Food Security Leadership Council

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Securing U.S. Leadership in Earth Information

for Global Food Security and American Agriculture

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KEY POINTS

- Agricultural production and food supply chains depend on Earth information systems.
- Earth information encompasses the data we collect about how our planet functions and the knowledge we derive from it.
- Producers, market actors, consumers, and policy makers all benefit from reliable data, analysis, and projections.
- U.S. government capabilities form a central pillar of the global Earth information ecosystem.
- The U.S. government must protect, sustain, and enhance the use of Earth information for agriculture and food security planning through a three-part plan:

01 **SECURE THE FOUNDATION.**
Protect critical capabilities from degradation, ensure sustained investment, and create durable institutional structures.

02 **BUILD SMARTER SYSTEMS.**
Close capability gaps where we have fallen behind international competitors, invest in next-generation forecasting and AI/ML, and rebuild research capacity.

03 **LEAD THE FUTURE.**
Strengthen the public and private ecosystem, coordinate federal Earth information as a unified national asset, and position the United States to lead for decades to come.

THE ESSENTIAL NATURE OF EARTH INFORMATION

The U. S. government should embark on an ambitious effort to strengthen and modernize the public Earth information capabilities that underpin domestic food production, agricultural competitiveness, and global food security.

Earth information encompasses the data we collect about how our planet functions and the knowledge we derive from it. It includes primary data from satellite observations, ground-based monitoring networks, and ocean and atmospheric sensors. These observations become usable information through weather and climate models and other forms of analysis. Together, this information supports agricultural decision making, disaster preparedness, and food security planning.

U.S. government capabilities form a central pillar of the global Earth information ecosystem. The United States has historically made much of this information available as a public good, and it is an integral part of government, scientific, and commercial systems that advance the public welfare.

Earth information capabilities and resources are distributed across multiple federal agencies, including the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), the United States Department of Agriculture (USDA), the U.S. Geological Survey (USGS), the National Science Foundation (NSF), and the Department of Energy (DoE). They depend on sustained partnerships with universities, national laboratories, and the private sector

WHY NOW?

The Earth information infrastructure underpinning American agricultural competitiveness and global food security early warning is vulnerable. Multiple programs supporting international capacity building, disaster preparedness, and Earth systems science have been scaled back or terminated, and foundational Earth science research institutions face sustained pressure.

These are not abstract risks. Programs that took decades to build can be degraded in a single budget cycle. Once a satellite data record is interrupted, it cannot be reconstructed. Once partner countries have retooled around Chinese or European systems, they are unlikely to switch back.

China is rapidly expanding its satellite constellation and forecasting partnerships across Africa and Asia. The European Centre for Medium-Range Weather Forecasts is widely considered to produce the world's best medium-range forecast models. Chinese researchers are advancing AI-driven weather models that outperform conventional subseasonal systems.

The United States exercises leadership through both technical infrastructure and institutional partnerships. The United States supplies long-running open datasets, global model outputs, technical standards, and training that are used to support national meteorological services, commercial products, and multilateral planning. In turn, U.S. forecasts rely on observations collected abroad and shared through the World Meteorological Organization.

If the U.S. contribution becomes less reliable, partners may rebuild their systems around European or Chinese systems. This would result in diminished influence over standards and product design, and domestic users could lose access to portions of the global data stream on which accurate forecasts depend. These losses could compound over time. Interrupted missions, dispersed science teams, and weakened research-to-operations pathways are costly and slow to rebuild. For American producers, diminished U.S. leadership in Earth information could result in less competitive forecasting and decision tools, weakened warning systems for drought and input supply shocks, and a reduced ability to anticipate global market disruptions.

THE MANY USES OF U.S. EARTH INFORMATION FOR FOOD SECURITY AND AGRICULTURE

Agricultural production and food supply chains **depend on Earth information** systems.

Producers, market actors, consumers, and policy makers all benefit from **reliable data**, **analysis**, and **projections**.

EARTH INFORMATION FOR GLOBAL FOOD SECURITY

U.S. Earth information is the foundation of the food insecurity early warning ecosystem. U.S. information informs global development planning and humanitarian response efforts. Global food insecurity monitoring and early warning operate through more than 20 major systems, frameworks, and analytical platforms. These include the Famine Early Warning Systems Network (FEWS NET)—now administered by the U.S. Department of State— the Food and Agriculture Organization's Global Information and Early Warning System, World Food Programmer's Vulnerability Analysis and Mapping tools and Hunger Map, the Integrated Food Security Phase Classification, World Bank food insecurity monitoring and crisis analytics, regional frameworks such as the Cadre Harmonisé, and government-led national systems. Each has its own mandate, methodology, geographic coverage, and reporting cycle.

Many of these systems rely on shared public inputs. Precipitation, vegetation, soil moisture, crop condition, and weather data are often commonly sourced across platforms, alongside market, price, household, and other socioeconomic information. U.S. products— including things like vegetation observations and rainfall estimates— form part of this shared foundation and are used alongside European, multilateral, national, and commercial sources.

This broad reliance makes the continuity and open availability of U.S. public data a system-wide necessity. Degradation at the source can propagate across many of the world's most important food security planning systems. The United States must therefore protect shared public data feeds and improve interoperability among the systems that use them, while preserving U.S. capacity to provide integrated, decision-oriented analysis for U.S. decision makers and partners.

