National Aeronautics and Space Administration

# EXPLORE EARTH

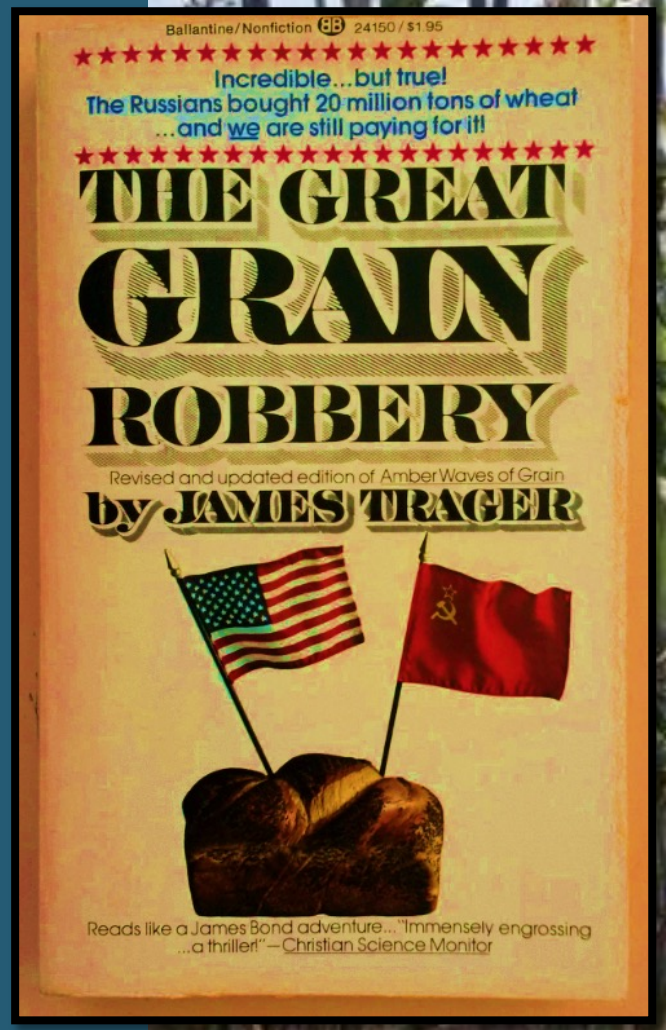
**Bradley DOORN**
Program Manager
Agriculture Applied Research Program
Earth Science Division, Science Mission Directorate
12 January 2023

Input costs are skyrocketing

Global markets are a mess

Can I get a decent rainfall forecast?

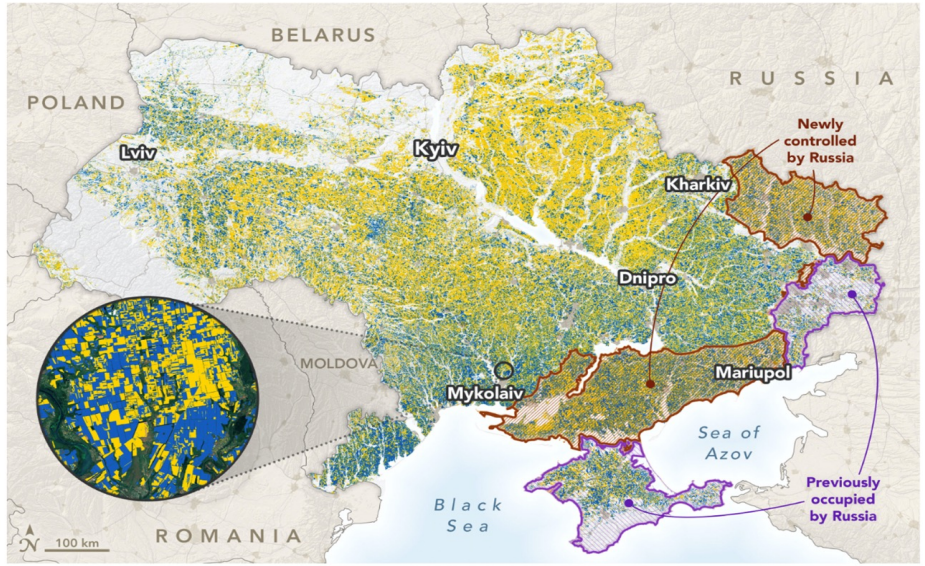
Why on Earth is NASA here?


We have been here for 50 years

We will be here for the next 50 years

## Winter & Spring Crops Across Ukraine (3 meters)

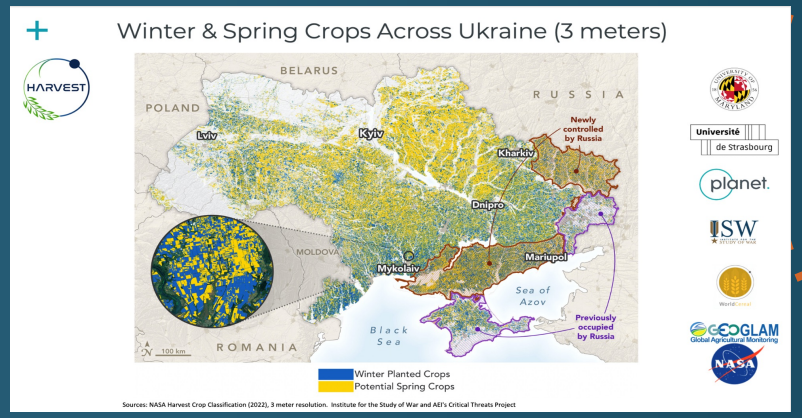



Sources: NASA Harvest Crop Classification (2022), 3 meter resolution. Institute for the Study of War and AEI's Critical Threats Project

