Global Yield Gap Atlas

Technology Extrapolation Domains (TEDs)

Tool tutorial

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TED justifications

- Traditional agricultural research is mostly conducted at specific locations.
- It’s a challenge to interpret results and upscale them to larger spatial scales
- TEDs classify sites based on key climate and soil factors that govern crop yield.
- Concept was developed in the context of the Global Yield Gap Atlas project.
- TEDs have been developed for the Unites States (US) and sub-Saharan Africa.

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TED applications

- If you are a farmer:

  View results of product trials to see if trials were conducted in regions with similar climate and soils to yours.

- If you conduct ag research:

  You might want to consider conducting research in a variety of TEDs to capture varying climate and soil conditions and represent well the main crop producing areas and/or those where your product is expected to deliver the largest impact.

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TED interactive tool website

https://www.toolted.org/

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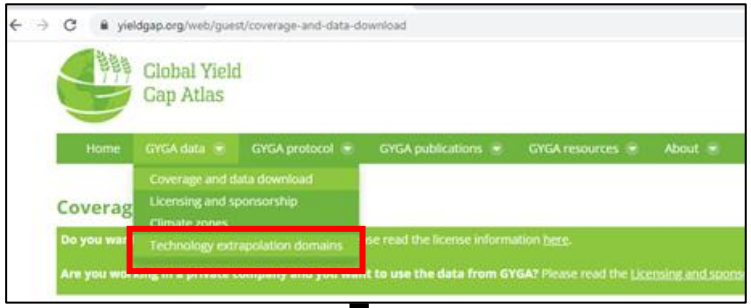
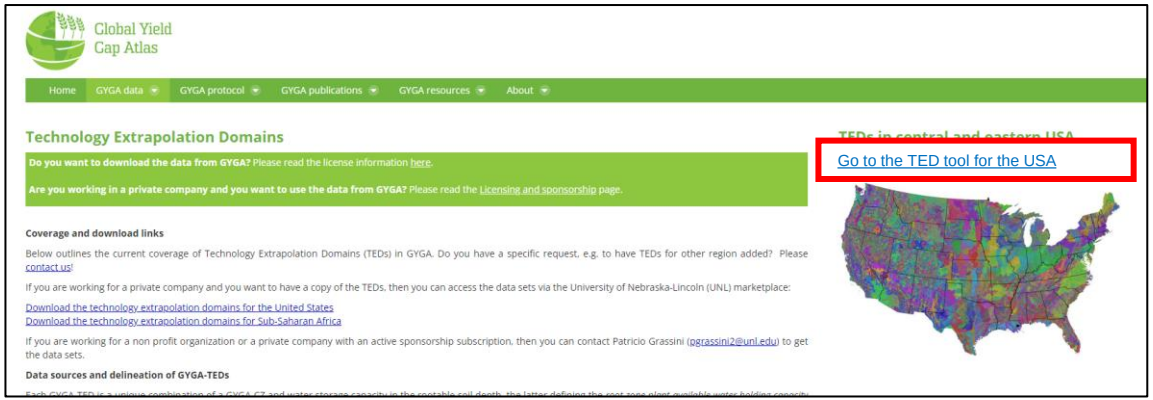
Access TED interactive tool via GYGA

From GYGA Homepage, click on GYGA data -> Technology extrapolation domain



Click on the link that will direct to TED tool



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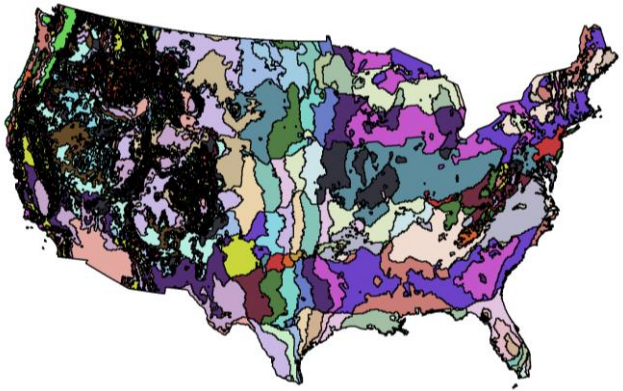
Components of TEDs

Unique TED = CZ + RZWHC

Climate Zones (CZ)

- Growing degree days (GDD)
- Aridity index (AI)
- Temperature seasonality (TS)

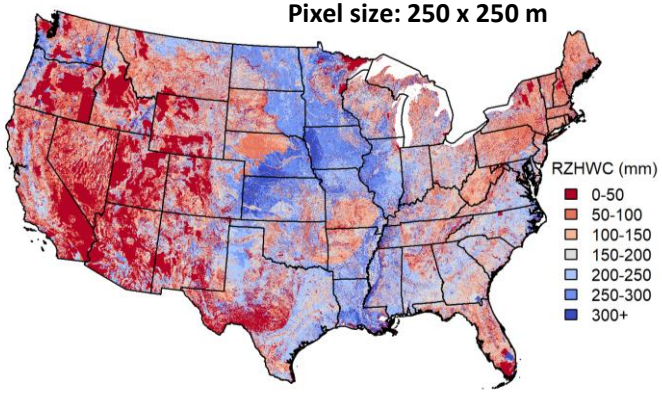


Source: van Wart et al.(2013)

Soil water storage capacity

- Root-zone water holding capacity (RZWHC)

Pixel size: 250 x 250 m



Source: gSSURGO, USDA-NRCS

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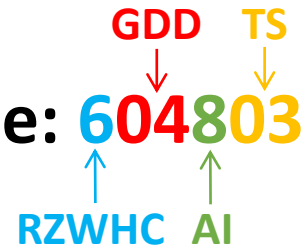
Values of TEDs based on components

TED = CZ + RZWHC

Each number is a code associated with a specific range of climatic and soil conditions.

Example TED value: 604803



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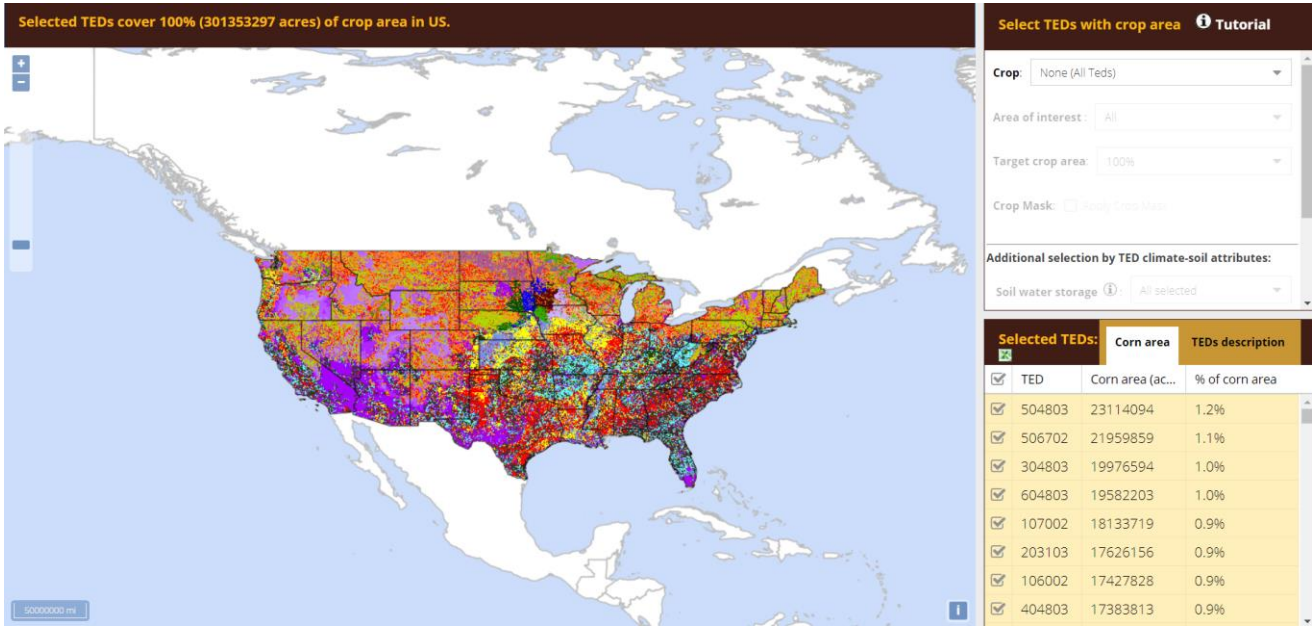
TED interactive tool



