Famine Early Warning System Wins Its Spurs

Monitoring program that spotted new crisis in Ethiopia sheds temporary status, but more is being asked of it

News reports of crop failures and impending famine in Ethiopia recall 1985 and the record international relief effort mounted to aid the region. This time, an early warning system, which includes computer analysis of satellite imagery, helped to alert aid organizations to the developing crisis and made a timelier reaction possible.

The obstacles to effective international assistance, however, remain formidable. The armed conflict and political problems that impeded the earlier effort persist in the region. And the U.S. famine early warning system (FEWS) (*Science*, 12 September 1986, p. 1145) is far from fine-tuned.

FEWS was created during the 1985 emergency, but has been run as a temporary project. In recent weeks, however, the U.S. Agency for International Development (USAID), which operates FEWS, decided to make an early warning system a regular part of the program in the agency's Africa bureau and began planning a 5-year project.

USAID has for some time recognized a long-term need for an early warning capability in Africa, says William Trayfors, who has been involved in administering FEWS from the start. And Congress likes the idea because it wants to be sure that relief agencies are not caught flat-footed in the face of an African famine, as they were in 1985. But despite FEWS' success in signaling trouble this year, Trayfors acknowledges that the program is "not without its warts."

To justify itself, an early warning system must give more than a general alarm. It is expected to provide specifics on where food shortages are developing, the numbers of people at risk, the amounts of food needed, and where and when it should be delivered.

Evaluations of FEWS have given it mixed grades. An assessment by Energy/Development International, a Washington-based consulting firm, for example, notes that USAID missions in Africa find fault with FEWS analyses. Distribution of FEWS reports in the countries covered* is limited, and coordination with other U.S. agencies and with relief organizations is said to be poor. Many of the difficulties faced by FEWS, however, come, so to speak, with the territory. Particularly in its efforts to apply advanced technology, FEWS has encountered many of the generic difficulties that beset relief and development operations in the region.

FEWS relies on a combination of information gathered on the ground and analysis of satellite imagery. Both have their limitations. In the very poor countries covered by FEWS even such basic information as census data and rainfall figures are unreliable. Food production estimates are fallible and governments in the region have been known to doctor data to strengthen their case for food aid. As the report puts it, "data available to FEWS is poor, inconsistent, and lacking credibility."

Certainly, early experience with FEWS shattered any illusions that a quick technological fix for the famine early warning problem could be achieved by a resort to remote-sensing data alone. To get better information during the 1985 emergency, USAID contracted with the Tulane University School of Public Health to send public health advisers to collect health and demographic data in the countries covered by FEWS. As the crisis ebbed, the advisers began to gather other kinds of information.

In Washington, analysis has been done by another contractor, a data management firm, Price, Williams & Associates. Price, Williams takes contributions from the FEWS field staff and combines it with meteorological data from the National Oceanic and Atmospheric Administration (NOAA) and a variety of social and physical data obtained from other sources and integrates all this with information gained from satellite imagery to prepare monthly reports on individual countries throughout the agricultural season. The operating premise is that accuracy will be achieved by a process of cross-checking and refining data to produce "convergence."

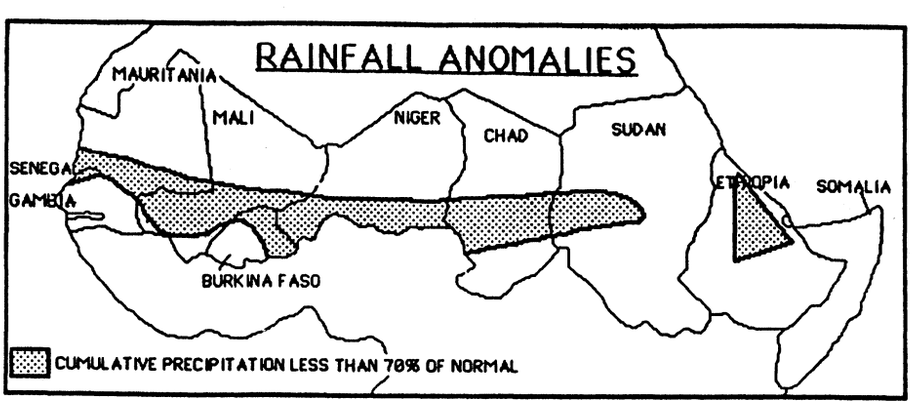
Satellite data are taken from a NOAA weather satellite's advanced very high resolution radiometer. NOAA tapes are processed for FEWS by a National Aeronautics and Space Administration (NASA) group headed by C. J. Tucker to ensure that geometric registrations are correct and provide a normalized vegetation index (NVI). Based on gradations of greenness, the NVI developed by the NASA group enables FEWS analysts to extrapolate crop status from general vegetation conditions.

The NASA group took over tape processing last year from a NOAA unit. Tucker and his colleagues have been producing NVI data for the region since 1981 and have provided FEWS with a historical record that is valuable in making comparisons of conditions from year to year.

Other changes have been made in the cause of improving FEWS. Experience showed that health and nutrition data gathered in the field were not the best early indicators of famine; emphasis in hiring field staff was shifted to people with expertise, for example, in agronomy. On the Washington end, the group has responded to criticism that the monthly reports lack timeliness by preparing and distributing brief updating bulletins at shorter intervals.

A major effort of the Washington group, according to Richard Collins, a manager in the analysis effort, is to create maps in

*FEWS currently monitors conditions in seven drought-prone countries in sub-Saharan Africa—Mauritania, Mali, Niger, Chad, Sudan, and Mozambique as well as Ethiopia.



