



NutrientStar

**How to use the Technology Extrapolation Domains
Geospatial Framework (TEDs)
A TUTORIAL**





Why TEDs?

- ★ Traditional agriculture research conducted in a specific location
- ★ Difficult to interpret results beyond the immediate area of the trial
- ★ TEDs group sites by shared climate and soils characteristics (the conditions most impacting crop growth)
- ★ Concept was developed by Drs. Ken Cassman, Justin Van Wart, Patricio Grassini, Juan I. Rattalino Edreira and the University of Nebraska – Lincoln for the Global Yield Gap Atlas



If you are a farmer:

- ★ View results of product trials to see if trials were conducted in a region with similar climate and soils to your own.



If you conduct ag research:

- ★ You might want to consider conducting research in a variety of TEDs to capture varying climate and soils conditions
- ★ You can also see where trials you may have conducted currently fall within the TED framework



Components of the TEDs

★ Climate zonation, including

- Location-specific observed weather data
- Growing degree days (GDD)
- Annual aridity index (AI)
- Temperature seasonality (TS)
- Hierarchical zonation scheme (Van Wort *et al*, 2013)

★ Soil water storage capacity

- Root zone plant-available water holding capacity (RZPAWHC)
- Mapped at 250 x 250 m pixel size

★ Each unique TED = (CZ) + (RZPAWHC)

TED #s correspond to their components



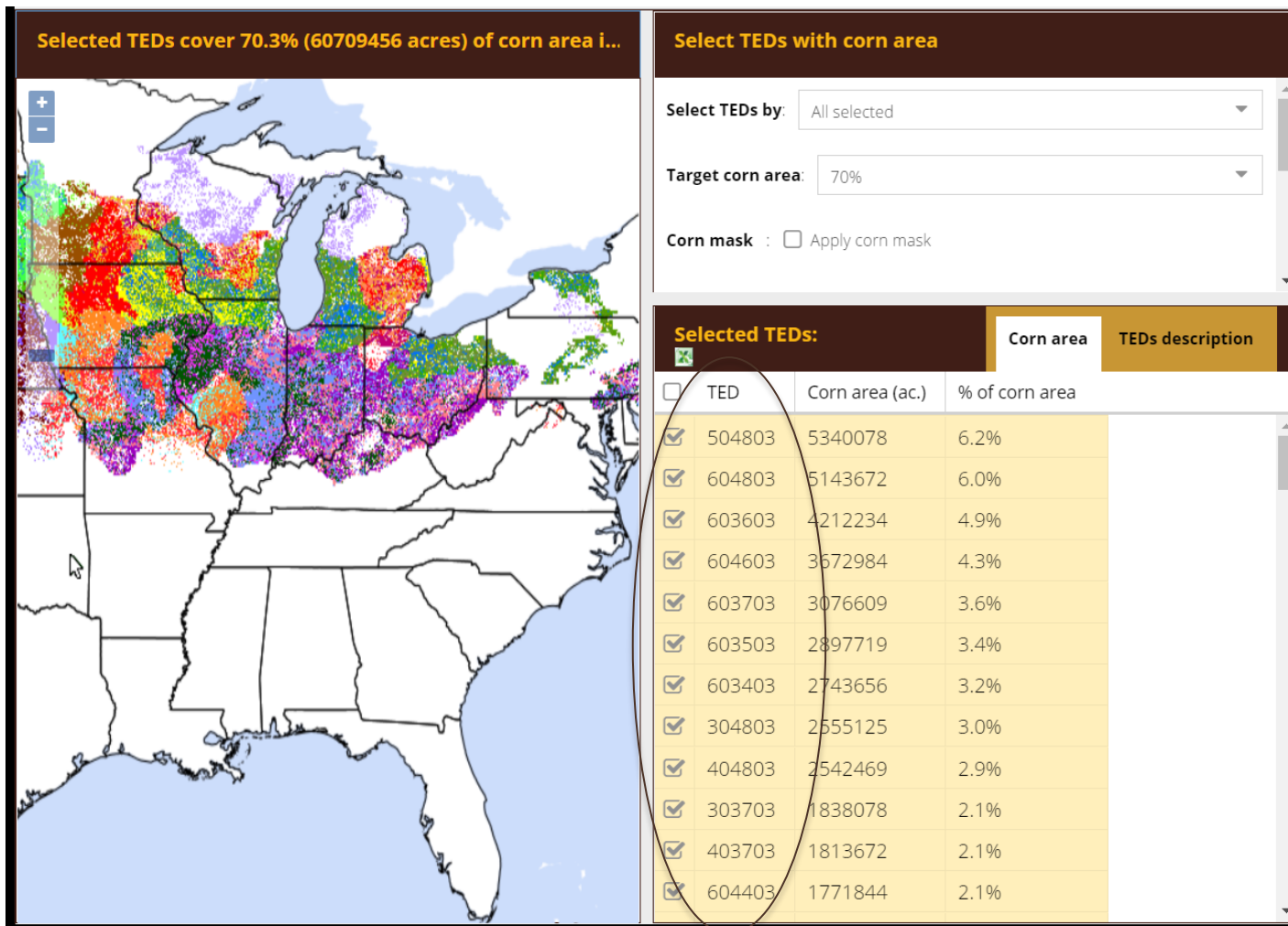
★ RZPAWHC = 800000

★ CZ:

- GDD = 6000
- AI = 800
- TS = 1

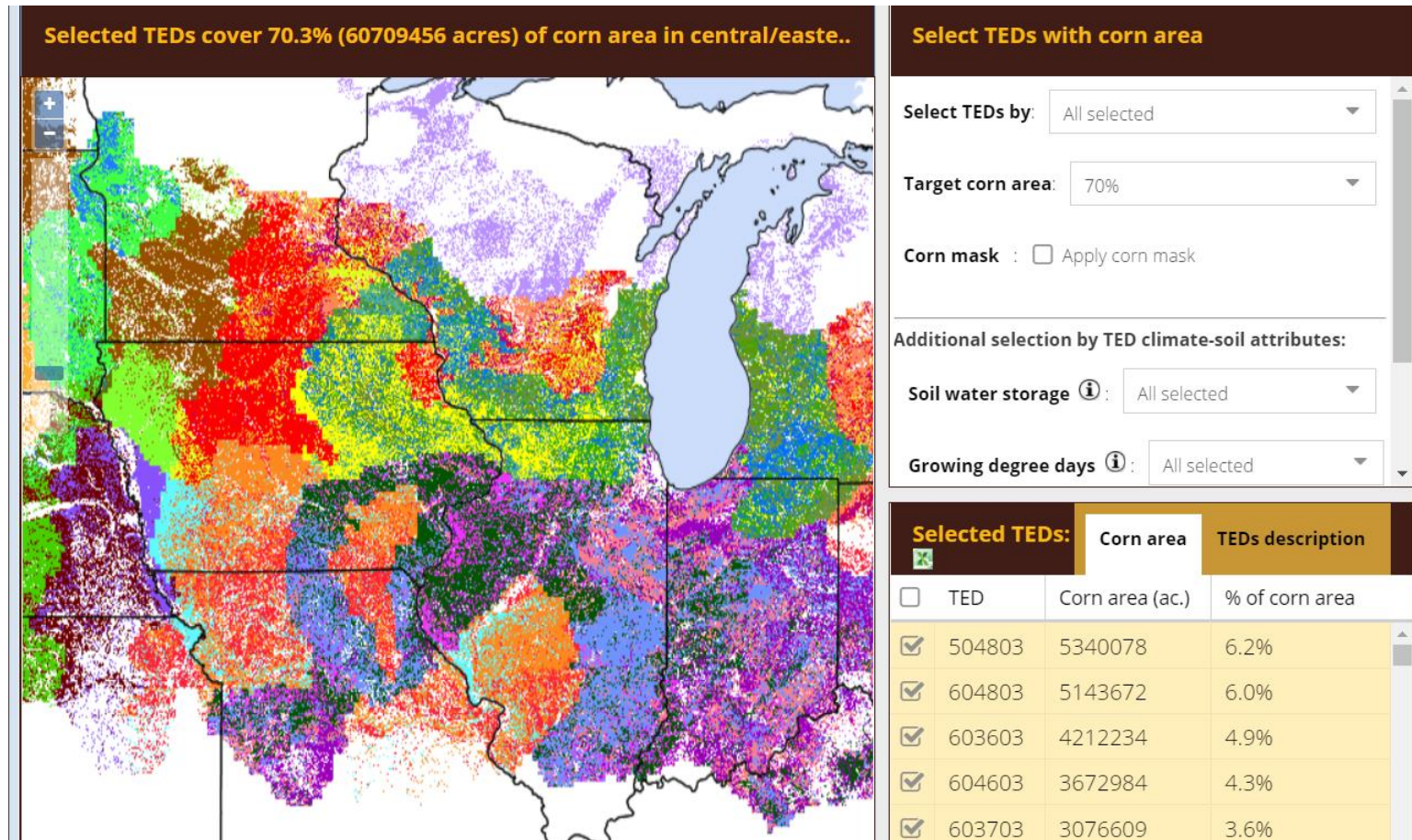
★ TED = CZ + RZPAWHC

How the TED #s appear on the website





How to use the TED interactive tool

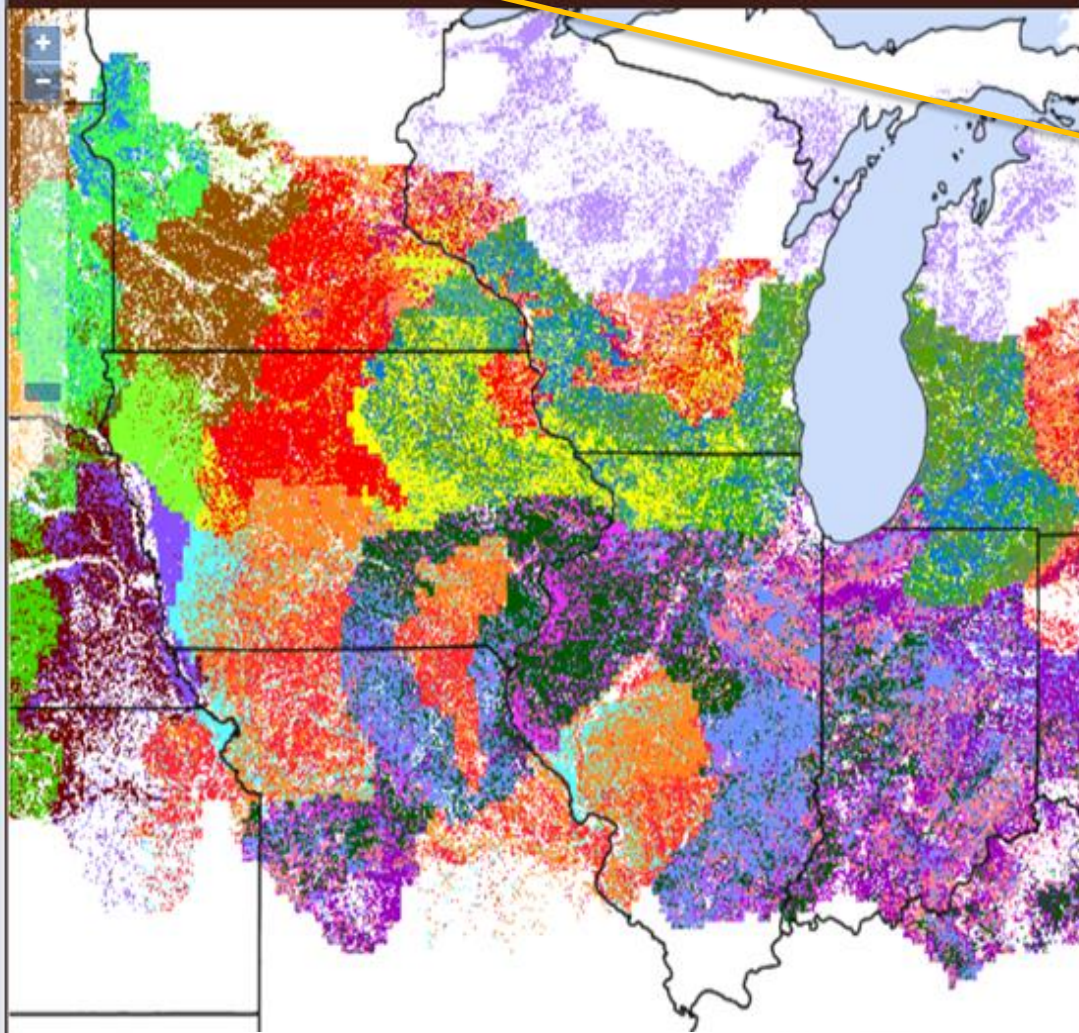




Selection drop-down menus

- ★ Users can select areas to display based on:
 - % of area that is capable of corn production in the US
 - Actual corn production (corn mask)
 - State
 - User-defined rectangle
 - TED climate-soil attributes

Selected TEDs cover 70.3% (60709456 acres) of corn area in central/easte..