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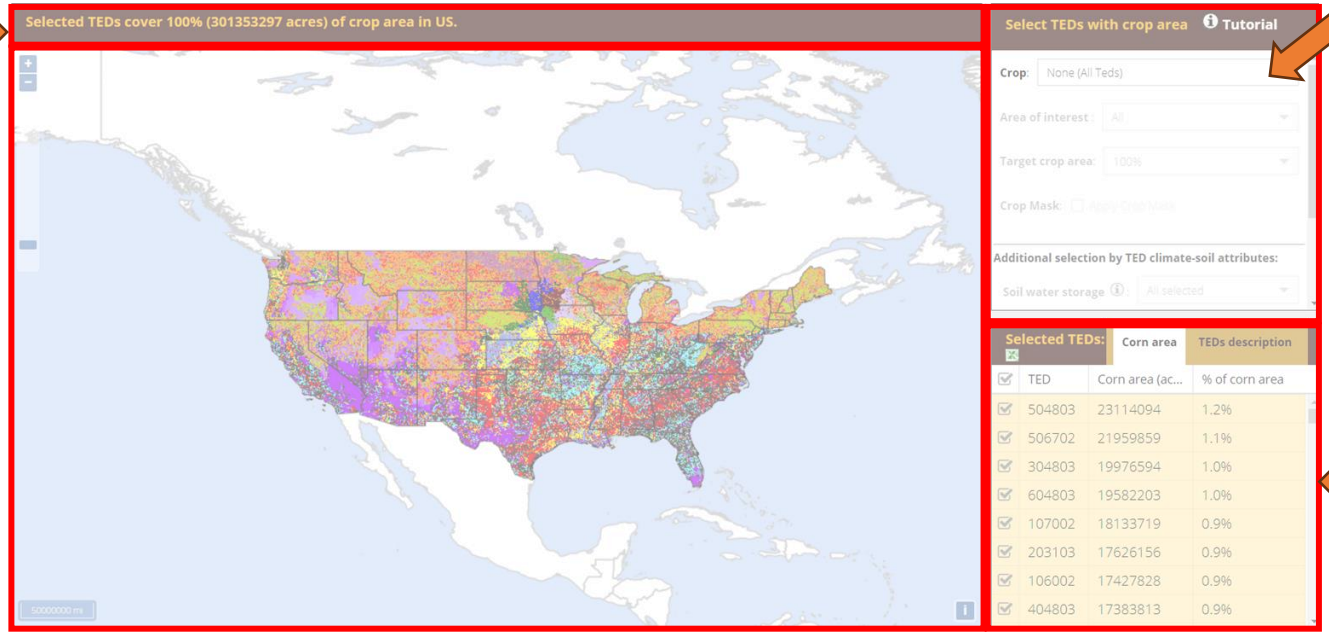
TED Tool layout

map header

TED selection menu



Selected TEDs table

interactive map

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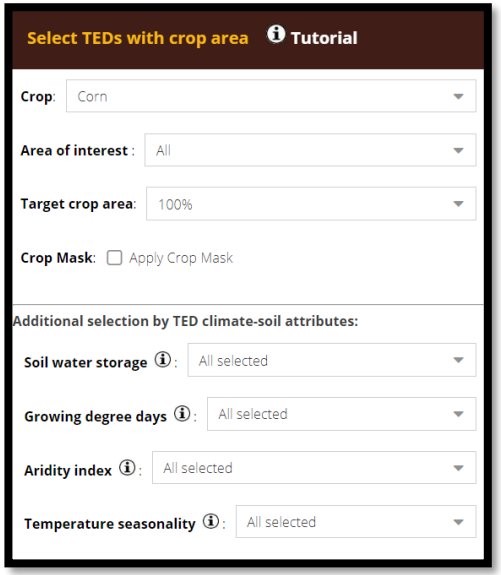
TED selection menu

For each crop, users can select areas to display based on:

1. Crop
2. Area of interest
3. Target crop area
4. Actual crop producing areas (crop mask)
5. TED climate-soil attributes
    - Soil water storage
    - Growing degree days
    - Aridity Index
    - Temperature seasonality



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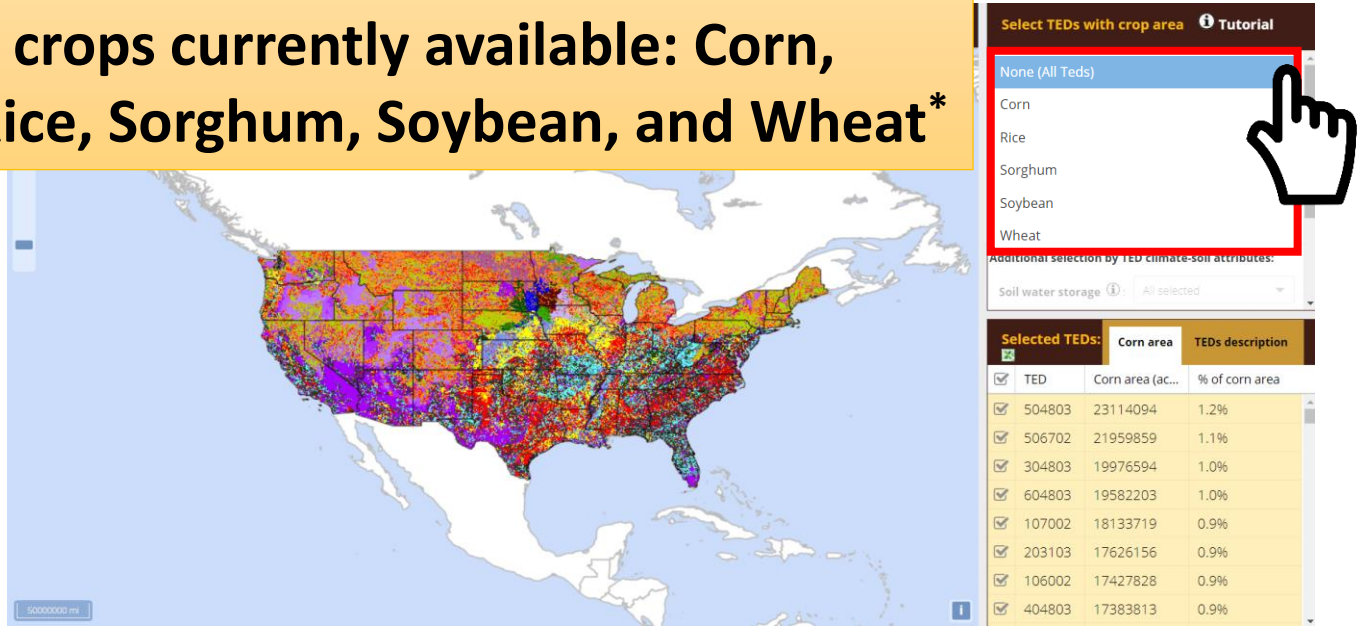
1. Select Crop

The first step is crop selection. This enables the other selection options.

5 crops currently available: Corn, Rice, Sorghum, Soybean, and Wheat*



* Wheat includes winter wheat, spring wheat, and durum wheat

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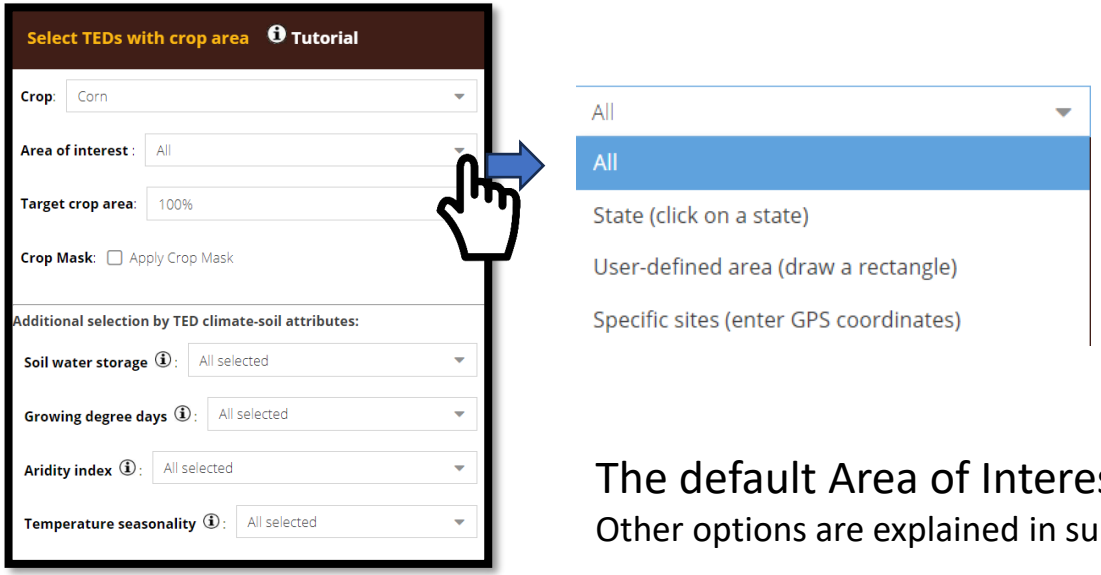
2. Area of interest



The default Area of Interest is the entire USA.

