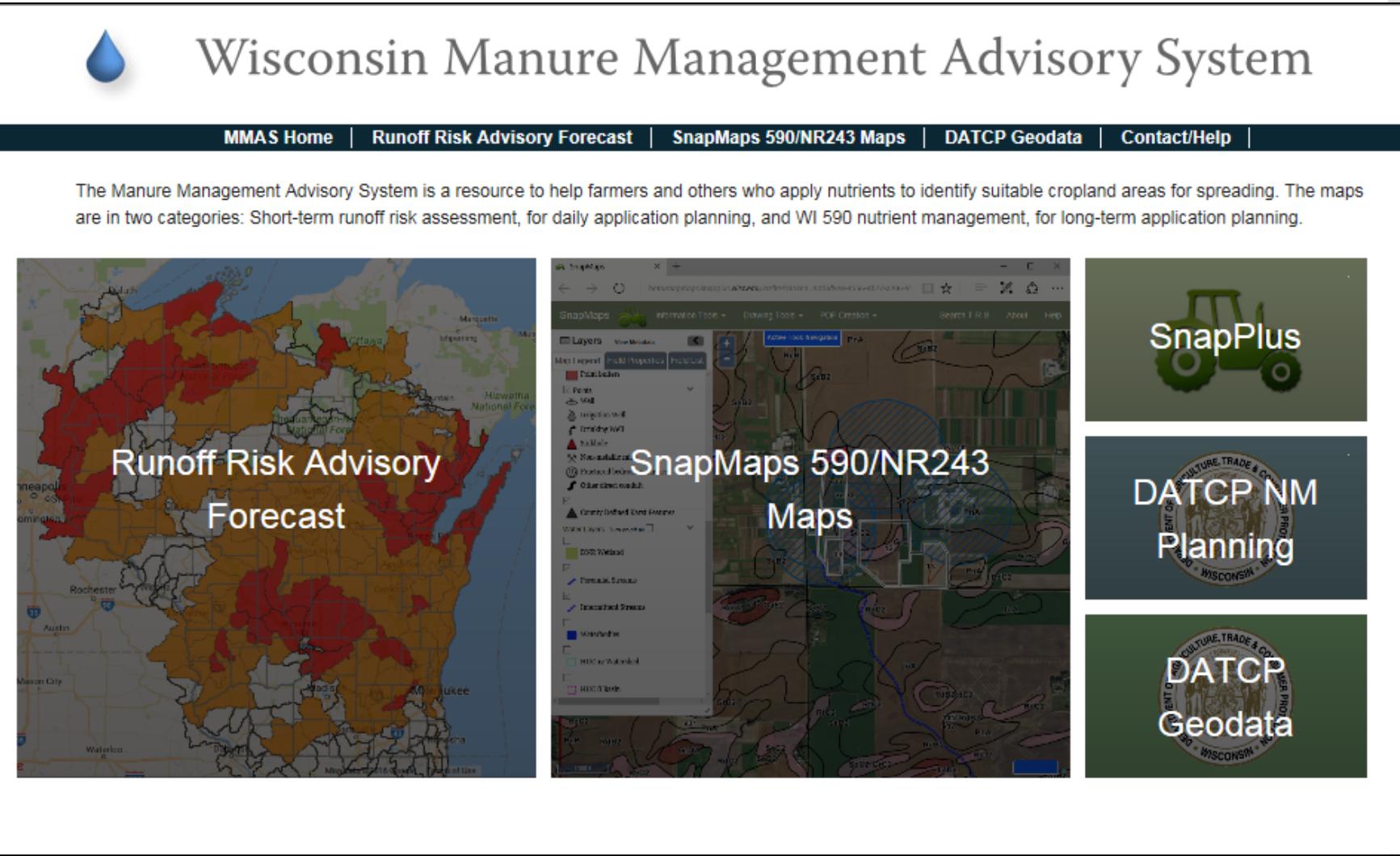
A two-pronged approach

WHY A MANURE ADVISORY SYSTEM?

- Winter of 2005-06
- NMPs account for the **chronic** risks associated with nutrient application.
How can we better deal with the acute loss drivers?
- **WI Legislature:** “establish and operate an online *manure management and advisory system* to assist farmers and manure applicators in identifying the least risky fields and times to apply manure.”
- Team formed in 2008



WISCONSIN'S MANURE ADVISORY SYSTEM



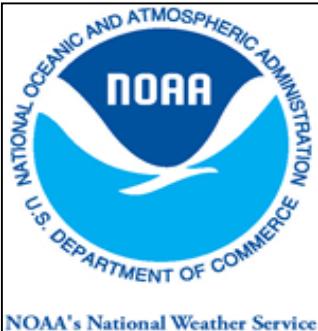
The screenshot shows the Wisconsin Manure Management Advisory System (MMAS) website. At the top left is a blue water droplet icon. The title "Wisconsin Manure Management Advisory System" is displayed prominently. Below the title is a navigation bar with links: MMAS Home, Runoff Risk Advisory Forecast, SnapMaps 590/NR243 Maps, DATCP Geodata, and Contact/Help. A descriptive text block explains the system's purpose: "The Manure Management Advisory System is a resource to help farmers and others who apply nutrients to identify suitable cropland areas for spreading. The maps are in two categories: Short-term runoff risk assessment, for daily application planning, and WI 590 nutrient management, for long-term application planning." Below the text are four images: "Runoff Risk Advisory Forecast" (a map of Wisconsin with county-level risk zones), "SnapMaps 590/NR243 Maps" (a screenshot of a GIS interface showing agricultural fields and water bodies), "DATCP NM Planning" (a logo featuring the DATCP seal and the text "NM Planning"), and "DATCP Geodata" (another logo featuring the DATCP seal and the text "Geodata").

www.manureadvisorysystem.wi.gov

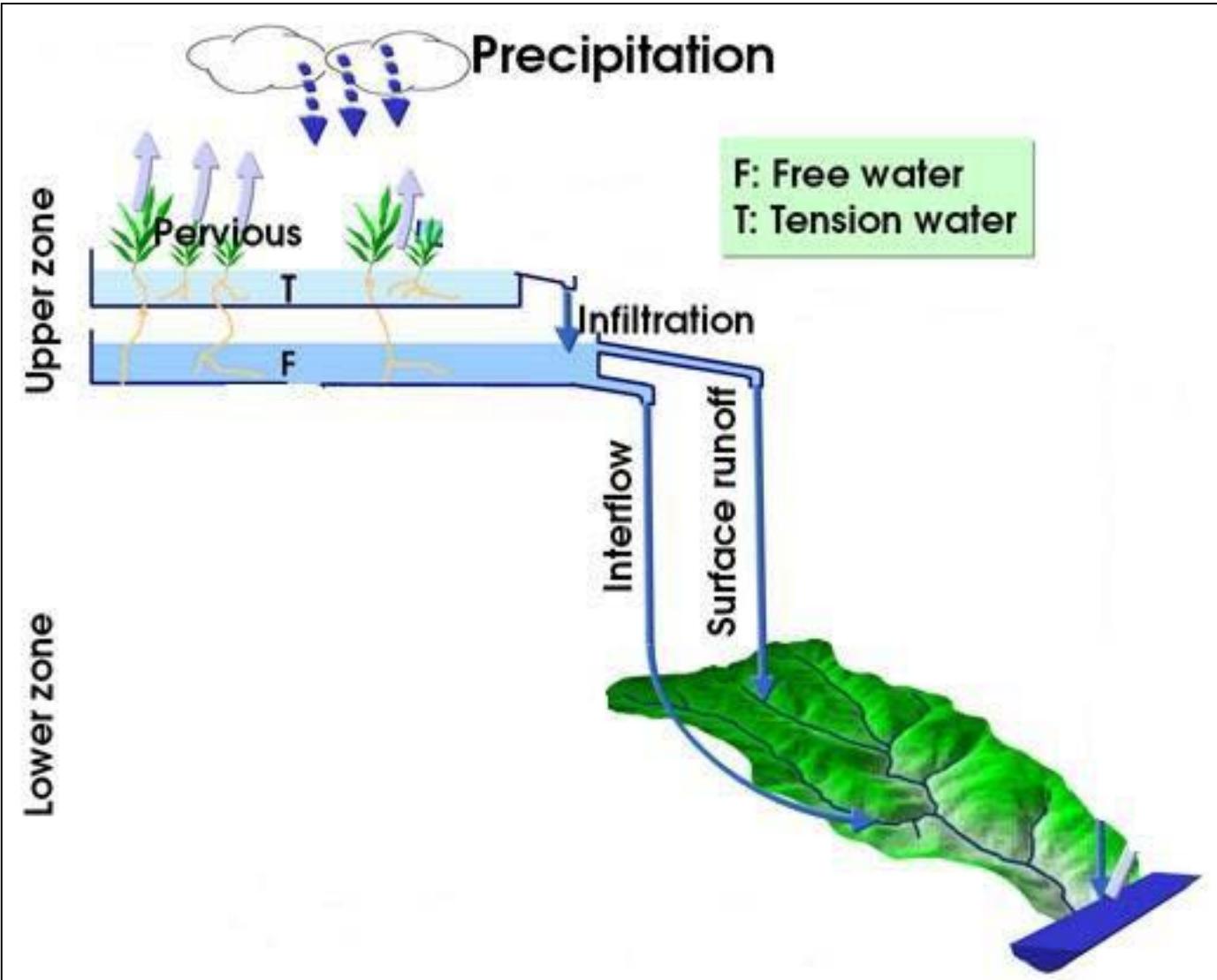
- Online
- Free
- One stop shop for Wisconsin Nutrient Management planning needs

