

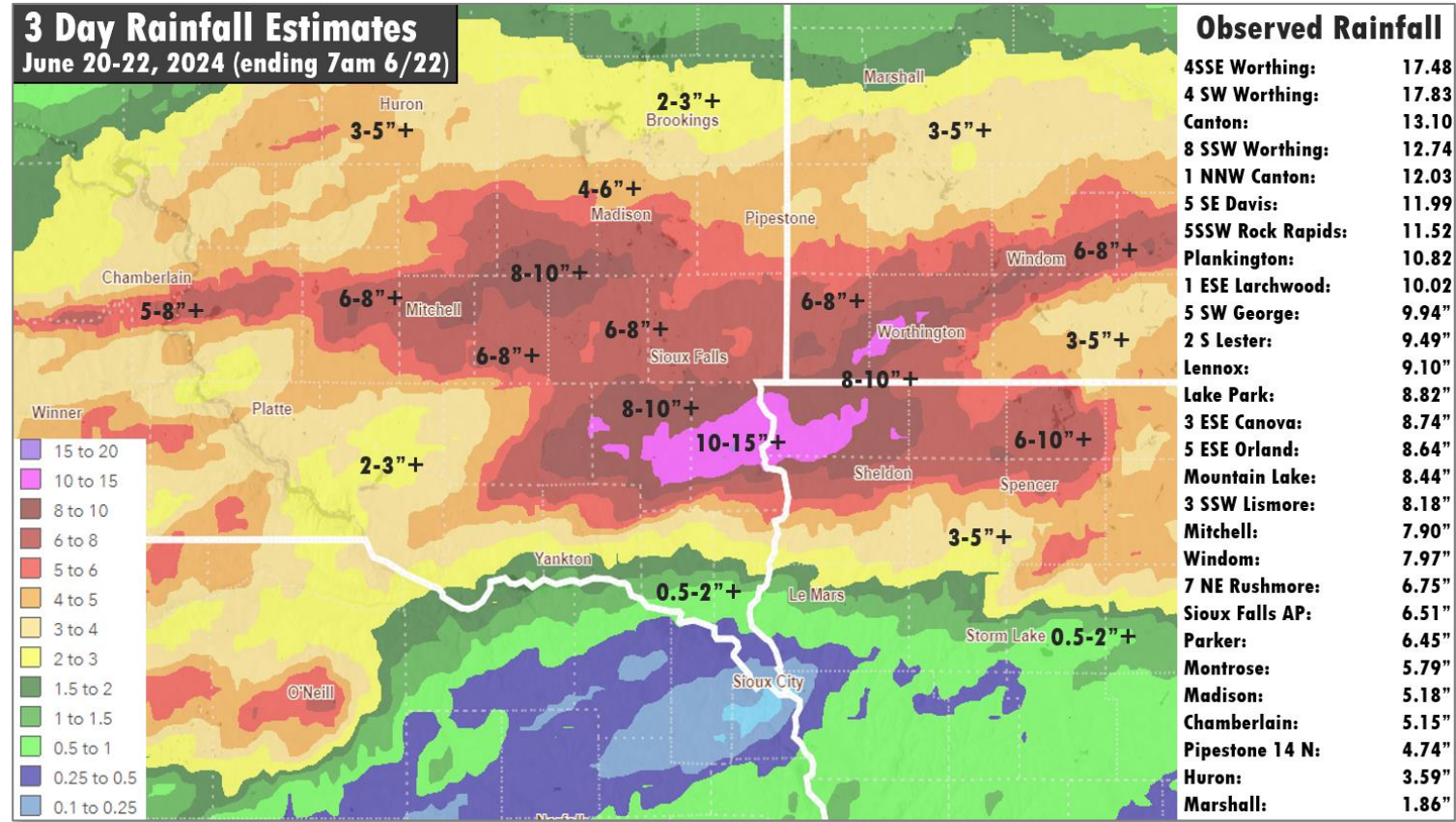
June 2024 Midwest Storm and Flooding

USDA NASS Disaster Monitoring Team



Event Summary

- **Late June 2024:** Heavy rainfall across NW Iowa, SW Minnesota, and SE South Dakota from June 20-22 resulted in rainfall totals exceeding 2 inches in most areas with widespread totals ranging from 5-10 inches.
- Some locations in SE South Dakota and NW Iowa reported 10-20 inches of rainfall.
- The event resulted in flash flooding, with record flooding observed at several river points and widespread, devastating floods in towns adjacent to rivers.



Report and Image Source: National Weather Service, NOAA

[Heavy Rain and Historic Flooding of Northwest Iowa, Southwest Minnesota, and Southeast South Dakota - June 20-22, 2024 \(weather.gov\)](https://www.weather.gov)



Examples of Flooding in Crop Areas



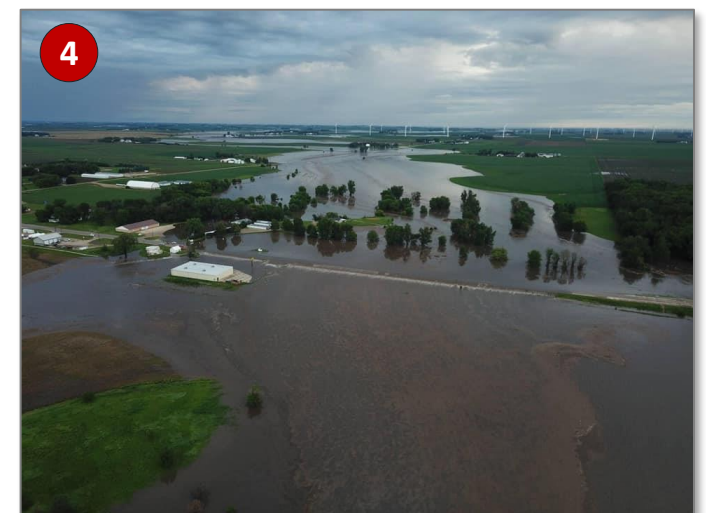
Davis, SD (Credit: Lukas Potgieter)



South of Alvard, IA (Credit: Dan Gottschalk)



Mountain Lake, MN (Credit: Mountain View Drones)



Paullina, IA (Credit: Cristie Tewes)

Website Source Hosting Photos:
[National Weather Service, NOAA](#)