Other options are explained in subsequent slides.

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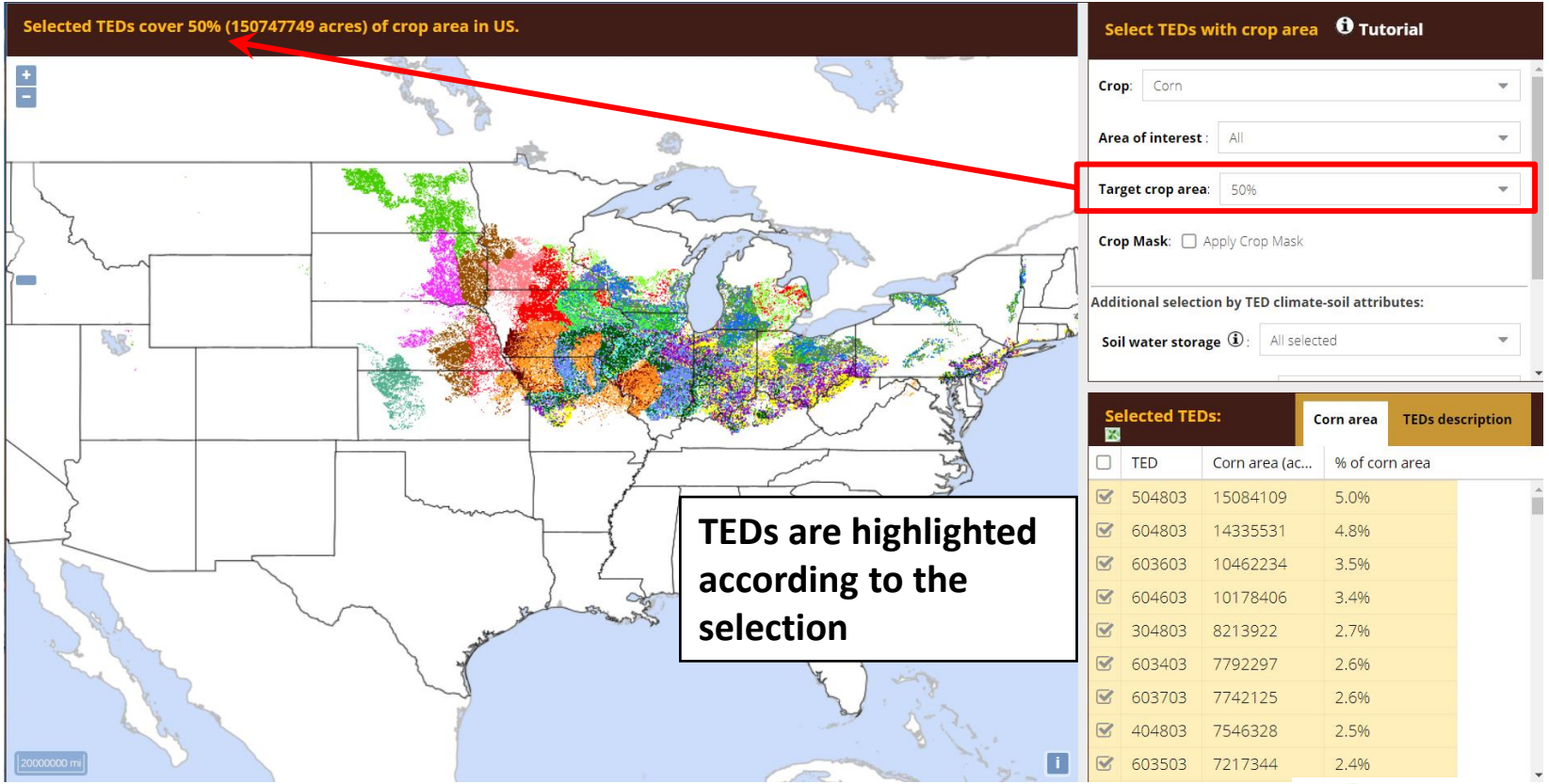
3. Target crop area



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TED selection – Important notes

- When the tool first loads, it shows all TEDs in the US

- The user can choose to view any % of crop area up to 100% - but when many TEDs are selected (e.g., those that cover 70% of all corn area in the US), each TED cannot be represented by a unique color, and the selection includes many TEDs with very small crop area.

- To better visualize the extent of each TED when the area of interest is the entire USA, we recommend selecting a crop area of 50% or less

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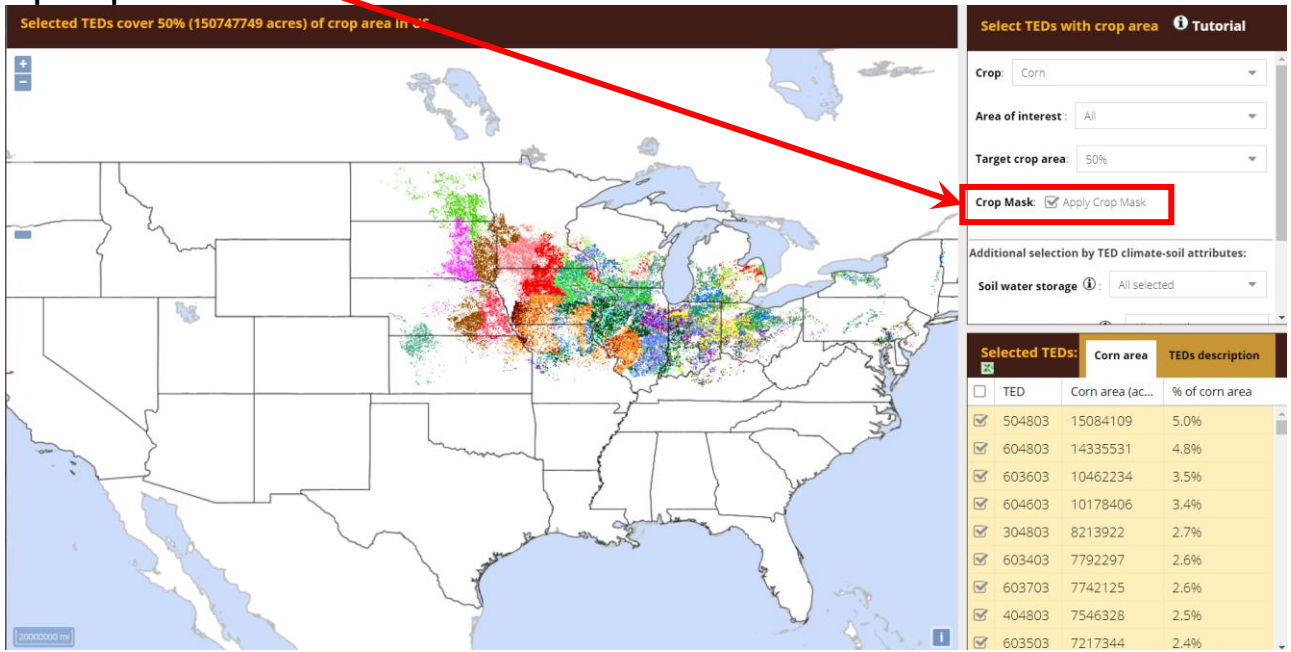
4. Actual crop production (corn mask)

Checking “apply crop mask” further filters areas where the selected crop is produced



Crop masks are based on 2008-2021 USDA-NASS cropland data layers.