# Agriculture Application Area Program Elements

NASA Harvest - International agriculture and global food security program

ACRES – Domestic agriculture program

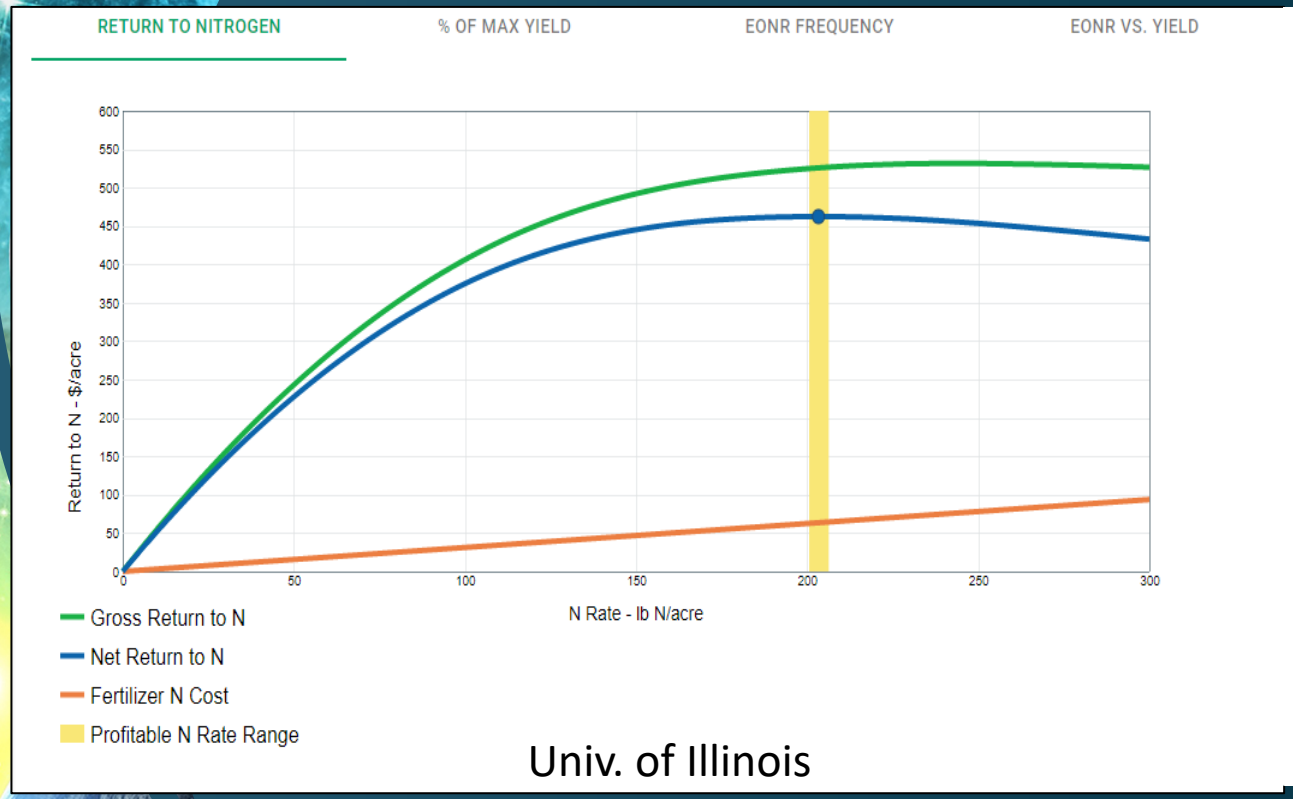



Launch at Commodity Classic 2023

USDA

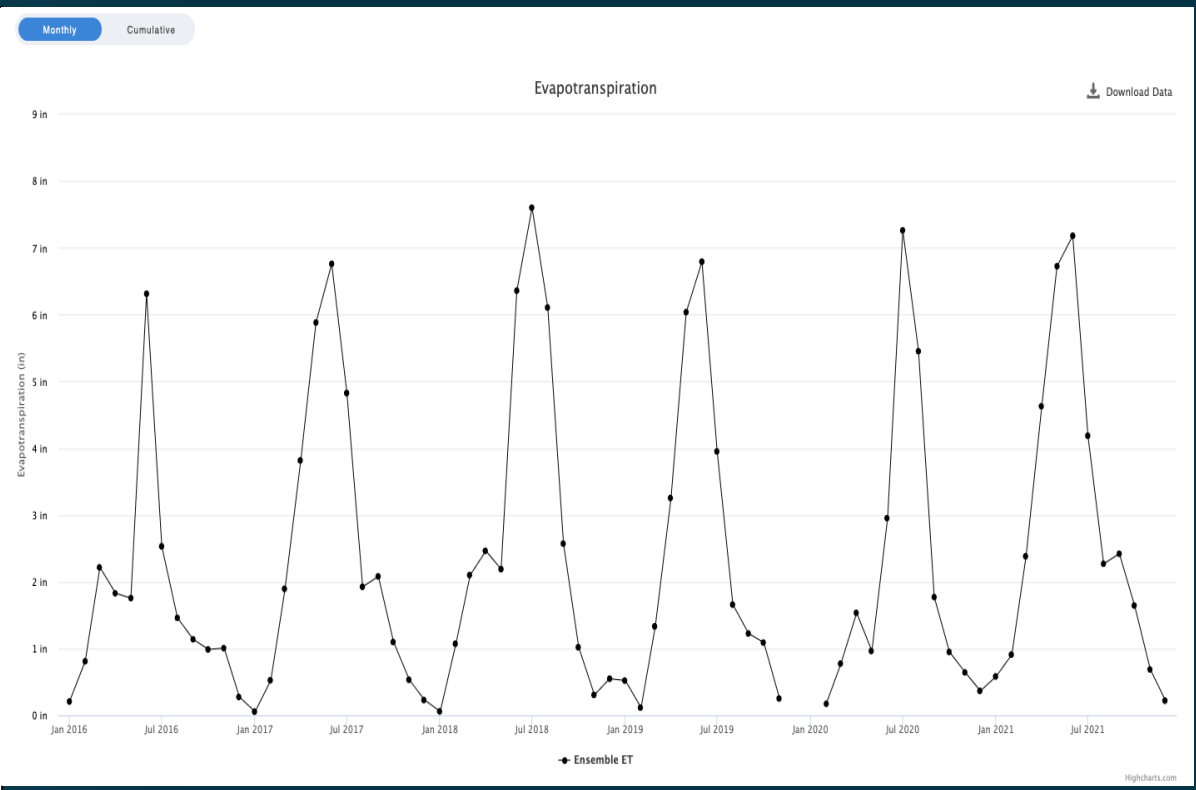
Partnership Activities from better drought forecasts to Climate-Smart Agriculture

# **Your Nation's** space program has an agriculture program




Univ. of Illinois

Fertilizer Management example



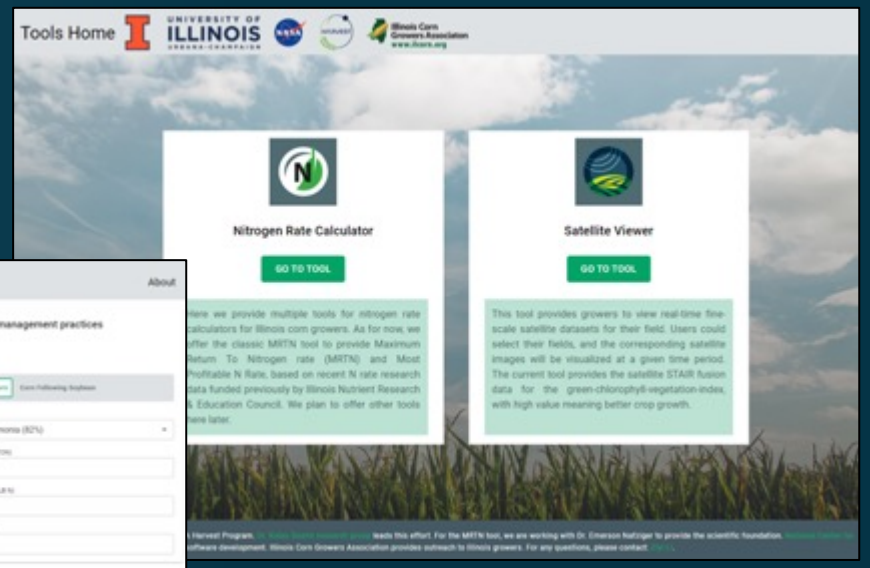

Water Demand example

# Using Satellite Data To Help Farmers Improve Field-Scale Nutrient Management

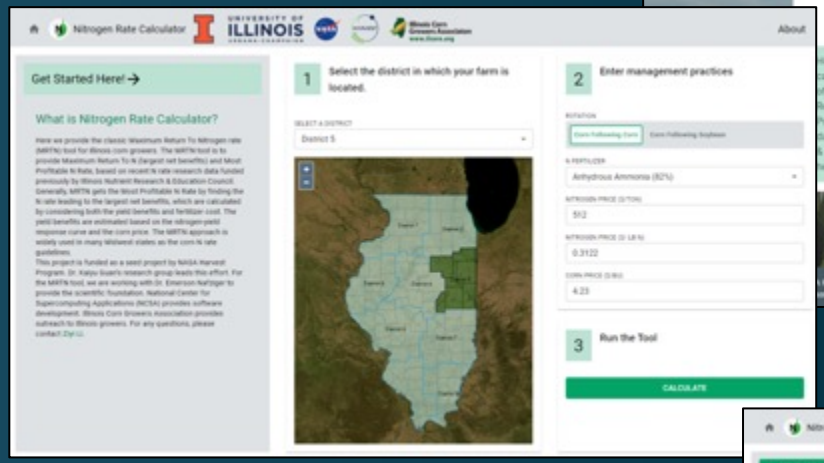
- Collaboration with Illinois Corn Grower Association farmer members through reciprocal learning & citizen science
  - Precision Conservation Management program: combining precision technology and data management with farm business to help farmers manage, adopt, and adapt conservation practices long-term and improve on-farm decision-making

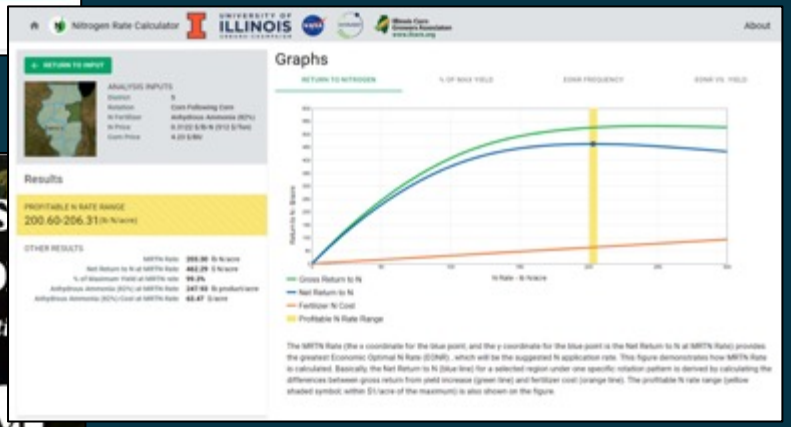
- Web-based software to guide Illinois farmers' decision-making for improved nitrogen fertilizer application
  - Based on the concept of Maximum Return to Nitrogen (MRTN) with newly-collected nitrogen fertilizer trial data in Illinois