Default target corn area when framework loads is 70%

Select TEDs with corn area

Select TEDs by: All selected

Target corn area: 70%

Corn mask : ☐ Apply corn mask

Additional selection by TED climate-soil attributes:

Soil water storage ⓘ : All selected

Growing degree days ⓘ : All selected

Selected TEDs:

Corn area		TEDs description	
<input type="checkbox"/>	TED	Corn area (ac.)	% of corn area
<input checked="" type="checkbox"/>	504803	5340078	6.2%
<input checked="" type="checkbox"/>	604803	5143672	6.0%
<input checked="" type="checkbox"/>	603603	4212234	4.9%
<input checked="" type="checkbox"/>	604603	3672984	4.3%
<input checked="" type="checkbox"/>	603703	3076609	3.6%
<input checked="" type="checkbox"/>	603503	2897719	3.4%
<input checked="" type="checkbox"/>	603403	2743656	3.2%
<input checked="" type="checkbox"/>	603303	2555435	3.0%

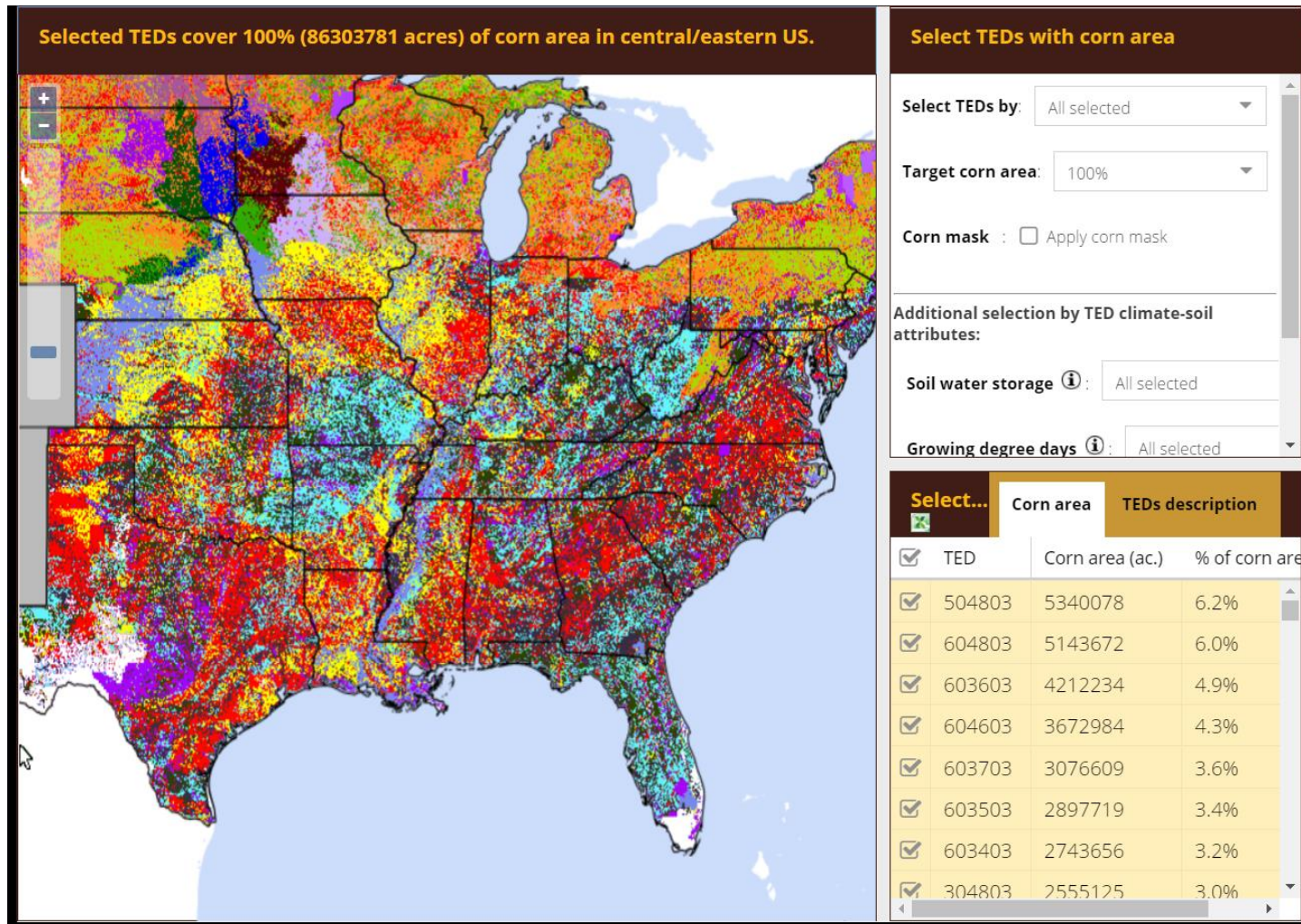


Important points to note:

- ★ When the tool first loads, you see only the TEDs that cover the top 70% of corn producing area in the US
- ★ You can choose to view any % of corn area up to 100% - but the tool performs less efficiently at 100% scale, and includes even areas with very small % of corn area (see next slide)
- ★ The pre-filter of 70% was chosen by the team to increase efficiency/speed loading