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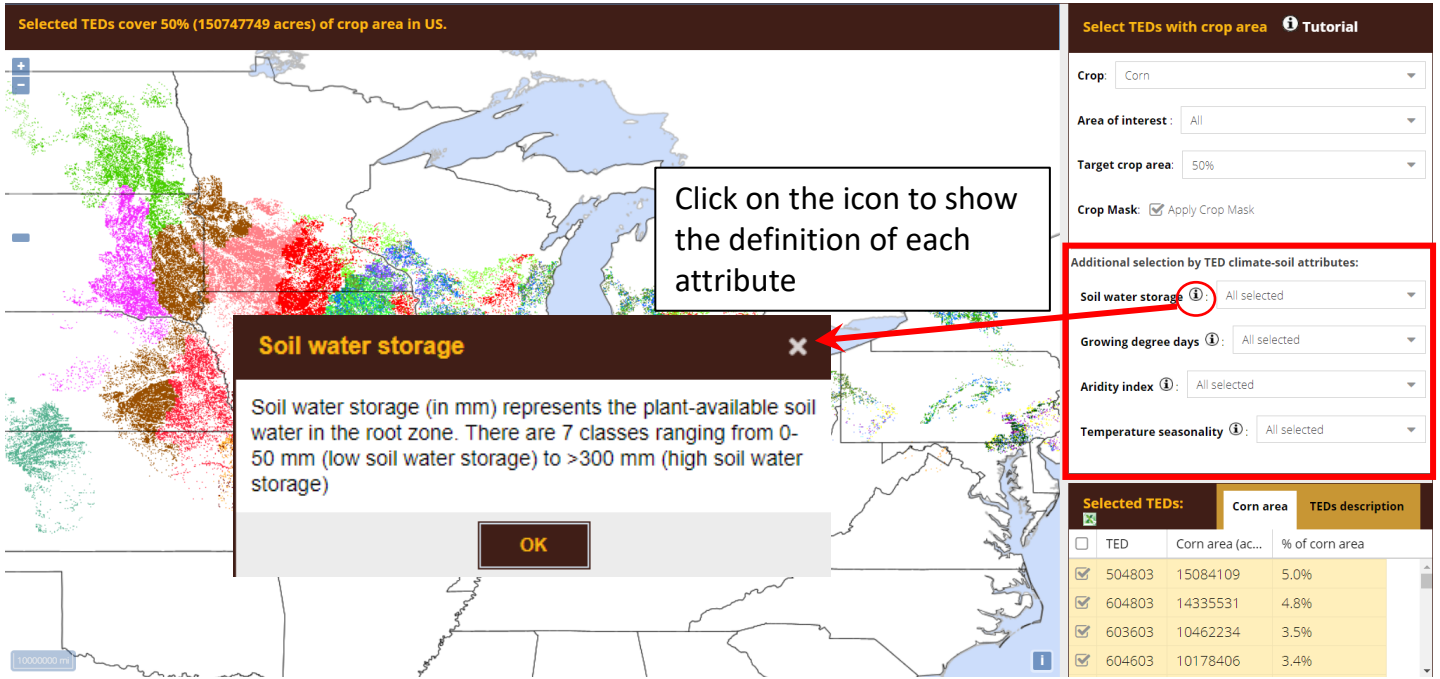
4. TED climate-soil attributes



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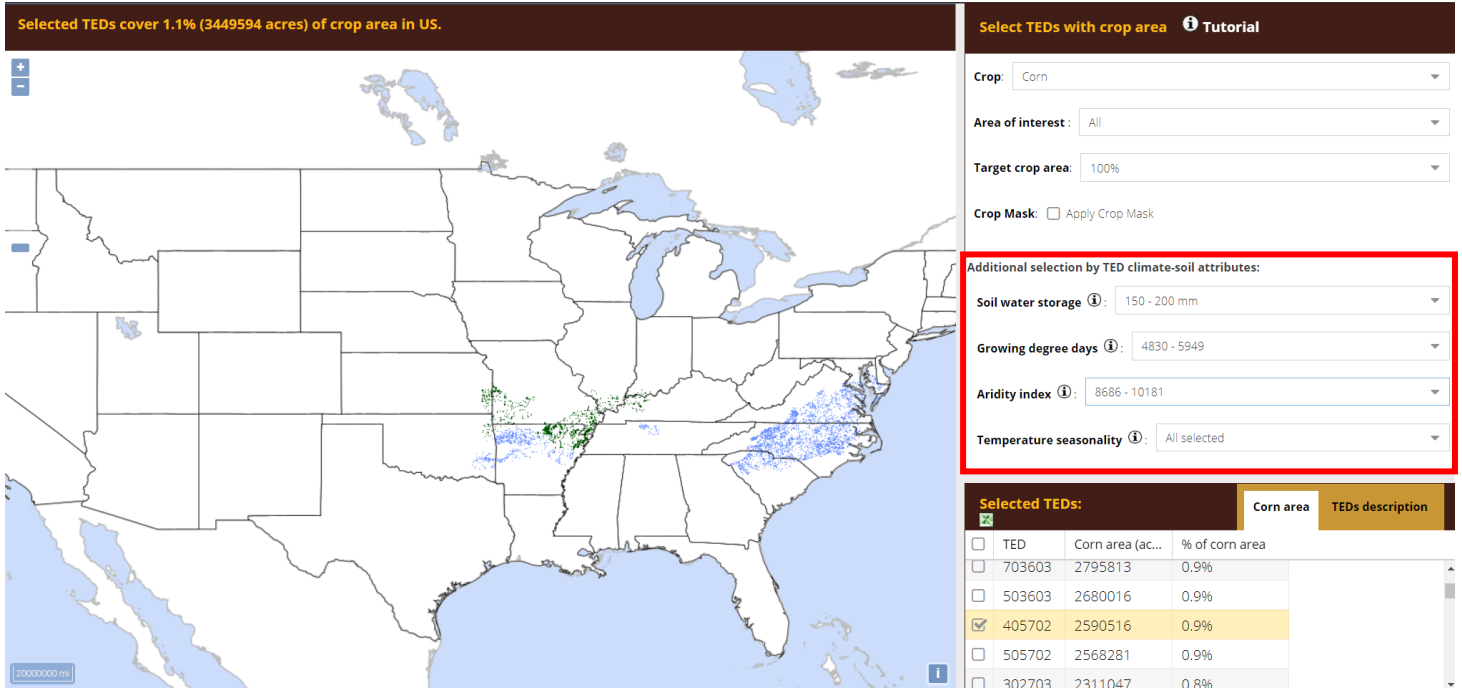
4. TED climate-soil attributes

You can select by combination of the 4 attributes defining TEDs



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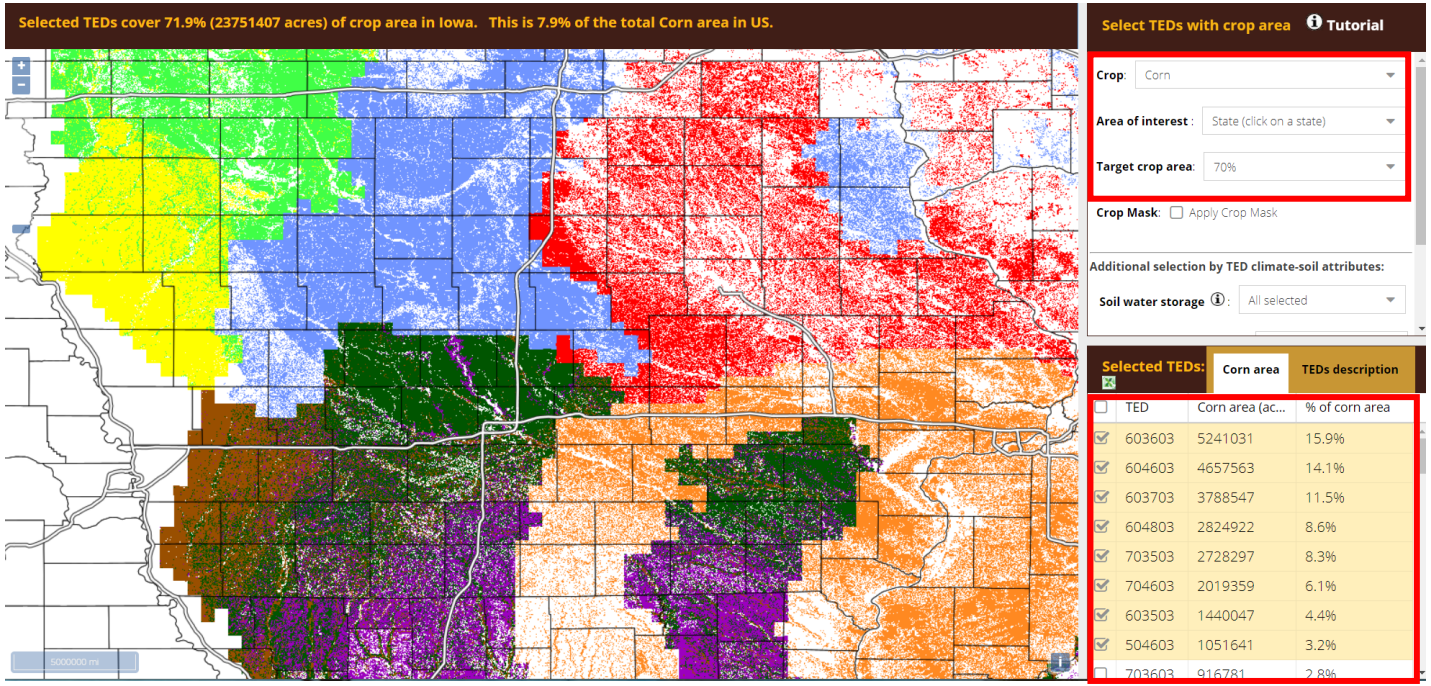
2.b. Area of interest: Select by State