- Focused on advancing tools by explicitly incorporating granular environmental conditions (i.e. soil and climate) and satellite data




https://harvest.ncsa.illinois.edu/



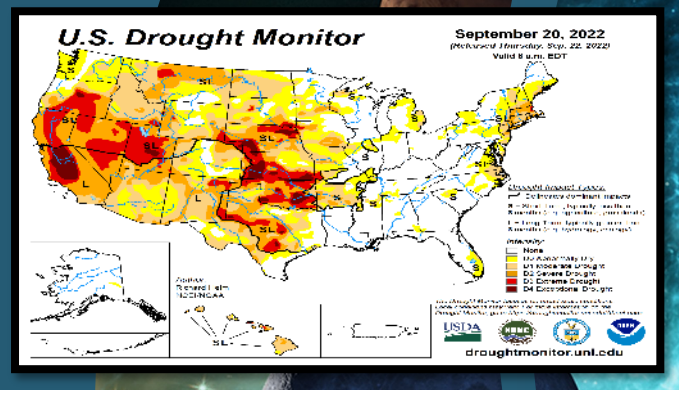



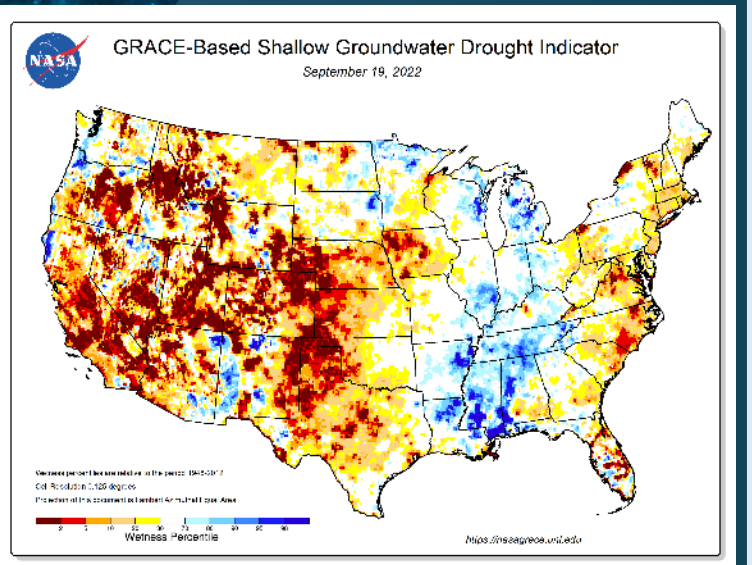


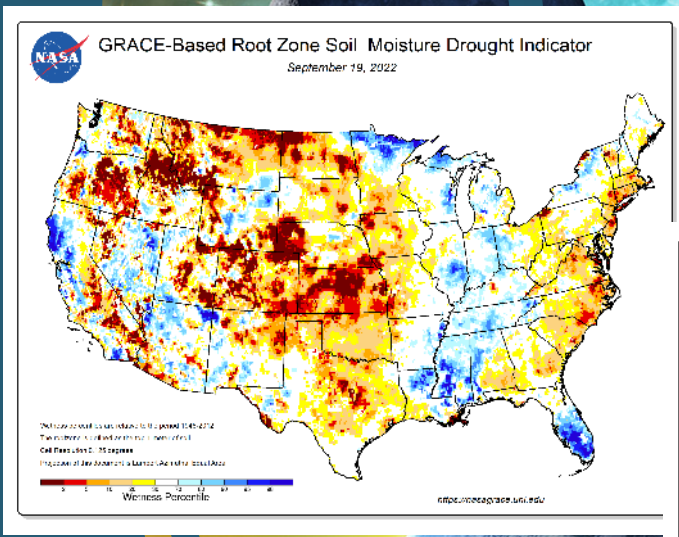
https://www.precisionconservation.org/pcm-booklet-2021/

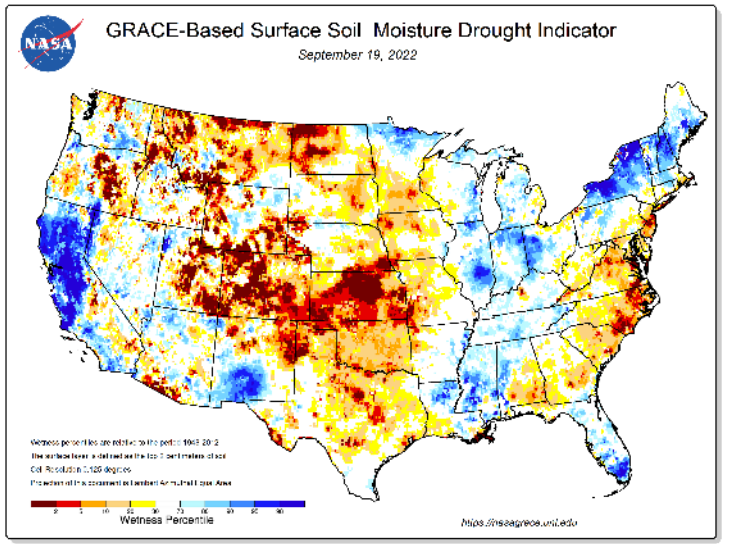
Guan et al

# U.S. DROUGHT MONITOR SUPPORTED BY NASA




## Western Water Applications Office (WWAO)

**Examples of other projects/activities:**

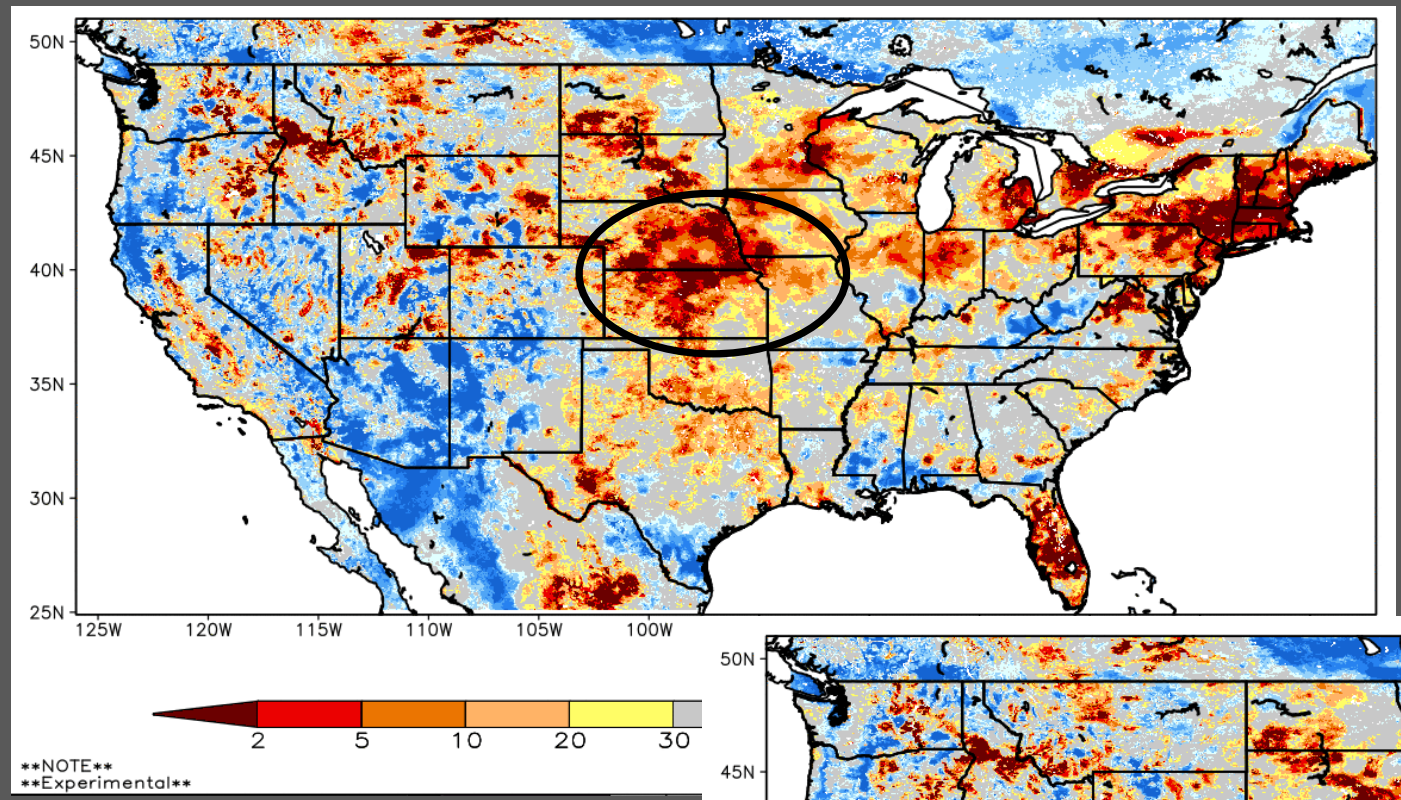
Snow Data for USDA NRCS Snow Monitoring and Runoff Forecasting

