POLICY FORUM: CLIMATE

The Ethiopia Food Crisis—Uses and Limits of Climate Forecasts

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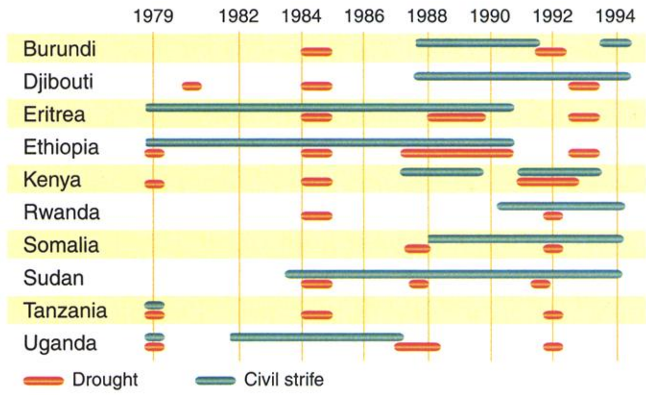
Famine has long been recognized as caused by a range of natural and sociopolitical factors, although fluctuations in rainfall have often been critical (*1*, *2*). Advances in our ability to predict seasonal-to-interannual climate, particularly the El Niño Southern Oscillation (ENSO), have therefore led to optimism about the potential for seasonal forecasts to contribute to greater food security in many regions of the world (*3*). Here, we show that even good climate forecasts are not a panacea by examining the food crisis that currently threatens 16 million people in Ethiopia and its neighboring countries in the Greater Horn of Africa. This review of the Ethiopian food crisis and of some of the challenges facing seasonal forecasting is sobering and underscores the need to foster more realistic expectations among both policy-makers and scientists about the uses and limits of seasonal climate forecasts in alleviating complex social problems.

Seasonal Forecasts and the Food Crisis

The immediate trigger for the 2000 food crisis in Ethopia was the failure of the rains in the (secondary) *belg* season that lasts from February to May. Agriculture during the *belg* season accounts for about 8 to 10% of Ethiopia's annual cereal and pulse production, but the significance of these crops is considerably higher in certain regions. The *belg* rains are also important for preparing land for the country's main *meher* cropping season from June to September, for livestock survival, and for replenishing pastures that sustain the livelihoods of the pastoral populations of southeastern Ethiopia. The 2000 *belg* rains were even more critical after a poor *meher* harvest for 1999 and because parts of southern and eastern Ethiopia had already witnessed consecutive years of drought in 1998 and 1999 that had killed many livestock and stretched the coping capacities of local populations.

A forecast for a high probability for poor *belg* rains was made by Ethiopia's National Meteorological Service Agency in January 2000. This forecast was reinforced a few weeks later in a consensus forecast by representatives of regional meteorological services and the world's leading climate-modeling groups (*4*). The Ethiopian government issued a major appeal for international assistance in January, and the February bulletin of the Famine Early Warning System (FEWS) of the U.S. Agency for International Development (USAID) headlined the implications of the consensus forecast for the already precarious food security situation in Ethiopia. The emergency Food Security Reserve of more than 300,000 metric tons (MT) that had been established by international donors and the Ethiopian government in 1992 had been depleted to 80,000 MT by January 2000—in part owing to the reluctance of international donors to replenish the reserves after having borrowed from them to meet the country's food aid needs during 1999. Meanwhile, as a result of drought and poor harvests in 1999, Ethiopia's food aid needs were already estimated at over 600,000 MT for the upcoming year. In the light of the climate forecast, FEWS cautioned "failure of the [2000] *belg* rainy season would increase relief requirements by several hundred thousand MT above the current estimates of relief food needs." Given the time lag of several months for shipments of food aid to reach target populations, FEWS called for "immediate action...by government and donors to increase the amount of emergency relief that will be delivered to Ethiopia" (*5*).

A major priority for the Ethiopian government, however, was its extended border war with Eritrea that was costing, according to some estimates, about $1 million a day. The international community, meanwhile, was preoccupied with other, more pressing, emergencies during 1999 such as the crisis in Kosovo. International donors were also suspicious that additional aid to Ethiopia would be diverted or, at a minimum, free up additional resources for the war effort. Not replenishing the emergency food reserves despite a deteriorating situation in the latter half of 1999 became a source of leverage to pressure Ethiopia and Eritrea to explore a peaceful resolution to their conflict. In this game of political chicken, it was the donors who ultimately blinked after parts of southeastern Ethiopia had already crossed from food insecurity to famine (*6*) with the 2-month delay and subsequent erratic 2000 *belg* rains and as images of starving children were beamed back to television audiences in Europe and North America. In late March, USAID significantly increased its food aid commitment for Ethiopia to 400,000 MT. This was followed by a similar pledge in mid-April by the European Union.



Drought and Civil Strife in the Greater Horn of Africa.

SOURCE: USAID—GREATER HORN OF AFRICA INITIATIVE

Climate Forecasts and Society: Linking Two Uncertain and Complex Systems

A humanitarian disaster on the order of the 1984–85 Ethiopian famine when close to 1 million people perished will likely be averted this year. Nevertheless, there will be a significant loss of life and livelihoods by the time the sanctioned aid is procured, shipped, and distributed over a period of several months. Climate forecasts for a poor 2000 *belg* season did play a role in sensitizing the government and the famine early-warning community and may have encouraged small anticipatory actions by affected populations such as cutting back on planted area, migration, and advance sale of livestock. However, government and donor decisions that had the most bearing on the crisis were still dictated not by leading indicators of a crisis such as climate forecasts, satellite vegetation index, and rainfall monitoring, but by lagging indicators—evidence of famine, death, and the resulting media pressure.

