DEPARTMENT OF AGRICULTURE WEATHER PROGRAMS

Weather is the most important factor influencing the Nation's variability in crop yields and related production. The Nation's food and fiber products are a critical resource impacting our domestic and international economic position and have taken on new dimensions in foreign affairs and national security. The continued expansion in export markets has reduced stocks and benefited our farm sectors as global consumption of total grains has exceeded production in recent years. The United States Department of Agriculture (USDA) conducts supporting research that focuses on understanding the interactions of weather and climate with plants, animals, forests, and forest ecological systems, and assists the Department of Commerce in determining farmers' needs for weather information and in disseminating that information to them.

METEOROLOGICAL PROGRAMS

Numerous agencies within the United States Department of Agriculture (USDA) require a wide range of high quality weather and climatological data to successfully carry out their missions. Some of the diverse applications that require accurate, timely, and comprehensive data include crop monitoring and weather impact assessment, agricultural yield and productivity modeling, natural resource conservation planning, forest fire potential monitoring, irrigation scheduling, water supply information, reinsurance and compliance programs, crop disaster assistance and emergency relief programs, integrated past management, crop yield modeling, and agricultural research studies. The following is a brief description of agency weather activities.

Office Of The Chief Economist/World Agricultural Outlook Board

The World Agricultural Outlook Board (WAOB), in cooperation with National Weather Service's (NWS) Climate Prediction Center, staffs and supports the Joint Agricultural Weather Facility (JAWF). Created in 1978 as an operational unit, JAWF meteorologists work as a team, monitoring global weather conditions and preparing real-time agricultural assessments (Figure 3-USDA-1). These assessments keep USDA commodity analysts, the Office of the Chief Economist (OCE), and the Secretary of Agriculture and top staff well informed of worldwide weather related developments and their affects on crops and livestock. In addition to providing these routine assessments, WAOB agricultural meteorologists are frequently requested to prepare special assessments when adverse or anomalous weather conditions (i.e., droughts, heat waves, freezes, floods) are observed in major crop producing regions. When integrated with economic analyses and information, these routine and special crop-weather assessments provide critical information to decision-makers formulating crop production forecasts and trade policy. They also help analysts identify potential agricultural markets for United States products worldwide.

The JAWF serves as the Department's focal point for weather data received from the World Meteorological Organization's (WMO) Global Weather Observing System. These data are used at JAWF and other USDA agencies for a number of agricultural applications. Another major source of domestic weather and climate data that is used by USDA comes from the NWS's Cooperative Observer (COOP) Network. WAOB agricultural meteorologists convert the weather data into information to assess crop development and yield potential of all

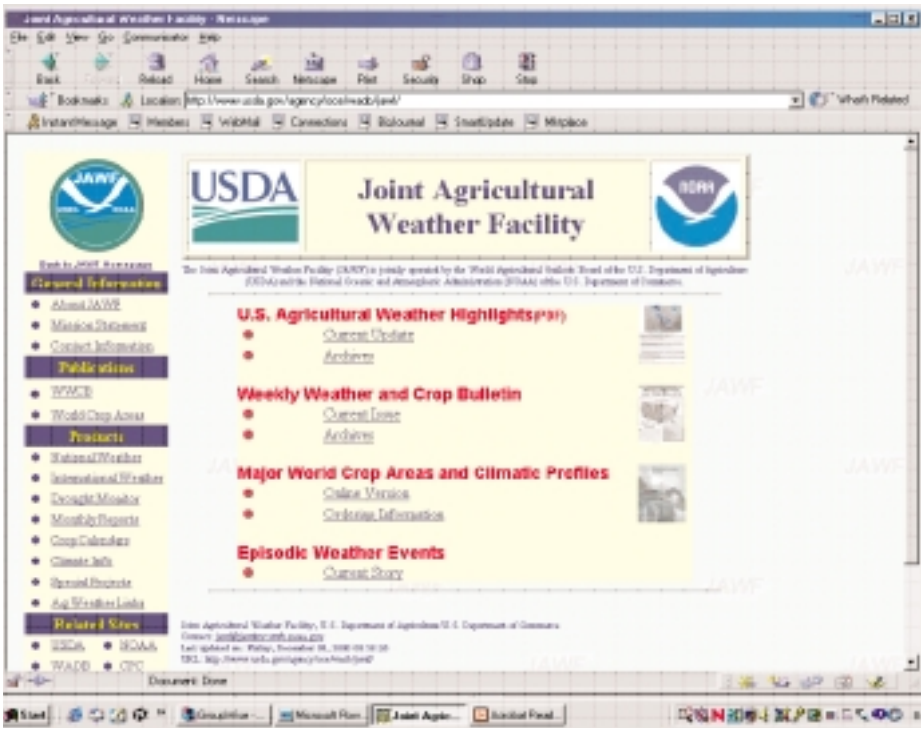
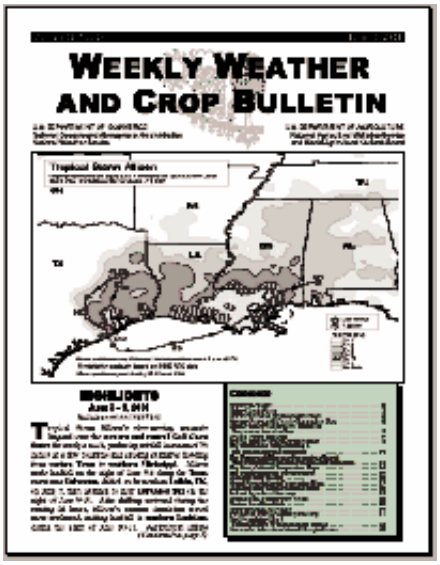