Monitoring Remote Stock Ponds in the Southwestern U.S. for Ranchers and USFS

Improving predictions of water yield and sediment loads in the Columbia River Basin through the incorporation of Landsat-derived vegetation parameters into an existing online process-based hydrology and erosion model (WEPPcloud) - USFS

NASS-Crop CASMA (Crop Condition and Soil Moisture Analytics)

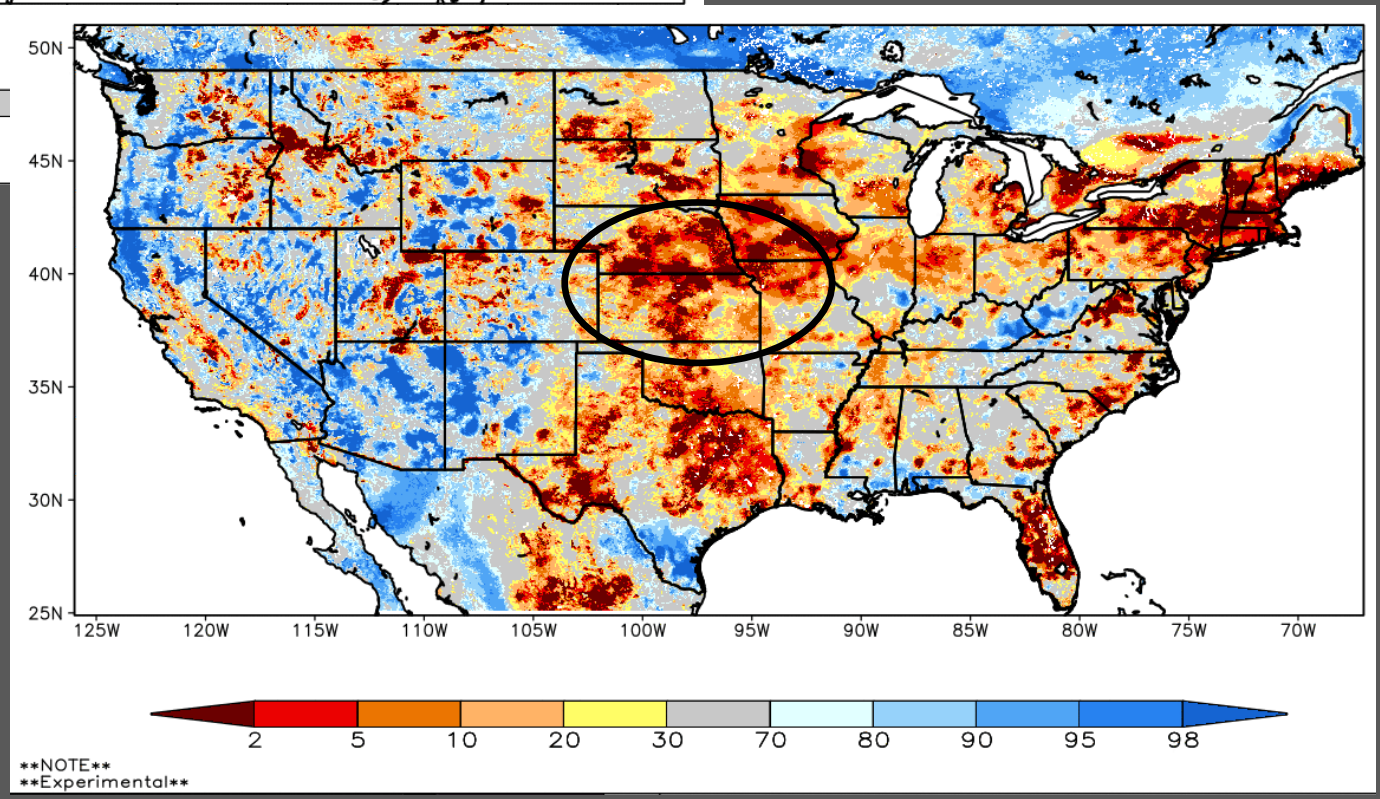

*The Crop-CASMA data viewer shows soil moisture anomalies for CONUS on April 01, 2022 with many western areas showing over 50% less moisture than average.*


14-day outlook of soil moisture issued on August 4 (for August 19)

Land surface models with predictions of upcoming weather can provide forecasts of soil moisture changes in a 14-day period.