Shortfall. *Shaded areas on summary map in FEWS bulletin for 12 September show where cumulative rainfall from 1 May through 10 September 1987 was less than 70% of normal.*

electronic form. Increasing attention in the past year has gone to applying so-called geographic information systems techniques in geographic data presentation in FEWS. Collins says that electronic composition of maps means that there is virtually "no limit on the layers, overlays" that can be incorporated. With an integrated database, political boundaries, rivers, vegetation, transportation systems, and population distribution can be indicated and the data manipulated, for example, to identify population living near roads. FEWS has gotten increasing help from U.S. Geological Survey experts.

To build the system, the FEWS group used available computer programs, but modified them by writing its own software. From the start, instructions were to "aim for Africanization," says Collins, meaning that the system should be designed so that the countries now being monitored could take over and operate it. This required that both hardware and software be suitable for transfer—FEWS has been designed to run on personal computers and the software is "user friendly and teachable."

FEWS was set up to meet an emergency, and its mission was not clearly defined. It has been subject to differing, sometimes conflicting demands and has operated on a series of short-term extensions that lent uncertainty to the enterprise. The FEWS primary mandate was to provide timely information for Washington decision-makers, which activated traditional tensions between Washington and the field. As the evaluation puts it, FEWS has "no explicit role for missions and host governments." An effective system "would provide valuable support to missions and country resource management activities." The need for support is most obvious in making crop estimates and in resource planning.

Realizing the potential would require improvement in the quality of data collected by host governments and creation of an adequate database for the region. Also implied is better cooperation with other aid organizations operating in the region and links with other early warning systems such as those of the United Nations Food and Agriculture Organization and the European Community. Such cooperation has so far been minimal.

The report calls FEWS a "valuable prototype which can serve as a basis for an effective long-term early warning system." USAID has begun the process of designing a future FEWS and will have to decide whether to make the investment and commitment necessary not only to make it a better warning system but also to give it broader influence on development of the region. ■ JOHN WALSH

Radon's Health Risks

The health risks from breathing radon are significantly higher for smokers, according to a recent report on radon by a National Research Council committee. But people can cut the risk of lung cancer from radon even after they have inhaled the radioactive gas by reducing further exposure, the committee concluded.

These are among the new findings of the report, "Health Risks of Radon and Other Internally Deposited Alpha-Transmitters." The report, which was released on 6 January, is based on a 3-year study funded by the Environmental Protection Agency (EPA) and the Nuclear Regulatory Commission, and is likely to be used by EPA to drive home the point with that radon is a serious problem.

Radon is a colorless, odorless gas that may be seeping into millions of American homes, EPA estimates. Radon is emitted by the radioactive decay of uranium in rock and soil and enters a building through cracks in the foundation, sump pumps, areas around drainage pipes, and other openings.

Authorities have had difficulty estimating the exact national dimensions of the indoor air pollution from radon. Radon may pose a problem in every state, EPA says based on a few surveys. In August, an EPA study of ten states showed that 21% of the 11,600 homes tested had elevated radon levels. Geology is a good indicator of high-risk areas, EPA says, but levels can vary widely from house to house.

The public health risks posed by radon have been unclear too, but the council report provides fresh findings. Experts have debated, for example, whether smoking greatly increases an individual's chances of developing lung cancer if the person is also exposed to radon. Specifically, they have questioned whether the separate risks of lung cancer from smoking and from radon exposure should be added or multiplied. The council committee found that radon exposure multiplies the lung cancer risk in smokers by at least tenfold.

Researchers also have disagreed whether the risk of lung cancer remains constant after people inhale radon, even when exposure is eliminated. Some researchers have maintained that the risk from radon, as a radioactive substance, remains the same over time, analogous to the cancer risk to atomic bomb survivors, William Ellett, staff director of the council study, explains. But the council study showed that the risk posed by radon is instead similar to the cancer risks posed by cigarette smoking. Reduced exposure to radon will reduce the chances of developing cancer, just as ceasing smoking cuts lung cancer risk. Radon exposure in homes can be reduced by increasing ventilation or sealing openings where the gas may be entering.

Uncertainties about the magnitude of the problem have led to a wide range of estimates about the number of excess lung cancer deaths. EPA has calculated that every year 5,000 to 20,000 lung cancer deaths are linked to radon, making the gas the second leading cause of lung cancer deaths. The risk estimates by the council committee fell into the middle of EPA's range, although it did not cite a specific number. Last year, 136,000 Americans died of lung cancer of which about 85% was caused by smoking, according to American Cancer Society estimates.

The committee developed its risk estimates by reviewing an extensive amount of original data from several key epidemiological studies of uranium miners from United States, Sweden, and Canada. The data were then analyzed with advanced statistical techniques developed in the past few years with the help of better, faster computers, says Jacob Fabrikant, committee chairman and professor at the University of California at Berkeley.

The council committee calculated its risk estimates using a measurement called working level months (WLM). A WLM expresses exposure based on a 170-hour work month to a specific amount of alpha particle energy per liter of air. EPA says that homeowners should reduce radon levels if they are equal to or greater than 4 picocuries per liter. A person who stays home an average of 12 hours per day exposed to 4 picocuries per liter would receive an annual exposure of about 0.5 WLM.

Only a few states, such as Pennsylvania and New Jersey, have extensive radon detection and educational programs about radon. Governments have little authority to control radon in the home, so regulatory action has been limited. EPA has been urging states to survey for radon and support educational programs. EPA itself is currently conducting another survey of another seven states this winter to detect radon on homes. ■ MARJORIE SUN