Figure 3-USDA-1. Joint Agricultural Weather Facility Home page.

major commodity crops for the major producing areas of the world. Special weekly briefings are provided to the Secretary of Agriculture and to the economic and commodity analysts of USDA. The Senate and House Agricultural Committees continue to request periodic agricultural weather briefings that focus on the severity and impact of drought, heat wave, and excessive wetness on major crop areas around the Nation.



JAWF's flagship publication is the *Weekly Weather and Crop Bulletin* (WWCB). First published in 1872 as the Weekly Weather Chronicle, the publication has evolved over the past 129 years into one that provides a vital source of information on weather, climate, and agricultural developments worldwide. The publication is a shining example of how two major departments within the federal government can mutually cooperate, combining meteorology and agriculture to provide a service that benefits the economic well being of the nation. The WWCB highlights weekly meteorological and agricultural developments on a national and international scale, providing written summaries of weather and climate conditions affecting agriculture, as well as detailed maps and tables of agrometeorological information that are appropriate for the season. The WWCB is available in electronic form over the Internet at the following URL: *www.usda.gov/agency/oce/waob/jawf/*.

Drought is the leading hazard in economic losses each year in the United States. In the summer of 1999, a monitoring tool known as the Drought Monitor was developed to help assess drought conditions in the United States. The Drought Monitor is a collaborative effort between federal and academic partners, including the University of Nebraska-Lincoln National Drought Mitigation Center, the USDA/OCE/WAOB/JAWF, the NOAA/NWS/Climate Prediction Center, and the NOAA/NESDIS/ National Climatic Data Center. A rotating team of nine lead authors, two of which work at the JAWF, assembles the Drought Monitor. Produced on a weekly basis, the Drought Monitor is a synthesis of multiple indices, outlooks, and impacts depicted on a map and in narrative form. The official Web site for the Drought Monitor can be found at *enso.unl.edu/monitor*. The Drought Monitor is released each Thursday at 8:30 A.M. Eastern Time.

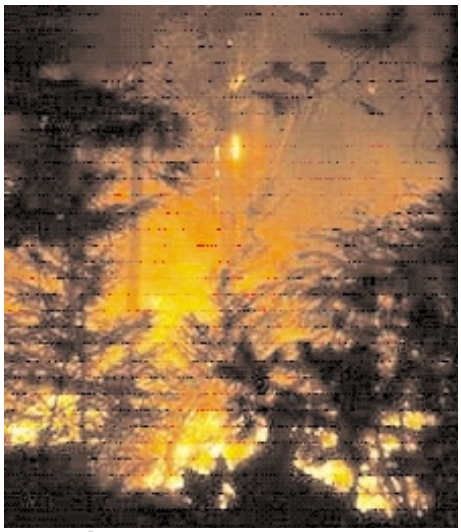
The WAOB/JAWF opened a field office in Stoneville, Mississippi in October 1998. The JAWF Mississippi Field Office is co-located with the Mississippi State University Delta Research Extension Center (DREC). The purpose of the co-located JAWF and DREC Data Center is to collect, quality control, and manage agricultural weather data and to make it available to the entire Delta agricultural community, including extension service, researchers, and farmers. In a cooperative effort between USDA, Mississippi State University, Mississippi State University Extension Service, and Meteor Communications Corporation, Inc., a meteor burst communication facility was established on Mississippi Agricultural and Forestry Experiment Station's land in Stoneville. This master communications facility is currently operational, and is being used to collect weather data from numerous meteor burst sites established in the Mississippi Delta region. Currently, there are six meteor burst sites located in the Delta.