GOALS OF THE RUNOFF RISK FORECAST TOOL

- Increase information available to producers to make **informed, daily decisions** about when and where to spread
- Identify and alert nutrient applicators of **days when the risk of runoff is high**
- Use **existing models** from NWS-NOAA to determine level of risk
- Use **actual on-farm/research data** to calibrate/validate model data



National Weather Service's Sacramento Flood Forecasting Model



RUNOFF RISK ADVISORY FORECAST

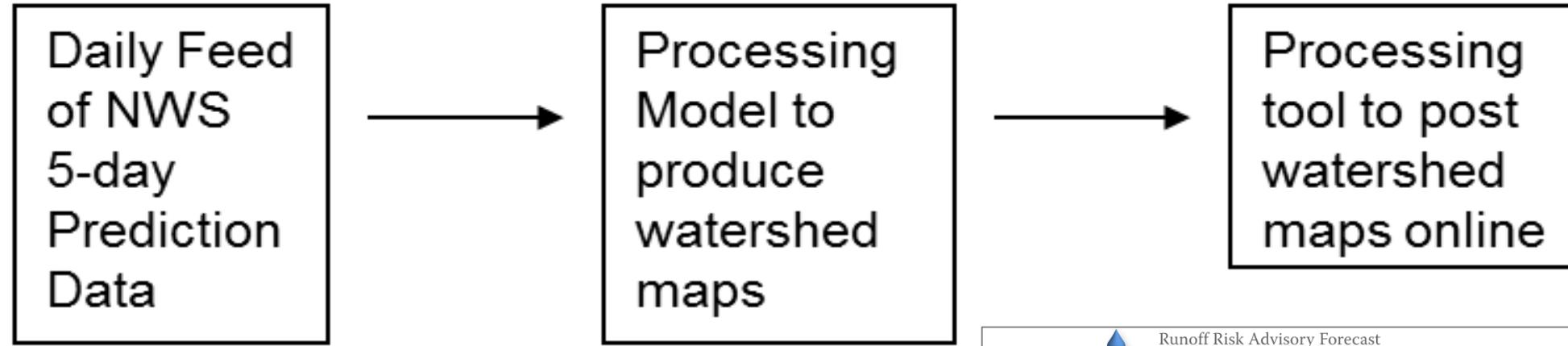
- Focuses on the **surface runoff** and **interflow** volumes that contribute to flood stage predictions

RUNOFF RISK ADVISORY FORECAST

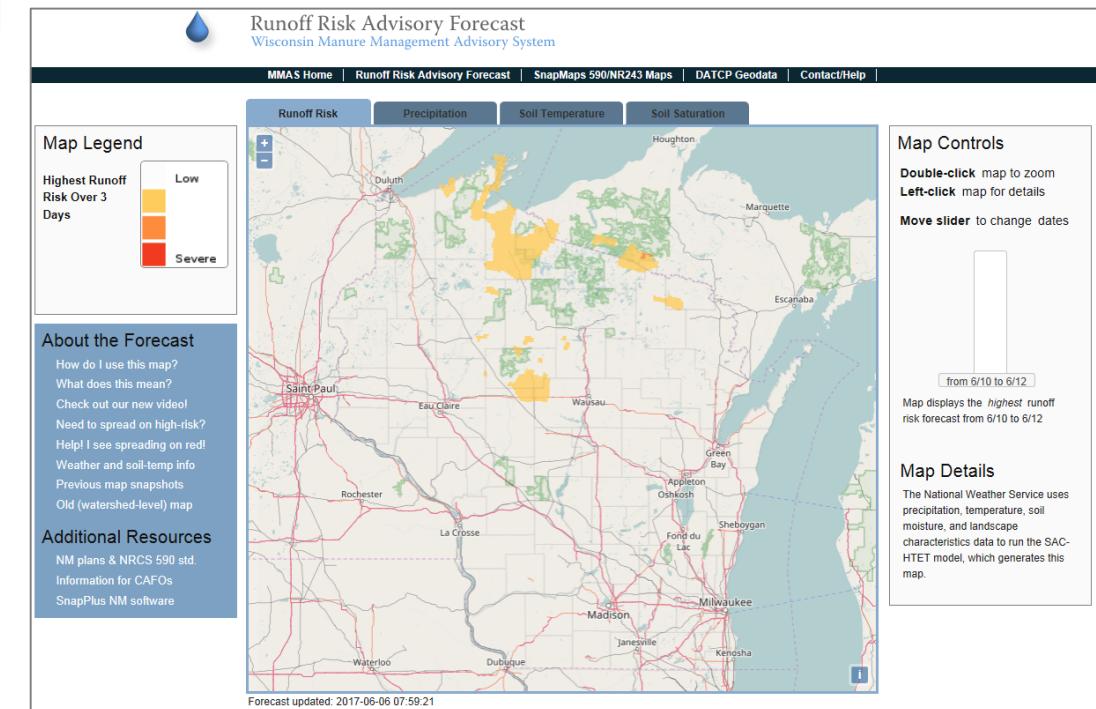
- A decision making tool, **NOT** a regulatory one
- Predicting the potential for runoff based on:
 - Predicted precipitation and temperature
 - ❖ Precipitation - out 72 hours
 - ❖ Temperature - out 10 days
 - *Note that manure spread today could still runoff 4 - 11 days from now.*
 - Modeled soil moisture content
 - Extent of snow cover
 - Modeled snow melt



HOW THE MAPS ARE PRODUCED



- Soil Saturation
 - Precipitation
 - Temperature
 - Snow pack
 - Snowmelt
 - Evapotranspiration
 - Land use/permeability





Runoff Risk Advisory Forecast

Wisconsin Manure Management Advisory System

[MMAS Home](#) | [Runoff Risk Advisory Forecast](#) | [SnapMaps 590/NR243 Maps](#) | [DATCP Geodata](#) | [Contact/Help](#)

Map Legend

Runoff Risk (3-day)		
Low	Moderate	High
No color		

Double-click map to zoom
Right-click map for details

About the Forecast

The RRAF shows daily runoff risk across Wisconsin using National Weather Service information about precipitation, temperature, soil moisture, and landscape characteristics.

Using this map

About the forecast

Check out our new video!

Need to spread on a high-risk day?