U.S. Earth information supports national meteorological services and reciprocal data exchange. Weather forecasting across the developing world relies on globally exchanged data. Agencies in Africa, Asia, Latin America, and Small Island Developing States use U.S. products for forecasting and disaster preparedness, while tools such as the Climate Predictability Tool allow local agencies to downscale global forecasts. Such partnerships are often reciprocal— partners can contribute land, ocean, and atmospheric observations through World Meteorological Organization exchange systems, U.S. models ingest those observations, and U.S. agencies gain calibration data, local expertise, and trusted channels for crisis coordination.

U.S. Earth information enables rapid agricultural assessments during crises. When conflict or extreme weather disrupts food production in inaccessible areas, satellite-based crop assessments are often the only reliable source of information for humanitarian response. The NASA Harvest consortium is building surge capacity for these assessments, but it depends on continued availability of the underlying public data.

U.S. Earth information enablesd climate-informed development planning. U.S.-produced seasonal forecasts and decadal projections shape how overseas investments are timed and where they are targeted. Seasonal predictions from NOAA's Climate Prediction Center routinely inform short-term resource mobilization decisions, such as water management and irrigation planning, while decadal outlooks help guide larger-scale infrastructure investments in regions where drought, flood, or yield shocks are projected to intensify.

EARTH INFORMATION FOR AMERICAN AGRICULTURE

U.S. Earth information enables crop loss verification and insurance programs. The Federal Crop Insurance Program covers roughly 90% of major crop acreage and provides around $200 billion in insured value annually. Satellite-based crop monitoring, supported by Landsat— a joint NASA and USGS program operating continuously since 1972— helps enable loss verification and fraud detection, saving at least $100 million annually in program administration.

U.S. Earth information informs commodity markets and price discovery. USDA issues a monthly World Agricultural Supply and Demand Estimates (WASDE) report that triggers immediate price adjustments across agricultural futures markets. These forecasts utilize satellite imagery and weather analysis to assess crop conditions globally. WASDE reports provide an avenue to transform Earth information into trusted market intelligence that can help American farmers manage production and market risks, although their integration with satellite data systems is still incomplete.

U.S. Earth information facilitates drought monitoring and disaster response. The U.S. Drought Monitor, produced through a partnership among NOAA, USDA, and the National Drought Mitigation Center at the University of Nebraska–Lincoln, combines satellite data with ground observations to trigger eligibility for federal disaster assistance. A farmer's access to programs such as the Livestock Forage Disaster Program and emergency loans depends directly on these determinations.

U.S. Earth information enables on-farm decision support. Precision agriculture, used across the majority of American farm acreage, depends on a stack of U.S. public infrastructure. Positioning signals, satellite imagery and weather data enable auto-guidance and variable-rate application technology, which together drive down input costs, raise yields, and improve environmental outcomes for American farmers. Weather and seasonal forecasting. Seasonal climate outlooks from NOAA's Climate Prediction Center help farmers decide when and what to plant. Next-generation products give early warning of emerging drought, sometimes weeks before it appears in other indicators.

U.S. Earth information provides substantial economic return on public infrastructure. Landsat generated an estimated $25.6 billion in economic value in 2023 across U.S. and international users. In California, a single groundwater management district saved $40 million in one year using Landsat derived data. These figures illustrate the value of the public infrastructure that agricultural users rely on.

EARTH INFORMATION FOR DOMESTIC FOOD AND NUTRITION SECURITY

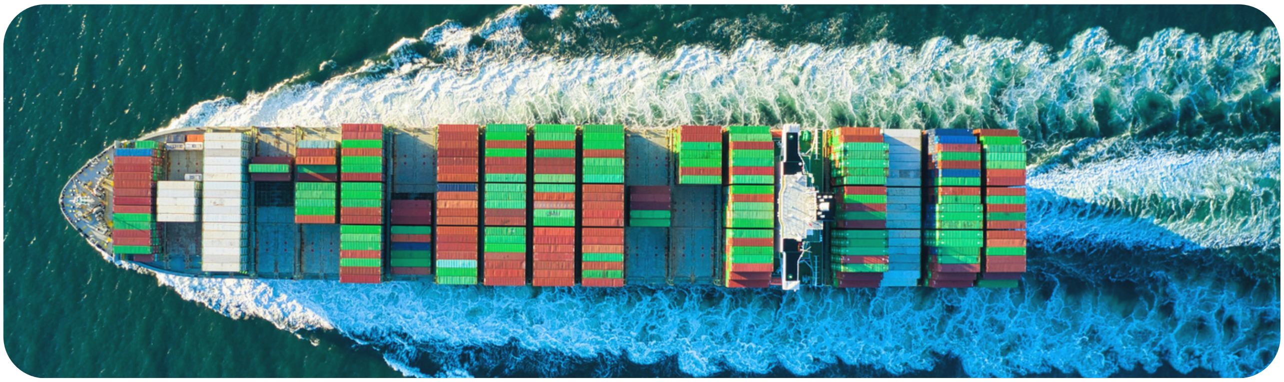
U.S. Earth information facilitates supply chain disruption forecasting. Extreme weather events increasingly disrupt food production, processing, and distribution. Earth information enables advance warning for supply chain actors to reroute logistics, adjust procurement, and position emergency food stocks in advance. Improved subseasonal forecasting across a range of two to six weeks would be particularly valuable for food distributors, retailers, and emergency food programs.

