NOAA National Environmental Satellite, Data, and Information Service

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NOAA's Satellite Applications Symposium Series: Land and Agriculture Improving Terrestrial Land Monitoring Capabilities Through New Satellite Technology Tuesday May 20, 2025, 900 AM - 340 PM EDT

LEO Update: Low Earth Orbit Observations for Agriculture and Drought Monitoring

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Outline

- Background- Remote sensing in Agriculture
 - Types of applications
- Meteorological Drought
- Examples of sources of LEO time series of vegetation indices for drought monitoring



Remote Sensing in Agriculture

- Remote sensing of agriculture is one of the oldest applications dating back to 1970's:
 - Acreage estimates
 - Crop type identification
 - Crop yield estimation
 - Crop condition estimation: abiotic and biotic stress due to droughts, heat, nutrition, pests, disease, pollution etc.
 - Soil type, moisture, composition
 - Phenology
 - Inundation due to floods, drainage
 - Agriculture meteorology (Photosynthetically active radiation, surface temperature, humidity etc.)
 - Precision agriculture
- Over 50 years of global LEO satellite observations for agriculture from NOAA, NASA, USGS, other international agencies, commercial.



SNPP, NOAA20, NOAA21



14x Orbits Earth 14 times pole-to-pole with SNPP



Images entire globe twice a day



State of the art instrumentation to collect data on Earth's atmosphere, lands, and oceans



Sends more than 2,000 gigabytes of data to Earth every day



NOAA-21 flies ~50 minutes/half an orbit, ahead of NOAA-20. Suomi NPP orbits between the two, about 25 minutes away from each.





Meteorological Drought 6 6 6 Decreased precipitation, increased temperature, and increased evapotranspiration Meteorological drought affects human demands and values for water, exhibited as hydrologic, agricultural, and socio-economic drought. Socio-economic - impacts increase to ecosystem services related to recreation, wildlife, and carbon sequestation. Hydrologic - streamflows, w quality, and reservoir Ecological drought is a water deficiency that evels decrease

Ecological drought is a water deficiency that creates ecosystem vulnerability, and affects ecological and landscape characteristics, land and water use, and resource management.

Major/Extended

Minor/Limited

Agricultural - productivity and crop survival decreases.

Scale of Drought and Length of Time

https://www.fs.usda.gov/managing-land/sc/drought

Types of Drought

•Hydrological drought: Reduced water in streams, lakes, and reservoirs.

•Agricultural drought: Reduced crop survival and productivity.

•Socio-economic drought: Reduced supply of economic goods (such as food and timber), such that these are unable to meet demands.

•Ecological drought: Ecosystem effects of drought, which can increase ecosystem vulnerability to other disturbances, and can affect a variety of plants and animals in forests and rangelands.





Economic Impacts of Droughts in the US





Basemap Sources: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, Cost of Major Drought Events Since 1980 INCREMENT P



Source(s): NCEI Updates Quarterly: 04/10/25

Drought.gov



Meteorological Drought

- Meteorological variables impacting drought
 - Water availability
 - o Soil moisture
 - Surface water: Reservoir, streamflow levels
 - Ground water
 - Precipitation: Rainfall/snowfall/runoff
 - Temperature
 - Evapotranspiration
- Satellite indices to monitor drought: Vegetation Indices, [e.g. Normalized Difference Vegetation Index (NDVI), Vegetation Health Index (VHI)] – proxy indices for crop health and state



Example of Vegetation Indices Data Sources

- NOAA/NESDIS/STAR
 - <u>https://www.star.nesdis.noaa.gov/smcd/emb/vci/VH/index.php</u>
- NASA GIMSS Global Agricultural Monitoring
 - <u>https://glam1.gsfc.nasa.gov</u>
- International-FEWS NET
 - https://earlywarning.usgs.gov/fews/



2024 VIIRS NDVI



https://www.nnvl.noaa.gov/view/globaldata.html#NDVI



2024 NDVI





NOAA/NESDIS/STAR

https://www.star.nesdis.noaa.gov/smcd/emb/vci/VH/index.php

2024 Vegetation Health Index (VHI)





2024 North America – Vegetation Indices







Time Series From NOAA/STAR





VIIRS NDVI Time Series of NASA GIMSS





Evaporative Drought Index



evaporative demand (E_0) : also known as "the thirst of the atmosphere"

https://psl.noaa.gov/eddi/#current_conditions

Generated by NOAA/ESRL/Physical Sciences Laboratory



⁽EDDI-percentile category breaks: 100% = driest; 0% = wettest)

Somes Examples of LEO Data For Drought Monitoring

- The US Drought Monitor
 - https://www.drought.gov/
- Famine and Early Warning System
 - <u>https://earlywarning.usgs.gov/fews/</u>



The National Integrated Drought Information System (NIDIS) The US Drought Monitor



https://www.drought.gov/



Questions to the Audience

- What are your information needs for agricultural applications?
- What type of satellite data do you need?
- Are you aware of satellite data that NOAA provides?