Forest Service

Historically, the Forest Service (FS) has collected meteorological data to assist in the control of forest fires and in the management of smoke from prescribed burning. Other activities also require weather data to ensure sound management decisions. To support these needs and requirements, a national weather program was established to coordinate all FS meteorological activities and to meet the increasing need for diverse weather information. The major objectives of the program are to: (1) improve quality control of weather data, (2) improve the design and operation of data collection from networks, (3) increase data recovery from the weather stations, and (4) upgrade station maintenance. Meteorological data collected from manual weather stations and Remote Automated Weather Stations (RAWS) support research of weather effects on forestry management, forest fires, smoke management, visibility protection in wilderness areas, and atmospheric deposition. A weather information management system and a library to archive all FS weather data are being developed in cooperation with regional climate centers. The FS monitoring network will provide essential data for use in Global Change Research Program (GCRP) work.

The FS operates more than 1,200 RAWS and manual stations, many in the western United States. Air temperature, relative humidity, soil moisture, wind direction and speed, and precipitation are transmitted via NOAA's Geostationary Operational Environmental Satellite (GOES) telemetry. These data are received via a direct-readout ground site in Boise, Idaho, in cooperation with the Bureau of Land Management. The main use of

the data is in the calculation of the fire danger rating for the FS and cooperating agencies. These data are also used by other resource managers, such as, road engineers, wildlife biologists, and hydrologists who monitor precipitation; silviculturalists (who are attempting to maximize tree-planting opportunities); and ecologists, soil specialists, and fisheries biologists (who monitor the effects of runoff). Another major user of RAWS data is the NWS for fire weather forecasting and flood warnings. FS research includes efforts to: (1) understand and control forest fire initiation by lightning, (2) improve the translation of mid-range forecast elements to describe forestry conditions, (3) incorporate drought information into management decision-making, and (4) better describe how regional climatic variability affects the use of daily weather information by foresters. The FS long-term monitoring network will provide critical data for use in the GCRP work.



Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS) continues to operate a network of 1,400 manual snow courses and over 600 automated data collection sites in conjunction with the Snow Telemetry (SNOTEL) project for the western United States and Alaska. The primary objective of the project is to forecast water supplies and streamflow for the coming spring run-off season. These measurements are made in cooperation with other federal, state, and local agencies, power companies, irrigation companies, and the provincial government of British Columbia.

Water-supply forecasts help irrigators make the most effective use of available streamflow for achieving their agricultural production goals. Farmers, who collectively irrigate more than 10 million acres of land in the western United States, benefit from these water supply forecasts. Other federal agencies and private organizations also use water supply forecast information to help them carry out their missions. These forecasts also help the federal government in administering international water treaties.

NRCS continues to upgrade the SNOTEL data collection system. The effort includes upgrading the data collection sites in the existing SNOTEL system with new state-of-the-art equipment and adding additional sites. The data collection site upgrades include replacement of snow pillows, transducers, damaged precipitation gages, antennas, towers, solar panels, battery temperature sensors, and deteriorated shelter houses. NRCS also operates the Soil Climate Analysis Network (SCAN). The SCAN stations measure precipitation, temperature, relative humidity, wind direction and speed, solar radiation, atmospheric pressure, snow water content, snow depth, soil moisture, and soil temperature. Both the SCAN and SNOTEL networks use meteor-burst communications to obtain the data in near real-time. There are more than 50 SCAN stations taking data in 37 states.

Foreign Agricultural Service

The Foreign Agricultural Service's (FAS) satellite remote-sensing program, operated by the Production Estimates and Crop Assessment Division (PECAD), is a critical element in USDA's analysis of global crop conditions and agricultural production providing timely, accurate, and unbiased estimates of global area, yield, and production. The PECAD mission of alert analysis requires rapid system response. Working in conjunction with the Farm Services Agency (FSA), PECAD provides alerts as well as routine crop condition assessments for crops in the United States. FAS provides early warning of environmental changes that affect the production and quality of commodities and renewable resources.