Weather and soil-temp info

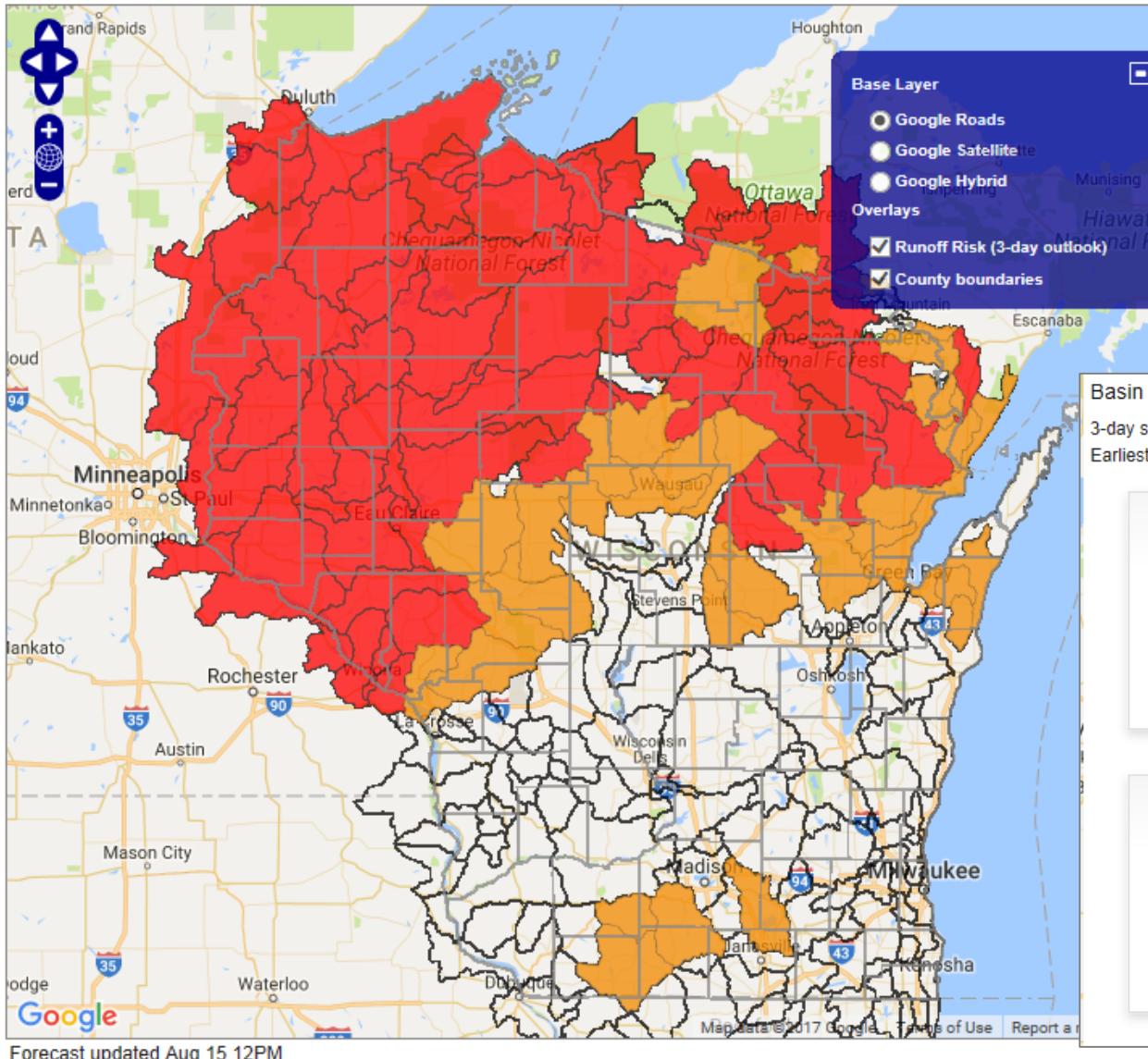
Snapshots of previous RRAF maps

Additional Resources

NM planning & NCFS 590 standard

Information for CAFOs

SnapPlus NM software

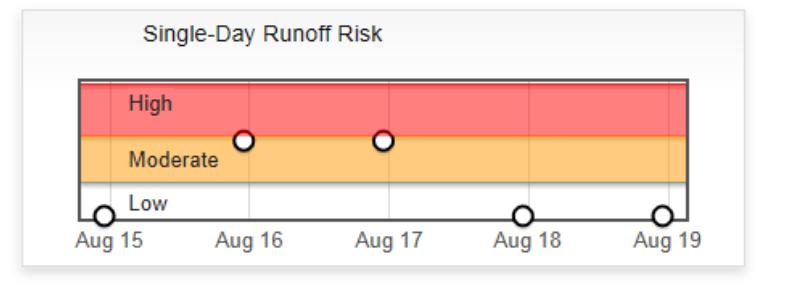
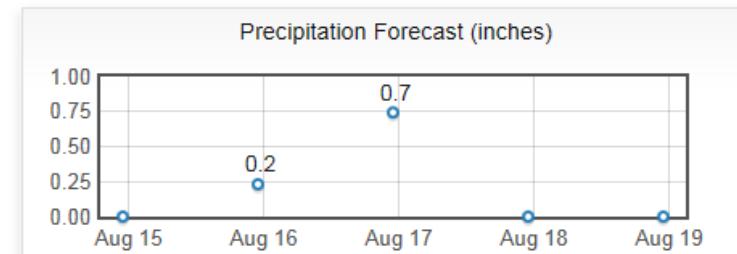


1ST GENERATION RRAF

- Large basins

Basin name: LITTLE WOLF R ROYALTON (ROYW3)

3-day spreading risk forecast on Aug 15: Moderate
Earliest runoff expected (after Aug 15): Aug 16



Forecast and Site Enhancements

- Scale down the forecast to smaller geographical extents (280 mi² to 4 km² grid)
 - Users want more local info – “The basin is red, but it never rained on my farm”
- Provide more supporting information and resources
 - “It’s red, but I HAVE TO spread today, now what??”
 - Maps of modeled soil moisture, soil temperature, snow pack, etc.
 - Easy links to local support services like County Land Conservation Departments, etc.

**2ND
GENERATION
RUNOFF
RISK
ADVISORY
FORECAST**



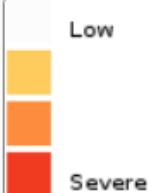
Runoff Risk Advisory Forecast

Wisconsin Manure Management Advisory System

[MMAS Home](#) | [Runoff Risk Advisory Forecast](#) | [SnapMaps 590/NR243 Maps](#) | [DATCP Geodata](#) | [Contact/Help](#) |