U.S. Earth information promotes food price stability. Accurate, publicly available agricultural market intelligence, derived from robust forecasting and yield projection systems, can help stabilize commodity markets and reduce the price volatility that disproportionately affects low-income American households.

EARTH INFORMATION FOR NATIONAL SECURITY AND BEYOND

Earth information underpins both operational capacity and strategic interests across many sectors, with ramifications well beyond the global food system. It enables situational awareness of the physical operating environment worldwide, for both military and civilian use. High accuracy positioning depends not only on the GPS constellation but also on continuously maintained terrestrial reference frames and measurements of Earth's shape, rotation, and orientation. The erosion of these public capabilities could degrade the precision needed for surveying, precision agriculture, navigation, and Earth-observing satellites. Earth information also allows the United States to track ice conditions and activity across an increasingly contested Arctic and provides the sea level and storm surge data that coastal military installations and overseas operations depend on.

U.S. Earth information also provides a foundation for international collaboration and soft power. U.S. observations and analyses flow through World Meteorological Organization systems and contribute to global assessments such as the Intergovernmental Panel on Climate Change, which assesses changes in temperature, ocean heat, ice, and sea level. Many meteorological agencies in Africa, Asia, and Latin America have also relied on U.S. data, tools, and training for forecasting and preparedness. Abandoning programs that support international partners would create space for competitors to establish their own technical relationships and would weaken U.S. access to partner observations, expertise, and standard setting forums.



PRINCIPLES FOR PUBLIC INVESTMENT IN EARTH INFORMATION SYSTEMS

Several foundational principles should guide U.S. investments in Earth information systems:

Continuity of data records. Multidecadal datasets, such as Landsat's record of Earth's surface and NOAA ocean temperature records, allow detection of trends and anomalies that shorter records cannot reveal. Many U.S. Earth information assets are among the longest continuous environmental records in existence. Once interrupted, these time series cannot be reconstructed, and the informational value of decades of prior investment is permanently degraded. Gaps in data continuity make it significantly harder to understand the difference between long-term changes and short-term variability. Such gaps widen uncertainty for projections on sea level rise, water availability, crop suitability, drought recurrence, and extreme events. They also weaken the baseline that is used to validate new satellites and to train and evaluate forecasting and AI models. A replacement mission can resume observation, but it cannot recreate measurements that were never collected.

Open access. Free and open Earth information has enabled a global ecosystem of researchers, agencies, startups, and agricultural enterprises to build on U.S. data products. Restricting access would erode this ecosystem and reduce the compounding value of public investment in U.S. Earth information systems.

Workforce prioritization. Earth information systems require highly specialized human capital that takes years to develop. Boom-and-bust funding cycles drive talent out of the field and erode institutional knowledge that cannot be quickly rebuilt.

Integration across timescales and sectors. Effective agricultural and food security decision making requires integration across time scales— daily weather, seasonal forecasts, and decadal climate outlooks. It also requires integration across geographic scales— from local farm conditions to global trade systems. Today's system remains fragmented across agencies, timescales, and domains. There is untapped strategic value in integrating these components to support coherent decision making.

Ground truth and in situ observation. Remote sensing is only as reliable as the ground truth data used for calibration, training, and validation of satellite models. Satellite estimates must be anchored to physical references or they may drift, accumulate biases, and lose credibility. As investment tilts toward satellites and AI/ML models, statistical programs and in situ data collection systems are at risk of being underfunded. Sustained investment in ground-based observation and agricultural statistics is a necessary precondition for advancing rigorous and reliable Earth information systems.

Public and private complementarity. Commercial Earth information products are valuable and growing, but they complement public infrastructure, rather than replace it. The U.S. government should maintain the foundational systems that provide the calibration backbone for commercial enterprises, and should make investments in regions and applications that may lack commercial incentives.

RISKS IN PRIVATIZATION OF EARTH INFORMATION SYSTEMS

There is growing interest in transferring some public functions to the private sector. Commercial solutions are valuable complements to public systems, but privatization of foundational capabilities carries significant risks:

Misaligned market incentives. Commercial firms invest where commercial demand is strongest and where returns are visible, for example, in high-value geographies, high-resolution imagery, and near-term analytics. They have weaker incentives to fund the costly infrastructure that supports the entire ecosystem—such as sustained global coverage, sensor intercalibration, field validation, stewardship of old archives, quality control, and continuity through instrument transitions. These functions are costly, slow, and difficult to monetize, but without them, all downstream products become less reliable.

Loss of data continuity and calibration. Public satellite systems, which provide global measurements of things like vegetation, fire, clouds, aerosols, and surface conditions, create long and stable records that help calibrate private Earth information products. Commercial providers frequently change sensors, orbits, and processing. If the public baseline is discontinued, the entire ecosystem degrades.

Restricted access and inequitable coverage. Private firms concentrate coverage on commercially attractive geographies. The regions that are most vulnerable to food insecurity may lack incentives for commercial investment.

Erosion of open data. Shifting core functions to actors who paywall data would fragment the global ecosystem that amplifies U.S. investments.