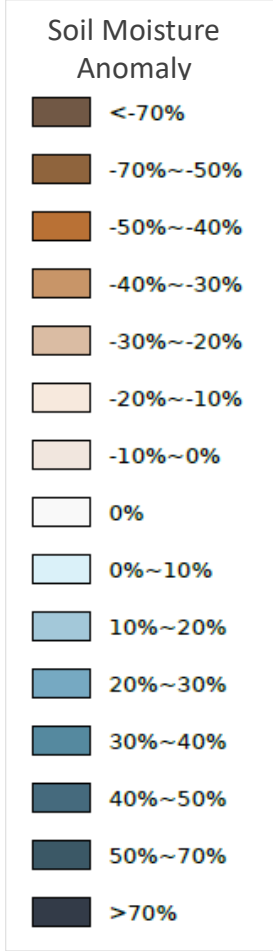
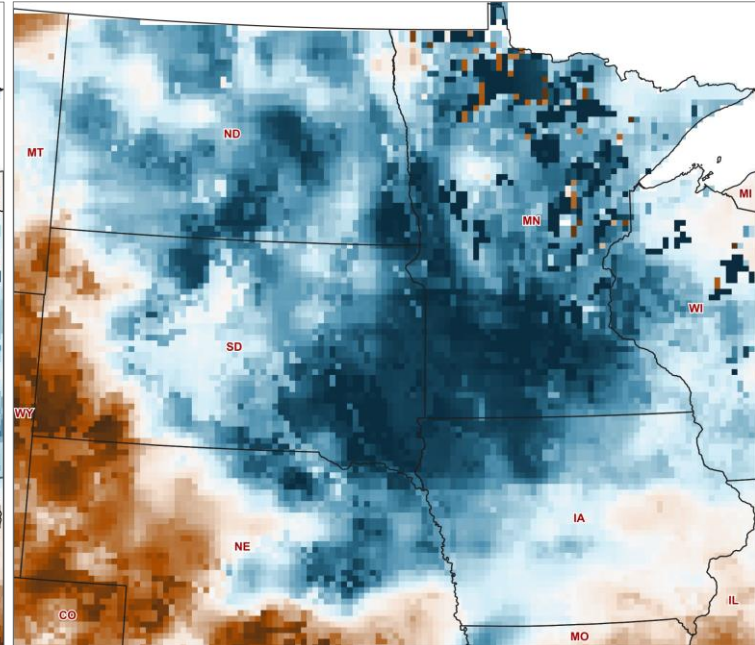
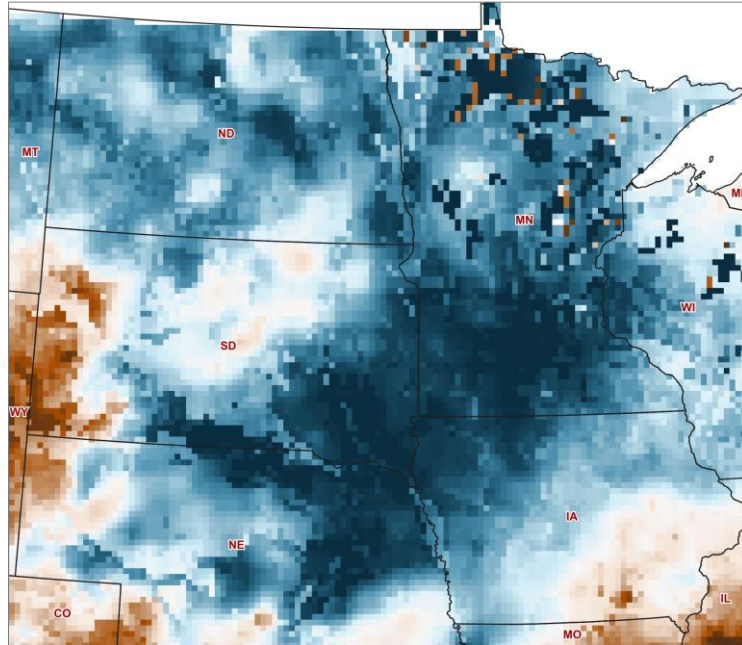
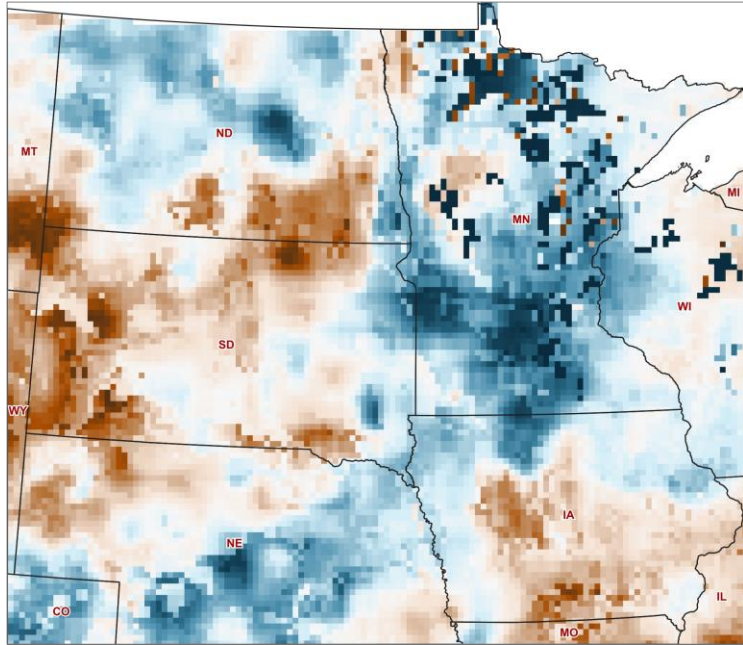


Soil Moisture Conditions

June 10 – 16, 2024:
SMAP 9 KM Anomaly Weekly Topsoil

June 17 – 23, 2024:
SMAP 9 KM Anomaly Weekly Topsoil

June 24 – 30, 2024:
SMAP 9 KM Anomaly Weekly Topsoil



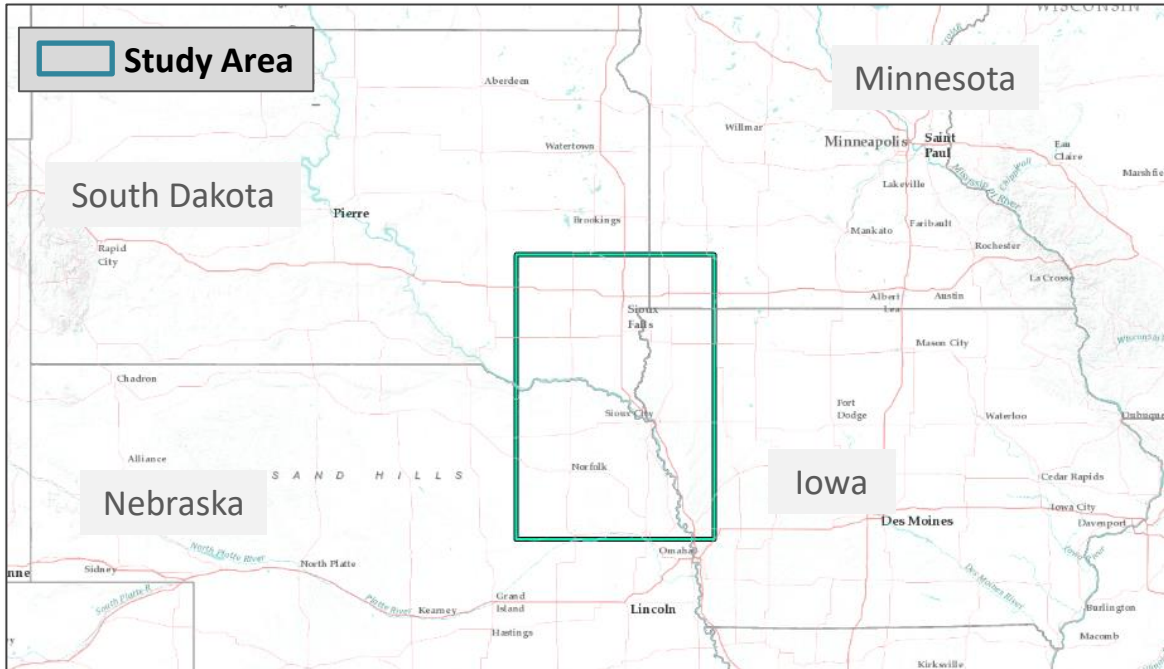
Note: The soil moisture anomaly (SMA) in CropCASMA is a measure of deviation of the current soil moisture value from the "normal" soil moisture level, which is represented by a historical average soil moisture value (from 2015 to current).