Map Legend

Highest Runoff Risk Over 3 Days

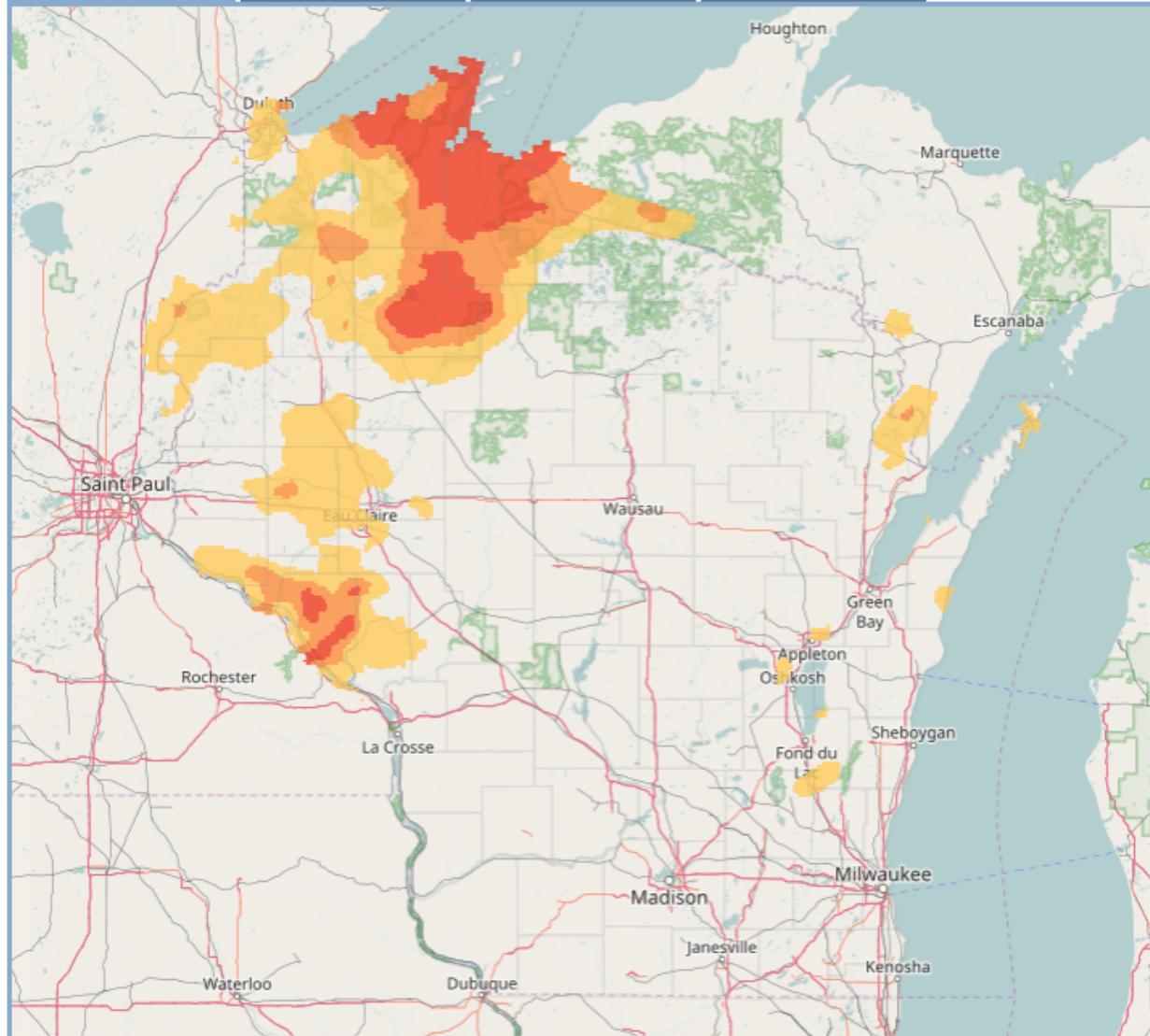


Runoff Risk

Precipitation

Soil Temperature

Soil Saturation



Forecast updated: 2017-08-15 07:56:47

TODAY

About the Forecast

- How do I use this map?
- What does this mean?
- Check out our new video!
- Need to spread on high-risk?
- Help! I see spreading on red!
- Weather and soil-temp info
- Previous map snapshots
- Old (watershed-level) map

Additional Resources

- NM plans & NRCS 590 std.
- Information for CAFOs
- SnapPlus NM software

Map Controls

Double-click map to zoom

Left-click map for details

Move slider to change dates

from 8/15 to 8/17

Map displays the *highest* runoff risk forecast from 8/15 to 8/17

Map Details

The National Weather Service uses precipitation, temperature, soil moisture, and landscape characteristics data to run the SAC-HTET model, which generates this map.



Runoff Risk Advisory Forecast

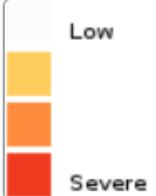
Wisconsin Manure Management Advisory System

[MMAS Home](#) | [Runoff Risk Advisory Forecast](#) | [SnapMaps 590/NR243 Maps](#) | [DATCP Geodata](#) | [Contact/Help](#) |

TOMORROW

Map Legend

Highest Runoff
Risk Over 3
Days

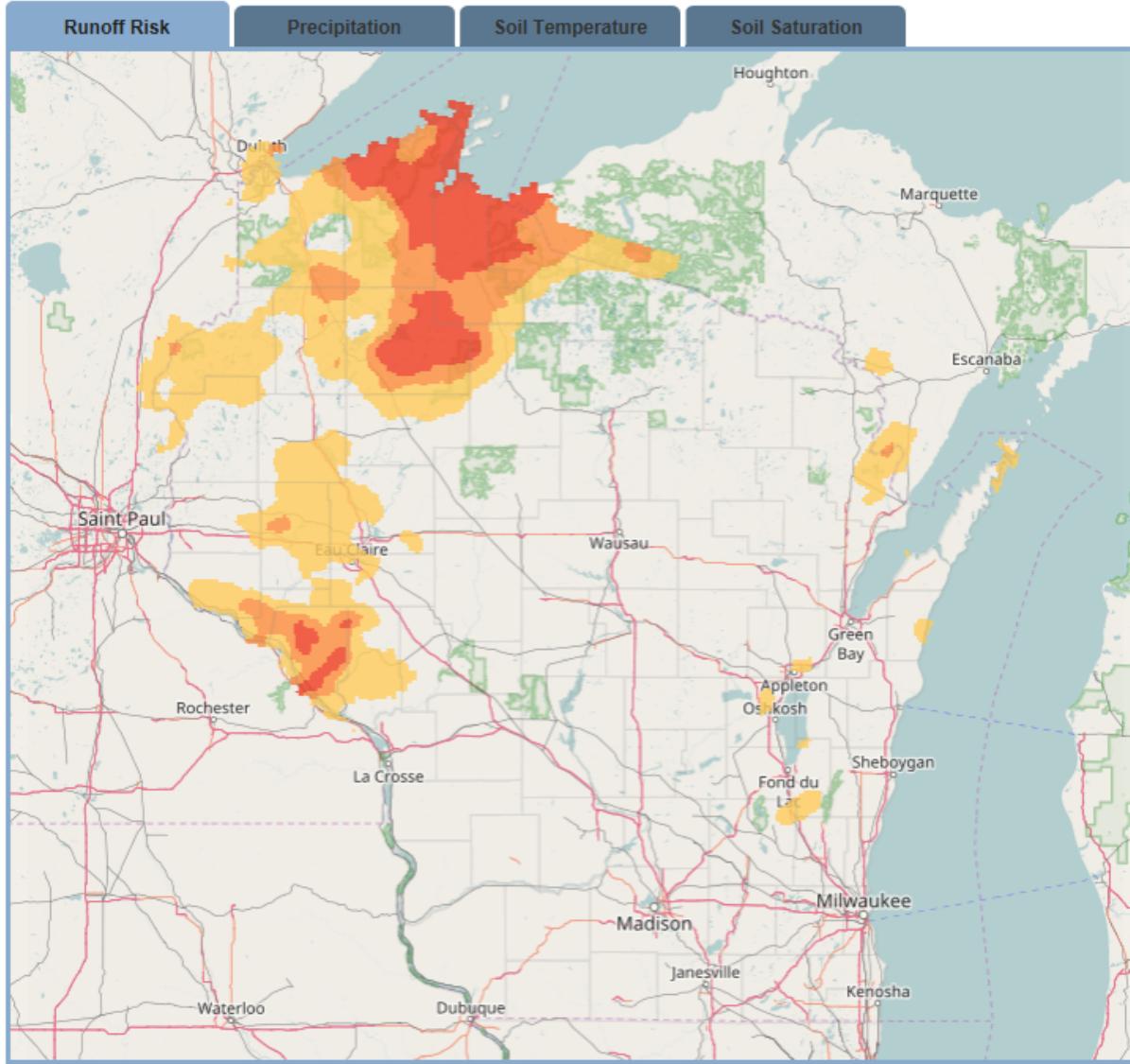


About the Forecast

- How do I use this map?
- What does this mean?
- Check out our new video!
- Need to spread on high-risk?
- Help! I see spreading on red!
- Weather and soil-temp info
- Previous map snapshots
- Old (watershed-level) map

Additional Resources

- NM plans & NRCS 590 std.
- Information for CAFOs
- SnapPlus NM software



Map Controls

Double-click map to zoom

Left-click map for details

Move slider to change dates



Map displays the *highest* runoff risk forecast from 8/16 to 8/18

Map Details

The National Weather Service uses precipitation, temperature, soil moisture, and landscape characteristics data to run the SAC-HTET model, which generates this map.





