

NESDIS's Impact on Agriculture

From Outer Space to Our Plates

As the world's population grows, demand for food increases. Thanks to advances in technology, farming has transformed to a highly efficient, data-driven industry. NOAA's National Environmental Satellite, Data, and Information Service (NESDIS) directly supports agriculture by providing essential data and tools that help us produce more food, enhance food security, and adapt to an ever-changing world.

Satellite and Ground-Based Monitoring

NESDIS operates a fleet of satellites that provide data vital to farmers: including crop health, soil moisture, weather, and climate. NESDIS satellites can spot crop diseases and pests early, predict yields, and guide decisions on water management, fertilization, and harvesting more efficiently. This technology allows farmers to make informed decisions and boost productivity, which benefits society as a whole.

Satellite data improves accuracy of weather forecasts, watches, and warnings, helping farmers anticipate weather patterns, monitor changes, and prepare for extreme weather events, such as hurricanes or droughts. Beyond individual farmers, NESDIS satellite and ground-based measurements contribute to sophisticated crop models and data products used by agronomists, economists, commodity traders, insurance companies, and both national and global food and relief organizations.

Data and Services

NESDIS satellite data plays a pivotal role in the development of precision agriculture techniques. By combining satellite imagery with ground-based measurements and GPS technology, farmers can obtain detailed maps of variations in soil composition, soil moisture levels, and crop health conditions. This can improve management

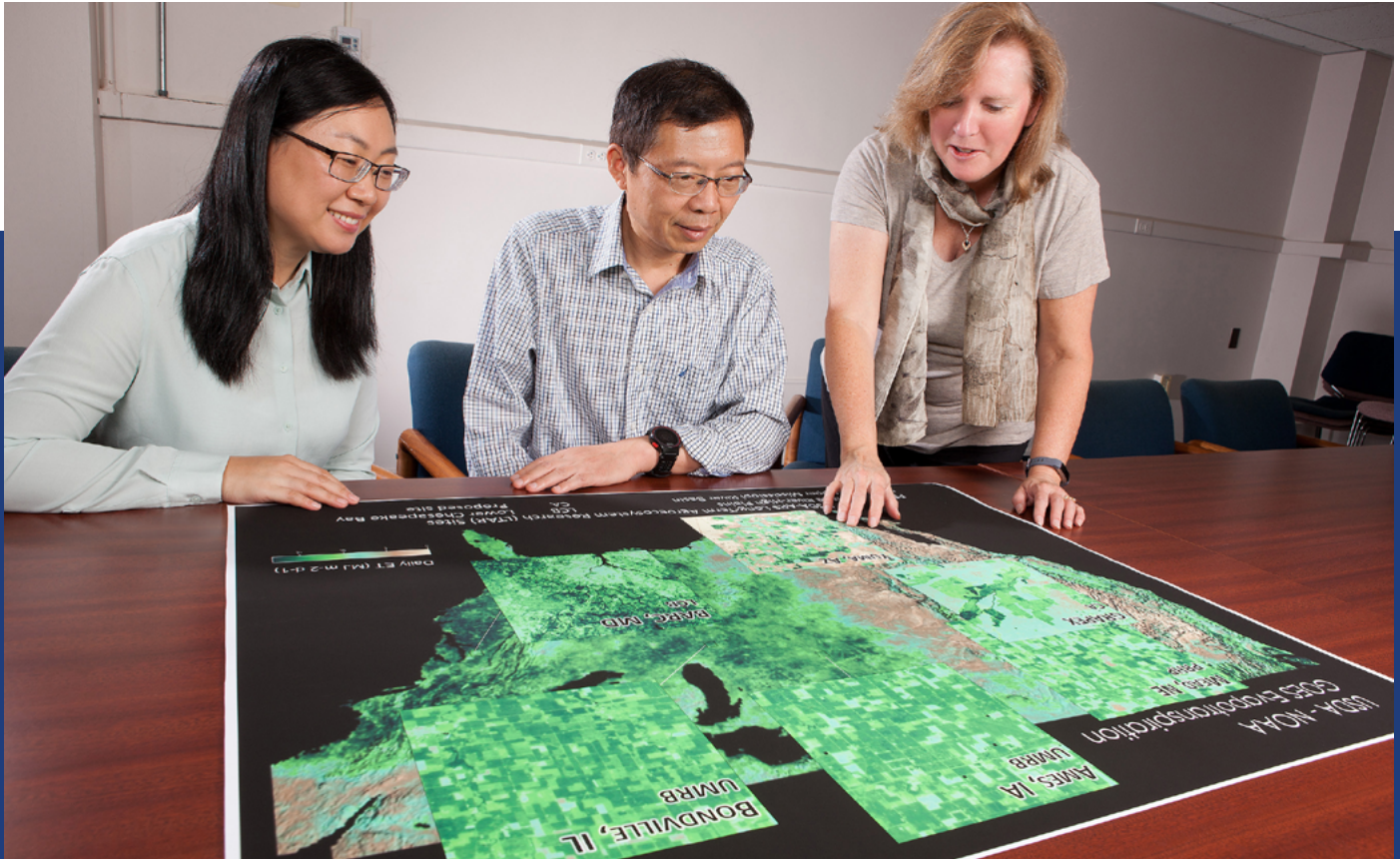
practices, such as precision application of farm inputs like water, fertilizer and pesticide, reducing waste and environmental impact while improving efficiency.