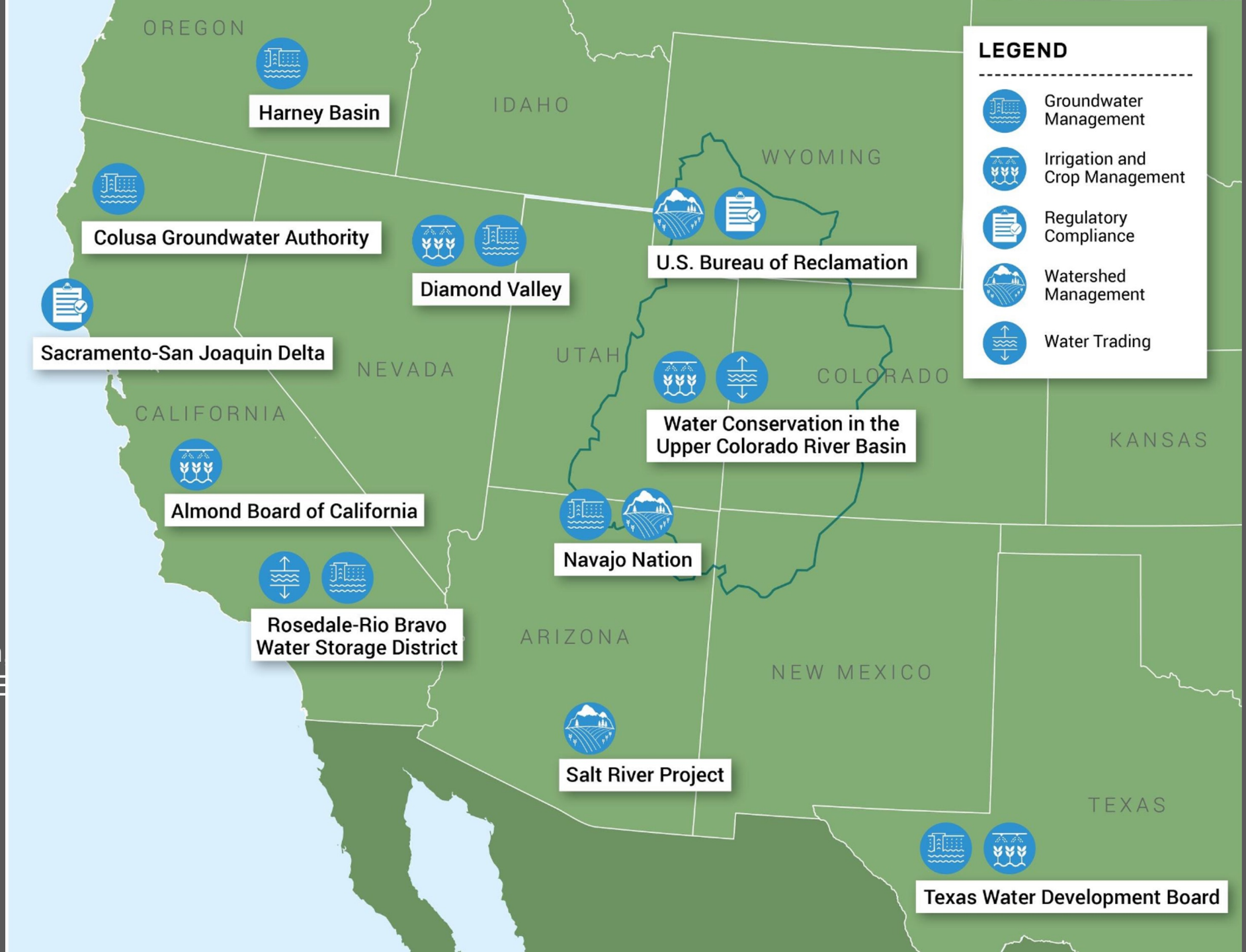
Actual soil moisture on August 19



# OPENET

## Filling the Biggest Data Gap in Water Management

EDF Environmental Defense Fund — Finding the ways that work
NASA
Google Earth Engine
DRI Desert Research Institute
USGS science for a changing world
USDA ARS
The World Bank
University of Idaho
Wisconsin — University of Wisconsin–Madison
University of Maryland
University of Nebraska Lincoln
California State University Monterey Bay
HabitatSeven




Forrest Melton,
Maurice Hall, E
April 24, 2019

OPENET Filling the Biggest Data Gap in Water Management

What is ET? | How to use Data | Methodologies | Known Issues | API | FAQ | Newsroom | About | Contact | Sign Out

Home Explore Data Use Cases Accuracy

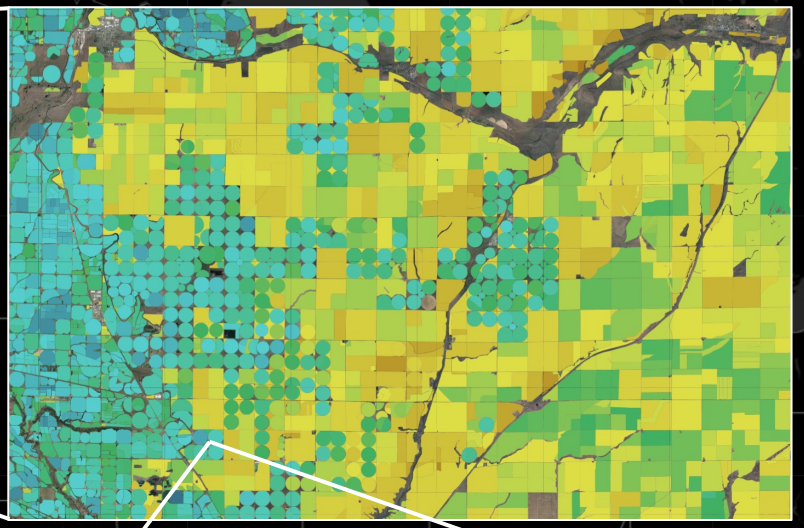
Search | Select Year 2021 | Variable ET | Raster View | Field View | New Here? Take a Tour!

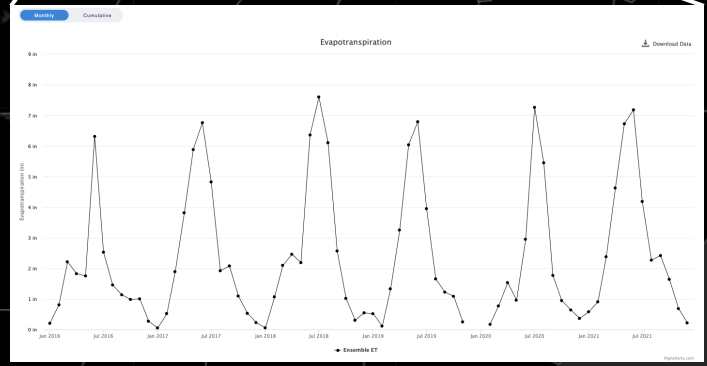
Cities | mm | in

27 in

Cumulative Ensemble Evapotranspiration (in)