Data Source: Soil Moisture Active Passive (SMAP) Surface, 9 KM Anomaly Weekly

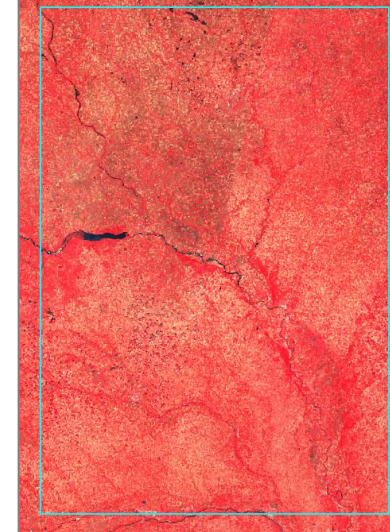
Map Source: [Crop-CASMA](#) (Crop Condition & Soil Moisture Analytics)



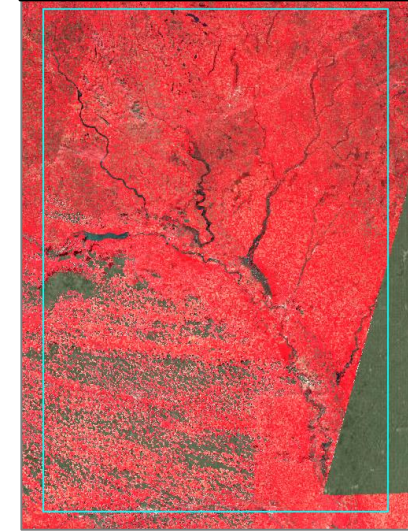
Study Area & Methodology



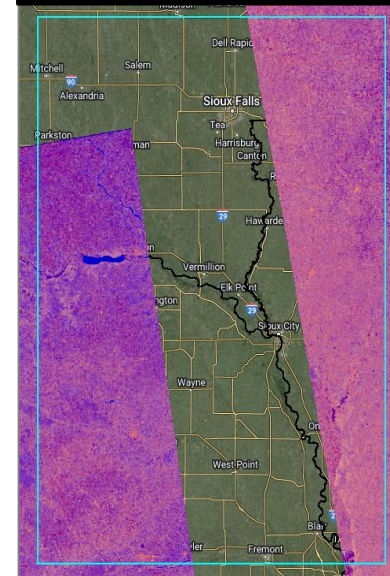
Pre-Event MSI: Sentinel-2
(June 1 – July 2, 2023)



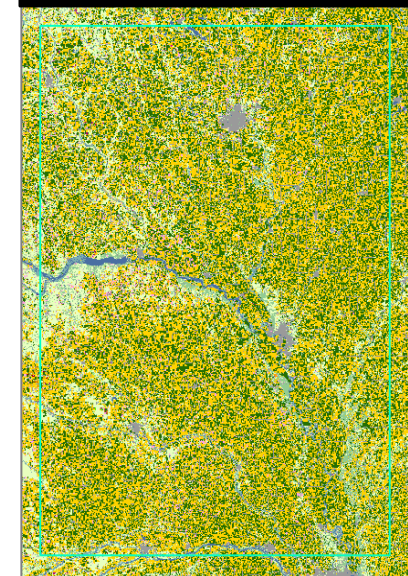
Post-Event MSI: Sentinel-2
(June 17 – June 30, 2024)



Pre & Post Event SAR:
Sentinel-1



Agriculture:
USDA-NASS CDL (2023)



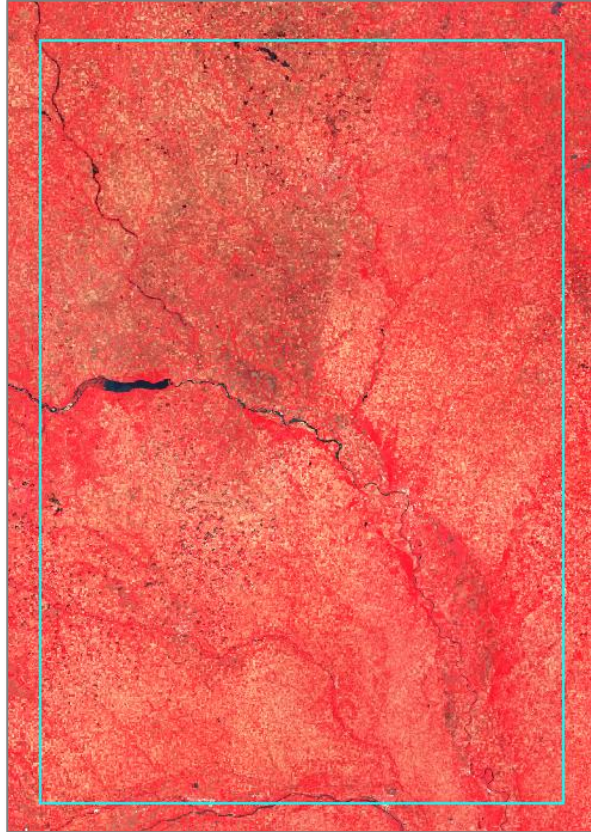
A disaster assessment was conducted using available Sentinel-1 Synthetic Aperture Radar (SAR) and cloud-free Sentinel-2 Multi-Spectral Instrument (MSI) coverage to identify likely inundated areas by the flooding events in late June 2024. Inundated areas were then intersected with the 2023 Cropland Data Layer (CDL) to estimate crops potentially affected by the floods within the study area.

Note: While inundation to crops may have occurred in other parts of SD, MN, IA, and NE (outside of the area displayed), the disaster assessment could only be conducted where adequate imagery coverage was available during this timeframe.