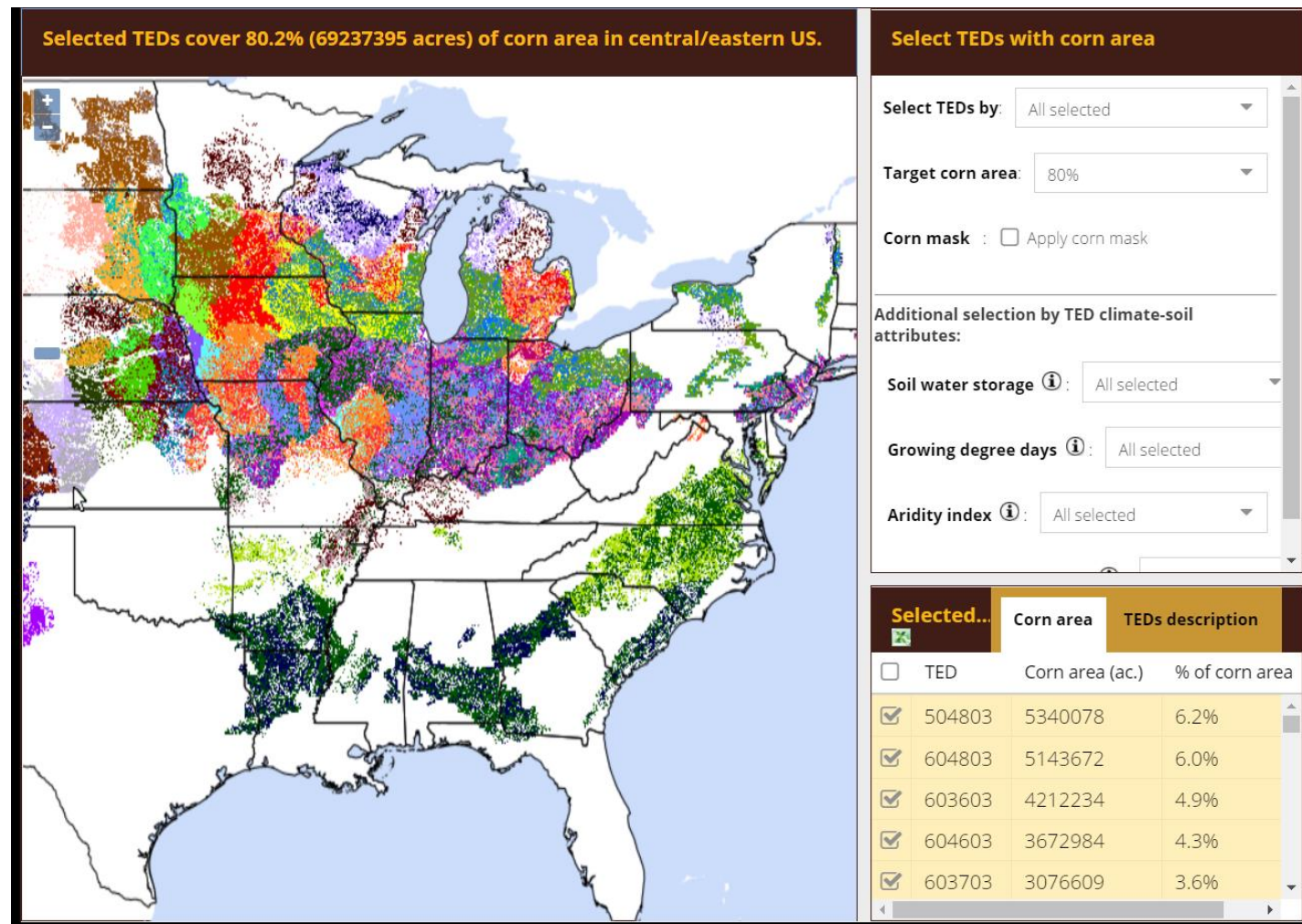


100% of corn area selected



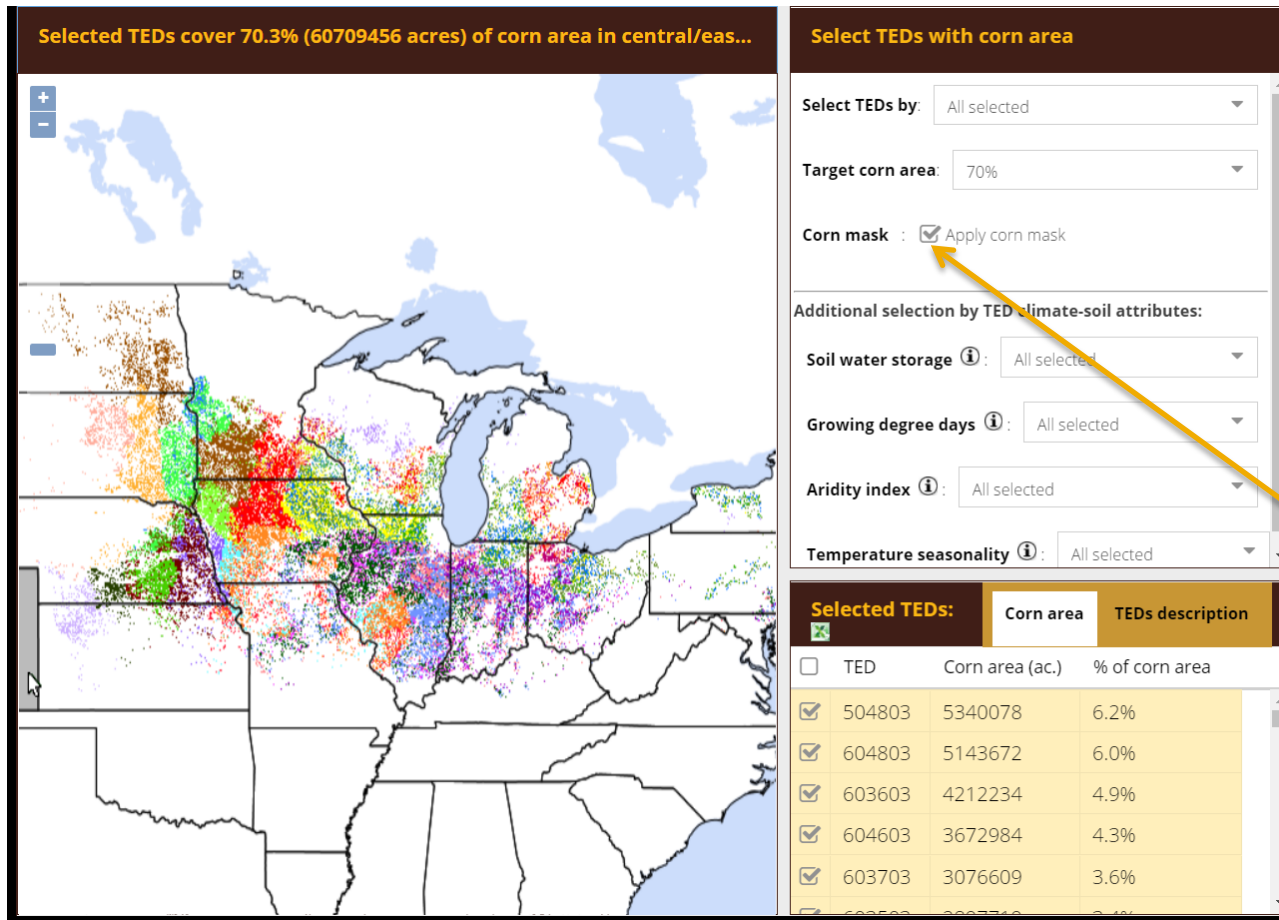


80% of corn area selected





Corn mask selection



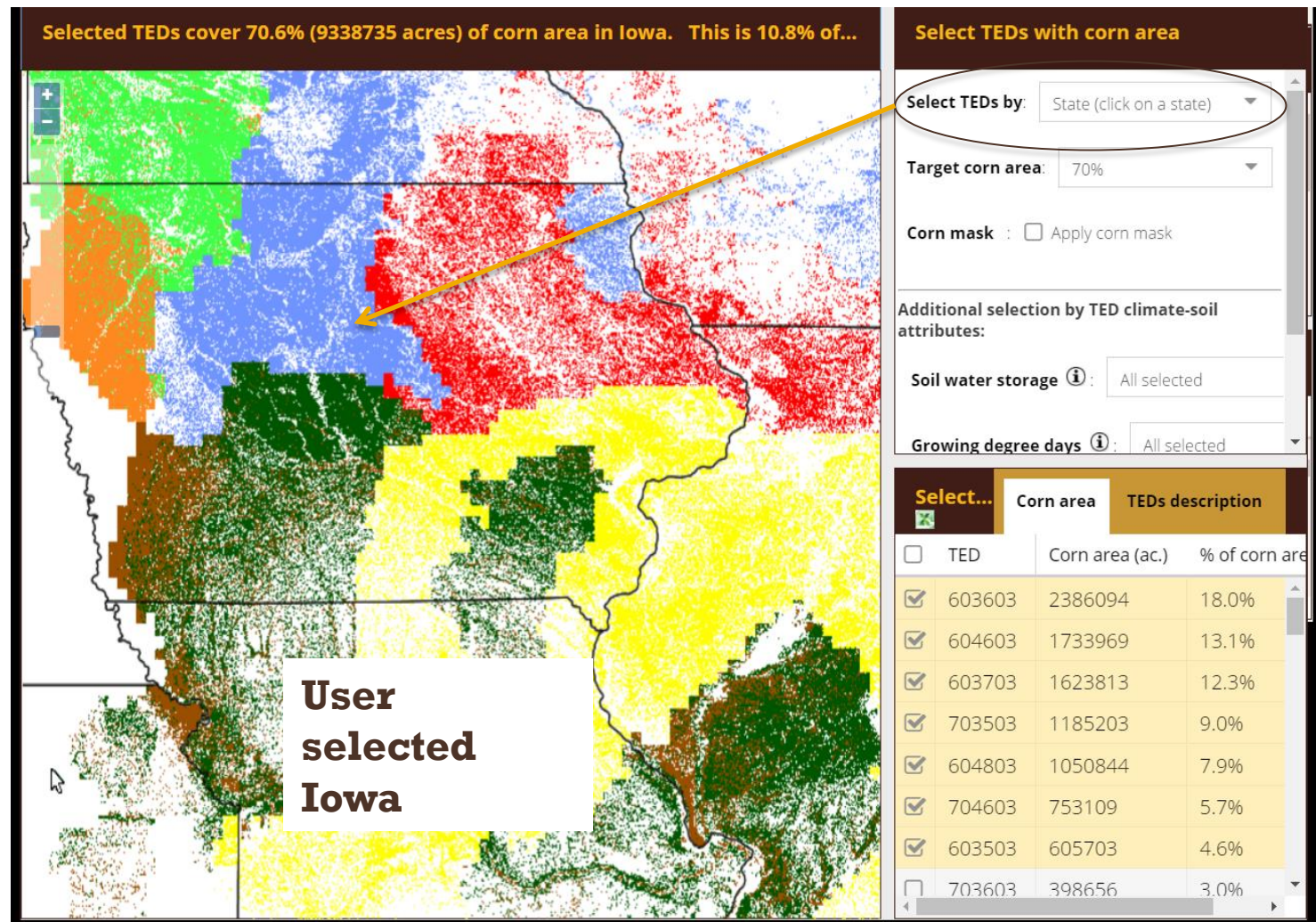