Conflicts of interest. Private firms serving commodity traders, insurers, or foreign governments face conflicts that may compromise analytical neutrality.

Cybersecurity and continuity. Private firms face acquisitions, pivots, bankruptcy, and cyberattacks. Critical national infrastructure requires the operational continuity that public stewardship provides.

Loss of surge capacity. During crises, public agencies redirect resources toward emergency assessments in ways contractors may not.

Approach to Public and Private Complementarity

The appropriate strategy is to delineate which functions must remain public goods, which can be complemented by commercial products, and which require hybrid models. Public and private sectors should discipline each other—public infrastructure should provide independent, calibrated baselines to check commercial products against, while commercial cost and innovation pressure pushes public programs toward efficiency and modernization. To guide these partnerships, the U.S. government should:

- Maintain a **public calibration and validation backbone** that is independent of any commercial provider it evaluates.
- Require that commercial data integrated into public decision making meet **documented standards** for accuracy, provenance and continuity.
- Structure data procurement to **preserve open access**, including licensing that permits public redistribution wherever feasible.
- **Avoid sole-source dependence** on any single provider for critical functions, given continuity risks of private sector enterprises.
- Develop incentives (e.g., committed demand, cost-sharing) to **encourage private investment in public good capabilities** where commercial incentives are weak.
- Build **conflict of interest** safeguards where providers also serve commodity traders, insurers, or foreign governments.

A Plan to Secure U.S. Leadership in Earth Information

for Global Food Security and American Agriculture

The U.S. government must protect, sustain, and enhance the use of Earth information for agriculture and food security planning.

01 **SECURE THE FOUNDATION.**
Protect critical capabilities from degradation, ensure sustained investment, and create durable institutional structures.

02 **BUILD SMARTER SYSTEMS.**
Close capability gaps where we have fallen behind international competitors, invest in next-generation forecasting and AI/ML, and rebuild research capacity.

03 **LEAD THE FUTURE.**
Strengthen the public and private ecosystem, coordinate federal Earth information as a unified national asset, and position the United States to lead for decades to come.

01 SECURE THE FOUNDATION

Protect and Renew National Investments in Earth Information Capabilities

- Conduct a comprehensive inventory of U.S. government Earth information systems and assess their uses and criticality.
- Provide predictable and sustained funding for critical capabilities across NOAA, NASA, USDA, NSF, and USGS, including satellite remote sensing; precipitation, soil moisture, and drought monitoring; water resources and hydrology; ocean monitoring; weather and climate forecasting; agroclimate and agricultural early warning; and famine early warning and food security monitoring (see Annex 1 for a non-exhaustive list of functions, products, programs, and missions).
- Establish durable budgetary approaches to flagship missions requiring long development timelines, protecting them from annual budget volatility. Options may include protected operations and maintenance resources, advance procurement where appropriate, and linking funding to higher visibility government programs that they enable.

Recommit to International Data Sharing and Capacity Building

- Identify the U.S. government-funded data feeds and analytical tools that partner country agencies and international food security monitoring platforms rely on.
- Ensure continuity of data and analytical tools with critical international dependencies, including CHIRPS, the Climate Predictability Tool and others.
- Expand American presence in regions where competitors are advancing their Earth information footprint, including developing programs that help partners develop forecasting capabilities based on U.S. technology, training, and data.

Preserve Critical Data Archives and Long-Term Records

- Commit to permanent stewardship of historical records and accelerate digitization of legacy data.

Launch a National Earth Information Workforce Initiative

- Produce and implement a long-term workforce development plan that inventories mission-critical roles, retirement and attrition risks, skills gaps, and hiring and retention targets across relevant agencies and national laboratories.
- Establish an Earth Information Corps with paid government fellowships, clearly defined pathways into permanent service, and regional partnerships with universities, minority-serving institutions, Tribal colleges and universities, community colleges, and professional societies.
- Establish a government-wide rotational program, similar in design to the Federal Rotational Cyber Workforce Program, with assignments lasting six to twelve months across agencies, national laboratories, universities, and selected private sector partners.

02 BUILD SMARTER SYSTEMS

Establish a National Earth Information Coordinator

- Designate a senior position within the Executive Office of the President to lead implementation of the National Plan for Civil Earth Observations, chair or direct a strengthened USGEO and work with OSTP and OMB to align investments currently fragmented across NASA, NOAA, USDA, USGS, DoE, and State.
- Ensure that the coordinator's mandate includes agriculture, food insecurity early warning, domestic nutrition security, and international capacity building.

Develop a USDA Earth Information Integration Roadmap

- Reduce costs and improve accuracy by deepening integration across USDA programs, including crop insurance, conservation, and nutrition assistance.

Advance a Government-Wide Commercial Earth Information Strategy

- Develop a government-wide framework for evaluating, purchasing and integrating commercial satellite data and AI/ML services, with clear guardrails for analytical independence, cybersecurity and human oversight.

Codify Open Data Principles

- Enshrine a commitment to free and open Earth observation data in legislation, protecting the ecosystem that multiplies the value of public investments.