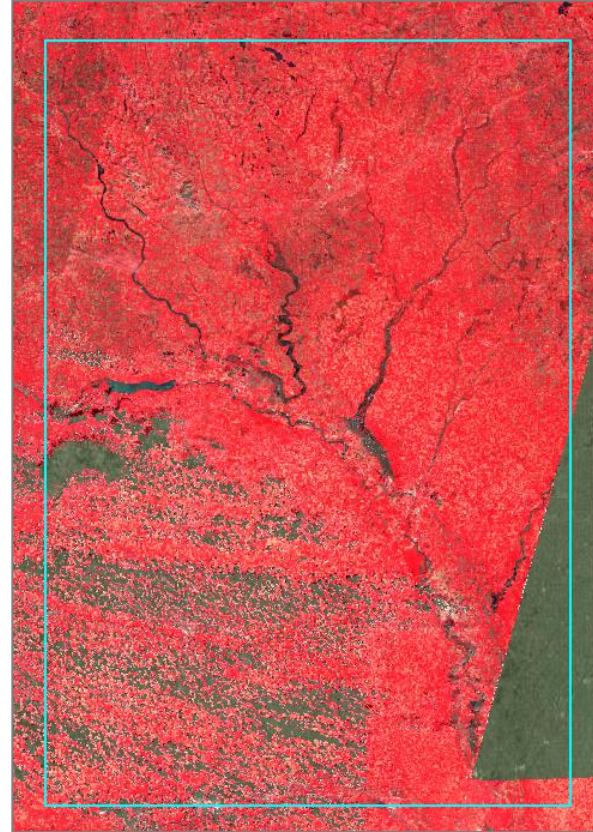


Model Inputs: Sentinel-2 MSI & 2023 Cropland Data Layer

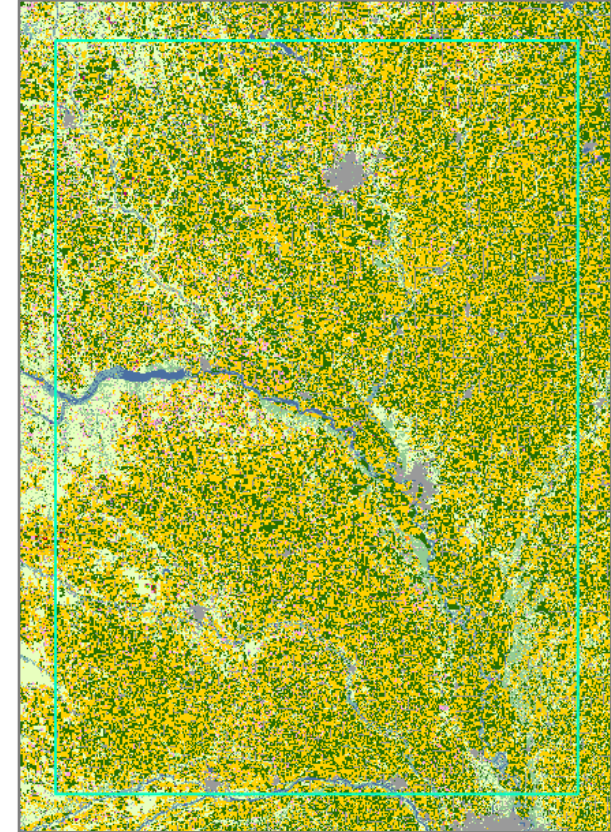
Pre-Event: Sentinel-2 MSI Median
Composite Image (June 1 – July 2, 2023)



Post-Event: Sentinel-2 MSI Median
Composite Image (June 17 – June 30, 2024)



Agriculture:
USDA-NASS 2023 Cropland Data Layer

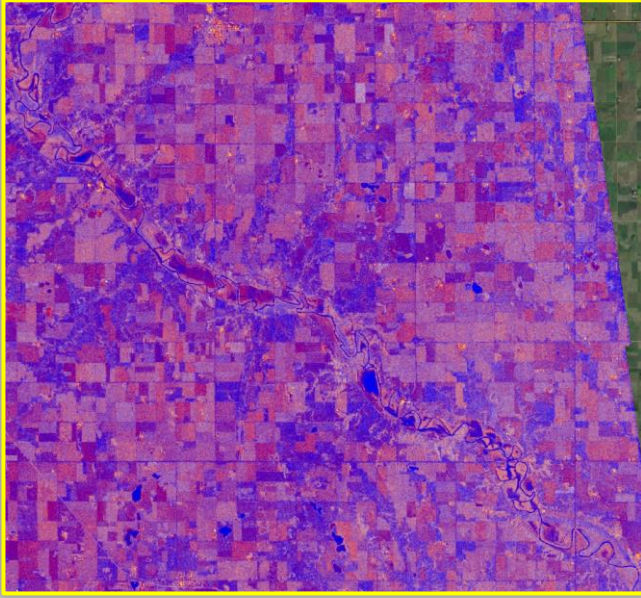


The Sentinel-2 [Multispectral Instrument \(MSI\)](#) is a wide-swath, high-resolution, multi-spectral imaging sensor. Combination of its spectral bands enables a wide range of uses, including the monitoring of vegetation, soil, and water cover. The images above (left, middle) are displayed as False Color Infrared to assist in the identification of water and stressed vegetation (plant-covered land appears deep red, denser plant growth is darker red, and water appears blue or black).

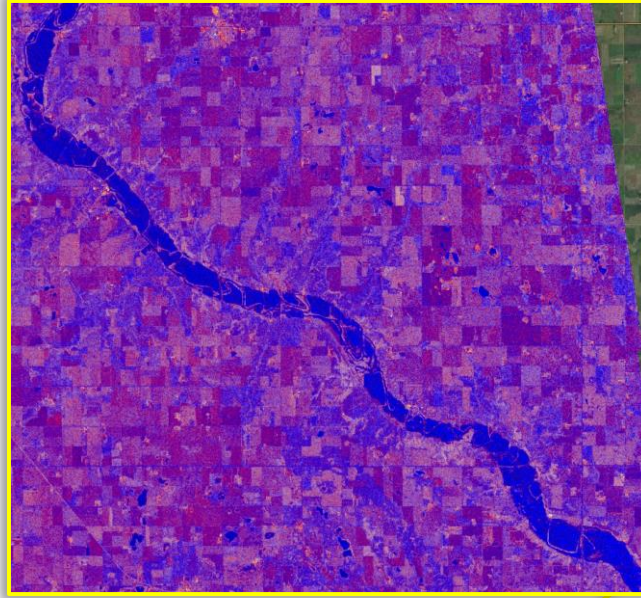
Note: Gaps in coverage exist for the study area since only Cloud-Free Sentinel-2 coverage was used in the disaster assessment model.

Model Input: Sentinel-1 (SAR)

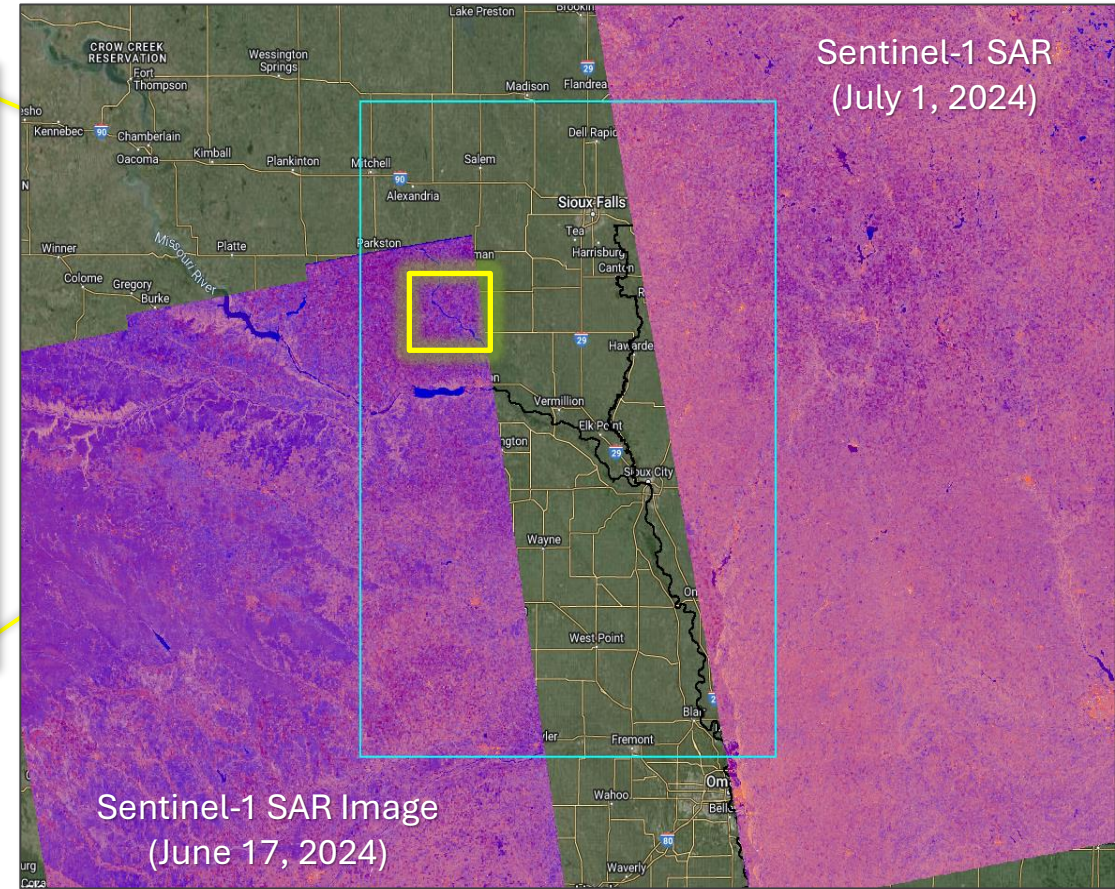
Pre-Event: Sentinel-1 SAR Median Image Composite (June 1 and July 3, 2023)



Post-Event: Sentinel-1 SAR Image (June 17, 2024)



The example above depicts likely inundation in the blue areas within the post-event image displayed above to the right.