The TED framework classifies areas of similar climate and soils.

Selecting “apply corn mask” further filters areas where corn is produced.

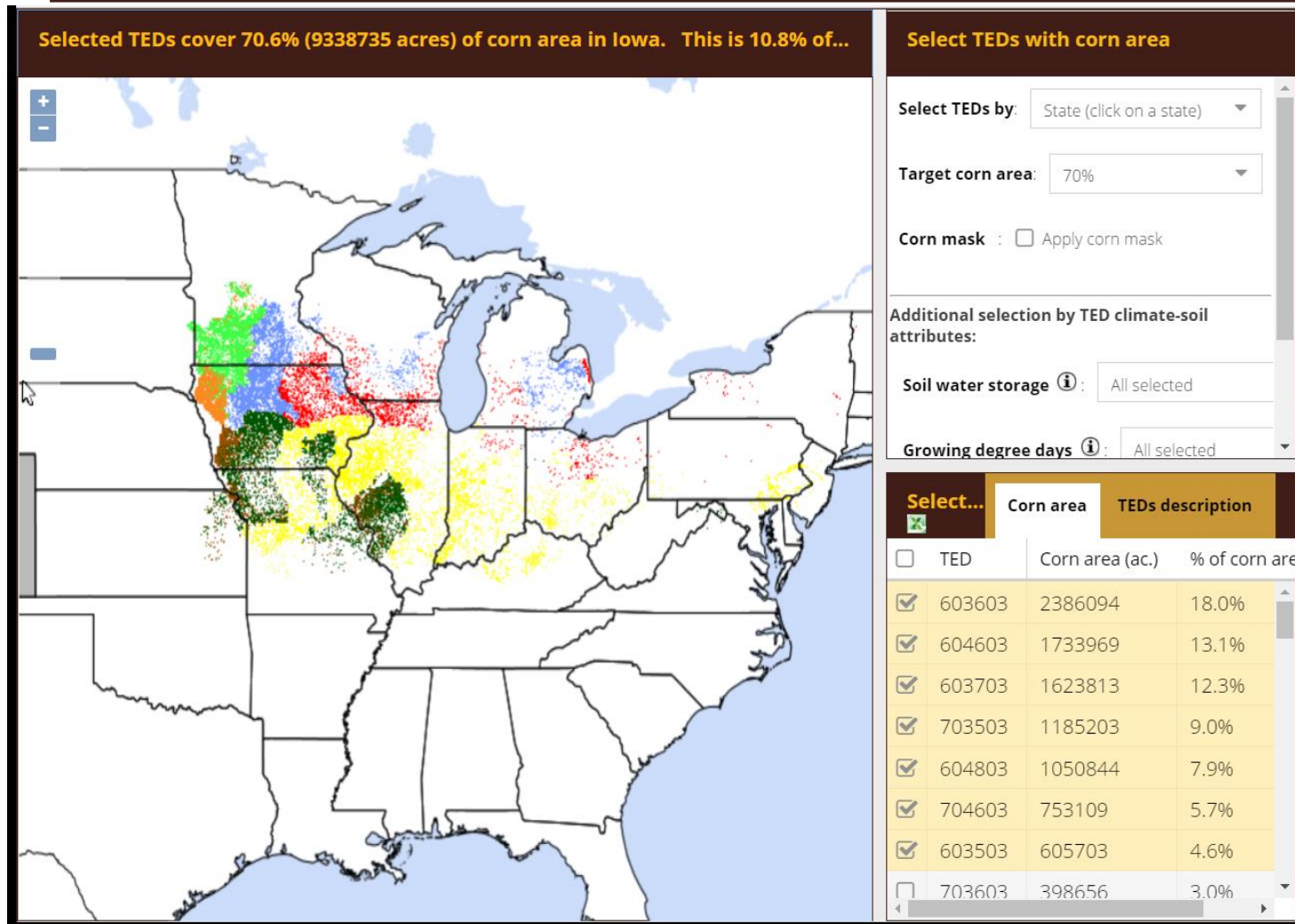
Corn mask is based on 2015 USDA-NASS crop area data map