Build a Next-Generation Food Insecurity Early Warning System

- Commission a design for a modular, adaptive system that predicts food insecurity and related humanitarian risks by combining Earth information with crop, market, trade, conflict, displacement, nutrition, and household data.
- Establish the function in authorizing legislation with a clear institutional home, a global monitoring mandate, capacity for deep country analysis, and multiyear funding that protects operations from annual volatility.
- Preserve and modernize the strongest capabilities of FEWS NET and other U.S. systems through an independent assessment and a staged migration plan that avoids operational gaps.
- Advance an open, interoperable data architecture with common formats, transparent provenance, documented uncertainty, and user-friendly interfaces that would allow IPC, WFP, FAO, national systems, and commercial tools to exchange inputs in a timely and efficient way.

Create an Agriculture and Food Security Earth Information Advisory Council

- Convene a federal advisory council, including agricultural industry stakeholders alongside food security and nutrition experts, to ensure that investments in Earth information infrastructure translate into useful products across the food value chain.

03 LEAD THE FUTURE

Launch a National Extreme Weather Prediction for Agriculture Initiative

- Launch a mission-scale, multiagency initiative to dramatically improve prediction of extreme events, such as droughts, floods, heat waves, severe storms and compound events, that threaten agricultural production and markets at home and abroad.

Win the Race on Subseasonal and Multiple Timescale Forecasting

- Accelerate progress in forecasting capabilities spanning two to six weeks, where U.S. skill currently lags but agricultural and food security planning value is high.
- Integrate subseasonal forecasts with shorter-term weather and longer-term outlooks to create a seamless framework spanning days to decades.

Invest in AI/ML Applications of Earth Information for Food Security Planning

- Expand public computing capacity and data infrastructure to support faster, higher-resolution Earth system modeling, data assimilation and operational analysis.
- Expand and coordinate existing efforts to develop open-source, interoperable foundation models trained across satellite, meteorological, hydrological, agricultural and socioeconomic information.
- Support the transition of promising AI tools into operational food security applications, including WFP's near-real-time food security monitoring, RAAPID's AI-enabled agricultural assessments, and methods that extract early warning signals from local and regional news sources.

Create an Earth Information Innovation Fund

- Create competitive funding opportunities for startups and research teams to build farmer-facing and food system applications on top of public data infrastructure, including for supply chain resilience.

Rebuild U.S. International Forecasting Presence

- Establish a new generation of partner-led forecasting and early warning programs built on American science and data.
- Support globally coordinated rapid agricultural assessment capabilities through networks of academic, governmental, and multilateral partners.

Invest in Earth Information for Agricultural R&D

- Support research applying advances in Earth information to agricultural productivity, such as crop improvement, precision soil and water management, and pest and disease forecasting.
- Coordinate with broader agricultural R&D investments to integrate Earth information into the national strategy for sustainable productivity growth.

FSLC believes the United States should renew and intensify its commitment to building global food security.

We are dedicated to developing a nonpartisan Blueprint for U.S. Leadership in Global Food Security, detailing actionable recommendations for U.S. policymakers.

Food Security Leadership Council

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Annex: Existing U.S.G. Earth Information Architecture for Agriculture and Food Security Planning

The United States Government maintains a suite of Earth information capabilities developed over decades. To distinguish what must be protected at the source from what can be redesigned downstream, this annex separates (A) primary and foundational infrastructure and observations, reference data, positioning, data stewardship and exchange, and core forecasting systems; and (B) derived analytics, early warning, and decision support systems. These tables are representative and illustrative rather than exhaustive. Program status and organizational affiliations are current as of August 2026.

A. Primary and Foundational Earth Information Infrastructure

Function	U.S. Government	Commercial, Academic & Nonprofit	International Public & Multilateral Systems	Role of U.S. Public Earth Information
Satellite Remote Sensing	Landsat (USGS/NASA): 50+ year land surface record. MODIS (NASA): legacy Terra/Aqua vegetation, fire, and surface observation record; transition to VIIRS is underway. NASA plans to end Terra science collection in February 2027 and Aqua in September 2027. VIIRS (NOAA/NASA): global daily environmental observations. GOES-R series (NOAA): geostationary weather and environmental monitoring. Landsat 10 (USGS/NASA): planned continuity mission with expanded capabilities; expected launch in 2031.	Planet Labs: near daily global imagery and geospatial analytics. Vantor (formerly Maxar Intelligence): very high-resolution imagery and spatial intelligence. BlackSky: high frequency imagery and analytics. ICEYE and Capella Space (an IonQ company): synthetic aperture radar imagery. Spire Global: radio occultation weather data and space services.	ESA/EU Copernicus Sentinel constellation: free and open global observations. JAXA: ALOS and GOSAT missions. JMA: Himawari geostationary satellites. ISRO: Resourcesat and Cartosat. Canada: RADARSAT Constellation Mission. Brazil and China: CBERS. China: Gaofen series and broader Earth observation fleet.	Provides foundational global observations of land, ocean, and atmosphere. U.S. systems anchor the long-term continuity of this record and supply the calibration references used across the global Earth information community.
Ground-based & In Situ Observing Networks	NOAA/NWS surface observing networks: routine weather observations. NOAA/NWS NEXRAD: national weather radar network. NOAA/NWS upper air network: radiosonde profiles for model assimilation and satellite validation. NOAA Global Monitoring Laboratory: atmospheric observations. USDA NRCS SCAN and SNOTEL: soil climate and snow water observations. USDA ARS Long-Term Agroecosystem Research network: field scale agricultural observations.	Commercial weather station, farm sensor, and Internet of Things networks. Vaisala and DTN: instruments, observations, and value-added weather services.	WMO Global Basic Observing Network and WIGOS: internationally coordinated and exchanged surface and upper air observations. National meteorological and agricultural observing networks.	Supplies the in-situ observations needed to initialize and verify forecast models, calibrate satellite products, and interpret conditions on farms and rangelands. These networks are also a primary channel through which foreign observations improve U.S. forecasts.
Ocean Observations & Monitoring	NOAA National Data Buoy Center: ocean and coastal buoy observations. NOAA/NASA: sea surface temperature and ocean color records. NASA/JPL, CNES, NOAA, and EUMETSAT: Jason altimetry series. NASA/CNES SWOT: ocean-surface topography. NASA PACE: ocean biology and biogeochemistry. NASA/GFZ GRACE-FO: changes in ocean mass. U.S. contributions to Argo: profiling float observations.	Sofar Ocean: Spotter buoys and ocean data services. Saildrone: autonomous surface vehicles and ocean observations.	Argo: international profiling float program. Copernicus Marine Service, implemented by Mercator Ocean International. IOC-UNESCO Global Ocean Observing System.	Monitors inputs that are essential to climate prediction, fisheries management, and extreme event forecasting (e.g., ENSO). U.S. contributions, including NOAA buoys, NASA/CNES altimetry, and roughly half of the international Argo array, are central to this infrastructure.