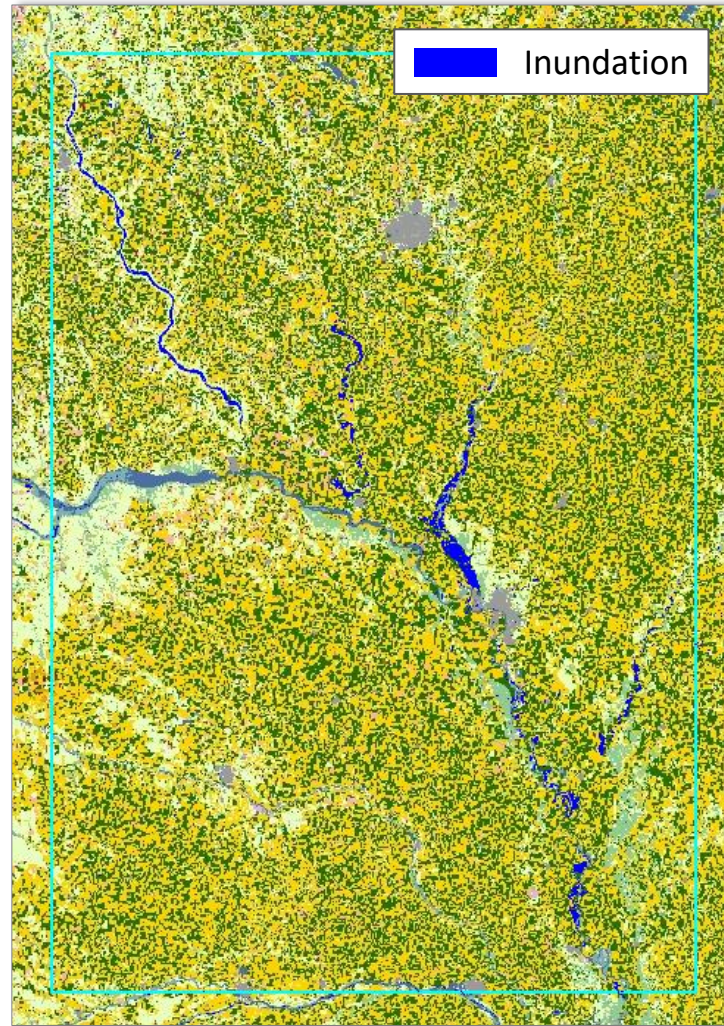
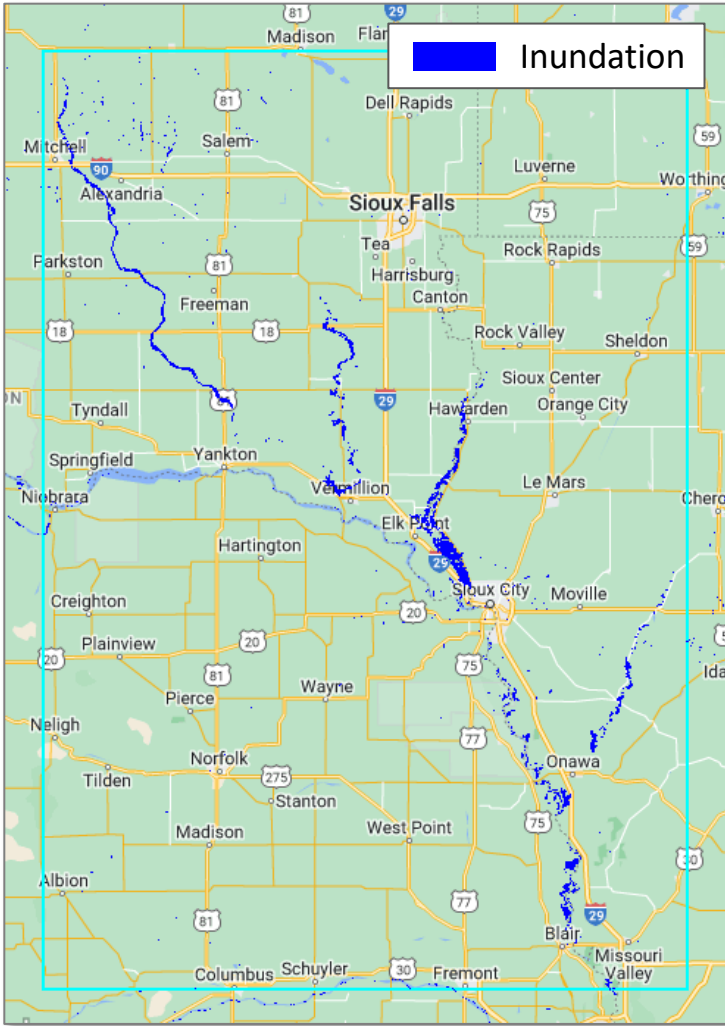


[SENTINEL-1 Synthetic Aperture Radar \(SAR\)](#) is an imaging radar mission providing continuous all-weather, day-and-night imagery at C-band. It is used for maritime monitoring, land monitoring, and emergency management applications (to include flood area detection).

Note: Sentinel-1 SAR coverage was not available for the entire study area for the needed timeframe. Only available scenes could be used in the disaster assessment model.



Crop Impact Assessment



*Crop Type	**Acres Affected
Corn:	70,000
Soybeans:	46,000
Fallow/Idle Cropland:	7,000
Grassland/Pasture:	3,000
Alfalfa:	2,000
Other Hay/Non-Alfalfa:	621
Oats:	314
Winter Wheat:	207
Rye:	143
Sorghum:	95
Spring Wheat:	57
Total:	130,000