Runoff Risk Advisory Forecast

Wisconsin Manure Management Advisory System

[MMAS Home](#) | [Runoff Risk Advisory Forecast](#) | [SnapMaps 590/NR243 Maps](#) | [DATCP Geodata](#) | [Contact/Help](#) |

Map Legend

Highest Runoff
Risk Over 3
Days



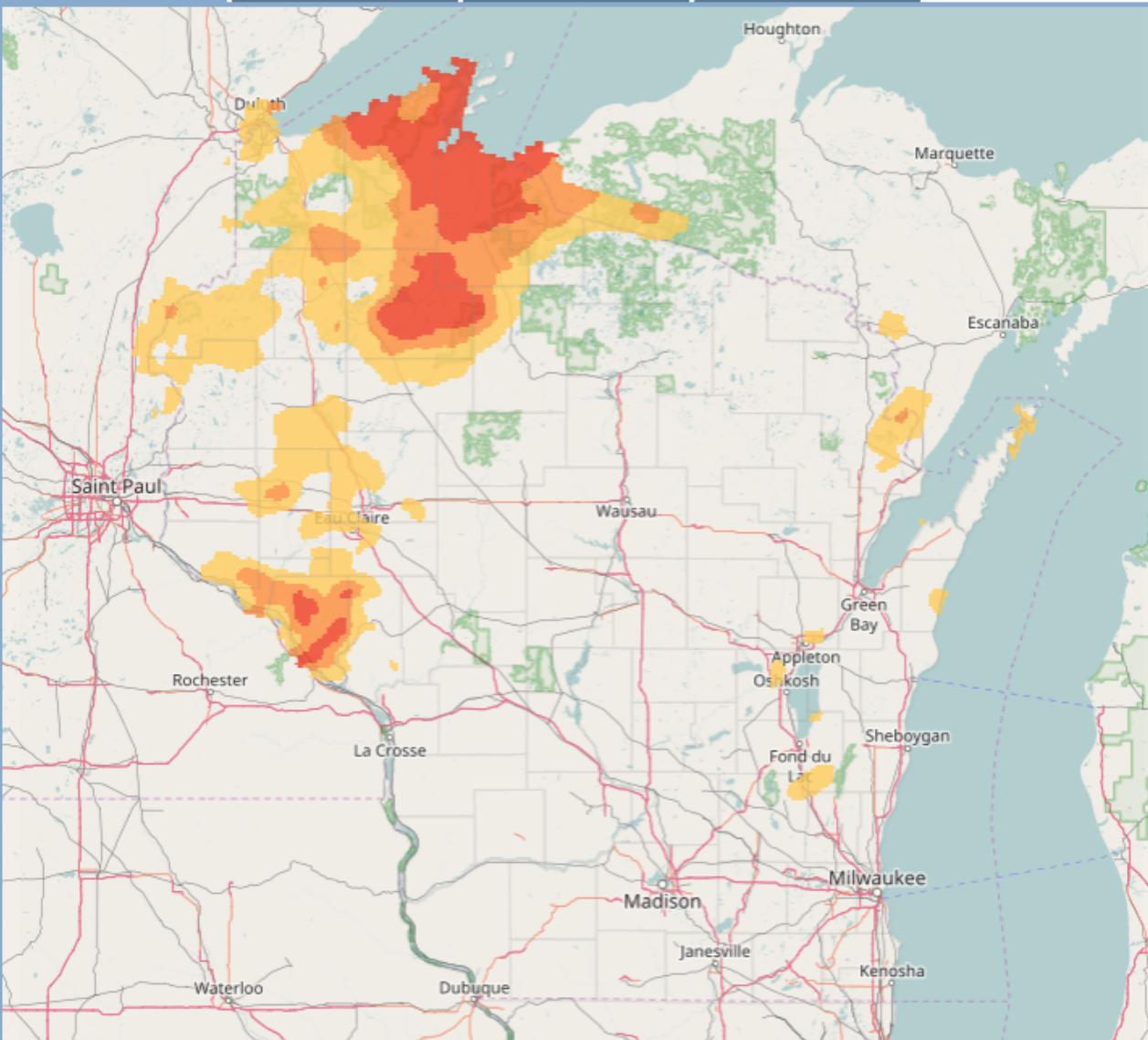
About the Forecast

- How do I use this map?
- What does this mean?
- Check out our new video!
- Need to spread on high-risk?
- Help! I see spreading on red!
- Weather and soil-temp info
- Previous map snapshots
- Old (watershed-level) map

Additional Resources

- NM plans & NRCS 590 std.
- Information for CAFOs
- SnapPlus NM software

Runoff Risk Precipitation Soil Temperature Soil Saturation



Forecast updated: 2017-08-15 07:56:47

Map Controls

- Double-click map to zoom
- Left-click map for details
- Move slider to change dates



Map displays the *highest* runoff risk forecast from 8/17 to 8/19

Map Details

The National Weather Service uses precipitation, temperature, soil moisture, and landscape characteristics data to run the SAC-HTET model, which generates this map.