0 in






https://openetdata.org

? About Crop Type and Field Boundaries

Opacity

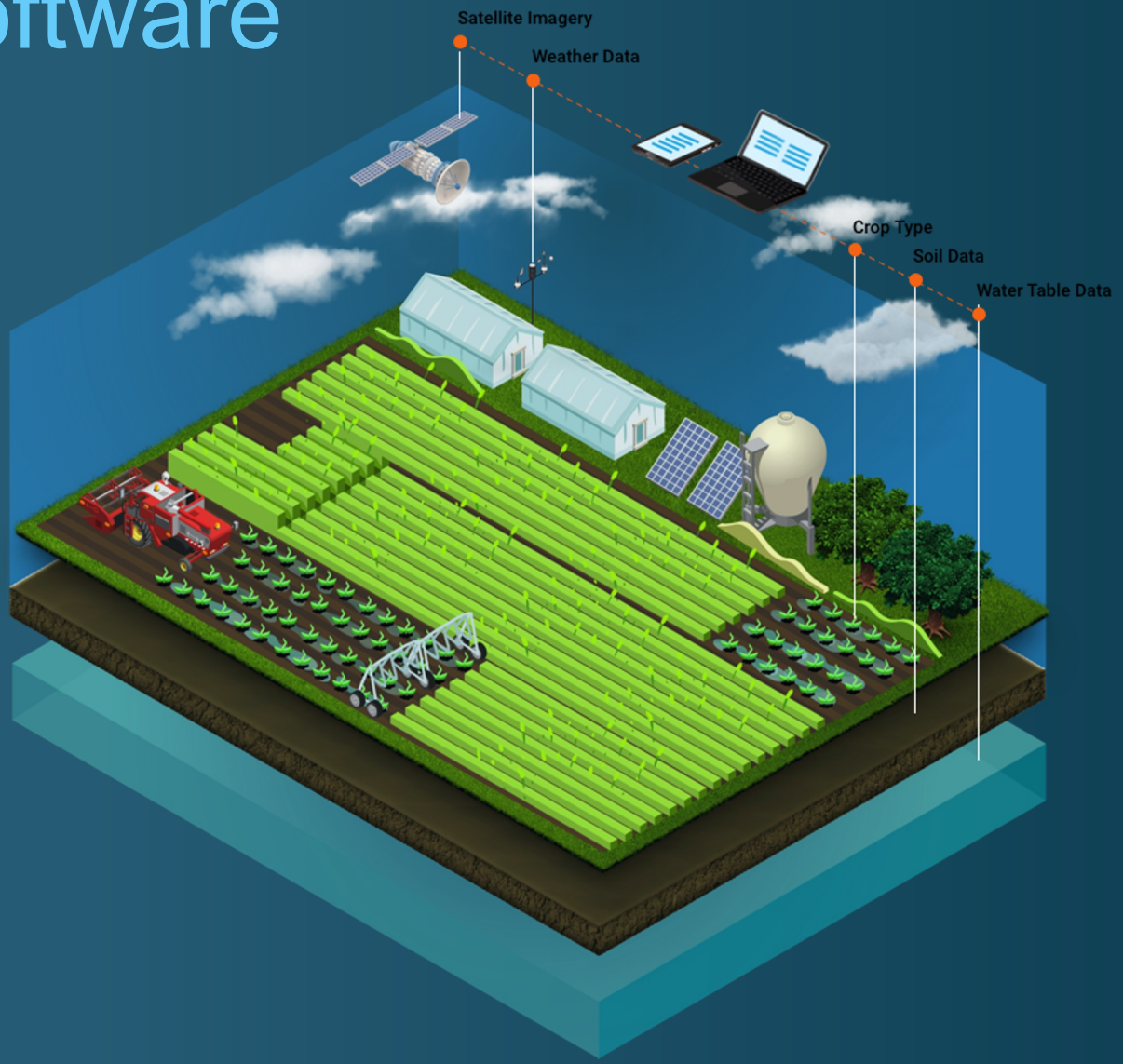
Powered by Google Earth Engine

Draw Custom Area

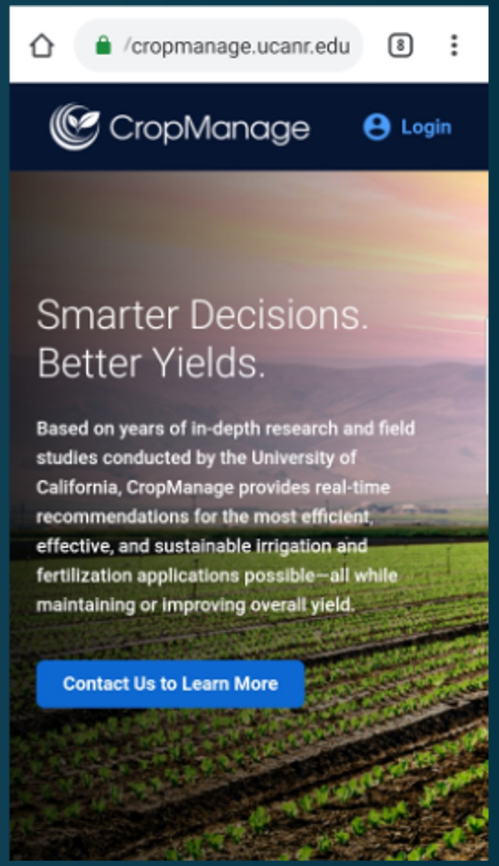
Google 100 mi

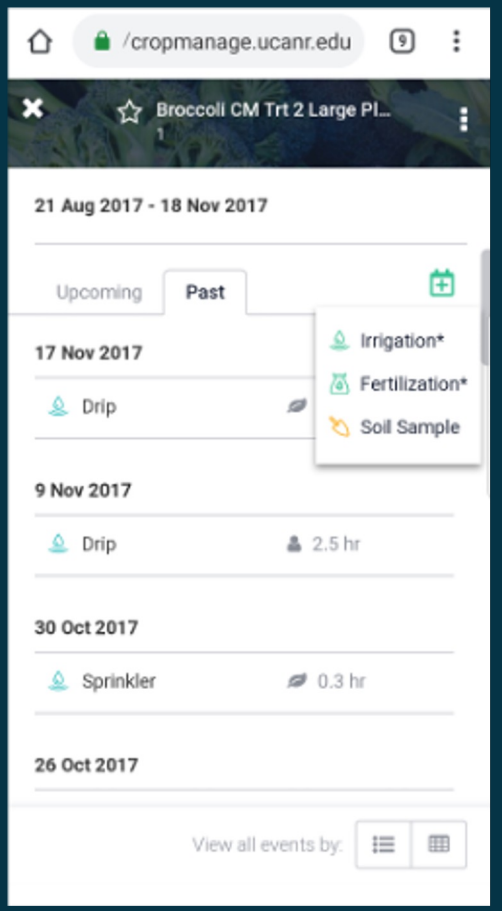
Leaflet | Map data ©2022 Google, INEGI | Terms of Use

# Linking Satellite Data with Irrigation Mgmt Software




## UCANR CropManage



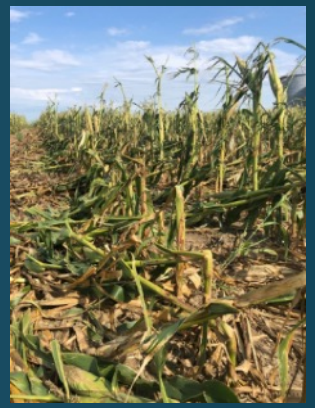

https://cropmanage.ucanr.edu/
Dr. Michael Cahn

# IMPACT: DISASTER ASSESSMENT- US DERECHO

On August 10, 2020 a severe derecho (strong wind storm) swept across Iowa, the largest corn/soy growing state, causing widespread damage, bending and flattened crops over approximately one-third of the state.

**Total loss** was estimated at **$31 Million**

Loss adjustment took 4 months to manually assess the damage caused and over 100,000 'man-hours' at a cost of $2.5 Million
(source:PlanetWatchers)



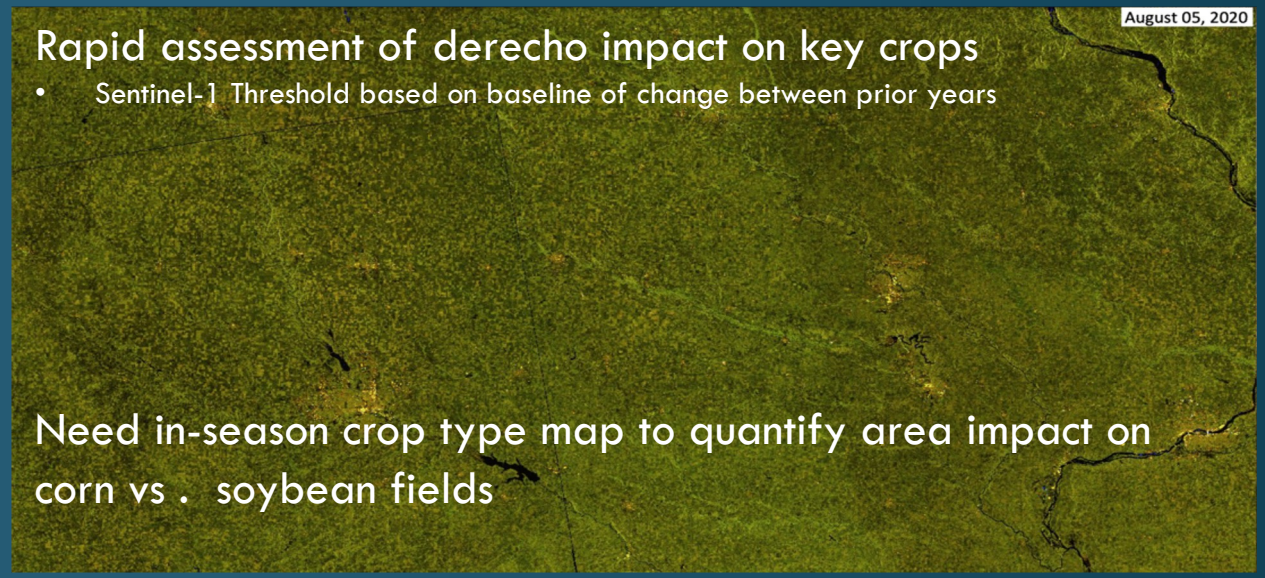
Open Access Article

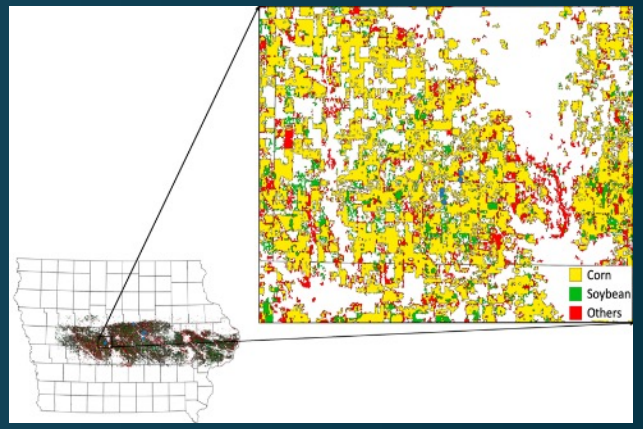
**Evaluating the Impact of the 2020 Iowa Derecho on Corn and Soybean Fields Using Synthetic Aperture Radar**

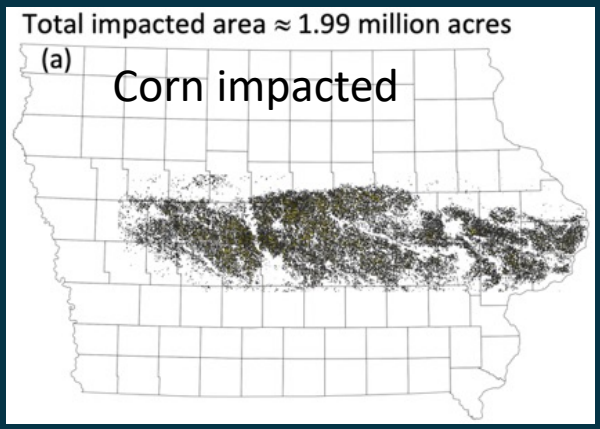
by Mehdi Hosseini [1,*], Hannah R. Kerner [1], Ritvik Sahajpal [1], Estefania Puricelli [1], Yu-Hsiang Lu [1], Afolarin Fahd Lawal [1], Michael L. Humber [1], Mary Mitkish [1], Seth Meyer [2] and Inbal Becker-Reshef [1]

[1] NASA-Harvest, Department of Geographical Sciences, University of Maryland, College Park, MD 20740, USA
[2] Food and Agricultural Policy Research Institute, University of Missouri, Columbia, MO 65211, USA
* Author to whom correspondence should be addressed.