**Only crop types where assessed inundation was at least fifty acres are listed above.*

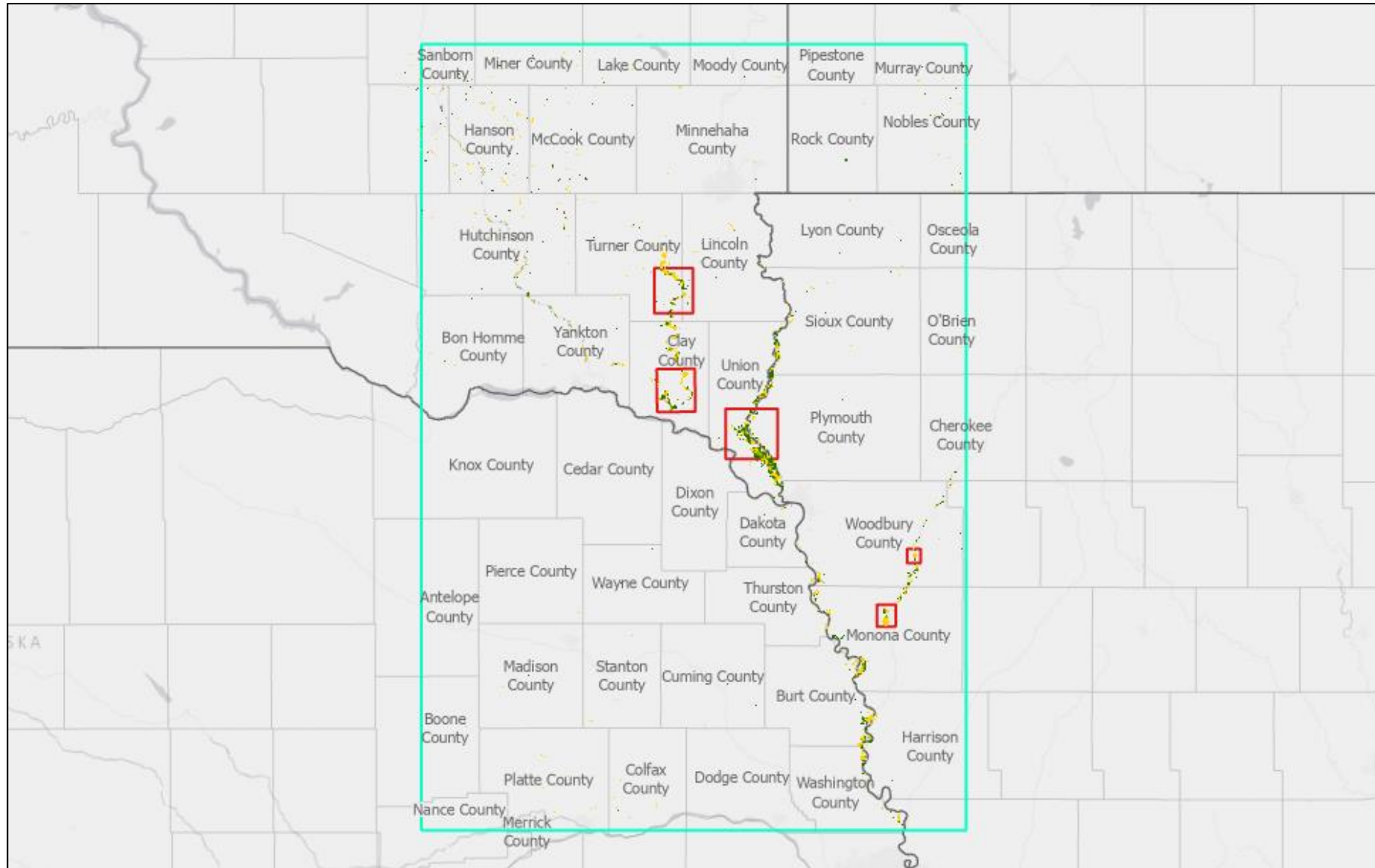
***Estimated acreage is approximate, rounded to the nearest thousandth for acreage over 1K, and based on analysis using the 2023 Cropland Data Layer (CDL).*



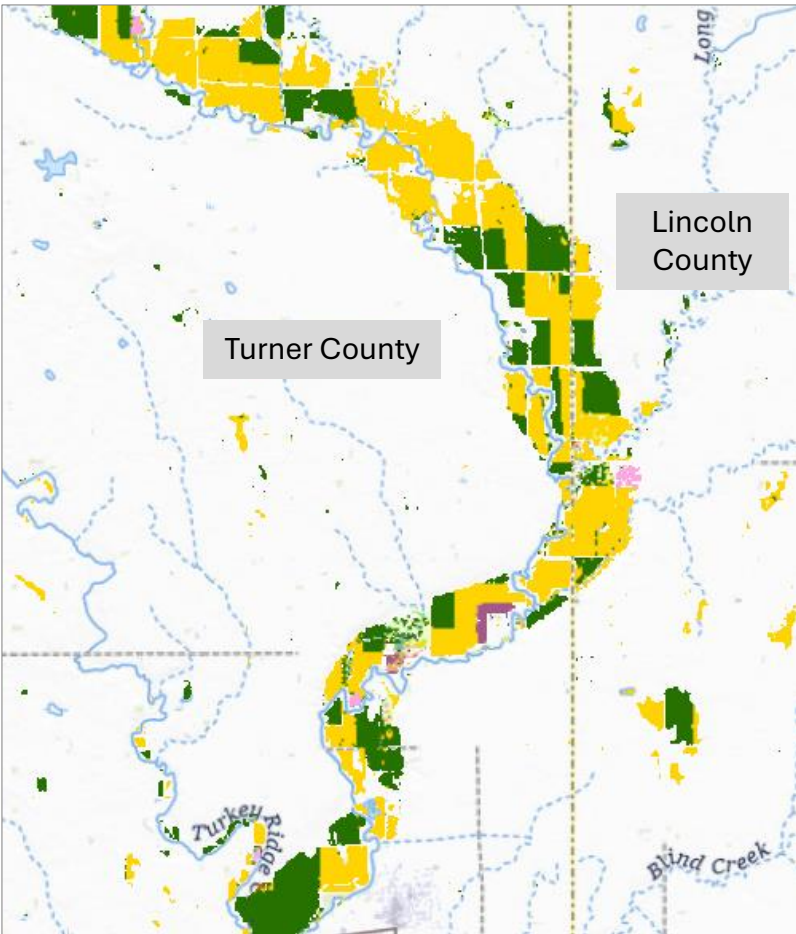
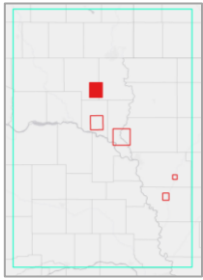
The above areas displayed in blue in the geographic reference map (left) and overlaid on the CDL (middle) are areas assessed as inundated within the overall study area for this disaster assessment. Acreage affected per crop type within the study area are listed in the table above (right). Noted: **Estimated acreage reported above is approximate and based on analysis using the 2023 CDL.**



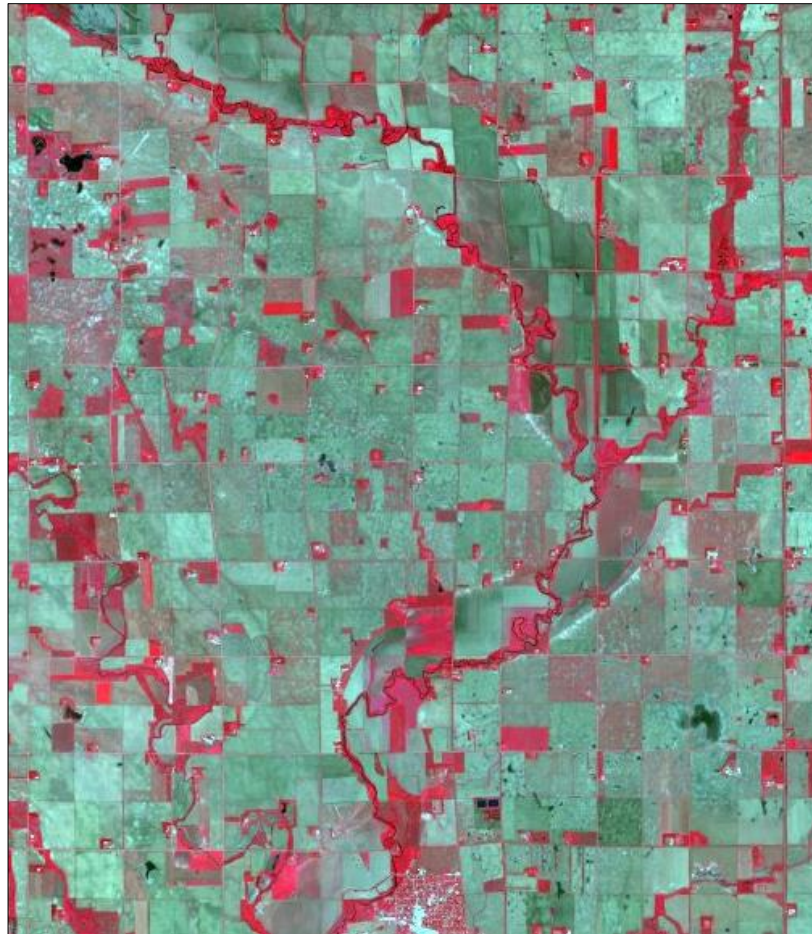
Select Areas Highlighting Inundated Croplands