Select by state

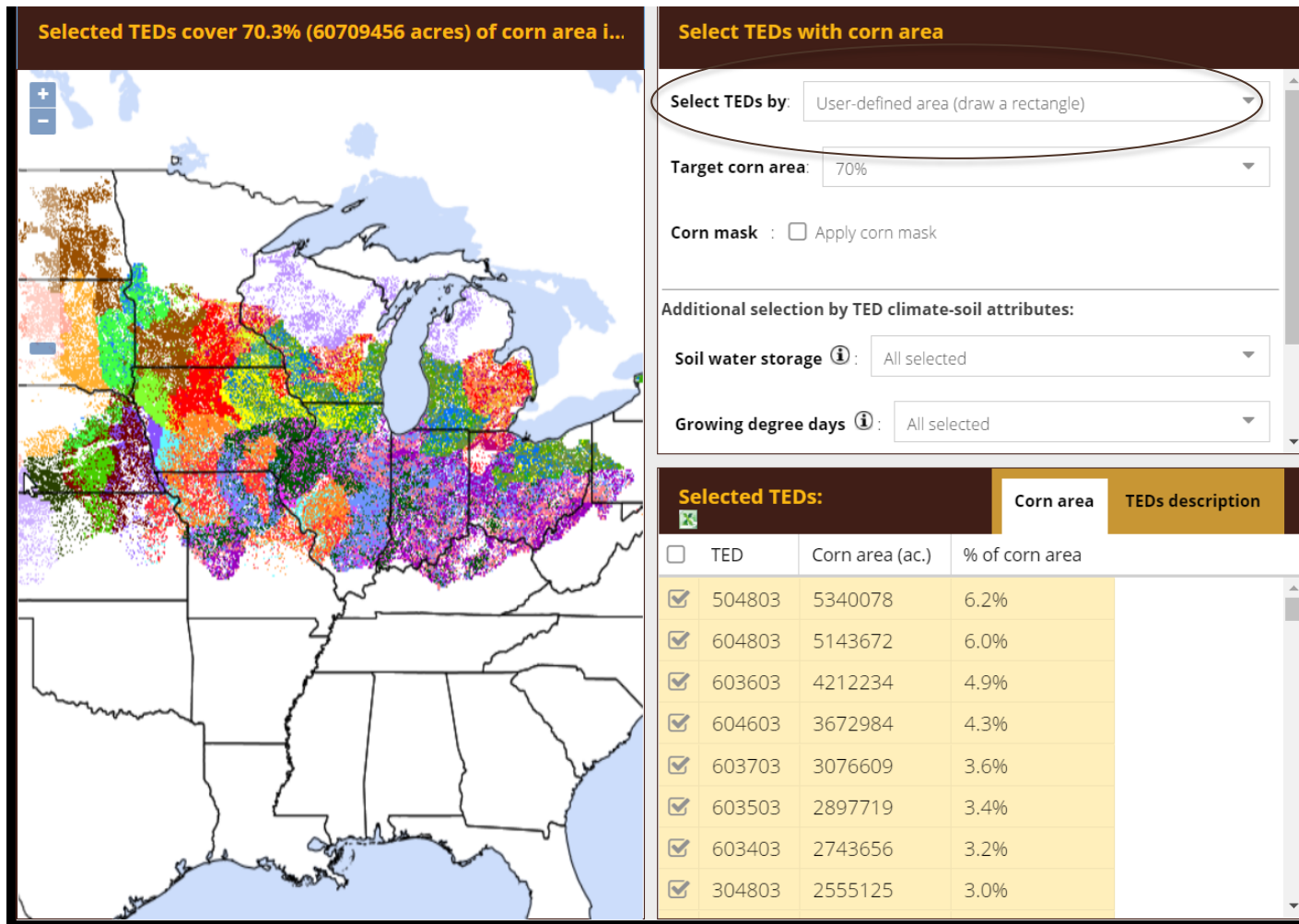


Inference zone for Iowa TEDs extends to other states

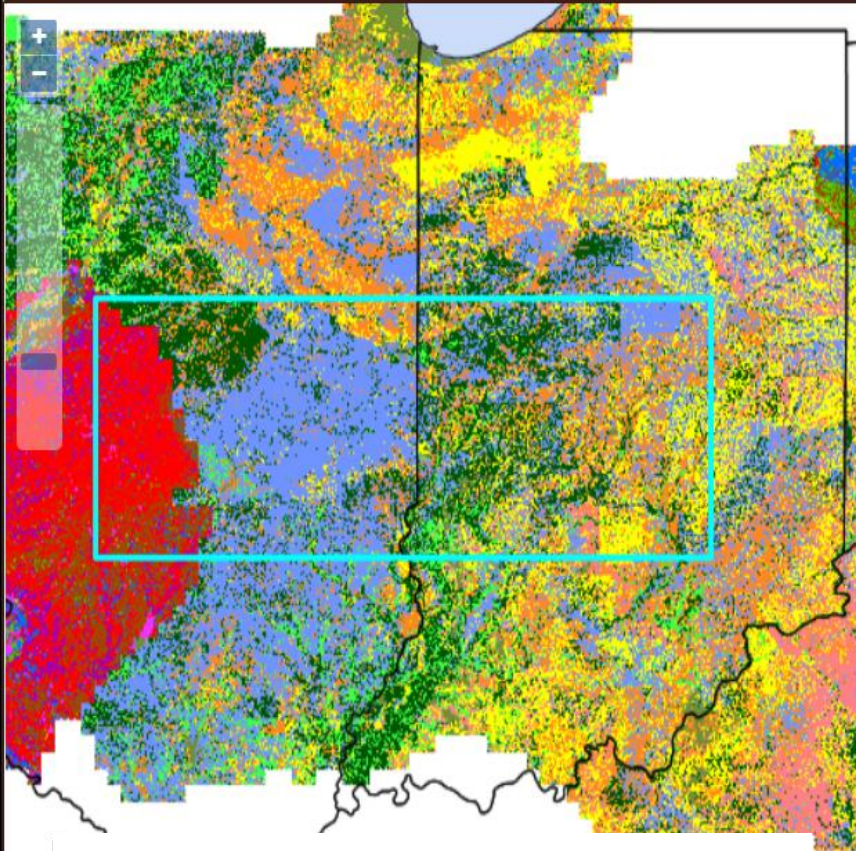




User-selected rectangle



Selected TEDs cover 100% (3955733 acres) of corn area in...



The user selected an area to display crossing two states and selected to view 100% of the TEDs within that rectangle

Select TEDs with corn area

Select TEDs by: User-defined area (draw a rectangle)

Target corn area: 100%

Corn mask : ☐ Apply corn mask

Additional selection by TED climate-soil attributes:

Soil water storage ⓘ : All selected

Growing degree days ⓘ : All selected

Selected TEDs:



Corn area

TEDs description

<input checked="" type="checkbox"/>	TED	Corn area (ac.)	% of corn area
<input checked="" type="checkbox"/>	504803	1596422	40.4%
<input checked="" type="checkbox"/>	604803	849906	21.5%
<input checked="" type="checkbox"/>	604603	473125	12.0%
<input checked="" type="checkbox"/>	404803	440656	11.1%
<input checked="" type="checkbox"/>	304803	265641	6.7%
<input checked="" type="checkbox"/>	504603	124094	3.1%
<input checked="" type="checkbox"/>	704803	105109	2.7%
<input checked="" type="checkbox"/>	704603	51734	1.3%