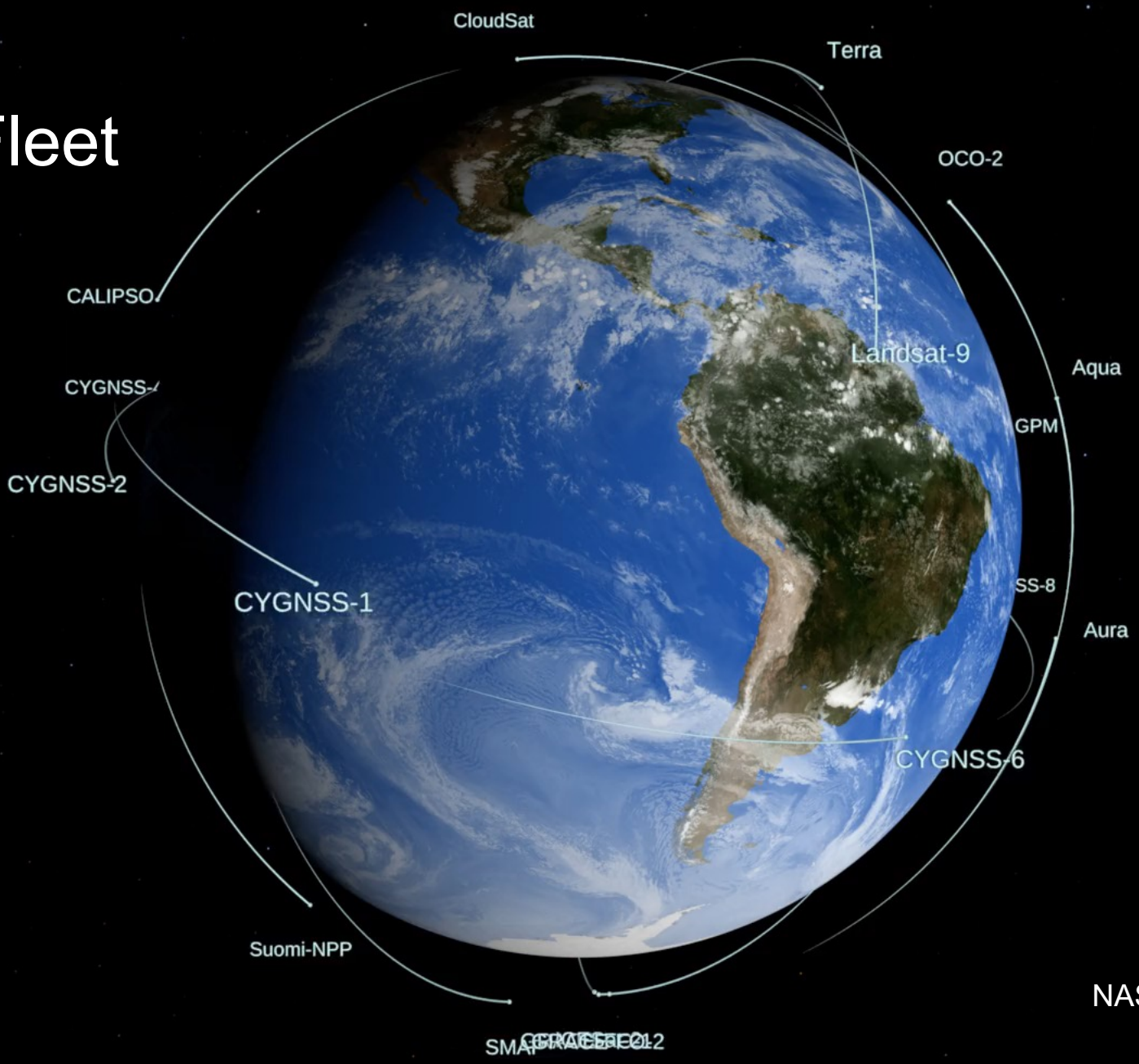
*Remote Sens.* **2020**, *12*(23), 3878; https://doi.org/10.3390/rs12233878