The FAS/PECAD analysts employ a proven "convergence of evidence" approach to crop assessment -- incorporating NOAA AVHRR, LandSat, and SPOT imagery, crop models, global weather data, United States agricultural attache reports, field travel, and ancillary data to forecast foreign grain, oilseed, and cotton production. To complement the remote sensing image data sets, weather data are also processed from 6,912 of the United Nations' WMO stations and from approximately 88,500 grid cells of the Air Force gridded weather data are processed on a daily basis. Crop models are based on daily data loaded from meteorological stations and/or Air Force gridded weather data. Some models add Vegetative Index Number (VIN) information. The goal of a crop model is to provide a number that can be quantified to yield per acre.

Farm Service Agency

The Farm Service Agency (FSA) uses agricultural weather data and related reports in several programs that provide assistance to farmers and ranchers for natural disasters and emergencies. One such program is The Noninsured Crop Disaster Assistance Program (NAP) that provides financial assistance to eligible producers affected by natural disasters. This federally funded program covers noninsurable crop losses and planting prevented by natural disasters. Haying and grazing of certain Conservation Reserve Program acreage may be

made available in areas suffering from weather-related natural disasters. Furthermore, weather information is used to support low-interest emergency loan assistance to eligible farmers to help cover production and physical losses in counties declared as disaster areas by the President or designated by the Secretary of Agriculture. FSA also uses agricultural weather information in commodity operations for storage, transportation scheduling, and distribution of Commodity Credit Corporation (CCC) commodities.

Risk Management Agency

The primary responsibility of the Risk Management Agency (RMA) is to administer the Crop Insurance Program. This program provides a safety net by protecting producers against a wide range of environmental risks as well as the risk of price fluctuations. Producer participation in the Crop Insurance Program is voluntary; however, participation is encouraged through premium subsidies. Crop insurance is delivered to producers through private insurance companies that share in the risk of loss. The companies are reimbursed for their delivery expenses and receive underwriting gains in years when crop losses are low. Weather data or analyses containing the data are used in these insurance services as well as in program compliance. It is used directly or indirectly in establishing rates and coverages, high risk areas, planting and harvesting dates, crop hardiness areas, new crop programs, and developing crop models and current year loss estimates. Some of the causes of crop losses include drought, wind, frost, freeze, excess wetness or heat, etc. The RMA and reinsured companies use specific weather data such as temperature, precipitation, and wind to establish if insurable natural conditions caused the loss. Furthermore, Insurance Services and compliance programs use historical and current weather data as an additional information resource in determining if losses are reasonable and if producers and reinsured companies are in compliance with the insurance contracts under the Standard Reinsurance Agreement (SRA).

Research Education and Economics

The mission of the USDA supporting research program is to develop and disseminate information and techniques to ensure high quality commodities and products while minimizing any adverse effects of agriculture on the environment.

The research efforts of the Agricultural Research Service (ARS) relate directly to the effects of climate on agricultural production and the natural resource base. These efforts are directed toward developing technologies and systems for: (1) managing precipitation and solar energy for optimum crop production; (2) improving our understanding of water-plant-atmosphere interactions; (3) optimizing the use of energy, water, and agricultural chemicals; (4) reducing plant and livestock losses from pests and environmental stress; (5) developing improved techniques for irrigation and drainage; and (6) minimizing the adverse effects of climate and weather, including atmospheric contaminants, on the environment.

The Cooperative State Research, Education, and Extension Service (CSREES) coordinates research programs in the state agricultural experiment stations, the 1890 Land Grant Distributions, and cooperating forestry schools. These institutions conduct a wide variety of research applicable to agriculture and forestry. Meteorological research in these institutions is practically all climatological. A proportion of each state's program is consolidated into broad regional research projects. Animals and plants are subjected to many climatic stresses and, therefore, are the focus of this research. Research on the changes in levels of ultraviolet (UV) radiation as part of the GCRP was significantly expanded through the CSREES competitive grants program in FY 1994. The work is coordinated with EPA's UV radiation program and will support assessment efforts to develop related national policy on the environment.

Investigations by NASS support domestic crop estimating programs for all major commodities. Promising studies are underway to develop models relating weather parameters and associated variables to corn ear weight and wheat head weight. Previous efforts to develop models for short-term forecasting have had only limited success. Research will continue in this area with the expectation that the relationships between weather variables and crop yield will improve as better plant process models become available and more information, such as soil moisture, are operationally observed. Weather data from the NWS observing network has been an integral part of NASS's state crop reporting system.