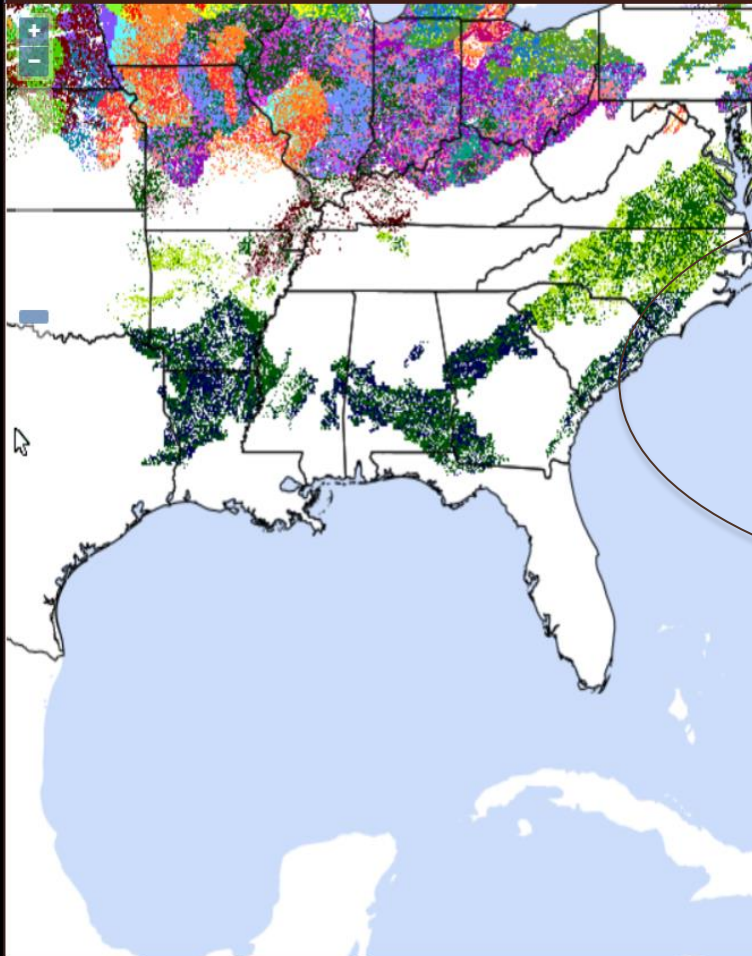


This feature allows users to upload any coordinates they wish to see which TED/s correspond to that location (note that the framework will include all TEDs within a 1-mile buffer of site)



Select by TED attributes

Selected TEDs cover 80.2% (69237395 acres) of corn area in ce...



Select TEDs with corn area

Select TEDs by: All selected

Target corn area: 80%

Corn mask : ☐ Apply corn mask

Additional selection by TED climate-soil attributes:

Soil water storage ⓘ : All selected

Growing degree days ⓘ : All selected

Aridity index ⓘ : All selected

Temperature seasonality ⓘ : All selected

Selected TEDs:

		Corn area	TEDs description
<input type="checkbox"/>	TED	Corn area (ac.)	% of corn area
<input checked="" type="checkbox"/>	504803	5340078	6.2%
<input checked="" type="checkbox"/>	604803	5143672	6.0%
<input checked="" type="checkbox"/>	603603	4212234	4.9%
<input checked="" type="checkbox"/>	604603	3672984	4.3%
<input checked="" type="checkbox"/>	603703	3076609	3.6%
<input checked="" type="checkbox"/>	603503	2827710	3.4%



Attributes selection

Corn mask : ☐ Apply corn mask

Additional selection by TED climate-soil attrib

Soil water storage ⓘ : 150 - 200 mm

ⓘ : All selected

ⓘ : All selected

ⓘ : All selected

Soil water storage

Soil water storage (in mm) represents the plant-available soil water in the root zone. There are 7 classes ranging from 0-50 mm (low soil water storage) to >300 mm (high soil water storage)

OK

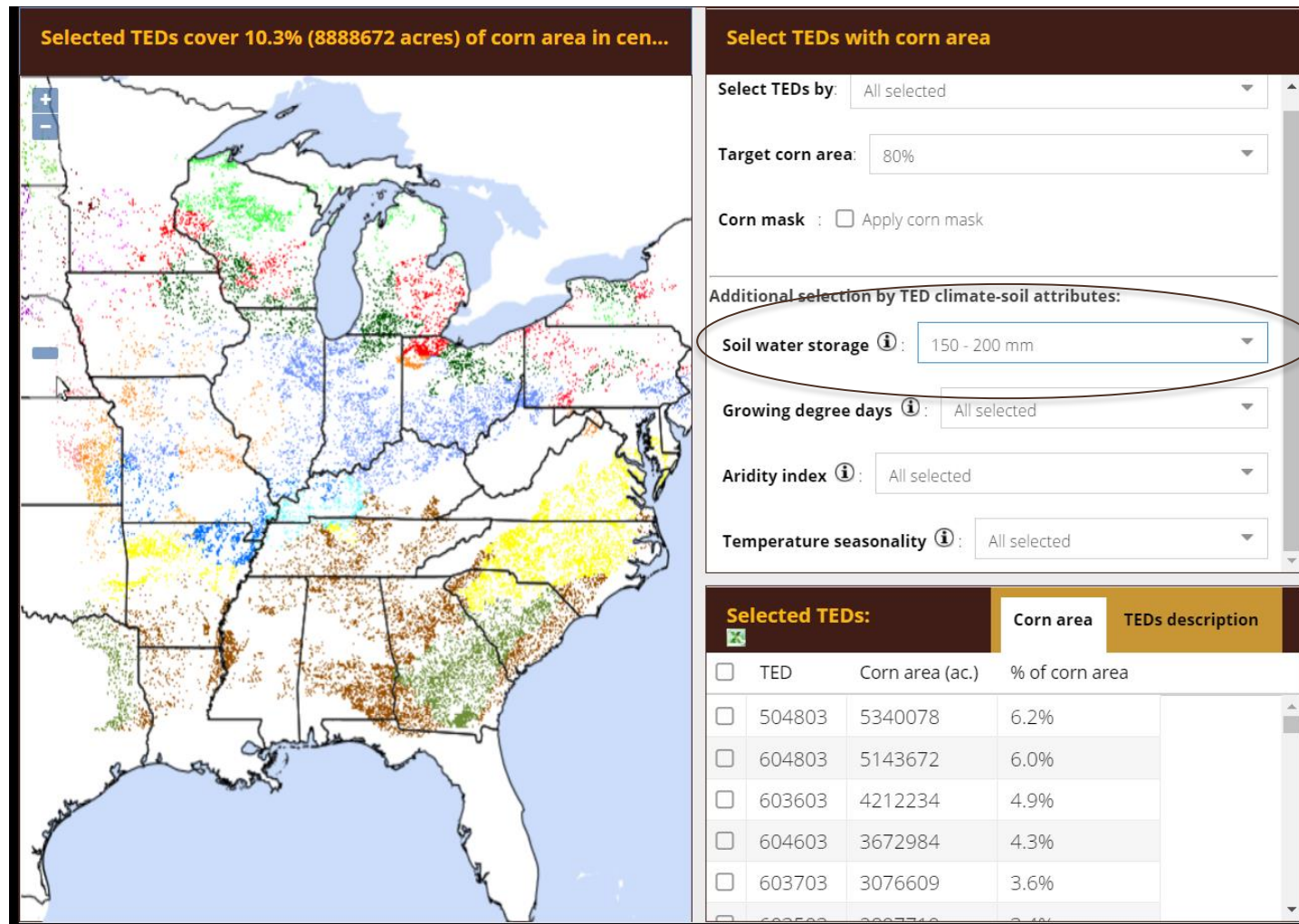
Selected TEDs:

☑ TED Corn area (ha) % of corn

Click on the information icon for a definition of the attribute



Select areas by soil water storage





Select by GDD

Selected TEDs cover 40.4% (34824583 acres) of corn area in ce...