TWO
DAYS
OUT

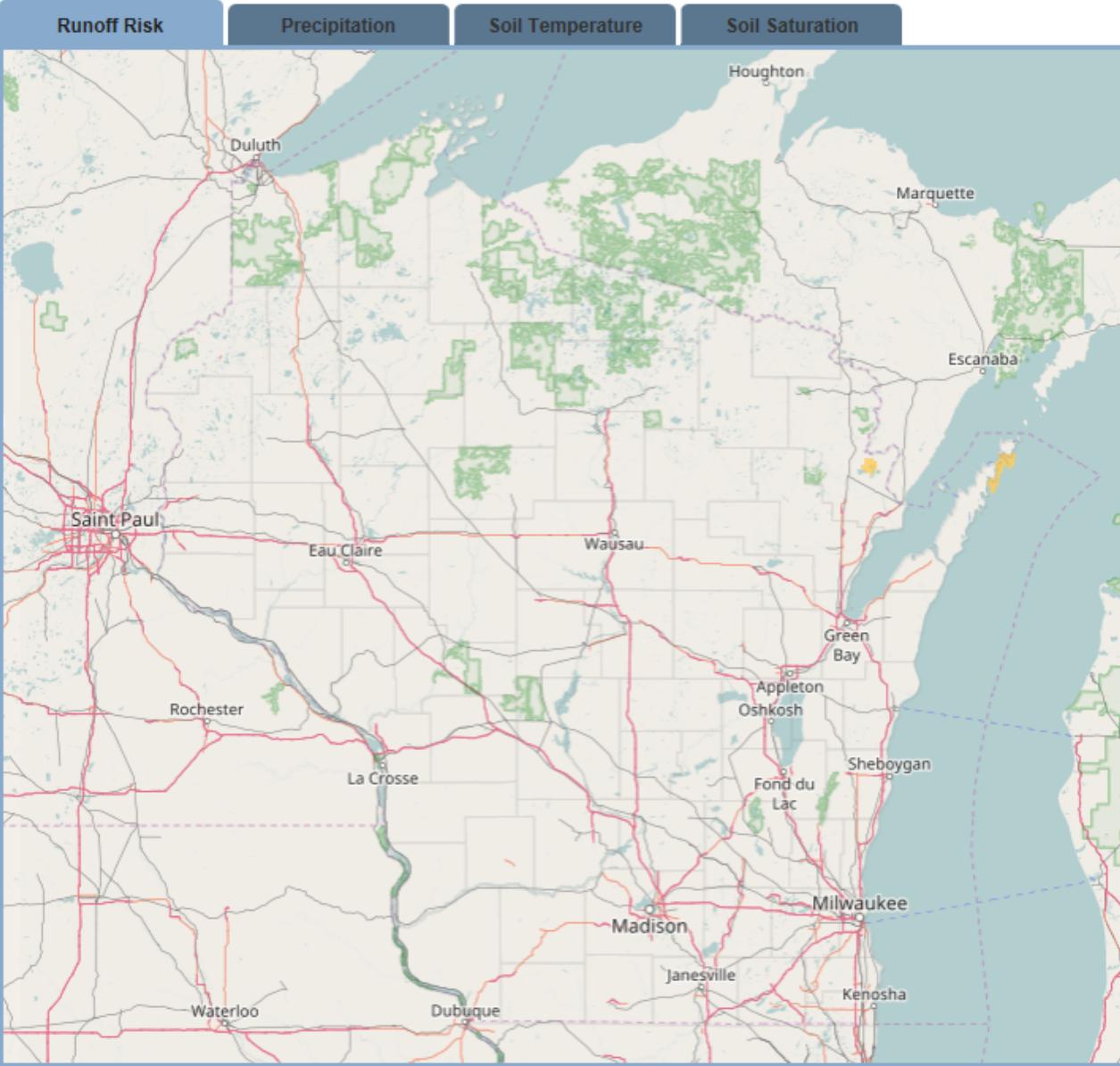




Runoff Risk Advisory Forecast

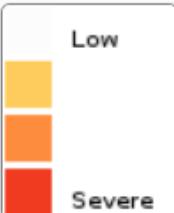
Wisconsin Manure Management Advisory System

[MMAS Home](#) | [Runoff Risk Advisory Forecast](#) | [SnapMaps 590/NR243 Maps](#) | [DATCP Geodata](#) | [Contact/Help](#) |



Map Legend

Highest Runoff Risk Over 3 Days



About the Forecast

- How do I use this map?
- What does this mean?
- Check out our new video!
- Need to spread on high-risk?
- Help! I see spreading on red!
- Weather and soil-temp info
- Previous map snapshots
- Old (watershed-level) map

Additional Resources

- NM plans & NRCS 590 std.
- Information for CAFOs
- SnapPlus NM software

Map Controls

Double-click map to zoom
Left-click map for details

Move slider to change dates



Map displays the *highest* runoff risk forecast from 8/18 to 8/20

Map Details

The National Weather Service uses precipitation, temperature, soil moisture, and landscape characteristics data to run the SAC-HTET model, which generates this map.

THREE
DAYS
OUT
-
VERY
LOW
RISK





Runoff Risk Advisory Forecast

Wisconsin Manure Management Advisory System

[MMAS Home](#) | [Runoff Risk Advisory Forecast](#) | [SnapMaps 590/NR243 Maps](#) | [DATCP Geodata](#) | [Contact/Help](#) |

Runoff Risk

Precipitation

Soil Temperature

Soil Saturation

Map Legend

Forecast
Precipitation
(in.)

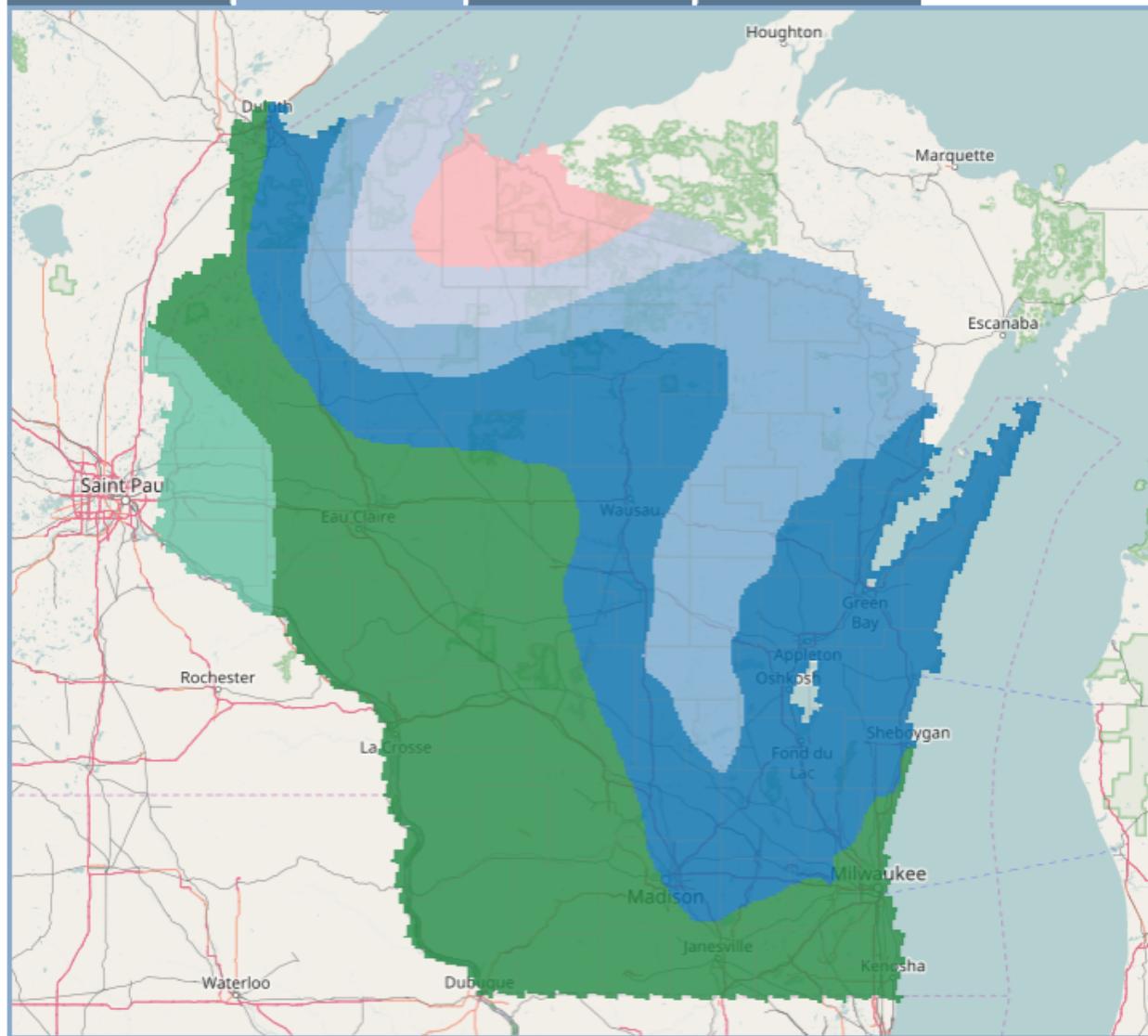
None
Trace
0.05
0.1
0.25
0.5
0.75
1.0
1.5
3.0
>= 5.0

About the Forecast

- How do I use this map?
- What does this mean?
- Check out our new video!
- Need to spread on high-risk?
- Help! I see spreading on red!
- Weather and soil-temp info
- Previous map snapshots
- Old (watershed-level) map

Additional Resources

- NM plans & NRCS 590 std.
- Information for CAFOs
- SnapPlus NM software



Forecast updated: 2017-08-15 07:56:47

Map Controls

Double-click map to zoom
Left-click map for details

Move slider to change date



Map displays precipitation (inches),
forecast on 8/17

Map Details

NOAA precipitation forecast, in
inches, for the given date indicated.