Example: user selected **70% of corn in Iowa**

Each color corresponds to one TED. In the case of Iowa, production areas were categorized into **eight TEDs.** Zooming out, the TED tool will show other areas where the same seven TEDs are found (*see next slide*).

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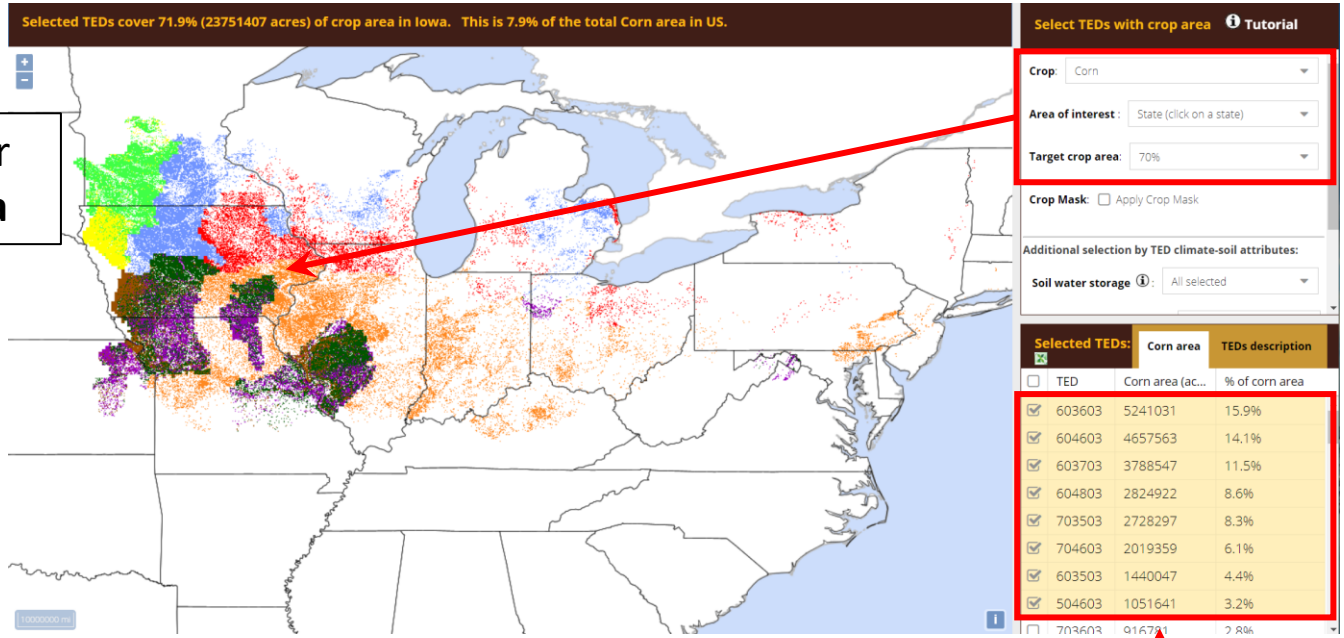
TEDs in Iowa extends to other states

Example: user selected **Iowa**



Each color corresponds to TED. In case of Iowa, production area were categorized into **eight TEDs**

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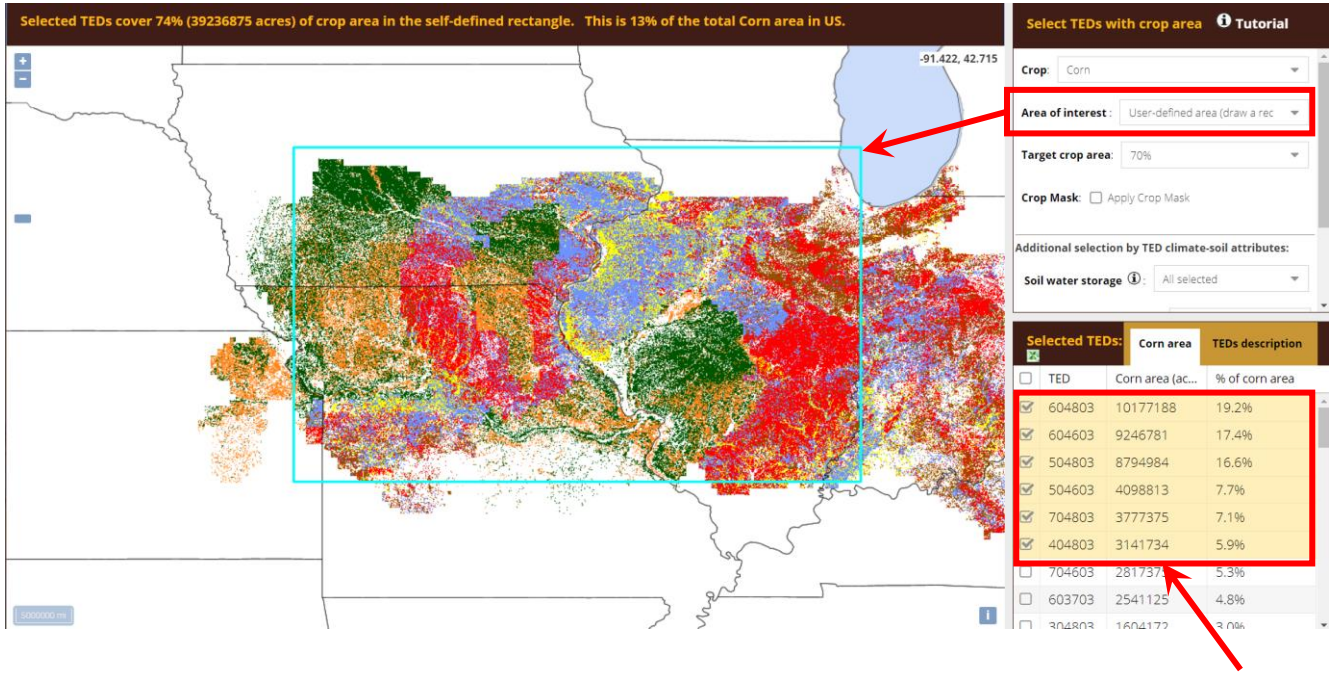
2.c. Area of Interest: User-defined rectangle



User selected an area including 70% of TEDs within the rectangle that was represented by **six TEDs**