Function	U.S. Government	Commercial, Academic & Nonprofit	International Public & Multilateral Systems	Role of U.S. Public Earth Information
Precipitation, Soil Moisture & Drought Monitoring	NASA SMAP: soil moisture observations. NASA/JAXA GPM and IMERG: global precipitation estimates. NOAA: precipitation monitoring systems. CHIRPS (UCSB/USGS): long-running rainfall estimates. NOAA National Integrated Drought Information System and Drought.gov: integrated drought information and coordination. U.S. Drought Monitor: NOAA, USDA, and National Drought Mitigation Center partnership. NOAA Climate Prediction Center: drought and seasonal outlooks. NASA GMAO: MERRA-2 and related reanalysis products.	Climavision and Tomorrow.io: commercial precipitation, weather, and agricultural analytics. Commercial water risk and drought impact analytics.	ESA SMOS and Climate Change Initiative: soil moisture observations and climate data records. EUMETSAT: satellite precipitation products. JAXA AMSR2: microwave observations. Copernicus Climate Change Service and Climate Data Store: quality assured climate data and products. WMO–Global Water Partnership Integrated Drought Management Programme: international drought policy and management framework. Copernicus European and Global Drought Observatories: drought indicators and assessments.	Provides the observational records and integrated indicators used to monitor precipitation deficits, soil moisture anomalies, water availability, and evolving drought. U.S. missions and public systems—including SMAP, GPM, CHIRPS, NIDIS, the U.S. Drought Monitor, and CPC outlooks—anchor continuity, calibration, and public drought assessment.
Water Resources & Hydrology	USGS National Water Information System: streamflow and groundwater observations. NASA/GFZ GRACE-FO: changes in terrestrial water storage. NASA/CNES SWOT: inland surface-water elevation and extent. NOAA River Forecast Centers: operational river forecasts. NOAA National Water Model: continental scale hydrologic prediction.	Upstream Tech: geospatial water monitoring and decision support. Waterplan: water risk analytics and management tools.	ESA CryoSat and Copernicus: ongoing cryosphere and hydrology observations and products. Global Runoff Data Centre: river discharge archive operated under WMO auspices. WMO HydroSOS: hydrological status and outlook framework.	Supports monitoring and forecasting of surface water, groundwater, and hydrologic extremes. USGS stream gauges, the NOAA National Water Model, and NASA missions (GRACE-FO with GFZ Germany; SWOT with CNES) anchor the U.S. contribution, alongside Copernicus, CryoSat-2, and the Global Runoff Data Centre.
Agricultural Statistics, Soils & Field Reference Data	USDA NASS Quick Stats and Census of Agriculture: production, acreage, livestock, price, and farm structure statistics. USDA NASS Cropland Data Layer: annual crop specific land cover mapping. USDA NRCS SSURGO, gNATSGO, and Web Soil Survey: authoritative soil information. USDA Farm Service Agency: field boundaries and reported acreage used for program administration and validation. USDA ERS, AMS, and FAS: economic, market, and trade information.	Commodity data vendors and proprietary farm management databases. Commercial soil, field boundary, and yield data services.	FAOSTAT and national agricultural statistical systems. Eurostat and European Commission agricultural data systems. World Bank commodity and development datasets.	Provides the statistical baselines, soil characteristics, field references, and market context required to translate Earth observations into crop acreage, yield, production, and food security assessments. These data also provide ground reference for remote sensing products.
Geodesy, Positioning & Spatial Reference	Department of Defense Global Positioning System: global positioning, navigation, and timing. NOAA National Geodetic Survey: National Spatial Reference System and CORS network. NASA Space Geodesy Project: reference frame and Earth orientation measurements. USGS 3D Elevation Program and The National Map: elevation and base geospatial data.	Trimble and Hexagon: precision positioning equipment, correction services, and geospatial platforms. Other commercial mapping and geospatial data services.	Galileo, BeiDou, GLONASS, and QZSS: complementary global and regional navigation systems. International GNSS Service and International Terrestrial Reference Frame.	Establishes the common coordinate, elevation, and timing framework needed to align satellite imagery, field boundaries, sensors, farm machinery, hydrologic networks, and other geospatial datasets. Precision agriculture depends on both GPS signals and maintained terrestrial reference systems.