"Water availability is a major issue facing agriculture in many parts of the globe today, and uncertainty in water supplies to support crops—both through rainfall and irrigation—will become even more volatile under changing climate conditions. We're using GOES data to monitor crop water availability and agricultural drought in the United States, and the thermal bands on GOES [satellites] in particular provide a very effective early warning signal of developing crop stress.

GOES is an excellent platform for regional monitoring, offering the necessary regional coverage and rapid temporal sampling required to quickly identify changes in water use and availability across the entire United States. Moreover, it provides much finer spatial detail (a couple of kilometers) than what can be attained with standard meteorological data."

*—Martha Anderson, Research Physical Scientist,
U.S. Department of Agriculture*





Scientists (left to right) Dr. Yun Yang, Dr. Feng Gao, and Dr. Martha Anderson from the USDA's Hydrology and Remote Sensing Laboratory view high-resolution maps of evapotranspiration (ET), or crop water use, over various agricultural landscapes in the United States. These detailed maps are generated using a combination of data sources, including land-surface temperature from NOAA's GOES satellites and leaf area index data from NASA's MODIS instrument. They will soon also incorporate data collected by the VIIRS instrument onboard NOAA's JPSS satellites. This information helps manage irrigation, estimate the effects of drought on yield, and map crop water productivity. Photo by Peggy Greb.

Additionally, NESDIS scientists from NCEI and STAR work closely with NOAA line offices and programs to deliver data and information to regions and underserved communities in the United States and around the globe where ground-based information on agricultural conditions or productivity is imprecise or uncollected.

Other federal agencies, such as the U.S. Department of Agriculture, rely on NESDIS satellite data and NESDIS scientists to support tools that farmers, commodity markets, and food-aid organizations rely on regularly. For example, NESDIS STAR scientists support the National Integrated Drought Information System with measurements from the VIIRS instrument aboard the Suomi-NPP satellite to monitor crop health over broad areas. This information helps farmers better predict yields, helps insurers analyze risk, and helps traders and food-relief organizations find pricing.

Disaster Management and Response

Natural disasters can devastate agricultural production. NESDIS satellite data helps monitor progression of a potential disaster, issue early warnings, and aid in response. For example, the evaporative stress index based on satellite evapotranspiration observations could provide a one-to-two-week early warning of a flash drought occurrence. Satellite data improves agricultural resiliency in the face of changing environmental and weather conditions.

Climate disasters, especially drought, can significantly reduce crop yield and livestock production. As drought-related crop losses intensify due to climate change, NOAA's Earth observation satellite data can improve efforts to prevent further loss of food production.

The U.S. Drought Monitor (USDM) is a map released weekly, showing the location and significance of drought across the United States and its territories using NESDIS satellite data on an array of land surface conditions. NESDIS has expanded the USDM to cover the U.S. Affiliated Pacific Islands, and as a result, Guam was able to apply for agricultural disaster assistance for the first time in history.

Weekly USDM publications are specifically used to determine Agriculture Disaster Declarations and deliver relief and aid to farmers. The USDM is also used to determine payouts from the USDA Livestock Forage Program (over \$1B annually), the Emergency Haying Program, and the Dry and Nonfat Milk Program.

For more information on the USDM, please see: NESDIS Impacts Brief Article on Tropical Cyclone Algorithms and Droughts Definitions: [Making an Impact on Extreme Events and Cascading Hazards](#).

Climate Change Adaptation

As the effects of climate change become increasingly evident, NESDIS data is becoming more important to farmers adapting to new challenges. Rising temperatures, shifting precipitation patterns, and more frequent extreme weather events pose significant risks to agriculture. NESDIS provides the data necessary for long-term climate analysis, helping farmers make strategic decisions about crop selection and management practices that are resilient to changing climate conditions.

