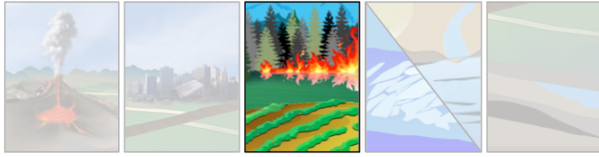


NISAR: The NASA-ISRO SAR Mission



Preparing Markets for Bountiful Harvests

NISAR will provide maps of developing crop area on a global basis every two weeks. Observations will be uninterrupted by weather and provide up-to-date information on the large-scale trends that affect international food security.

Modern Remote Sensing Technology and Farming

In recent years, with the rise of silicon, modern technology has permeated all levels of society. Through GPS, automation and space technology, the discipline of agricultural production has been no exception, and indeed has historically always been an early adopter of new technology.

Food security and the accomplishments of agribusiness are founded on the continuity of a global food supply that fluctuates with changing national policies, regional climate variability and market forces that govern what individual farmers and corporate farming entities plant and harvest every year. In challenging environments such as this, information leads to efficiency, stability and success.

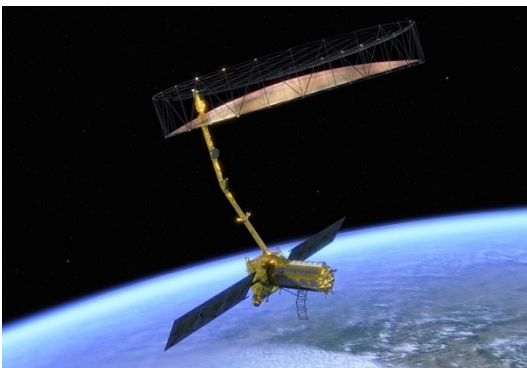


Photos (clockwise): Flickr, CC BY-NC 2.0: Kimberly Reinhart, Jason & Kris Carter, fishhawk, Eric Baker

Crop Area Monitoring

To feed a growing population of more than 8 billion, food production and supply occur on a global basis. In order to better guide policy and decision making, national and international organizations work to transparently monitor

trends and conditions of agriculture in a timely basis. Because of the variable nature of planting and harvesting practices, efforts such as this are manpower intensive and time consuming tasks.



The NISAR Mission – Reliable, Consistent Observations

The NASA–ISRO Synthetic Aperture Radar (NISAR) mission, a collaboration between the National Aeronautics and Space Administration (NASA) and the Indian Space Research Organization (ISRO), will provide all-weather, day/night imaging of nearly the entire land and ice masses of the Earth repeated 4-6 times per month. NISAR's orbiting radars will image at resolutions of 5-10 meters to identify and track subtle movement of the Earth's land and its sea ice, and even provide information about what is happening below the surface. NISAR will also provide information on crop area and forest biomass over time and with enough detail to reveal changes on field scales. Products are expected to be available 1-2 days after observation, and within hours in response to disasters, providing actionable, timely data for many applications.

Among the organizations that track the trends in agricultural production on a global basis is the United Nations Food and Agriculture Organization (FAO). According to FAO's 2015 statistics, over eleven percent of the Earth's land surface (1.5 billion hectares) is used for farming. With an increasing population, after taking into account expected improvements in land use efficiency, the amount of land dedicated to food production is expected to grow 7% by 2030 to keep up with demand. This increase is equivalent to an additional 90 million hectares, roughly the size of Texas and Oklahoma combined.

With the world's population critically dependent on the timely production of food and fresh water resources, the need is greater now than ever before for the application of technology to assure that population needs are met. Among the technical tools that are used to address these issues are the satellites that provide synoptic views of the globe from space. Satellite sensors are routinely used to guide decision-makers and commercial interests alike in

scheduling future plantings and monitoring the effects of policy changes and a dynamic global marketplace.

The upcoming NISAR mission will provide dependable observations throughout the growing season. The use of actively generated microwave signals (L- and S-band, or equivalently, 24 cm and 10 cm wavelength) on board the satellite, means that the observations will be able to be reliably planned, collected and distributed at time scales that are commensurate with the satellite's 12-day repeat cycle of the full set of orbits, which images each agricultural site at least once every 6 days. Radar images from satellites such as NISAR are known for their ability to penetrate through clouds and their day/night imaging capability, which is a major limitation of optical sensors for agriculture applications. Radar imagery will provide near-weekly observations of almost all land areas that complement the optical data and provide independent information that is sensitive to the changing structure and moisture conditions of the crops being imaged. In addition, NISAR's data products will be available open access.

Radar Imaging of Crops

Observations of the Earth's land surfaces from space using radar allows reliable and repeated measurements to be made throughout the growing season. The structures of different crop and land cover types provide a rich variety of responses to the radar illumination in terms of varying polarization and frequency signatures. Because of the rapid, time-varying nature of crop rotation, growth, and harvest, frequently repeated radar observations can be used to determine both the type of crop and its stage of growth. Information like this is used to predict the health of the region's crops and the planned agricultural output.

Shown at right are data collected by SIR-C, a NASA mission launched on board the space shuttle in 1994. Data from areas such as the Dnieper River region of Ukraine were collected at study sites distributed throughout the globe and have been used by NISAR mission planners and other space agencies worldwide to understand how radar data can be used to improve our knowledge of the world around us. Modern day synthetic aperture radars (SAR), such as the Canadian Space Agency's Radarsat and the European Commission's Sentinel satellite series, have benefited from the SIR-C mission and are being actively used today.



Two-frequency radar image of the Dnieper River growing region collected in 1994 by NASA's Shuttle Imaging Radar program. In this false color image, developing wheat fields show up as bright magenta and forests as the bright white patches that follow the river's border