Select TEDs with corn area

Select TEDs by: All selected

Target corn area: 70%

Corn mask : ☐ Apply corn mask

Additional selection by TED climate-soil attributes:

Soil water storage ⓘ: All selected

Growing degree days ⓘ: 3792 - 4829


Aridity index ⓘ: All selected

Temperature seasonality ⓘ: All selected

Selected TEDs:		Corn area	TEDs description
<input type="checkbox"/>	TED	Corn area (ac.)	% of corn area
<input checked="" type="checkbox"/>	504803	5340078	6.2%
<input checked="" type="checkbox"/>	604803	5143672	6.0%
<input type="checkbox"/>	603603	4212234	4.9%
<input checked="" type="checkbox"/>	604603	3672984	4.3%
<input type="checkbox"/>	603703	3076609	3.6%
<input type="checkbox"/>	603503	2887710	3.4%



Select by multiple attributes




Additional selection by TED climate-soil attributes:

Soil water storage ⓘ : 200 - 250 mm

Growing degree days ⓘ : 3792 - 4829

Aridity index ⓘ : 10182 - 12876

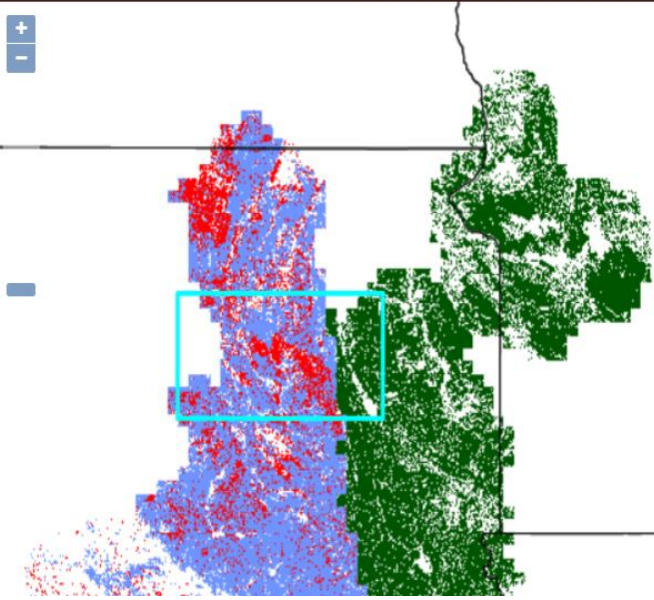
Temperature seasonality ⓘ : High

Selected TEDs:		Corn area	TEDs description
			
<input type="checkbox"/>	TED	Corn area (ac.)	% of corn area
<input checked="" type="checkbox"/>	504803	5340078	6.2%
<input type="checkbox"/>	604803	5143672	6.0%
<input type="checkbox"/>	603603	4212234	4.9%
<input type="checkbox"/>	604603	3672984	4.3%
<input type="checkbox"/>	603703	3076609	3.6%
<input type="checkbox"/>	603503	2887710	3.4%



Export feature

Selected TEDs cover 79.3% (539454 acres) of corn area in the s...



The user selects an area and clicks on the Excel icon

Select TEDs with corn area

Select TEDs by: User-defined area (draw a rectangle)

Target corn area: 70%

Corn mask : ☐ Apply corn mask

Additional selection by TED climate-soil attributes:

Soil water storage ⓘ: All selected

Growing degree days ⓘ: All selected

Aridity index ⓘ: All selected

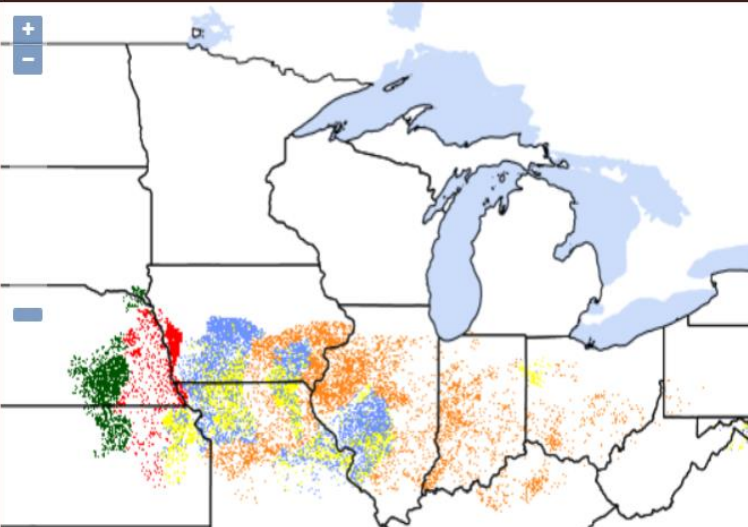
Temperature seasonality ⓘ: All selected

Selected TEDs:		Corn area	TEDs description
<input type="checkbox"/>	TED	Corn area (ac.)	% of corn area
<input checked="" type="checkbox"/>	603303	287266	42.2%
<input checked="" type="checkbox"/>	603403	139516	20.5%
<input checked="" type="checkbox"/>	503303	112672	16.6%
<input type="checkbox"/>	603203	59328	8.7%
<input type="checkbox"/>	403303	32047	4.7%
<input type="checkbox"/>	603303	12173	1.8%



Practical application

Selected TEDs cover 15.2% (13094063 acres) of corn area in ce...



The NutrientStar AGROTAIN report lists TEDs in which trials were conducted – these TEDs are shown above as they would be selected on the interactive website. Results by TED are listed in the AGROTAIN report.

Select TEDs with corn area

Select TEDs by: All selected

Target corn area: 70%

Corn mask : ☐ Apply corn mask

Additional selection by TED climate-soil attributes:

Soil water storage ⓘ: All selected

Selected TEDs:



Corn area

TEDs description

<input type="checkbox"/>	TED ↓	Corn area (ac.)	% of corn area
<input type="checkbox"/>	605802	171594	0.2%
<input type="checkbox"/>	605703	367109	0.4%
<input type="checkbox"/>	605102	157656	0.2%
<input checked="" type="checkbox"/>	604803	5143672	6.0%
<input checked="" type="checkbox"/>	604603	3672984	4.3%
<input type="checkbox"/>	604503	1542453	1.8%
<input checked="" type="checkbox"/>	604403	1771844	2.1%
<input type="checkbox"/>	604303	207688	0.2%
<input type="checkbox"/>	604203	363266	0.4%
<input type="checkbox"/>	604103	260391	0.3%
<input type="checkbox"/>	603703	2076600	2.5%



For more information

Contact the
NutrientStar team at
info@nutrientstar.org