Global Food Security

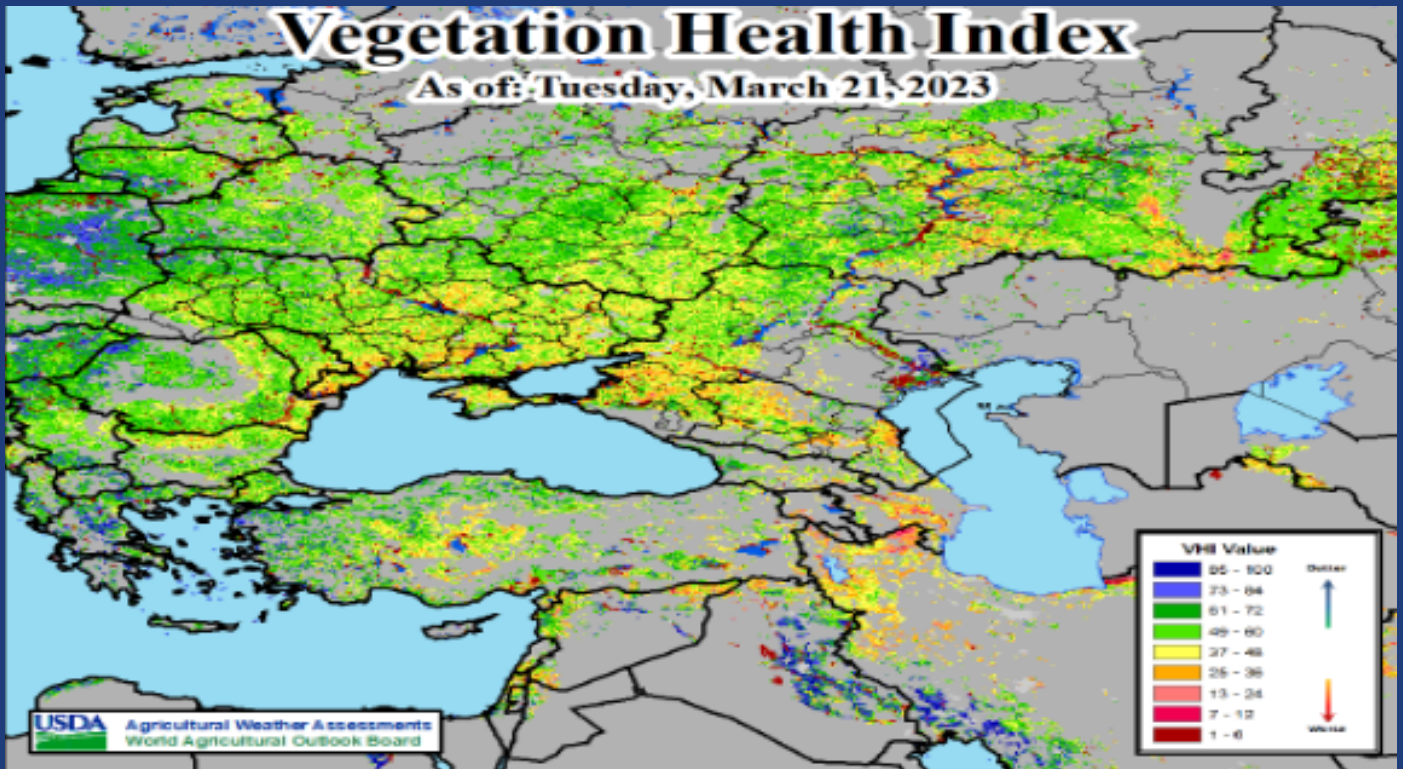
NESDIS's impact on agriculture extends beyond the United States. By collaborating with international partners and sharing data, NESDIS contributes to global food security efforts. Timely information about weather patterns, crop conditions, and food supply helps governments and organizations make informed

decisions regarding food distribution, aid, and disaster relief in vulnerable regions worldwide.

"I'm a farmer in Columbus, Mississippi, and I have a healthy pine forest planted 25 years ago. Farming trees is a long-term investment, with returns coming decades after planting. If I lost my forest from wildfire, disease, or insect infestation, I would be financially devastated. Satellite data provides invaluable insights about the weather; precipitation patterns; and threats like droughts, floods, and wildfires; empowering me to make informed decisions to mitigate risks, manage resources, and protect my trees."

—Billy Cox, Cox Centennial Farm
Columbus, Mississippi





NESDIS In Action

NESDIS isn't just about satellites in space—it's about making a difference here on Earth.

NESDIS vegetation health index (VHI) data products have been used by USDA's World Agricultural Outlook Board to forecast crop yield since the 1990s. The VHI map in the right figure is used to feed USDA's crop models. The plot in the figure indicated that VHI data contributed to the sunflower production forecast significantly together with weather data. USDA uses near real time weekly VHI data from NESDIS delivered by NESDIS Vegetation Health Product team.

By providing farmers with essential data from satellite and ground-based observations, NESDIS is transforming agriculture, boosting food security, and helping us adapt to a changing world. As technology continues to advance, we can expect NESDIS to remain at the forefront of agricultural innovation, shaping the future of food production for generations to come.