PRECIP FORECAST





Runoff Risk Advisory Forecast

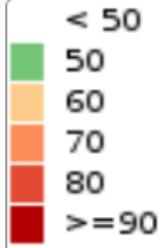
Wisconsin Manure Management Advisory System

[MMAS Home](#) | [Runoff Risk Advisory Forecast](#) | [SnapMaps 590/NR243 Maps](#) | [DATCP Geodata](#) | [Contact/Help](#) |

SOIL
TEMP
FORECAST

Map Legend

Modeled Soil
Temp, °F (Avg.
of top 10")

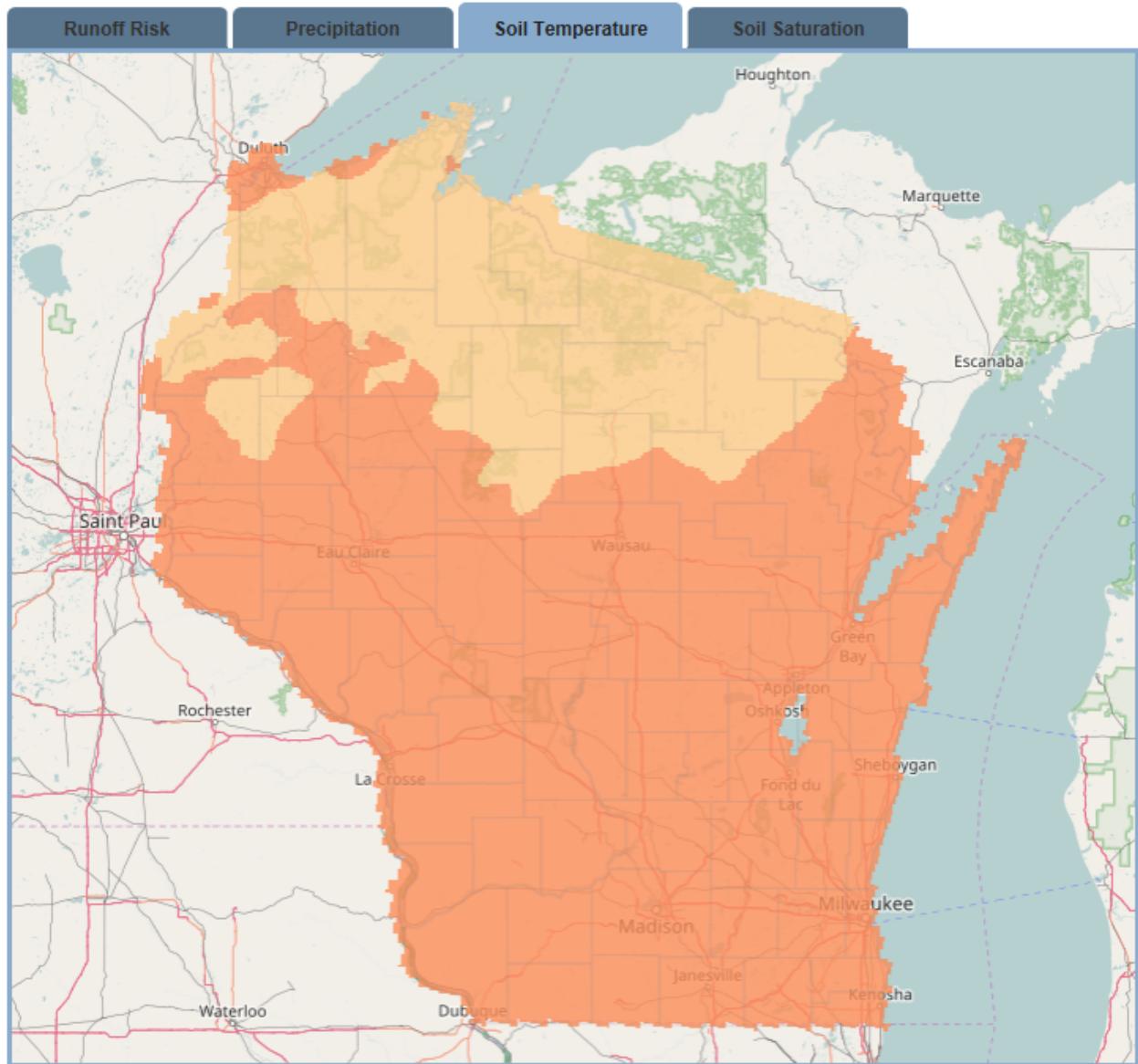


About the Forecast

- [How do I use this map?](#)
- [What does this mean?](#)
- [Check out our new video!](#)
- [Need to spread on high-risk?](#)
- [Help! I see spreading on red!](#)
- [Weather and soil-temp info](#)
- [Previous map snapshots](#)
- [Old \(watershed-level\) map](#)

Additional Resources

- [NM plans & NRCS 590 std.](#)
- [Information for CAFOs](#)
- [SnapPlus NM software](#)



Map Controls

- Double-click** map to zoom
- Left-click** map for details
- Move slider** to change date

on 8/15

Map displays modeled average soil temperature (°F) in top 10 inches, forecast on 8/15

Map Details

This is the average of the soil temperatures (at 2, 4, 6, 8, and 10 inches) output by the model. Note that these are *not* measurements made by an instrument, but forecast values.



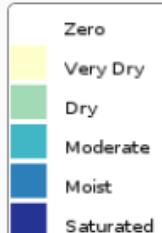
Runoff Risk Advisory Forecast

Wisconsin Manure Management Advisory System

[MMAS Home](#) | [Runoff Risk Advisory Forecast](#) | [SnapMaps 590/NR243 Maps](#) | [DATCP Geodata](#) | [Contact/Help](#)

Map Legend

Modeled Soil
Saturation (at
6")