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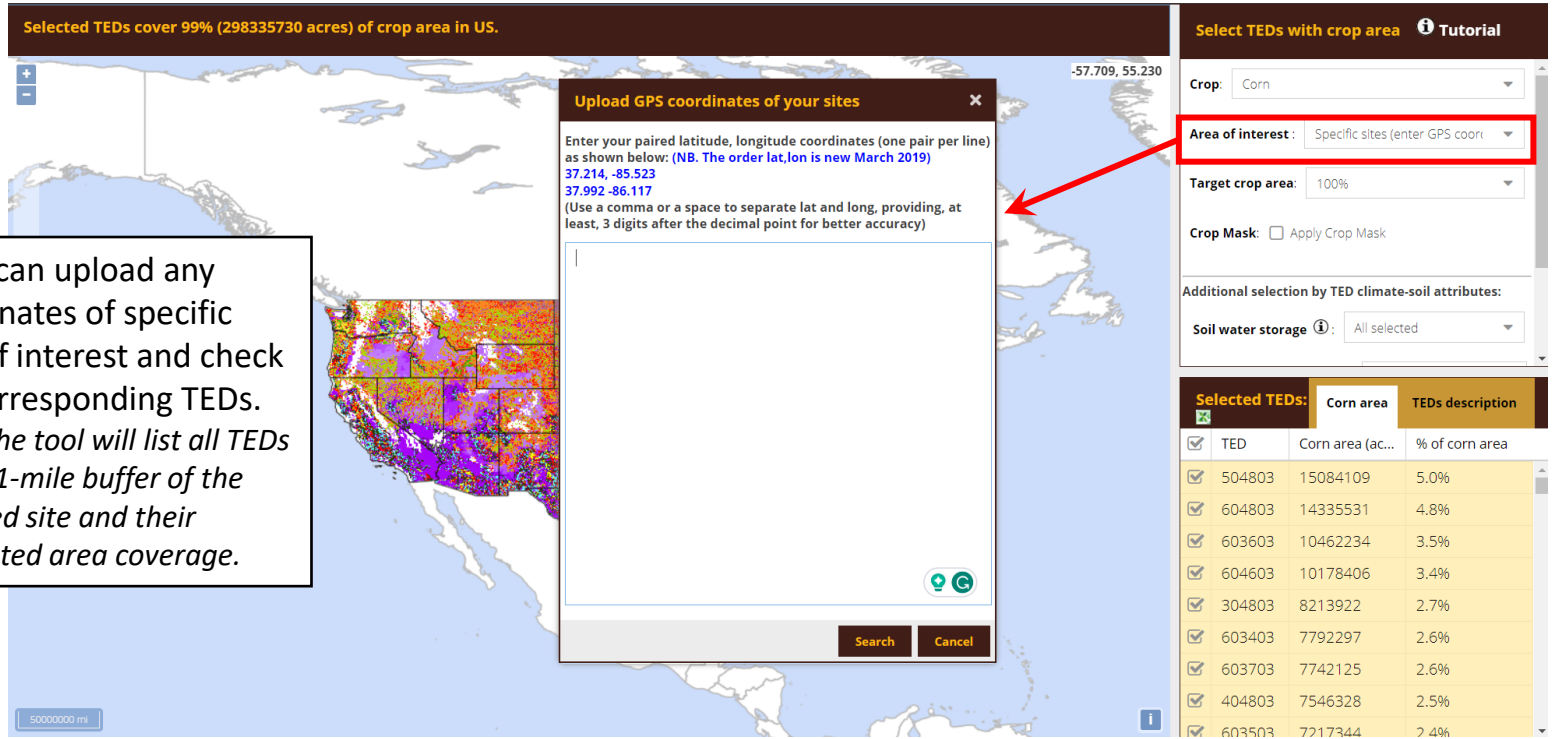
2.d. Area of interest: Specific sites (GPS coordinates)

Users can upload any coordinates of specific area of interest and check the corresponding TEDs.
Note: the tool will list all TEDs within 1-mile buffer of the specified site and their associated area coverage.



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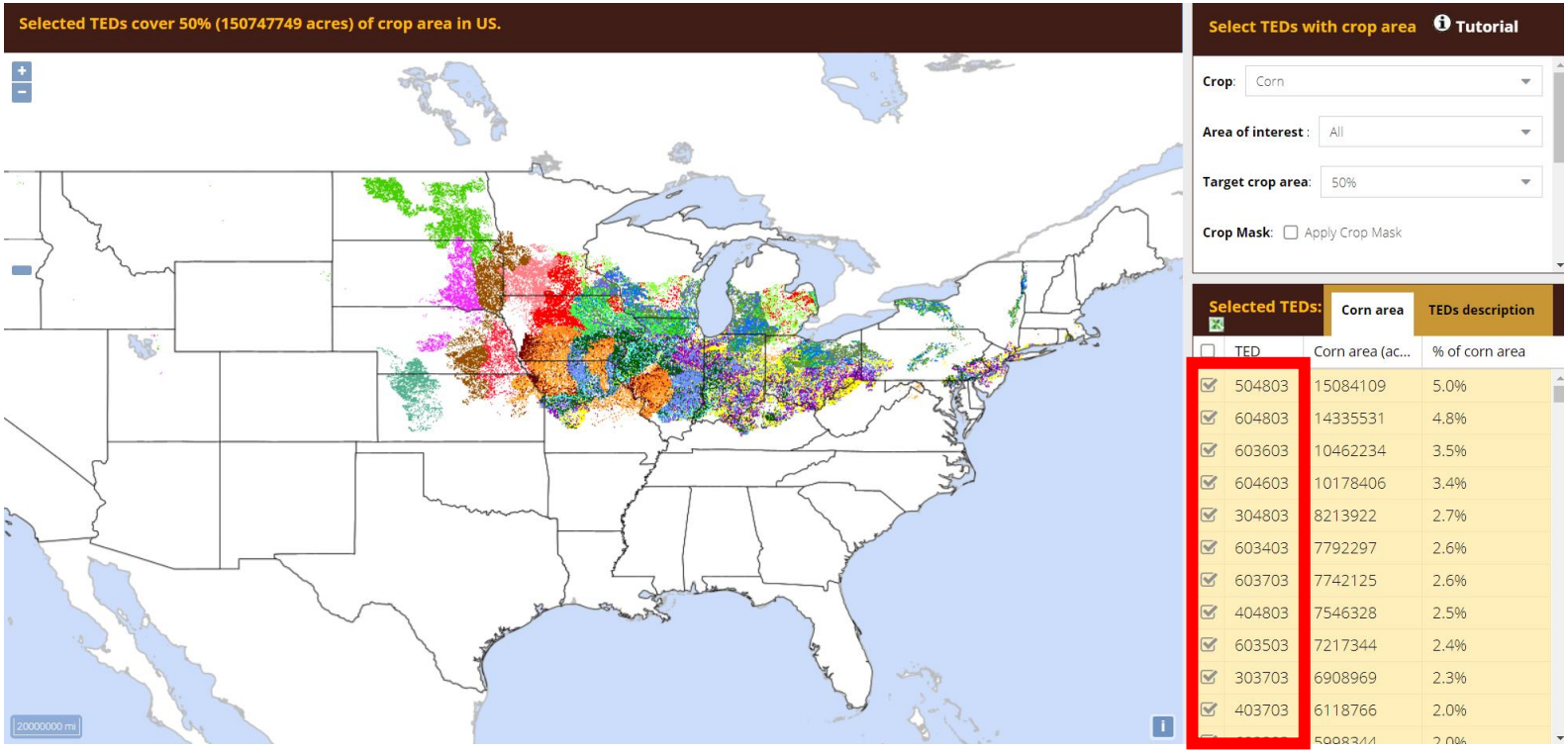
List of selected TEDs