Function	U.S. Government	Commercial, Academic & Nonprofit	International Public & Multilateral Systems	Role of U.S. Public Earth Information
Data Stewardship, Processing & Access	NASA EOSDIS, Earthdata, and Distributed Active Archive Centers: processing, discovery, archive, and distribution of Earth observation data. NOAA National Centers for Environmental Information: climate, weather, ocean, coastal, and geophysical archives. USGS EROS Center: Landsat and land record processing, archive, and distribution. Federal cloud and high-performance computing infrastructure: operational processing and model production.	AWS Registry of Open Data, Google Earth Engine, Microsoft Planetary Computer and Planetary Computer Pro, and Esri Living Atlas. Commercial cloud computing, catalog, processing, and data hosting services.	Copernicus Data Space Ecosystem and Copernicus Climate Data Store. ECMWF data services and international Earth observation archives.	Converts raw observations into discoverable, documented, quality controlled, and analysis ready records. Long term archives, metadata, reprocessing, application programming interfaces, and compute capacity are essential infrastructure rather than optional downstream services.
International Data Exchange & Standards	NOAA and NWS participation in WMO observing and information systems. NASA, NOAA, and USGS participation in GEO and the Committee on Earth Observation Satellites. Federal Geographic Data Committee and National Spatial Data Infrastructure standards.	Commercial, academic, and nonprofit data nodes implementing open interfaces and metadata standards. Private sector participation in geospatial standards development.	WMO WIS 2.0: operational since January 2025, with transition from GTS/WIS1 continuing. WIGOS and the Global Basic Observing Network. GEO and the Committee on Earth Observation Satellites. Open Geospatial Consortium and ISO geospatial standards. IOC-UNESCO GOOS and Argo data exchange.	Keeps observations and products moving across borders and systems through shared technical standards, metadata, and exchange mechanisms. U.S. models depend on foreign observations, while partner services and commercial users depend on reliable access to U.S. data and model output.
Weather Forecasting & Climate Prediction	NOAA National Weather Service: operational weather services. NOAA Climate Prediction Center: subseasonal and seasonal outlooks. NOAA Global Forecast System: operational global numerical weather prediction. NOAA Unified Forecast System: community-based modeling framework supporting NOAA's operational prediction applications.	The Weather Company, AccuWeather, Tomorrow.io, DTN, StormGeo, and Spire: commercial forecasts and services. Google DeepMind WeatherNext 2, Microsoft Aurora, and NVIDIA Earth-2: AI weather model families and platforms; experimental products are not official public warnings.	ECMWF: operational IFS and AIFS global forecasting systems. UK Met Office, JMA, DWD, Météo-France, Environment and Climate Change Canada, and IMD: national forecasting systems. China: Pangu-Weather, FengWu, and FuXi AI weather model families; these are distinct from national warning authority.	Produces operational forecasts from hours to seasonal scales. U.S. modeling infrastructure (GFS, UFS) and ECMWF's IFS are major public global forecasting systems on which many commercial and regional forecasting systems depend.

B. Derived Analytics, Early Warning, and Decision Support

Function	U.S. Government	Commercial, Academic & Nonprofit	International Public & Multilateral Systems	Role of U.S. Public Earth Information
Famine Early Warning & Food Security Monitoring	U.S. Department of State FEWS NET: integrated climate, market, field, and food security analysis. U.S. public data products: shared rainfall, vegetation, weather, soil moisture, crop, and market inputs used across multiple systems.	IMPACT/REACH: combines satellite remote sensing with household, market, and field assessments to monitor food security risks. Commercial and nonprofit analytics: food security and risk platforms built on blended datasets.	WFP Vulnerability Analysis and Mapping and HungerMap Live. Integrated Food Security Phase Classification partnership. Cadre Harmonisé: classification framework supported by CILSS and ECOWAS for West Africa and the Sahel. FAO Global Information and Early Warning System. FAO-WFP Hunger Hotspots and the FSIN Global Report on Food Crises. IFPRI Food Security Portal and food price early warning tools. World Bank Global Food and Nutrition Security Dashboard. UN anticipatory action frameworks and national early warning systems.	Provides early warning of food insecurity by combining Earth observations with price, market, trade, conflict, displacement, nutrition, household, and field data. FEWS NET is a distinct U.S. analytical capability within a broader ecosystem that includes IPC and Cadre Harmonisé partners, WFP, FAO, IFPRI, the World Bank, and national systems.
Crop Monitoring & Agricultural Market Intelligence	USDA Foreign Agricultural Service: global crop assessments. USDA WASDE: monthly supply and demand estimates. NASA and USDA agricultural Earth observation research and public data products.	RAAPID (non-federal academic): rapid agricultural assessment and Earth observation integration. EarthDaily Analytics: commercial Earth observation data and analytics. Its new constellation entered commercial operations in 2026. Privateer: geospatial intelligence platform incorporating former Orbital Insight capabilities. Kpler: commercial commodity and maritime trade-flow intelligence used to assess agricultural supply chains.	G20 Agricultural Market Information System. FAO agricultural monitoring systems. GEOGLAM Crop Monitor: consensus crop condition and early warning assessments. European Commission Joint Research Centre: MARS.	Delivers global agricultural production estimates and market intelligence by integrating Earth observation, meteorological, and statistical inputs. USDA FAS and WASDE remain among the most globally influential public sources of agricultural market information; RAAPID, commercial providers, and international programs extend and reuse these inputs.
Agroclimate Monitoring & Agricultural Early Warning	USDA Climate Hubs: regional climate information and decision support for working lands. USDA NASS Crop-CASMA: crop condition and soil moisture assessment. USDA Foreign Agricultural Service: agroclimate informed global crop assessments.	Commercial crop weather and agricultural impact analytics. Agricultural input, insurance, and commodity firms using public agroclimate and crop condition indicators.	FAO Agricultural Stress Index System: satellite based agricultural drought and vegetation stress monitoring. European Commission Joint Research Centre ASAP: crop monitoring and agricultural early warning products.	Translates weather, climate, soil moisture, vegetation, crop condition, phenology, and field information into early warning of growing season stress and production risk. It supports producers, agricultural agencies, and food security analysts while remaining distinct from famine early warning, which also requires market, conflict, displacement, nutrition, and household data.