Such constraints on decision-making are compounded by significant limitations in the seasonal climate forecasts themselves, many of which are lost in the long communication link to end-users (*7*). Despite re-

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cent advances in our ability to predict the evolution of sea-surface temperatures in the tropical Pacific—particularly the onset and evolution of El Niño and La Niña events (*8*), forecasts of regional climate have considerably higher uncertainties (*9*). A number of factors are involved, including the inherent chaos in the climate system, inadequate understanding of the influence of the tropical Indian and Atlantic oceans on regional climates, and the coarse spatial resolution of climate models and uncertainties in the data used to initialize them.

Seasonal forecasts therefore are typically presented in terms of the probabilities that total rainfall (or average temperature) for 3-month seasons over regions spanning several hundred square miles will fall into three tercile classes: the wettest or hottest third of years, the normal third of years, and the driest or coolest third, relative to the historical record. Forecast categories themselves can be wide—"above normal" seasonal rainfall, for example, could in some regions encompass totals from 200 to upward of 2000 millimeters. Users often operate on considerably smaller spatial scales such as a farm plot or a river watershed. Finally, even rainfall that might classify as "normal" when totaled over 3 months could be catastrophic if it were to fall over just a few days.

Toward Socially Robust Knowledge

Recent years have witnessed a number of efforts to apply advances in seasonal climate forecasting in social decision-making worldwide (*10*, *11*). For such knowledge to be usable, it must not only be reliable but also socially robust: "the product of an intensive and continuous interaction between data and other results, between people and environments, between applications and implications" (*12*).

The volatile mix of drought and strife symptomatic of the current as well as many previous crises in Ethiopia and its neighbors in the Greater Horn of Africa (see figure, p. 1693), however, implies that even good forecasts of the climatic determinants of food insecurity need not lead to demonstrable improvements in social outcomes.

Given this context, applications of climate forecasts should not be considered as stand-alone efforts, but instead be strategically incorporated with other information. The famine early-warning community, particularly FEWS, did integrate climate forecasts for Ethiopia with other information such as harvest assessments, vegetation indices, and field reports. However, given that donor response in Ethiopia was triggered more by media coverage, the early-warning bulletins clearly did not suffice by themselves. In cases where providers have sufficient confidence in their climate forecasts, alternate channels of communication such as opinion pieces in leading newspapers should be explored.

The appropriate target audience for forecasts must also be defined. It may seem that the most vulnerable populations (such as small subsistence farmers) are the most desirable beneficiaries of climate forecast information. However, like the pastoralists in southeastern Ethiopia whose coping capacities were already exhausted by successive years of drought, such recipients may have few choices. A related problem is that efforts to push forecasts to maximize agricultural production (for example, by encouraging monocropping), may undermine traditional coping strategies such as crop mixing, which tend to guarantee some yield under a range of climate conditions. Small-scale users may also be most vulnerable to poor forecasts—both because the quality of seasonal forecasts becomes more uncertain at finer spatial scales, and because such users might not have sufficient resources to survive a poor harvest. Observed conditions obviously can and have deviated from the most likely outcome in the forecasts, often with significant consequences to users who either were not aware, or failed to take into account the probabilistic nature and track record of the forecasts. For example, farmers in parts of Mozambique reacted to expectations for a high likelihood of below-normal rainfall during January to March 1998 by planting in low-lying areas to have better access to water, only to be flooded when rainfall turned out to be above normal. There is therefore a need for more-comprehensive assessment and communication of the quality and track record of different forecasting schemes (*13*), including traditional techniques. What might be a plausible aberration in terms of frequent probabilities to a climate scientist might, in fact, cost some users their entire livelihoods.

Private firms that operate on large spatial scales, have decision-making flexibility, and can weather a poor forecast might in fact be better equipped to make use of forecasts. Such use, though, may be to the detriment of more vulnerable groups. Climate forecast disseminators have an obligation to consider issues of equity related to the use of their forecasts (*14*).

Application of seasonal forecasts, by definition, emphasizes short-term responses. There is therefore a risk of reinforcing short-term coping strategies at the expense of longer-term adaptations and resilience to chronic problems. In the case of the current Ethiopian crisis, the short-term solutions involved targeting and delivery of food aid to ward off mass starvation this year. To lessen the magnitude and recurrence of future emergencies, however, requires greater attention to social inequities, market forces, political instability, and civil strife, which are outside the domain of science, as well as sustainable strategies for the better management of climate variability—where climate science and data can play an important role. Ironically, as donor-driven efforts to encourage climate forecast use increase, there has been a steady deterioration in the collection, quality control, and exchange of climatological data in many of the world's most vulnerable regions (*15*). Such data are critical for understanding climate variability.

In conclusion, seasonal climate forecasting is a promising but imperfect tool whose utility is now being tested in increasingly diverse and challenging environments. For such knowledge to become practically useful and remain fundable, it must forge a partnership with society that is based on a clear understanding of social needs and a transparent presentation of its own potential contribution.

References and Notes

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3. See, for example, the keynote address by the Secretary General of the World Meteorological Organization at the 1996 World Food Summit (www.fao.org/wfs/final/rep2/wmo.htm).
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