Scroll down in the lower right panel to see the full list

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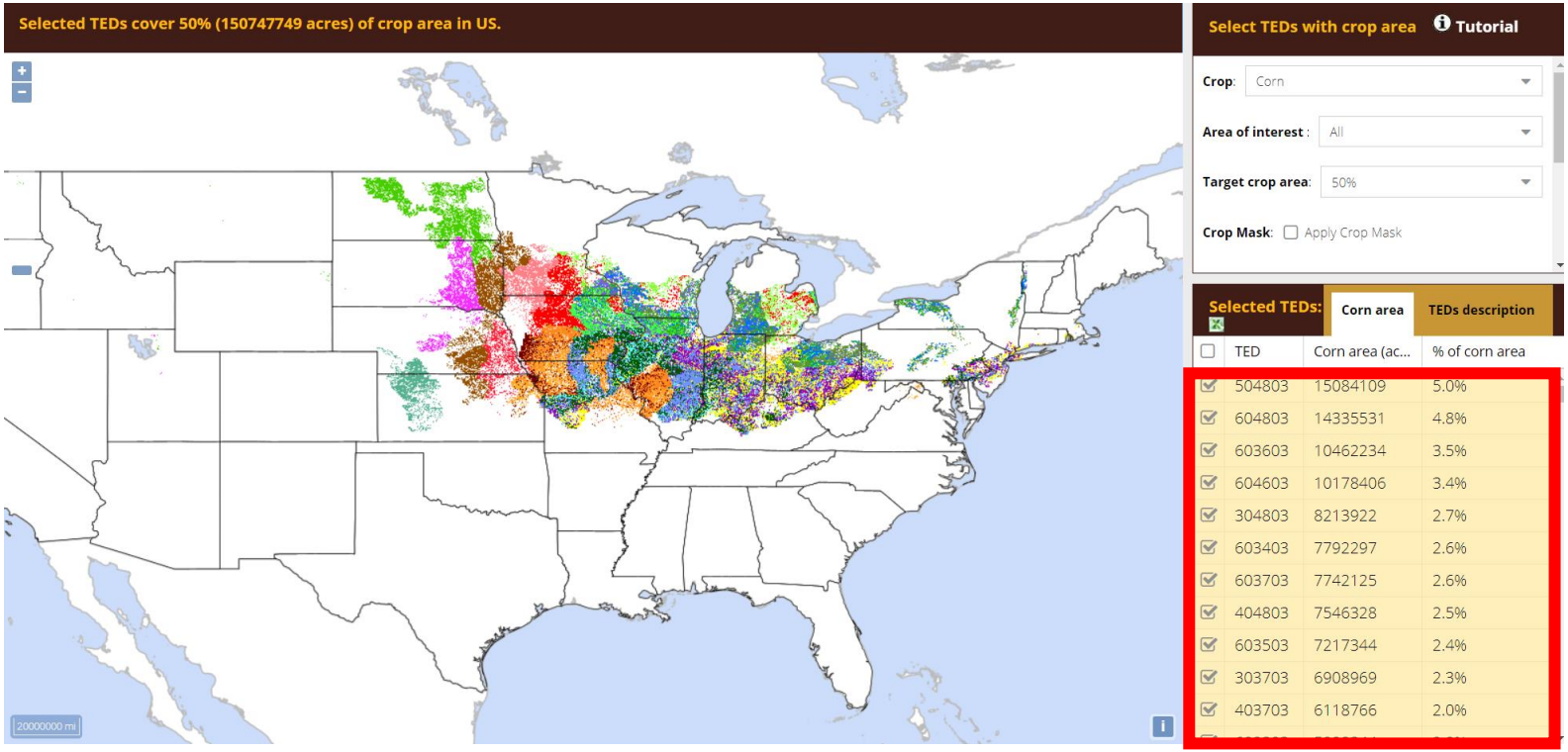
Associated crop area for each TED



Crop area (acres and % of US total) represented by each TED for the selected crop is shown

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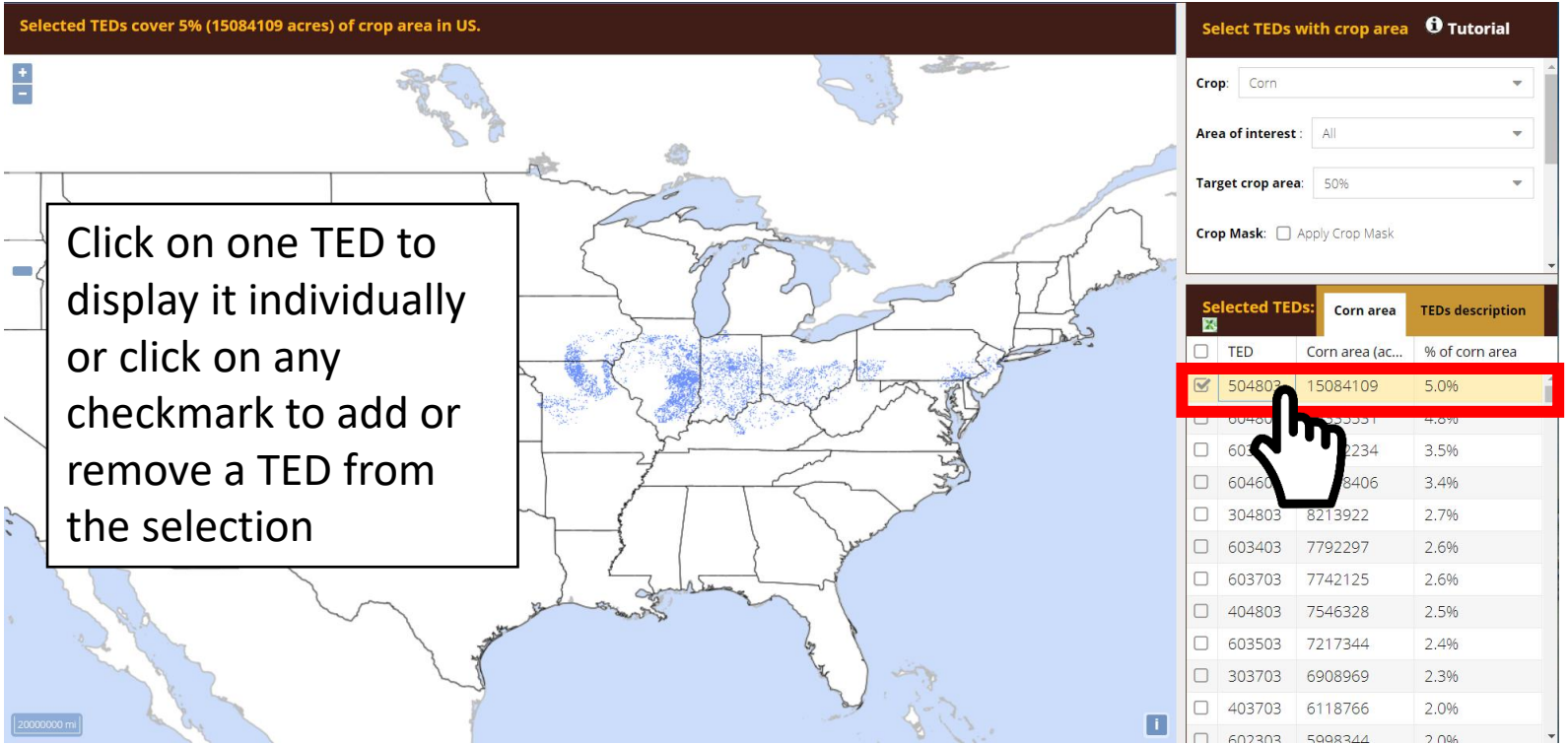
Further TED selection