Function	U.S. Government	Commercial, Academic & Nonprofit	International Public & Multilateral Systems	Role of U.S. Public Earth Information
Agricultural Biosecurity & Pest/Disease Surveillance	USDA APHIS Cooperative Agricultural Pest Survey: early detection of high-risk plant pests. USDA APHIS national animal health surveillance systems. USDA APHIS Integrated Plant Health Information System. USDA Agricultural Research Service: pest, pathogen, and disease research and diagnostics.	Animal health, genomic, diagnostic, and remote crop stress detection services. Commercial farm management and supply chain surveillance platforms.	FAO EMPRES-i+: global animal disease information system. World Organization for Animal Health WAHIS. International Plant Protection Convention and regional plant protection organizations. CGIAR and national plant and animal health networks.	Detects and tracks biological threats that can disrupt crops, livestock, trade, and food supplies. These systems combine field surveillance, diagnostics, administrative reporting, climate and habitat information, and increasingly remote sensing and predictive analytics.
Earth Information Capacity Building & Technical Assistance	NASA and USAID SERVIR partnership (2005–2025): concluded U.S. capacity building program; a regionally led collaborative continues outside the former federal program. NASA ARSET: remote sensing training for applied users.	Google.org and Microsoft AI for Good: philanthropic and corporate capacity building initiatives.	WMO training programs. ESA and GMES & Africa capacity building initiatives. GEO and CEOS regional networks, including AfriGEO and AmeriGEO. World Bank and UNDP climate information programs. China: current Earth observation capacity partnerships, including remote sensing application centers linking China and Africa and training.	Builds technical capacity for Earth intelligence use in developing countries and emerging economies. U.S. programs (SERVIR through 2025, NASA ARSET) served as a major sustained channel for this work; WMO, ESA, GEO/CEOS, World Bank and UNDP programs, and China's Digital Belt and Road now form a more distributed ecosystem.
On-Farm Decision Support & Precision Agriculture	USDA-supported Cooperative Extension System. USDA Natural Resources Conservation Service. USDA Agricultural Research Service. NASA and USDA supported agricultural decision tools and research platforms.	Bayer Climate FieldView: digital farm management platform. PTx Trimble: precision agriculture joint venture between AGCO and Trimble. CNH and its Raven brand. Corteva Granular/Granular Link. Syngenta Cropwise. Ag Leader. OneSoil. AgroStar (India). John Deere.	CGIAR digital agriculture tools. EU Copernicus based agricultural services.	Translates Earth observation and geospatial data into field level agricultural decisions. Commercial platforms draw on foundational public infrastructure—including GPS and the National Spatial Reference System, weather observations and forecasts, soils, and USDA and NASA data layers—and extend it into integrated farm management tools.
Agricultural Risk Finance & Insurance	USDA Risk Management Agency: federal crop insurance program. NOAA precipitation observations and derived indices: inputs to rainfall-index insurance and agricultural risk modeling.	Swiss Re, Munich Re, and AXA Climate: insurance, reinsurance, and risk analytics. Arbol, Descartes Underwriting, and Skyline Partners: parametric insurance and risk transfer products.	African Risk Capacity (ARC). CCRIF SPC (formerly the Caribbean Catastrophe Risk Insurance Facility). Pacific Catastrophe Risk Insurance Company (PCRIC), established through the Pacific Catastrophe Risk Assessment and Financing Initiative (PCRAFI).	Underpins risk pricing, insurance design, and financial resilience tools for climate and weather-related shocks. USDA RMA uses NOAA precipitation data in rainfall-index insurance programs, while public weather, climate, and drought records support broader agricultural risk analysis. Regional sovereign parametric pools (including ARC, CCRIF SPC, and PCRIC) extend risk-financing mechanisms to climate-vulnerable states.