# NASA Earth Observing Fleet
# 28 Earth observing satellites




***~1,000 Earth observing satellites today…growing exponentially***

December 2021

NASA Scientific Visualization Studio
svs.gsfc.nasa.gov/4928


NASA
NASA EARTH
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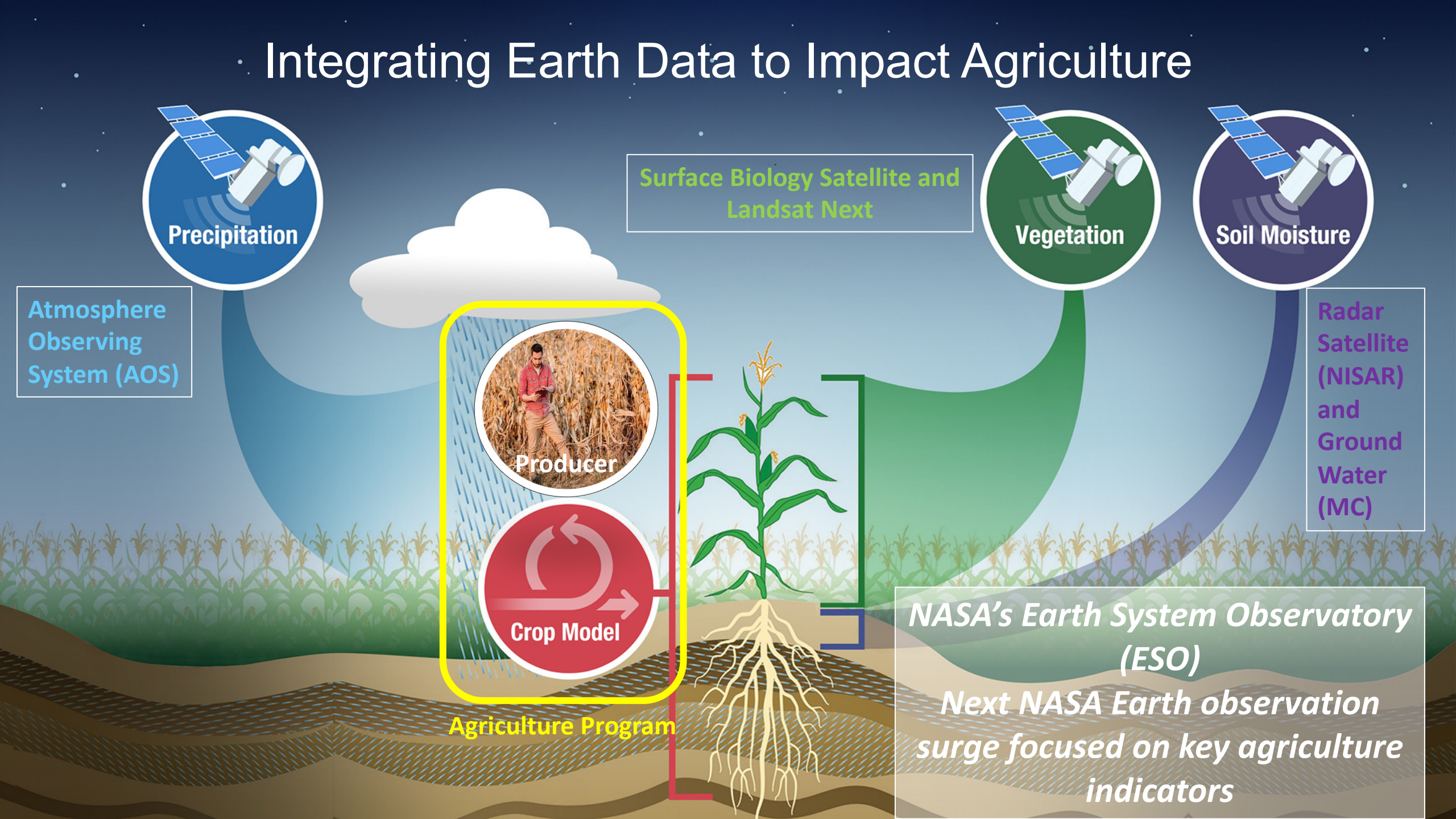
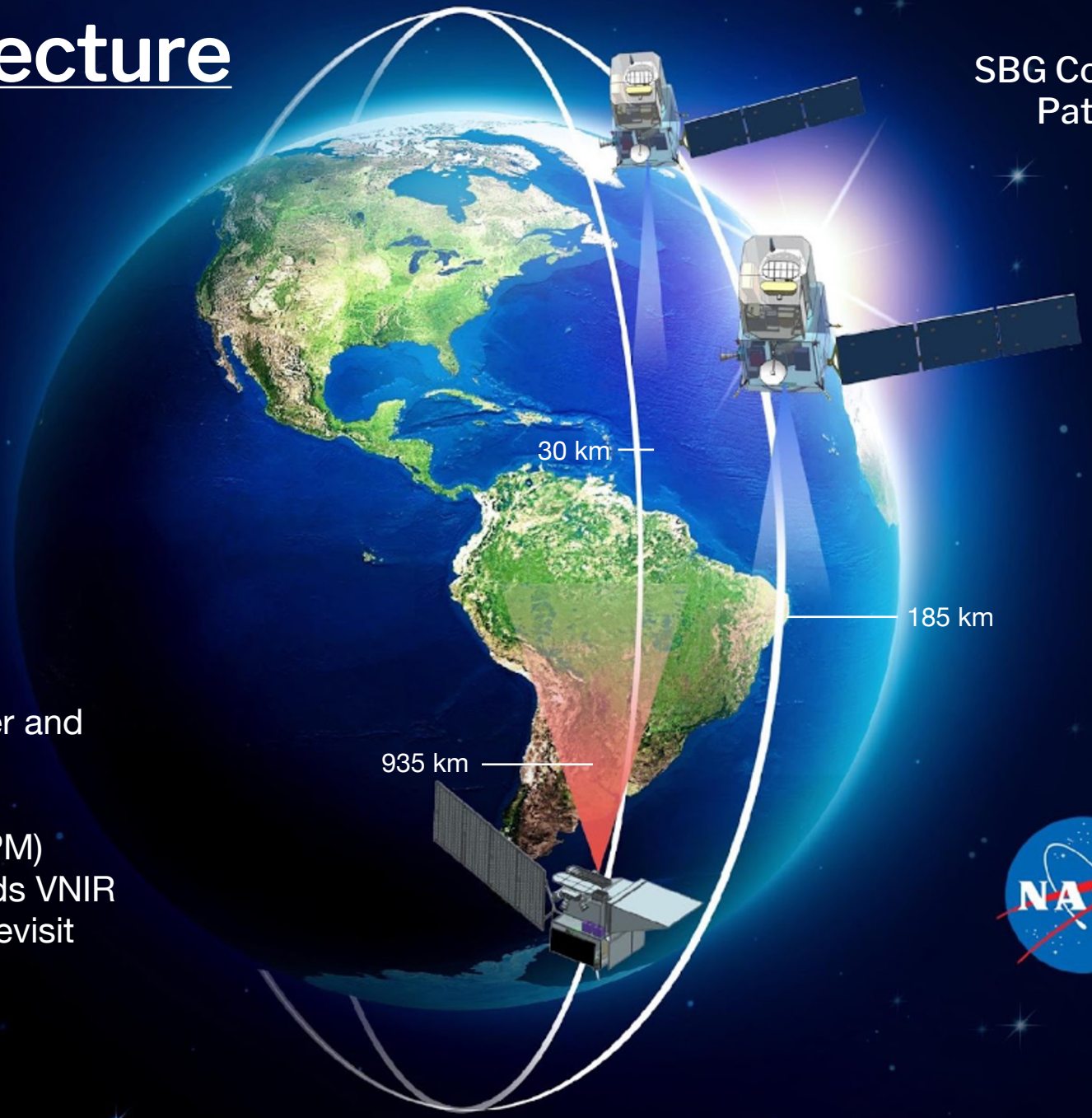
Moving Forward

*Supported by NASA Applied Science Program, CNES-French Investment Program*

# Integrating Earth Data to Impact Agriculture



# SBG Architecture




SBG Constellation Pathfinder

## SBG Light

Wide-swath VSWIR spectrometer

Sun-sync orbit (late AM)
185 km swath
16 day revisit
10 nm, 200+ bands
30 meter GSD
High SNR and radiometric performance
**~5 deg off-nadir tilt**

## SBG Heat

Wide-swath TIR imager and ASI VNIR camera

Sun-sync orbit (early PM)
5+ bands TIR, 2+ bands VNIR
935 km swath, 3 day revisit
60 meter GSD
0.2K NeDT

# Space For Ag Tour

## ESD Director Karen St Germain
## August 2022

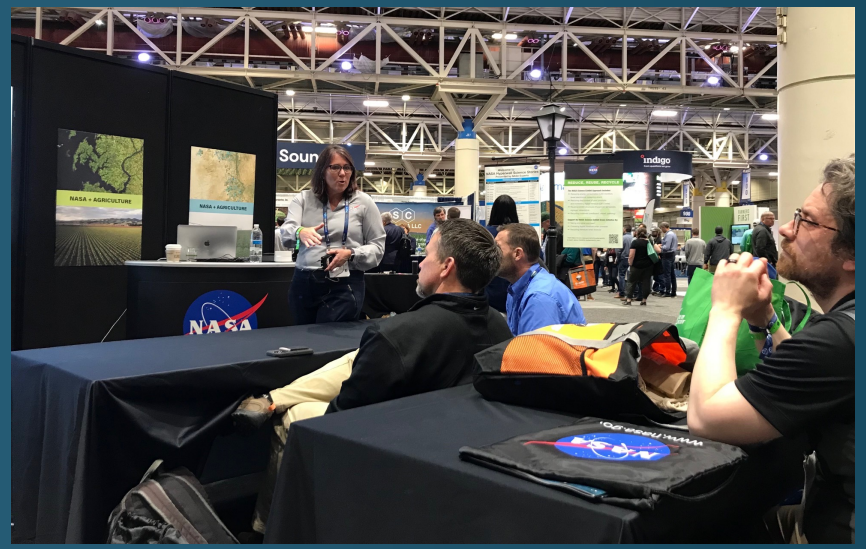
**NASA ESD Leadership's Objective**

Involve agricultural producers in the development of useful and practical guidance for Earth science applications. Engage producers and their allied industries through a strategic plan that incorporates direct outreach, communication and media

- Visit Kansas and Nebraska land grant universities and agricultural research institutes
- Visit with Nebraska and Kansas famers and Extension Educators
- Meet with crop association members
- Commodity Classic 2023

# NASA Activities – Broadening our Community

- NASA Acres Program (Domestic)
- NASA Harvest Program (Global)
- Western Water Applications Office
  - Basin Needs Assessments
- 14 Water Resource Projects – aligned with agriculture
- Meetings with NACD
- “Space for Ag” Tour
- USDA Outlook Forum
- Commodity Classic

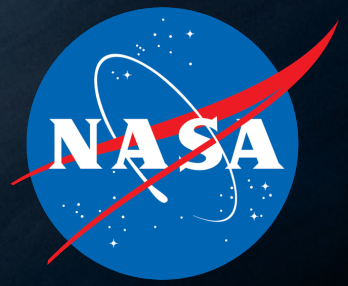





# NASA Activities – Broadening our Community – in Kansas

KSU Konza Praire Biological Station

**<u>Your Nation's</u>**
Space Program has an agriculture program




**NASA EARTH**
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Google: NASA Agriculture