Turner County & Lincoln County, South Dakota



Inundated Crops



Pre-Event: Sentinel-2 Color Infrared
(June 10, 2024)



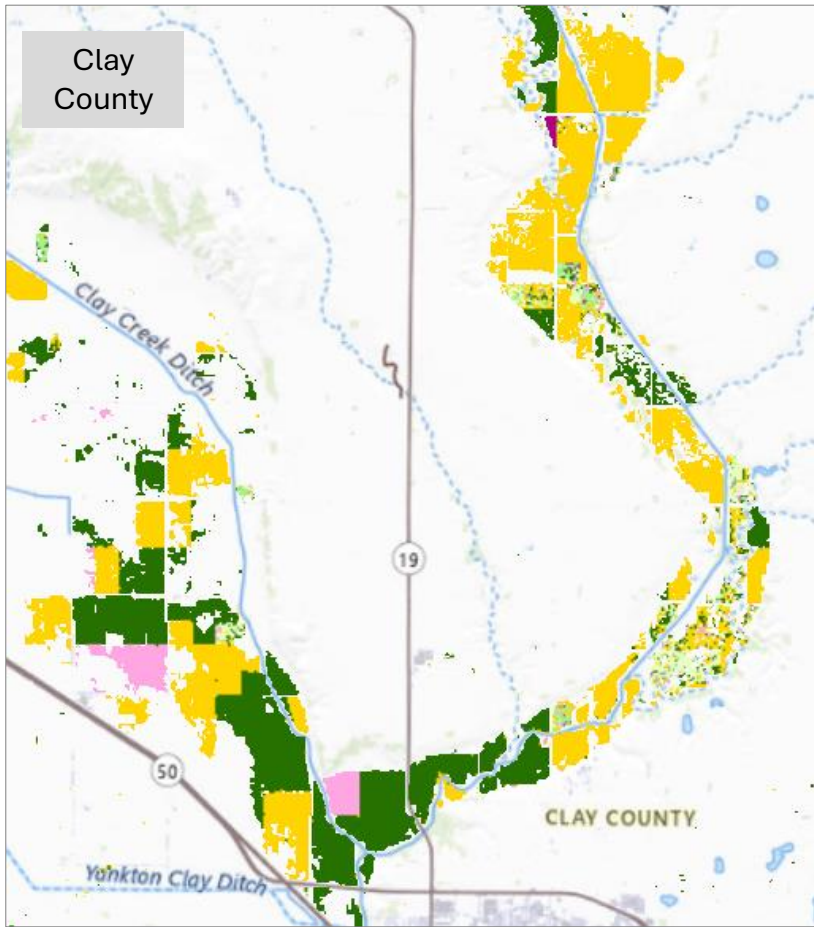
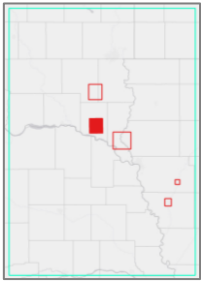
Post-Event: Sentinel-2
Color Infrared (June 30, 2024)



Data Sources: USGS TNM Topo Base Map, Sentinel-2 Imagery: Color Infrared with DRA Image Service
Credits: USGS, Esri, European Commission, European Space Agency, Amazon Web Services



Clay County, South Dakota



Inundated Crops



Pre-Event: Sentinel-2 Color Infrared
(June 10, 2024)



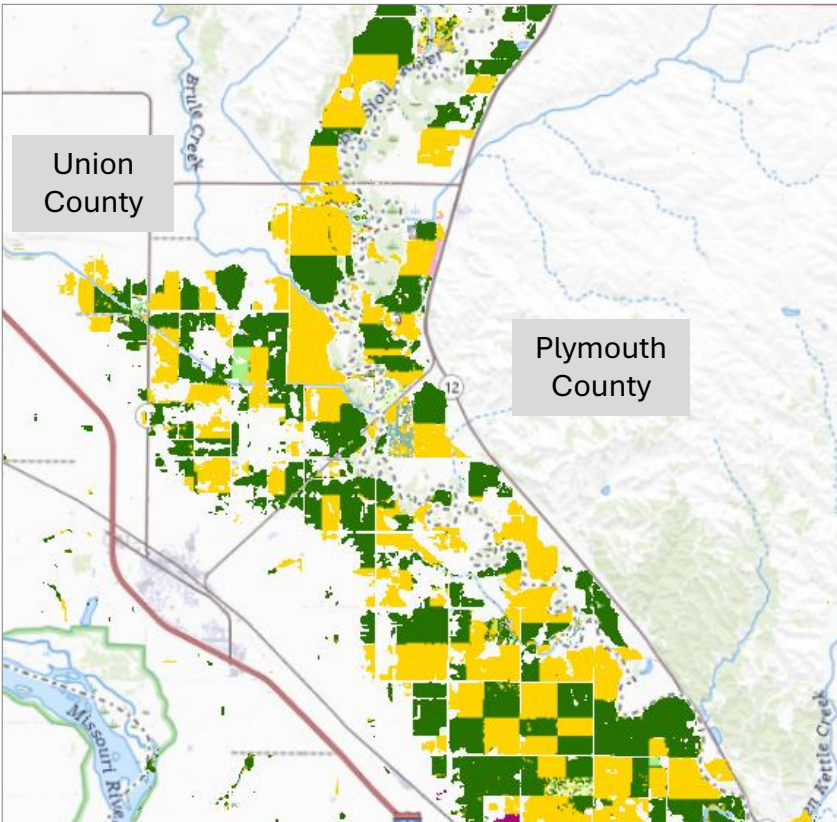
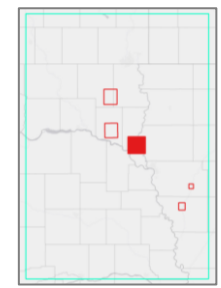
Post-Event: Sentinel-2
Color Infrared (June 30, 2024)



Data Sources: USGS TNM Topo Base Map, Sentinel-2 Imagery: Color Infrared with DRA Image Service
Credits: USGS, Esri, European Commission, European Space Agency, Amazon Web Services



Union County, South Dakota & Plymouth County, Iowa



Inundated Crops



Pre-Event: Sentinel-2 Color Infrared
(June 10, 2024)