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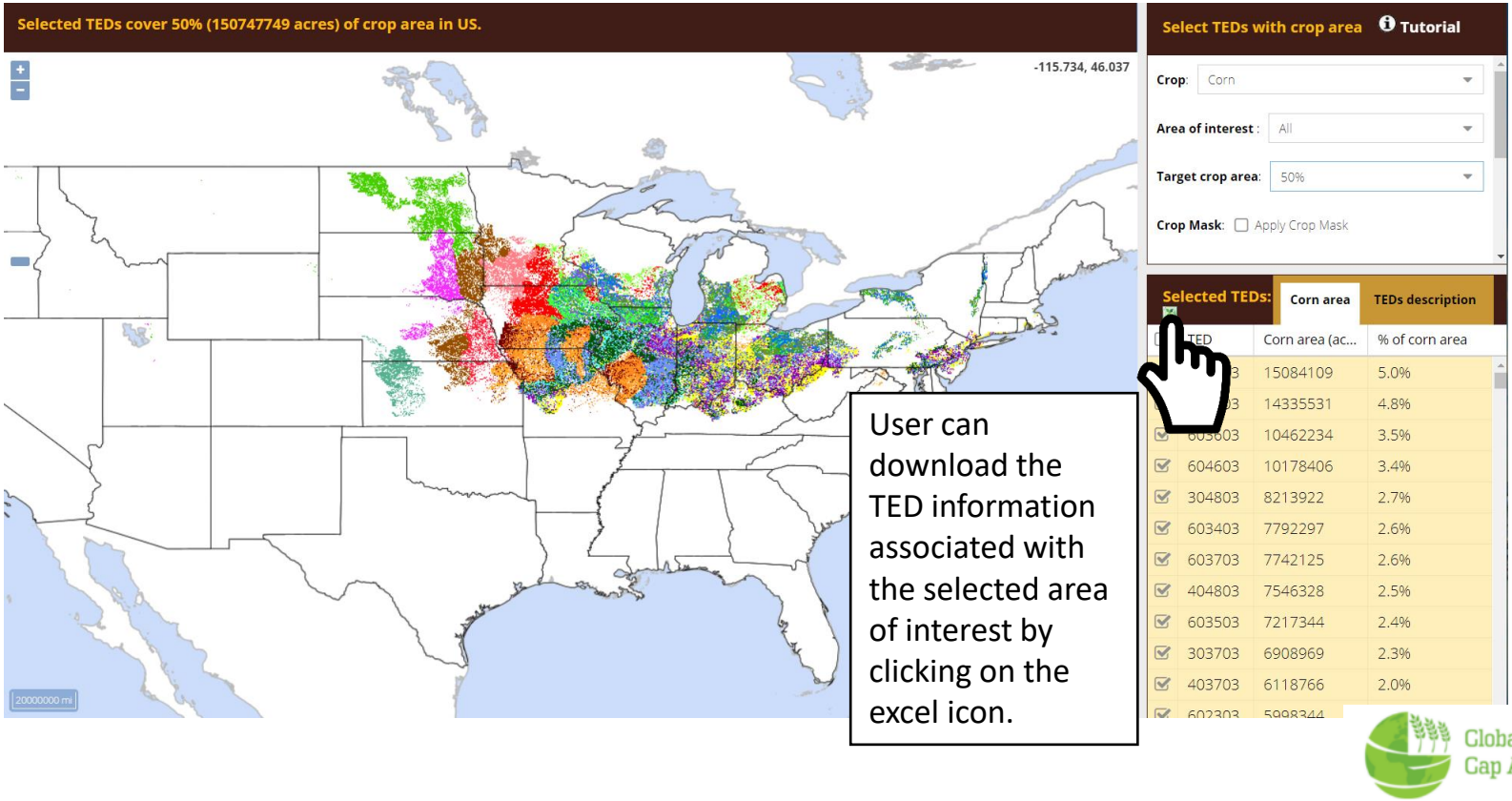
Export selected TED information



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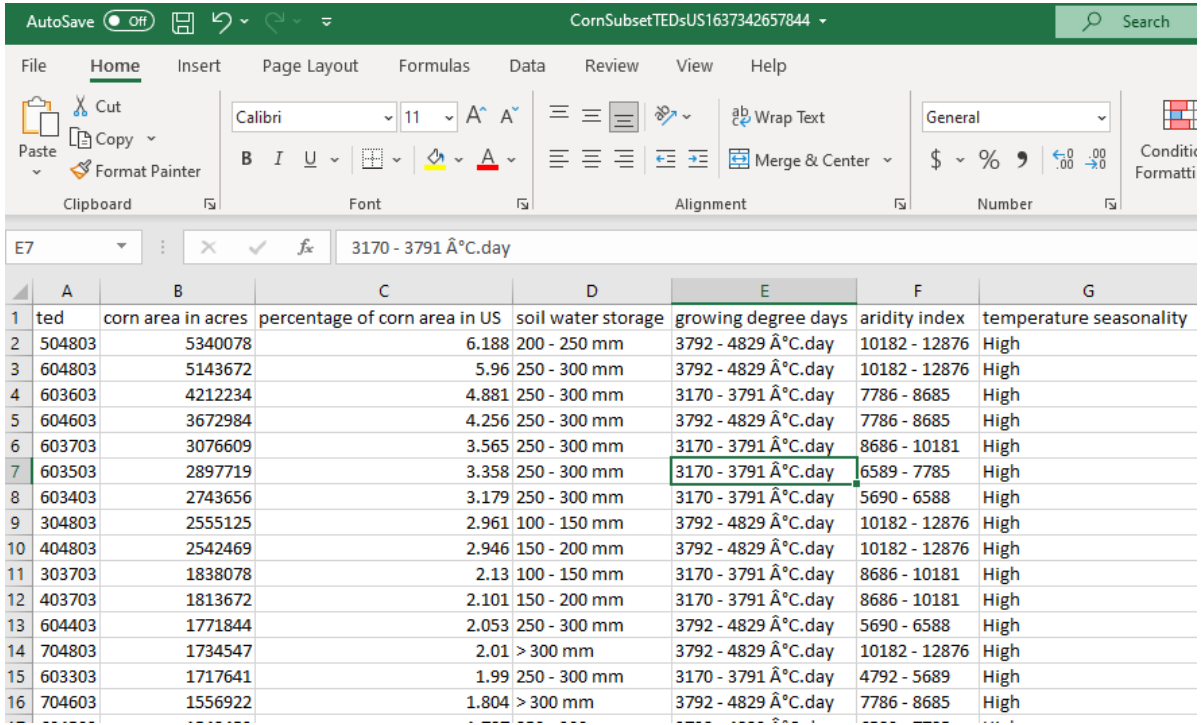
Downloaded file with TEDs and attributes

TED download in csv-format

Thank you for your interest in GYGA TEDs. In case the download doesn't start please click here.



	A	B	C	D	E	F	G
1	ted	corn area in acres	percentage of corn area in US	soil water storage	growing degree days	aridity index	temperature seasonality
2	504803	5340078	6.188	200 - 250 mm	3792 - 4829 Â°C.day	10182 - 12876	High
3	604803	5143672	5.96	250 - 300 mm	3792 - 4829 Â°C.day	10182 - 12876	High
4	603603	4212234	4.881	250 - 300 mm	3170 - 3791 Â°C.day	7786 - 8685	High
5	604603	3672984	4.256	250 - 300 mm	3792 - 4829 Â°C.day	7786 - 8685	High
6	603703	3076609	3.565	250 - 300 mm	3170 - 3791 Â°C.day	8686 - 10181	High
7	603503	2897719	3.358	250 - 300 mm	3170 - 3791 Â°C.day	6589 - 7785	High
8	603403	2743656	3.179	250 - 300 mm	3170 - 3791 Â°C.day	5690 - 6588	High
9	304803	2555125	2.961	100 - 150 mm	3792 - 4829 Â°C.day	10182 - 12876	High
10	404803	2542469	2.946	150 - 200 mm	3792 - 4829 Â°C.day	10182 - 12876	High
11	303703	1838078	2.13	100 - 150 mm	3170 - 3791 Â°C.day	8686 - 10181	High
12	403703	1813672	2.101	150 - 200 mm	3170 - 3791 Â°C.day	8686 - 10181	High
13	604403	1771844	2.053	250 - 300 mm	3792 - 4829 Â°C.day	5690 - 6588	High
14	704803	1734547	2.01	> 300 mm	3792 - 4829 Â°C.day	10182 - 12876	High
15	603303	1717641	1.99	250 - 300 mm	3170 - 3791 Â°C.day	4792 - 5689	High
16	704603	1556922	1.804	> 300 mm	3792 - 4829 Â°C.day	7786 - 8685	High

Note: the csv-file has a UTF-8 encoding. If the file is opened in Excel, a Â symbol will appear before the GDD units.

To avoid that, you can follow the instructions on this link

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Access to TEDs

- **TEDs can be accessed via :**
  - **https://www.toolted.org**
  - **https://www.yieldgap.org/web/guest/technology-extrapolation-domains**
- **The TEDs can be requested for free in the case of non-profit organizations.**
- **In the case of for-profit organizations, there are two ways to have access to the TEDs:**

  1. By purchasing a GYGA sponsorship or commercial license, which provides access to all the data included in the GYGA website: https://www.yieldgap.org/licensing-and-sponsorship

  2. By purchasing a license ONLY for accessing the TEDs *via* NUtech ventures:
    - **TEDs for the entire United States: https://marketplace.unl.edu/nutechmarketplace/nutech-teds.html**
    - **TEDs for Sub-Saharan Africa: https://marketplace.unl.edu/nutechmarketplace/nutech-teds-ssa.html**
- **If you want to discuss extensions and/or applications of TEDs for other geographic areas or uses, feel free to contact us at: pgrassini2@unl.edu (Professor Patricio Grassini, University of Nebraska-Lincoln).**

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Acknowledgements

Development of the TED tool was supported by

- Bill and Melinda Gates Foundation
- Advanced Research Projects Agency – Energy of the U.S. Department of Energy

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