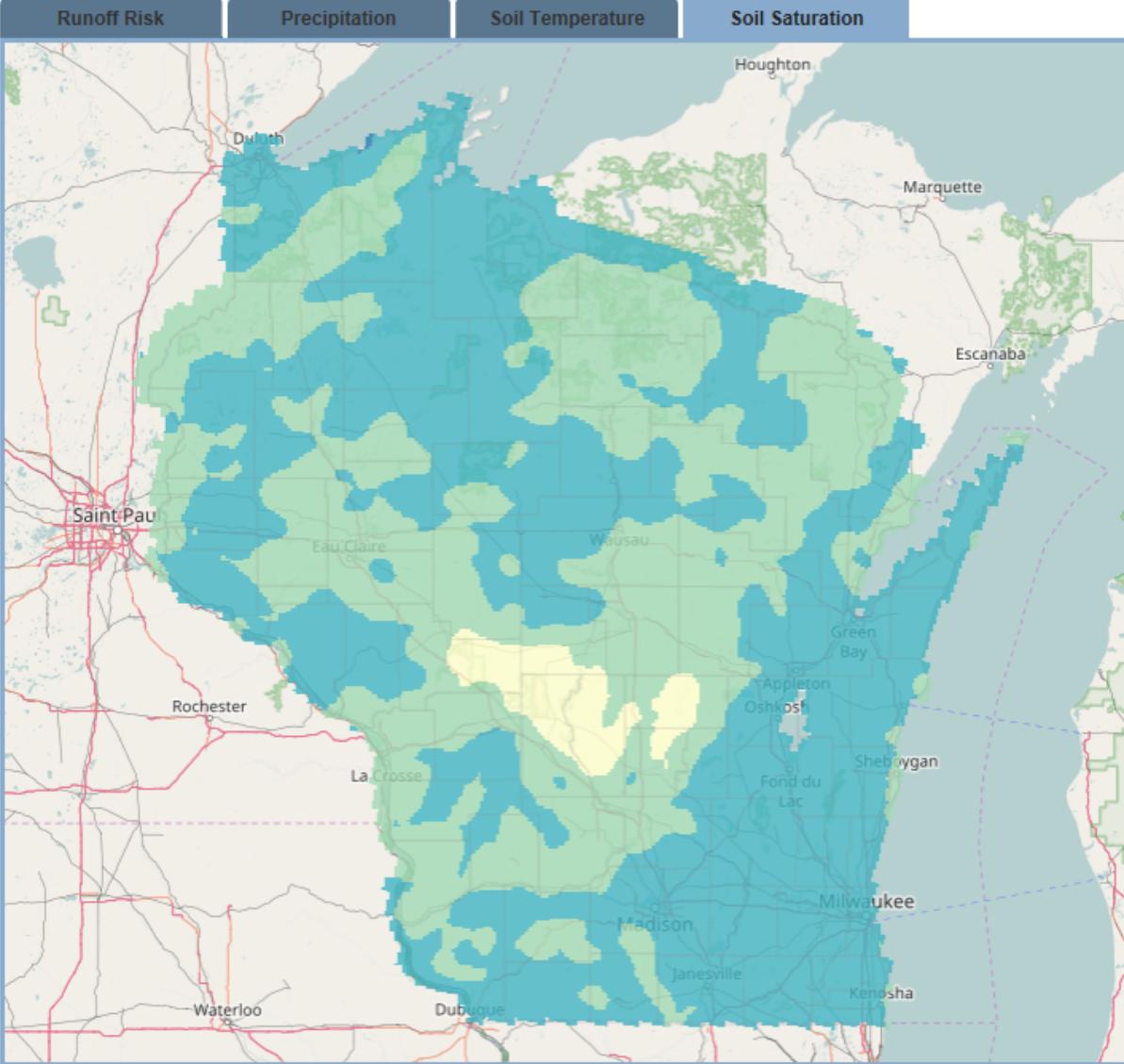


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- Need to spread on high-risk?
- Help! I see spreading on red!
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Additional Resources

- NM plans & NRCS 590 std.
- Information for CAFOs
- SnapPlus NM software



Map Controls

Double-click map to zoom

Left-click map for details

Move slider to change date

on 8/15

Map displays modeled soil
saturation at 6-inch depth, forecast
on 8/15

Map Details

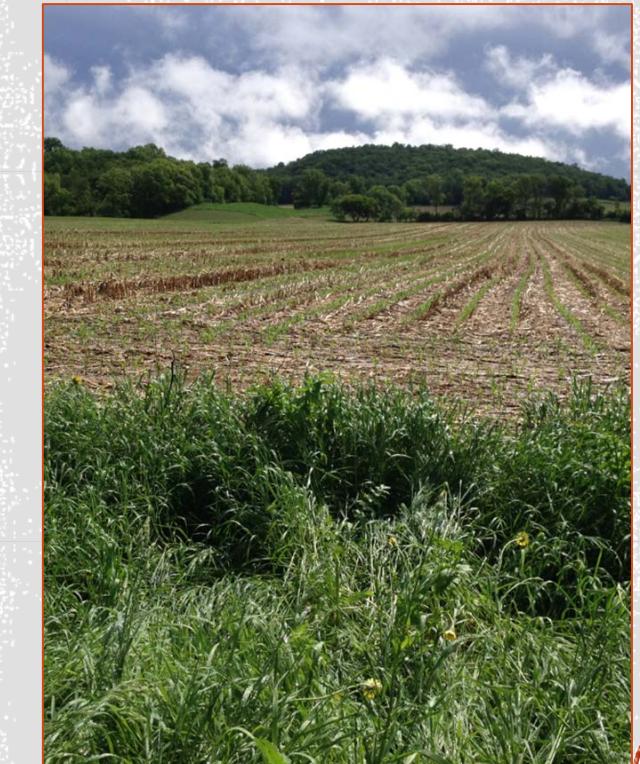
This is the soil saturation value at 6 inches output by the model. This is expressed as a fraction: $(\text{moisture} - \text{wilting-point moisture}) / (\text{saturation moisture} - \text{wilting-point moisture})$, and scaled to 0-100. Note that these are *not* measurements made by an instrument, but forecast values.

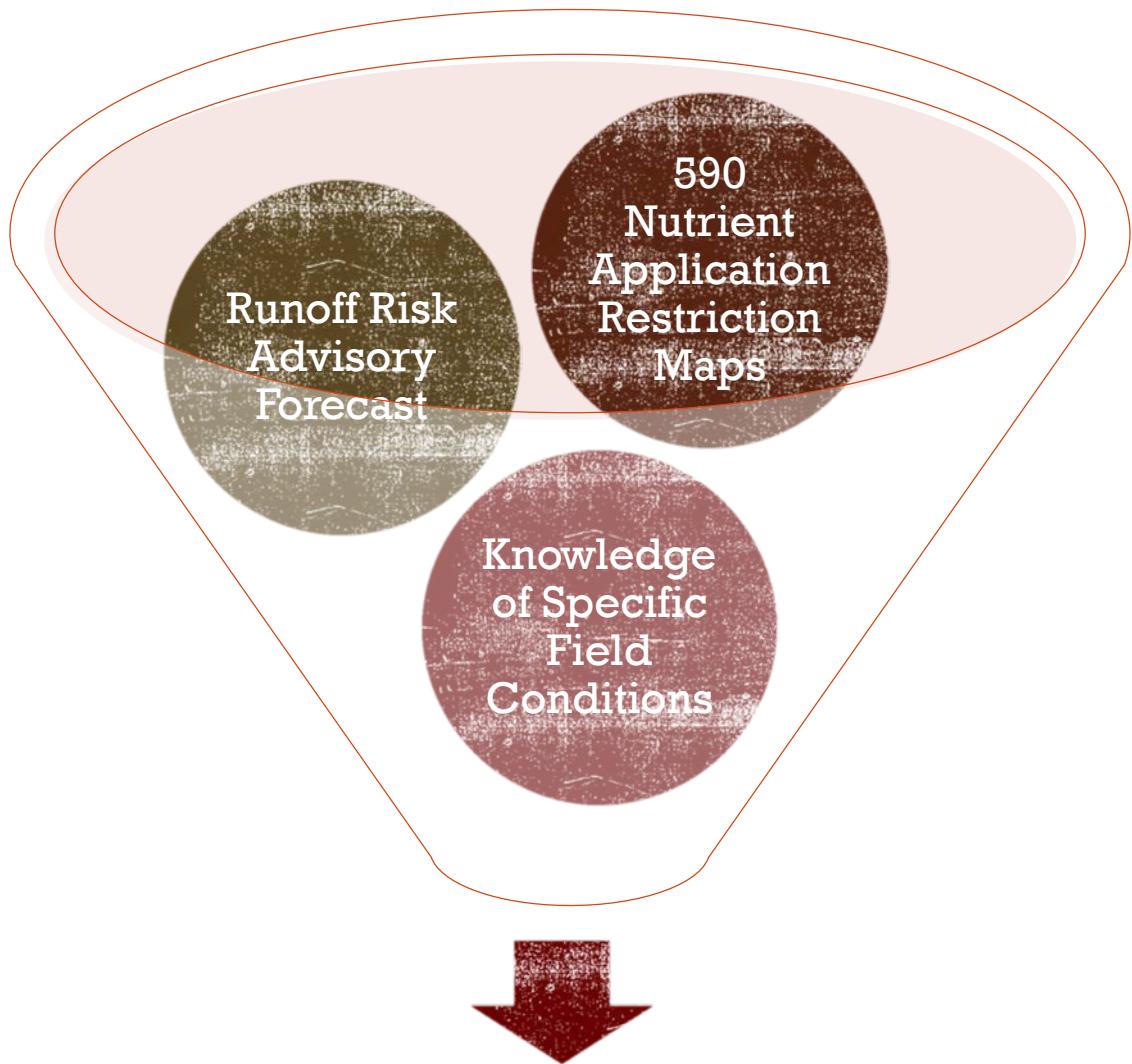
SOIL MOISTURE FORECAST

Social Science

- Answer the questions –
 - How do people use the website?
 - How do users interpret the forecast?
 - Is it intuitive?
 - What other resources, training can we provide?
 - Apps? Daily Notifications?
 - **Does this information translate into changes in behavior??**
- Partnering with UW-Madison, Discovery Farms, PNAAW, County LCDs, Private sector agronomists and ag co-ops

NEXT STEPS





**Better Decisions on the Timing
of Nutrient Applications**

IT'S A SYSTEM!