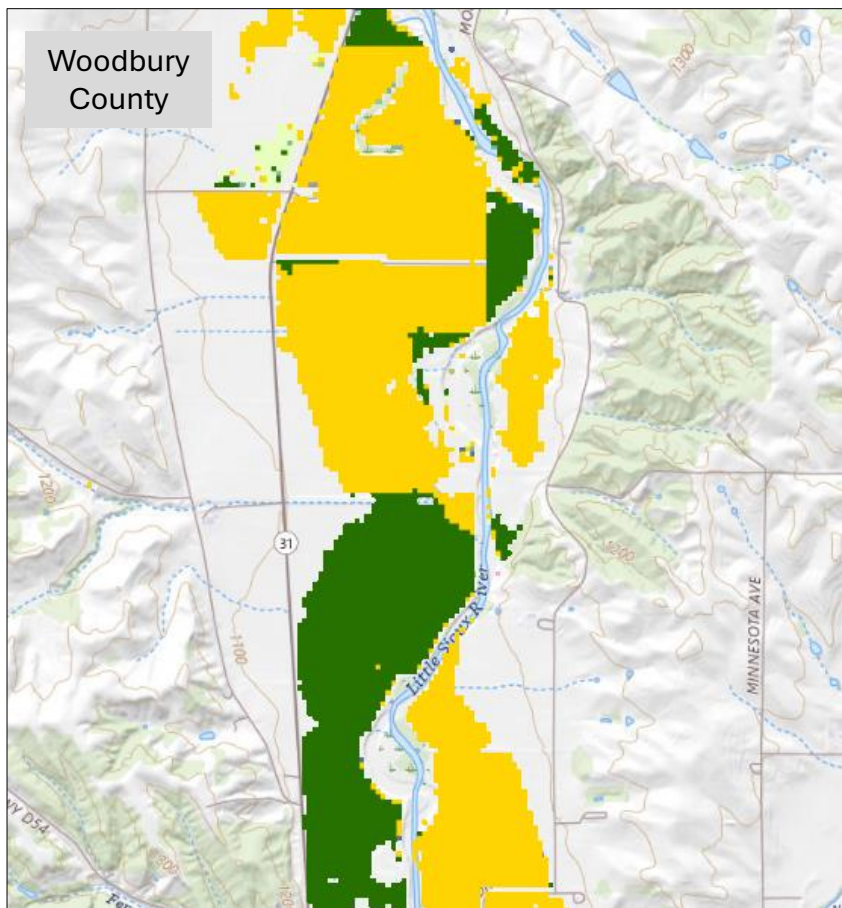
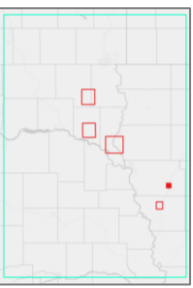
Post-Event: Sentinel-2 Color Infrared
(June 30, 2024)



Data Sources: USGS TNM Topo Base Map, Sentinel-2 Imagery: Color Infrared with DRA Image Service
Credits: USGS, Esri, European Commission, European Space Agency, Amazon Web Services



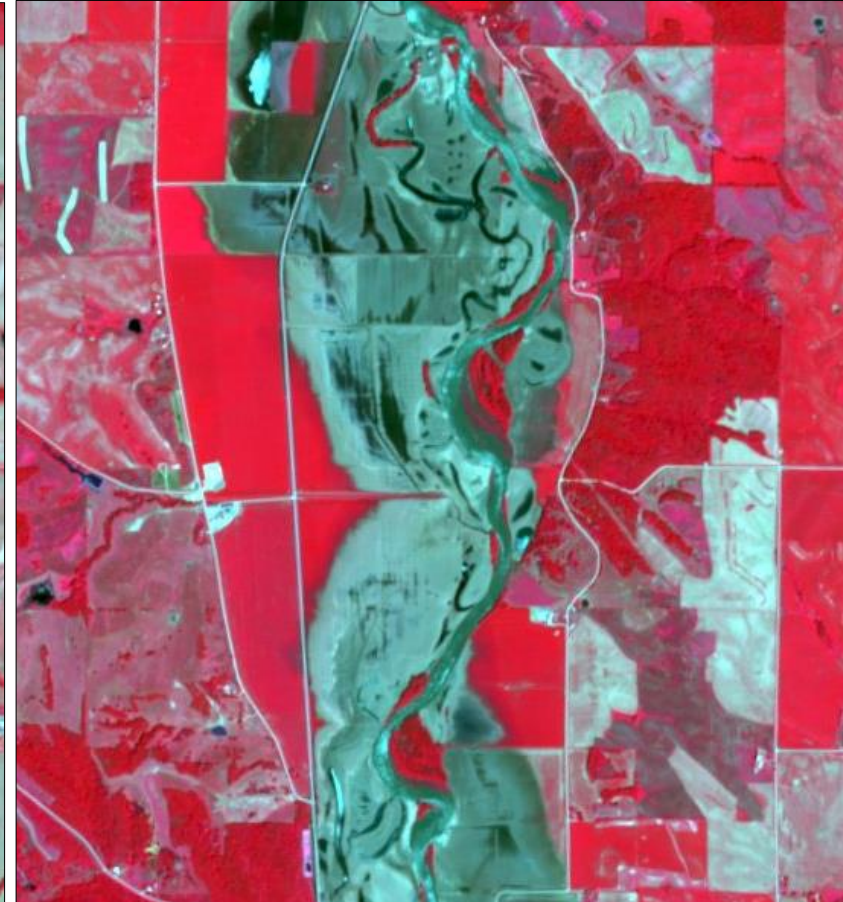
Woodbury County, Iowa



Inundated Crops



Pre-Event: Sentinel-2 Color Infrared
(June 10, 2024)



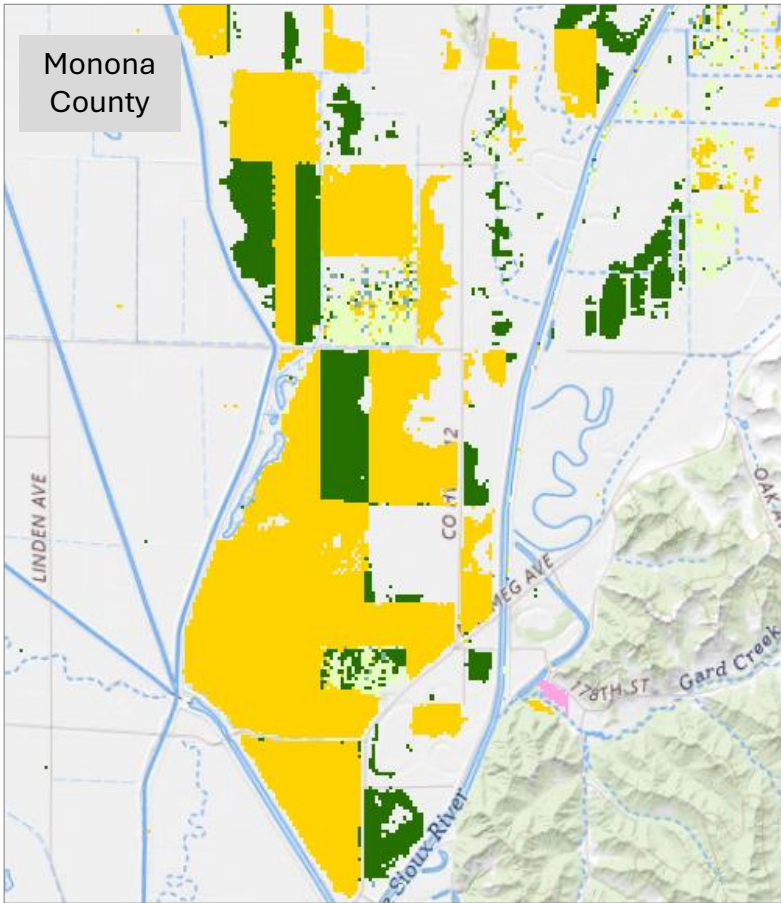
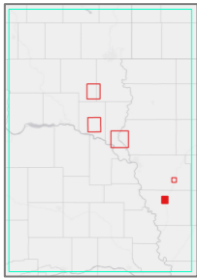
Post-Event: Sentinel-2 Color Infrared
(June 30, 2024)



Data Sources: USGS TNM Topo Base Map, Sentinel-2 Imagery: Color Infrared with DRA Image Service
Credits: USGS, Esri, European Commission, European Space Agency, Amazon Web Services



Monona County, Iowa



Inundated Crops



Pre-Event: Sentinel-2 Color Infrared
(June 10, 2024)



Post-Event: Sentinel-2
Color Infrared (June 30, 2024)



Data Sources: USGS TNM Topo Base Map, Sentinel-2 Imagery: Color Infrared with DRA Image Service
Credits: USGS, Esri, European Commission, European Space Agency, Amazon Web Services

